RELAYS
215 AND 255 TYPES
AND ASSOCIATED 18B CONNECTING BLOCK
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 215- and 255-type relays and associated 18B connecting block.

1.02 This section is reissued to revise the requirement covering flexible contact spring alignment, to revise the List of Tools, Gauges, Materials, and Test Apparatus, and to revise the procedure covering adjustment of contact travel.

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 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 requirements formerly given in Fig. 215A referred to on circuit drawings are now covered by requirement 2.11(c). The methods formerly given in Fig. 215A are now covered in Part 3 of this section.

1.06 The information formerly given in Fig. 10 referred to on circuit drawings is now covered in Part 3 of this section.

2. REQUIREMENTS

2.01 ***Cleaning***

(a) Contacts shall be clean and free from pits and buildups.

Gauge by eye.

(b) Pole-piece screws shall be clean and free from magnetic particles.

Gauge by eye.

(c) The inside of the cover shall be clean.

Gauge by eye.

(d) The surfaces of the flexible contact springs which bear against each other shall be clean.

Gauge by eye.

2.02 ***Tightness of Relay Terminals, Screws, and Nuts***

(a) The terminal block shall be held securely to the relay base by the terminal block mounting screws.

Gauge by feel.

(b) The relay terminals shall be straight and shall be held tightly by the associated locknuts.

Gauge by eye and feel.

(c) The mounting posts shall be held firmly in the terminal block by their associated mounting nuts.

Gauge by feel.

2.03 ***Relay Mounting:*** Fig. 1(A) — Relays shall be held securely by their associated mounting plate and connecting block.

Gauge by feel.

2.04 ***Cover Fit:*** The cover locking plate shall hold the relay cover firmly against the terminal block but the cover shall not be so tight as to prevent removing or replacing it with the fingers.

Gauge by feel.

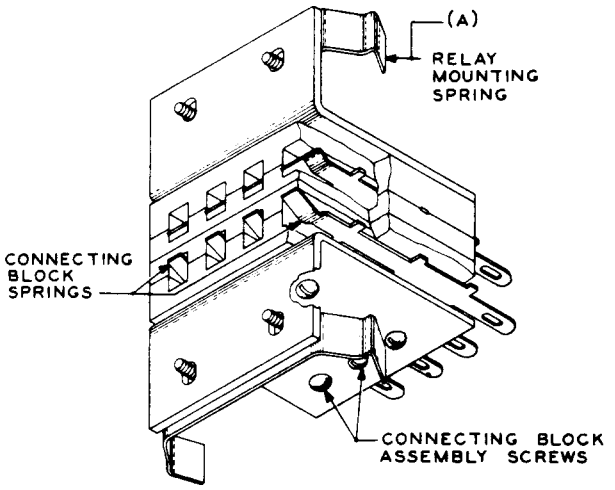

Fig. 1 – 18B Connecting Block

2.05 *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.

2.06 *Contact Alignment*

(a) Fig. 2(A) — Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contacts, 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.

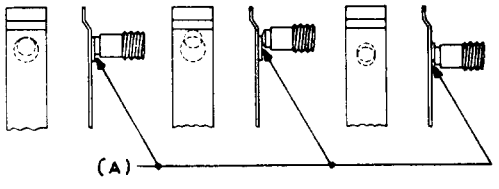

Fig. 2 – Contact Alignment

2.07 *Flexible Contact Spring Alignment*

(a) *215-Type Relays*

(1) *Flexible Contact Springs Riveted to Armature:* Fig. 3(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.

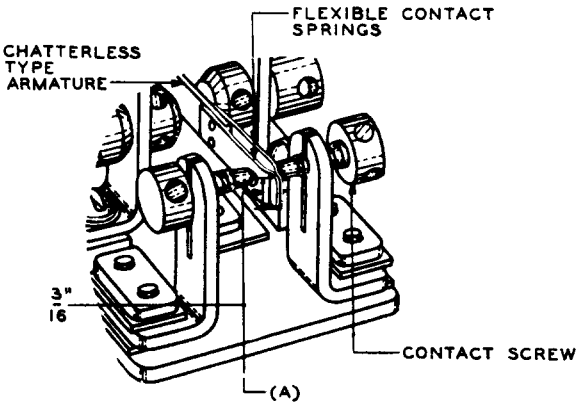

Fig. 3 – Flexible Contact Spring Alignment (215-type relay shown)

(2) *Flexible Contact Springs Welded to Armature:* The ends of 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 bearing edges.

Gauge by eye.

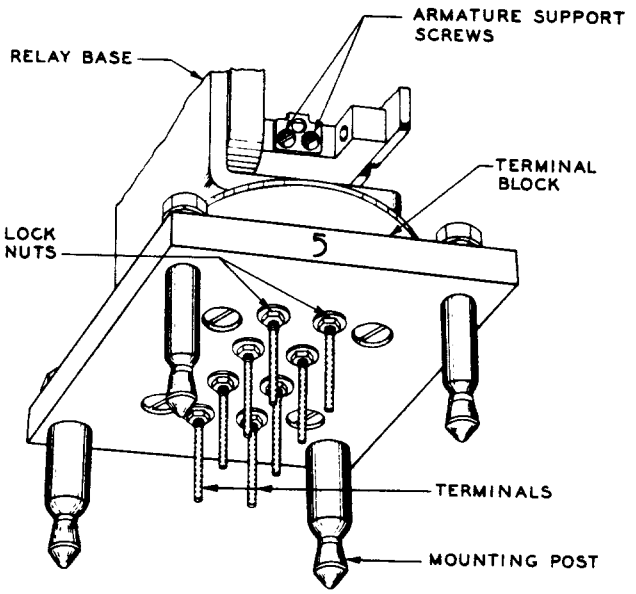

Fig. 4 – Terminal Block Assembly

(b) ***255-Type Relays:*** The contact springs shall bear against each other on at least one point. If the point of contact is at the front edges of the springs, the gap at every point across the front edges shall not exceed 0.002 inch. If the point of contact is behind the front edges, the gap at the edges shall not exceed 0.012 inch.

Gauge by eye.

*2.08 ***Tightness of Contact Screws:*** Fig. 5(A) — Contact screws shall be sufficiently tight in their bracket to hold any adjusted position.

Gauge by feel.

*2.09 ***Tightness of Pole-Piece Screw Locknuts*** (knurled tension nuts on 255-type relays): The locknuts or knurled tension nuts shall be sufficiently tight to hold the pole-piece screws in the adjusted position.

Gauge by feel.

2.10 ***Contact Travel:*** Fig. 5(B) — The contact travel, that is the distance the armature can travel in passing from a position against one contact screw to a position against the opposite contact screw, shall be

Min 0.003 inch
Max 0.005 inch

Use the 74D gauge.

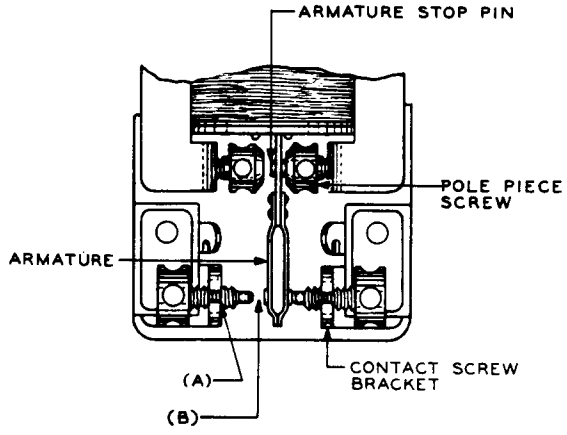

Fig. 5 – Contact Travel

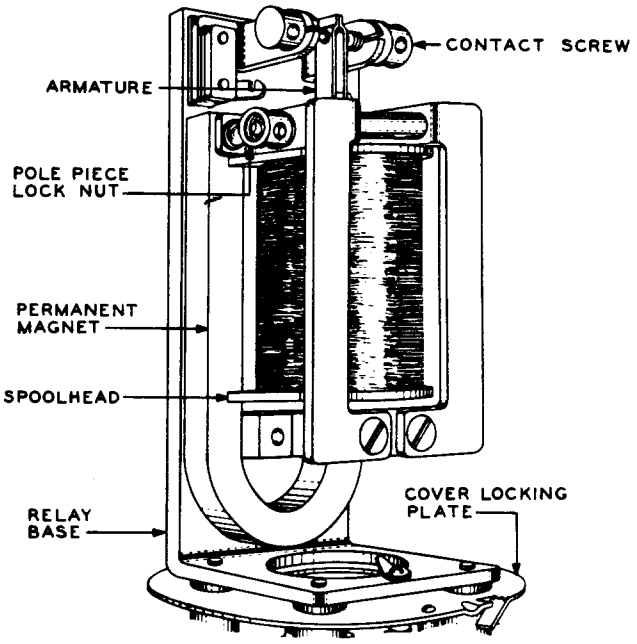

Fig. 6 – 215-Type Relay

2.11 ***Electrical Requirements***

(a) Except as specified in (b) and (c) the relay shall meet the electrical requirements specified on the circuit requirements table.

(b) When a 215B or 215FB relay is used in a toll ringer or signaling circuit in a toll office, and an ac voltage test set is to be used, and ac voltage requirements are not shown in the circuit requirements table, the ac voltage requirements shown in the following table shall be used. If the relay fails to meet these requirements, it shall be removed and placed in the relay adjusting circuit. It shall meet the ac voltage requirements covered by the section covering the ac voltage test set used.

SERIES CONN.	TYPE OF ADJ	FREQ IN CYCLES	TEST SET METER READINGS TEST SET CONNECTED TO T & R LEADS	
			TEST	
			Opr	Nopr
Complete Ringer Circuit	High Range	1000/20	1.25	0.50
	Low Range	1000/20	2.25	0.90

(c) When the circuit requirements table specifies the electrical test and readjust requirements to be in accordance with the BSP or refers to Fig. 215A, the relay shall meet the requirements covered by the section covering the testing equipment used.

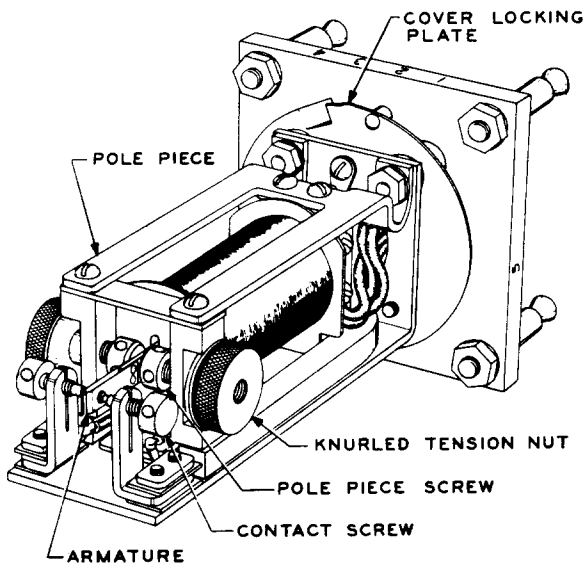

Fig. 7 – 255-Type Relay

3. ADJUSTING PROCEDURES

3.001 ***List of Tools, Gauges, Materials, and Test Apparatus***

CODE NO.	DESCRIPTION
TOOLS	
46	3/8-Inch Hex. Single-End Socket Wrench
340	Adjusting Key
363	Spring Adjuster
403A	5/32- and 3/16-Inch Hex. Double-End Socket Wrench
484A	Magnetic Shunt
485A	Smooth Jaw Pliers
KS-6320	Orange Stick
KS-6854	3-1/2 Inch Screwdriver
KS-14250 L1	Flashlight
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
GAUGES	
70J (or replaced 70E)	0-150 Gram Gauge
74D	Thickness Gauge Nest
MATERIALS	
P-484674	Card
KS-14666	Cloth
—	Hardwood Toothpicks, Flat at One End and Pointed at Other
TEST APPARATUS	
111A2 or 116A1	Relay Test Panel
or 2A	Relay Test Table
35 Type	Test Set

3.002 ***Remagnetization of Relays:*** A tool has been provided for remagnetizing the permanent magnets of relays used in telegraph equipment and detailed procedures for using this tool are covered in Section 040-231-811. The following paragraphs cover the particular applications of remagnetization of relay magnets.

(a) ***Relays in Telegraph Equipment in Toll Offices:*** When the permanent magnet has been dismounted from the relay for any reason, remagnetize the magnet after reassembly before readjusting the relay. Permanent magnets may also be remagnetized if the performance of the relay indicates that such action is advisable.

(b) ***Relays Used in Telephone Circuits in Local Offices:*** When necessary to remove the magnet from the relay to make adjustments or for other reasons, the strength of the magnet may be reduced. No provision is made for the remagnetization of these relays as a field maintenance operation.

(1) ***Relays Used in Condenser Timed Relay Circuits:*** Do not make any adjustment or replacement which involves loosening or removing the armature, the pole-piece mounting screws, or the permanent magnet. For these cases the relay must be entirely reconditioned (including remagnetization) before being placed in service.

3.01 ***Cleaning*** (Reqt 2.01)

(1) Clean the contacts and other parts in accordance with Section 069-306-801 and, if necessary, readjust the contact travel as covered in 3.10-3.11.

(2) Invert the cover and tap it lightly to remove any loose material inside the cover, then wipe the inside of the cover with a piece of clean, dry KS-14666 cloth. Invert the cover and tap it lightly to dislodge and remove remaining particles.

3.02 ***Tightness of Relay Terminals, Screws, and Nuts*** (Reqt 2.02)
3.03 ***Relay Mounting*** (Reqt 2.03)

(1) If a relay is not held securely by the associated mounting plate and connecting block, remove the relay from the mounting and determine whether the mounting posts or terminal block are loose.

(2) If a mounting post is loose, tighten the nut holding it to the terminal block using the 46 wrench.

(3) If the terminal block is loose, tighten the screws holding it to the relay base using the 4-inch E screwdriver.

(4) If neither the mounting posts nor the screws holding the relay base to the terminal block are loose, tension the mounting springs on the connecting block as required using the 485A pliers and tighten the connecting block mounting screws securely.

(5) If the relay terminals do not make good contact with the connecting block springs correct as follows: remove the block from its mounting by removing the connecting block mounting screws and then remove the connecting block assembly screws using the 3-inch C screwdriver. With the block unassembled, adjust the tip of the particular spring or springs at fault as required with the 485A pliers, reassemble the block and fasten it securely to its mounting.

(6) When necessary, straighten relay terminals with 485A pliers and tighten loose locknuts with the 403A wrench. In tightening the nuts, exercise care not to twist the connecting wires from the terminals.

3.04 ***Cover Fit*** (Reqt 2.04)

(1) If the cover does not fit properly, check that the pins on the cover are not broken and that the cover is not bent. If the cover pins are broken or the cover is bent, replace the cover.

(2) If the cover does not lock securely, apply the 485A pliers at the crimp in the cover locking plate and bend the plate slightly towards the terminal block.

3.05 ***Armature and Spool Clearance*** (Reqt 2.05)
3.06 ***Contact Alignment*** (Reqt 2.06)

Note: See 3.002(b)(1) covering adjustment of relays used in condenser timed relay circuits.

(a) ***Armature Movement:*** If the armature does not clear the inside of the spool, correct as follows:

(1) First remove the relay from the connecting block.

(2) Using the 340 adjusting key, back off the contact screws on each side sufficiently to give the armature free play between the pole-piece screws.

(3) On the 215-type relays, loosen the locknuts with the 340 adjusting key. On the 255-type relays, loosen the knurled tension nuts with the fingers. Back off the pole-piece screws on each side as far as they will go using the 340 adjusting key. This is done in order to insure that the armature will assume its normal mechanical position. The armature in its "normal mechanical position" should be in an approximate central position with respect to the coil and spool-head with the relay held in a horizontal or vertical position.

(4) Center the armature horizontally as follows. Using the 3-inch C screwdriver, slightly loosen the screws that hold the front and rear spoolheads to the base of the relay. Move the coil to the right or left, as required, to center the armature in the slot.

(5) Center the armature vertically as follows. Using the 3-inch C screwdriver, slightly loosen the screws that hold the armature to its support. Move the armature up or down, as required, to bring the contacts into vertical alignment. After making this adjustment, there should be a clearance between the armature and spool.

(6) After the adjustments have been completed, tighten all loose screws using the 3-inch C screwdriver. Exercise care not to change the position of the coil or armature when tightening the screws. With the armature in its final adjusted position, the armature should be in the center of the slot in the spoolhead and should not strike any part of the spool.

(7) If the pole-piece screws appear dirty, clean them as outlined in 3.01.

(b) ***Contact Alignment:*** If the contacts are not properly aligned, proceed as follows:

(1) To align contacts vertically, remove the relay from the connecting block and move the armature up or down as required as outlined in (a) (5).

(2) If the contact screws are not approximately in line with each other as gauged by eye, adjust the contact screw brackets to the right or left as required using the 485A pliers. Then realign the contacts, if necessary, as covered in (b) (1).

(3) To align the contacts from front to rear, move the armature forward or backward, loosen the screws holding the armature to its support as covered in (6). Move the armature forward or backward, as required. If it is impossible to align the contacts in this manner, loosen the screws holding the contact screw bracket to the base of the relay using the 3-inch C screwdriver. Then move the bracket until the contacts line up properly. In making this adjustment 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.

(4) After the adjustment is completed, firmly retighten all screws loosened and readjust as covered in 3.10-3.11.

3.07 ***Flexible Contact Spring Alignment*** (Reqt 2.07)

(1) If the tips of the flexible contact springs do not rest against each other properly, back off the contact screws with the 340 adjusting key and adjust the tips of the springs as required using the 363 spring adjuster.

(2) 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 70J gauge to measure the tension and hold the other spring with the flat end of the KS-6320 orange stick. If necessary, back off the contact screws with the 340 adjusting key and adjust the tension by applying the 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 bias and sensitivity as covered in 3.10-3.11.

3.08 ***Tightness of Contact Screws*** (Reqt 2.08)

(1) If the contact screws are not sufficiently tight in the bracket, remove the screw from the bracket and force the two parts of the bracket together sufficiently with the 485A pliers to insure that the screw will hold any adjusted position and then replace the screw. Use the 340 adjusting key to remove and replace the contact screws. Readjust the relay as covered in 3.10-3.11.

3.09 ***Tightness of Pole-Piece Screw Locknuts (knurled tension nuts on 255-type relays)*** (Reqt 2.09)

(1) Tighten the locknuts on 215-type relays securely with the 340 adjusting key while holding the pole-piece screw in the adjusted

position with another 340 adjusting key. Tighten the knurled tension nuts on 255-type relays by turning with the fingers. Adjust the knurled tension nuts to hold the pole-piece screw in position but not sufficiently tight to prevent advancing the pole-piece screw without loosening the tension nut.

3.10 *Contact Travel* (Reqt 2.10)
3.11 *Electrical Requirements* (Reqt 2.11)

WITH TESTING EQUIPMENT

Adjusting Contact Travel Without Readjustment of Pole-Piece Screws

(1) This method of adjustment makes use of a magnetic shunt which is placed on the relay during contact screw adjustment so as to free the armature from the influence of the permanent magnetic field.

(2) The procedures covered herein are, in general, for use in readjusting the contact screws after these screws have been backed off either to permit cleaning and burnishing the contacts or for any other reason. These procedures may also be applied in cases where a check of the total contact travel indicates that the contact travel requirement is not satisfactorily met. In all other cases when necessary, readjust the relay as covered in (7) through (15).

(3) Insert the relay in the connecting block of the testing equipment and place the 484A magnetic shunt across the front end of the yoke directly above the pole-piece screws as shown in Fig. 8 and 9. This should result in freeing the armature from magnetic influence sufficiently to cause it to assume a position approximately midway between the pole-piece screws provided the contact screws do not interfere. Connect battery to the contacts by means of the testing equipment. If the armature rests against either contact under this condition, back off the contact screw until it clears the armature.

(4) Adjust the total contact travel on relays used in telegraph service as outlined in Method A below. Adjust the travel on all other relays as outlined in Method B.

Method A: Remove the 0.005-inch blade from the 74D thickness gauge nest and place it between the front ends of the flexible contact springs. Allow the gauge to be held in position by the tension of the spring. Turn in one contact screw until it just touches the armature contact as indicated by the testing equipment and then back it off until it ***just breaks*** with the armature contact. Repeat the operation with the other contact screw. Remove the gauge from between the flexible contact springs.

Method B: Turn in one contact screw with the 340 adjusting key as shown in Fig. 8 until it just touches the armature as indicated by the testing equipment and then back it off one-half the specified total contact travel. One twelfth of a turn of the contact screw corresponds to 0.002-inch contact travel. Repeat the above operation with the other contact screw.

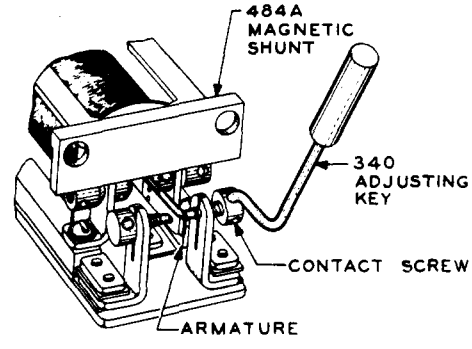

Fig. 8 – Method of Adjusting for Total Contact Travel — 215-Type Relay

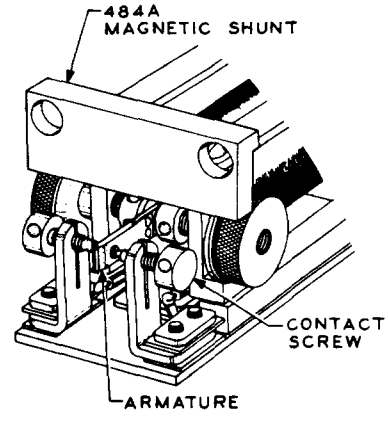

Fig. 9 – Method of Applying Magnetic Shunt to 255-Type Relays

(5) Remove the 484A magnetic shunt from the relay and apply the bias requirement as covered in the section covering the particular type of testing equipment used. If the relay meets the test requirement but not the readjust requirement, correct as follows. Using the two 340 adjusting keys turn both contact screws simultaneously by equal amounts in the same direction of rotation as viewed from the front of the relay until the relay meets the readjust bias requirement. In this manner the normal position of the armature with respect to the contact screws is changed without changing the total contact travel. Then check the sensitivity requirement and if the requirement is not met, readjust as covered in (7) through (15).

(6) If upon removal of the shunt as covered in (5) the bias in either direction exceeds the test limit, it may be due to an error in setting the contact screws. Carefully repeat (3) and (4) and if the bias still exceeds the test limit, it is an indication that the pole-piece screws are not properly located or that other readjustment is required. In this case clean the relay as covered in 3.01, and readjust the relay as covered in (7) through (15).

Adjustment When Change in Pole-Piece Screw Position is Necessary

(7) With the relay inserted in the connecting block of the testing equipment, loosen the locknuts on 215-type relays and back off the pole-piece screws as far as possible with the 340 adjusting key or the 3-inch C screwdriver. Back off the pole-piece screws on 255-type relays, with the KS-6854 screwdriver. The knurled tension nut shall be set so that the pole-piece screw may be adjusted without changing the position of the knurled tension nut. The 340 adjusting key may also be used to turn the pole-piece screw. Place the 484A magnetic shunt across the front end of the yoke directly above the pole-piece screws as shown in Fig. 8 and 9.

(8) Adjust the total contact travel on relays used in telegraph service as outlined in Method A below. Adjust the travel on all other relays as outlined in Method B.

Method A: Connect battery to the contacts of the relay with the testing equipment. Remove the 0.005-inch blade from the 74D thickness gauge nest and place it between the front ends of the flexible contact springs. Allow the gauge to be held in position by the tension of the springs. Turn in one contact screw until it just touches the armature contact as indicated by the testing equipment. Then back off the contact screw until it ***just breaks*** with the armature contact. Repeat this operation with the other contact screw. Remove the gauge from between the flexible contact springs and remove the magnetic shunt.

Method B: Connect battery to the contacts of the relay with the testing equipment and advance one contact screw with the 340 adjusting key as shown in Fig. 8 until the screw just touches the armature as indicated by the testing equipment. Then back off the contact screw one half the total contact travel. One twelfth of a turn of the contact screw corresponds to 0.002-inch contact travel. Repeat this operation with the other contact screw, after which remove the magnetic shunt.

(9) ***Bias:*** To adjust the relay for zero bias turn one pole-piece screw in with the 340 adjusting key or KS-6854 screwdriver as shown in Fig. 10 until it strikes the armature and moves the armature sufficiently to just rest against the contact screw on the side opposite to that on which the pole-piece screw is being advanced. This condition shall be met with the locknut tight on 215-type relays or tensioned as outlined in 3.09(1) for 255-type relays. Then back off the pole-piece screw one-half turn after first loosening the locknut if a 215-type relay. Tighten the locknut securely if a 215-type relay. Turn in the other pole-piece screw until the relay meets the bias requirement after the locknut has been securely tightened. Tighten the locknut if a 215-type relay by holding the pole-piece screw with one 340 adjusting key and turning the locknut with the other or, if the relay is a 255 type, adjust the knurled tension nuts when required, by turning with the fingers. Check that the sensitivity requirement is met.

(10) ***Sensitivity:*** If the relay fails to meet the sensitivity requirement, adjust the pole-piece screws with the 340 adjusting key taking care to maintain zero bias until the sensitivity requirement is met.

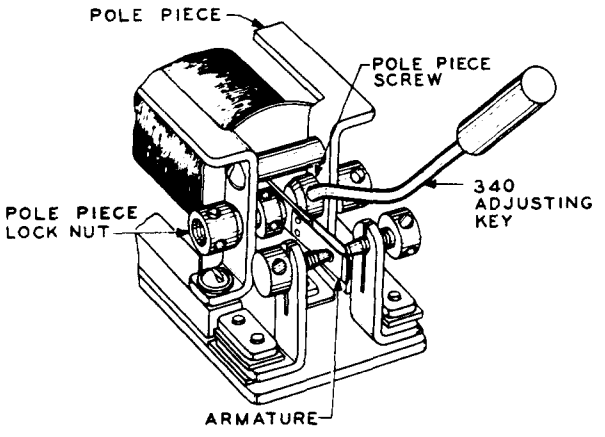

Fig. 10 – Method of Adjusting Pole-Piece Screw

(11) If it is impossible to adjust the relay for bias and sensitivity by turning the pole-piece screws, it may be an indication that the contact screws have not been set properly. Repeat the adjustments outlined in (7) and (8) and readjust for bias and sensitivity. If the relay still fails to meet these requirements, the trouble may be due to lack of symmetry in the armature and pole pieces. Repeat (7) and (8) and make the bias adjustment by turning in the pole-piece screw opposite the one previously turned in to obtain the pole gap setting. If the relay still fails to meet these requirements, it may be due to the difference in the height of the armature stop pins in which case it will be necessary to replace the armature.

(12) ***Contact:*** Apply the contact requirement. If the requirement is not met it may be an indication of dirty contacts, large contact separation, poor connection in contact circuit, unsatisfactory over-all adjustment, or weak magnets on the relay. Remagnetize weak magnets as covered in 3.002. Clean the contacts as covered in 3.01. Repeat the adjustments outlined in (7) and (8) and readjust for bias and sensitivity.

(13) If the contact closure is still not steady (chattering contacts) it may indicate that either the pressure between the flexible armature springs is insufficient or excessive or a poor contact at some point in the electrical path between the relay terminal and the contact point. Check the pressure between the flexible armature springs covered in 3.07 and make adjustments as required. Then adjust for contact travel, bias, and sensitivity as outlined in (7) through (11).

(14) Place the 484A magnetic shunt on the relay and repeat (3), (4), and (5) as an additional check on the mechanical condition of the relay. If in (5) upon removal of shunt, the bias now exceeds the test limit, or if after correcting the bias the sensitivity requirement is not met, it is usually an indication that the armature is defective and requires replacement, after which readjust the relay as outlined in (7) through (13). Then repeat the tests outlined in this paragraph.

(15) ***Final Check:*** Replace the cover on the relay and check to insure that the relay meets its electrical requirements.

WITHOUT TESTING EQUIPMENT

Adjusting Contact Travel Without Readjustment of Pole-Piece Screws

(16) The procedures covered in (17) through (21) are, in general, for use in readjusting the contact screws after these screws have been backed off either to permit cleaning and burnishing contacts or for any other reason. These procedures may also be applied in cases where a check of the total contact travel indicates that the contact travel requirement is not satisfactorily met. In all other cases readjust the relay as covered in (22) through (32).

(17) Release the armature by placing the 484A magnetic shunt on the relay as shown in Fig. 8 and 9.

(18) See that both contact screws are backed off at least one turn. Remove the 0.005-inch blade from the 74D thickness gauge nest, and place it between the front ends of the flexible contact springs.

(19) Using the 340 adjusting key, adjust one contact screw until it just touches the armature contact. This can be judged by inserting the white P-484674 card underneath the contacts, with the short sides of the card against the contact screw bracket, and viewing the contact gap from above the relay. If there is still doubt as to whether or not the

contacts touch, press lightly on the other side of the armature with the 340 adjusting key, and observe whether or not there is movement of the armature. The card may be left permanently in the relay. Contact closure may also be indicated by connecting a KS-14250 L1 flashlight between the armature terminal and the appropriate contact terminal.

(20) Adjust the other contact screw as described in (19), and remove the gauge from between the flexible contact springs.

(21) Remove the 484A magnetic shunt.

Adjustment When Change in Pole-Piece Screw Position Is Necessary

(22) Loosen the locknuts, or knurled tension nuts, and fully back off the pole-piece screws. Check that the armature stands approximately midway between the contact screws and, if necessary, set the contact screws as outlined in (18), (19), and (20).

215-Type Relays

(23) With the right-hand pole-piece screw fully backed off, advance the left-hand pole-piece screw using the 340 adjusting key so that it pushes the armature over until it just touches the right-hand contact screw. This may be determined as described in (19). This condition must be met with the locknut friction tight. Back off the pole-piece screw 3/8 turn, and lock in position.

(24) With the relay standing on a nonmetallic horizontal surface or lying in such a position that the pole-piece screws are horizontal, advance the right-hand pole-piece screw until either of the following conditions is met.

(a) The armature stands midway between the two screw contacts, as gauged by eye, and will not remain on either contact.

(b) The armature contact will just remain against each screw contact after the armature has been pushed lightly against it.

The condition must be met with the locknuts tight.

(25) If the armature stop pins touch either pole-piece screw when the armature is pushed lightly from side to side, back off the pole-piece screw which was adjusted first slightly more than the amount specified in (23) and readjust the other pole-piece screw as described in (24).

(26) If difficulty is experienced in meeting these conditions, repeat the entire procedure starting with the opposite pole-piece screw.

255-Type Relays

(27) With the right-hand pole-piece screw fully backed off, advance the left-hand pole-piece screw using the 340 adjusting key so that it pushes the armature over until it just touches the right-hand contact screw. This may be determined as described in (19). This condition must be met with the knurled tension nut sufficiently tight to hold the pole-piece screw in any adjusted position. Back off the left-hand pole-piece screw one-half turn.

(28) With the relay standing vertically on a horizontal surface and the armature pointing upward, advance the right-hand pole-piece screw (that is, the one not yet adjusted) until the armature moves to a position approximately midway between the contact screws with both knurled tension nuts sufficiently tight to hold the pole-piece screws in position as covered in 3.09(1). If the armature remains against either contact screw when the armature is pushed lightly against it, adjust the right-hand pole-piece screw until the armature stands between the contact screws and will not remain against either contact.

(29) With the relay standing vertically as specified in (28), advance each pole-piece screw, in turn, a very small amount at a time, keeping the armature balanced midway between the contacts, until the armature will just remain against each contact when the armature has been pushed lightly against it with the tip of a 340 adjusting key.

(30) Starting with the relay in a vertical position on a horizontal surface, check the adjustment by tipping the relay to one side slowly until the armature falls from the upper to the lower contact. Note the angle at which this occurs, which should be before the relay has reached a horizontal position.

(31) Tip the relay to the opposite side, and note the angle at which the armature falls to the lower contact. If this angle is approximately equal to the angle noted in (30) the relay is in satisfactory adjustment.

(32) If the angles are not approximately equal, the pole-piece screws should be adjusted in or out, a very slight amount at a time, until the requirements of (29), (30), and (31) are met.