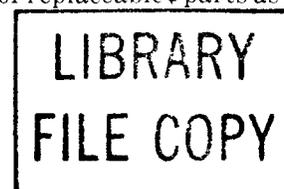


**324-, 325-, 328-, 334-, AND 338-TYPE SWITCHES  
PIECE-PART DATA AND REPLACEMENT PROCEDURES**

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL . . . . .	1	12. Final Positioning Operations of New Card . . . . .	15
2. PIECE-PART DATA . . . . .	1	13. Repair of Wire-Wrap Terminals Using P-12F824 Terminal . . . . .	15
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<b>Figures</b>		<b>1. GENERAL</b>	
1. Front View of Switch . . . . .	2	1.01 This section covers the information necessary for ordering parts to be used in the maintenance of 324-, 325-, 328-, 334-, and 338-type switches. It also covers the approved procedures for replacing these parts.	
2. Partial Rear View of Switch Showing Magnet Mounting Parts and Terminal Spacers . . . . .	3	1.02 Revision arrows have been used to indicate significant changes. The reasons for reissuing this section are listed below.	
3. Partial Front View of Switch Showing Vertical Unit With Holding Armature Removed . . . . .	3	(1) To revise Table A	
4. Method of Assembling Coil Spring of Selecting Finger . . . . .	9	(2) To revise Fig. 13	
5. Method of Determining Front Contact Make Gauging Valve . . . . .	11	(3) To add test sets to Part 3	
6. Carbon Impressions of Contact Between Holding Armature and Holding Magnet Core Pole Face . . . . .	13	(4) To update the practice to standard format.	
7. Applying Blocking Tool . . . . .	13	1.03 For field maintenance, replace only those piece parts described by numbers and names in Part 2 of this section.	
8. Blocking Tool in Position . . . . .	14	1.04 Part 4 of this section covers the approved procedures for the replacement of the parts covered in Part 2.	
9. Rotate Card to a Flat Position With Tweezers . . . . .	14	1.05 Before making any replacement on the apparatus covered herein, make the associated circuit busy in accordance with the approved methods.	
10. Grasping a New Card for Replacement . . . . .	14	<b>2. PIECE-PART DATA</b>	
11. Inserting New Card in Spring Combination . . . . .	15	2.01 Figures 1, 2, and 3 show the names, numbers, and locations of replaceable parts as listed by	

**NOTICE**

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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.

**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.

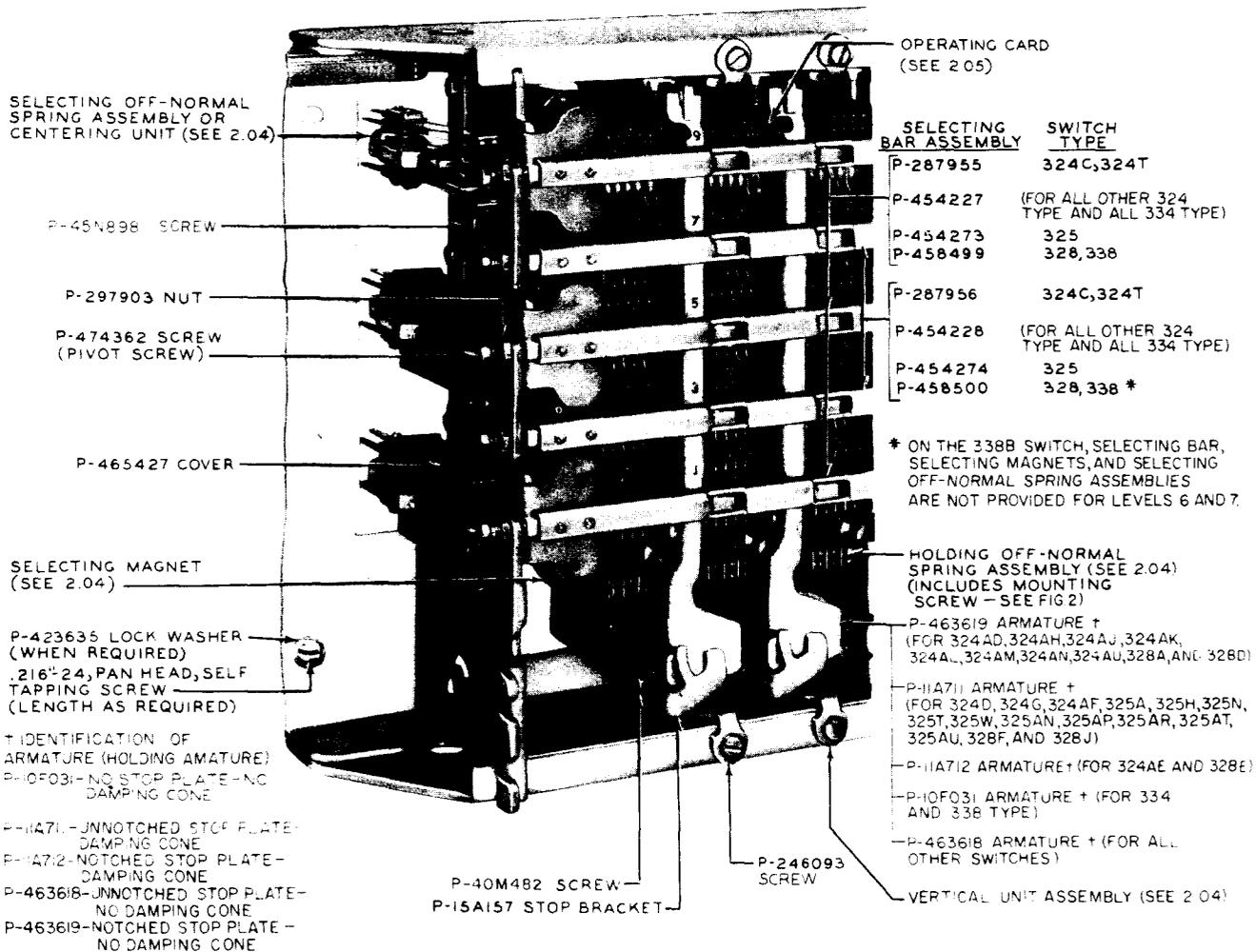
**2.03** When ordering piece parts for replacement purposes, give both the number and the name of the piece part; for example, P-465427 cover. Do not refer to the section number or to any information

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 324-, 325-, 328-, 334-, and 338-type switches.

**2.05 Operating Cards:** The piece-part data for the operating cards of all switches is as follows:

- P-16A101 operating card (3-wire switches)
- P-16A102 operating card (4-wire switches)
- P-16A103 operating card (5-wire switches)
- P-16A104 operating card (6-wire switches)



**Fig. 1—Front View of Switch**

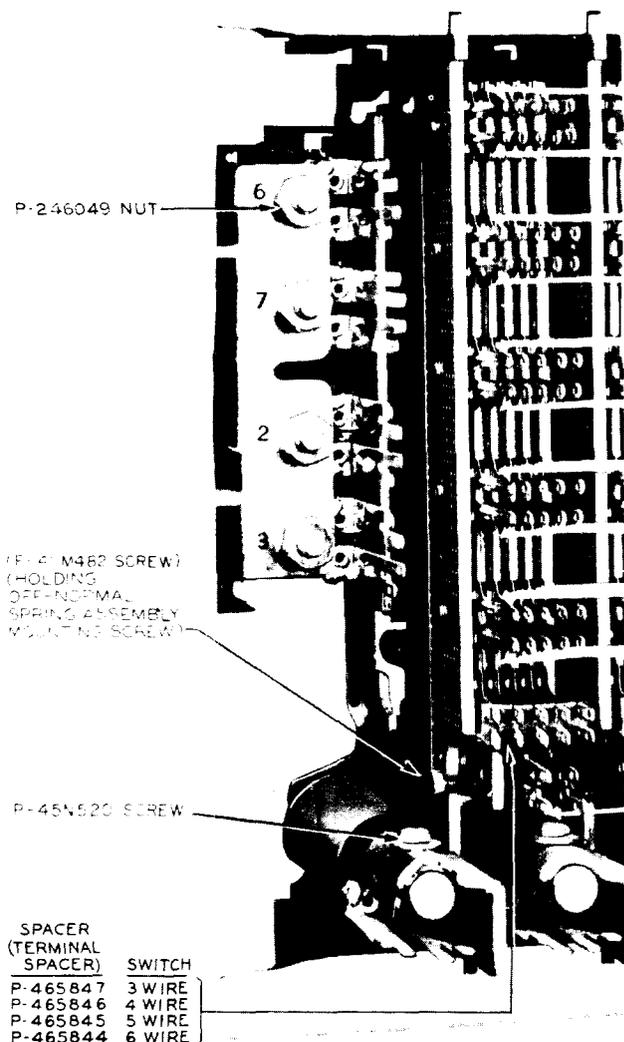


Fig. 2—Partial Rear View of Switch Showing Magnet Mounting Parts and Terminal Spacers

**2.06 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.

**3. APPARATUS**

**3.01 List of Tools, Test Sets, Gauges, and Materials:** The following tools, test sets, gauges, and materials are used in this section:

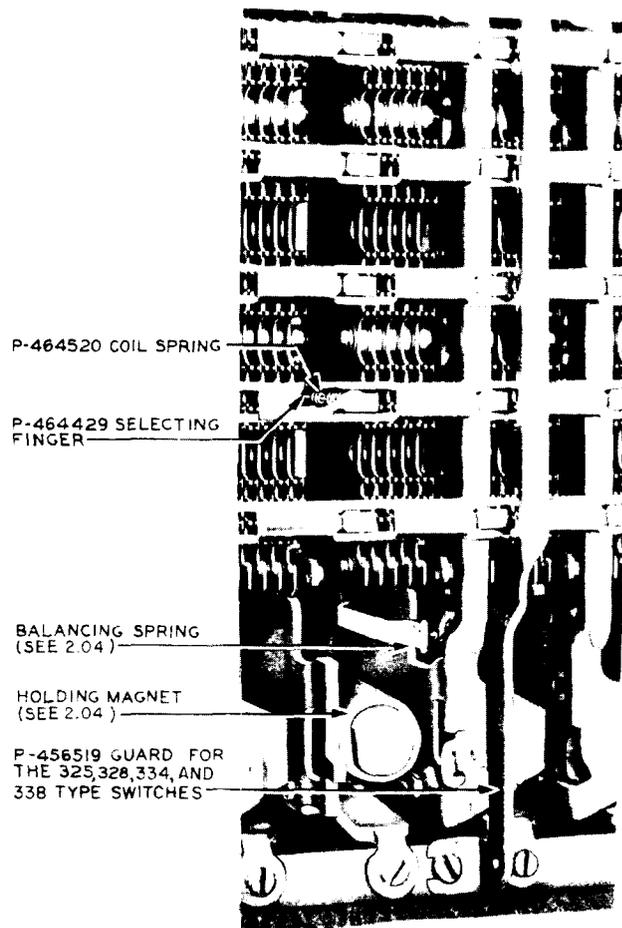


Fig. 3—Partial Front View of Switch Showing Vertical Unit With Holding Armature Removed

TOOLS	DESCRIPTION
—	◆Soldering Iron◆
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
418A	5/16- and 7/32-Inch Hex Open Double-End Flat Wrench
KS-7665 (485A)	Smooth-Jaw Pliers

See notes and footnotes at end of table.

SWITCH	VERTICAL UNIT ASSEMBLY	HOLDING OFF-NORMAL SPG ASSEM	SEE NOTE	PART NO	"P" PART NO.	RES (OHMS)	SELECTING OFF-NORMAL SPG ASSEM	"P" PART NO.	PART NO.	RES (OHMS)
321C	P-485255	P-463606	1	841526205	P-463646	330	P-454594	P-464444	841186885	240
321D	P-485287	P-463614		840021885	P-463644	1570	P-464444	P-464444	840021869	600
321E	P-485266	P-463610		840021885	P-463644	1570	P-464444	P-464444	840021869	600
321F	P-485270	P-463611		840021885	P-463644	1570	P-455481	P-464444	840021869	600
321G	P-485288	P-463614		840021885	P-463644	1570	P-455481	P-464444	840021869	600
321J	P-485259	P-463614		840021877	P-463647	1250	P-464444	P-464444	840021869	600
321K	P-485260	P-463620*	3	841526205	P-463646	330	P-455482	P-464444	840021869	600
321M	P-485263	P-463603	4	840021877	P-463647	1250	P-455481	P-464444	840021869	600
321N	P-485264	P-463607		841526197	P-463645	200	P-455481	P-464444	841526189	157
321P	P-485265	P-463610		840021877	P-463647	1250	P-455481	P-464444	840021869	600
321R	P-485269	P-463607	5	841526197	P-463645	200	P-455481	P-464444	841526189	157
321T	P-485271	P-463602		841526205	P-463646	330	P-455482	P-464444	841186877	43
321W	P-485266	P-463620*	6	840021885	P-463644	1570	P-455482	P-464444	841186885	240
321Y	P-485260	P-463620*		840021877	P-463647	1250	P-455482	P-464444	841186885	240
321AA	P-485279	P-463608	9	841526205	P-463646	330	P-455482	P-464444	841186885	240
321AB	P-485258	P-463610		840021885	P-463644	1570	P-455481	P-464444	840021869	600
321AC	P-485281	P-463614		840021885	P-463644	1570	P-464444	P-464444	840021869	600
321AD	P-485282	P-463620*		840021893	P-493701	1250	P-455482	P-464444	841186877	43
321AE	P-485284	P-463620*		840021893	P-493701	1250	P-455482	P-464444	841186877	43
321AF	P-11A713	P-463614		840021885	P-463644	1570	P-464444	P-464444	840021869	600
321AG	P-485263	P-463603		840021877	P-463647	1250	P-455482	P-464444	841186885	240
321AH	P-15A957	P-463610		840021893	P-493701	1250	P-455482	P-464444	841186877	43
321AJ	P-485286	P-463614		841526213	P-16A217	900	P-464444	P-464444	840021864	600
321AK	P-10F131	P-463604		841526213	P-16A217	900	P-464444	P-464444	840021869	600
321AL	P-10F132	P-463620*	10	841526213	P-16A217	900	P-464444	P-464444	840021869	600
321AM	P-10F398	P-463610	11	841526213	P-16A217	900	P-464444	P-464444	840021869	600
321AN	P-10F415	P-10F413	16	841526205	P-16A217	900	P-455483	P-464444	840021869	600
321AR	P-485255	P-463606		841526205	P-463646	330	P-454594	P-464444	841186885	240
321AS	P-11A866	P-463620*	2	840021877	P-463647	1250	P-455483	P-464444	840021869	600
321AT	P-10F859	P-11F016		841526205	P-463646	330	P-455483	P-464444	841186885	240
321AT	P-10F131	P-463604		841526213	P-16A217	900	P-455483	P-464444	840021869	600
321AW	P-10F861	P-13F096		841526205	P-463646	330	P-455481	P-464444	840021869	600
325A	P-485287	P-463614		840021885	P-463644	1570	P-464444	P-464444	840021869	600
325B	P-485253	P-463620*		840021885	P-463644	1570	P-464444	P-464444	840021869	600
325C	P-485266	P-463620*		840021885	P-463644	1570	P-464444	P-464444	840021869	600
325D	P-485256	P-463610		840021885	P-463644	1570	P-455481	P-464444	840021869	600
325E	P-485254	P-463614		840021885	P-463644	1570	P-455483	P-464444	840021869	600
325F	P-485254	P-463614		840021885	P-463644	1570	P-466075	P-464444	841186885	240
325G	P-485267	P-463604		840021885	P-463644	1570	P-455483	P-464444	840021869	600

TABLE A4

♦TABLE A♦ (Contd)

SWITCH	VERTICAL UNIT			HOLDING MAGNET			SELECTING OFF-NORMAL SPG ASSEM	SELECTING MAGNET	
	VERTICAL UNIT ASSEMBLY	HOLDING OFF-NORMAL SPG ASSEM	SEE NOTE	PART NO.	"P" PART NO.	RES (OHMS)	"P" PART NO.	PART NO.	RES (OHMS)
325H	P-485252	P-463610	7	840021885	P-463644	1570	P-464444†	840021869	600
	P-485289	P-463610	8						
325J	P-485268	P-463605		840021885	P-463644	1570	P-455481	840021869	600
325N	P-485252	P-463610		840021885	P-463644	1570	P-464444†	840021869	600
325T	P-485288	P-463614		840021885	P-463644	1570	P-464444†	840021869	600
325U	P-485281	P-463614		840021885	P-463644	1570	P-464444†	840021869	600
325W	P-485252	P-463610	7	840021885	P-463644	1570	P-464444†	840021869	600
	P-485290	P-463610	8						
325Y	P-485280	P-463611		840021885	P-463644	1570	P-455483	841186893	34
325AA	P-485277	P-463620*		840021885	P-463644	1570	P-464444†	840021869	600
325AB	P-485277	P-463620*		840021885	P-463644	1570	P-455483	841186893	34
325AC	P-485283	P-463612		840021877	P-463647	1250	P-455481	840021869	600
325AD	P-485253	P-463620*	7	840021885	P-463644	1570	P-464444†	840021869	600
	P-485281	P-463614	8						
325AE	P-485273	P-463620*		841526221	P-463648	1940	P-464444†	840021869	600
325AF	P-485275	P-463620*		841526221	P-463648	1940	P-464444†	840021869	600
325AG	P-485274	P-463610		841526221	P-463648	1940	P-455481	840021869	600
325AH	P-485276	P-463614		841526221	P-463648	1940	P-455483	840021869	600
325AJ	P-485276	P-463614		841526221	P-463648	1940	P-466075†	841186885	240
325AK	P-485257	P-463614		840021885	P-463644	1570	P-466075†	841186885	240
325AL	P-485257	P-463614		840021885	P-463644	1570	P-455483	840021869	600
325AM	P-485285	P-463620*		840021877	P-463647	1250	P-464444†	840021869	600
325AN	P-11A714	P-463620*		840021885	P-463644	1570	P-464444†	840021869	600
325AP	P-11A713	P-463614		840021885	P-463644	1570	P-464444†	840021869	600
325AR	P-11A713	P-463614	7	840021885	P-463644	1570	P-464444†	840021869	600
	P-11A714	P-463620*	8						
325AT	P-10F091	P-463620*		840021885	P-463644	1570	P-464444†	840021869	600
325AU	P-10F089	P-10F090		840021885	P-463644	1570	P-464444†	840021869	600
328A	P-485278	P-463620*		840021893	P-493701	1250	Note 12	Note 14	
328B	P-485260	P-463620*		840021877	P-463647	1250	P-455483	840021869	600
328D	P-485278	P-463620*		840021893	P-473701	1250	Note 13	Note 14	
328E	P-11A715	P-463620*		840021893	P-473701	1250	Note 13	Note 14	
328F	P-11A866	P-463620*		840021877	P-463647	1250	P-455483	840021869	600
328G	P-485259	P-463614		840021877	P-463647	1250	P-455483	840021869	600
328H	P-485263	P-463603		840021877	P-463647	1250	P-455481	840021869	600
328J	P-10F412	P-463603		840021877	P-463647	1250	P-455481	840021869	600
328K	P-10F857	P-11F016		840021877	P-463647	1250	P-455481	840021869	600
328L	P-11A866	P-463620*	7	840021877	P-463647	1250	P-455481	840021869	600
	P-10F412	P-463603	8						
334A	P-10F038	P-10F033		841526163	P-10F028	155	P-455481	841521689	157
334B	P-10F039	P-10F033		841526163	P-10F028	155	P-455481	841521689	157
338A	P-10F040	P-463602		841526171	P-10F029	330	P-455483	840021869	600
338B	P-10F041	P-463602		841526171	P-10F029	330	P-455483†	840021869†	600
338C	P-10F856	P-10F801		841526171	P-10F029	330	P-455483	840021869	600
338D	P-10F858	P-10F801		841526171	P-10F029	330	P-455483	840021869	600

See notes and footnotes at end of table.

♦TABLE A♦ (Contd)

**Note 1:** For positions 0, 1, 2, 3, and 5.

**Note 2:** For position 4.

**Note 3:** For positions 0, 3, 4, 5, 6, and 7.

**Note 4:** For positions 1, 2, 8, and 9.

**Note 5:** For positions 0, 1, and 5.

**Note 6:** For positions 2, 3, and 4.

**Note 7:** For positions 0L through 9L.

**Note 8:** For positions 0R through 9R.

**Note 9:** For positions 0 through 7.

**Note 10:** For positions 1, 2, 3, 4, 7, 8, and 9.

**Note 11:** For positions 0, 5, and 6.

**Note 12:** P-466075 centering unit for positions 0 and 1; P-455483 selecting off-normal spring assembly for positions 2 through 9.

**Note 13:** P-466075 centering unit for positions 0 and 1; P-464444 centering unit for positions 2 through 9.

**Note 14:** 841186885 selecting magnet (240 ohms) for positions 0 and 1; 840021869 selecting magnet (600 ohms) for positions 2 through 9.

**Note 15:** The selecting off-normal spring assembly and the selecting magnets are not provided on levels 6 and 7.

**Note 16:** For positions 0, 1, 2, 3, 5, 6, and 7.

\* Order as balancing spring. Spring mounted with one P-299453 screw.

† Order as centering unit.

‡ See Note 15.

TOOLS	DESCRIPTION	TOOLS	DESCRIPTION
541A	1/4-Inch 12-Point Double-End Box Wrench	168H	0.031-Inch Nonmagnetic Thickness Gauge
544A	1/4-Inch Hex Offset Socket Wrench	168K	0.037-Inch Nonmagnetic Thickness Gauge
672A	Spring Blocking Tool	168P	0.076-Inch Nonmagnetic Thickness Gauge
673A	Tweezers	168R	0.090-Inch Nonmagnetic Thickness Gauge
KS-6320, L1	Orange Stick [modified as covered in subparagraphs 4.17(2), 4.19(1), and 4.21(2)]	168S	0.083-Inch Nonmagnetic Thickness Gauge
KS-14220	Wrench consisting of:	R-8550	6-Inch Steel Scale
L1	Sliding "T" Handle		
L7	6-Inch Extension Bar	<b>MATERIALS</b>	
L14	7/16-Inch 12-Point Socket	KS-16832, L2	Lubricant
AT-7858	6-Inch Diagonal D6 Pliers	P-12F824	Terminal
AT-7860	B Long-Nose Pliers	—	320 Aloxite Cloth
AT-7825	4-Inch E Screwdriver	—	22-Gauge Bare Tinned Copper Wire
<b>♦TEST SETS</b>		—	Carbon Paper
35F	Test Set (or equivalent)		
ITE 440	Test Set (or equivalent)♦		
<b>GAUGES</b>		<b>4. REPLACEMENT PROCEDURES</b>	
74D	Thickness Gauge Nest	<b>GENERAL</b>	
79B	0-1000 Gram Push-Pull Tension Gauge, equipped with 645A Pull Finger	<b>4.01</b>	No replacement procedures are specified for screws or parts where replacement procedures consist of a simple operation.
168D	0.016-Inch Nonmagnetic Thickness Gauge	<b>4.02</b>	Soldering of strap leads, when necessary, will be done in accordance with the section covering soldering on crossbar switches and 245-type relays. ♦Solderless wrapped leads, if removed from a connection, must be soldered when they are reinstalled.♦
168E	0.019-Inch Nonmagnetic Thickness Gauge	<b>4.03</b>	After making any replacement of parts of 324- or similar-type switches, the replacement part shall meet the readjust requirements involved as specified in Section 030-720-701 covering this apparatus. Other parts whose adjustments may have been disturbed by the replacing operations shall be
168F	0.021-Inch Nonmagnetic Thickness Gauge		
168G	0.022-Inch Nonmagnetic Thickness Gauge		

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checked to the readjust requirements, and an overall operation check shall be made of the switch before restoring the circuit to service.

**4.04 *Selecting Bar:*** To remove the selecting bar, proceed as follows:

- (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 wrench. Turn the pivot screw out sufficiently with the 43 wrench to free the selecting bar and remove the selecting bar.

◆**Note:**◆ **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 ensure 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.

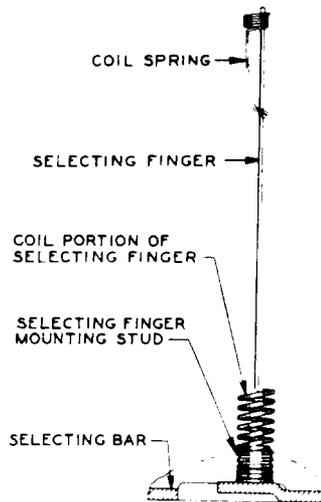
- (3) Before mounting the new selecting bar, make sure the container of lubricant has been shaken as covered in previous note. Then dip a piece of 22-gauge bare tinned copper wire into KS-16832, L2, lubricant to a depth of approximately 3/8 inch and quickly remove the wire. Apply the drop of lubricant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

**4.05 *Selecting Finger:*** To remove the selecting finger, proceed as follows:

- (1) Remove the selecting bar, as covered in paragraph 4.04.
- (2) Remove the old selecting finger by pulling it off with the B 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 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 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 6-inch diagonal pliers so 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. 4. Force the coil

spring over the tip of 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 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.



**Fig. 4—Method of Assembling Coil Spring of Selecting Finger**

(7) Remount the selecting bar, as covered in paragraph 4.04, except that no oil should be placed on the pivot screws.

**4.06 Selecting Magnet:** Remove the associated selecting bar, as covered in paragraph 4.04. Unsolder or unwrap the leads connected to the magnet to be replaced. Remove the magnet clamping nut with the KS-14220 wrench and remove the magnet. Substitute the new magnet and reassemble the magnet clamping nut. Securely tighten the magnet clamping nut, exercising care to align the coil so 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 paragraph 4.04, except that no oil should be placed on the pivot screws.

**4.07 Selecting Off-Normal Spring Assembly or Centering Unit:** Unsolder or unwrap the leads, if any. Remove the selecting off-normal spring

assembly or centering unit bracket mounting screws with the 544A wrench and remove the spring assembly. 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.

**4.08 Holding Off-Normal Spring Assembly:**

Unsolder or unwrap 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. Mount the new spring assembly. Securely tighten the mounting screw. Resolder the leads to their proper terminals.

**4.09 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.

**4.10 Vertical Unit:** To remove the vertical unit, proceed as follows:

- (1) Remove the selecting bars, as covered in paragraph 4.04.
- (2) Unsolder or unwrap the necessary crosspoint strap wires as described in the section covering soldering on crossbar switch and 245-type relays. Unsolder or unwrap the holding magnet leads. Unsolder or unwrap 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, as covered in paragraph 4.08 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 reuse the balancing spring, remove the balancing spring mounting screw 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 all cases, except 325T, 325W, 325Y, 325AA,

325AB, 325AC, 325AK, 325AL, 325AM, 325AT, and 325AU switches, locate it so there is at least 1/32-inch clearance between the new vertical unit and all parts of adjacent vertical units. On the 325T, 325W, 325Y, 325AA, 325AB, 325AC, 325AK, 325AL, 325AM, 325AT, and 325AU switches locate the switch so the clearance between the pileup screws and the operating cards of the adjacent vertical unit is at least 7/64 inch. 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 covered in the section covering soldering on cross-bar switch and 245-type relays. Resolder any other leads which were removed.

(7) Remount the selecting bars, as covered in paragraph 4.04, 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.

**4.11 Multiple Strip Terminal Spacer:** Remove the old spacer with a pair of B long-nose pliers. Unsolder the wires from the multiple strip terminals and remove all excess solder from the terminals. Hold the new spacer so 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.

#### Holding Armature

**4.12 ⚠Warning⚠:** *In removing and mounting holding armatures, it will be necessary to exercise care to avoid damaging the operating cards in paragraphs 4.13, 4.14, and 4.15.*

**4.13** In some cases where vertical units are mounted on close centers, difficulty may be experienced in removing and mounting the holding armature because of interference between operating cards on adjacent vertical units. In this case, with the 4-inch E screwdriver, loosen the mounting screws of the vertical unit in which the armature is being removed. Also loosen the mounting screws of the verti-

cal unit to the right and move the vertical units away from each other, after which the armature can be removed and a new one mounted, as covered in paragraphs 4.14 and 4.15. Then shift the vertical units back into position, taking care to leave the clearance between all parts of adjacent vertical units, as specified in paragraph 4.10.

**4.14 Removing Holding Armature:** Loosen the stop bracket screws with the 541A wrench, taking care to avoid damaging the adjacent magnet. Remove the stop bracket. Grasp the armature at a point close to the core in such a way as to keep it in an unoperated position. Gently draw the armature forward until it clears the armature support lug (about 3/32 inch), rotate the armature to clear the operating cards, and slowly draw it downward and outward to free it from the top bearing lug. Remove the armature from the vertical unit, making sure it does not catch on the selecting fingers.

**4.15 Mounting Holding Armature:** Grasp the bottom right corner of the armature and carefully insert the fork at the top end into the bearing lug on the base, making sure that the armature does not catch on the selecting fingers or operating cards and being careful to maintain the clearance between the armature and the operating cards. Position the armature on the armature support lug. Remount the stop bracket, adjusting the gap between the armature and the core to approximately 0.083 inch using the 168S gauge. Securely tighten the stop bracket screw.

#### Holding Magnet (324-, 325-, and 328-Type Switches)

**4.16 Removing Holding Magnet:** Remove the holding armature, as covered in paragraph 4.14. Unsolder the leads connected to the magnet. Remove the magnet clamping screw with the 541A wrench and remove the washer and magnet.

**4.17 Mounting Holding Magnet:** To mount the holding magnet, proceed as follows:

- (1) Mount the new magnet, pushing the magnet as far forward as the elongated hole in the base will permit. Tighten the clamping screw finger tight.
- (2) Remount the holding armature, as covered in paragraph 4.15. Remount the stop bracket, adjusting the core gap within limits of 0.076 to

0.090 inch using the 168P and 168R gauges. Tighten the stop bracket mounting screw finger tight. Carefully insert the 168G (0.022 inch) gauge over the armature. Block operated any selecting armature. Modify a KS-6320, L1, orange stick by cutting off approximately 1-1/2 inches from each end. Make the cuts at right angles to the length of the orange stick.

(3) Manually operate the holding armature and place one end of the modified orange stick against the armature. Tap the other end with the handle of a screwdriver moving the magnet inward until at least one contact of each bifurcated spring in the crosspoint closes. Note that the gauge remains properly positioned on the armature. Securely tighten the magnet mounting screw.

(4) Replace the 168G (0.022 inch) gauge with the 168K (0.037 inch) gauge. Manually operate the holding armature. No contacts on the bifurcated springs shall close. However, if the contacts on the bifurcated springs close, check the position of the magnet as covered above. If they still close, check the readjust requirements as specified in Section 030-720-701. Check that all crosspoints meet this requirement.

(5) After the requirements are met and with the 168S (0.083 inch) gauge in position and the holding armature operated manually, reset the stop bracket and tighten the stop bracket mounting screw. Resolder the leads to the proper terminals of the magnet. Restore the selecting armature to normal.

#### Holding Magnet (334- and 338-Type Switches)

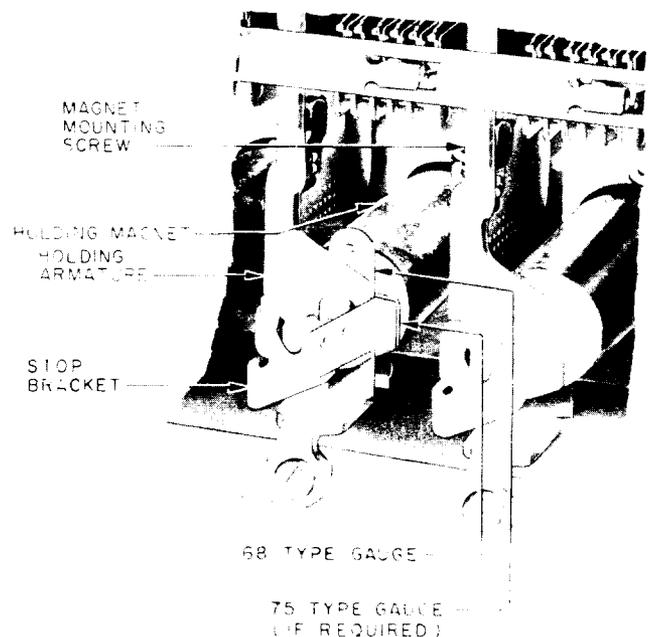
**4.18** Before removing the holding magnet to be replaced, determine an approximate reference point for positioning the new magnet, as covered in paragraph 4.19.

**4.19 *Determining Approximate Reference Point for Positioning New Holding Magnet:*** To determine a reference point for a new holding magnet, proceed as follows:

(1) To obtain an approximate reference point for positioning the new holding magnet before removing defective magnet, determine the armature gap at which at least one contact of each bifurcated spring in level 1 on the vertical unit closes

(front contact make gauging value). To do this, block operated No. 1 selecting armature by inserting a wedge between the No. 0 armature and the adjacent edge of the end plate of the switch. A suitable wedge can be made by cutting about 1-1/2 inches from the end of a KS-6320, L1, orange stick.

(2) Determine the gauging value by trial using a suitable 168-type gauge together with a 75-type gauge, if necessary. The 75-type gauges are part of the 74D gauge nest. Apply the 168-type gauges to the armature from the right, as shown in Fig. 5, making sure that the gauge retaining spring clears the armature stop bracket, that the gauge handle is against the edge of the armature, and that the armature is against the knife edge. If a 75-type gauge is needed, remove the gauge from the 74D gauge nest and approximately position it on the armature before applying the 168-type gauge. Then place the 168-type gauge on the 75-type gauge and position the 75-type gauge against the intersection of the handle and gauging portion of the 168-type gauge. Operate the armature against the gauges and record the contact make gauging value.



**Fig. 5—Method of Determining Front Contact Make Gauging Valve**

## SECTION 030-720-801

**4.20 Removing Holding Magnet:** Remove the holding armature, as covered in paragraph 4.14. Unsolder or unwrap the leads connected to the magnet. Remove the magnet mounting screw with the 541A wrench and remove the magnet and washer.

**4.21 Mounting and Positioning Holding Magnet:** To mount and position the holding magnet, proceed as follows:

- (1) Mount the magnet using a new washer and mounting screw. Push the magnet as far forward as the elongated hole in the base will permit. Tighten the mounting screw finger tight. Remount the holding armature and stop bracket, as covered in paragraph 4.15.
- (2) Modify a KS-6320, L1, orange stick by cutting off about 1-1/2 inches from each end. Make the cuts at right angles to the length of the orange stick.
- (3) Apply to the armature the 168- and 75-type gauges corresponding to the front contact make gauging value, as determined in paragraph 4.19. Make sure the gauges are positioned on the armature, as described in paragraph 4.19.
- (4) Place one end of the modified KS-6320, L1, orange stick against the holding armature and move the armature so the gauge touches the magnet core. Then tap the orange stick with the handle of a screwdriver, moving the magnet inward, until at least one contact of each bifurcated spring in level 1 closes. Securely tighten the magnet mounting screw. Unblock the selecting armature and remove the gauges from the holding armature.
- (5) To ensure satisfactory positioning of the holding magnet, the following two conditions must be met.
  - (a) The armature should remain magnetically latched in the operated position when a pull of minimum 900 grams is applied to the edge of the armature. The method of obtaining this condition is covered in (6).
  - (b) With the armature operated, the contact between the armature and core pole face should be completely within 1/8 inch of the center of the pole face. The method of obtaining this condition is covered in (7).
- (6) To determine whether the armature remains magnetically latched in the operated position

when a pull of minimum 900 grams is applied to the armature, proceed as follows:

- (a) After a reverse soak of 0.050 ampere, apply a momentary current of 0.095 ampere (see Note). This will magnetically latch the armature in the operated position with the holding off-normal springs the only load on the armature. Apply the pull finger of the 79B gauge to the midpoint of the edge of the armature so the finger engages the armature by 1/16 inch. Holding the gauge horizontal and at right angles to the armature, exert a slowly increasing pull on the gauge and determine the pull required to unlatch the armature from the magnet.

◆**Note:** To measure current, use a 35F or ITE 440 test set (or equivalent).

- (b) If the unlatching pull is less than 900 grams, reposition the holding magnet as follows. Loosen the magnet mounting screw just enough to permit adjustment of the magnet position. Place the end of the modified orange stick against the armature and move the armature inward so it touches the magnet core. Then tap the orange stick with the handle of the screwdriver, moving the magnet inward slightly. Tighten the magnet mounting screw and again determine the pull necessary to unlatch the armature from the magnet as covered in (a).
  - (c) If the unlatching force is still less than 900 grams but is greater than the previous measurement, again reposition the magnet inward until the 900-gram measurement is met. If, however, the unlatching force is less than the initial measurement, slightly move the magnet outward in a similar manner but place the orange stick on the mounting end of the magnet core.
- (7) To determine whether the contact between the armature and the core pole face is completely within 1/8 inch of the center of the pole face, proceed as follows:
    - (a) Cut a strip of white paper approximately 1 inch wide and 2 inches long. Similarly, cut a strip of carbon paper to the same size. Hold the two strips of paper together with the carbon side of the carbon paper against the white paper. Then insert the strips of paper between the

armature and core with the white paper against the core pole face. While holding the strips of paper in this position, electrically operate and release the armature once. Remove the strips of paper.

(b) Examine the impression made by the carbon paper on the white paper. A dot, similar to that shown in Fig. 6A, indicates satisfactory contact between the armature and core pole face. An arc-shaped impression, similar to that shown in Fig. 6B, indicates that the contact between the armature and core is more than 1/8 inch from the center of the core pole face, which is unsatisfactory. If this is the case, reposition the magnet as covered in (6)(b). Move the magnet inward slightly if the arc-shaped impression on the paper is to the left of the center of the pole face or outward if the arc-shaped impression is to the right of center. Recheck (6) after repositioning the magnet.

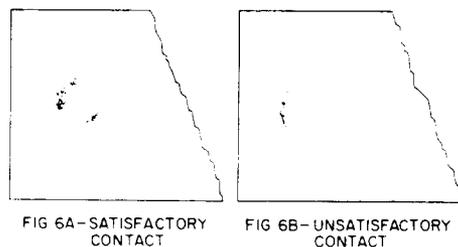


Fig. 6—Carbon Impressions of Contact Between Holding Armature and Holding Magnet Core Pole Face

### Operating Card

**4.22 General:** To facilitate the removal of the operating card, remove the selecting bar associated with the card to be replaced as covered in paragraph 4.04. If the selecting bar removed was in the uppermost or lowermost position, also remove the adjacent selecting bar. If the selecting bar removed was in any position other than that specified above, then also remove both the upper and lower adjacent selecting bars. If more than the two adjacent selecting bars are removed, label them so they can be replaced in the positions from which they were removed.

**4.23** Remove the holding armature associated with the unit on which the card is to be replaced, as covered in paragraphs 4.13, 4.14, and 4.15. Also, remove the holding armature in the position to the left of the one removed.

**4.24 Removing Card: Warning: Do not use excessive force in removing a card since this may cause the card to become wedged or a spring to be bent.** To remove the card, proceed as follows:

(1) At the position of the card to be replaced, hold the 672A blocking tool with the lever at the right and the springs of the tool just in back of the springs of the vertical unit at which the card is to be replaced. Where the card is on a unit having less than six contacts per crosspoint, place the tool so the lever is at the right and when in position will operate the right-hand operating spring. Force the tool into position, as shown in Fig. 7 and 8, exercising care not to damage the springs. (Make sure the tool is fully seated; that is, the front end of the tool strikes the ends of the springs, as shown in Fig. 8, and all the associated contacts of the crosspoint are closed.)

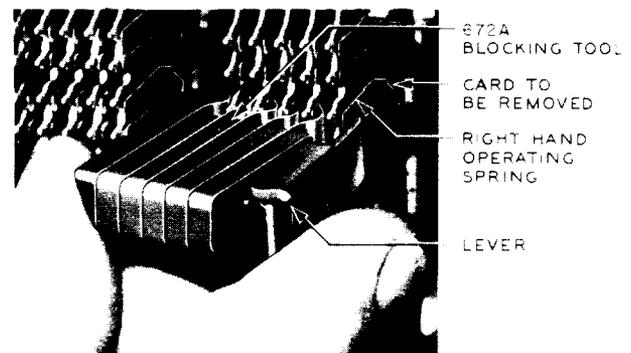


Fig. 7—Applying Blocking Tool

(2) Grasp one end of the card with the 673A tweezers, as shown in Fig. 9, and rotate the card 90 degrees until it is lying flat. Withdraw the card from the spring assembly with the tweezers or the KS-7665 (485A) pliers at the right-hand side of the unit unless the card is broken, in which case remove each part from the side of the vertical unit associated with the respective part. Removal of the card will be facilitated if it is moved slightly toward the rear of the switch as it is being withdrawn.

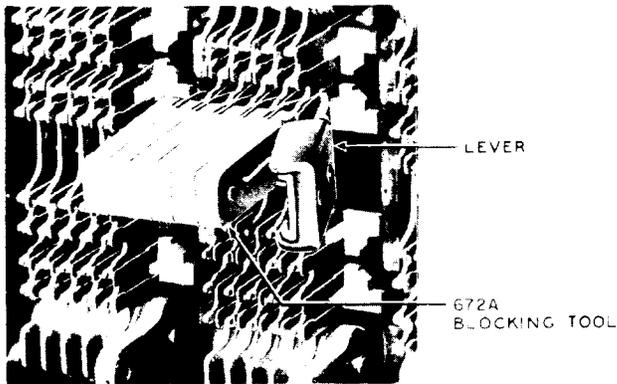


Fig. 8—Blocking Tool in Position

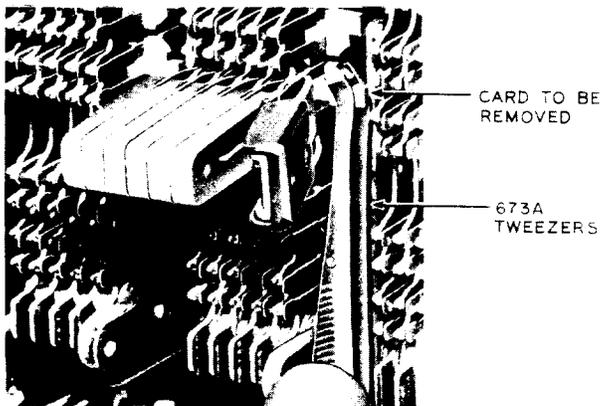


Fig. 9—Rotate Card to a Flat Position With Tweezers

**4.25 Mounting Card: Warning: If the card tends to bind, do not attempt to force it into position. Restore the card to its horizontal position and then shift it slightly to the right or left or front or rear as required, and then again attempt to rotate it into position. Excessive force used in positioning a card may cause it to break or may distort a spring.**  
To mount a card, proceed as follows:

(1) Never reuse a card since each insertion and removal of a card tends to round the edges, thereby causing the card to fit loosely.

(2) Grasp a new card near the center with the KS-7665 (485A) pliers with the armature end of the card toward the right and the long tang in a direction away from the pliers, as shown in Fig. 10.

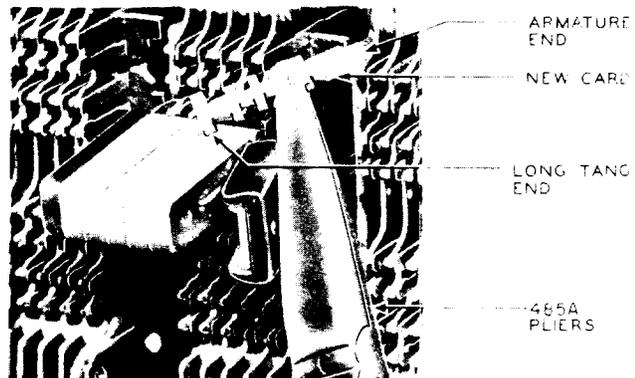


Fig. 10—Grasping a New Card for Replacement

(3) Insert the card armature end first in the space between the unit on which the card is to be replaced, and the vertical unit at the right until the long tang end of the card is adjacent to the card opening in the vertical unit. Then while holding the card in this position, rotate the card in a horizontal direction so the long tang end of the card enters the card opening, as shown in Fig. 11. Use the orange stick to assist in this operation and to free the card if it wedges or binds on the springs. Gently slide the card to the left until the card lines up with those immediately above and below it. When the card is in this position, grasp the armature end of the card with the tweezers and rotate it 90 degrees so the pointed side of the card at the armature end will point toward the corresponding part of the card associated with the crosspoint directly above or below. During this turning operation, use the orange stick at the left side, as shown in Fig. 12, to guide the card both front and rear and right and left into the proper grooves.

(4) After the card has been positioned vertically, move the card lightly at each side noting that it moves freely.

**4.26** Remove the spring blocking tool from the springs. Remount the holding armatures, as covered in paragraph 4.15, making sure that each armature is replaced in the same position from which

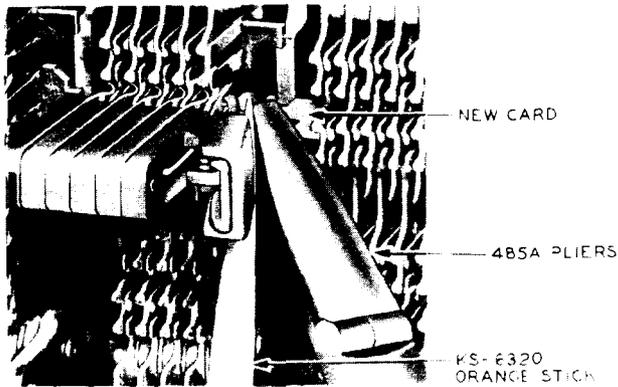


Fig. 11—Inserting New Card in Spring Combination

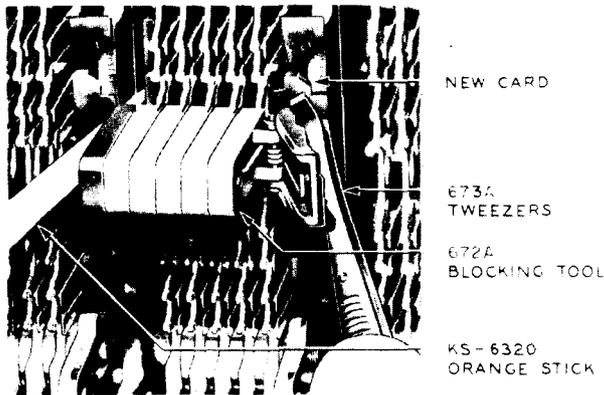


Fig. 12—Final Positioning Operations of New Card

it was removed. Remount the selecting bars, as covered in paragraph 4.04, except do not lubricate the pivot screws. In remounting the selecting bars, take care that they are reassembled in the same horizontal positions from which they were removed.

4.27 To repair wire-wrap terminals using the P-12F824 terminal, clip off any remaining stubs of the original wire-wrap terminals as shown in Fig. 13. Tin the spring stub approximately 3/8 inch from clipped end. Slip the P-12F824 terminal over the stub and plier-crimp in place. Reheat the joint to flow solder. Do not add more solder when making this connection. It is not permissible to make solderless wire-wrap connections on a terminal when solder splashes are present. Two solderless wire-wrapped connections can be made to the repaired terminal.

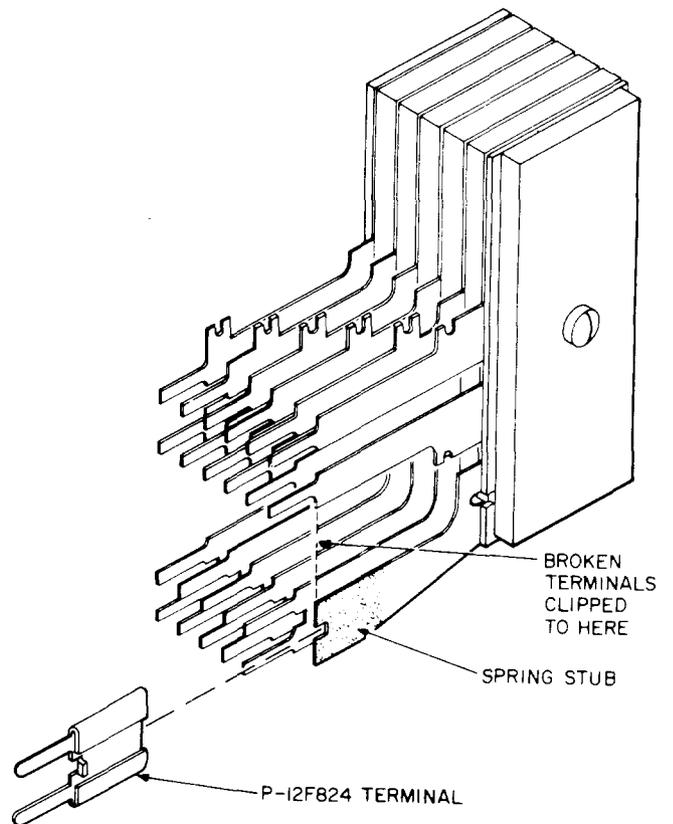


Fig. 13—Repair of Wire-Wrap Terminals Using P-12F824 Terminal