

*BSM # 840B*

# 197- AND 198-TYPE SWITCHES

## PAWLS AND PAWL PINS

### PIECE-PART DATA AND REPLACEMENT PROCEDURES

#### 1. GENERAL

1.01 This section covers the piece-part data and replacement procedures for pawls and pawl pins of 197- and 198-type switches.

1.02 This section is reissued to revise the procedures covering replacement of vertical and rotary pawls and pawl pins. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted. Detailed reasons for reissue will be found at the end of the section.

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. This information is called "Piece-Part Data."

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2. This information is called "Replacement Procedures."

1.05 Information enclosed by parentheses ( ) is not ordering information. This information may be references 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. PIECE-PART DATA

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

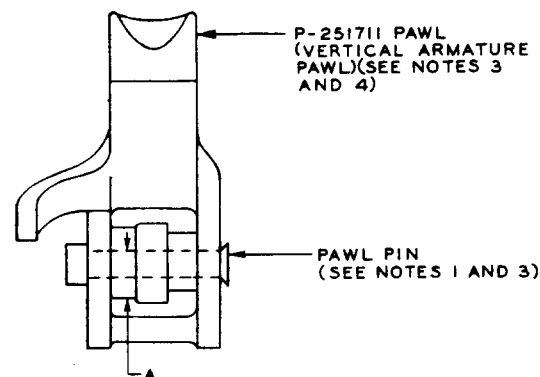


Fig. 1 - Vertical Pawl and Pawl Pin

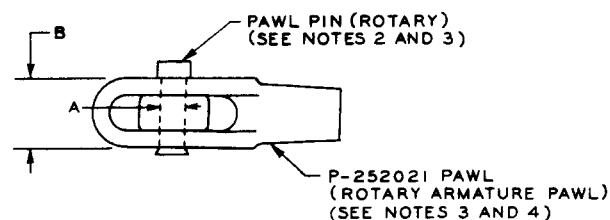


Fig. 2 - Rotary Pawl and Pawl Pin

#### Notes for Fig. 1 and 2

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

PAWL PIN (vertical)	PIN DIAMETER "A" (see 3.10)
P-252534	0.090
P-252535	0.094
P-252536	0.105

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

PAWL PIN (rotary)	PIN DIAMETER "A" (see 3.19)
P-252537	0.094
P-252538	0.105
P-252539	0.090

## SECTION 030-705-805

3. Before replacing a pawl or pawl pin, check the mounting holes in the pawl and the bearing in the armature as covered in 3.03 and determine the replacement pawl pin required as covered in 3.10 for vertical pawl pins and 3.19 for rotary pawl pins.
4. Replace pawls only where a 0.105-inch diameter pawl pin will fit. Where a 0.105-inch pawl pin will not fit, replace the armature assembly as covered in Section 030-705-802.

### 3. REPLACEMENT PROCEDURES

#### 3.01 *List of Tools and Gauges*

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
417A	1/4-Inch and 3/8-Inch Hex. Open Double-End Flat Wrench
485A	Smooth Jaw Pliers
†494B	Pawl Pin Remover
†495A	Pawl Pin Replacer
†496A	Pin Pliers
556A	7/32-Inch Hex. Double-End Offset Socket Wrench
563A	90° Offset Screwdriver
564A	45° Offset Screwdriver
KS-6320	Orange Stick
R-1051	6-Inch Pillar File
P-220366	Dental Mirror
—	4-Ounce Riveting Hammer
—	1/16-Inch Pin Punch
—	P-Long-Nose Pliers
—	3-Inch C Screwdriver
—	4-Inch E Screwdriver
—	6-Inch Tweezers, "Piano," Hammacher Schlemmer and Co. No. 56 (or equivalent)
<b>GAUGES</b>	
†130A	0.089-Inch and 0.093-Inch Double-End Plug Gauge

†These tools and gauges are part of the 1001A tool kit.

#### **Check of Vertical and Rotary Pawl and Pawl Pin (before removing pawl pin)**

**3.02** Before removing a pawl pin, make the following checks to determine the parts requiring replacement.

(1) Check the pawl for wear using the P-220366 dental mirror. Check the rotary pawl for cracks in the bend in the pawl (see Fig. 11). If the vertical pawl on an armature with an armature arm requires replacement, replace the vertical armature assembly in accordance with Section 030-705-802.

(2) Determine whether the pawl pin is tight or loose in the pawl. To do this, hold the armature unoperated with the KS-6320 orange stick and move the pawl manually. If there is more than 0.015-inch play between the pawl and pin as gauged by eye and feel, remove the pin and pawl if required, in accordance with 3.04 for vertical pawls and 3.14 for rotary pawls. After removing the pawl pin, check the parts as covered in 3.03.

#### **Check of Vertical and Rotary Armature and Pawl (after removing pawl pin)**

**3.03** After removing the pawl pin, check the bearing in the armature and the mounting holes in the pawl for excessive wear. An armature bearing or pawl hole is excessively worn if it appears to be oval as gauged by eye. If the armature bearing or the holes in the pawl are excessively worn on a vertical armature assembly having an armature arm, replace the entire armature assembly in accordance with Section 030-705-802. If one or both holes in the pawl on other armature assemblies are excessively worn, replace the pawl as covered in 3.12 and 3.13 for vertical pawls or 3.21 and 3.22 for rotary pawls. If the armature and pawl are in satisfactory condition, replace the pin as covered in 3.07 through 3.11 for vertical pawl pins or 3.17 through 3.20 for rotary pawl pins.

#### **REPLACEMENT OF VERTICAL PAWL AND PAWL PIN**

**3.04 General:** In order to replace a vertical pawl, it is necessary to remove the vertical armature assembly from the switch as covered in 3.05. Replacement of a vertical pawl pin may or may not require removal of the armature assembly depending on the type of pawl pin and

on whether the pin is tight or loose in the pawl. Procedures for replacing vertical pawl pins are covered in 3.07 through 3.11 and for replacing vertical pawls in 3.12 and 3.13.

### 3.05 *Removing Vertical Armature Assembly:*

If it is necessary to remove the vertical armature assembly (see 3.04), proceed as follows.

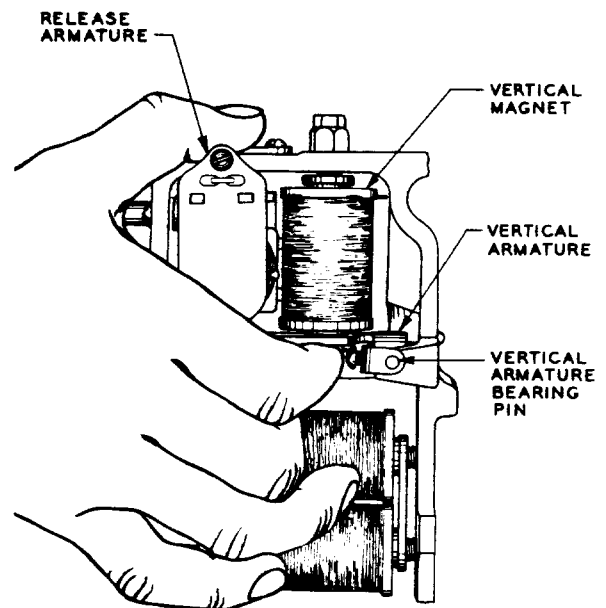
- (1) Lift the release armature from the lugs on the release magnet bracket and rotate the armature so that it is approximately at right angles to its normal position. If the release contact spring assembly obstructs removal of the armature, loosen the spring assembly mounting screw, using the 563A and 564A offset screwdrivers, and suspend the spring assembly by its leads, taking care not to damage the leads.
- (2) Loosen the screw in the vertical armature bearing pin clamp, using the 4-inch E screwdriver or the 556A wrench. Press the vertical armature spring downward and swing it to the right as far as possible.
- (3) Tap lightly on the left end of the armature bearing pin, using the pin punch and if necessary the 4-ounce riveting hammer until the right side of the bearing pin can be grasped with the fingers or 485A pliers. Remove the pin and pin clamp. See Fig. 3.
- (4) Working from the right side of the switch, lower the armature end of the assembly and rotate the assembly to disengage the armature lug from the release link. Remove the armature assembly from the switch.

### 3.06 *Mounting Vertical Armature Assembly*

- (1) Hold the armature assembly with the pawl pin vertical, the pawl finger uppermost, and the armature spring swung against the armature bearing lug. Insert the pawl behind the double dog, tilting the pawl downward so that the pawl finger clears the switch frame. Then lower the armature end of the assembly below the armature pin mounting lug on the frame and rotate the assembly into place so that the lug on the armature engages the release link, the slot at the rear of the armature registers with the associated pin in

the frame, and the armature bearing holes are in line with the corresponding holes in the frame.

- (2) Insert the bearing pin from the left side of the switch, positioning the armature from the right side as required so that the pin enters the two bearing pin holes in the armature. Position the bearing pin clamp on the mounting lug of the frame and push the bearing pin through the holes in the clamp. If necessary, tap the pin lightly on the left end. Tighten the bearing pin clamp screw using the 4-inch E screwdriver or 556A wrench. Swing the armature spring into position so that it engages the "T" head of the armature spring adjusting screw. Remount the release armature on the release magnet bracket lugs. If the release contact spring assembly was removed, position the spring assembly mounting bracket under the head of the mounting screw. Before tightening the screw, make sure that the springs are behind the release armature stud and in position to be engaged squarely by the stud.



**Fig. 3 – Method of Supporting the Vertical Armature While Removing or Remounting the Bearing Pin**

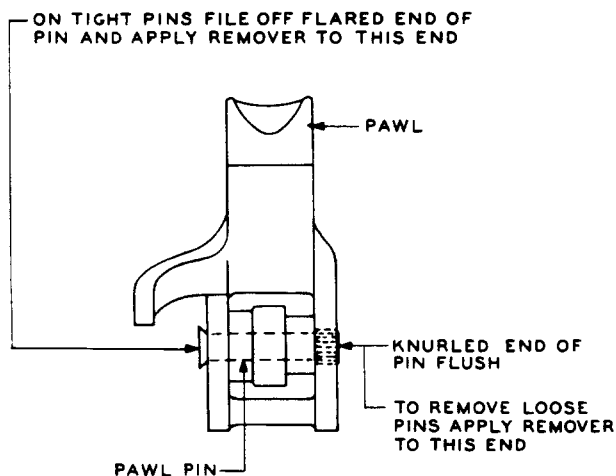
## Replacing Vertical Pawl Pin

## 3.07 Removing Vertical Pawl Pin per Fig. 4

## (1) Loose Pawl Pin

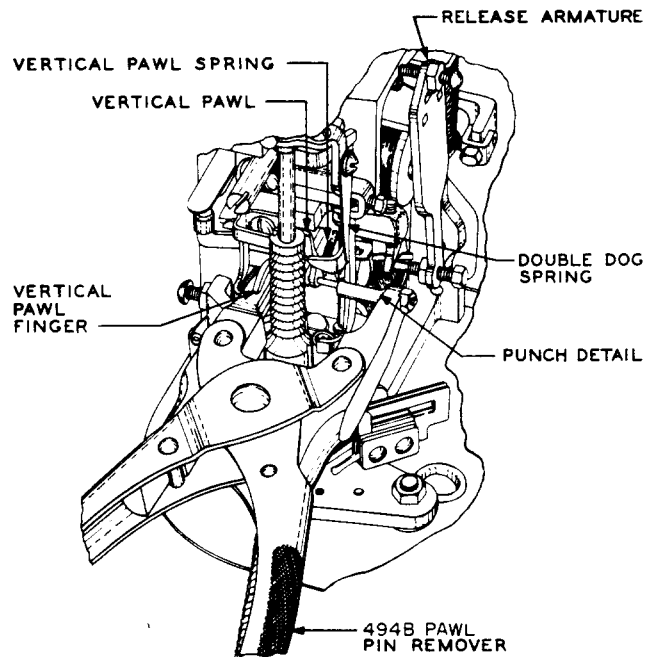
(a) Set the punch detail of the 494B pawl pin remover so that the flattened surface faces away from the handles of the remover. To change the position of the punch detail, loosen the nut with the 417A wrench. Hold the remover directly in front of the switch with the punch detail toward the right.

(b) Slide the beveled jaw of the remover between the vertical pawl finger and the lower lug of the stationary dog until the left jaw of the remover straddles the flared end of the pin.



**Fig. 4 – Vertical Pawl with Headless-Type Pawl Pin Having Knurl at Right of Pawl**

(c) Place the punch detail directly in line with the knurled end of the pin as shown in Fig. 5. In some cases, changing the position of the double dog may aid in lining up the punch detail. Then, compress the tool until the pin is ejected from the pawl. In some cases, it will be necessary to complete the removal of the pin with the P-long-nose pliers.



**Fig. 5 – Position of 494B Pawl Pin Remover When Loose Pawl Pin is Removed From the Right**

## (2) Tight Pawl Pin

(a) Remove the vertical armature assembly from the switch as covered in 3.05. Remove the pawl spring using the 6-inch tweezers. Replace the spring, if necessary (Section 030-705-802).

(b) File off the flared end of the pawl pin with the R-1051 pillar file, taking care not to mar the finish of the pawl. Apply the punch detail of the 494B pawl pin remover to the filed end of the pin and straddle the other end of the pin with the split jaw of the remover. Compress the handles of the pawl pin remover until the pin is ejected from the pawl. In some cases it will be necessary to complete the removal of the pin with the P-long-nose pliers.

## 3.08 Removing Vertical Pawl Pin per Fig. 6

## (1) Loose Pawl Pin

(a) Set the punch detail of the 494B pawl pin remover so that the flattened surface of the detail is toward the handles of

the remover. To change the position of the punch detail, loosen the nut with the 417A wrench.

(b) Hold the remover so that the punch detail is at the left as shown in Fig. 7. Tip the handles slightly upward and slide the remover so that the punch detail passes to the rear of the lower lug of the stationary dog. If the armature has an armature arm, slide the remover so that the punch detail is under the vertical armature arm by lifting the armature arm slightly upward.

(c) Rotate the remover from left to right so that the handles are directly in front of the switch. Exercise care not to mar or damage the switch shaft during this operation. Place the remover over the pin so that the punch detail is directly in line with the knurled end of the pin, and the split jaw of the remover straddles the other end of the pin as shown in Fig. 8.

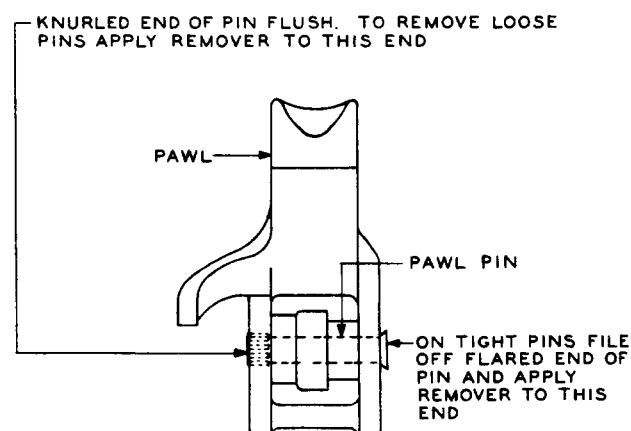
(d) Compress the remover handles until the pin is ejected from the pawl. In some cases it will be necessary to complete the removal of the pin, using the P-long-nose pliers. If it is not possible to draw the pin straight out due to interference with the double dog, it will be satisfactory to force the pin slightly forward in order to remove it.

## (2) *Tight Pawl Pin*

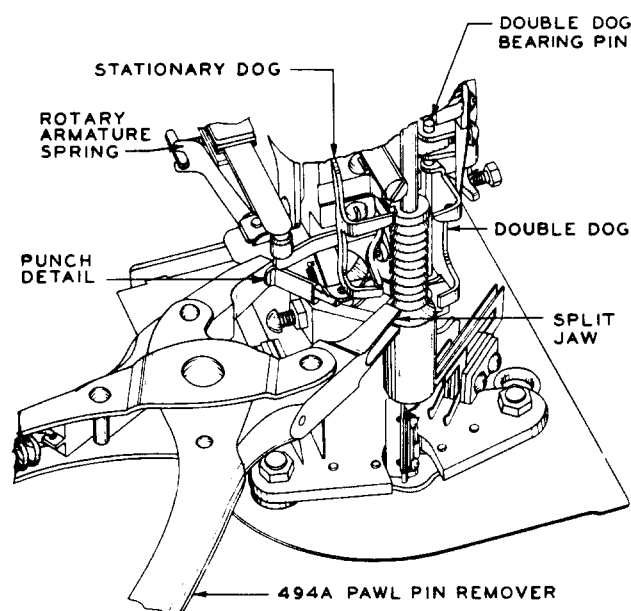
(a) Remove the vertical armature assembly from the switch as covered in 3.05.

(b) File off the flared end of the pawl pin using the R-1051 pillar file, taking care not to mar the finish of the vertical pawl. Position the 494B pawl pin remover so that its punch detail is directly in line with the filed end of the pawl pin, its split jaw straddles the knurled end of the pin, and the beveled side of the jaw is adjacent to the vertical pawl finger. Compress the handles of the tool until the pin is ejected from the pawl. In some cases it will be necessary to complete the removal of the pin with the P-long-nose pliers.

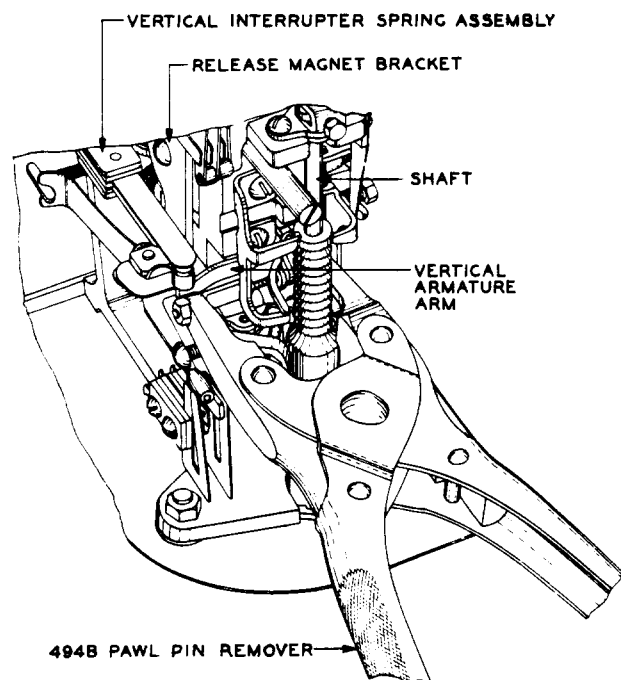
**3.09 Removing Vertical Pawl Pin per Fig. 9 and 10:** Remove both loose and tight pawl pins as covered in 3.07(2).



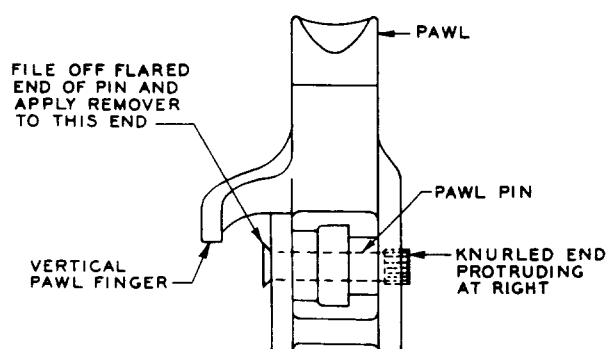
**Fig. 6 – Vertical Pawl with Headless-Type Pawl Pin Having Knurl Flush at Left of Pawl**



**Fig. 7 – Method of Inserting the 494B Pawl Pin Remover Showing the Shoulder of the Punch Detail in Line with the Vertical Edge of the Casting Which Mounts the Rotary Pawl Guide**



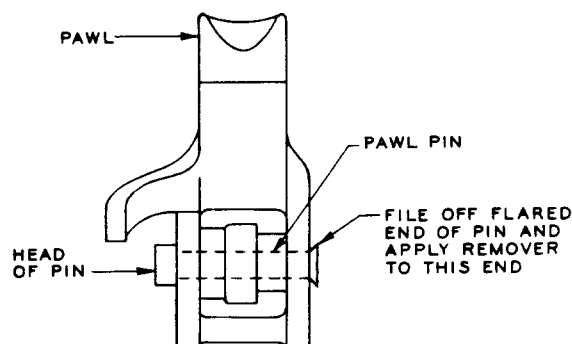
**Fig. 8 – Position of 494B Pawl Pin Remover When Removing Loose Pawl Pins From the Left**



**Fig. 9 – Vertical Pawl with Headless-Type Pawl Pin Having Knurl Protruding at Right of Pawl**

### 3.10 Determination of Replacement Vertical Pawl Pin Required

(1) If a headless-type vertical pawl pin with a protruding knurl (Fig. 9) is being replaced, make sure that the P-252536 pawl pin (Note 1 for Fig. 1 and 2) is used as the replacement.



**Fig. 10 – Vertical Pawl with Headed-Type Pawl Pin Used for Replacement Purposes**

(2) If other than the headless-type pawl pin covered in (1) is being replaced, determine the proper replacement pin as follows. Attempt to insert the 0.093-inch end of the 130A gauge into the mounting holes of the pawl and the bearing of the armature. If the gauge does not enter the armature and pawl, use the P-252534 (0.090-inch diameter) pawl pin. (See note 1 for Fig. 1 and 2.) If the gauge enters but is snug, use the P-252535 (0.094-inch diameter) pawl pin, and if the gauge is loose, use the P-252536 (0.105-inch diameter) pawl pin.

**3.11 Mounting Vertical Pawl Pin:** To mount the vertical pawl pin proceed as covered in (1) if the vertical armature assembly was removed from the switch or as covered in (2) if the armature assembly was not removed.

#### (1) Armature Assembly Removed

(a) Remove the pawl spring from the pawl using the 6-inch tweezers. Position the pawl in the armature and insert the replacement pawl pin in the mounting holes of the pawl and the bearing of the armature from the left. Check the play between the pawl and pin. If the play exceeds 0.015 inch as gauged by eye and feel, substitute a new pawl and pin as covered in 3.13.

(b) Hold the 495A pawl pin replacer so that the riveting stud detail is over the head of the pawl pin and the riveting pin detail fits in the opening at the other end of the pin. Then, hold the replacer against

the pin so that the head of the pin is against the side of the pawl and compress the handles firmly to flare out the end of the pin. Check for the requirement covering vertical pawl play in Section 030-705-702.

(c) Check the pawl spring and if it has closed loops on each end or is distorted, replace it (Section 030-705-802). Hook the open loop end of the pawl spring in the hole in the pawl with the end of the open loop outward. Hook the other end over the armature hook or pin. The tension of the spring should be sufficient to hold the pawl in its extreme forward position.

(d) Mount the vertical armature assembly as covered in 3.06.

## **(2) Armature Assembly Not Removed**

(a) Line up the holes in the pawl with the bearing hole in the armature and insert one end of the 130A gauge (the larger diameter end, if possible) into the armature bearing hole through the hole at the right side of the pawl. With the pawl held on the armature by the gauge, grasp the pawl pin in the grooves of the 496A pin pliers and position the pliers between the vertical pawl finger and the lower lug of the stationary dog. Insert the pawl pin into the pawl holes and armature bearing from the left while withdrawing the 130A gauge from the right. If the stationary dog interferes with insertion of the pin, it may be necessary to remove the stationary dog. However, do not remove the stationary dog unless it is absolutely necessary. Check the play between the pawl and pin. If the play exceeds 0.015 inch as gauged by eye and feel, substitute a new pawl pin as covered in 3.12 and 3.13.

(b) Hold the 495A pawl pin replacer so that the riveting stud detail is toward the left with the end of this detail in line with the vertical edge of the casting which mounts the rotary pawl guide. The position of the replacer should be similar to that shown in Fig. 8. Then, while tipping the handle slightly upward, slide the replacer so that the riveting stud detail will pass below and to the rear of the lower lug of the stationary dog and under the vertical armature arm (on switches so equipped).

Rotate the replacer from left to right so that the handles are directly in front of the switch and the flattened grooved portion of the riveting stud detail is directly behind the stationary dog. Take care not to mar or damage the switch shaft during this operation. Position the replacer so that the riveting stud detail fits over the head of the pawl pin and the riveting pin detail fits into the opening at the other end of the pin. With the replacer positioned as described and held against the pawl pin so that the head of the pin is against the side of the pawl, compress the handles firmly to flare out the end of the pin. Check for the requirement covering vertical pawl play in Section 030-705-702.

## **Replacing Vertical Pawl**

### **3.12 Removing Vertical Pawl**

- (1) Remove the vertical armature assembly from the switch as covered in 3.05.
- (2) Remove the vertical pawl pin as covered in 3.07 through 3.09 and remove the pawl.

### **3.13 Mounting Vertical Pawl**

- (1) Before mounting the replacement pawl, check whether the P-252536 pawl pin (0.105-inch diameter) can be inserted in the armature bearing.
- (2) If the P-252536 pawl pin does not enter the bearing, replace the vertical armature assembly as covered in Section 030-705-802. If the pin can be inserted, mount the pin and replacement pawl as covered in 3.11(1).

## **REPLACEMENT OF ROTARY PAWL AND PAWL PIN**

**3.14 General:** To replace the rotary pawl or pin, it is necessary in all cases to first remove the rotary armature assembly from the switch. Procedures for removing and mounting the rotary armature assembly are covered in 3.15 and 3.16 respectively; for replacing the rotary pawl pin, in 3.17 through 3.20; and for replacing the rotary pawl, in 3.21 and 3.22.

### **3.15 Removing Rotary Armature Assembly:**

To remove the rotary armature assembly proceed as follows.

(1) Disengage the rotary armature spring from the armature spring adjusting screw.

(2) Loosen the bearing pin clamp screw on the lower bearing pin of the rotary armature using 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 access to the bearing pin clamp screw is blocked by a terminal assembly, remove the terminal assembly using the 3-inch C screwdriver. If it is difficult to disengage the rotary armature assembly from the upper armature bearing pin, loosen the upper bearing pin clamp screw with the 4-inch E screwdriver or 556A wrench sufficiently to move this pin upward enough to free the armature assembly. Remove the armature assembly.

### 3.16 Mounting Rotary Armature Assembly

(1) Position the lower bearing pin clamp on the switch frame and insert the bearing pin from above the lower switch coverplate. Temporarily clamp the pin so that the top of the pin is just under-flush with the top of the clamp.

(2) Position the rotary armature assembly on the upper bearing pin, taking care that the rotary pawl is between the rotary pawl frontstop and the rotary guide. Also make sure that the arm of the armature is in position to operate the rotary interrupter springs if provided. If the upper bearing pin was raised to remove the armature assembly, lower the pin to its previous position and securely tighten the clamp screw.

(3) Hold the lower bearing pin with the 485A pliers from below the lower coverplate and loosen the pin clamp screw. Raise the pin so that it enters the rotary armature bearing hole and position it to meet the requirement covering rotary armature play in Section 030-705-702.

### Replacing Rotary Pawl Pin

#### 3.17 Removing Rotary Pawl Pin per Fig. 11

(1) Remove the rotary armature assembly as covered in 3.15.

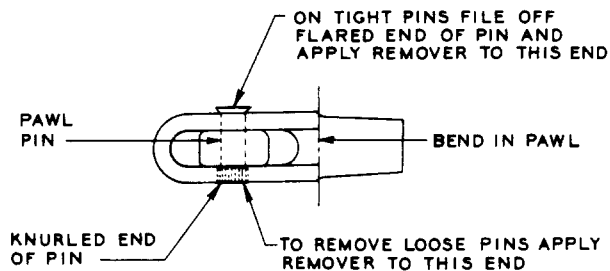


Fig. 11 – Rotary Pawl with Headless-Type Pawl Pin Having Knurl Flush

#### (2) Loose Pawl Pin

(a) Position the 494B pawl pin remover so that its punch detail is in line with the knurled end of the pawl pin and its split jaw straddles the flared end of the pin as shown in Fig. 12. Compress the handles of the pawl pin remover until the pin is ejected from the pawl. In doing this, take care that the remover does not slide from its position on the pawl.

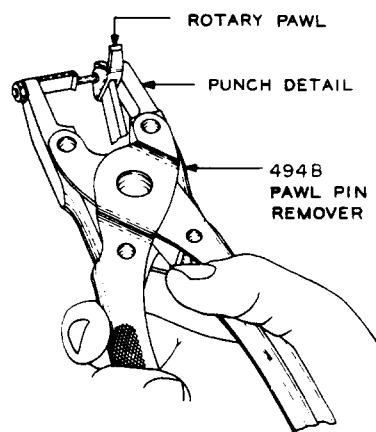


Fig. 12 – Method of Removing a Rotary Pawl Pin From a Rotary Pawl

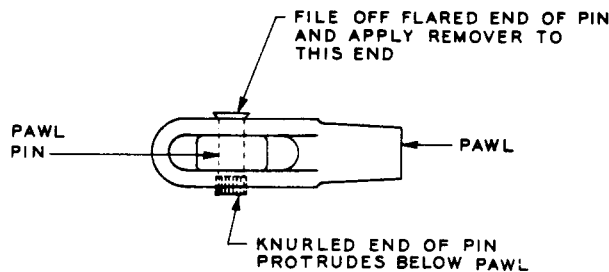
#### (3) Tight Pawl Pin

(a) File off the flared end of the pawl pin using the R-1051 pillar file. Take care not to mar the finish of the pawl.

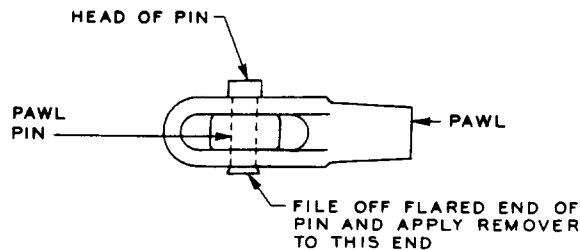


(b) Position the 494B pawl pin remover so that its punch detail is in line with the filed end of the pawl pin and its split jaw straddles the other end of the pin. Compress the handles of the pawl pin remover until the pin is ejected from the pawl. In doing this, take care that the remover does not slide from its position on the pawl.

**3.18 Removing Rotary Pawl Pin per Fig. 13 and 14:** Remove both loose and tight rotary pawl pins as covered in 3.17(1) and (3).



**Fig. 13 – Rotary Pawl with Headless-Type Pawl Pin Having Protruding Knurl**



**Fig. 14 – Rotary Pawl with Headed-Type Pawl Pin Used for Replacement Purposes**

### 3.19 Determination of Replacement Rotary Pawl Pin Required

(1) If a headless-type rotary pawl pin with a protruding knurl (Fig. 13) is being replaced, make sure that the P-252538 pawl pin (Note 2 for Fig. 1 and 2) is used as the replacement.

(2) If other than the headless-type pawl pin covered in (1) is being replaced, determine the proper replacement pin as follows. Attempt to insert the 0.093-inch end of the 130A gauge into the mounting holes of the pawl and the bearing of the armature. If the gauge does not enter the armature or pawl, use the P-252539 (0.090 inch) pawl pin. If the gauge enters but is snug, use the P-252537 (0.094 inch) pawl pin and, if the gauge is loose, the P-252538 (0.105 inch) pawl pin.

### 3.20 Mounting Rotary Pawl Pin

(1) Insert the rotary pawl pin into the mounting holes of the pawl and the bearing of the armature from the top, using the 496A pin pliers. Check the play between the pawl and pin. If the play exceeds 0.015 inch as gauged by eye and feel, substitute a new pawl and pin as covered in 3.21 and 3.22.

(2) Hold the 495A pawl pin replacer so that the riveting stud detail is over the head of the pawl pin and the riveting pin detail fits in the opening at the other end of the pin. Then, hold the replacer against the pin so that the head of the pin is against the top of the pawl and compress the handles firmly to flare out the end of the pin. Check for the requirement covering rotary pawl play in Section 030-705-702.

(3) Check the pawl spring and if it has closed loops on each end or is distorted, replace it (Section 030-705-802). Hook the open loop end of the pawl spring in the hole in the pawl with the end of the open loop upward. Hook the other end over the armature hook or pin. The tension of the spring should be sufficient to hold the pawl in its extreme forward position.

(4) Mount the armature assembly as covered in 3.16.

### Replacing Rotary Pawl

#### 3.21 Removing Rotary Pawl

(1) Remove the rotary armature assembly from the switch as covered in 3.15.

(2) Remove the rotary pawl pin as covered in 3.17 and 3.18 and remove the pawl and pawl spring.

**3.22 Mounting Rotary Pawl**

(1) Before mounting the replacement pawl, check whether the P-252538 (0.105-inch diameter) pawl pin can be inserted in the armature bearing.

(2) If the P-252538 pawl pin does not enter the bearing, replace the rotary armature assembly as covered in Section 030-705-802. If the pin can be inserted, mount the pin and replacement pawl as covered in 3.20.

**REASONS FOR REISSUE**

1. To add information covering use of parentheses (1.05).
2. To revise the List of Tools and Gauges (3.01).
3. To revise the information covering check of vertical and rotary pawl and pawl pin (3.02).
4. To revise the information covering check of vertical and rotary armature and pawl (3.03).
5. To revise the information covering replacement of vertical pawl and pawl pin (3.04).
6. To revise the information covering determination of replacement vertical pawl pin required (3.10).
7. To revise the procedure for removing vertical pawl (3.12).
8. To revise the procedure for mounting vertical pawl (3.13).
9. To revise the information covering replacement of rotary pawl and pawl pin (3.14).
10. To revise the procedure covering mounting of rotary armature assembly (3.16).
11. To revise the information covering determination of replacement rotary pawl pin required (3.19).
12. To revise the procedure covering mounting of rotary pawl (3.22).