

**SWITCHES**  
**300, 301, 302, AND 303 TYPES**  
**PIECE-PART DATA AND REPLACEMENT PROCEDURES**

**1. GENERAL**

**1.01** This section covers the information necessary for ordering parts to be used in the maintenance of 300-, 301-, 302-, and 303-type switches. It also covers approved procedures for replacing these parts.

**1.02** This section is reissued to include a method of preparation of the KS-16832 L2 lubricant and to bring the section up to date. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted.

**1.03** Part 2 of this section covers the piece-part numbers and the corresponding names of the piece parts which it is practicable to replace in the field in the maintenance of the switches. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the 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** Before making any replacement on the apparatus covered herein, make the associated circuit busy in accordance with the approved methods.

**1.06 Preparation of KS-16832 L2 Lubricant:**

This lubricant is provided in 2-ounce and 1-pint containers. A small wide-mouth 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. PIECE-PART DATA**

**2.01** The figures included in this part show the various piece parts in their proper relation to other parts of the apparatus. Piece-part numbers are given together with the names of the parts as listed by the Western Electric Company Merchandise Department. Where these names differ from those in general use in the field, the latter names in some cases are shown in parentheses.

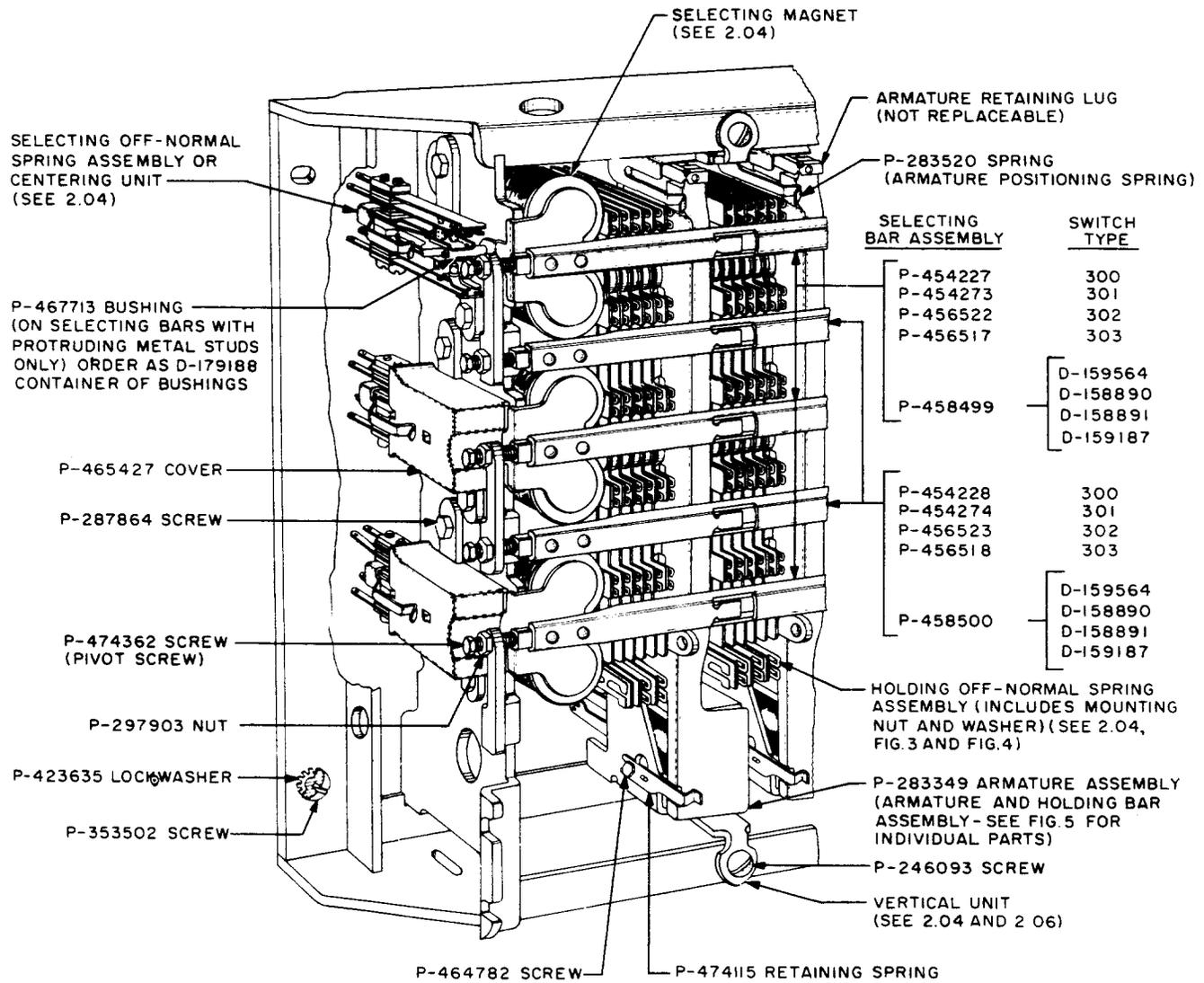
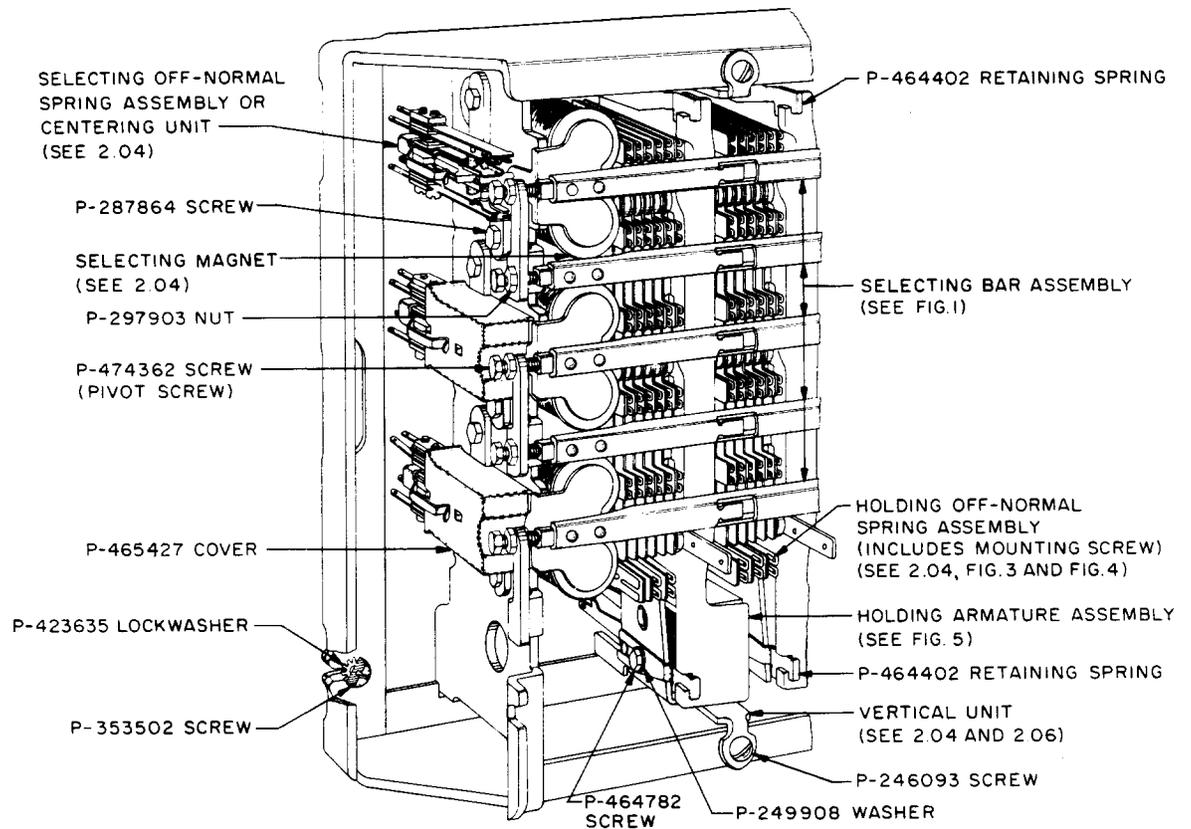


Fig. 1 - General View of Switch Equipped With Vertical Units Having Armature Retaining Lug



**Fig. 2 – General View of Switch Equipped With Vertical Units Having Upper and Lower Retaining Springs**

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**2.02** 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.

**2.03** When ordering piece parts for replacement purposes, give both the number and the name of the piece part. For example, P-465427 Cover. Do not refer to the BSP number

or to any information shown in parentheses following the piece-part numbers.

**2.04** Table A is a list of numbers and corresponding names of piece parts which are not common to all 300-, 301-, 302-, and 303-type switches.

**2.05 Horizontal Strapping:** When ordering a complete switch for replacement purposes, order by switch code, and if strapping is wanted, specify the desired strapping in the order.

TABLE A

SWITCH		HOLDING OFF-NORMAL SPRING ASSEMBLIES (see Fig. 3 and 4)		HOLDING MAGNET (see 2.07)				SELECTING OFF-NORMAL SPG ASSEM	SELECTING MAGNET	
CODED	D SPEC	BRACKET TYPE	CLAMP TYPE	SHORT	MEDIUM	LONG	RES (ohms)		PART NO.	RES (ohms)
300A	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-97283	-	P-454173	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
300C	-	P-457501	P-454175	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-97285	-	P-454175	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
300D	D-97286	(Note 1)	(Note 1)	P-290318	P-290319	P-290320	330	P-454594	P-454602	240
300E	-	P-298979	P-454592	P-290312	P-290313	P-290314	1570	P-455481	P-454224	600
-	D-97287	-	P-454592	P-290327	P-290328	P-290329	1940	P-455481	P-454224	600
300H	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-97290	-	P-454173	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
300J	-	P-457501	P-454175	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-97291	-	P-454175	P-290324	P-290325	P-290326	1480	‡P-464444	P-454224	600
300K	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-97292	-	P-454173	P-290324	P-290325	P-290326	1480	‡P-464444	P-454224	600
300R	D-97297	P-457501	P-454175	P-290321	P-290322	P-290323	1250	‡P-464444	P-454224	600
300S	D-97298	#P-472751	†P-464441	P-290321	P-290322	P-290323	1250	P-455483	P-454224	600
300T	D-97299	(Note 2)	(Note 2)	P-290318	P-290319	P-290320	330	P-455482	P-454221	43
300U	D-97300	P-457496	P-454170	P-290321	P-290322	P-290323	1250	P-455481	P-454224	600
300W	D-97301	P-457506	P-455887	P-290315	P-290316	P-290317	200	P-454075	P-454222	157
300Y	D-97302	P-457499	P-454173	P-290321	P-290322	P-290323	1250	P-455481	P-454224	600
300AB	-	P-457506	P-455887	P-290315	P-290316	P-290317	200	P-455481	P-454222	157
300AC	-	P-457851	-	P-290312	P-290313	P-290314	1570	P-454075	P-454224	600
300AD	-	P-298728	-	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
300AE	-	(Note 3)	(Note 3)	P-290318	P-290319	P-290320	330	P-455482	P-454221	43
301A	-	#P-472751	†P-464441	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-98093	#P-472751	†P-464441	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
301C	-	P-457501	P-454175	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-98095	-	P-454175	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
301D	-	#P-472751	†P-464441	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-98096	#P-472751	†P-464441	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
301E	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	P-455481	P-454224	600
-	D-98097	P-457499	P-454173	P-290327	P-290328	P-290329	1940	P-455481	P-454224	600

TABLE A (cont)

SWITCH		HOLDING OFF-NORMAL SPRING ASSEMBLIES (see Fig. 3 and 4)		HOLDING MAGNET (see 2.07)				SELECTING OFF-NORMAL SPG ASSEM	SELECTING MAGNET	
CODED	D SPEC	BRACKET TYPE	CLAMP TYPE	SHORT	MEDIUM	LONG	RES (ohms)		PART NO.	RES (ohms)
301F	-	P-457497	P-454171	P-290312	P-290313	P-290314	1570	P-455483	P-454224	600
-	D-98098	P-457497	P-454171	P-290327	P-290328	P-290329	1940	P-455483	P-454224	600
301G	-	P-457497	P-454171	P-290312	P-290313	P-290314	1570	‡P-466075	P-454602	240
-	D-98099	P-457497	P-454171	P-290327	P-290328	P-290329	1940	‡P-466075	P-454602	240
301J	-	P-457498	P-454172	P-290312	P-290313	P-290314	1570	P-455481	P-454224	600
-	D-98101	-	P-454172	P-290327	P-290328	P-290329	1940	P-455481	P-454224	600
301K	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-98102	-	P-454173	P-290327	P-290328	P-290329	1940	‡P-464444	P-454224	600
301L	-	P-298978	P-454176	P-290312	P-290313	P-290314	1570	P-455481	P-454224	600
-	D-98103	-	P-454176	P-290327	P-290328	P-290329	1940	P-455481	P-454224	600
301M	-	P-457851	-	P-290312	P-290313	P-290314	1570	P-454075	P-454224	600
301N	-	P-457498	-	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
301P	-	P-298728	-	P-290312	P-290313	P-290314	1570	P-294031	P-454224	600
301R	-	P-457499	-	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
301S	-	P-457997	-	P-290312	P-290313	P-290314	1570	P-294031	P-454224	600
301T	-	P-457506	-	P-290365	P-290366	P-290367	925	‡P-464444	P-454224	600
301U	-	P-457499	-	P-290312	P-290313	P-290314	1570	P-454075	P-454224	600
302A	-	P-457501	P-454175	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
302B	-	P-298728	-	P-290312	P-290313	P-290314	1570	P-294031	P-454224	600
303A	-	P-457499	P-454173	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-158864	(Note 4)	-	P-290318	P-290319	P-290320	330	P-455482	P-454221	43
-	D-158889	#P-472751	-	P-290312	P-290313	P-290314	1570	P-455482	P-454602	240
-	D-158890	#P-472751	-	P-290312	P-290313	P-290314	1570	‡P-464444	P-454224	600
-	D-158891	#P-472751	-	P-290312	P-290313	P-290314	1570	P-458726	P-458498	34
-	D-158892	#P-472751	-	P-290321	P-290322	P-290323	1250	P-455482	P-454602	240
-	D-159187	#P-476809	-	P-290321	P-290322	P-290323	1250	(Note 5)	(Note 6)	-
-	D-159564	P-298979	-	P-290312	P-290313	P-290314	1570	P-458726	P-458498	34

# Order as balancing spring. Spring mounted with one P-294046 screw.

† Order as balancing spring. Spring mounted with two P-219712 screws.

‡ Order as centering unit.

#### Notes

1. Only positions 0 through 5 equipped. P-457502 (bracket type) or P-454593 (clamp type) holding off-normal spring assembly for positions 0, 1, 2, 3, and 5; P-458103 (bracket-type) or P-454591 (clamp type) holding off-normal spring assembly for position 4.
2. P-457494 (bracket type) or P-454168 (clamp type) holding off-normal spring assembly for positions 0, 3, 4, 5, 6, and 7; P-458103 (bracket type) or P-454591 (clamp type) holding off-normal spring assembly for positions 1, 2, 8, and 9.
3. Only positions 0 through 4 equipped. P-458102 (bracket type) or P-298723 (clamp type) holding off-normal spring assembly for positions 0 and 4; P-458103 (bracket type) or P-454591 (clamp type) holding off-normal spring assembly for positions 1, 2, and 3.
4. Only positions 0 through 5 equipped. P-458102 (bracket type) or P-298723 (clamp type) holding off-normal spring assembly for positions 0, 1, and 5; P-458103 (bracket type) or P-454591 (clamp type) holding off-normal spring assembly for positions 2, 3, and 4.
5. P-466075 centering unit for positions 0 and 1; P-455483 selecting off-normal spring assembly for positions 2 through 9.
6. P-454602 selecting magnet (240 ohms) for positions 0 and 1; P-454224 selecting magnet (600 ohms) for positions 2 through 9.

**2.06 Vertical Units:** If a vertical unit is required for a 300-, 301-, 302-, or 303-type switch and a suitable spare vertical unit is not available locally, replace the entire switch with one of a later design (304-, 305-, 306-, 307-, or 308-type switch) which will be supplied automatically when an order is received for a 300-, 301-, 302-, or 303-type switch. This is due to the fact that the vertical units for the 300-, 301-, 302-, or 303-type switches have been rated "Mfr Disc." The vertical units of the replaced switch can then be used to fill future needs for spare parts on other 300-, 301-, 302-, and 303-type switches. Vertical units of the 300-, 301-, 302-, and 303-type switches of the same number of wires are interchangeable if the proper holding off-normal spring assembly or balancing spring and holding magnet are used. However, vertical units having armature retaining lug and lower retaining spring should not be interchanged or mixed on the same switch with vertical units having both upper and lower retaining springs because of interference between holding off-normal spring assemblies and differences in holding magnet winding terminals.

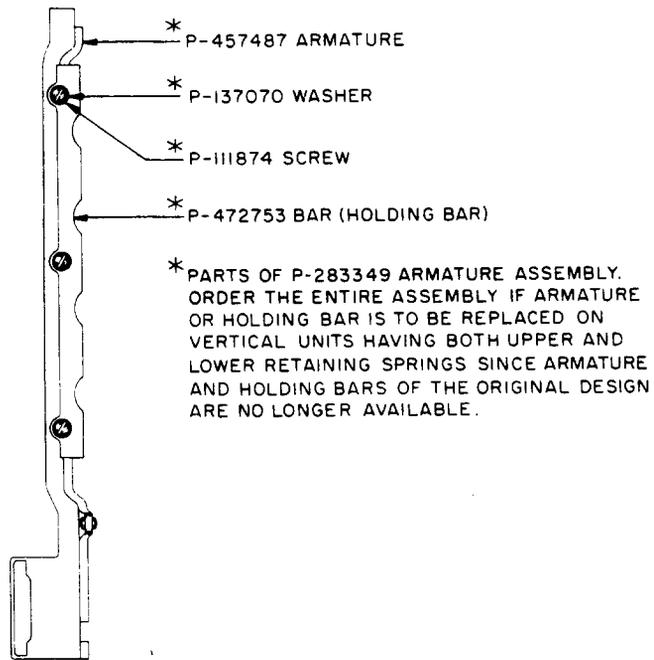


Fig. 5 - Holding Armature Assembly

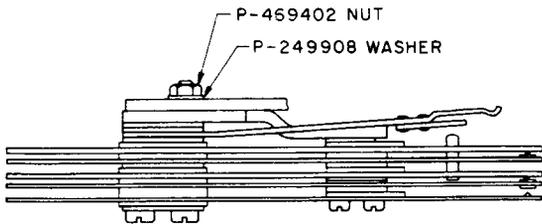


Fig. 3 - Bracket-Type Holding Off-Normal Spring Assembly

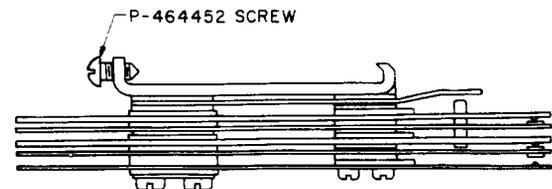


Fig. 4 - Clamp-Type Holding Off-Normal Spring Assembly

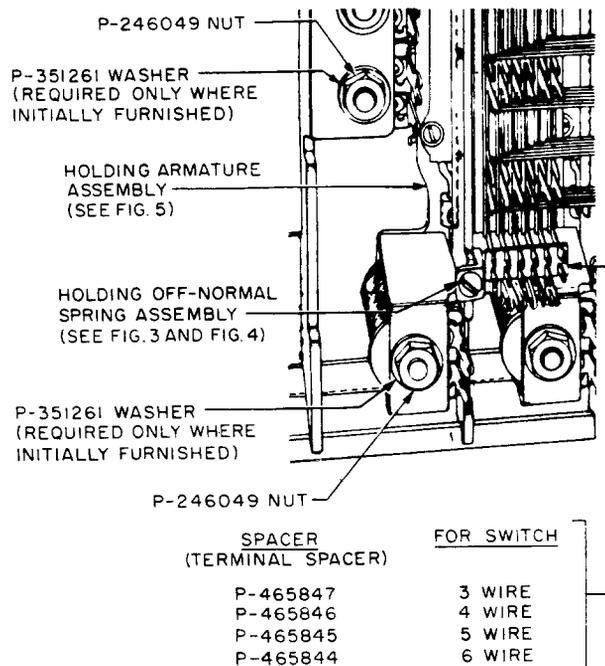
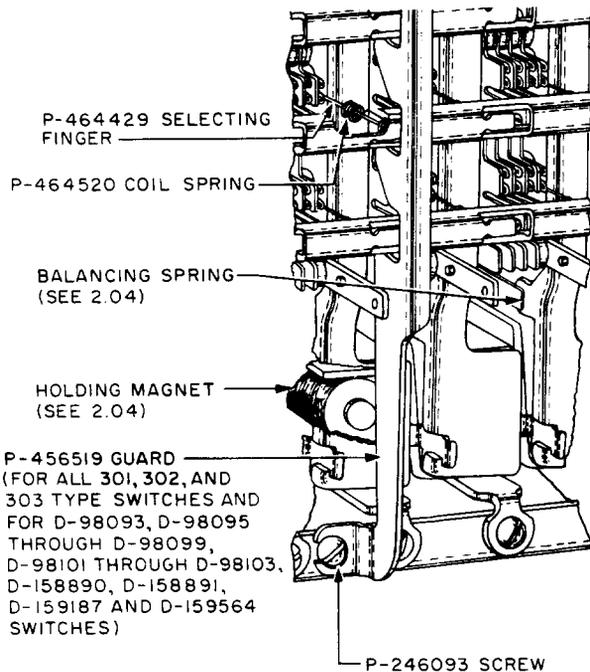


Fig. 6 - Partial Rear View of Switch Showing Magnet Mounting Parts and Terminal Spacers

**2.07 Holding magnets** are available in three lengths to facilitate the selection of a magnet of the proper length to insure that the magnet is underflush of the pole pieces by

Min 0.002 inch  
Max 0.005 inch

Magnets of each length should be ordered so as to permit the selection of the proper magnet required for replacement. Magnets with or without front spoolheads may be used interchangeably.



**Fig. 7 – Partial Front View of Switch Showing Guard and Selecting Finger**

**3. REPLACEMENT PROCEDURES**

**3.01 List of Tools, Gauges, and Materials**

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
43	3/16- and 1/4-Inch Hex. Open Double-End Flat Wrench
206	30-Degree Offset Screwdriver
207	90-Degree Offset Screwdriver
373D	Contact Burnisher Holder

CODE OR SPEC NO.	DESCRIPTION
418A	5/16- and 7/32-Inch Hex. Open Double-End Flat Wrench
485A	Smooth-Jaw Pliers
538A	9/32-Inch Hex. Offset Socket Wrench
539A	1/4-Inch Hex. Open Double-End Flat Wrench
541A	1/4-Inch 12-Point Double-End Box Wrench
544A	1/4-Inch Hex. Offset Socket Wrench
KS-2993	Brush
KS-14164	Brush
KS-14220	Wrench Consisting Of:
L1	Sliding "T" Handle
L7	6-Inch Extension Bar
L14	7/16-Inch 12-Point Socket
P-10A200	Sleeve (part of D-179188 container of bushings)
R-1051	File
—	P-Long-Nose Pliers
—	5-Inch Diagonal Pliers
—	4-Inch E Screwdriver
—	Combination Pliers
—	Smooth Cut File
<b>GAUGES</b>	
131A	Thickness Gauge Nest
P-243664	0.002-Inch Feeler (part of KS-6909 thickness gauge nest)
P-243667	0.005-Inch Feeler (part of KS-6909 thickness gauge nest)
R-8550	6-Inch Steel Scale
<b>MATERIALS</b>	
KS-16832 L2	Lubricant

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CODE OR SPEC NO.	DESCRIPTION
MATERIALS	
P-467713	Bushing (part of D-179188 container of bushings)
—	320 Aloxite Cloth
—	22-Gauge Bare Tinned Copper Wire
—	Varnish Vehicle (part of D-159194 aluminum enamel)

### General

**3.02** No replacement procedures are specified for screws or parts where the replacement procedure consists of a simple operation.

**3.03** Soldering of strap leads, when necessary, shall be done in accordance with the section covering soldering on crossbar switch and 245-type relays.

**3.04** After making any replacement of parts of 300- or similar-type switches, the part or parts replaced shall meet the readjust requirements involved as specified in Section 030-715-701 covering this apparatus. Other parts, whose adjustments may have been disturbed by the replacing operations, shall be checked to the readjust requirements and an overall operation check shall be made of the switch before restoring the circuit to service.

**3.05 *Switches on Unit Mountings:*** In some cases, all the apparatus of a circuit including a 300-, 301-, 302- or 303-type switch is mounted on unit mounting bars and the circuit is mounted as a unit on the framework. To facilitate mounting the unit, the switch shown in Fig. 2 has cutouts in the frame for clearing the heads of the screws used to fasten the unit mounting bars to the framework. If a switch of the type shown in Fig. 2 is to be replaced by a new switch of the type shown in Fig. 1 which does not have cutouts in the frame, it may be necessary to remove the unit mounting screws which would interfere with the proper mounting of the new switch and to use one or more of the switch mounting screws to mount both the switch and the unit mounting bar on the framework. In this case, it will be necessary to use a longer screw to mount the switch and the unit mount-

ing bar, and it may be necessary to drill clearance holes through the unit mounting bar to permit the screws to properly enter the hole in the framework.

### 3.06 *Selecting Bar*

(1) If the switch is equipped with a guard, remove it.

(2) Loosen the pivot screw locknut at the armature end of the selecting bar with the 418A or 539A wrench. Turn the pivot screw out sufficiently with the 43 wrench to free the selecting bar and remove the selecting bar.

(3) Before mounting the new selecting bar, make sure the container of lubricant has been shaken as covered in 1.06. Then dip a piece of 22-gauge bare tinned copper wire into KS-16832 L2 lubricant to a depth of approximately 3/8-inch and quickly remove the wire. Apply the drop of lubricant retained on the wire in the bearing hole at one end of the selecting bar and another drop of lubricant in the bearing hole at the other end of the selecting bar.

(4) Hold the selecting bar so that each selecting finger will enter between the proper operating cards and holding armature. Gently move the selecting bar toward the switch until in position, taking care that the selecting armature stud enters between the centering springs. Turn the pivot screw into the selecting bar and when the selecting bar is properly positioned, securely tighten the pivot screw locknut. If guard was removed, remount it.

### 3.07 *Selecting Finger*

(1) Remove the selecting bar as covered in 3.06.

(2) Remove the old selecting finger by pulling it off with the P-long-nose pliers.

(3) Use the 373D contact burnisher holder to aid in installing the new selecting finger, as follows. Loosen the chuck adjusting nut of the burnisher holder. Place the selecting finger in the chuck of the contact burnisher holder so that the straight portion of the finger enters the handle of the holder and the coil portion

of the finger will be engaged by the chuck. Press the coil portion of the finger into the chuck as far as it will go. About 1/4 inch of the coil will project outside the chuck. Then lightly tighten the nut, taking care not to crush the coil portion of the selecting finger inside the chuck.

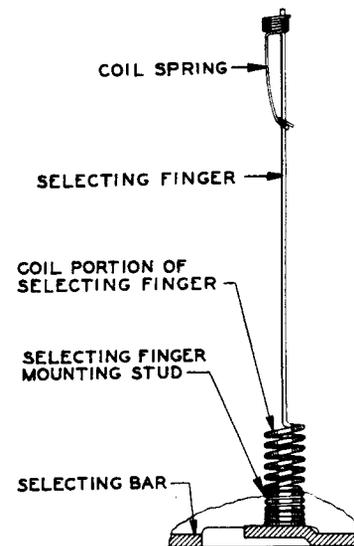
(4) Screw the selecting finger onto the selecting finger mounting stud and turn the finger until the end turn of the coil bottoms firmly against the selecting bar. Loosen the chuck adjusting nut and remove the contact burnisher holder. Make sure that there are five to seven free turns of the coil portion of the selecting finger beyond the free end of the selecting finger mounting stud. If there are less than five or more than seven free turns of the coil, remove the selecting finger and install another finger as covered above.

(5) Determine the length of the adjacent selecting finger by means of the R-8550 steel scale and cut the tip of the new selecting finger off with the 5-inch diagonal pliers so that the new finger is the same length as the adjacent finger. Remove any burrs from the tip of the selecting finger by looping a piece of 320 Aloxite cloth over the finger and drawing it over the tip several times until the burrs are removed.

(6) Thread the loop end of a new coil spring onto the selecting finger, taking care to place the proper side of the loop toward the coil portion of the finger as illustrated in Fig. 8. Force the coil spring over the tip of the selecting finger and push the spring onto the selecting finger, being careful to avoid personal injury due to the sharp tip of the selecting finger. Push the coil spring on the selecting finger so that the tang at the loop end is just inside the coil portion of the selecting finger, and when the coil spring is in position, make sure it does not bind at the loop end.

(7) Remount the selecting bar as covered in 3.06 except that no oil should be placed on the pivot screws.

**3.08 Selecting Magnet:** Remove the associated selecting bar as covered in 3.06. Unsolder the leads connected to the magnet to be replaced. Remove the magnet clamping nut with the KS-14220 wrench and remove the magnet. Sub-



**Fig. 8 – Method of Assembling Coil Spring of Selecting Finger**

stitute the new magnet and reassemble the magnet clamping washer, if provided, and the nut. Securely tighten the magnet clamping nut, exercising care to align the coil so that there is a clearance between the frame and the winding terminals. Resolder the leads to the proper terminals of the magnet. Remount the selecting bar as covered in 3.06, except that no oil should be placed on the pivot screws.

**3.09 Selecting Off-Normal Spring Assembly or Centering Unit:** Unsolder the leads, if any. Remove the selecting off-normal spring assembly or centering unit bracket mounting screws with the 538A or the 544A wrench depending upon whether 9/32-inch (earlier type) or 1/4-inch (later type) head screws are used. When the switch is mounted in the terminating sender casing, it may be necessary to loosen and move the switch (the small distance that the slots allow) to provide room in which to remove the screws. Remove the spring assembly and mount the new spring assembly on the switch. When the spring assembly is properly positioned, securely tighten the mounting screws. Resolder the leads, if any, to their proper terminals.

**3.10 Holding Off-Normal Spring Assembly:** Unsolder the leads to the holding off-normal spring assembly. From the terminal side

of the switch, loosen the spring assembly bracket mounting screw with the 541A wrench or the 4-inch E screwdriver, as required. Mount the new spring assembly. Securely tighten the mounting screw. Resolder the leads to their proper terminals.

**3.11 *Balancing Spring:*** Where a balancing spring is provided in place of a holding off-normal spring assembly, remove the balancing spring mounting screw with the 206 and 207 offset screwdrivers. Substitute the new part, securely tightening the mounting screw.

**3.12 *Vertical Unit***

- (1) Remove the selecting bars as covered in 3.06.
- (2) Unsolder the necessary crosspoint strap wires as described in the section covering soldering on crossbar switch and 245-type relays. Unsolder the holding magnet leads. Unsolder the wiring to the holding off-normal spring assembly if it is to be replaced. If a holding off-normal spring assembly is provided and it is not to be replaced, loosen the holding off-normal spring assembly bracket mounting screw or nut as covered in 3.10 and dismount the spring assembly, taking care not to damage the wiring to the spring assembly.
- (3) Remove the vertical unit mounting screws with the 4-inch E screwdriver and then remove the vertical unit.
- (4) If the vertical unit is equipped with a balancing spring instead of a holding off-normal spring assembly and it is desired to re-use the balancing spring, remove the balancing spring mounting screws with the 4-inch E screwdriver. Remove the balancing spring and transfer it to the new vertical unit.
- (5) Mount the new vertical unit on the switch and, in the case of 6-wire switches, locate it so that there is at least a 1/32-inch clearance between the new vertical unit and all parts of adjacent vertical units. When properly positioned, securely tighten the vertical unit mounting screws.
- (6) Mount the holding off-normal spring assembly, if provided. Resolder the strap wires as described in the section covering soldering on crossbar switch and 245-type relays. Resolder any other leads which were removed.

(7) Remount the selecting bars as covered in 3.06, except that no oil should be placed on the pivot screws. In remounting the selecting bars, take care that they are reassembled on the same horizontal positions from which they were removed.

**3.13 *Multiple Strip Terminal Spacer:*** Remove the old spacer with a pair of P-long-nose pliers. Unsolder the wires from the multiple strip terminals and remove all excess solder from the terminals. Hold the new spacer so that the wide surfaces are horizontal, and carefully push the spacer into position between the two rows of terminals with a screwdriver blade so the spacer enters the rounded portions of the slots in the terminals. Rotate the spacer so the wide surfaces are vertical, taking care that the terminals enter the proper slots in the spacer. Resolder the wires to their proper terminals.

**3.14 *Holding Armature and Holding Bar Assembly — All Switches Except 6-Wire Switches:***

To remove the holding armature and holding bar assembly, push the lower retaining spring clear of the armature, taking care not to distort the spring. At the same time draw the lower end of the armature forward until free of the armature retaining lug or retaining spring. Move the assembly downward and forward until free of the vertical unit. If only the armature is being replaced, remove the holding bar mounting screws with the 4-inch E screwdriver and transfer the holding bar to the new armature. Reassemble the holding armature assembly in the vertical unit by placing the upper end of the holding armature beneath the armature retaining lug or the upper retaining spring. Push the lower retaining spring to the left and gently move the armature into position. If any of the requirements for the vertical unit specified in Section 030-715-701 are not met, attempt to correct the condition by removing the holding armature assembly and shifting the holding bar as required. When the holding bar is properly positioned, securely tighten the holding bar mounting screws and reassemble the holding armature assembly in the vertical unit.

**3.15 *Holding Armature and Holding Bar Assembly — 6-Wire Switches:***

Proceed as covered in 3.14 except that in some cases it may be necessary to remove the lower selecting bar to obtain sufficient clearance for removing and

reassembling the holding armature and holding bar assembly on the switch. In some cases, difficulty may be experienced in reassembling the holding armature and holding bar assembly in the vertical unit because of interference of the actuating springs. In this case, with the 4-inch E screwdriver, loosen the vertical unit mounting screws of the vertical unit in which the armature is being reassembled. Also, loosen the mounting screws of the vertical unit to the right and move the vertical units away from each other after which the armature assembly can be placed in position. Then shift the vertical units back into their original positions, taking care to leave at least a 1/32-inch clearance between all parts of adjacent vertical units.

### **Holding Magnet**

**3.16 Removing Holding Magnet:** Remove the holding armature and holding bar assembly as covered in 3.14 and 3.15. Unsolder the leads connected to the magnet. Remove the magnet clamping nut with the KS-14220 wrench and remove the magnet.

### **3.17 Mounting Holding Magnet**

(1) Substitute a new medium length magnet, reassemble the clamping washer and nut, and securely tighten the clamping nut exercising care to align the coils so that there is a clearance between the frame and the winding terminals.

(2) Place a blade of the 131A thickness gauge nest across the pole pieces so it can be used as a straightedge, and by means of the P-243664 and P-243667 feelers, make sure that the core of the holding magnet is underflush of the pole pieces over the entire width of the core by

Min 0.002 inch  
Max 0.005 inch

If these conditions are not met, remove the magnet as covered above and substitute a longer or shorter magnet as required.

(3) It is desirable to have the underflush toward the minimum value to permit easier application of the electrical requirements. Occasionally, the core of the short coil holding magnet may be too long to meet the underflush

condition. When this occurs, the poleface of the core should be carefully filed down. Where filing is necessary, remove the short coil from the vertical unit as covered above. Then with a smooth cut file, file down the poleface of the core slightly, taking care that the poleface surface remains perpendicular to the core length. Remove any filings from the magnet with the KS-2993 brush. Reassemble the magnet and check the underflush condition as covered above.

(4) It is satisfactory if all parts of the core poleface are between 0.002 inch and 0.005 inch underflush. If necessary, repeat the above filing operation until the minimum clearance is met. When the underflush condition is satisfactory, protect the core from rusting by applying a thin coating of the varnish vehicle of D-159194 aluminum enamel over the surface of the poleface with the KS-14164 brush. Allow the varnish to dry thoroughly. (This varnish requires approximately 4 hours to dry.) When replacing a holding magnet marked SPECIAL SHORT, file the core poleface of a short coil as covered above.

(5) Reassemble the holding armature and holding bar assembly as covered in 3.14 and 3.15 and resolder the leads to the proper terminals of the magnet.

**3.18 Retaining Spring:** Loosen the retaining spring mounting screw with the 541A wrench and remove the spring taking care not to turn the screw out because difficulty may be experienced in reassembling the screw in the hole. Substitute the new spring and securely tighten the mounting screw. In some cases, it may be necessary to remove the top selecting bar as covered in 3.06 to obtain better movement of the wrench.

**Caution:** In tightening the retaining spring mounting screw, exercise extreme care not to twist the head off the screw.

**3.19 Retaining Spring Mounting Screw (except bottom screw on 301-, 302-, and 303-type switches):** Remove the retaining spring as covered in 3.18. Remove the retaining spring mounting screw and washer with the 541A wrench. To start the new screw into position in the vertical unit, proceed as follows. Remove the holding armature and holding bar assembly as covered in

3.14 and 3.15. Hold the flat side of a clean R-1051 6-inch pillar file against the core of the holding magnet so that the pole piece contacts the file at a point about 1/2 inch from the end of the file. Energize the holding magnet a few seconds so as to magnetize the file. Place the washer on the retaining spring mounting screw. Place the head of the screw on the magnetized file and carefully place the tip of the screw in the hole in the vertical unit. Tilt the file slightly so that it contacts the edge of the screw head and push or pull on the file so as to rotate the screw in the direction necessary to start the screw. Turn the screw in a few turns. Reassemble the retaining spring as covered in 3.18. Reassemble the holding armature and holding bar assembly as covered in 3.14 and 3.15.

**3.20 Bottom Retaining Spring Mounting Screw on 301-, 302-, and 303-Type Switches:** Proceed as covered in 3.19 except in replacing the screw, holding the tip of the screw in the hole in the vertical unit with the magnetized file, and use the 418A wrench to turn the screw into the hole. If difficulty is experienced because of insufficient space between the vertical units, loosen the vertical unit mounting screws and shift the vertical units farther apart as covered in 3.15.

### 3.21 Armature Positioning Spring

(1) To remove the armature positioning spring, grasp the tab which is to the right of the vertical unit mounting lug with the smooth-jaw pliers as shown in Fig. 9. Then

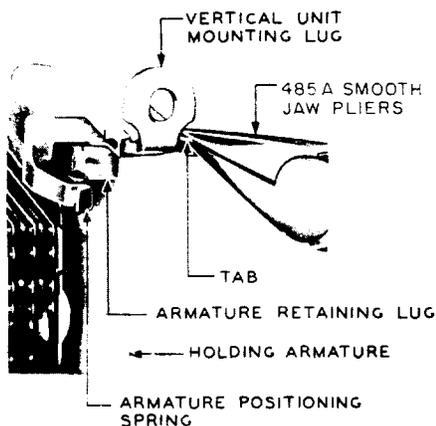


Fig. 9 – Method of Removing Armature Positioning Spring

twist the tab slightly to the right to clear the vertical unit mounting lug and at the same time pull the spring forward until clear of the vertical unit. When removing the armature positioning spring from the vertical unit mounted behind the selecting bar guard, exercise care not to damage the spring by snagging it on the guard.

(2) To mount the armature positioning spring, grasp it with the smooth-jaw pliers as shown in Fig. 10 and push it straight onto the vertical unit until the notched portion of the spring engages the frame of the vertical unit and the tab locks behind the vertical unit mounting lug. Then while still grasping the spring with the pliers, check whether it is locked on the vertical unit by attempting to pull the spring forward. If properly locked, the spring will stay on the vertical unit. In some cases the spring may bind against the vertical unit mounting lug at point (A) in Fig. 10. When this occurs, do not attempt to force the spring into place, but shift the pliers to the tab as shown in Fig. 10 and press the tab inward and twist it slightly to the left. Then check as above to determine whether the spring is properly locked on the vertical unit.

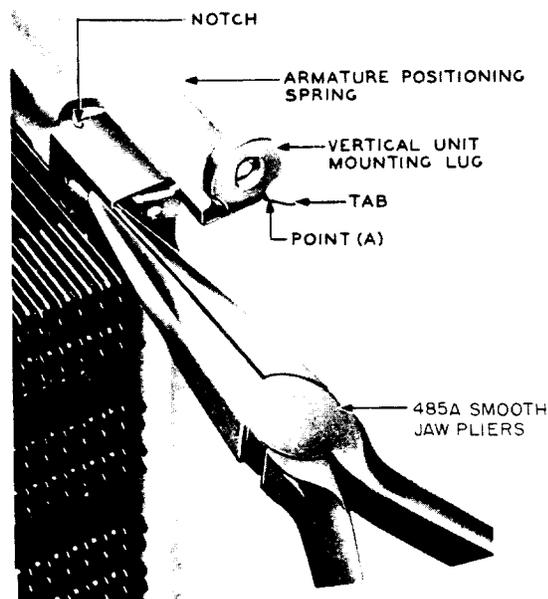


Fig. 10 – Method of Mounting Armature Positioning Spring

### 3.22 *Selecting Armature Bushing*

- (1) Remove the selecting bar as covered in 3.06. Remove the bushing from the stud by crushing it with the P-long-nose pliers. Round off the crimped end of the stud with the P-long-nose pliers to permit pressing on the replacing bushing. Place a new bushing in position on the end of the stud as shown in Fig. 11.
- (2) Place the P-10A200 sleeve over the bushing. Force the bushing on the stud and against the armature with the combination

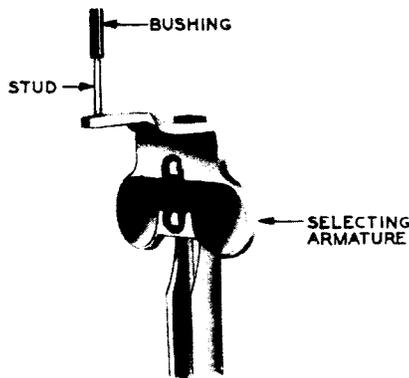


Fig. 11 – Bushing and Armature

pliers, as shown in Fig. 12, being careful not to break the bushing. After the bushing is in place, remove the P-10A200 sleeve and flatten the tip of the stud with the P-long-nose pliers. Remount the selecting bar as covered in 3.06.

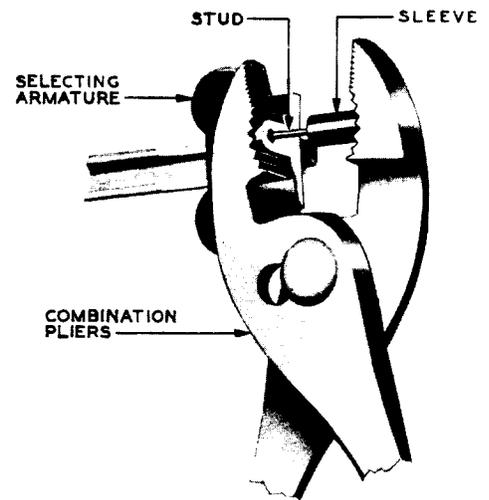


Fig. 12 – Method of Installing Bushing