RELAYS
206, 227, 231 AND 239 TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 206-, 227-, 231-, and 239-type relays.

1.02 This section has been reissued to provide correct references to other Plant Series sections. In this process marginal arrows have been omitted.

1.03 Reference shall be made to Section 020-010-711 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 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 The letters A and B and the numbers 1 to 13 inclusive specified in the "BSP Fig." column shown on circuit requirement tables indicate the particular adjustment to apply to the relay. These adjustments are applied as covered in Part 3 of this section.

1.06 Adjustments A and B

(a) Adjustments A and B provide a more precise way of obtaining a balance by means of electrical operate and nonoperate current flow requirements. The electrical balance adjustment eliminates the need for the magnetic balance or magnetic airgap requirements specified in adjustments 1 to 13 inclusive. Adjustments A and B will provide more margin for deterioration, secure a more stable adjustment, and also facilitate adjustment.

(b) The adjustments A and B are to be applied when specified on the circuit requirement tables. Adjustment A applies to relays without biasing springs and adjustment B applies to relays equipped with biasing springs.

(c) Where adjustment A or B is specified in the "BSP Fig." column of the circuit requirement table, the electrical balance is obtained by using the operate and nonoperate readjust current flow values shown in the first two lines of the electrical requirements or the corresponding values in the case of parallel requirements.

1.07 Application of adjustments A and B, as well as adjustments 1 to 13, will be facilitated by the use of the J94724A contact closure test set as covered in Section 100-138-101. This test set includes the No. 587A contact closure indicator. The lighting and extinguishing of the two lamps of the contact closure indicator are used to provide a positive means of indicating closed or open contacts. However, the adjustments can be applied without the use of the test set, in which case observation of the contacts when applying these adjustments may be facilitated by the use of the No. 510C test lamp.

1.08 Operated Position of Armature: The operated position is that position in which the armature rests against the right or left contact. When positive battery is connected to the inner end of the winding, the armature is held against the right-hand contact and when negative battery is connected to the inner end of the winding the armature is held against the left-hand contact.

1.09 Unoperated Position of Armature: The unoperated position is in general the reverse of the operated position. However, on relays adjusted in accordance with adjustments 9, 10, and 13, the armature may float between the contacts when no current is flowing in the winding. Where used, the biasing spring positions the armature against the right-hand contact.

1.10 Operate: A relay is said to operate if, when current is connected to its winding, the armature moves from its unoperated position and makes reliably the contact toward which it moves.

1.11 Nonoperate: A relay is said to nonoperate if the armature does not move from the unoperated position sufficiently to cause the closed contact to become unreliable.

1.12 Hold: A relay is said to hold, if after the relay is operated and the current is either reduced abruptly or interrupted momentarily, the armature does not move from its operated position sufficiently to break the contact which has been made.

1.13 Release: A relay said to release if, when the current in the winding is reduced, the armature returns to the unoperated position.

1.14 Dust and dirt on the contacts or pole-piece screws will seriously affect the operation of these relays. In view of this the cover or cover cap should not be removed unnecessarily and in the case of 239-type relays care should be exercised to see that 2.04(c) is met in order to insure a dustproof joint at the back end of the plate on the cover cap.

1.15 Some of the earlier 206-type relays were equipped in the field with a permalloy cover to guard against magnetic interference. The permalloy cover can readily be distinguished in that it has two sections, the front section being removable by pulling it out. Relays so equipped should be considered as 227-type relays and should be tested and adjusted in accordance with the requirements and adjusting procedures covered herein applying to the 227 type.

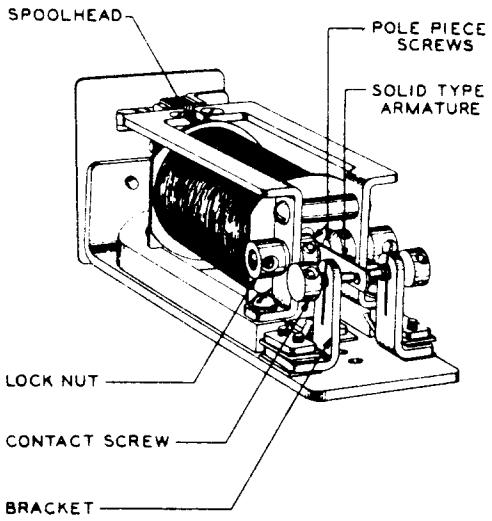

Fig. 101 - 206- or 227-type Relay

2. REQUIREMENTS

GENERAL REQUIREMENTS

2.01 Cleaning: The contacts and other parts shall be cleaned, when necessary in accordance with Section 069-306-801.

2.02 Relay Mounting: Relays shall be fastened securely to the mounting plate.

Gauge by feel by grasping the base of the relay with the thumb and forefinger.

2.03 Cover Clearance

(a) There shall be a clearance between the cover of the relay (including the cover cap) and any adjacent apparatus including relay covers.

Gauge by eye.

(b) When the relay is mounted on a channel-type mounting plate there shall be a clearance between the relay cover and the flanges of the mounting plate of

Min 1/64 inch

Gauge by eye.

2.04 Cover Cap

(a) The cover cap of relays so equipped shall fit snugly, but shall not be so tight as to prevent removing or replacing it with the fingers.

Gauge by eye and feel.

(b) (239-type Relays Only): The tension of the cover cap prongs shall hold the cover cap insulator against the shell in such a position that the insulator overlaps the inside edge of each side of the shell by approximately equal amounts.

Gauge by eye.

(c) (239-type Relays Only): Fig. 102(A) - With the cover cap removed from the relay and held so that the cover cap insulator is in a vertical position and the coverplate is at the top, the outer end of the coverplate shall be approximately 1/16 inch above a line perpendicular to the cover cap insulator and passing through the intersection of the coverplate and the insulator.

Gauge by eye.

*2.05 Flexible Contact Spring Alignment

(a) Flexible Contact Springs Riveted to Armature: Fig. 103(A) - The tips of the flexible contact springs shall be approximately flat, shall bear upon each other at the top and bottom edges, and shall make at least a line contact for at least 25 per cent of the distance across the 3/16 inch width.

Gauge by eye.

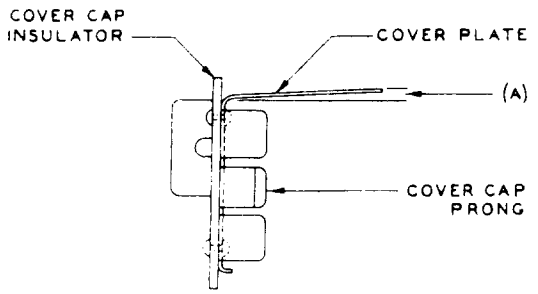

Fig. 102 - Cover Cap - 239-type Relay

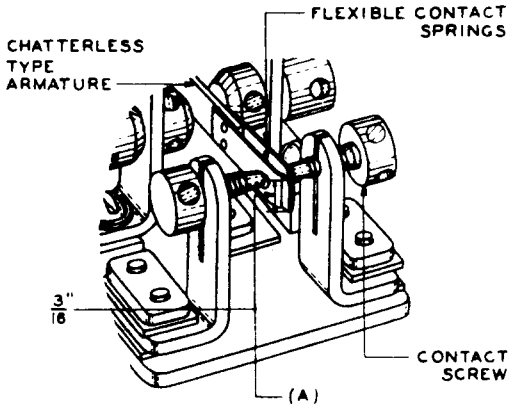

Fig. 103 - Flexible Contact Spring Alignment

(b) Flexible Contact Springs Welded to Armature: The contact springs shall bear upon each other on at least one point and shall not have more than a 0.002-inch gap at any point across the front edges.

Gauge by eye.

2.06 Biasing Spring Position

(a) Fig. 104(A) - There shall be a clearance between the armature and the coil portion of the biasing spring.

Gauge by eye.

(b) There shall be a clearance between the coil portion of the biasing spring and the contact soldering lug.

Gauge by eye.

(c) Fig. 104(B) - With the relay in the final adjustment the straight portion of the biasing spring shall rest approximately flat against the armature. This shall be considered satisfactory if the top end of the straight portion rests against the armature and the clearance, if any, between the bottom edge of the armature and the straight portion of the biasing spring does not exceed 0.020 inch.

Gauge by eye.

2.07 Armature and Spool Clearance: The armature shall not touch the inside of the spool in any position which the armature may assume with the relay either operated or unoperated.

Gauge by eye.

2.08 Contact Alignment: Fig. 105(A) - Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact, except for opposing contacts having the same diameter in which case their centers shall not be out of alignment more than 25 per cent of the contact diameter.

Gauge by eye.

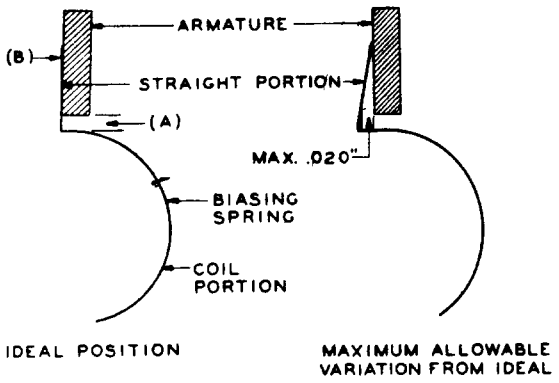

Fig. 104 - Allowable Variation in Biasing Spring Position

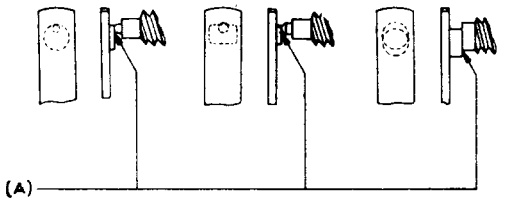

Fig. 105 - Contact Alignment

*2.09 Tightness of Contact and Biasing Screws: Fig. 106(A) - Contact and biasing screws shall be sufficiently tight in their brackets to hold any adjusted position.

Gauge by feel.

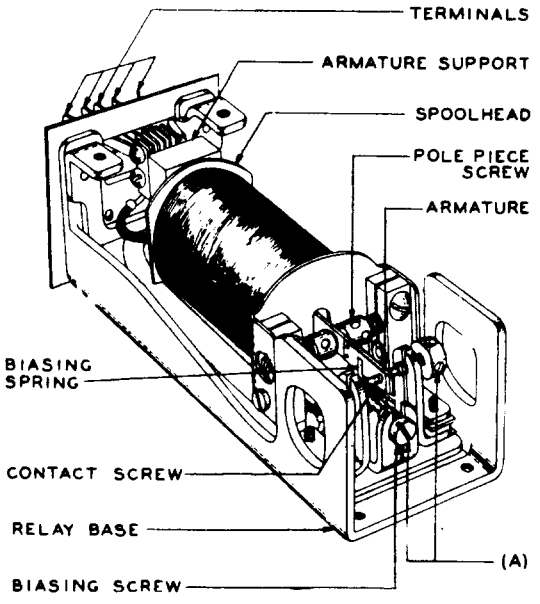

Fig. 106 - 239-type Relay

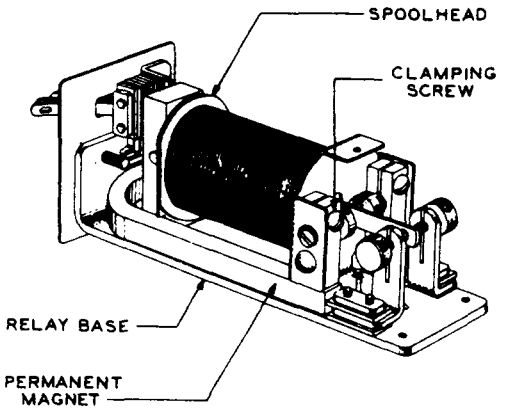

Fig. 107 - 231-type Relay

*2.10 Tightness of Pole-piece Screws: Fig. 108(A) - Pole-piece screws shall be sufficiently tight in the pole piece to insure their holding any adjusted position unless locknuts or clamping screws are provided in which case the locknuts or clamping screws shall be sufficiently tight to hold the pole-piece screws in any adjusted position.

Gauge by feel.

2.11 Contact Travel: Fig. 108(B) - The contact travel shall be

Min 0.004 inch, Max 0.006 inch

Use the No. 74D gauge applied between the armature and either contact. On relays equipped with a biasing spring, measure the contact travel on the left side with the relay in the normal position and on the right side with the relay operated on the test operate current. To measure the contact travel on relays not equipped with a biasing spring, operate the relay on the test operate current to position the armature on one side and then reverse the current so that the armature moves to the other side.

If there is a difference between the measured travel on opposite sides of the armature it is an indication that the contact on the side of the armature having the smaller travel has a build-up. In this case clean the contacts, in accordance with Section 069-306-801 in order to meet the requirement on both sides.

2.12 Contact Make: (Relays Equipped With Chatterless Armatures) - With the relay electrically operated on the soak current and with a 0.0015-inch gauge inserted between the pole-piece screw and the associated armature stop pin on the side to which the armature is operated, the contacts shall make.

Use the No. 92R gauge and check on both contacts.

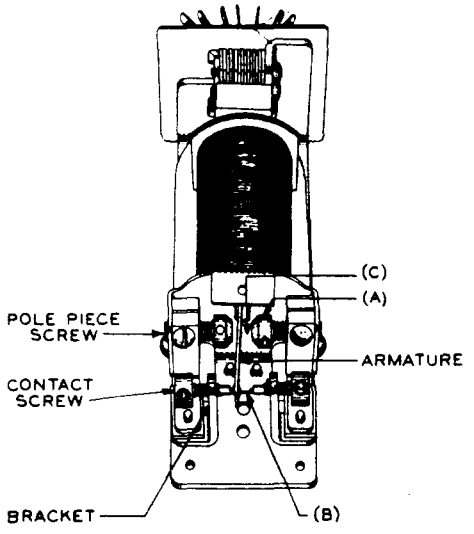

Fig. 108 - 231-type Relay

REQUIREMENTS FOR ADJUSTMENTS A AND B

2.13 Electrical Requirements

(a) The relay shall meet the electrical requirements specified on the circuit requirement table. Relays not equipped with biasing spring shall meet the requirements in both directions. In the case of the A adjustment, the test nonoperate current flow value in the circuit requirement table is usually shown as OC (open circuit). This means that the armature shall remain on the contact to which it was operated by the soak current after the soak current has been removed.

Note: Where the circuit requirement table specifies an adjusting network, check all these requirements with the adjusting network connected.

(b) Where no release current flow value or where OC is specified on the circuit requirement table, relays having biasing springs shall release on open circuit.

2.14 Pulse Repeating Requirements: When specified on the circuit requirement table the relay shall meet the pulse repeating requirement covered in Sections 040-011-711 and 040-012-711.

REQUIREMENTS FOR ADJUSTMENTS 1 TO 13

2.15 Magnetic Balance: Applies to all 206-, 231-, and 239-type relays equipped with solid armatures as covered in requirement 2.15(a), and adjusted in accordance with adjustments 1, 2, 3, 7, 8, 11, and 12 as covered in Part 3 of this section. It also applies to 206-, 231-, and 239-type relays equipped with chatterless ar-

matures as covered in requirement 2.15(b) and adjusted in accordance with adjustment 13 as covered in Part 3 of this section.

(a) 206-, 231-, and 239-type Relays Having Solid Armatures: The armatures shall stick magnetically to each contact in turn within the limits specified in the following table. [For method of checking and special conditions see (1) to (4).]

Sticking Pressure at Each Contact		See Notes
Min	Max	
5 grams	7 grams	A
1 gram	3 grams	B

Use the No. 70F gauge.

Note A: For any 206-type relay equipped with a solid armature in code groups A to Y, AA to AY, BA to BY, and CA to CY inclusive.

Note B

1. For any 231- and 239-type relay equipped with a solid armature.
2. For any 206-type relay equipped with a solid armature in code groups - FA to FY and GA to GY inclusive.

(1) Method of Checking Relays When a Soak Current Is Specified: On relays equipped with biasing springs, release the biasing spring from the armature. Apply the specified soak current to the relay. Apply the gauge to the front end of the armature and set the gauge to measure the maximum tension of 7 or 3 grams, as required, depending on the code of the relay as covered in notes A or B above. Disconnect the soak current and observe that the armature leaves the contact with the tension applied. Again apply the soak current and set the gauge to measure the minimum tension of five grams or one gram, as required, depending on the code of the relay. Disconnect the soak current and observe that the armature does not leave the contact with the tension applied. Repeat this test at the other contact after first applying the soak current to the relay in the opposite direction. When checking multiwinding relays, only the soak value for one of the windings shall be used in applying the magnetic balance.

(2) Method of Checking Relays When No Soak Current Is Specified: Follow the procedure covered in (1) using the operate readjust current. In this case, the minimum pressures covered in (a) need not be met but the armature shall stick magnetically to each contact in turn when the current is disconnected. The difference in pressure at the two contacts shall not, however, exceed two grams. When checking multiwinding relays where an operate readjust value is specified for more than one winding, only the operate readjust for one of the windings shall be used in applying the magnetic balance.

(3) Method of Checking Relays Bridged by a Condenser Where the Circuit Drawing Specifies an Adjusting Network: Check the magnetic balance as covered in (1) when a soak current is specified, or (2) when no soak current is specified, with the adjusting network connected, since the purpose of the adjusting network is to minimize the effect of the bridged condenser.

(4) Method of Checking Relays Bridged by a Condenser Where the Circuit Drawing Does Not Specify an Adjusting Network and Where a Soak Is or Is Not Specified: Proceed as outlined in (2).

(b) 206-, 231-, and 239-type Relays With Chatterless Armatures: When the number 13 is specified in the "BSP Fig." column of the circuit requirement table, the following requirement shall apply. With the current disconnected after the relay has been operated on the specified soak current (or the operate current where no soak current is specified), the armature shall stand free of either contact or stand free of either contact when moved away manually from the contact to which it was operated. This condition shall be met on each contact in turn.

2.16 Magnetic Airgap: Fig. 108(C) - Applies to all 206-, 231-, and 239-type relays having chatterless armatures and adjusted in accordance with adjustments 4, 5, 6, 9, and 10. Magnetic airgap requirements also apply to all 227-type relays which are always equipped with solid armatures.

(a) Relays Equipped With Chatterless Armatures: The magnetic airgap, that is, the clearance between the stop pins on the armature (or the armature itself when no stop pins are provided) and either pole-piece screw with the armature against the opposite pole-piece screw, shall be as indicated below:

Type of Relay	Magnetic Airgap
206	Max 0.010 inch
231	Max 0.018 inch
239	Max 0.018 inch

Use the No. 92A or 92D gauge.

(b) 227-type Relays: The magnetic airgap, that is, the clearance between the armature and either pole-piece screw, with the armature resting against the opposite contact screw, shall be

Max 0.010 inch

Use the No. 92A gauge.

2.17 Electrical Requirements

(a) The relay shall meet the electrical requirements specified on the circuit requirement table. Relays not equipped with biasing springs shall meet the requirements in both directions.

Note: Where the circuit requirement table specifies an adjusting network, check all these requirements with the adjusting network connected.

(b) Where the relay is equipped with a cover and cover cap and solid armature, the relay shall meet the electrical requirements with the cover and cover cap in place.

Note: Where the relay is tested with the cover and cover cap in place, the contact closure test set cannot be used. In such cases, it is suggested that the check for the operation of the armature be made by listening for the "click" of the armature. The check for the nonoperate requirement may be made by listening to determine that there is not a "click" of the armature.

(c) Where no release current flow value or where OC is specified on the circuit requirement table, relays having biasing springs shall release on open circuit.

2.18 Pulse Repeating Requirements: When specified on the circuit requirement table the relay shall meet the pulse repeating requirement covered in Sections 040-011-711 and 040-012-711.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Test Apparatus

Code or Spec No.	Description
Tools	
340 (two reqd)	Adjusting Key
363	Spring Adjuster
422A	90-degree Offset Screwdriver
423A	45-degree Offset Screwdriver
485A	Smooth-jaw Pliers
510C	Test Lamp [Must be equipped with No. 561A tool (straight tip) and W2CB (24V) or W2BL (48V) cord]
KS-6320	Orange Stick
KS-6854	3-1/2-inch Screwdriver
-	3-inch Cabinet Screwdriver
-	6-1/2-inch P-long-nose Pliers
-	4-inch Regular Screwdriver
Gauges	
70D	0 to 50 Gram Gauge
70F	0 to 10 Gram Gauge
74D	Thickness Gauge Nest
92A	0.010-inch Nonmagnetic Offset Thickness Gauge
92D	0.018-inch Nonmagnetic Offset Thickness Gauge
92R	0.0015-inch Nonmagnetic Offset Thickness Gauge
Test Apparatus	
35 Type	Test Set
J94724A	Contact Closure Test Set (SD-95365-01) (Includes No. 587A Contact Closure Indicator)
†R-2717	Filter

† Not required when J94724A test set is used.

GENERAL PROCEDURES

3.01 Cleaning (Rq 2.01)

(1) Clean the contacts and other parts when necessary in accordance with Section 069-306-801.

3.02 Relay Mounting (Rq 2.02)

(1) If the relay is not fastened securely to the mounting plate, tighten the mounting screws with the 4-inch regular screwdriver, taking care that the cover clearance requirement is met.

3.03 Cover Clearance (Rq 2.03)

(1) If the cover clearance requirement is not met, loosen the relay mounting screws with the 4-inch regular screwdriver and shift the relay as required.

3.04 Cover Cap (Rq 2.04)

(1) If the cover cap does not fit properly, adjust the cover cap prongs as required with the fingers or P-long-nose pliers.

(2) If the coverplate on the cover cap on 239-type relays does not fit snugly against the inside of the cover, remove the cover cap from the relay and check that the outer end of the coverplate is properly located as covered in requirement 2.04(c). If necessary, adjust the position of the coverplate by bending as required with the fingers.

Note: On 206-type relays, the top of the cover is indicated by either a black dot or an embossing. Covers not marked in this manner should be placed on the relay so that the cover retaining spring is on top.

3.05 Flexible Contact Spring Alignment (Rq 2.05)

(1) If the tips of the flexible contact springs do not rest against each other properly, proceed as follows. Back off the contact screws with the No. 340 adjusting key and adjust the tips of the springs as required, using the No. 303 spring adjuster. Check that the flexible springs rest against each other in line with the armature with a pressure of 20 to 50 grams measured on one spring at the contact, with the other spring held so that it cannot follow its mate. Use the No. 70D gauge to measure the tension and hold the other spring with the flat end of the KS-6320 orange stick. If necessary, adjust the tension by applying the No. 363 spring adjuster to the spring as close as practicable to the point where it is joined to the armature. Adjust the spring toward or away from the other contact spring as required, at the same time keeping the contact springs in good alignment with the armature and with each other. Reset the contact screws and adjust for contact travel as covered in 3.11(2), (3), or (5).

3.06 Biasing Spring Position (Rq 2.06)

(1) If there is no clearance between the armature and the coil portion of the biasing spring, remove the biasing spring screw by pulling it out while turning it slightly back and forth. Use the P-long-nose pliers on slotted head screws and the fingers on knurled head screws to grasp the head of the screw. Exercise care in this operation not to damage the biasing spring as a forcible removal of the screw will damage the spring. Then reduce the size of the outer coil of the spring by grasping the spring between the thumb and forefinger and turn the biasing screw in a direction which will tighten the spring on the biasing screw. Exercise care not to wind the spring more than necessary to reduce the diameter of the coil the required amount. Remount the biasing screw.

(2) If the biasing spring does not rest flat against the armature with the relay in adjustment, remove the biasing screw from the relay as covered in (1) and adjust the flat portion of the biasing spring with the No. 485A pliers.

(3) If the biasing spring is distorted to the extent that it cannot be satisfactorily adjusted, as covered in (1) and (2), replace with a new biasing spring assembly.

3.07 Armature and Spool Clearance (Rq 2.07)
3.08 Contact Alignment (Rq 2.08)

(1) If the armature does not clear the inside of the spool, correct by centering the armature vertically or horizontally as follows:

To Center the Armature Horizontally

(2) On 206-type relays, remove the cover and turn back the biasing spring if provided. Using the No. 340 adjusting key, loosen the pole-piece screw locknuts and back off the pole-piece and contact screws sufficiently to allow the armature to assume its normal mechanical position. Loosen the two front coil support screws on the underside of the relay base with the No. 422A and No. 423A offset screwdrivers and move the coil to the right or left as required to bring the armature into an approximate central position with respect to the opening in the coil and spoolhead and then tighten the screws securely.

(3) On 231- and 239-type relays, if the armature does not clear the inside of the coil in a horizontal direction, refer the matter to the supervisor.

To Center the Armature Verticallly and to Obtain Contact Alignment

(4) Remove the relay from the frame and if the relay is a 231- or 239-type relay also remove the cover. Slightly loosen the screw holding the armature to its support, using the 3-inch cabinet screwdriver. Then move the armature up or down as required to bring it into an approximate central position with respect to the coil, noting that the contacts are in alignment vertically.

(5) If it is impossible to align the contacts from front to rear as outlined in (4), loosen the screws holding the contact screw brackets to the base of the relay and then move the brackets until the contacts line up properly. It is desirable to set the contact screw brackets so that the contact screws strike the contacts on the armature as near the center as possible. Tighten the screws securely and remount the relay.

3.09 Tightness of Contact and Biasing Screws (Rq 2.09)

(1) If a contact screw is not sufficiently tight in its brackets, remove the screw from the bracket. Then, with the P-long-nose pliers, force the split portion of the bracket closer together. Use the No. 340 adjusting key to remove and replace contact screws.

(2) If the biasing screw is not tight enough to hold an adjusted position, pull the screw forward as though it were being com-

pletely removed as in 3.06(1). However, in this operation, it is only necessary to free the thicker portion (shoulder) of the biasing screw of its slot in the bracket. Exercise care in this operation that the biasing spring is not damaged. Force the split portion of the biasing screw bracket closer together with the P-long-nose pliers. Replace the biasing screw shoulder in its slot in the bracket.

3.10 Tightness of Pole-piece Screws (Rq 2.10)

(1) If the pole-piece screws are not sufficiently tight in the pole pieces and are not provided with locknuts or clamping screws, place locknuts on the pole-piece screws and tighten them securely with the No. 340 adjusting key. If the locknuts on the pole-piece screws are not sufficiently tight, tighten them with the No. 340 adjusting key, holding the pole-piece screw in the adjusted position with another No. 340 adjusting key. If the pole-piece screws on relays equipped with clamping screws are not sufficiently tight, tighten the clamping screws with the KS-6854 screwdriver.

3.11 Contact Travel (Rq 2.11)

(1) If necessary, remove the build-ups from the contacts in accordance with Section 069-306-801.

(2) If complete readjustment for contact travel is required proceed as follows. Where a biasing spring is furnished, back it off and loosen the pole-piece screw locknuts with the No. 340 adjusting key or the clamping screws with the KS-6854 screwdriver. Back off the pole-piece screws and the contact screws so that the armature will assume its normal mechanical position. When the contact closure test set is available, adjust the contact travel of relays equipped with chatterless armatures as covered in (3), except where the circuit requirement table specifies special contact travel, in which case proceed as in (5). For relays equipped with solid armature proceed as covered in (4). Where the contact closure test set is not available, adjust for contact travel as covered in (5) for both chatterless and solid armatures.

(3) Relays Equipped With Chatterless Armatures (Using the Contact Closure Test Set): Remove the 0.009-inch blade from the No. 74D gauge nest and insert it between the tips of the flexible contact spring. Allow the gauge to be held in position by the tension of the springs. Turn in one contact screw with the No. 340 adjusting key as shown in Fig. 109 until it just touches the armature contact. Repeat the operation with the other contact screw. Remove this gauge and substitute the 0.008-inch blade. Note that neither lamp lights.

(4) Relays Equipped With Solid Armature (Using the Contact Closure Test Set): Turn in each contact screw with the No. 340 adjusting key until they just touch the armature contacts. Back off each contact screw from the armature contact approximately 1/12 of a turn (approximately 1/3 the distance between the hole centers in the head of the contact screw), and observe that the armature stands approximately midway between the contact screws. With the contact screws in this position, remove the 0.006-inch blade from the No. 74D gauge nest and place it between the left contact screw and the armature contact. Move the contact screws equally until both contacts are just made. Remove this gauge and substitute the 0.004-inch blade. Move the armature manually toward the gauge. The right-hand contacts should break. Repeat the gauging check using first the 0.006-inch gauge and then the 0.004-inch gauge between the right contacts.

(5) All Relays - (Contact Closure Test Set Not Available): Adjust for contact travel for both chatterless and solid armatures as follows. Advance one contact screw as shown in Fig. 109 until it just touches the armature, and then back it off 1/2 the specified contact travel. One twelfth (1/12) of a turn of the contact screw (approximately 1/3 the distance between hole centers in the head of the contact screw) corresponds to approximately 0.002 inch. Repeat this operation with the other contact screw. Check that the armature in its normal mechanical position, as described in 3.07(2), does not make contact with either contact screw but stands approximately midway between the contact points. With the No. 74D gauge check that the total contact travel is within the specified limits.

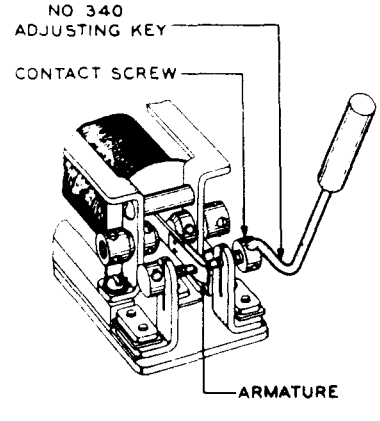

Fig. 109 - Method for Adjusting for Contact Travel

3.12 Contact Make (Rq 2.12)

Procedures for Adjustments A and B

3.13 Electrical Requirements (Rq 2.13)
3.14 Pulse Repeating Requirements (Rq 2.14)

Procedures for Adjustments 1 to 13

3.15 Magnetic Balance (Rq 2.15)
3.16 Magnetic Airgap (Rq 2.16)
3.17 Electrical Requirements (Rq 2.17)
3.18 Pulse Repeating Requirements (Rq 2.18)

(1) Use the 35-type test set for application of electrical values. When adjusting relays which have soak requirements as part of the adjustment, apply the soak current associated with the operate, nonoperate, hold, or release requirement before applying the requirement itself. On adjustments where the biasing spring is not involved, apply the requirements in both directions. For relays bridged by a condenser and where the circuit requirement table specifies an adjusting network, use the J94724A contact closure test set or the R-2717 filter. The test set and the filter provide a condenser of 4.28 to 4.36 MF in series with 4600 ohms ±1 per cent and also a resistance of 500 ohms ±1 per cent.

(2) Adjustment of the relays is made by changing the gap between pole-piece screws and armature, and changing the biasing spring tension on relays so equipped. These adjustments are interrelated and when adjusting for one, consideration must be given to the other. The required amount of change in the position of the pole-piece screws depends upon the airgap between the pole-piece screws and the armature and the strength of the magnetizing flux from the permanent magnet. As the gap between the pole-piece screws and the armature is decreased, the adjustment becomes more critical, because a slight change in position of the pole-piece screws will cause a relatively large change in sticking pressure. Since the magnetic circuit of the relay is similar to a Wheatstone bridge, a change in the sticking pressure of the armature on one side will also more or less affect the sticking pressure on the opposite side, depending upon the size of the airgaps.

(3) On relays equipped with pole-piece screw locknuts, use one No. 340 adjusting key to hold the pole-piece screw in position while tightening the locknut with another No. 340 adjusting key. Use the KS-6854 screwdriver for loosening the pole-piece clamping screws on relays so equipped. After each adjustment of the pole-piece screw, tighten the locknuts or clamping screws, when provided, sufficiently to hold the pole-piece screws firmly in the adjusted position. Use the 3-inch cabinet screwdriver or the fingers to turn the biasing spring screw.

(4) The particular adjusting procedure to be followed depends upon the adjustment letter or number specified in the "Fig. No." column of the circuit requirement table. These adjustments are designated A, B, and 1 to 13, inclusive and are covered in the following paragraphs.

PROCEDURES FOR ADJUSTMENTS A AND B

Adjustment A - Relays Without Biasing Springs

(5) The readjust operate and nonoperate current flow values for this adjustment appear on the first two lines shown on the circuit requirement table. Use the corresponding values in the case of parallel requirements.

(6) Adjust the relay for contact travel as covered in 3.11 and then proceed as follows.

(7) Preliminary Setting of Pole Piece: Apply the soak current to the relay winding continuously. The current shall be applied so that the relay is energized in a direction to move the armature toward the left contact. Then move the left pole-piece screw toward the armature until it engages the armature and has moved the armature sufficiently to break the left contact. Move the left pole-piece screw away from the armature just sufficiently so that the left contact just makes. Repeat the above procedure for the right pole-piece screw with the soak current reversed. Remove the soak current from the relay winding. Tighten the pole-piece clamping screws or locknuts sufficiently to hold its adjusted position but still permit changes in adjustment.

(8) Application of Operate Requirement: Apply the readjust operate current to the relay winding continuously. The current shall be applied so that the relay is energized in a direction to move the armature towards the left contact. Momentarily apply soak current to the relay winding in the same direction as the readjust operate current. If the left contact is not made prior to the application of the soak current, it will make. Reverse the readjust operate current so that the relay is energized in a direction to move the armature towards the right contact and if left contacts remain closed, move the left pole-piece screw away from the armature until the armature operates to the right contact. Momentarily apply soak current to the relay winding in a direction to keep the armature on the right contact. Reverse the readjust operate current so that the relay is now energized in a direction to move the armature toward the left contact. If right contact remains closed, move the right pole-piece screw away from the armature until the armature operates to the left contact. Repeat the

above procedure until the armature operates satisfactorily in both directions. Remove the operate current from the relay winding.

(9) Application of Nonoperate Requirement: Apply the readjust nonoperate current continuously in the same manner as that described for the operate current. When the readjust nonoperate current is reversed after a momentary application of the soak current, the armature should not leave the contact. If the nonoperate requirement is not met, turn the pole-piece screw in until the relay meets the requirement, and then recheck (8).

(10) Contact Make (Relays Equipped With Chatterless Armatures): With a 0.0015-inch gauge inserted between one pole-piece screw and the associated armature stop pin and with the soak current flowing in the direction tending to hold the gauge, the contacts shall make. This requirement shall be met on both contacts.

(11) If the requirement covering contact make is not met after adjusting the relay as covered in (5) to (9), it is an indication that either the permanent magnet is weak or that other parts of the relay structure have magnetically deteriorated. In such cases refer this matter to the supervisor and then proceed as follows. Back off both pole-piece screws equally until the contact make requirement is just met in both directions. Backing off of both pole-piece screws should be done regardless of whether one contact meets the requirement satisfactorily. With the pole-piece screws backed off the readjust electrical requirements and the test nonoperate requirement shall be disregarded. Check that the relay operates in each direction on the test operate value.

Adjustment B - Relays Equipped With Biasing Springs

(12) The adjustment consists of two parts. The first part is applied with the tension of the biasing spring released from the armature and is the same as adjustment A covered in (5) to (10), inclusive. If the contact make covered in (10) cannot be met, proceed as in (13). The second part is applied as covered in (14) using the remaining current flow values specified on the circuit requirement table.

(13) If the requirement covering contact make is not met after adjusting the relay as covered in (5) to (9), it is an indication that either the permanent magnet is weak or that other parts of the relay structure have magnetically deteriorated. In such cases refer this matter to the supervisor and then proceed as follows. Back off both pole-piece screws equally until the contact make requirement is just met in both directions. Backing off of both pole-piece screws should be done regardless of whether one contact meets the requirement satisfactorily. With the pole-piece screws backed off, the readjust operate and nonoperate shown on the first two lines of the circuit requirement table shall be disregarded and the remaining readjust requirements for use with the biasing spring shall be used.

(14) Application of Operate, Nonoperate, Hold, and Release Electrical Requirements With the Biasing Spring Engaged: Tension or remove tension from the biasing spring until the electrical requirements are met using the 3-inch cabinet screwdriver or the fingers to adjust the biasing spring screw.

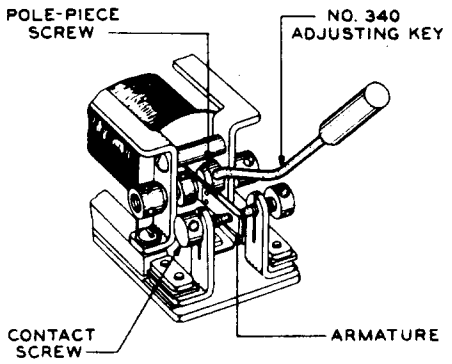

Fig. 110 - Method for Adjusting Pole-piece Screws

PROCEDURES FOR ADJUSTMENTS 1 TO 13

Adjustments 1, 2, and 3 - Relays Equipped With Solid Armatures and Biasing Springs

(15) On all relays except 227-type relays, proceed as in (16). For 227-type relays proceed as covered in (18)

(16) Release the tension of the biasing spring against the armature by turning the biasing screw in a counterclockwise direction. Loosen the locknuts or clamping screws, and fully back off the pole-piece screws. Note exception in (17). Note that the armature stands approximately midway between the contacts, and if necessary, set the contact screws as outlined in 3.11(2), (4), or (5). Readjust the magnetic airgaps on each side by turning in the pole-piece screws gradually and equally until the armature, when moved by hand, will just stick to either contact. Check for magnetic balance as specified in the requirement. If the pressure is not within the specified limits, slightly readjust the magnetic airgaps until the relay meets the magnetic balance requirement. Apply the

electrical requirements and tension the biasing spring against the armature by turning the biasing screw in a clockwise direction as required. If the electrical requirements cannot be met with the above adjustment together with the biasing spring, it is an indication that the sticking pressure is either too high or too low. Reduce the sticking pressure to meet the operate or release value by slightly turning out the pole-piece screws, or increase the sticking pressure to meet the nonoperate or hold value by slightly turning in the pole-piece screws. Care should be taken to maintain the magnetic balance.

(17) The pole-piece screws of 231- and 239-type relays of earlier design, when fully backed off, may press against the inside of the cover, thereby affecting the adjustment of the relay. To determine whether the pole-piece screw touches the cover, use a piece of bond paper inserted between the inside of the cover and the relay frame. If the paper binds, it is an indication that the pole-piece screw is touching the cover. Pole-piece screws on relays of later design have a longer head and shorter threaded portion and cannot touch the cover.

Adjustments 4, 5, and 6 - Relays Equipped With Chatterless Armatures and Biasing Springs

(18) Release the tension of the biasing spring against the armature by turning the biasing screw in a counterclockwise direction. Loosen the locknuts or clamping screws, and fully back off the pole-piece screws. See exception in (17). Note that the armature stands approximately midway between the contact screws and, if necessary, set the contact screws as outlined in 3.11(2), (3), or (5). Readjust the magnetic airgap on each side by turning in the pole-piece screws gradually and equally until the proper 92-type gauge placed between either pole-piece screw and the armature forces the armature over so that it rests firmly against the pole piece on the opposite side. Apply the electrical requirements and tension the biasing spring against the armature as required. If it is impossible to secure a satisfactory adjustment with the magnetic airgaps set at the maximum value together with the biasing spring, reduce the airgaps on each side gradually and equally by turning in the pole-piece screws. If the performance test indicates that the contact closure is not steady (chattering contacts), it is an indication that either the pressure between the flexible contact springs is excessive or insufficient, or that the contacts are dirty. If necessary, adjust the flexible contact springs as covered in 3.05. If the contacts are dirty, clean them in accordance with 3.01.

Adjustments 7, 8, 11, and 12 - Relays Equipped With Solid Armatures and Not Equipped With Biasing Springs

(19) For 227-type relays, proceed as covered in (21).

(20) Loosen the locknuts or clamping screws, and fully back off the pole-piece screws. Note exception in (17). Note that the armature stands approximately midway between the contacts, and if necessary set the contact screws as described in 3.11(2), (4), or (5). Readjust the magnetic airgaps on each side by turning in the pole-piece screws gradually and equally until the armature, when moved by hand, will just stick to either contact. Check for magnetic balance as specified in the requirement. If the sticking pressure is not within the specified limits, slightly readjust the magnetic airgaps until the relay meets the magnetic balance requirement. Apply the electrical requirements and note that the relay meets the electrical requirements on either contact and that it operates properly in either direction on current reversals. If the electrical requirements cannot be met with the above adjustment, it is an indication that the sticking pressure is either too high or too low. Reduce the sticking pressure to meet the operate or release value by slightly turning out the pole-piece screws, or increase the sticking pressure to meet the nonoperate or hold value by slightly turning in the pole-piece screws. Care should be taken to maintain the magnetic balance.

Adjustments 9 and 10 - Relays Equipped With Chatterless Armatures and Not Equipped With Biasing Springs

(21) Loosen the locknuts or clamping screws, and fully back off the pole-piece screws. See exception in (17). Note that the armature stands approximately midway between the contact screws and, if necessary, set the contact screws as described in 3.11(2), (3), or (5). Readjust the magnetic airgap on each side by turning in the pole-piece screws gradually and equally until the proper 92-type gauge placed between either pole-piece screw and the armature forces the armature over so that it rests firmly against the pole-piece screw on the opposite side. Apply the electrical requirements and note that the relay meets the electrical requirements on either contact and that it operates properly on current reversals. If it is impossible to secure a satisfactory adjustment with the magnetic airgap set at the maximum value, reduce the airgaps on each side gradually and equally by turning in the pole-piece screws. If the performance test indicates that the contact closure is not steady (chattering contacts), it is an indication that either the pressure between the flexible contact springs is excessive or insuf-

ficient, or that the contacts are dirty. If necessary, adjust the flexible contact springs as covered in 3.05. If the contacts are dirty, clean them in accordance with 3.01.

Adjustment 13 - Relays Equipped With Chatterless Armatures and Not Equipped With Biasing Springs

(22) If the relay fails to meet its electrical requirements, or if the armature does not remain floating between the contacts or floating when moved away from the contact against which it is resting, readjust the airgap on both sides. To do this loosen the locknuts or clamping screws, if provided, and fully back off the pole-piece screws. See exception in (17). Note that the armature stands midway between the contacts. If necessary, set the contact screws as covered in 3.11(2), (3), or (5). Turn in first one pole-piece screw and then the other until the armature approaches the position where it will barely stay against the contact on the side to which the pole-piece screw is being adjusted. Back off the pole-piece screws slightly until the armature will stand equidistant between the contacts. Note that the relay meets its magnetic balance, contact make, and electrical requirements on both contacts, and that it operates properly on current reversals.