

**197- AND 198-TYPE SWITCHES
PARTS MOUNTED ABOVE COVERPLATE
EXCEPT PAWLS, PAWL PINS,
AND CONTACT SPRING ASSEMBLIES
PIECE-PART DATA AND REPLACEMENT PROCEDURES**

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NOTICE

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1. GENERAL

1.01 This section covers the piece-part and replacement procedures for parts mounted above coverplate except pawls, pawl pins, and contact spring assemblies of the 197- and 198-type switches.

1.02 The reasons for reissuing this section are listed below. Revision arrows are used to emphasize the more significant changes.

- (1) To revise Fig. 12 and 20

- (2) To add a Note

- (3) To add changes from Addendum 1, Issue 7

- (4) To make minor changes as required.

The Equipment Test List is not affected.

1.03 Part 2 of this section covers the piece-part numbers and corresponding names of the parts which it is practicable to replace in the field in the maintenance of switches. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts.

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2.

2. PIECE-PART DATA

2.01 The method of ordering parts for replacement purposes is covered in Part 2 of Section 030-705-801.

2.02 Information enclosed by parentheses () is not ordering information. This information may be reference to notes, parts referred to in other portions of the section and not considered replaceable, or part names in general use in the field if these names differ from those assigned by the manufacturer.

2.03 KS-16832, L2, lubricant when required in this instruction should be prepared as follows. This lubricant is provided in 2-ounce and 1-pint containers. A small widemouth container, such as the 2-ounce jar in which the lubricant is available, should be used as a receptacle from which to dispense the lubricant. If allowed to stand more than 1 day without agitation, the lubricant ingredients tend to separate; therefore, before each day's use, shake the container of lubricant for approximately 30 seconds to insure mixing of the ingredients. The proper method of shaking the lubricant consists of repeated rapid turning of the container to an upside-down position and back to the upright position. If the lubricant from a 1-pint container is to be used, the lubricant must be mixed as just described before it is poured into the smaller container. Under storage conditions, the cover should be tight on the container.

2.04 One dip of KS-16832, L2, lubricant, for the purpose of this section, is the amount of lubricant retained on a KS-14208 brush after being dipped into the lubricant to a depth of 1/2 inch and the tip lightly touched against the edge of the container to remove any surplus.

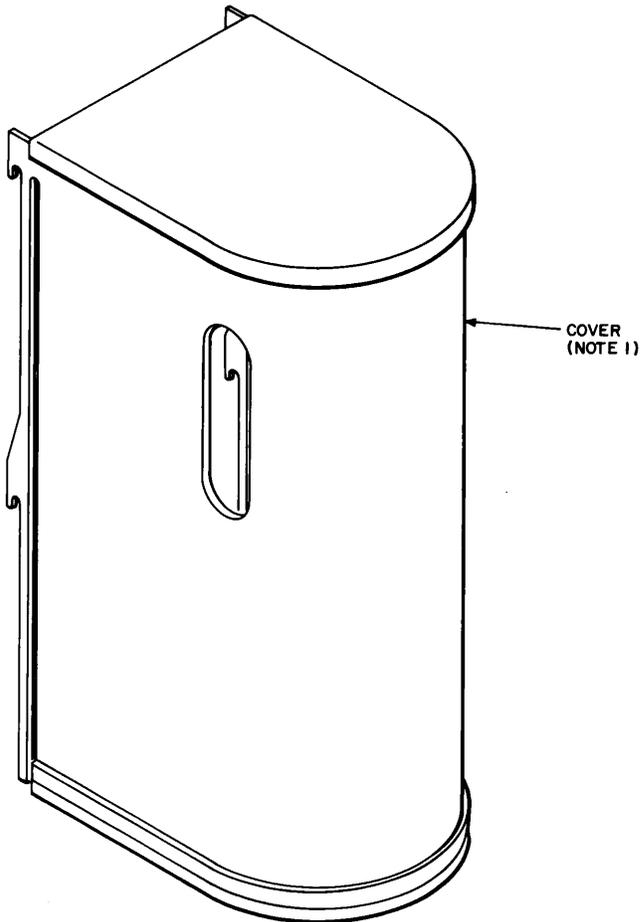


Fig. 1—Switch Covers

NOTE 1 FOR FIG. 1

COVER (UNINSULATED)	*HEIGHT (INCHES)
P-252083	10-1/2
P-252084	13
P-252301	14-7/8
P-252374	15-1/2
P-252371	15-3/4
P-485222	17
P-252905	17
P-252372	18-1/4
P-252373	19-1/2
P-252906	23-1/16
P-484719	24-1/4

* Do not specify height in the order.

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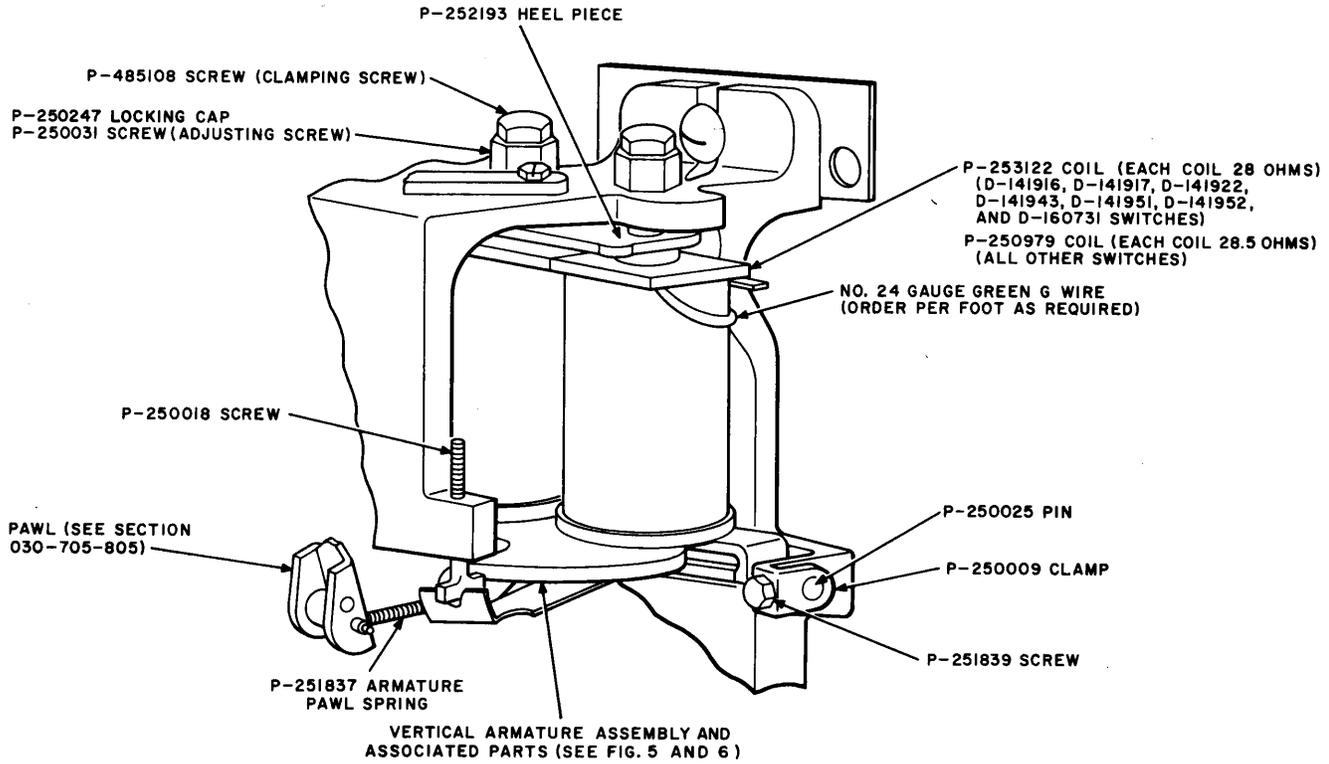


Fig. 2—Vertical Magnet and Associated Parts

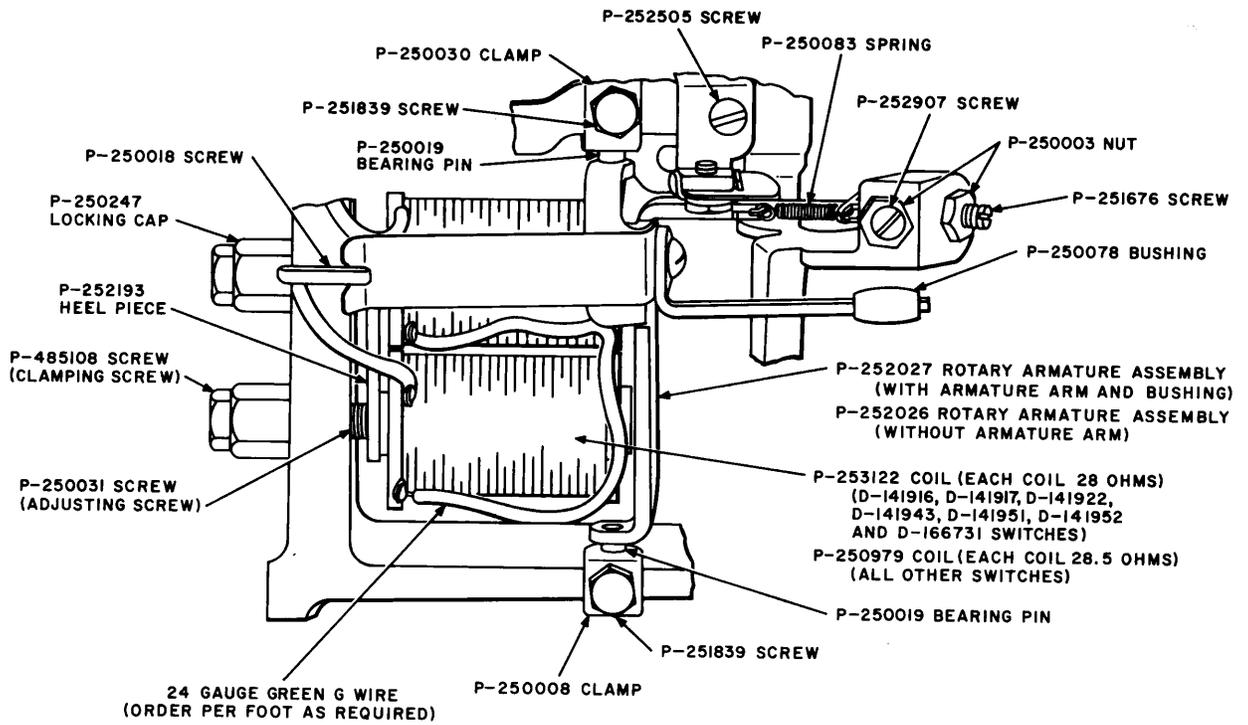


Fig. 3—Rotary Magnet and Associated Parts

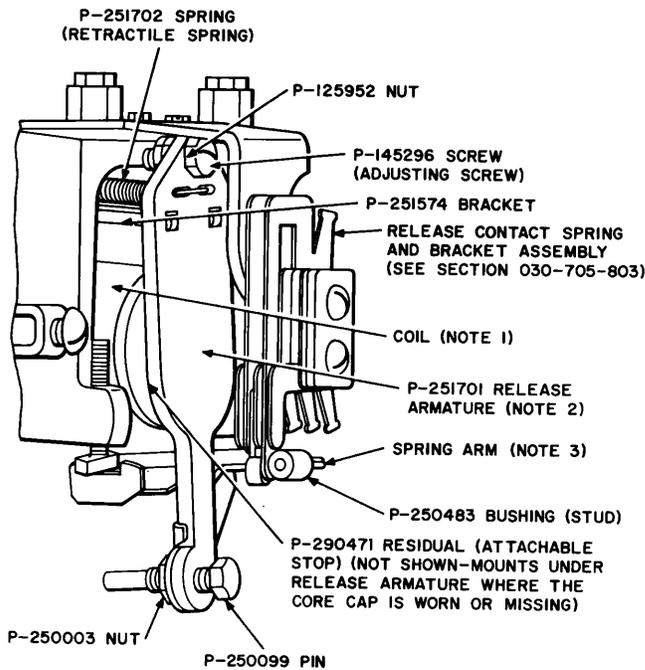
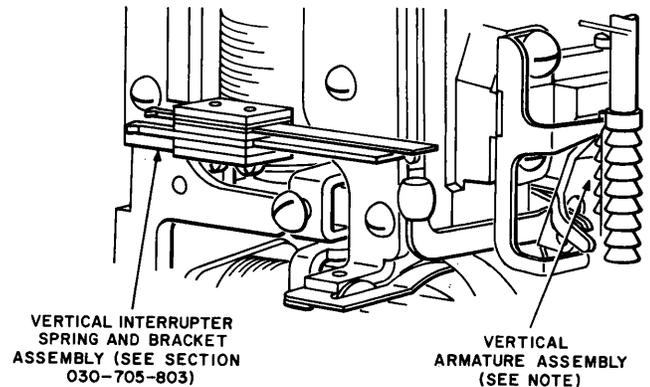


Fig. 4—Release Magnet and Associated Parts



NOTE:
 WHEN REPLACING THE EARLIER TYPE VERTICAL ARMATURE ASSEMBLY, ORDER THE P-251721 VERTICAL ARMATURE ASSEMBLY, P-251574 BRACKET AND VERTICAL INTERRUPTER SPRING AND BRACKET ASSEMBLY, AND MOUNTING SCREWS IN ACCORDANCE WITH SECTION 030-705-803.

Fig. 5—Vertical Armature Assembly With Vertical Armature Arm

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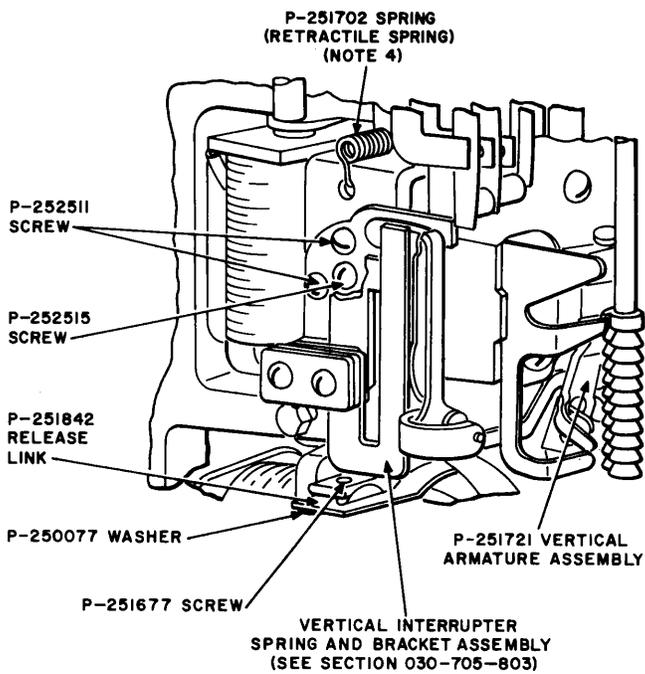


Fig. 6—Bell Crank-Type Armature Assembly, Release Link, and Associated Parts

NOTES FOR FIG. 4 AND 6

1. P-253121 coil (46 ohms) (D-141916, D-141917, D-141922, D-141943, D-141951, D-141952, and D-160731 switches) P-250161 coil (115 ohms) (all other switches)
2. When it is necessary to replace either the release armature or the retractile spring on switches equipped with a release armature having the retractile spring hooked to a pin in the armature, order both the P-251701 release armature and P-251702 spring and replace both parts.

3.	SPRING ARM	ASSOCIATED WITH
	P-485112	Single make or break combination
	P-251458	All other spring combinations

4. When replacing the retractile spring by a spring having the hooks at both ends parallel to the long axis of the spring, discard the spring mounting screw if provided.

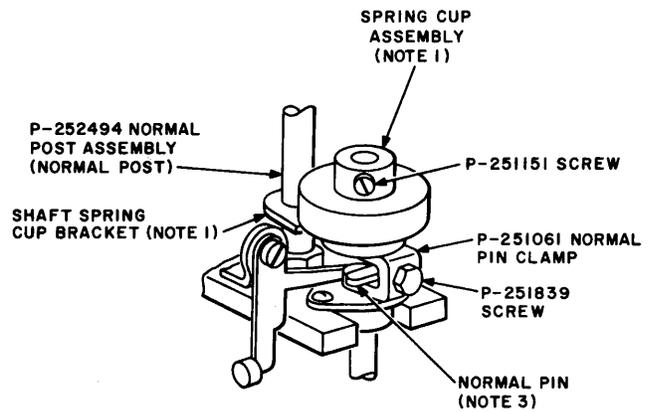


Fig. 7—Cup-Type Shaft Spring Assembly and Associated Parts—Assembly Without Normal Post Collar

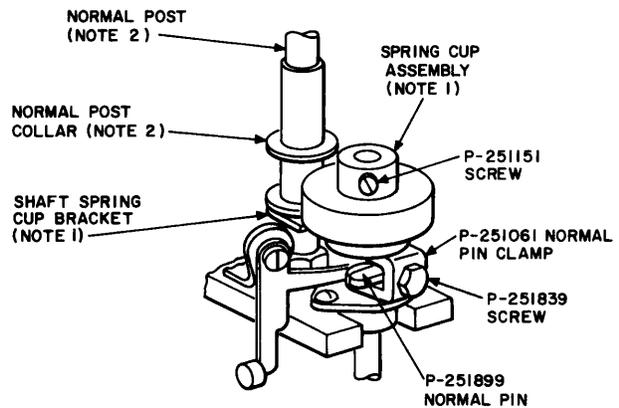


Fig. 8—Cup-Type Shaft Spring Assembly and Associated Parts—Assembly With Normal Post Collar

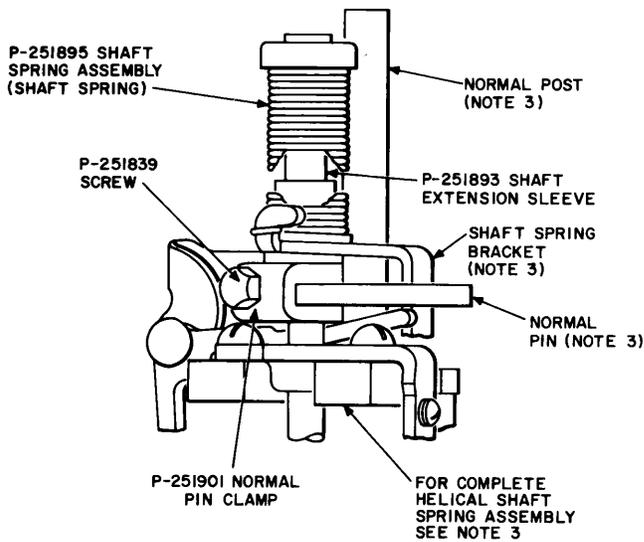


Fig. 9—Helical Shaft Spring Assembly and Associated Parts

NOTES FOR FIG. 7, 8, AND 9

1. When necessary to replace the spring cup assembly or the shaft spring cup bracket, order a helical shaft spring assembly as covered by Note 3.
2. When necessary to replace the normal post collar, order a P-252497 normal post assembly and a P-2901141 helical shaft spring assembly.
3. When ordering give part number followed by name of part.
4. For 197AF, 197AG, 197AH, 197AJ, 197BB, 197BN, 197BS, and D-91385 switches having normal post springs per Fig. 10.
5. For 197P, 197R, 197AD, 197AE, 197AY, 197BD, 197BP, and 197BR switches having normal post springs per Fig. 10.
6. These normal posts replace both the nut and the post on switches equipped with 2-piece normal posts. If either part of the 2-piece normal post requires replacement, order a new normal post and replace both parts.

PART NAME	PART NO.	FOR SWITCHES EQUIPPED WITH NORMAL POST SPRINGS PER FIG.
Normal Pin	P-251899	None
	P-251900	10
	P-251899	11
Shaft Spring Bracket	P-251887	10 (See Note 4.)
	P-251888	10 (See Note 5.)
	P-251886	11
*Helical Shaft Spring Assembly	P-290112	None
	P-290113	10 (See Note 4.)
	P-290114	10 (See Note 5.)
	P-290112	11
Normal Post Assembly	P-252494	None (See Note 6.)
	P-252497	10 or 11 (See Note 6.)

* Helical shaft spring assemblies include screw, normal pin clamp, shaft spring, shaft spring bracket, shaft extension sleeve, and normal pin.

FOR PIECE PART INFORMATION ON
NORMAL POST SPRING ASSEMBLY
AND ASSOCIATED NORMAL
POST CAM—SEE SECTION 030-705-803

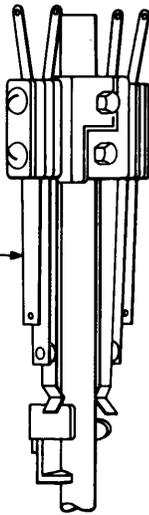


Fig. 10—Normal Post Spring Assembly Operated by Shaft Spring Bracket

FOR PIECE-PART INFORMATION
SEE SECTION 030-705-803

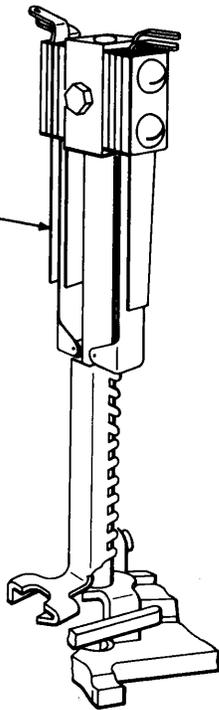


Fig. 11—Normal Post Spring Assembly Operated by Normal Post Cam and Rollers

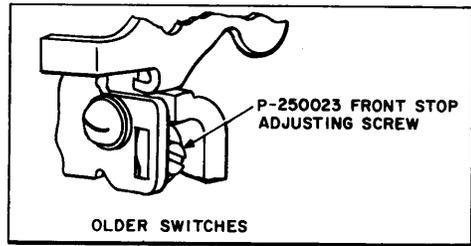
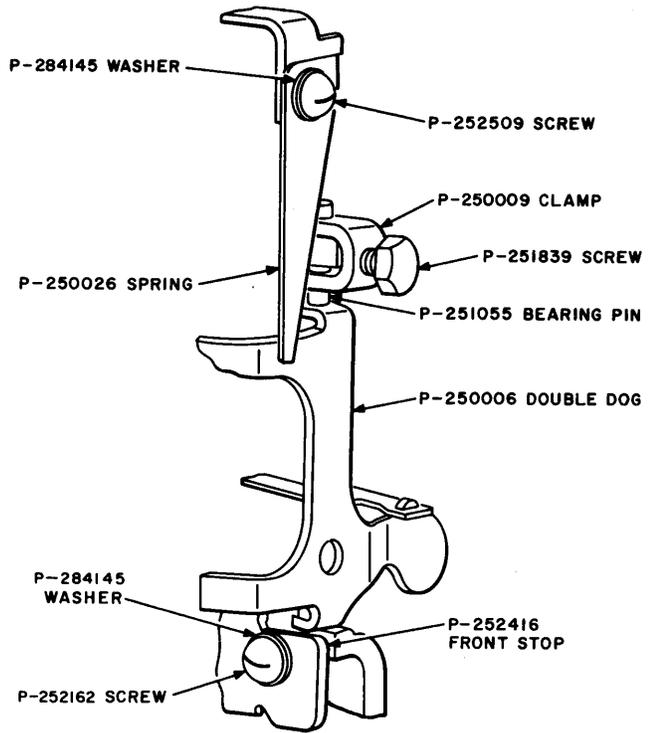


Fig. 12—Double Dog and Associated Parts

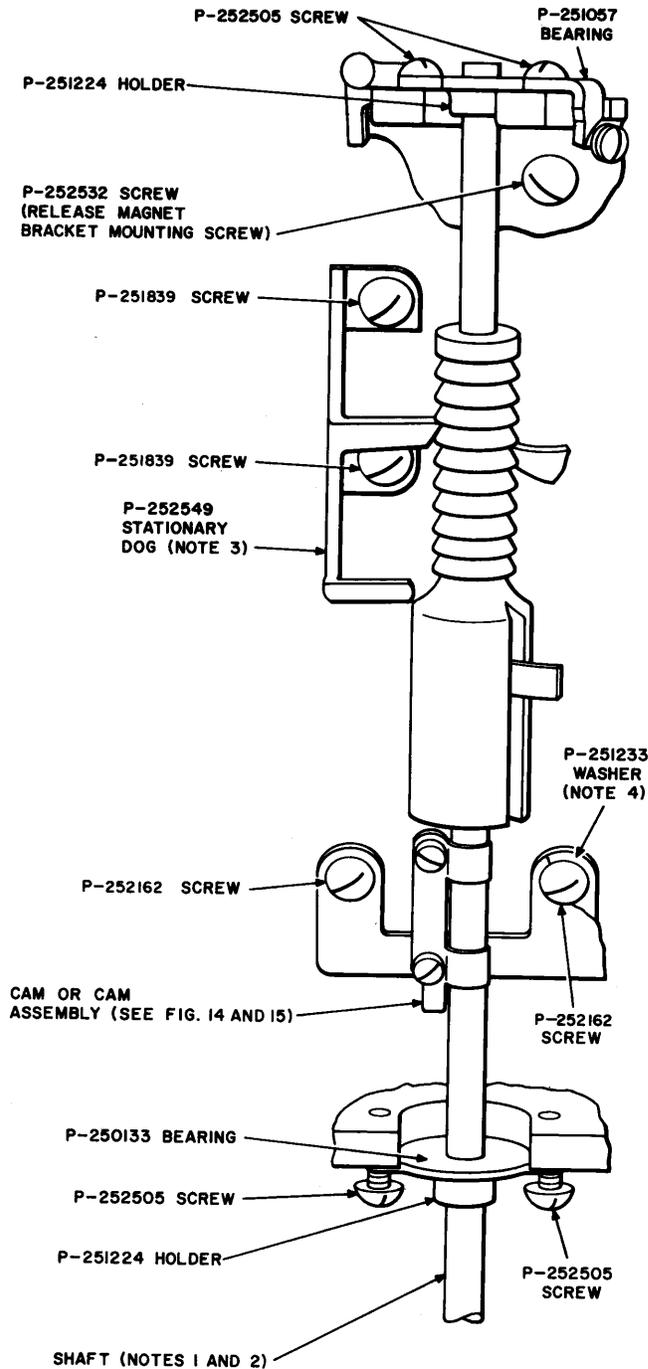


Fig. 13—Shaft, Cam, Stationary Dog, and Associated Parts

NOTES FOR FIG. 13

1. When ordering, give part number followed by name of part.

SHAFT	NO. OF BANKS
P-252520	1 or 2
P-252521	3
P-252481	4

- When ordering shafts for the 197AR and 197BE switches having wipers equipped with assembly clamping nuts, order a complete set of new wipers in accordance with Section 030-705-804.
- When replacing the stud or stationary dog on switches having a stud mounted above the stationary dog, order the P-252549 stationary dog and the P-252532 screw. Mount the screw in place of the stud.
- Used on switches equipped with rotary off-normal springs or cam springs, but not with rotary interrupter springs.

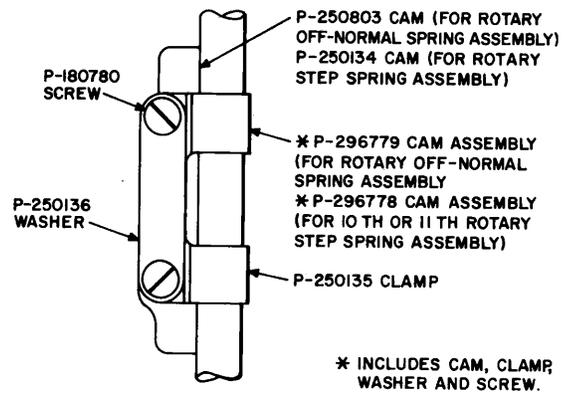


Fig. 14—Parts for Cam Assembly Used With Separate Rotary Off-Normal or Rotary Step Spring Assembly

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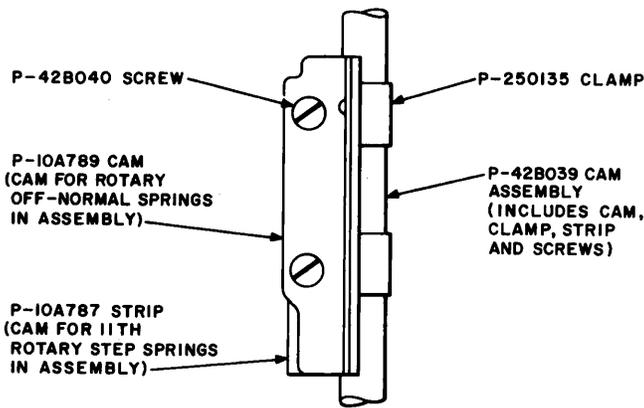


Fig. 15—Parts for Cam Assembly Used With Combined Rotary Off-Normal and Rotary Step Spring Assembly

3. REPLACEMENT PROCEDURES

3.01 List of Tools and Materials

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
48	Combination 7/32- and 1/4-inch Hex double-end socket wrench and screwdriver
417A	1/4- and 3/8-inch open double-end flat wrench
418A	5/16- and 7/32-inch open double-end flat wrench
485A	Smooth-jaw pliers
476A	3/16-inch Hex offset socket wrench
556A	7/32-inch Hex double-end offset socket wrench
563A	90-degree offset screwdriver
564A	45-degree offset screwdriver
581A	25/64-inch flat open-end wrench
KS-6257	3/8-inch "T" Hex socket wrench

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
KS-14208	Brush, artist
R-1681	5/16-inch "T" Hex socket wrench
AECo H-7067	Double-dog adjuster
—	6-inch half-round second cut commercial file
—	4-ounce riveting hammer
—	1/16-inch pin punch, L. S. Starrett Company No. 565 (or equivalent)
—	6-inch tweezers, American Piano Supply Company No. 91 or equivalent
—	3-inch C screwdriver
—	4-inch E screwdriver

MATERIALS

KS-16832, L2	Lubricant
KS-7860	Petroleum spirits
—	Clear varnish

3.02 The replacement procedures given in this section are covered in the following order:

Vertical Mechanism and Associated Parts (paragraphs 3.03 through 3.08)

Rotary Mechanism and Associated Parts (paragraphs 3.09 through 3.16)

Double Dog, Stationary Dog, and Associated Parts (paragraphs 3.17 through 3.19)

Release Mechanism and Associated Parts (paragraphs 3.20 through 3.26)

Shaft and Associated Parts (paragraphs 3.27 through 3.38)

Normal Post and Associated Parts (paragraphs 3.39 through 3.41)

VERTICAL MECHANISM AND ASSOCIATED PARTS

3.03 *Vertical Magnet Clamping Screw and Associated Parts:*

To replace the vertical magnet clamping screw, turn the screw in a counterclockwise direction with the 418A wrench until the vertical magnet is released. If required, turn the locking cap in a counterclockwise direction with the 581A wrench until the adjusting screw is clear of the switch frame. Tilt the adjusting screw, locking cap, and clamping screw toward the front of the switch, and withdraw the assembly from below the relays. Substitute the required part, and mount the parts in position.

3.04 *Vertical Magnet Heelpiece:* To replace the vertical magnet heelpiece, turn the magnet clamping screws in a counterclockwise direction with the 418A wrench sufficiently to permit the vertical magnets to drop down and rest on the vertical armature. The magnet heelpiece may then be withdrawn from the right side of the switch with the 485A pliers. Place the new heelpiece in position with the pliers. Adjust the vertical magnets to the proper position, and fasten them securely to the frame by tightening the clamping screws. If the clamping lugs of the winding terminals protrude from the spoolhead sufficiently to interfere with the heelpiece, bend the clamping lugs flush with the spoolhead with a 3-inch C screwdriver.

3.05 *Vertical Magnet:* To replace the vertical magnets, unsolder the leads at the terminals. If the left-hand coil on switches equipped with the earlier-type vertical interrupter spring assembly is to be replaced, it will be necessary to remove the right coil first and then the left coil and to remount the coils in the reverse order. Turn the clamping screw on the top of the frame in a counterclockwise direction with the 418A wrench sufficiently to release the coil. Remove coil and place the new one in position, so the terminal lugs on the spoolhead are located at the top of the coil and on the outside of the switch frame. Fasten the new coil in position by inserting the clamping screw and tightening it securely, taking care that the magnet heelpiece is in its correct position. Reconnect the leads. When it is necessary to replace the coil connecting wire, cut a 4-1/2 inch length of 24-gauge green "G" wire and solder it to the terminals.

3.06 *Vertical Armature Bearing Pin Clamp and Bearing Pin*

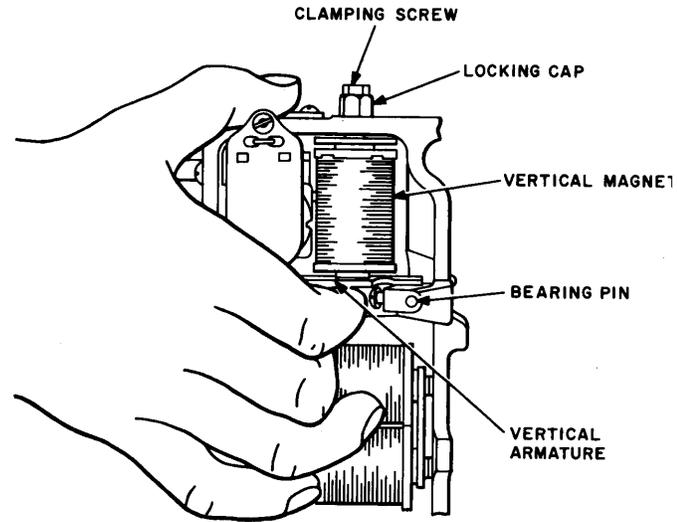


Fig. 16—Method of Supporting Vertical Armature While Replacing Bearing Pin

- (1) To replace the vertical armature bearing pin clamp and bearing pin, disengage the vertical armature spring from the "T" head of the adjusting screw and swing the spring to the right until it clears the head of the screw. Loosen the bearing pin clamp screw with the 4-inch E screwdriver or with the 556A wrench. If only the bearing pin clamp is to be replaced, tap the vertical armature bearing pin from left to right with the 1/16-inch pin punch and, where necessary, with the 4-ounce riveting hammer until the pin disengages the bearing pin clamp; then replace the clamp. If the bearing pin is to be replaced, tap it until it can be withdrawn from the right-hand side of the switch by means of the fingers or with a pair of 485A pliers.
- (2) Insert the new bearing pin from the left-hand side of the switch, guiding the vertical armature with the right hand as shown in Fig. 16 so that the pin engages the hole in the armature. After the pin has engaged the hole in the right-hand side of the armature, place the bearing pin clamp in position and adjust the armature and the clamp so that the pin enters the hole in the clamp. Tap with the hammer. When the pin is in position, tighten the bearing pin clamp screw and replace the armature spring on the "T" head of the armature spring adjusting screw.

3.07 Vertical Armature Assembly

(1) To replace the vertical armature assembly, lift the release armature from the lugs on the release magnet bracket and rotate the release armature so that it is at right angles to its normal position. In some cases it may be necessary to remove the release contact spring assembly to permit the armature to be lifted from the lugs on the bracket. If this is necessary, loosen the screw which mounts the release magnet bracket to the frame with the 563A and 564A offset screwdrivers. Remove the release contact spring assembly from the frame by drawing the assembly toward the front or rear of the switch, as required, to free the contact springs from the stud on the release armature. Take care not to break the leads on the spring assembly when the spring assembly is supported by them. Remove the vertical armature bearing pin clamp and vertical armature bearing pin as described in subparagraph 3.06(1).

(2) When the bearing pin is removed, remove the vertical armature from the right side of the switch by tilting it downward so the rear end of the armature drops below the lug on the frame which supports the bearing pin clamp. Turn the armature slightly to permit its removal. When the switch is equipped with an armature arm, the removal of the armature will be facilitated if the arm is bent in a direction away from the frame. To bend the arm, use the AECo H-7067 adjuster applied at the stud end of the arm while holding the armature with the fingers. (See Fig. 17.) Also in this case, replace the vertical interrupter spring assembly as described in Section 030-705-803 and the release magnet bracket as described in paragraph 3.26.

(3) Remove the protective lubricant from the bearings in the new armature with KS-7860 petroleum spirits. Place the vertical armature in position by reversing the above procedure, being sure that the pin in the frame engages the slot in the rear end of the vertical armature and that the pawl finger is over the lower lug of the stationary dog. Replace the vertical armature bearing pin from the left-hand side of the switch as described in subparagraph 3.06(2). Restore the release armature to position. Swing the vertical armature retractile spring into position so that it will engage the "T" head of the vertical armature spring adjusting screw. Remount the

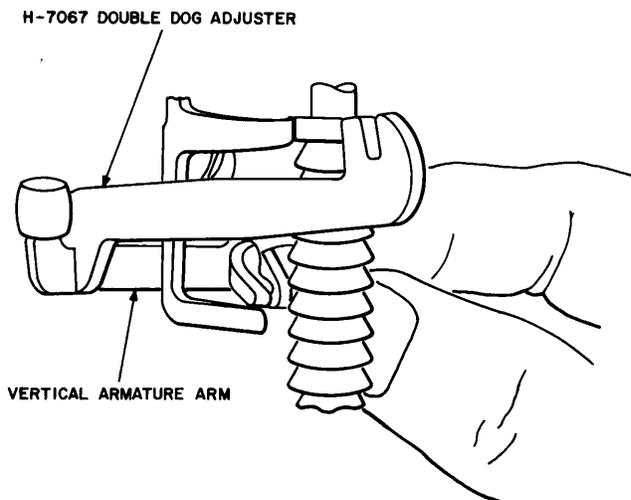


Fig. 17—Method of Bending Vertical Armature Assembly Equipped With Arm

release contact spring assembly if it was removed. Lubricate the parts in accordance with Section 030-705-706.

3.08 Vertical Armature Pawl Spring

(1) To replace the vertical armature pawl spring, remove the vertical armature assembly as described in paragraph 3.07. Replace the pawl spring on the armature assembly, and remount the armature assembly. On switches where the vertical armature assembly has an arm, proceed as follows.

(2) Remove the double dog as described in paragraph 3.18. Disengage the vertical armature spring from the adjusting screw, and swing it to the right. Unhook the pawl spring from the pin or hook on the armature and also from the pawl using the 6-inch tweezers. Hook the open end of the new spring in the hole at the right of the pawl with the open end of the spring facing outward (toward the right). Place the looped end over the pin or hook on the armature. (See Fig. 18.) The tension of the spring after it has been placed in this position should be sufficient to hold the pawl in its extreme forward position. Remount the double dog as described in paragraph 3.18.

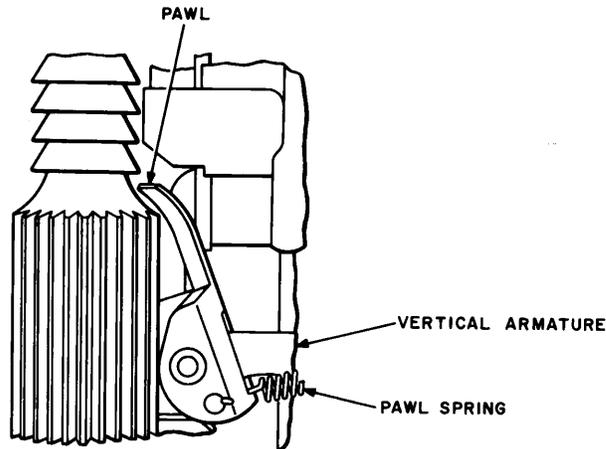


Fig. 18—Method of Attaching Vertical Armature Pawl Spring to Vertical Pawl

ROTARY MECHANISM AND ASSOCIATED PARTS (Fig. 19 and 20)

3.09 Rotary Magnet Clamping Screw and Associated Parts: To replace the rotary magnet clamping screw and associated parts, loosen the coverplate screw or screws located in back of the rotary magnet with the 3-inch C screwdriver and remove the coverplate from over the mounting screw. Then remove the rotary magnet clamping screw with the R-1681 or 418A wrench while the rotary magnet is held in position. Replace the clamping screws. Turn the locking cap slightly with the 581A or KS-6257 wrench to release the tension of the adjusting screw. Then withdraw the locking cap from the head of the adjusting screw with the fingers. If the magnet adjusting screw is also to be replaced, turn the locking cap in a counterclockwise direction using the 581A or KS-6257 wrench until the adjusting screw is free from the frame. Substitute the required part, and mount the parts in position.

3.10 Rotary Magnet Heelpiece: To replace the rotary magnet heelpiece, remove the magnet clamping screw as described in paragraph 3.09. Draw the rotary magnets forward until the heelpiece can be removed from the adjusting screws. Place the new heelpiece in position with the 485A pliers, and replace the clamping screws. If the clamping lugs of the winding terminals protrude from the spoolhead sufficiently to interfere with the heelpiece, bend the clamping lugs flush with the spoolhead using a 3-inch C screwdriver.

3.11 Rotary Magnets: To replace a rotary magnet, unsolder the leads to the rotary magnet to be replaced. Remove the clamping screws, as described in paragraph 3.09, and withdraw the magnet coils from the right-hand side of the switch. Place the new magnet coil in position with the lugs on the spoolhead pointing towards the left-hand side of the switch and fasten the magnets in position by inserting the clamping screws. Adjust the magnet to its proper position, being sure that the heelpiece is properly placed, and tighten the magnet clamping screws securely. Reconnect the leads to the magnet. Where it is necessary to replace the coil connecting wire, cut a 2-1/2 inch length of 24-gauge green "G" wire and solder it to the terminals.

3.12 Rotary Armature Bearing Pin Clamp, Bearing Pin, and Rotary Armature Assembly

(1) To replace the rotary armature and associated parts free the rotary armature spring from the armature spring adjusting screw. Loosen the bearing pin with the 4-inch E screwdriver or the 556A wrench, withdraw the bearing pin from below the coverplate with the 485A pliers, and remove the bearing pin clamp. If necessary to replace the upper bearing pin, bearing pin clamp, or armature, remove the armature assembly from its position. In certain cases where a terminal pileup blocks access to the bearing pin clamp screw, it will be necessary to remove the terminal block with a 3-inch C screwdriver first. If difficulty is experienced in disengaging the armature assembly from the upper bearing pin, loosen the upper bearing pin clamp screw with the 4-inch E screwdriver or the 556A wrench sufficiently to permit the upper bearing pin to be moved upward far enough to release the rotary armature.

(2) Substitute the parts as required. Remove the protective lubricant from the new armature bearings using KS-7860 petroleum spirits and, when reassembled, lubricate in accordance with Section 030-705-706. Place the upper bearing pin and bearing pin clamp in position, and tighten the clamp screw. Place the rotary armature in position, noting carefully that the pawl passes between the frontstop and the pawl guide and that the arm of the armature is in the proper position for operating the interrupter springs (if equipped). Mount the lower bearing pin and

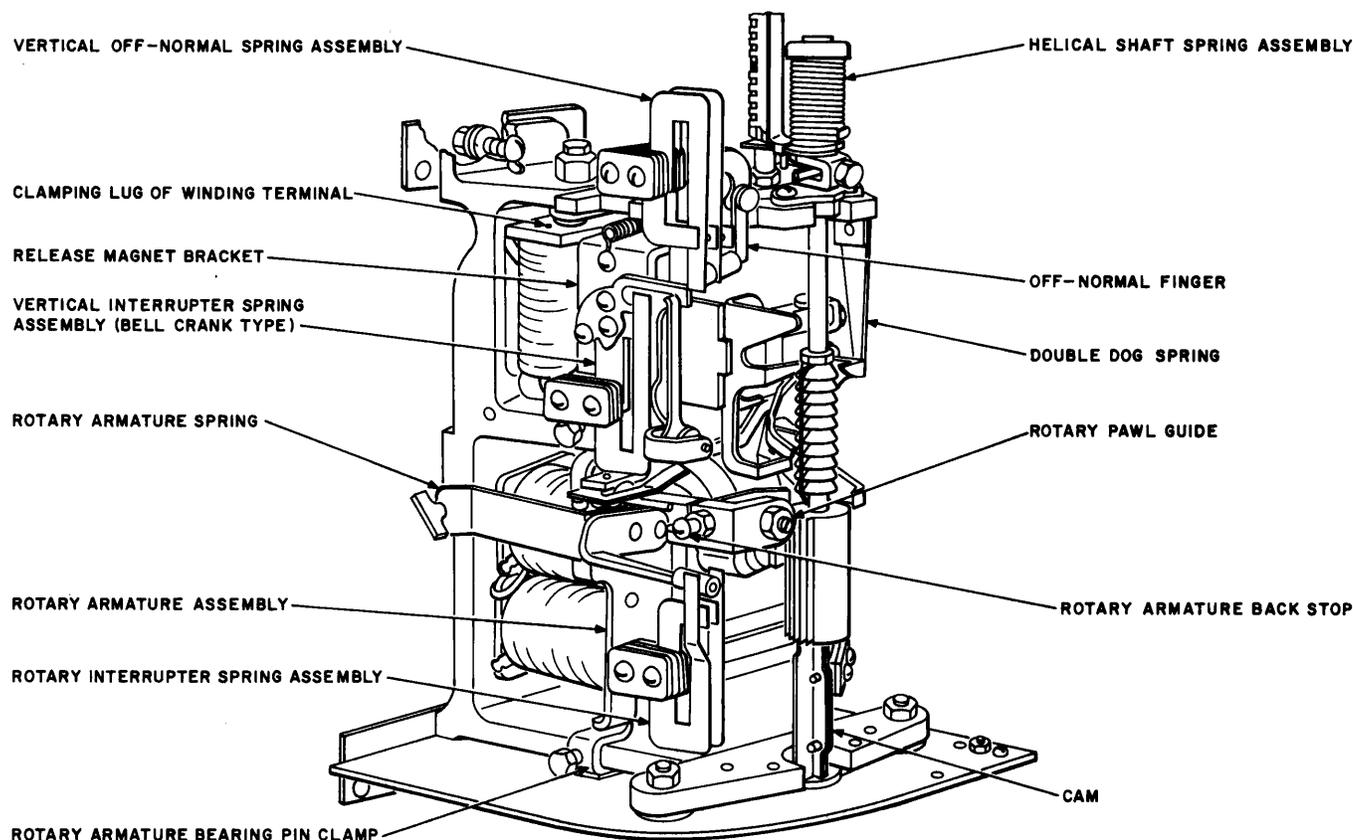


Fig. 19—Parts of 197-Type Switch as Viewed From the Left Side

clamp in position, and tighten the clamp screws securely. Place the rotary armature spring on the head of the adjusting screw. Mount the terminal pileup if it was removed.

3.13 *Rotary Pawl Frontstop and Frontstop Adjusting Screw*

(1) To replace the rotary pawl frontstop and the frontstop adjusting screw, disengage the double dog from the slot in the release link and raise the shaft to the tenth level. To raise the shaft to the tenth level on switches arranged to take five vertical steps only, loosen the wipers on the shaft with the 3-inch C screwdriver or with the $\nabla 476A$ wrench. To raise the shaft on 198-type switches, loosen the normal pin clamp screw with the 3-inch C screwdriver or the 556A wrench and shift the normal pin so the stationary dog will clear the vertical teeth. If required, remove the frontstop mounting screw with the 4-inch E screwdriver and withdraw the frontstop from its position below the double dog. If

equipped with a frontstop adjusting screw, remove the adjusting screw with the 3-inch C screwdriver.

(2) Substitute the required part. Place the frontstop in position; then insert the mounting screw loosely, and adjust the frontstop to the proper position as described in Section 030-705-702. Remount the wipers if they were loosened, or reset the normal pin.

3.14 *Bushing for Rotary Armature Arm:*

To replace the bushing on the rotary armature arm, heat the rotary armature arm with a soldering copper sufficiently to permit the removal of the rubber bushing with the 485A pliers. Keep the armature arm warm enough to soften the new bushing slightly but not hot enough to mar the bushing. Force the new bushing into position on the end of the armature arm.

3.15 *Rotary Pawl Guide and Rotary Armature Backstop:* To replace the

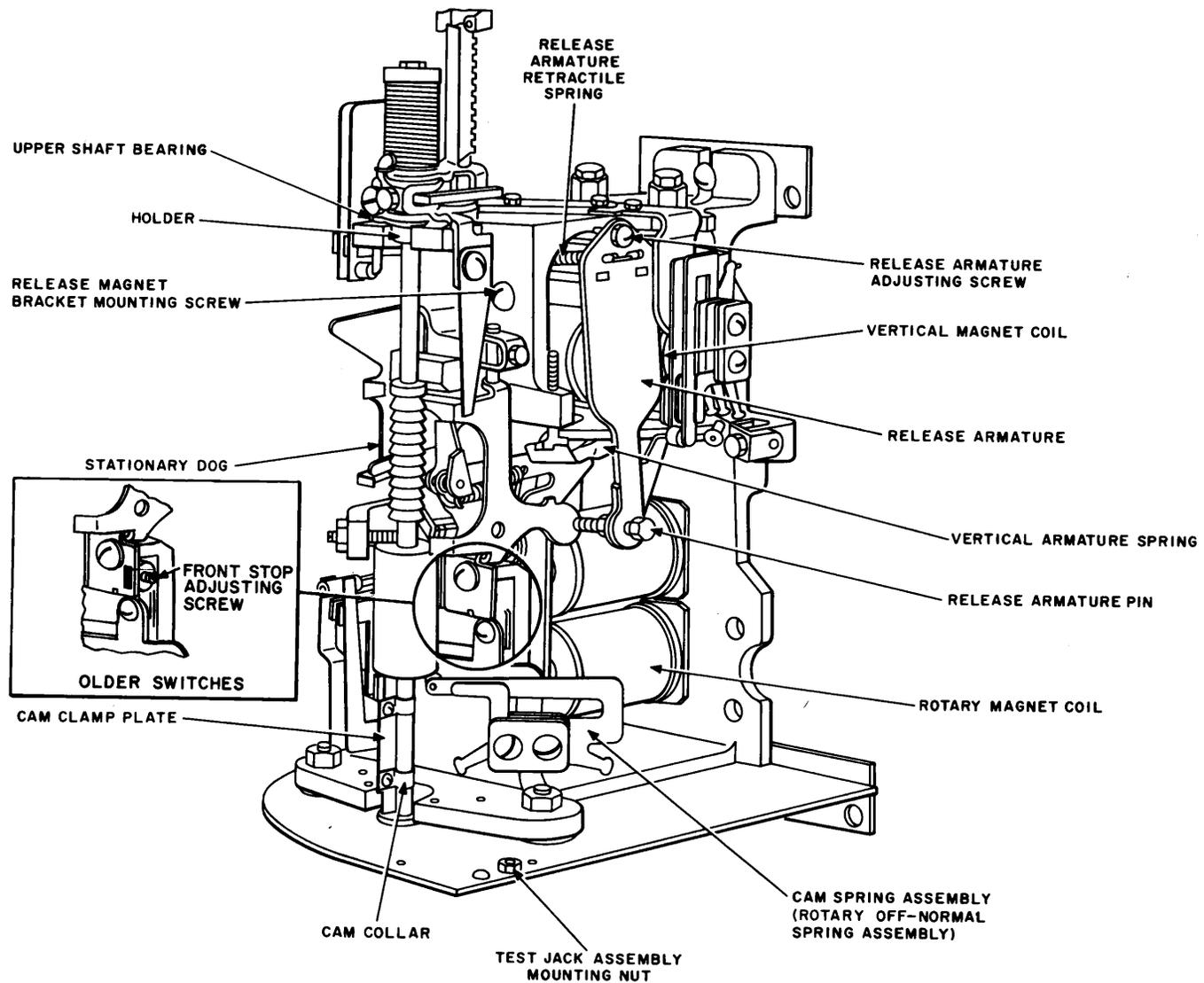


Fig. 20—Parts of 197-Type Switch as Viewed From the Right Side

rotary pawl guide and rotary armature backstop, loosen the locknut holding the rotary armature backstop or rotary pawl guide with the 418A wrench and remove the pawl guide or backstop. Use the screwdriver portion of the 48 combination wrench and screwdriver to remove the pawl guide and the 4-inch E screwdriver to remove the backstop. Substitute the new part, adjust the pawl guide or backstop to its power position, and retighten the locknut securely.

3.16 Rotary Pawl Spring

- (1) To replace the rotary pawl spring, unhook the rotary pawl spring from the hook pin

on the armature and also from the pawl using the 6-inch tweezers. Hook the open end of the new spring around the pawl, and place the looped end over the hook or pin as shown in Fig. 21.

- (2) The tension of the spring after it has been placed in this position should be sufficient to hold the pawl in its extreme forward position.

DOUBLE DOG, STATIONARY DOG, AND ASSOCIATED PARTS

3.17 Double-Dog Spring: To replace the double-dog spring, remove the double-dog spring mounting screw with the 3-inch C screwdriver.

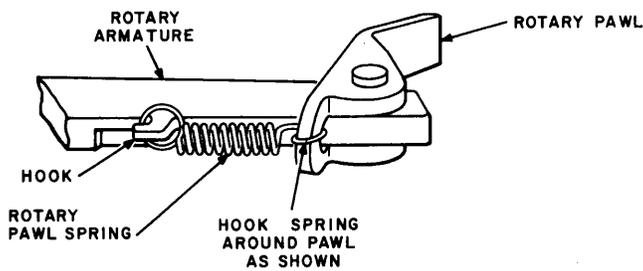


Fig. 21—Method of Attaching Pawl Spring to Rotary Armature Pawl

Place the new double-dog spring in position and insert and securely tighten the mounting screw.

3.18 Double-Dog Bearing Pin, Bearing Pin Clamp, and Double Dog: To replace any of these parts, loosen the double-dog spring mounting screw with the 3-inch C screwdriver and move the double-dog spring until it disengages the double dog. Disengage the double dog from the slot in the release link. Loosen the double-dog bearing pin clamp screw with the 4-inch E screwdriver of the 556A wrench, and withdraw the bearing pin vertically with the 485A pliers releasing the double dog. Replace the defective part. If the double dog is to be replaced, remove the protective finish from the double-dog bearings using KS-7860 petroleum spirits. Mount the double dog in position, and engage the bearing pin in the frame at the lower end of the double dog. Tighten the bearing pin clamp screw, and restore the double-dog spring to position. Tighten the double-dog spring mounting screw securely. Lubricate the bearing in accordance with Section 030-705-706.

3.19 Stationary Dog: To replace the stationary dog, remove the two stationary dog mounting screws with the 4-inch E screwdriver and remove the stationary dog. Mount the new stationary dog, taking care that the vertical pawl finger is over the lower lug of the stationary dog before fastening the stationary dog in position. Securely tighten the mounting screws.

RELEASE MECHANISM AND ASSOCIATED PARTS

3.20 Release Armature Adjusting Screw and Locknut: To remove the release armature adjusting screws and locknut, loosen the locknut with the 418A wrench and remove the release armature adjusting screw from the armature

with the 3-inch C screwdriver. Substitute the new part, mounting the screw with the threaded end toward the frame.

3.21 Release Armature Pin and Locknut and Release Armature Spring Arm:

To remove the release armature pin and locknut, loosen the locknut with the 418A wrench and remove the pin with the 417A wrench. On switches equipped with a release contact spring assembly, the removal of the pin will free the armature spring arm which may be replaced if necessary. Substitute the required part, and mount the parts in the armature. If the stud on the new arm touches springs other than the operating spring, bend the arm slightly with the 485A pliers.

3.22 Stud on Release Armature Spring Arm:

To replace the stud on the release armature spring arm, grasp the arm at a point just back of the stud with the 485A pliers and rotate the pliers slightly in such a direction as to force the stud from the lug of the arm. To mount the new stud in position on the arm, place the stud on the end of the lug. Grasp the front end of the stud and the arm behind the lug with the pliers, and compress the pliers slowly and steadily until the stud assumes its normal position on the lug. If difficulty is experienced in forcing the stud onto the arm, the arm may be heated slightly with a soldering copper which will soften the stud sufficiently to permit it to be forced into position on the arm.

3.23 Release Armature and Release Armature Retractable Spring

- (1) **General:** To replace the release armature retractile spring, proceed as described in
- (2). To replace a release armature, proceed as described in (3).
- (2) To replace the release armature retractile spring, proceed as follows.
 - (a) Remove the retractile spring mounting screw (where equipped) with the 3-inch C screwdriver. Where no retractile spring mounting screw is used, detach the spring from the release magnet bracket. In each case hold the spring taut with the 485A pliers, so the tension of the spring when released does not snap the screw and spring through the switch. Hold the spring with one of the

jaws of the pliers inserted between coils of the spring. Release the tension of the spring. Remove the armature and spring from the switch where conditions permit to facilitate removal of the spring. Remove the spring from the armature.

(b) In replacing the release armature retractile spring where the spring is connected to a lug staked in the armature, it is necessary to replace both the armature and the spring.

(c) Release armature retractile springs are of two types. On one type the hooks at both ends of the spring are formed parallel to the long axis of the spring. Where the replacement spring is of this type, discard the retractile spring mounting screw. On the other type of spring, the hook at one end is parallel to the long axis of the spring and the hook at the other end of the spring is perpendicular to the long axis. Where the replacement spring is of this type, the spring mounting screw must be retained.

(d) Hook the proper end of the release armature retractile spring through the hole in the release armature in such a position that the hook on the other end of the spring is below the spring. (Where the spring is of the type having both hooks parallel to the long axis of the spring, the smaller diameter hook is connected to the armature.) Place the armature on the lugs of the release magnet bracket, if it was removed, passing the spring between the top of the bracket and the frame of the switch. Stretch the spring with the 6-inch tweezers until the hook on the free end of the spring is in a position which will permit the insertion of the spring mounting screw where this is to be used, or until the spring can be inserted into the hole in the release magnet bracket. Insert the retractile spring mounting screw into position, where used, and tighten securely.

(3) **Release Armature:** To replace the release armature, proceed as follows.

(a) Remove the release armature retractile spring as described in (2). Remove both the spring and the armature from the switch. In some cases it may be necessary to remove the release contact spring assembly to permit

the armature to be lifted from the lugs on the release magnet bracket. Remove the release armature retractile spring from the armature. Remove the parts from the old armature as covered in paragraph 3.21, and place them on the new one.

(b) In replacing the release armature where the release armature retractile spring is connected to a lug staked in the armature, it is necessary to replace both the armature and the spring.

(c) In certain cases where the new armature interferes with the bracket on the release contact spring assembly, dismount this assembly as follows: Unsolder the leads connected to the release contact springs. Remove the screw which mounts the release contact spring assembly bracket to the frame with the 563A and 564A offset screwdrivers. Remove the release contact spring assembly from the frame by drawing the assembly toward the front or rear of the switch as required to free the contact springs from the stud on the release armature. File the bracket with a 6-inch half-round second cut commercial file until satisfactory clearance is assured. Varnish the filed portion of the bracket.

(d) Mount the release armature and its associated retractile spring as described in (2)(c). Remount the release contact spring if it was removed.

3.24 Release Magnet: To replace the release magnet, unsolder the leads connected to the terminals of the magnet. Lift the armature from the lugs on the release magnet bracket, and rotate it to a position at right angles to normal. It may be necessary to remove the release contact spring assembly to permit the armature to be lifted from the lugs on the bracket. Remove the magnet mounting screw with the 4-inch E screwdriver, and withdraw the magnet from the right side of the switch. Place the new magnet in position with the two terminals on the spoolhead pointing toward the rear of the switch, and fasten it in place by tightening the mounting screw securely. Connect the leads to the magnet, and restore the armature to position. Remount the release contact spring assembly if it was removed.

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3.25 Release Link: To replace the release link, remove the release link screw with the 418A wrench. Disengage the slot in the link from the double dog, and withdraw the link from the left-hand side of the switch. Place the new link in position, and mount the release link washer and screw. Adjust the position of the link, and tighten the screw.

3.26 Release Magnet Bracket

(1) To replace the release magnet bracket, remove the release armature as described in subparagraph 3.23(1) and remove the release link as described in paragraph 3.25. On switches equipped with a bell crank operated vertical interrupter spring assembly per Fig. 19, remove the screws which hold the spring assembly bracket to the release magnet bracket with the 3-inch C screwdriver and remove the spring assembly. Remove the screw which holds the magnet to the magnet bracket with the 4-inch E screwdriver. When replacing the release magnet bracket on switches having a cover stud mounted in place of the left magnet mounting screw, mount the cover stud in place of the bracket mounting screw to the right of the shaft. On switches equipped with the type vertical interrupter spring assembly per Fig. 5 and 6, remove the screws which mount this assembly using the 4-inch E screwdriver. This will permit the assembly to be moved away from the switch sufficiently to permit the withdrawal of the magnet bracket.

(2) Remove the screw at the bottom of the magnet bracket with the 4-inch E screwdriver. Remove the release magnet bracket mounting screw or screws and, where provided, remove the switch cover guide stud from the front of the frame on the left with the 4-inch E screwdriver. Withdraw the magnet bracket from the left-hand side of the switch, taking care that the connections of the magnet and vertical interrupter springs are not broken or strained in this operation.

(3) Place the new magnet bracket in position. Remount the switch cover guide stud, where provided, in the mounting hole to the right of the shaft. Discard one mounting screw, leave the mounting hole to the left of the shaft empty, tighten the magnet bracket mounting screw, and fasten the magnet in position on the magnet bracket. Remount the vertical interrupter spring assembly. Remount the release armature and

release link as described in paragraphs 3.23 and 3.25, respectively.

SHAFT AND ASSOCIATED PARTS

3.27 Cam and Cam Clamp Plate: To replace the cam and cam clamp plate, raise the shaft to the fifth or sixth level with the double dog out of the slot in the release link. Loosen the cam clamp screw with the 3-inch C screwdriver sufficiently to release the cam. Substitute the new part, taking care that the cam is in the proper position for operating the cam springs before tightening the cam clamp screws.

3.28 Cam Collar: To replace the cam collar, raise the shaft to the fifth or sixth level with the double dog out of the slot in the release link. Remove the cam clamp screws with the 3-inch C screwdriver. Place the point of the screwdriver between the two clamping surfaces of the cam collar, and spread the cam collar open until it can be removed from the shaft. Using the screwdriver, spread the new cam collar in the same manner as the collar which was removed from the shaft and place the new collar in position on the shaft. Squeeze the two clamping surfaces of the cam collar together with the 485A smooth jaw pliers, and replace the cam and the cam clamp plate. Adjust the cam to its proper position for operating the cam springs, and tighten the clamping screws securely.

HELICAL-TYPE SHAFT SPRING ASSEMBLY AND ASSOCIATED PARTS (Fig. 22)

3.29 Shaft Spring

(1) **General:** To replace the shaft spring, proceed as covered in (2) and (3). To remove the shaft spring to permit the replacement of other parts, where the shaft spring itself is not to be replaced, proceed as covered in (4).

(2) To replace the shaft spring, grasp the spring cap with the fingers and turn the cap in a clockwise direction as far as the bayonet slot in the shaft extension sleeve will permit. Then lift the cap so the crossbar is free of the slot in the shaft extension sleeve, and allow the spring to unwind slowly. Disengage the lower loop of the spring from the lug on the shaft spring bracket, and remove the spring by lifting it from the shaft extension sleeve.

- (3) Lubricate the shaft extension sleeve as covered in Section 030-705-706. Place the new spring over the sleeve, and engage the lower loop of the spring with the lug on the shaft spring bracket. Then turn the shaft spring cap in a clockwise direction. After each quarter turn, the crossbar in the spring cap may be dropped into the slots in the shaft extension sleeve to maintain the tension while a new hold is secured for any further increase in tension that may be necessary. When finally adjusted, observe that the crossbar in the spring cap is engaged in the bayonet slots so as to lock the spring firmly in the adjusted position. Check that the shaft spring tension requirement is met.
- (4) If the shaft spring is to be removed to permit the replacement of other parts, but is not itself to be replaced, place a vertical pencil mark on the shaft spring below the cap to facilitate remounting the spring. Remove the shaft spring as covered in (2), and make the necessary replacements of the other parts. Then mount the shaft spring as covered in (3). When doing this, continue to turn the shaft spring until the pencil marks placed on the shaft spring again form a vertical line. The shaft spring will then probably have the same tension as it did prior to its removal. Check that the shaft spring tension requirement is met.

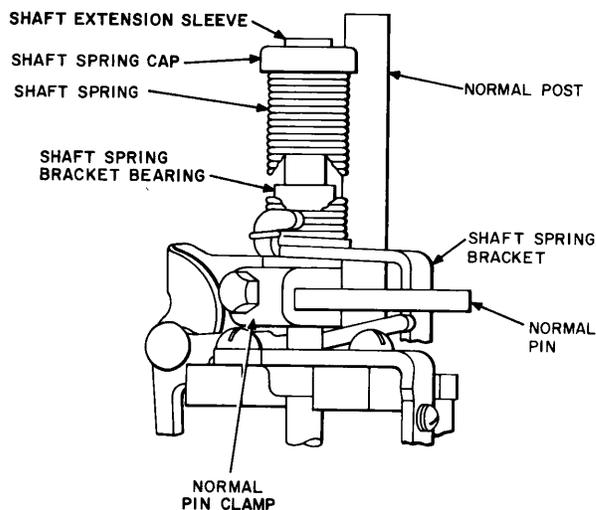


Fig. 22—Helical-Type Shaft Spring Assembly

3.30 Shaft Spring Bracket

- (1) To replace the shaft spring bracket, first remove the normal post springs, when so equipped, by loosening the spring assembly setscrew with the 3-inch C screwdriver or the $\nabla 476A \blacklozenge$ wrench and lifting the assembly from the normal post. Then remove the shaft spring as described in subparagraph 3.29(1). Remove the shaft spring bracket by lifting it upward until it is free of both the shaft extension sleeve and the normal post.
- (2) Guide the new shaft spring bracket into position so the shaft spring bracket bearing goes over the sleeve and so the rear of the shaft spring bracket encircles the normal post. When in position, observe that the normal pin stop is between the normal post and the normal pin. Place the shaft spring in position as described in subparagraph 3.29(2).

3.31 Normal Pin

- (1) To replace the normal pin, remove the shaft spring as described in subparagraph 3.29(1). Then loosen the normal pin clamp screw with the 556A wrench, and withdraw the pin. Substitute the new pin as described in (2).
- (2) Turn the shaft extension sleeve so the key slot in the sleeve coincides with the slot in the switch shaft. Locate the normal pin clamp on the sleeve so the normal pin clamp screw is opposite the slots in the shaft and sleeve. Then insert the normal pin in the clamp so the pin engages the slots in both the shaft and the sleeve, and tighten the clamp screw with the 556A wrench until the point of the screw touches the normal pin. In order to be sure that the pin engages the slot in both the shaft and the sleeve, loosen the clamp screw approximately one-fourth turn and, while holding the shaft stationary, turn the sleeve on the shaft and note the amount of play. If the pin engages the slot in both the shaft and the sleeve, the movement of the sleeve will be limited by the normal pin while, if the pin engages the slot in the sleeve only, the sleeve will be free to turn on the switch shaft. Observe that the normal pin stop is between the normal post and the normal pin. Tighten the clamp screws securely, taking care not to bend the shaft or shear off the head of

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the screw. Place the shaft spring in position as described in subparagraph 3.29(3).

3.32 *Normal Pin Clamp and Shaft Extension Sleeve*

(1) To replace the normal pin clamp and the shaft extension sleeve, remove the shaft spring as described in subparagraph 3.29(1). Then lift the shaft spring bracket so the shaft spring bearing clears the sleeve, and turn the bracket on the normal post so it will not interfere with the removal of the normal pin clamp. Remove the normal pin as described in subparagraph 3.31(1), and then lift the clamp and the shaft extension sleeve from the switch shaft.

(2) Substitute the new sleeve on the switch shaft, slip the new clamp over the sleeve, and then tighten the normal pin in position as described in subparagraph 3.31(2). After tightening the clamp screw, observe that the clamp strikes the upper shaft bearing squarely. Where it is found that the clamp strikes the bearing on one side instead of squarely, reverse the clamp so the surface formerly adjacent to the bracket is adjacent to the bearing. If the clamp still fails to strike squarely, it will be necessary to replace the clamp with one that does strike squarely. After the normal pin and clamp are properly located, tighten the clamp screw securely, taking care not to bend the shaft or shear off the head of the screw. Place the shaft spring bracket bearing of the shaft spring bracket over the sleeve with the normal pin stop between the normal post and the normal pin, and remount the shaft spring in position as described in subparagraph 3.29(2).

CUP-TYPE SHAFT SPRING ASSEMBLY AND ASSOCIATED PARTS

3.33 *General:* When it is necessary to replace the spring cup, shaft spring cup bracket, normal post collar, or a long normal post, replace the entire shaft spring assembly. To do this, remove the parts in the following manner. On switches equipped with normal post springs, remove the normal post spring assembly from the normal post by loosening the setscrews with the 3-inch C screwdriver or with the 476A wrench. Loosen the screw or screws, holding the spring cup assembly to the shaft with the 3-inch C screwdriver, and

allow the spring cup to rotate until the spring tension is entirely released. Then lift the spring cup assembly and shaft spring cup bracket from the top of the shaft. Loosen the normal pin clamp screw with the 4-inch E screwdriver or with the 556A wrench. Withdraw the normal pin from the side of the switch, and remove the normal pin clamp from the top of the shaft. Mount the parts of the helical-type shaft spring assembly as covered in subparagraph 3.32(2). Make sure in this case that the normal pin clamp screw does not interfere with the lever on the vertical off-normal spring assembly on the tenth or eleventh rotary step. If interference exists, loosen the vertical off-normal spring assembly clamping screws with the 563A or 564A offset screwdriver or the 417A wrench. Shift the vertical off-normal spring assembly, as required, to give clearance. Tighten the mounting screws.

3.34 *Normal Pin:* To replace the normal pin, loosen the normal pin clamp screw with the 4-inch E screwdriver or the 556A wrench. Remove the normal pin. To substitute the new pin, place the clamp so that the clamp screw is opposite the slot in the shaft. Then insert the pin in the clamp so it engages the slot in the shaft, and tighten the clamp screw. When using the 556A wrench, do not tighten the screw sufficiently to bend the shaft nor shear off the head of the screw.

3.35 *Normal Pin Clamp*

(1) To replace the normal pin clamp, remove the normal pin as described in paragraph 3.34. Loosen the screw or screws, holding the spring cup assembly to the shaft with a 3-inch C screwdriver. Raise the cup spring and shaft spring cup bracket assemblies until they are free of the shaft. Remove the normal pin clamp.

(2) Slip the new clamp over the shaft, and then tighten the pin in position as described in paragraphs 3.34. After tightening the clamp screw, observe that the clamp strikes the shaft bearing squarely. Where it is found that the pin clamp strikes the bearing on one side instead of squarely, reverse the clamp so that the surface formerly adjacent to the shaft spring bracket is adjacent to the bearing. If the clamp still fails to strike squarely, it will be necessary to replace it with one that does strike squarely. After the normal pin and clamp are properly located, place the shaft spring cup bracket and spring cup over the shaft and lower them into position

with the normal pin stop between the normal post and the normal pin. Place the spring cup assembly in the shaft spring cup bracket as shown in Fig. 23, taking care that the spring is properly engaged in the slot of the shaft spring cup bracket. Rotate the spring cup in a clockwise direction until the proper tension is obtained on the shaft, and tighten the spring cup setscrew securely. On switches that are equipped with shafts which are spotted to receive the setscrew in the cup assembly, take care that the setscrew engages one of the spots countersunk in the shaft, so the head of the setscrew will not interfere with the operation of the normal post springs.

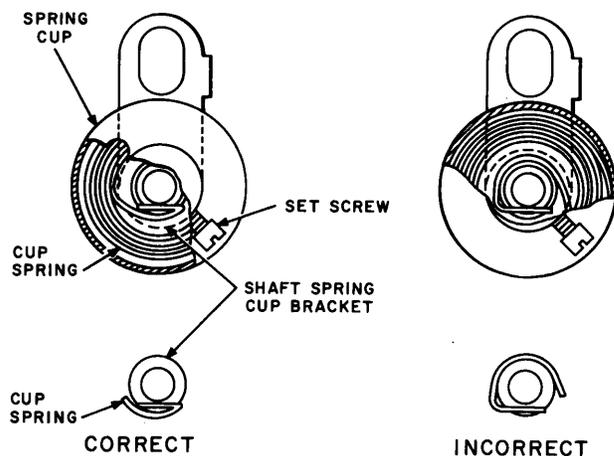


Fig. 23—Correct and Incorrect Methods of Attaching Spring Cup Spring to the Shaft Spring Cup Bracket

BEARINGS AND HOLDERS

NOTE: Do not replace oil felt washers when the procedures outlined in paragraphs 3.36 and 3.37 are performed on older switches. New products are manufactured without felt washers.

3.36 Upper Shaft Bearing and Holder

- (1) To replace any of these parts, remove the shaft spring assembly and associated parts as described in paragraphs 3.29 through 3.32 (helical shaft spring assembly) or paragraphs 3.33 through 3.35 (cup-type shaft spring assembly).

- (2) Loosen the double-dog spring mounting screw with the 3-inch C screwdriver, and swing the spring toward the front of the switch so it disengages the double-dog. Remove the two upper shaft bearing mounting screws and remove the bearing, the double-dog spring, and holder from the top of the shaft.

- (3) Reassemble the parts. Loosen the lower bearing mounting screws, and shift the shaft as far to the rear of the switch as the holes in the bearing permit. Tighten the bearing mounting screws securely. Lubricate the parts in accordance with Section 030-705-706.

3.37 Lower Shaft Bearing and Holder

- (1) To replace any of these parts, loosen the setscrews in the wiper hubs with the 3-inch C screwdriver on the 476A wrench. Remove the wipers from the shaft.

- (2) Remove the two mounting screws in the lower shaft bearing with the 3-inch C screwdriver and remove the holder from the lower end of the shaft.

- (3) **Where the Lower Bearing Can Pass Through the Hole in the Coverplate:** Remove the bearing from the end of the shaft. Mount a new holder. Place the bearing and holder on the shaft, and pass them through the hole in the coverplate. Fasten the bearing mounting screws in position. Then loosen the upper bearing mounting screws, and shift the shaft as far to the rear of the switch as the holes in the bearing permit. Tighten the bearing mounting screws securely, and remount the wipers on the shaft. Lubricate the parts in accordance with Section 030-705-706.

- (4) **Where the Lower Bearing Cannot Pass Through the Hole in the Coverplate:** Remove the two bank clamping nuts using the 417A wrench, and lower the banks. Remove the screws which hold the coverplate to the frame with the 3-inch C screwdriver. Lower the coverplate below the shaft. Where wiring interferes with lowering the right side of the coverplate, keep this side stationary and tilt the left side of the coverplate downward sufficiently to permit removing it from the end of the shaft. Remove the bearing from the lower end of the shaft. Replace the bearing

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on the shaft. Remount the coverplate. Mount a new holder, and fasten them securely in position. Then loosen the upper bearing mounting screws, and shift the shaft as far to the rear of the switch as the holes in the bearing permit. Tighten the bearing mounting screws securely, and remount the wipers on the shaft. Lubricate the parts in accordance with Section 030-705-706.

SHAFT

3.38 *Shaft*

(1) Remove the shaft spring assembly and associated parts as described in paragraphs 3.29 through 3.32 (helical shaft spring assembly) or paragraphs 3.33 through 3.35 (cup-type shaft spring assembly). Remove the wipers from the shaft as covered in subparagraph 3.37(1). Then remove the upper shaft bearing and associated parts as covered in subparagraph 3.36(2). Remove the lower holder as described in subparagraph 3.37(2).

(2) ***Where the Lower Bearing Can Pass Through the Hole in the Coverplate:*** Remove the bearing from the lower end of the shaft. Move the top of the shaft forward, and lift it out of the coverplate.

(3) ***Where the Lower Bearing Cannot Pass Through the Hole in the Coverplate:*** In some cases it may be necessary to loosen the two screws holding the coverplate to the switch frame to permit the lower bearing to be moved forward. Hold the top of the shaft between the thumb and forefinger, and grasp the lower part of the shaft at the point just below the coverplate. Exert a slight pressure toward the front of the switch. In this manner the lower bearing may be moved toward the front of the switch far enough to permit the removal of the shaft.

(4) ***Remounting Shaft:*** Where the shaft is equipped with a cam, remove the cam from the shaft and mount it on the new shaft using the 3-inch C screwdriver. Place the lower bearing between the frame and the coverplate, and pass the shaft through the bearing and coverplate from above. Replace the lower shaft bearing where necessary. Mount the holder on the shaft from the bottom, and partially tighten the bearing mounting screws. Remount the upper shaft

bearing, the normal pin clamp, normal pin, shaft spring bracket, and shaft spring on the switch, as covered in paragraphs 3.29 through 3.36, replacing these parts where necessary. Mount the shaft as far toward the rear of the switch as the holes in the shaft bearings permit, and tighten the bearing mounting screws securely. Remount the wipers on the shaft.

NORMAL POST AND NORMAL POST CAM (Fig. 24)

3.39 *Short Normal Post (Used on Switch Not Having Normal Post Springs)*

(1) To replace a short normal post, raise the shaft to the fifth or sixth vertical step (197-type switches) with the double dog out of the slot in the release link. Remove the normal post by turning it in a counterclockwise direction with the 418A wrench. When the normal post is free of the frame, hold the post in position with the thumb and forefinger of the right hand and rotate the normal post and shaft manually to a position where the normal post may be withdrawn from the lower side of the shaft spring bracket.

(2) Place the new normal post in the slot in the shaft spring bracket in the same position as the old normal post, holding it in position with the thumb and forefinger of one hand. With the other hand, engage the double dog with the release link and carefully rotate the switch to rotary normal. Release the double dog from the slot in the release link thus holding the shaft in position on the fifth or sixth vertical step. Place the normal post in position on the frame, and tighten it securely with the 418A wrench.

3.40 *Long Normal Post (Used on Switch Having Normal Post Springs):*

To replace a long normal post, remove the normal post spring assembly setscrew or screws with the 3-inch C screwdriver or the $\diamond 476A$ wrench and lift the spring assembly from the top of the normal post. Then replace the normal post as described in subparagraph 3.39(2). Where a normal post cam is provided, guide the normal post between the mounting lugs of the normal post cam. Remount the normal post springs on the normal post in their proper position, and securely tighten the setscrew or screws.

3.41 Extra Long Normal Post and Normal Post Collar: To replace an extra long normal post or normal post collar, discard the normal post collar, replace the normal post with the standard long normal post used with normal post springs as described in paragraph 3.40, and equip the switch with a complete helical shaft assembly.

3.42 Release Magnet Attachable Stop

- (1) On switches equipped with a release spring assembly, loosen the spring assembly mounting screw with the 563A or 564A offset screwdriver. Disengage the release spring assembly from the stud on the release armature arm, and swing it out of the way sufficiently to permit the release armature to be removed from the release bracket. Remove the release armature and the attachable stop from the lugs of the bracket.
- (2) Mount the new attachable stop and then the release armature on the lugs of the release magnet bracket. If provided, mount the release spring assembly in position and securely tighten the assembly mounting screw. Check the requirements for the release mechanism covered in Section 030-705-702 and the requirements for the release spring assembly covered in Section 030-705-703.

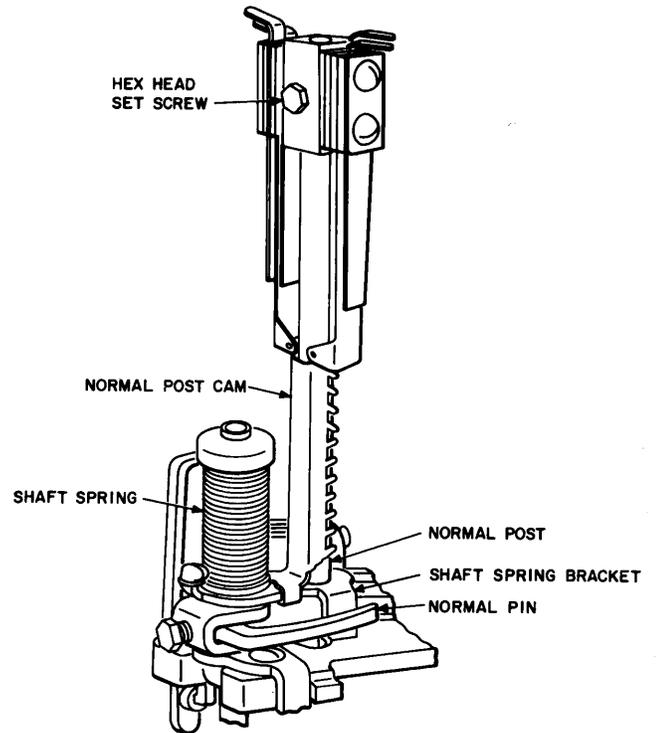


Fig. 24—Normal Post Spring Assembly Operated by Normal Post Cam and Rollers