RELAYS

245, 254, 263, AND 264 TYPES

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 245-, 254-, 263-, and 264-type relays.

1.02 This section is reissued to add procedures for mounting stud caps to facilitate meeting the contact make requirement and to delete procedures for mounting armature plates; also to revise the contact separation requirement and the procedures covering armature travel and clearance between armature backstop screw and pole piece. Detailed reasons for reissue will be found at the end of the section.

1.03 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements listed herein.

*1.04 Asterisk: Requirements are marked with an asterisk (*) when to check for them would necessitate the dismantling or dismounting of the apparatus, or would affect the adjustment involved or other adjustments. No check need be made for these requirements, unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.

1.05 245-, 254-, 263-, and 264-type relays are each made up of two magnets and their associated parts. For the purpose of this section, a relay is arbitrarily considered as comprising one magnet, its associated armature, and contacts.

1.06 Operate: A relay is said to operate if, when current is connected to its winding, the associated armature moves until the stop disc rests against the core and all the contacts are made.

1.07 Nonoperate: A relay is said to nonoperate if, when current is connected to its winding, the armature does not move sufficiently to close any contacts.

1.08 Normal Position: A relay is said to be in the normal position when the armature rests against the backstop lug (see Fig. 14), all contacts are open, and the armature studs are resting against the armature.

1.09 Armature travel is the gap between the armature stop disc and the core when the armature is resting against the armature backstop lug.

1.10 The term contact spring when used in this section includes, unless otherwise specified, the contact bars welded to the end of the spring. The front end of the spring may or may not be bifurcated.

1.11 A pair of contacts as referred to in this section consists of a single contact bar on one contact spring and the corresponding contact bar on the opposing contact spring.

1.12 The term contact make applies to the electrical circuit between the two springs. Contact make may involve the closing of only one pair of the two pairs of contacts.

1.13 Use of the No. 510C Test Lamp: The No. 510C test lamp, equipped with a No. 561A straight tip or No. 562B offset tip, may be used to facilitate adjustment and gauging operations.

2. REQUIREMENTS

2.01 Cleaning

(a) Contacts shall be cleaned when necessary, in accordance with Section 069-306-801. After cleaning any contact, a check shall be made to see that both contacts on the bifurcated spring involved close as specified in requirement 2.13(b).

(b) Other parts shall be cleaned when necessary in accordance with the approved procedures.

2.02 Mounting of Relay and Relay Magnet

(a) The screws mounting the relay on the framework shall be tight.

Gauge by feel.

(b) The magnet shall be mounted securely on the pole piece.

Gauge by feel.

2.03 Retaining Spring Tension: Figs. 1(A) and 1(B) or Figs. 2(A) and 2(B) - The retaining spring tension measured at the end of the spring as the spring leaves the relay frame shall be

Test - Min 87.5 grams
Readjust - Min 100 grams

Use the No. 70J gauge.

To check this requirement, raise the armature manually so that the retaining spring does not touch the sides of the slot in the armature.

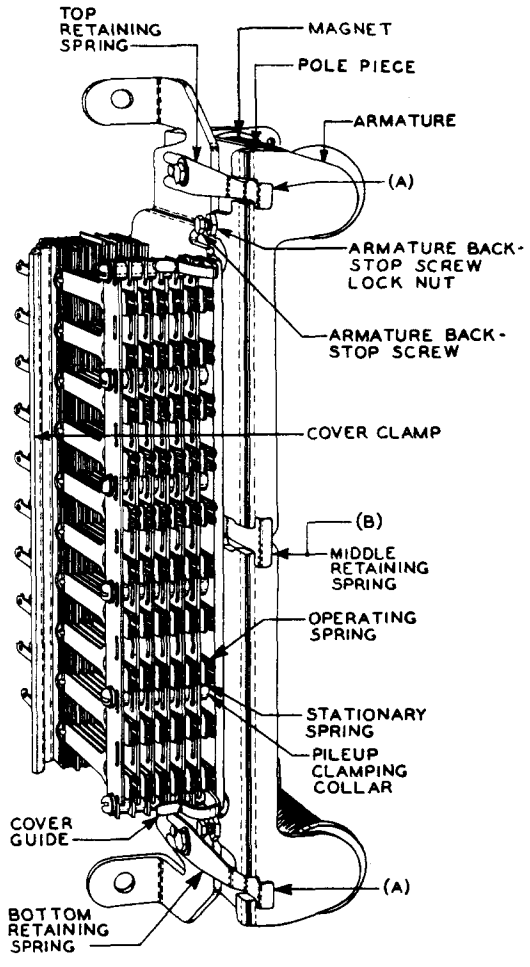

Fig. 1 - 245-type Relay

2.04 Freedom of Movement of Armature: The armature shall not bind. This requirement is met, if the five following conditions exist with the armature in the normal position.

(a) Play in the up and down direction.

Gauge by eye and by feel.

(b) Play not to exceed 0.010 inch in the left and right and in and out directions at the top or bottom retaining springs.

Gauge by eye and by feel. See (f).

(c) Play not to exceed 0.007 inch in the in and out direction at the middle retaining spring.

Gauge by eye and by feel. See (f).

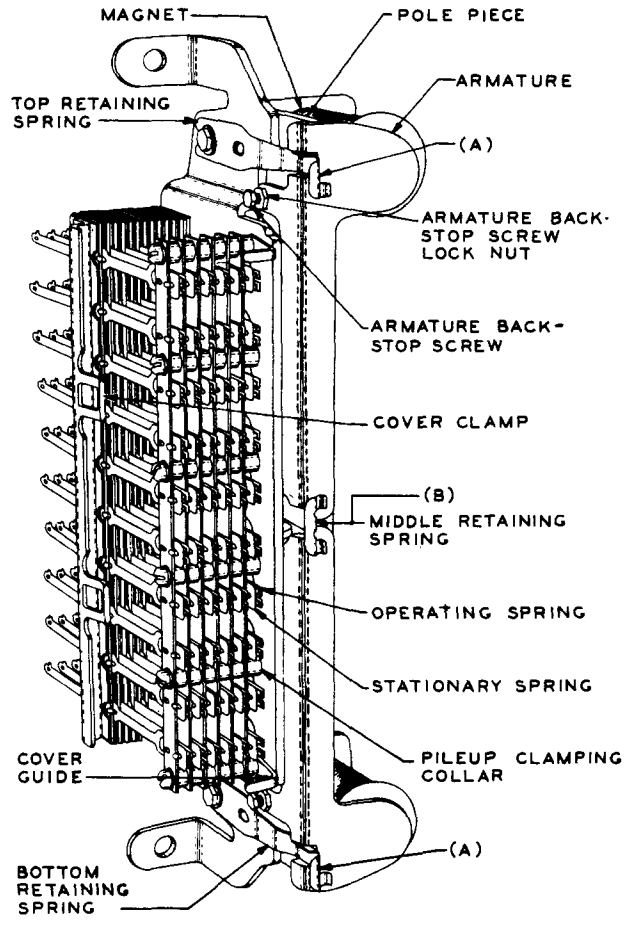

Fig. 2 - 263-type Relay

(d) Play not to exceed 0.010 inch in the left and right direction at the middle retaining spring.

Gauge by eye and by feel. See (f).

(e) Fig. 3(A) - With the end play of the armature taken up in the downward direction, the armature shall not bind on the narrow portion of the middle retaining spring.

Gauge by eye and by feel. See (f).

(f) To check the minimum limits of (b) to (e) in doubtful cases, proceed as follows: Make sure that the armature is in the normal position. Raise or lower the armature so that the top or bottom retaining spring can be moved without touching the slot in the armature. With the armature in this position, press the spring toward the armature (to the right) and then carefully move the spring away from the armature. If no bind is felt between the armature and the spring, the minimum requirement is met on the top

or bottom retaining spring. Proceed in the same manner on the middle retaining spring except that in this case take up the end play of the armature in the downward direction.

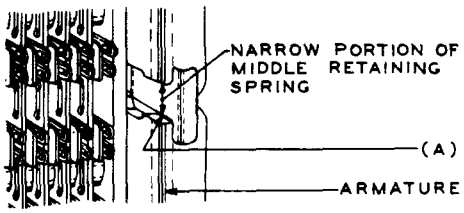

Fig. 3 - Freedom of Movement of Armature

2.05 Overlap of Armature: With the armature in its normal position and with the end play taken up in the downward direction:

(a) The armature shall completely overlap or at least be flush with the pole piece.

Gauge by eye.

(b) Fig. 4(A) - The middle retaining spring shall overlap the inner end of the armature by

Min 1/32 inch

Gauge by eye for relays with middle retaining springs of the type shown in Fig. 4, and use the No. 160A armature overlap gauge for relays with middle retaining springs of the type shown in Fig. 5 as follows: Insert the armature overlap gauge back of the lip of the middle retaining spring as shown in Fig. 5. With the end play of the armature taken up in the downward direction, press the gauge lightly toward the armature on which the requirement is to be checked. The entire width of the mark on the gauge should be underflush with respect to the lip of the middle retaining spring.

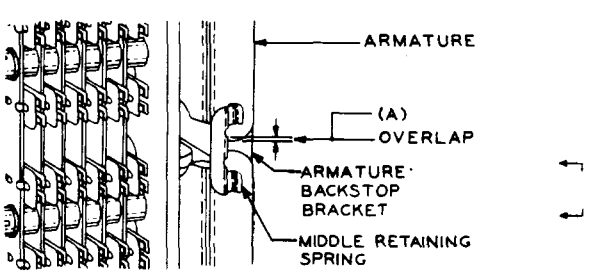

Fig. 4 - Overlap of Middle Retaining Spring

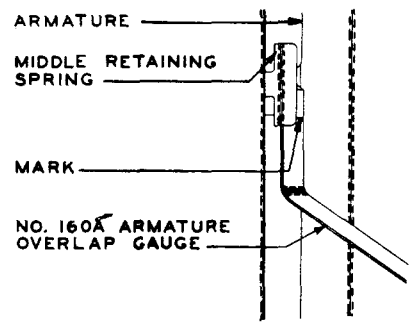

Fig. 5 - Method of Checking Overlap of Middle Retaining Spring

*2.06 Clearance Between Armature Backstop Screw and Pole Piece: Fig. 6(A) - With the armature resting against the armature backstop lug (see Fig. 14) and with the knife edges of the backstop bracket and pole piece engaging the armature, the clearance, if any, between the backstop screw and the pole piece shall be

Test - Max 0.005 inch
Readjust - Max 0.002 inch

Use the No. 74D gauge.

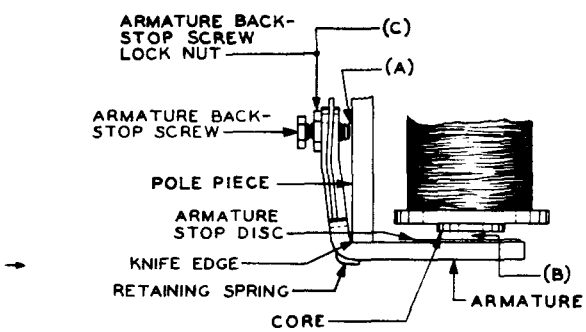

Fig. 6 - Clearance Between Armature Backstop Screw and Pole Piece

2.07 Armature Travel: Fig. 6(B) - With the armature in the normal position and with the knife edges of the pole piece and backstop bracket engaging the armature, the gap between the armature stop disc, and the center of the core shall be

Min 0.032 inch
Max 0.048 inch

Use the No. 141A gauge as shown in Fig. 7.

The maximum requirement shall be met at any position along the vertical center line through the core.

Note: To insure that the armature is in contact with the armature backstop lug and the knife edges of the pole piece and backstop bracket, apply a light pressure to the armature with the thumb and forefinger at points adjacent to the armature retaining springs while inserting the No. 141A gauge.

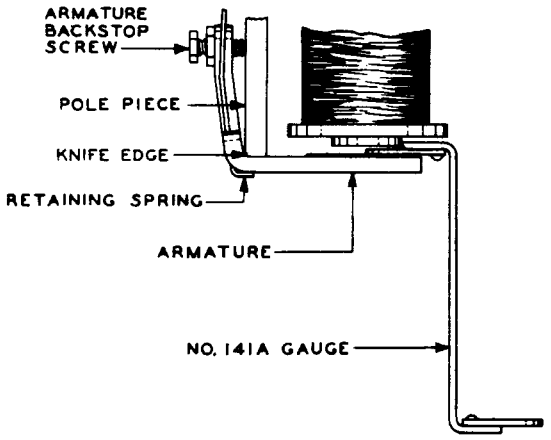

Fig. 7 - Method of Checking Armature Travel

2.08 Tightness of Locknut: Fig. 6(C) - The backstop screw locknut shall be tight.

Gauge by feel.

2.09 Contact Alignment

(a) Fig. 8(A) - On all relays equipped with standard contacts, the contacts shall line up so that the width on the contact surface of each contact bar falls wholly within the length of its mating bar.

Gauge by eye.

(b) Fig. 9(A) - On relays equipped with heavy contacts, the contact alignment shall be within the limits indicated in Fig. 9.

Gauge by eye.

2.10 Operating Spring Tension Test

(a) The operating spring furthest from the armature in each horizontal row of contact springs shall bear against its associated operating stud, or its attached stud shall bear against the preceding operating spring. When the spring furthest from the armature is moved in the direction to close its contacts, the preceding operating springs shall not follow.

Gauge by eye and by feel.

To check this requirement move the operating spring furthest from the armature in the direction to close its contacts with the KS-6320 orange stick and note whether or not the preceding operating springs follow.

(b) If the preceding operating springs follow when the operating spring furthest from the armature is moved, the following requirement shall be met. The tension of the operating spring furthest from the armature shall be such that

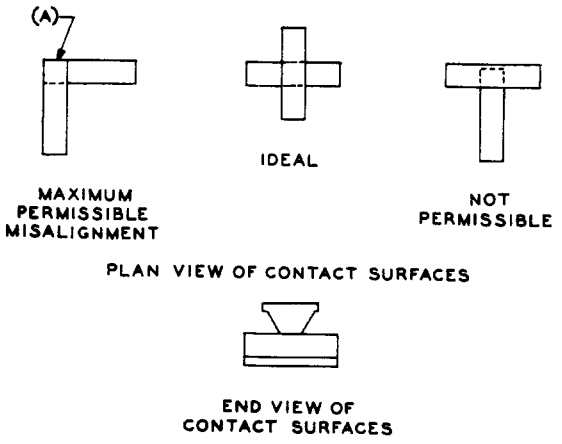

Fig. 8 - Alignment of Standard Contacts

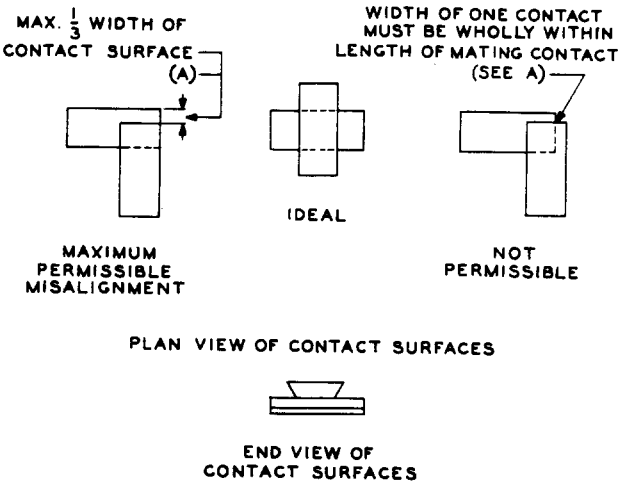

Fig. 9 - Alignment of Heavy Contacts

neither contact of the spring makes when a pressure of

Min 8 grams

is applied at the tips of the spring in the direction to close the contacts. The preceding operating springs may follow and the closure of their contacts is permissible when the operating spring furthest from the armature is moved.

Use the No. 70F gauge. Apply the tip of the gauge so that it engages both prongs of the bifurcated spring. See note under readjust.

Readjust

(a) The tension of the operating spring furthest from the armature shall be such that neither contact of the spring makes when a pressure of

Min 10 grams

is applied at the tips of the spring in a direction tending to close the contacts. The preceding operating springs may follow and the closure of their contacts is permissible when the operating spring furthest from the armature is moved.

Use the No. 70F gauge. Apply the tip of the gauge so that it engages both prongs of the bifurcated spring.

Note: When the tension requirements specified above are met, the contact separation of the pair of contacts furthest from the armature will always be greater than the minimum value specified in requirement 2.12.

2.11 Spring Clearance: Fig. 10(A) - With the armature electrically operated, the clearance between any operating spring and the associated stationary spring to the left shall be

Min 0.005 inch

Gauge by eye.

2.12 Contact Separation: With the armature in its normal position, the contact separation shall be

Min 0.008 inch ←

Gauge by eye.

2.13 Contact Make: The contacts shall close as specified below when the magnet is electrically energized with the specified thickness gauge inserted between the armature stop disc and the core.

(a) At least one contact of each bifurcated spring shall close on

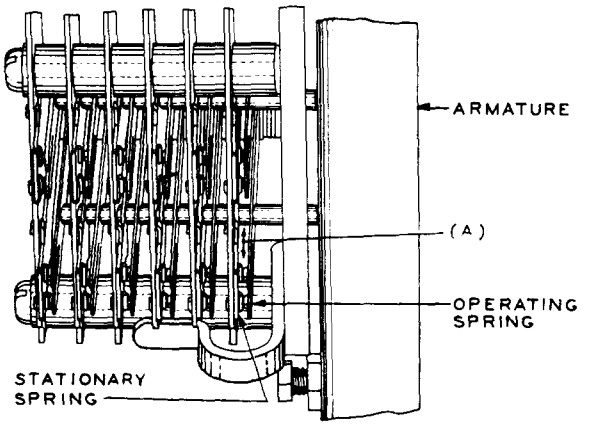

Fig. 10 - Spring Clearance With Relay in Operated Position

	Before Turnover	After Turnover
Test	- 0.015 inch	0.012 inch
Readjust	- 0.018 inch	0.018 inch

(b) Both contacts of each bifurcated spring shall close on

Test	- No requirement
Readjust Only	- 0.012 inch

(c) To check these requirements, hold the 138-type or the R-2441 gauge against the armature as shown in Fig. 11. Press the gauge against the armature, thereby causing the armature to operate and move the gauge in a rotary direction until it strikes the core. Allow the armature to release sufficiently to force the gauge between the core and the armature stop disc. Make sure that the stop on the gauge rests against the side of the core but does not enter between the armature and core. The gauge in its final position is illustrated in Fig. 12. Energize the relay and note whether the contacts close. In case of doubt as to whether a contact makes, use the KS-6320 orange stick applied to the tip of the bifurcated operating spring and attempt to move the contact toward the associated stationary spring. A movement of the operating spring without a corresponding movement of the associated stationary spring indicates that the contact is not closed.

2.14 Electrical Requirements: The relay shall meet the electrical requirements specified on the circuit requirement table.

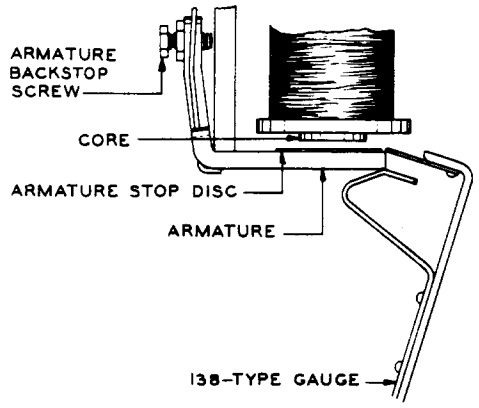

Fig. 11 - Method of Placing Gauge on Relay

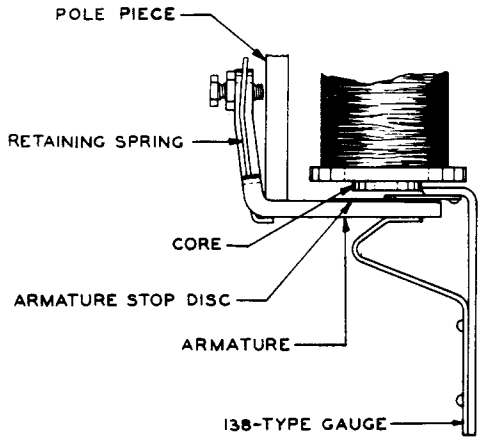

Fig. 12 - Gauge in Position for Checking Contact Make

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Materials

Code or Spec No.	Description
Tools	
388A	3/16- and 1/4-inch Hex. Open Double-end Offset Wrench
416B	Spring Adjuster
510C	Test Lamp [equipped with No. 561A straight tip or No. 562B offset tip and W2BL(48V) cord]
524A	Spring Adjuster
524B	Spring Adjuster
535A	Spring Adjuster
541A	1/4-inch 12-point Double-end Box Wrench
544A	1/4-inch Hex. Offset Socket Wrench (for 245- and 254-type relays only)
545A	Adjuster
546A	Adjuster
568A	1/4-inch 12-point Offset Box Wrench (For 263- and 264-type relays only)
569A	Spring Support
606A (2 Reqd)	Armature Tab Adjuster
→ 664A →	Operating Spring Stud Cap Mounting Tool
KS-6320	Orange Stick
KS-7782	Parallel Jaw Pliers
KS-14220, Lists 1,7, and 14	7/16-inch Hex. T-Handle Socket Wrench
-	5-inch Diagonal Pliers
-	5-inch Regular Screwdriver
→ - →	6-inch Tweezers, American Piano Supply Co., No. 56
Gauges	
70F	10-0-10 Gram Gauge
70J (or the replaced 70E)	0-150 Gram Gauge
74D	Thickness Gauge Nest
138A	0.012-inch Thickness Gauge
138B	0.018-inch Thickness Gauge
141A	0.032- and 0.048-inch Thickness Gauge
160A	Armature Overlap Gauge
R-2441	0.015-inch Thickness Gauge (required before turnover only)
Materials	
→ KS-14666	Cloth

Code or Spec No.	Description
P-15A974	Cap (0.016-inch armature stud cap)
P-15A975	Cap (0.008-inch armature stud cap)
P-15A976	Cap (0.016-inch armature stud cap)
P-15A977	Cap (0.008-inch armature stud cap)
P-15A978	Cap (0.005-inch operating spring stud cap)
P-15A979	Cap (0.010-inch operating spring stud cap)
P-15A980	Cap (0.016-inch operating spring stud cap)

3.002 Remounting Armatures: When more than one armature is removed from a group of relays, take care to remount the armatures on the same relays from which they were removed. If armatures are interchanged, there is a hazard of changing the adjustments on the operating springs.

3.003 Relay Cover Tightness: When the cover of a 245- or 254-type relay equipped with a cover clamp of the type illustrated in Fig. 1 is removed, exercise care to remount the cover on the same relay from which it was removed. If the covers of these relays are interchanged, a loose fit may result. If the cover rattles when the relay operates, indicating looseness, this may be corrected by bowing the portion of the cover which is engaged by the cover clamp toward the clamp with the fingers.

3.01 Cleaning (Rq 2.01)

(1) Clean the contacts in accordance with Section 069-306-801.

(2) Clean the other parts in accordance with approved procedures.

3.02 Mounting of Relay and Relay Magnet (Rq 2.02)

(1) Tighten the relay mounting screws with the 5-inch regular screwdriver.

(2) Tighten the magnet clamping nuts with the KS-14220 wrench. To prevent the magnet from turning when tightening the mounting nut, insert the blade of the 5-inch regular screwdriver between the rear spoolhead and the pole piece from the front of the relay.

3.03 Retaining Spring Tension (Rq 2.03)
3.04 Freedom of Movement of Armature (Rq 2.04)
3.05 Overlap of Armature (Rq 2.05)

(1) If a retaining spring does not meet the tension requirement, first make sure that the spring mounting screw is tight and if necessary, tighten it. Use the No. 541A wrench to tighten the top and bottom retaining spring mounting screws. On 245- and 254-type relays, use the No. 544A wrench to tighten the middle retaining spring mounting screw and on 263- and 264-type relays, use the No. 568A wrench.

(2) If this does not relieve the condition on the top or bottom retaining spring, loosen the retaining spring mounting screw with the No. 541A wrench and remove the spring. Adjust the spring as required with the KS-7782 parallel jaw pliers. Do the adjusting on the straight portion of the spring in front of the point where the mounting screw and washer engage the spring. Remount the spring, taking care that it is positioned so that the freedom of movement of armature and the overlap of armature requirements are met, and securely tighten the spring mounting screw. In some cases the top or bottom retaining springs of 245- and 254-type relays may be retensioned by means of the No. 416B adjuster applied to the spring at a point in front of the relay frame.

(3) To retension the middle retaining spring, place the No. 569A spring support between the relay frame and the operating springs nearest the relay frame as shown in Fig. 13 so that the slots in the spring support engage the pile-up clamping collars and the beveled edge is toward the springs. Then lift the top retaining spring out of the slot in the armature of the top relay and pull the end of the armature forward about 1/4 inch. Raise the middle retaining spring and remove the armature. Remove the armature of the bottom relay in the same manner. Tension the spring as required with the No. 416B spring adjuster. If a satisfactory adjustment cannot be obtained in this manner, loosen the retaining spring mounting screw about 3/4 turn with the No. 544A or No. 568A wrench and remove the spring. Then adjust the spring as required with the KS-7782 parallel jaw pliers.

(4) Remount the spring, using a screwdriver blade to assist in placing the spring under the washer. Partially tighten the spring mounting screw. Raise the top

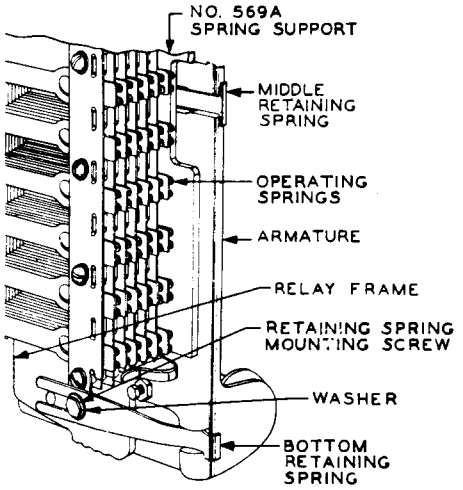

Fig. 13 - Position of Spring Support When Removing and Mounting Armature

or bottom retaining spring and place the armature of the associated relay under it. Then raise the middle retaining spring and push the armature into position. Remount the other armature in the same manner. Remove the No. 569A spring support.

(5) Make sure that the armature has the specified play and also that the armature completely overlaps the pole piece when the end play of the armature is taken up in a downward direction. If necessary, loosen the retaining spring mounting screws as covered in (2) and (3) and position the springs as required. When the requirements are met, securely tighten the spring mounting screws.

(6) If the in and out play is slightly excessive, in some cases this may be corrected by tapping lightly on the end of the retaining spring.

(7) If the armature does not have the specified side play, remove the retaining spring as covered in (2) or (3) and adjust the front end of the spring as required with the KS-7782 parallel jaw pliers. Remount the spring on the relay as covered in (4) and (5). When mounted, the spring should rest on the armature backstop bracket in the case of the middle retaining spring and on the pole piece in the case of the top or bottom retaining spring.

3.06 Clearance Between Armature Backstop Screw and Pole Piece (Rq 2.06)
3.07 Armature Travel (Rq 2.07)
3.08 Tightness of Locknut (Rq 2.08)

(1) If the maximum specified clearance between the armature backstop screw and the pole piece is exceeded, loosen the backstop screw locknut with the No. 541A wrench. With the armature in its normal position, hold the locknut and turn the screw in with the No. 388A wrench until it just touches the pole piece. While holding the screw in this position, tighten the locknut. Check the armature travel.

(2) If the armature travel is below the specified minimum, this may be due to the armature backstop screw being incorrectly positioned. If the screw is resting against the pole piece, reposition it as follows. Loosen the backstop screw locknut with the No. 541A wrench and, while holding the locknut, turn the screw out with the No. 388A wrench until the screw clears the pole piece. Then with the armature in its normal position, turn the screw in until it just touches the pole piece and securely tighten the locknut.

(3) If the minimum armature travel requirement still is not met, turn the backstop screw out one or two turns as covered in (2) and adjust the armature backstop lug slightly away from the armature. To do this, use the No. 545A adjuster with the end marked "open" for the upper backstop lug as shown in Fig. 14 or use the No. 546A adjuster for the lower backstop lug. On 263- and 264-type relays, both lugs can be adjusted with the No. 545A adjuster. Repeat this operation until the armature travel is satisfactory and reposition the backstop screw as covered in (2).

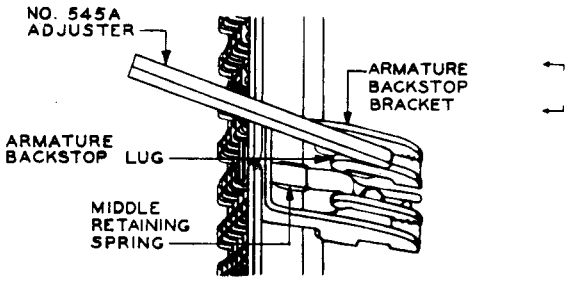

Fig. 14 - Method of Adjusting Armature Backstop Lug for Armature Travel

Note: In adjusting the lug away from the armature, if interference in encountered with the relay to the right due to the flexing of the frame of the relay being adjusted, this may be overcome by placing a finger against the center of the relay and exerting pressure to the left while making the adjustment.

(4) If the armature travel is above the specified maximum, adjust the backstop lug as covered in (3), except adjust the lug toward the armature with the end of the adjuster marked "close." Then reposition the backstop screw as covered in (2) until it just touches the pole piece.

Note: In adjusting the backstop lug toward the armature, in some cases it may not be possible to place the end of the adjuster marker "close" on the lug because of interference from the relay on the right. Where this occurs, use the end of the adjuster marker "open."

(5) Check requirements 2.10, 2.13, and 2.14 after completing adjustments.

3.09 Contact Alignment (Rq 2.09)

(1) If the contacts are not properly aligned, refer the matter to the supervisor.

3.10 Operating Spring Tension (Rq 2.10)
3.11 Spring Clearance (Rq 2.11)

Operating Spring Tension

(1) If this requirement is not met, check the contact separation on the spring at fault and, if necessary, increase the contact separation so that it is not less than 0.018 inch by adjusting the individual members of the spring as covered in 3.12 to 3.13(7). If the requirement still is not met, retension the operating spring furthest from the armature as follows.

(2) Use the No. 524A spring adjuster where the adjuster can be applied from above the spring to be adjusted and the No. 524B spring adjuster where the adjuster must be applied from beneath the spring.

(3) To provide sufficient space to manipulate the adjusters on 50 and 60 contact relays, it will usually be necessary to remove the armature of the relay to the left of the one to be adjusted as covered in 3.03 to 3.05(3). On 30 and 40 contact relays, the adjustment can usually be made without removing any armatures.

(4) Place the proper spring adjuster on the spring and slide it back to the base of the spring. Adjust the spring to the right, exercising care not to disturb adjacent springs. Then draw the adjuster forward slightly and repeat the adjusting operation. Recheck the spring tension and contact separation. Do not adjust the spring any more than necessary since excessive adjusting will decrease the spring clearance and contact separation on this spring. Take care when adjusting springs to avoid tilting. Tilted springs cause unequal contact separation of the two pairs of contacts and may result in failure of one of the contacts on the bifurcated spring to close. Make sure that the contact separation on the spring just adjusted is not less than 0.018 inch and if necessary adjust the individual members of the spring as covered in 3.12 to 3.13(7).

(5) If the requirement still is not met, apply the adjuster just in front of the point where the adjuster was last applied and repeat the adjusting operation. Proceed in this manner until the requirement is met. Make sure that the spring clearance is satisfactory and that requirement 2.13 is met.

Spring Clearance

(6) If failure to meet this requirement is common throughout the unit operated by the particular armature, refer the matter to the supervisor. However, if failure to meet the requirement is confined to the tips of a bifurcated operating spring, adjust the individual members of the spring as covered in 3.12 to 3.13(7).

3.12 Contact Separation (Rq 2.12)
3.13 Contact Make (Rq 2.13)

General

(1) These two requirements represent the minimum and maximum limits which the contact springs should meet and both must be taken into consideration when making any changes in the adjustment of a spring. Where the minimum contact separation requirement is not met, the adjustment is made by bending the individual members of the operating springs. If a spring fails to meet the contact make requirement by a small amount, the adjustment is also made by bending the individual members of the spring. However, when the deviation from the contact make requirement is considerable, the condition should be corrected by the application of stud caps described below.

(2) Failure to meet the contact make requirement is generally due to stud wear. Stud caps are provided to compensate for this wear and may be applied to relays having either solid or tab-type armatures. On relays having solid armatures equipped with armature plates, the caps should be applied without removing the plates. On relays having tab-type armatures, adjustments should be made by

bending the tabs only after maximum thickness stud caps have been applied. On 263- and 264-type relays having solid armatures, with or without armature plates, consider replacing the solid armatures by tab-type armatures as covered in Section 040-247-801 if the maximum thickness stud caps have been applied and the relay is in need of further readjustment.

(3) Application of stud caps reduces the contact separation of the springs involved and therefore the minimum contact separation requirement must always be checked after caps have been applied. Two types of stud caps are provided as described in (4) and (5).

(4) Armature Stud Caps: This stud cap, shown in Fig. 15, is mounted on the end of a worn armature stud adjacent to the armature. Armature stud caps having two bore diameters are required, one for mounting on the 0.125-inch diameter stud of 245- and 254-type relays and the other on the 0.110-inch diameter studs of 263- and 264-type relays. However, the outside diameter of both of these stud caps is the same. Armature stud caps are provided in two thicknesses, measured at the bottom of the cap, to compensate for varying degrees of stud wear. The bottom thickness is indicated by the color of the cap as covered in (14) which gives details of these caps. To facilitate identification of the various armature stud caps, they are supplied in packages marked with the proper P number.

Fig. 15 - Armature Stud Cap

(5) Operating Spring Stud Caps: This stud cap, shown in Fig. 16, is mounted on the right side of an operating spring adjacent to a worn stud. Operating spring stud caps are provided in only one diameter size which is large enough to seat both 0.110- and 0.125-inch diameter studs. These stud caps are provided in three thicknesses to compensate for varying degrees of stud wear. The thickness is indicated by the color of the cap as covered in (15) which gives details of these caps. Operating spring stud caps are mounted only on even-numbered operating springs counting from the armature in each horizontal row.

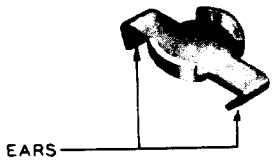

Fig. 16 - Operating Spring Stud Cap

Preliminary Checks Before Making Adjustments

(6) Before changing the adjustments of any springs, check that requirements 2.04, 2.07, and 2.10 are met.

Contact Separation

(7) If the minimum contact separation requirement is not met, adjust the individual members of the operating springs as required with the No. 535A spring adjuster applied near the outer end of the member. Always adjust the contact separation as close to the minimum specified value as practicable, consistent with meeting the other requirements. In adjusting the springs, the associated studs may be forced out of their normal position and remain in a different position so that true contact separation or contact make cannot be observed. To correct this, operate and release the relay electrically several times to permit the studs to take their normal position before making the final check following an adjustment.

(8) After adjusting for contact separation, check that the contact make requirement is met.

Contact Make

(9) First check the individual horizontal rows in which contacts fail to meet the contact make requirement to determine whether armature stud or operating spring stud caps have previously been mounted in these rows. Remove the armature stud caps and operating spring stud caps from these rows as covered in (23) and (29), respectively.

(10) Then determine the amount the contacts in individual horizontal rows deviate from the requirement. To do this, insert the No. 138B gauge between the core and armature associated with the contacts involved as described in requirement 2.13(c). Electrically energize the relay. Check whether the separation remaining on all the contacts in the respective horizontal rows is greater or less than 0.005 inch using the No. 74D gauge.

(11) Adjustment by Bending Springs: If results of the check described in (10) show that all the springs in a horizontal row have remaining contact separations less than 0.005 inch, adjust the individual members of the springs involved as described in (7).

(12) Adjustment by Use of Stud Caps: If results of the check described in (10) show that any springs in a horizontal row have remaining contact separations 0.005 inch or greater, correct the condition by the use of armature stud and/or operating spring stud caps selected as described in (14) and (15), respectively. Use an armature stud cap where the 0.005-inch contact separation is exceeded at the first pair of springs from the armature, or at this pair of springs as well as at others in the same horizontal row. Where the 0.005-inch contact separation is exceeded on springs other than the first pair in a horizontal row, use one or more operating spring stud caps instead of an armature stud cap.

(13) Adjustment by Bending Tabs of Tab-type Armatures: Where maximum thickness stud caps have been applied to relays having tab-type armatures, further adjustments may be made by bending the tabs as covered in (30) to (33).

(14) Selection of Armature Stud Caps: Where the use of an armature stud cap is indicated as covered in (12), select the proper cap by comparing the contact separation of the first pair of springs from the armature (relay energized against the No. 138B gauge) with the reduction in contact separation provided by the armature stud caps listed in Table A. Note that an armature stud cap will reduce the contact separation of all springs in a horizontal row by the same amount. Select the cap which when mounted will necessitate the least amount of spring adjustment to meet both the contact make and contact separation requirements. If necessary, also use operating spring stud caps as described in (15) to minimize spring adjustment. Use as thick a cap as practicable to minimize the need for future adjustment.

(15) Selection of Operating Spring Stud Caps: Where the use of operating spring stud caps as described in (12) or their use in conjunction with an armature stud cap is indicated as covered in (14), proceed as follows. Select the proper operating spring stud cap by comparing the contact separation at springs other than the first pair from the armature (relay energized against the No. 138B gauge) with the reduction in contact separation provided by the operating spring stud caps listed in Table B. Select the proper operating spring stud cap by comparing the separation remaining at the contacts in the individual horizontal rows as determined in (10) with the reduction in contact separation provided by the operating spring stud caps listed in the table. Note that operating spring stud caps are mounted on even-numbered operating springs counting from the armature and that an operating spring stud cap will reduce the contact separation at all springs to the left of the cap in the horizontal row by the same amount. Select the cap or caps which when mounted will necessitate the lease amount of spring adjustment to meet both the contact make and contact separation requirements. Use as thick a cap as practicable to minimize the need for future adjustment.

Table A - Armature Stud Caps

Armature Stud Cap No.	Stud Diam (Inches)	Cap Thickness (Inches)	Approx Reduction in Contact Separation (Inches)	Color of Caps	Type of Relay
P-15A974	0.125	0.016	0.024	Black	245 and 254
P-15A975	0.125	0.008	0.012	White	245 and 254
P-15A976	0.110	0.016	0.024	Black	263 and 264
P-15A977	0.110	0.008	0.012	White	263 and 264

Table B - Operating Spring Stud Caps

Operating Spring Stud Cap No.	Cap Thickness (Inches)	Approx Reduction in Contact Separation (Inches)	Finish on Cap
P-15A978	0.005	0.0075	Unfinished (Nickel Silver)
P-15A979	0.010	0.015	Black
P-15A980	0.016	0.024	Copper

Mounting Stud Caps - General

(16) Mounting of stud caps on relays should preferably be done during periods of light load. Where practicable, associated circuits should be removed from service in accordance with approved procedures.

(17) It may be advantageous before attempting to mount stud caps on working apparatus to practice doing this work on spare apparatus if available.

(18) While mounting stud caps on relays, precautions should be taken to prevent caps which may be dropped from lodging on springs or other parts of adjacent apparatus where they may cause trouble. Protect the apparatus below the relay being worked on by a KS-14666 cloth or other practicable means.

Mounting Armature Stud Caps

(19) Remove the armature associated with the springs being worked on as follows. Insert the No. 569A spring support between the relay frame and adjacent operating springs as shown in Fig. 13. Then raise the top (or bottom) retaining spring out of the slot in the armature and pull the armature forward about 1/4 inch. Raise the middle retaining spring and remove the armature.

(20) Holding the proper cap firmly with the 6-inch tweezers, seat the cap on the stud as shown in Fig. 17. Since armature stud caps fit loosely on the studs, make sure that the cap is fully seated on the stud. Use the end of the tweezers to push the cap fully on the stud.

(21) Mount the armature by raising the top (or bottom) retaining spring and positioning the armature under it. Then raise the middle retaining spring and position the armature under it. Take care not to unseat the armature stud caps while mounting the armature. If on an armature having an armature plate, difficulty is experienced in mounting the armature due to snagging the plate on the studs, tilt

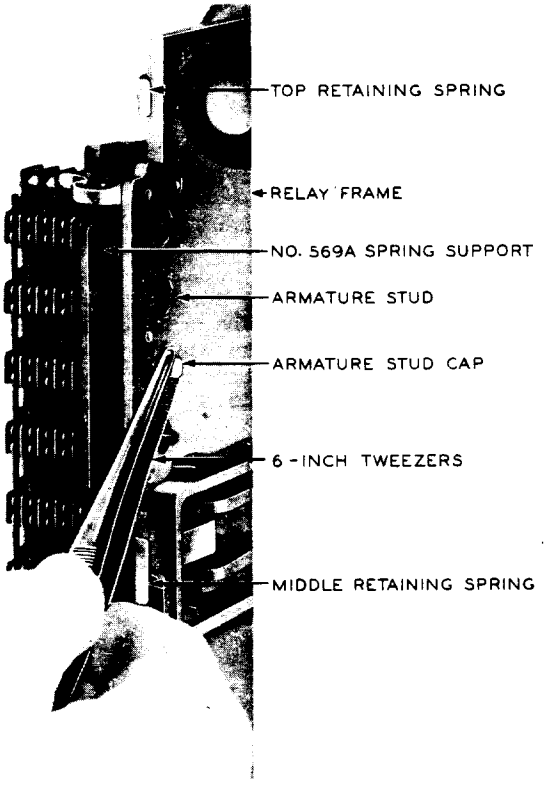

Fig. 17 - Mounting Armature Stud Cap on 245-type Relay

the No. 569A spring support to obtain greater stud clearance. Remove the spring support.

(22) After the armature has been mounted, check the contact separation and contact make requirements. If the contact make requirement is not met and the operating springs require only slight adjustment, adjust the springs as covered in (7). Otherwise, use either an armature stud cap of different thickness, or an operating spring stud cap, or both in accordance with (12). However, in the

case of relays having tab-type armatures, if maximum thickness stud caps have been used, bend the tabs as covered in (30) to (33).

Removing Armature Stud caps

(23) Remove the armature as covered in (19). Using the 6-inch tweezers, firmly grasp the cap and remove it from the stud, taking care not to drop it. After mounting another armature stud cap if necessary, mount the armature as covered in (21).

Mounting Operating Spring Stud Caps

(24) No. 664A Operating Spring Stud Cap Mounting Tool: The tool for holding the operating spring stud cap while mounting it on the spring is shown in Fig. 18 with a cap held in the tool. The cap is held in the U-shaped slot at one end of the tool by a slide which engages the cap between the ears. When the cap is placed on the relay spring, the slide on the tool butts against the end of the spring and slides backward when the tool is moved forward to position the cap on the spring. A pivoted stop on the tool limits the backward movement of the slide and thus the forward movement of the tool to facilitate positioning the cap on the spring in line with the stud. For 245- and 254-type relays, the short portion of the stop is used to limit this movement. When the tool is used on 263- and 264-type relays, the stop is swung around to bring its long portion toward the slide. The hook at the other end of the tool is used to remove caps from operating springs.

(25) To mount an operating spring stud cap, proceed as follows. If the cap is to be mounted on a 245- or 254-type relay, position the stop on the No. 664A tool with the short portion of the stop toward the slide. For a 263- or 264-type relay, position the stop with the long portion toward the slide. Place the proper operating spring stud cap in the bottom of the U slot of the tool so that the cap will be engaged by the slide. Hold the cap in the bottom of the U slot and move the slide so that its notches engage the ears of the cap as shown in Fig. 18.

(26) With the cap in the tool, hold the front part of the tool against the right side of the operating spring with the slide butting on the end of the spring as shown in Fig. 19. Make sure that the ears of the cap engage the edges of the spring. Move the tool forward slightly to start the cap on the spring and then pull the slide back against its stop. While pushing the spring slightly to the left with the tool, move the tool forward until the cap touches the stud. Then continuing pressure to the left, rock the tool sideways slightly and move it forward slowly until the stud seats itself

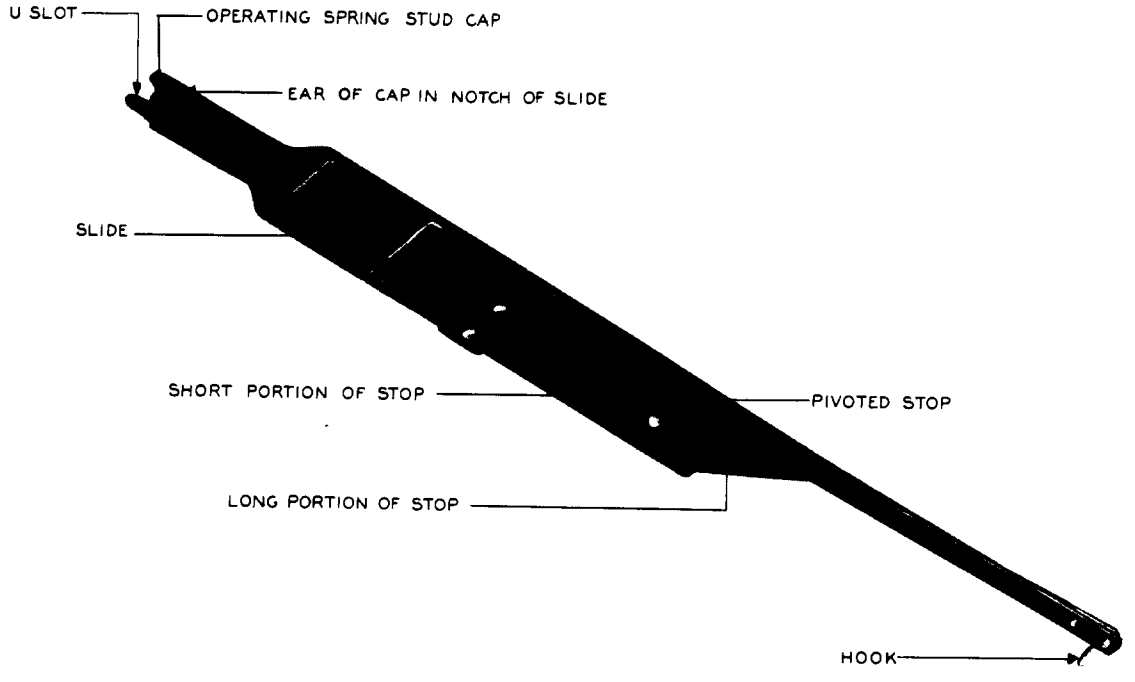

Fig. 18 - No. 664A Operating Spring Stud Cap Mounting Tool With Cap Held in Tool

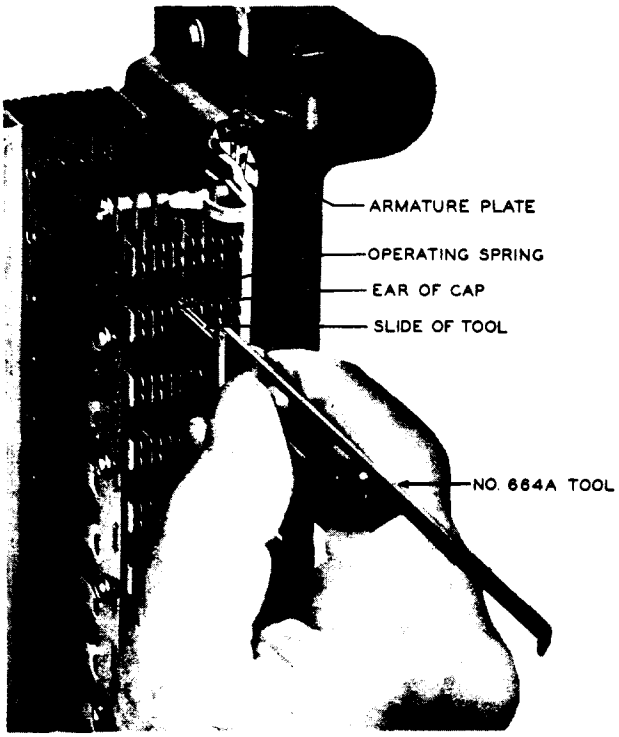

Fig. 19 - Mounting Operating Spring Stud Cap on 245-type Relay Equipped With Armature Plate

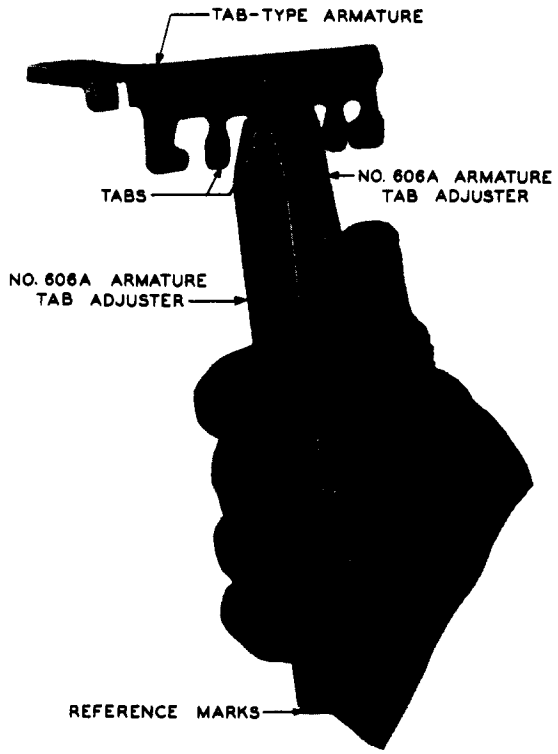

Fig. 20 - Method of Adjusting Tab on Tab-type Armature

in the cap. In most cases, the stud will seat itself in the cap when the slide on the tool butts against the end of the spring. Remove the tool.

(27) With the aid of the No. 510C test lamp, check that the stud is properly seated in the cap. If the stud is misaligned due to a bowed or tilted spring, it may not seat itself properly. In this case, place the hook of the tool behind the right end of the stud and rock the stud slightly until it seats itself in the cap. If the cap has been pushed too far in on the spring to seat the stud, place the hook of the tool behind the cap. Then, while pressing the spring to the left with the tool, pull the cap forward slightly to seat the stud.

(28) After stud caps have been mounted on operating springs, electrically operate and release the relay several times, then check the contact separation and contact make requirements. If the contact make requirement is not met and the operating springs require only slight adjustment, adjust the springs as covered in (7). Otherwise, mount operating spring stud caps of more suitable thickness. However, in the case of relays having tab-type armatures, if maximum thickness stud caps have been used, bend the tabs as covered in (30) to (33).

Removing Operating Spring Stud Caps

(29) To remove an operating spring stud cap, place the hook of the No. 664A tool behind the cap. While pushing the spring slightly to the left with the tool, pull the tool outward to bring the cap to the front of the spring. Pull the cap from the spring and catch it in the hand taking care not to drop the cap on adjacent apparatus.

Adjusting Tabs of Tab-type Armatures

(30) When it is necessary to adjust tabs to meet the contact make requirement, proceed as follows.

(31) Remove the armature associated with the springs being worked on as covered in (19). Place one No. 606A armature tab adjuster on the solid part of the armature and a second tab adjuster on the tab to be adjusted as shown in Fig. 20. Since the slot in the tab adjuster is at an angle to the length of the adjuster, it may be necessary to reverse the position of either or both adjusters to satisfactorily adjust the tab. The position

of the adjusters should if possible be such that they overlap one another as shown in Fig. 20. The reference marks on the handles of the adjusters are used to gauge the amount that the tabs have been adjusted. Each mark indicates a 0.005-inch change in the position of the tab. A change of 0.005 inch in the position of the tab is equivalent to a change of 0.0075 inch in the separation of associated contacts.

Caution: In using the No. 606A tab adjusters, make sure that they are firmly seated against the edge of the tab and the edge of the solid part of the armature, respectively.

(32) Using the tab adjusters as described in (31), bend the tab toward the stud slightly more than the amount indicated by the separation of the contacts as measured in (10). While bending the tab, observe the movement of one adjuster with respect to the other one as indicated by the reference marks. After tab adjustments have been completed, mount the armature on the relay as covered in (21).

(33) Check the requirements for contact separation and contact make on all contacts associated with the tab which was adjusted. If the operating springs require only slight adjustment, adjust the springs as covered in (7). Otherwise, readjust the tab.

3.14 Electrical Requirements (Rq 2.14)

(1) Failure of a relay to meet the electrical requirements may be due to excessive armature travel or operating spring tension or to the armature not moving freely. If necessary, correct these conditions as covered in 3.03 to 3.05, 3.06 to 3.08, and 3.10 and 3.11.

(2) If any changes are made in the adjustments to meet the electrical requirements, check requirements 2.03, 2.11, and 2.13.

REASONS FOR REISSUE

1. To revise definition of normal position (1.08).
2. To add a paragraph covering use of the No. 510C test lamp (1.13).
3. To revise Figs. 4, 6, 7, and 14.
4. To revise the requirement covering armature travel and associated note (2.07).
5. To revise the contact separation requirement (2.12).
6. To revise the list of tools, gauges, and materials (3.001).
7. To revise procedures covering clearance between armature backstop screw and pole piece, armature travel, and tightness of locknut (3.06 to 3.08).
8. To revise procedures covering contact make to cover mounting of stud caps and to delete procedures for mounting armature plates (3.12 and 3.13).
9. To delete Figs. 15 and 16 of previous issue and to add the following new figures: Figs. 15, 16, 17, 18, and 19.