324, 325, 328, 334, AND 338 TYPE SWITCHES
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 324-, 325-, 328-, 334-, and 338-type switches. It also covers the approved procedures for replacing these parts.

1.02 This section is reissued to:

(1) Add addendum 1 and 2 changes

(2) Add new part numbers for the holding and selecting magnets in Table A.

Revision arrows have been used to indicate significant changes. The Equipment Test List is not affected.

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.

1.04 Part 4 of this section covers the approved procedures for the replacement of the parts covered in Part 2.

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 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.

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.

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 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)

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, Gauges, and Materials:***

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
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
485A	Smooth-jaw pliers
541A	1/4-inch 12-point double-end box wrench
544A	1/4-inch hex offset socket wrench
672A	Spring blocking tool
673A	Tweezers
KS-6320	Orange stick [modified as covered in paragraphs 3.18, 3.20, and 3.22(2)]
KS-6320	Orange stick
KS-14220	Wrench consisting of:
L1	Sliding "T" handle
L7	6-inch extension bar

TABLE A

SWITCH	VERTICAL UNIT			HOLDING MAGNET		SELECTING OFF-NORMAL SPG ASSEM	SELECTING MAGNET	
	VERTICAL UNIT ASSEMBLY	HOLDING OFF-NORMAL SPG ASSEM	SEE NOTE	PART NO.	RES (OHMS)	PART NO.	PART NO.	RES (OHMS)
324C	P-485255	P-463606	1	841526205	330	P-454594	841186885	240
	P-485272	P-463609	2					
324D	P-485287	P-463614		840021885	1570	†P-464444	840021869	600
324E	P-485256	P-463610		840021885	1570	†P-464444	840021869	600
324F	P-485270	P-463611		840021885	1570	P-455481	840021869	600
324G	P-485288	P-463614		840021885	1570	†P-464444	840021869	600
324J	P-485259	P-463614		840021877	1250	†P-464444	840021869	600
324K	P-485260	‡P-463620		840021877	1250	P-455483	840021869	600
324L	P-485262	P-463602	3	841526205	330	P-455482	841186877	43
	P-485261	P-463609	4					
324M	P-485263	P-463603		840021877	1250	P-455481	840021869	600
324N	P-485264	P-463607		841526197	200	P-455481	841526189	157
324P	P-485265	P-463610		840021877	1250	P-455481	840021869	600
324R	P-485269	P-463607		841526197	200	P-455481	841526189	157
324T	P-485271	P-463602	5	841526205	330	P-455482	841186877	43
	P-485272	P-463609	6					
324W	P-485266	‡P-463620		840021885	1570	P-455482	841186885	240
324Y	P-485260	‡P-463620		840021877	1250	P-455482	841186885	240
324AA	P-485279	P-463608	9	841526205	330	P-455482	841186885	240
324AB	P-485258	P-463610		840021885	1570	P-455481	840021869	600
324AC	P-485281	P-463614		840021885	1570	†P-464444	840021869	600
324AD	P-485282	‡P-463620		840021893	1250	P-455482	841186877	43
324AE	P-485284	‡P-463620		840021893	1250	P-455482	841186877	43
324AF	P-11A713	P-463614		840021885	1570	†P-464444	840021869	600
324AG	P-485263	P-463603		840021877	1250	P-455482	841186885	240
324AH	P-15A957	P-463610		840021893	1250	P-455482	841186877	43
324AJ	P-485286	P-463614		841526213	900	P-464444	840021864	600
324AK	P-10F131	P-463604		841526213	900	†P-464444	840021869	600
324AL	P-10F132	‡P-463620	10	841526213	900	†P-464444	840021869	600
	P-485286	P-463614	11					
324AM	P-10F398	P-463610		841526213	900	†P-464444	840021869	600
324AN	P-10F415	P-10F413		841526213	900	P-455483	840021869	600
324AR	P-485255	P-463606	16	841526205	330	P-454594	841186885	240
	P-485272	P-463609	2					
324AS	P-11A866	‡P-463620		840021877	1250	P-455483	840021869	600
324AT	P-10F859	P-11F016		841526205	330	P-455483	841186885	240
324AU	P-10F131	P-463604		841526213	900	P-455483	840021869	600
324AW	P-10F861	P-13F096		841526205	330	P-455481	840021869	600
325A	P-485287	P-463614		840021885	1570	†P-464444	840021869	600
325B	P-485253	‡P-463620		840021885	1570	†P-464444	840021869	600
325C	P-485266	‡P-463620		840021885	1570	†P-464444	840021869	600
325D	P-485256	P-463610		840021885	1570	P-455481	840021869	600
325E	P-485254	P-463614		840021885	1570	P-455483	840021869	600
325F	P-485254	P-463614		840021885	1570	†P-466075	841186885	240

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.	RES (OHMS)	PART NO.	PART NO.	RES (OHMS)
325G	P-485267	P-463604		840021885	1570	P-455483	840021869	600
325H	P-485252	P-463610	7	840021885	1570	†P-464444	840021869	600
	P-485289	P-463610	8					
325J	P-485268	P-463605		840021885	1570	P-455481	840021869	600
325N	P-485252	P-463610		840021885	1570	†P-464444	840021869	600
325T	P-485288	P-463614		840021885	1570	†P-464444	840021869	600
325U	P-485281	P-463614		840021885	1570	†P-464444	840021869	600
325W	P-485252	P-463610	7	840021885	1570	†P-464444	840021869	600
	P-485290	P-463610	8					
325Y	P-485280	P-463611		840021885	1570	P-455483	841186893	34
325AA	P-485277	‡P-463620		840021885	1570	†P-464444	840021869	600
325AB	P-485277	‡P-463620		840021885	1570	P-455483	841186893	34
325AC	P-485283	P-463612		840021877	1250	P-455481	840021869	600
325AD	P-485253	‡P-463620	7	840021885	1570	†P-464444	840021869	600
	P-485281	P-463614	8					
325AE	P-485273	‡P-463620		841526221	1940	†P-464444	840021869	600
325AF	P-485275	‡P-463620		841526221	1940	†P-464444	840021869	600
325AG	P-485274	P-463610		841526221	1940	P-455481	840021869	600
325AH	P-485276	P-463614		841526221	1940	P-455483	840021869	600
325AJ	P-485276	P-463614		841526221	1940	†P-466075	841186885	240
325AK	P-485257	P-463614		840021885	1570	†P-466075	841186885	240
325AL	P-485257	P-463614		840021885	1570	P-455483	840021869	600
325AM	P-485285	‡P-463620		840021877	1250	†P-464444	840021869	600
325AN	P-11A714	‡P-463620		840021885	1570	†P-464444	840021869	600
325AP	P-11A713	P-463614		840021885	1570	†P-464444	840021869	600
325AR	P-11A713	P-463614	7	840021885	1570	†P-464444	840021869	600
	P-11A714	‡P-463620	8					
325AT	P-10F091	‡P-463620		840021885	1570	†P-464444	840021869	600
325AU	P-10F089	P-10F090		840021885	1570	†P-464444	840021869	600
328A	P-485278	‡P-463620		840021893	1250	Note 12	Note 14	
328B	P-485260	‡P-463620		840021877	1250	P-455483	840021869	600
328D	P-485278	‡P-463620		840021893	1250	Note 13	Note 14	
328E	P-11A715	‡P-463620		840021893	1250	Note 13	Note 14	
328F	P-11A866	‡P-463620		840021877	1250	P-455483	840021869	600
328G	P-485259	P-463614		840021877	1250	P-455483	840021869	600
328H	P-485263	P-463603		840021877	1250	P-455481	840021869	600
328J	P-10F412	P-463603		840021877	1250	P-455481	840021869	600
328K	P-10F857	P-11F016		840021877	1250	P-455481	840021869	600
328L	P-11A866	‡P-463620	7	840021877	1250	P-455481	840021869	600
	P-10F412	P-463603	8					
334A	P-10F038	P-10F033		841526163	155	P-455481	841521689	157
334B	P-10F039	P-10F033		841526163	155	P-455481	841526189	157
338A	P-10F040	P-463602		841526171	330	P-455483	840021869	600
338B	P-10F041	P-463602		841526171	330	*P-455483	*840021869	600
338C	P-10F856	P-10F801		841526171	330	P-455483	840021869	600
338D	P-10F858	P-10F801		841526171	330	P-455483	840021869	600

TABLE A (Contd)

Notes:

1. For positions 0, 1, 2, 3, and 5.
2. For position 4.
3. For positions 0, 3, 4, 5, 6, and 7.
4. For positions 1, 2, 8, and 9.
5. For positions 0, 1, and 5.
6. For positions 2, 3, and 4.
7. For positions 0L through 9L.
8. For positions 0R through 9R.
9. For positions 0 through 7.
10. For positions 1, 2, 3, 4, 7, 8, and 9.
11. For positions 0, 5, and 6.
12. P-466075 centering unit for positions 0 and 1; P-455483 selecting off-normal spring assembly for positions 2 through 9.
13. P-466075 centering unit for positions 0 and 1; P-464444 centering unit for positions 2 through 9.
14. 841186885 selecting magnet (240 ohms) for positions 0 and 1; 840021869 selecting magnet (600 ohms) for positions 2 through 9.
15. The selecting off-normal spring assembly and the selecting magnets are not provided on levels 6 and 7.
16. For positions 0, 1, 2, 3, 5, 6, and 7.

* See Note 15.
† Order as centering unit.
‡ Order as balancing spring. Spring mounted with one P-299453 screw.

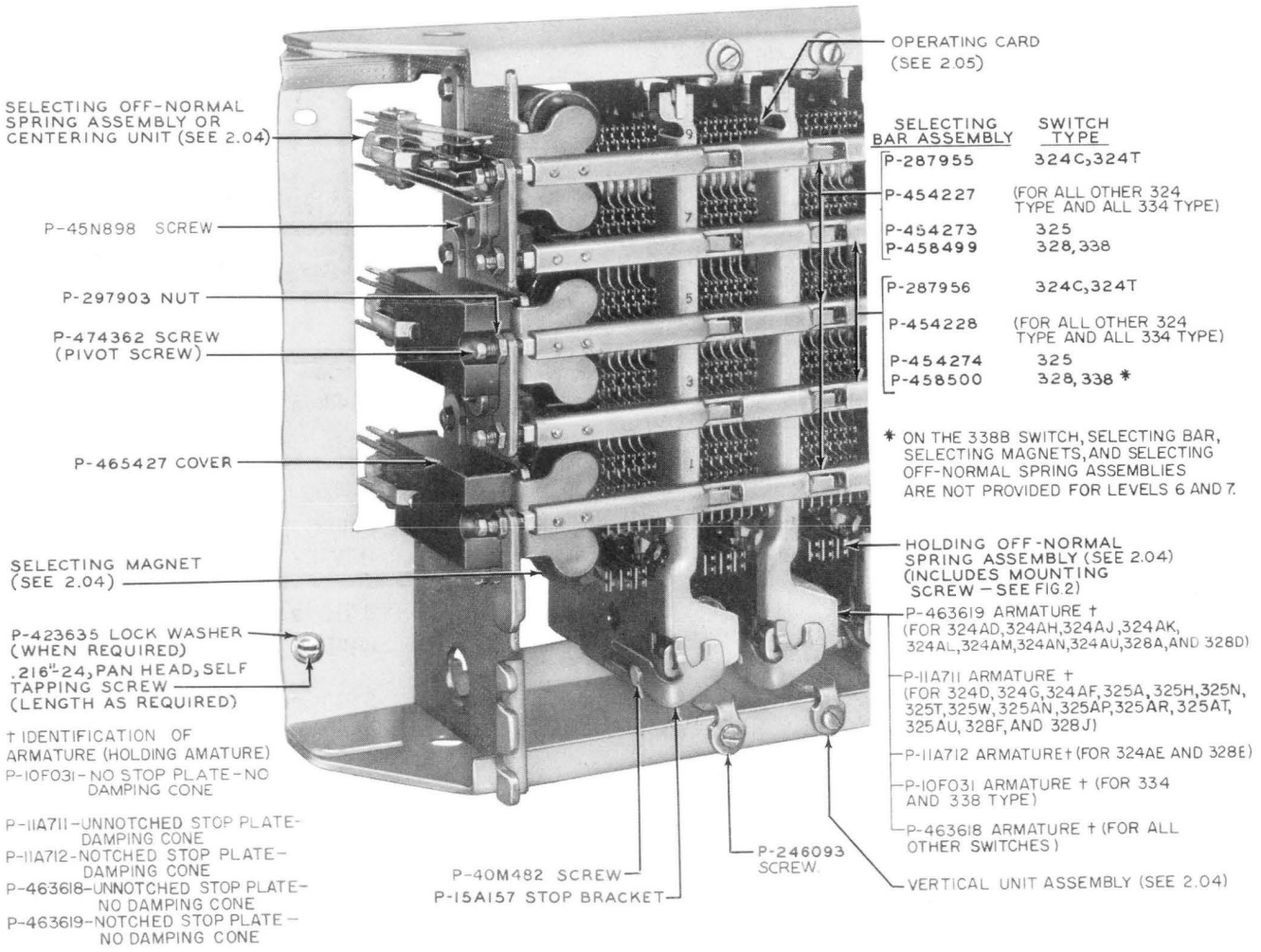

Fig. 1—Front View of Switch

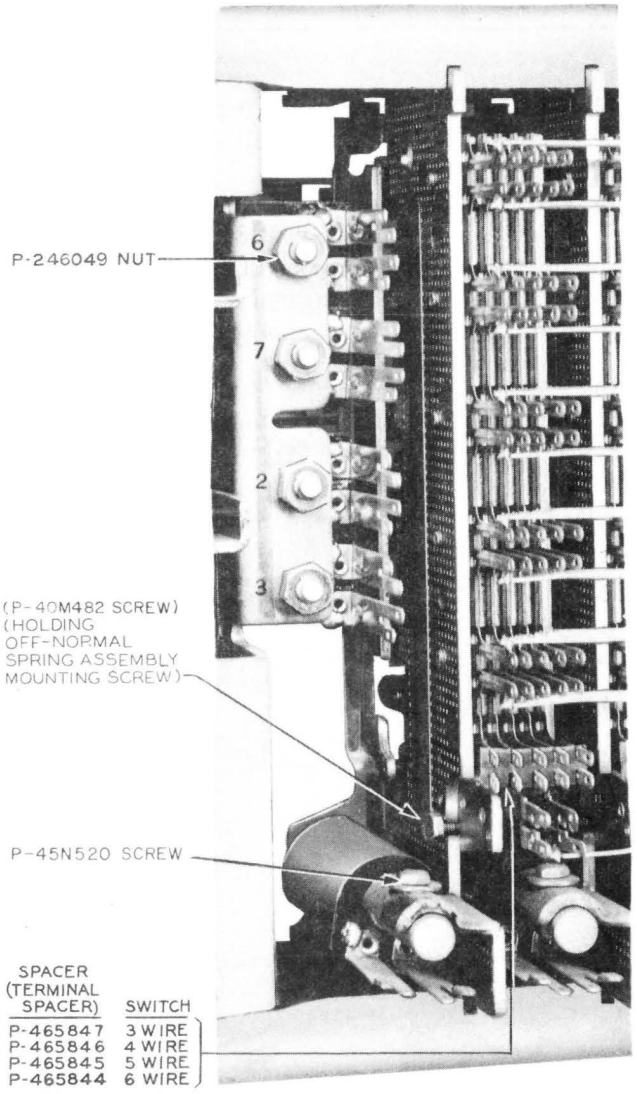

Fig. 2—Partial Rear View of Switch Showing Magnet Mounting Parts and Terminal Spacers

TOOLS	DESCRIPTION
L14	7/16-inch 12-point socket
AT-7858	5-inch diagonal D6 pliers
AT-7860	B long-nose pliers
AT-7825	4-inch E screwdriver

GAUGES

74D	Thickness gauge nest

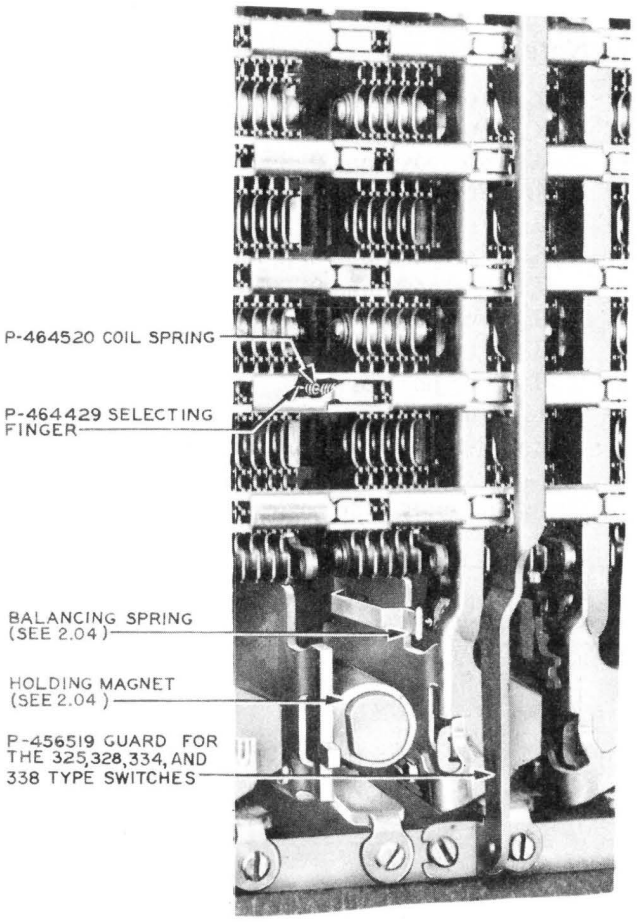

Fig. 3—Partial Front View of Switch Showing Vertical Unit With Holding Armature Removed

GAUGES	DESCRIPTION
79B	0-1000 gram push-pull tension gauge, equipped with 645A pull finger
168D	0.016-inch nonmagnetic thickness gauge
168E	0.019-inch nonmagnetic thickness gauge
168F	0.021-inch nonmagnetic thickness gauge
168G	0.022-inch nonmagnetic thickness gauge
168H	0.031-inch nonmagnetic thickness gauge

GAUGES	DESCRIPTION
168K	0.037-inch nonmagnetic thickness gauge
168P	0.076-inch nonmagnetic thickness gauge
168R	0.090-inch nonmagnetic thickness gauge
168S	0.083-inch nonmagnetic thickness gauge
R-8550	6-inch steel scale

MATERIALS	
KS-16832, L2	Lubricant
P-12F824	Terminal
—	320 Aloxite cloth
—	22-gauge bare tinned copper wire
—	Carbon paper

4. REPLACEMENT PROCEDURES

GENERAL

4.01 No replacement procedures are specified for screws or parts where replacement procedures consists of a simple operation.

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

4.03 After making any replacement of parts of 324- or similar-type switches, the part or parts replaced 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 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:***

(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.

(3) Before mounting the new selecting bar, make sure the container of lubricant has been shaken as covered in paragraph 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 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:***

(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 check 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 5-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.

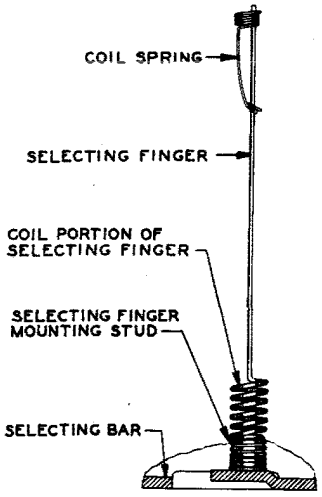

Fig. 4—Method of Assembling Coil Spring of Selecting Finger

(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 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 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 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:***

(1) Remove the selecting bars, as covered in paragraph 4.04.

(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, 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, 324AT, 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 crossbar 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 ***General:*** In removing and mounting holding armatures, it will be necessary to exercise care to avoid damaging the operating cards.

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 vertical 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:***

(1) Mount the new magnet, pushing the magnet as far forward as the elongated hole in the base will permit. Tighten the clamping screw friction 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 friction tight. Carefully insert the 168G (0.022 inch) gauge over the armature. Block operate any selecting armature. Modify a KS-6320 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:***

(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 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.

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

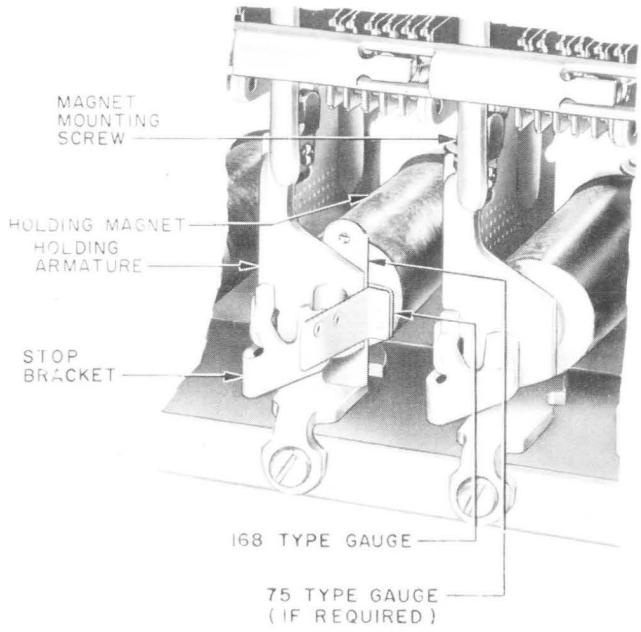

Fig. 5—Method of Determining Front Contact Make Gauging Valve

4.21 ***Mounting and Positioning Holding Magnet:***

(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 friction tight. Remount the holding armature and stop bracket, as covered in paragraph 4.15.

(2) Modify a KS-6320 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 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. 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.

(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.

(8) After positioning the holding magnet, check the vertical unit for the front contact make and armature airgap requirements covered in Section 030-720-701.

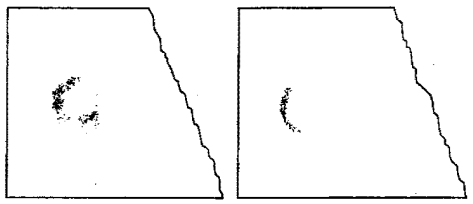

FIG. 6A – SATISFACTORY CONTACT

FIG. 6B – UNSATISFACTORY CONTACT

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 4.12, 4.13, and 4.14. Also, remove the holding armature in the position to the left of the one removed.

4.24 ***Removing Card:***

(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.)

(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 485A pliers at the

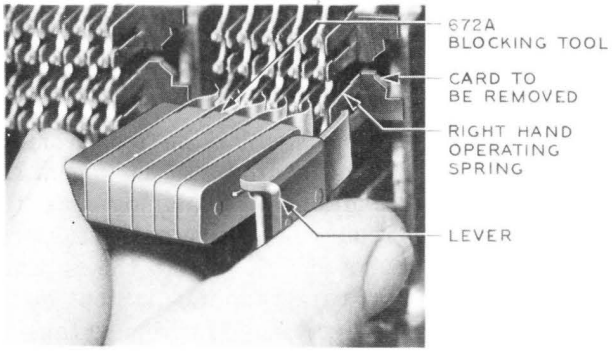

Fig. 7—Applying Blocking Tool

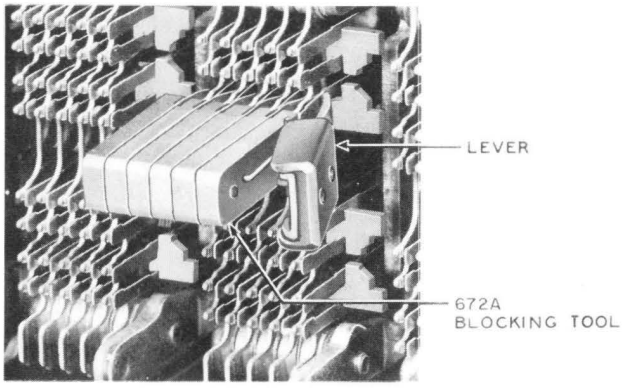

Fig. 8—Blocking Tool in Position

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.

Caution: Do not use excessive force in removing a card since this may cause the card to become wedged or a spring to be bent.

4.25 ***Mounting Card:***

(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 485A pliers with the armature end of the card toward the right and the long tang in a

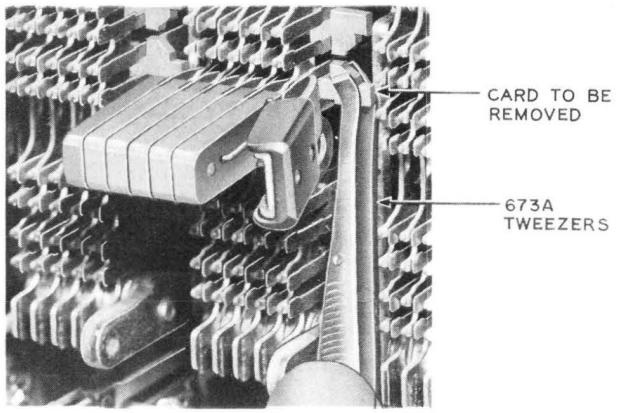

Fig. 9—Rotating Card to a Flat Position With Tweezers

direction away from the pliers, as shown in Fig. 10.

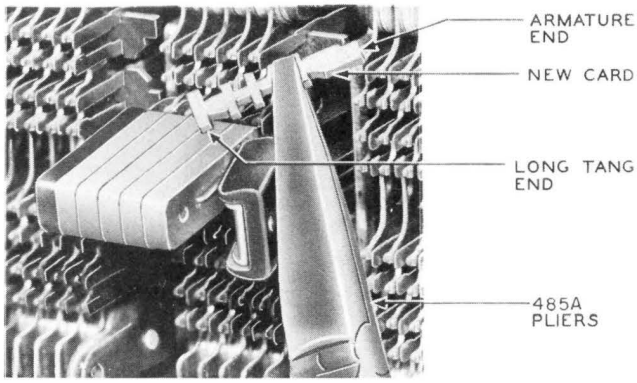

Fig. 10—Grasping a New Card for Replacement

(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.

Caution: 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.

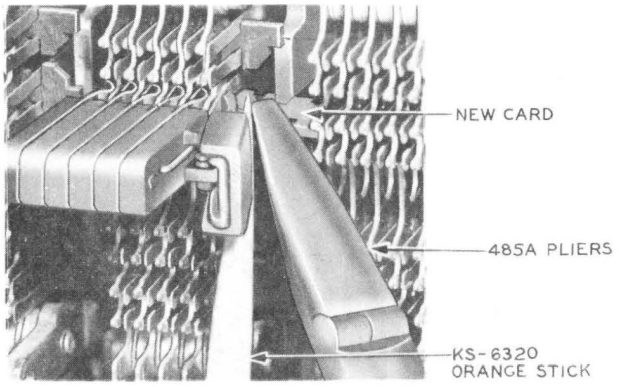

Fig. 11—Inserting New Card in Spring Combination

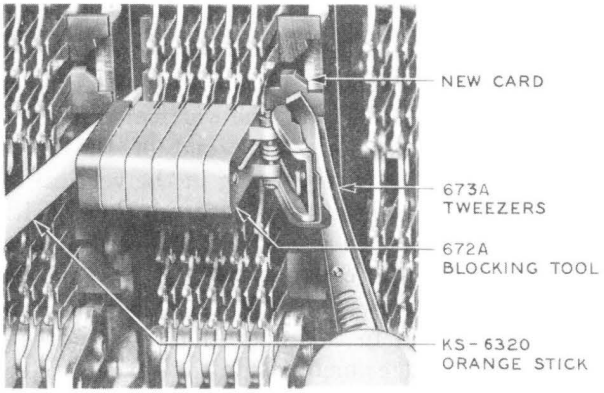

Fig. 12—Final Positioning Operations of New Card

(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 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 use the P-12F824 terminal, any remaining stubs of the original wire-wrap terminals are clipped off, as shown in Fig. 13, and the spring stub tinned.

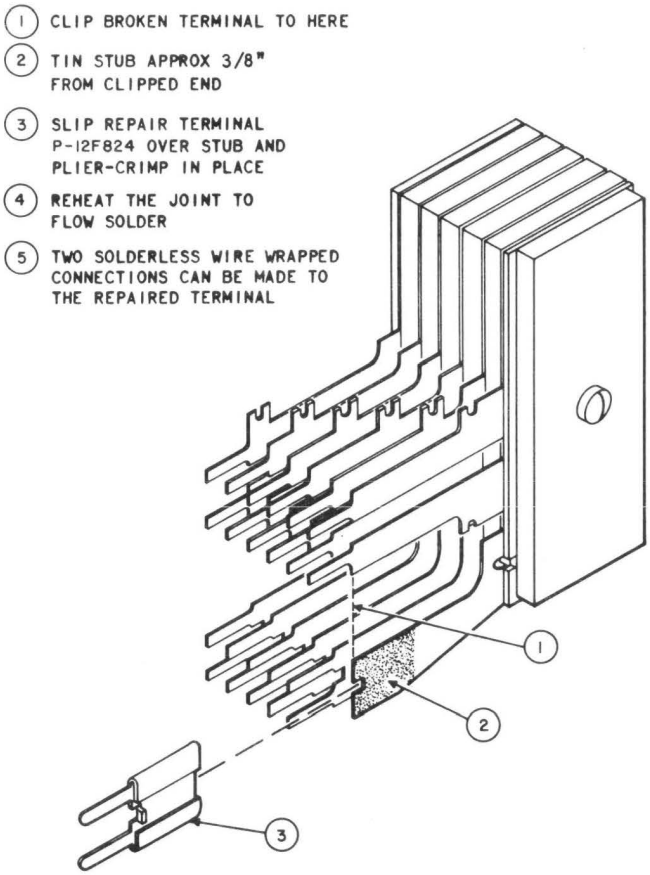

Fig. 13—Repair of Wire-Wrap Terminals Using P-12F824 Terminal

4.28 The repair terminal, P-12F824, is applied over the clipped spring stub, the wrap-around tabs crimped with pliers, and the two pieces sweated together. If no additional solder is applied during the sweating operation, the wire-wrap portion of the new terminal will remain in satisfactory condition for solderless wire-wrapping. It should be noted that it is not permissible to solderless wire-wrap on a terminal when solder splashes are present.