

**RELAYS**  
**U AND UA TYPES**  
**REQUIREMENTS AND ADJUSTING PROCEDURES**  
**(FOR CONDENSED SECTION, SEE 040-937-701)**

**1. GENERAL**

**1.01** This section covers U- and UA-type relays.

**1.02** This section is reissued to:

- Revise List of Tools, Gauges, Materials, and Test Apparatus
- Add spring tension values omitted from Issue 11 (Fig. 101 through 243 and Fig. 245).

This reissue does not affect the Equipment Test List.

**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** *Operate:* A relay is said to *operate* if, when current is connected to its winding, the armature moves sufficiently to meet the following conditions.

- (a) *All Relays:* All normally open contacts close, and all normally closed contacts open.
- (b) *Relays Equipped With Stop Discs:* At least one stop disc rests against the core or, when an attachable separator is provided, the armature presses the flap of the separator against the core.
- (c) *Relays Not Equipped With Stop Discs:* The armature itself rests against the core.

**1.05** *Nonoperate:* A relay is said to *nonoperate* if, when current is connected to its winding, the armature does not move from its position against the backstop.

**1.06** *Hold:* A relay is said to *hold* if, when the current is reduced abruptly from the soak or operate value to the hold value, the armature does not move from the operated position.

**1.07** *Release:* A relay is said to *release* if, when the current is reduced abruptly to the release value or the current is removed, the armature moves from the core to its unoperated position in which the armature is resting against the backstop, and all normally open contacts are open and all normally closed contacts are closed.

**1.08** *Armature gap* is the gap between the core and the nearer stop disc on the armature, or the armature itself when no stop discs are provided in any position that the armature may assume between the unoperated and the operated positions of the relay. If an attachable separator is used, the armature gap is the gap between the core and the flap of the separator when the flap is flat against the armature, or between the core and the nearer stop disc if the thickness of the separator is less than the height of the nearer stop disc.

**1.09** *Armature travel* is the armature gap when the armature is resting against the backstop.

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**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 *pretensioned spring* is a spring which has been tensioned during its manufacture. Such a spring may be recognized by one or more distinct bends between the insulators and the contact end of the spring.

**1.12** Since the bends in pretensioned springs are formed during manufacture to provide the necessary tensions, these bends should not be disturbed during adjustment.

**1.13** 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.

**1.14** The terms *contact make* or *break* apply to the electrical circuit between the two springs. Contact make may involve the closing of only one pair of the two pairs of contacts. Contact break involves the opening of both pairs of contacts.

**1.15** The year of manufacture of U- and UA-type relays is stamped on the spoolhead preceded or followed by dashes, three to indicate the first quarter, two the second quarter, one the third quarter, or none the last quarter.

**1.16 Identification of Stop Disc Height**

(a) On relays manufactured during 1936 and subsequently, the small prick punch marks on the armature identify the original height of the stop discs as indicated in the table below. With the relay mounted in its normal position, the punch marks are located on the right-hand side of the armature and approximately 3/8 inch from the backstop.

(b) On relays manufactured prior to 1936, the grooves on the armature identify the original height of the stop discs as indicated in the table below. With the relay mounted as indicated in (a), the grooves are located on the right-hand side and on the lower portion of the yoke of the armature.

ORIGINAL STOP DISC HEIGHT	ARMATURE MARKING
0.005 Inch	≡≡≡ (3 groove marks)
0.010 Inch	≡≡ (2 groove marks)
0.015 Inch	— (1 groove mark)

ORIGINAL STOP DISC HEIGHT	ARMATURE MARKING
0.005 Inch	None
0.010 Inch	• • (2 punch marks)
0.015 Inch	• (1 punch marks)

**2. REQUIREMENTS**

**2.01 Cleaning:** The contacts and other parts of the relay shall be cleaned in accordance with the section covering cleaning and reconditioning relay contacts. After cleaning any contact, a check shall be made to see that both contacts on the bifurcated spring involved meet requirement 2.20(c).

**2.02 Relay Mounting:** Relays shall be fastened securely to the mounting plate. Gauge by feel by grasping the core and armature between the thumb and forefinger and attempting to move the relay.

**2.03 Vertical Clearance**

(a) The clearance between the springs of the relay and apparatus mounted directly above or below shall be

Min 1/4 inch

Gauge by eye.

**Note:** This clearance is satisfactory if it can be obtained by removing the covers of the apparatus directly above or below, provided such covers are readily removable.

(b) Springs shall not touch the relay cover or the magnetic shields if provided.

Gauge by eye.

**2.04 Cover Spring and Cover Guide Pressure and Cover Cap Tightness**

(a) The cover cap on relays so equipped shall fit snugly. The relay cover shall be securely held in position when the cover cap is being removed and shall resist lateral and vertical displacement during the routine relay maintenance procedures.

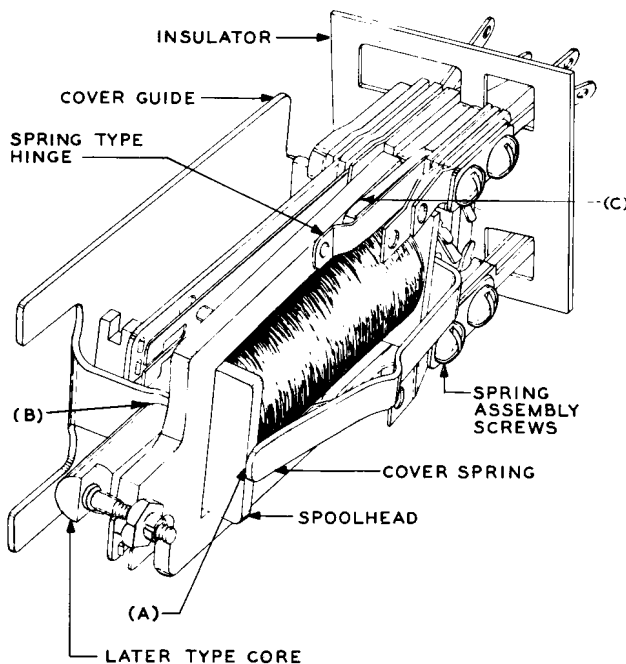
Gauge by feel.

(b) **Fig. 1(A)**—The cover spring shall bear on the front spoolhead when the cover is off.

Gauge by feel.

(c) **Fig. 1(B)**—The free end of the cover guide shall bear on the core when the cover is removed, or after the guide has been pushed toward the core.

Gauge by eye.



**Fig. 1—U-Type Relay Arranged for Mounting Individual Cover and Equipped With Spring-Type Hinge**

**2.05 Contact Alignment**

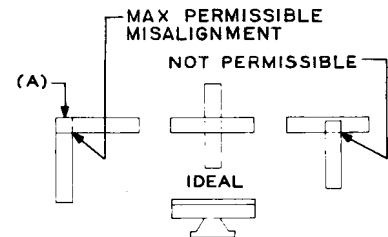
(a) **Fig. 2(A)**—On all relays equipped with standard contacts, the contacts shall line up so the width on the contact surface of each

contact bar falls wholly within the length of its mating bar.

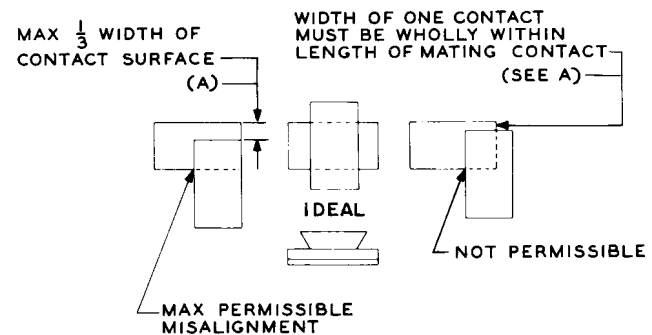
Gauge by eye.

(b) **Fig. 3(A)**—On relays equipped with heavy contacts, the contact alignment shall be within the limits indicated in Fig. 3.

Gauge by eye.



**Fig. 2—Alignment of Contact Surfaces—Standard Contacts**



**Fig. 3—Alignment of Contact Surfaces—Heavy Contacts**

**2.06 Spring Tang Position**

(a) The spring tang shall not rub on the spoolhead when moved from its normal position of rest on the spoolhead in the direction of the travel of the spring.

Gauge by eye and feel.

(b) The free end of the spring tang shall overlap the vertical edge of the spoolhead, Fig. 4(A).

- (1) On relays manufactured prior to the second quarter of 1948, the full width of the spring tang shall lie entirely within the projection of the top and bottom edges of the slots in the spoolhead.
- (2) On relays manufactured during the second quarter of 1948 and subsequently, the spring tang may project 1/3 of its width above the top edge of the slot in the spoolhead.

Gauge by eye.

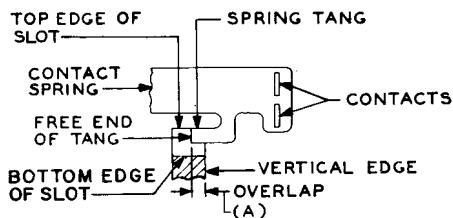


Fig. 4—Spring Tang Position

**2.07 Adjusting Stud Clearance:** Fig. 5(A)—On a relay having an adjusting stud, there shall be a clearance between the armature and the adjusting stud in all positions of the armature travel.

Gauge by eye.

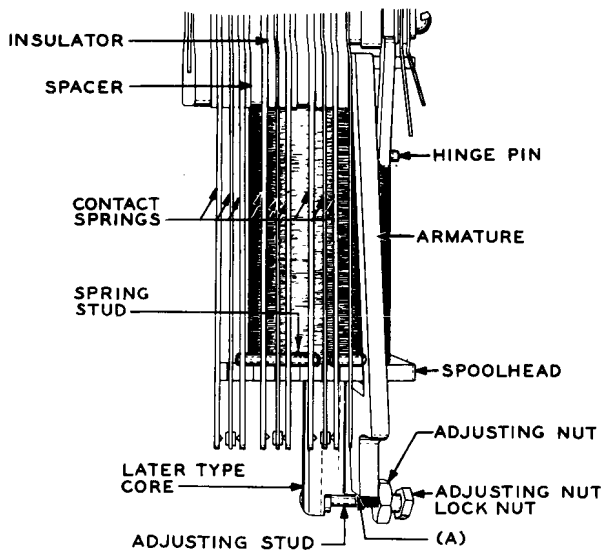


Fig. 5—U-Type Relay—Top View

**2.08 Adjusting Nut Tightness:** On a relay having an adjusting stud, the adjusting nut shall be sufficiently tight on the stud to prevent its being turned with a torque of 3 ounce-inches.

To check this requirement, attempt to turn the adjusting nut with the thumb and forefinger. In case of doubt, this may be checked by the use of the 474A wrench and the 70D gauge. With the wrench on the nut, the gauge shall be applied in the hole in the free end of the wrench, and the nut shall not turn when a pressure of 40 grams is applied at right angles to the wrench in the clockwise direction as shown in Fig. 6.

**Note:** When an adjusting nut locknut is used, the adjusting nut tightness requirement 2.08 is waived.

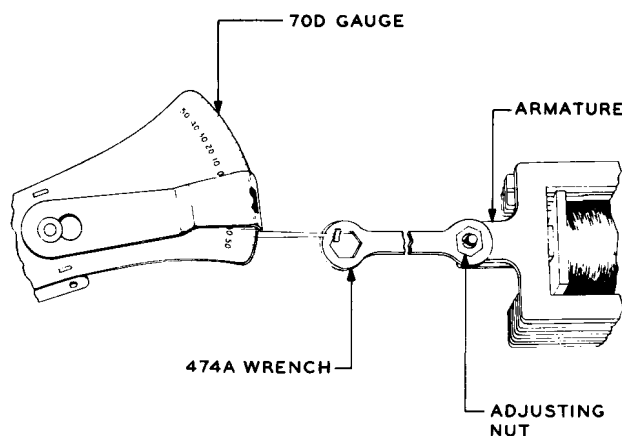


Fig. 6—Method of Checking Tightness of Adjusting Nut

**2.09 Adjusting Nut Locknut Tightness:** On a relay having an adjusting stud, the adjusting nut locknut, where provided, shall be sufficiently tight against the adjusting nut to prevent its being turned with a torque of 3 pound-inches.

To check locknut tightness, hold the adjusting nut in place with a 474A wrench, and with another 474A wrench on the locknut, apply the 62B gauge in the hole in the free end of the wrench on the locknut in the same manner as shown in Fig. 6. The locknut shall not turn when a pressure of 600 grams is applied at right angles to the wrench in the direction to tighten the locknut.

**2.10 Application of D-178259, D-178260, and D-178261 Attachable Separators:** Fig. 7

- (a) The attachable separators shall be applied in the field when U-type relays fail to release properly as judged by circuit operation, and this failure is due to missing or worn stop discs or to the discs pounding into the core.
- (b) The thickness of the attachable separator shall correspond to the original height of the stop discs as covered in 1.16.
- (c) **Relays Having Adjusting Stud:** The attachable separator shall be positioned on a relay equipped with the later type of core by means of the ears on the front of the metal clip of the separator resting against the step on the core of the relay. On relays equipped with the earlier type of core, the separator shall be positioned by the ears of the metal clip resting against the front end of the core.
- (d) **Relays Having Welded Backstop:** The attachable separator shall be positioned on a relay having a welded backstop so the front edge of the metal clip of the separator rests against the rear surface of the welded backstop.

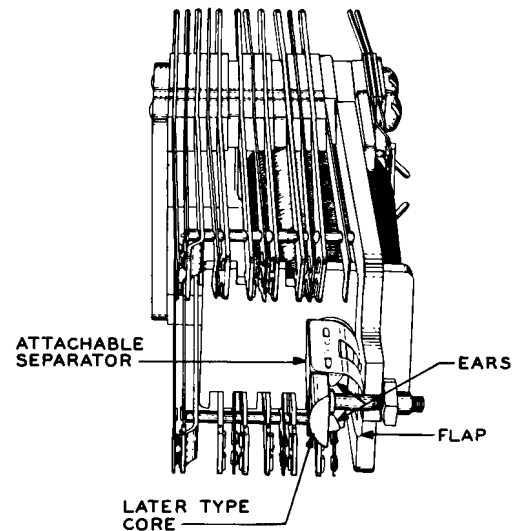
**Note:** In order to mount the separator, it will be necessary to remove both ears from the metal clip.

- (e) The flap of the attachable separator shall be free in the armature gap and shall not be wrinkled or snagged.

**2.11 Application of D-180479 and D-180480 Armature Stop Assemblies:** The armature stop assembly shall be positioned on a UA-type relay so that it rests between the core and the armature with both tabs wrapped around the core. The plastic stop will be held in place by the metal retaining clip.

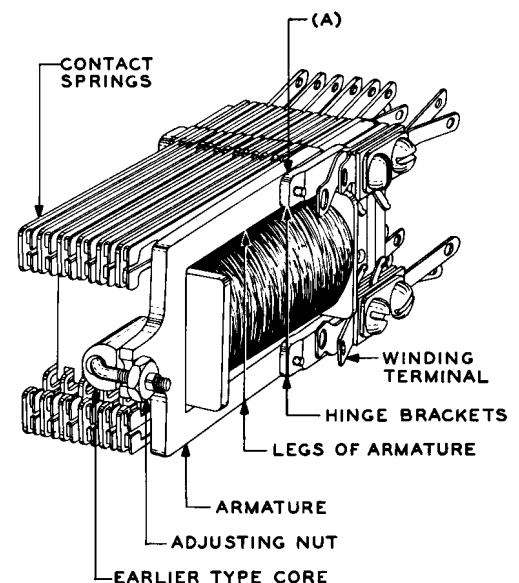
**2.12 Armature Position:** Fig. 1(C) and 8(A)—Both legs of the armature shall bear against the hinge bracket with the relay electrically operated and shall also bear against the hinge bracket after the relay has released.

Gauge by eye.



**Fig. 7—Attachable Separator Mounted on Relay Core**

**Note:** If the relay armature is not equipped with stop discs, this requirement may be met with the relay electrically energized against a 0.005-inch blade of the 66D gauge.



**Fig. 8—U-Type Relay—General View**

**2.13 Armature Travel:** Fig. 9(A)—The armature travel shall be in accordance with the value specified for the relay in the armature travel

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column on the circuit requirements table. Unless otherwise specified, the armature travel tolerance shall be  $+0.003$  inch.

Use the 131A gauge.

To check the armature travel requirement on relays not equipped with attachable separators, attempt to insert a gauge 0.003 inch larger than the specified gap with the long axis of the gauge in the position as shown in Fig. 10. Where an attachable separator is provided, carefully insert the gauge, from the bottom, between the flap of the separator and the core as shown in Fig. 11 in order not to damage the separator. If the gauge enters, it should enter with a snug fit. Do not force the gauge.

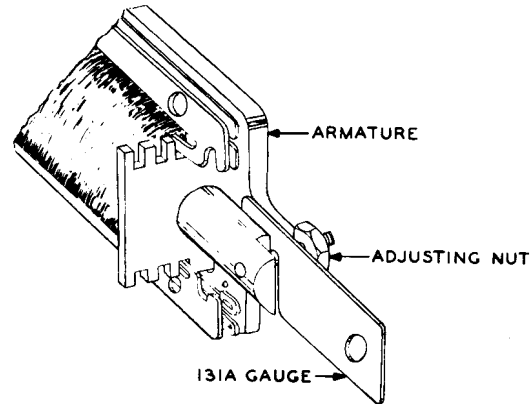


Fig. 10A—Relay Having Adjusting Stud

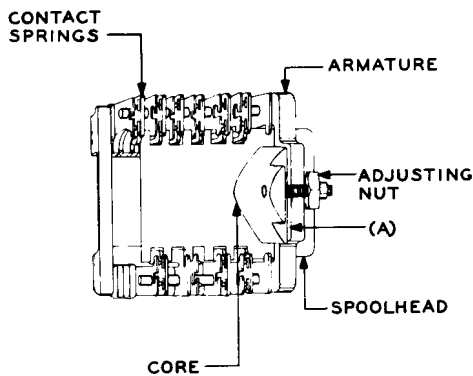


Fig. 9—UA-Type Relay—Front View

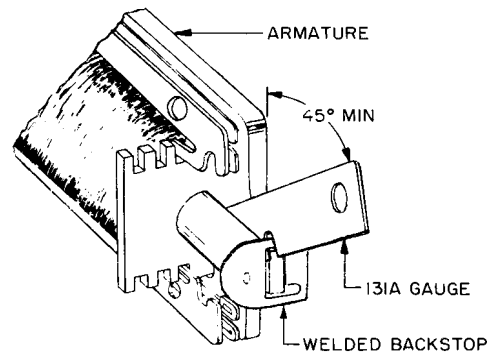


Fig. 10B—Relay Having Welded Backstop

### 2.14 Spring Tension

(a) The tension of each spring measured in grams shall be in accordance with the information given on Fig. 101 through 350, which is referred to in the BSP Fig. No. column of the circuit requirements table. The values given are to be used when the letter H appears in the Cont Pressure column of the circuit requirements table. Where SPL appears in the Cont Pressure column of the circuit requirements table, the spring tensions, contact make, and break contact pressure shall be as specified herein for H contact pressure, except as modified by notes on the circuit requirements table.

(b) The springs shall be tensioned toward the armature. Unless the abbreviation Arm. Opr is shown associated with an arrow mark

Fig. 10—Position of Gauge When Checking Armature Travel

leading to a spring, the tension shall be measured with the armature in the unoperated position. A spring tensioned against the spoolhead shall register the required tension just as the tang of the spring leaves the spoolhead. A spring whose contacts are tensioned against the contacts of an opposing spring shall register the required tension just as the contacts break. A spring tensioned against a stud shall register the required tension just as it leaves the stud. A spring tensioned against another spring or against the armature through a stud shall register the required tension just as the stud leaves the

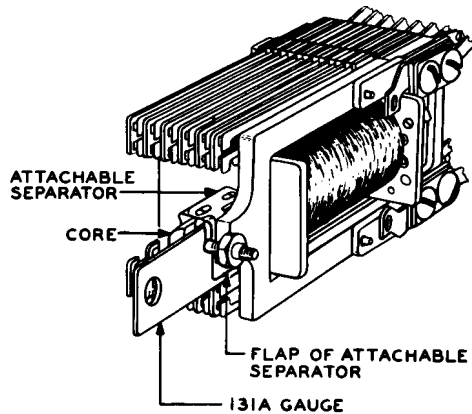


Fig. 11A—Relay Having Adjusting Stud

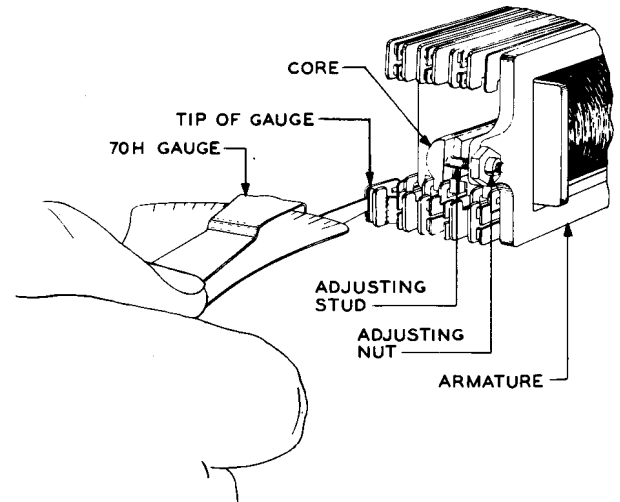


Fig. 12—Method of Checking Spring Tension

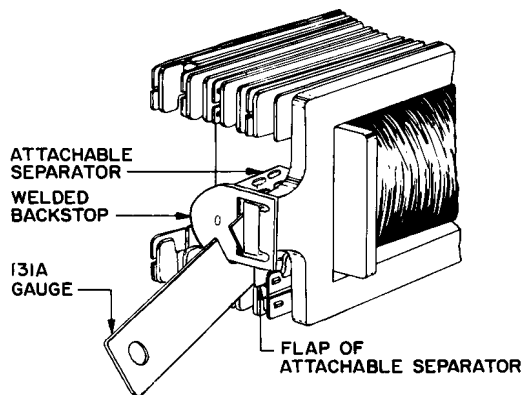


Fig. 11B—Relay Having Welded Backstop

Fig. 11—Position of Gauge When Checking Armature Travel on Relay Equipped With Attachable Separator

other spring or the armature. Use the 70H or 70J gauge to check the tension. Apply the gauge so the tip of the gauge engages both prongs of the bifurcated springs as indicated in Fig. 12. When gauging tensions on solid springs, apply the tip of the gauge near the front end of the spring just in front of the contacts.

### (c) *A Springs*

(1) Where the letter A appears associated with a particular spring, it means that this spring need have no definite tension but shall be tensioned **toward** the armature. When the A springs are tensioned **against** the armature either directly or indirectly through studs, the tensions of all such A springs on the relay, together with the tensions of any D springs that may also be similarly tensioned against the armature, shall hold the armature against the adjusting nut with sufficient pressure to insure that requirement 2.16 is met.

(2) Where the relay is equipped with a pin-type hinge, in no case shall this tension in one spring combination be more than 2-1/2 times that in the other spring combination. To check this pressure on relays equipped with either a pin- or spring-type hinge, block unoperated the armature using the 768A armature blocking tool. Check the pressure of the stud against the armature by applying the 70H gauge to the spring nearest the armature. Apply the tip of the gauge just in front of the stud.

**Note:** That part of the requirement which specifies that all A springs are to be tensioned toward the armature is met for test purposes if there is no stud gap present at the springs for which no stud gap is specified. For example, in spring combination 123 no stud gap should be present on either side of spring 4, and in spring combination 172 no stud gap should be present on either side of spring 4 or between spring 7 and the stud on spring 6. Where a D spring is present, this requirement shall be met with the D spring lifted off its associated stud.

(d) **B Springs:** Where the letter B appears associated with a particular spring, it means that this spring, together with the tensions of any A and D springs which may in turn be tensioned against it, shall have a combined tension of

**Test:** Min 18 grams  
**Readjust:** Min 20 grams

Use the 70H gauge applied to the B spring.

**Example:** On Fig. 141, the B tension specified for spring 7 is the combined tension of springs 2, 5, and 7 and is checked by applying the gauge to the tip of spring 7.

(e) **Buffer Springs**

(1) Buffer springs designated X' (in association with a second letter to indicate adjustment) in Fig. 101 through 350 are provided on certain relays to aid in meeting the electrical requirements. Where the letter F appears associated with a buffer spring, this buffer spring shall be used only in case spring tension, in addition to that provided by the other springs, is required to meet the specified release current flow requirements. On relays equipped with F buffer springs in both spring combinations, either or both buffer springs shall be used as required for the individual relay.

(2) The tension of each X' buffer spring designated F used shall be

**Test:** Min 20 grams  
 Max 100 grams

**Readjust:** Min 25 grams  
 Max 100 grams

Use the 70H or the 70J gauge applied to the tip of the spring.

**2.15 Position of X' Buffer Springs Designated F**

(a) Each X' buffer spring designated F used in meeting the release electrical requirement shall meet the following requirements.

(1) **Readjust Only:** When the relay is electrically energized against a 0.013-inch gauge inserted in the armature gap, there shall be a perceptible stud gap at the stud which operates the buffer spring.

Use the 131A gauge.

(2) When the relay is electrically energized against a gauge inserted in the armature gap, there shall be no stud gap at the stud which operates the buffer spring.

**Test:** 0.004 inch  
**Readjust:** 0.006 inch

Use the 131A gauge.

(b) If an X' buffer spring designated F is not used, there shall be a stud gap at the stud which operates the buffer spring when the relay is electrically operated.

Gauge by eye.

**2.16 Armature Back Tension:** Fig. 13(A)—The armature shall be held against the backstop with a pressure of

		U TYPE	UA TYPE
<b>Test</b>	Min	18 grams	5 grams
<b>Readjust</b>	Min	22 grams	9 grams



Use the 70H or the 70J gauge applied to the back of the armature at a point approximately midway between the points where the stop discs are normally located as indicated in Fig. 13.

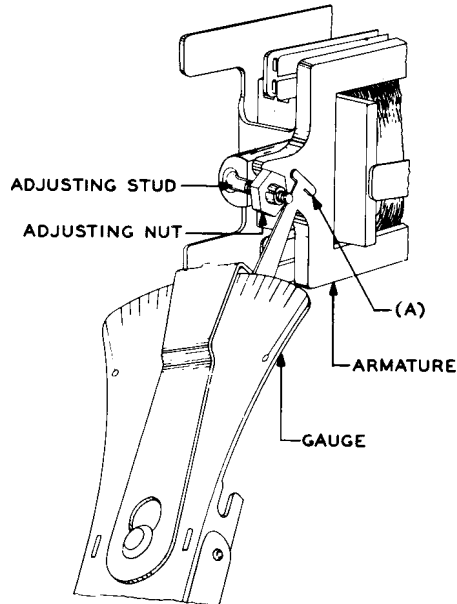


Fig. 13—Method of Checking Armature Back Tension

**2.17 Spring Stud Clearance:** Fig. 14(A)—The spring studs shall clear the springs through which they pass in all positions of the armature travel.

Gauge by eye.

**2.18 Straightness of Springs:** All springs other than pretensioned springs (see 1.11 and 1.12) shall be free of sharp bends or kinks due to adjustment except that, in the case of thin (0.013 or 0.018 inch) springs, a kink may be permitted provided it is within 1/4 inch from where the spring leaves the insulators. A gradual bow in a spring is permissible.

Gauge by eye.

**2.19 Separation Between Springs:** The clearance between adjacent springs whether in the unoperated or the electrically operated position of the relay shall be

Min 0.008 inch

Gauge by eye.

**2.20 Stud Gap:** Fig. 14(B)

(a) **Stud Gaps Designated T:** With the relay unoperated, the clearance between the stud and the spring at the points designated T on Fig. 101 through 350 shall be

Min 0.006 inch

This requirement is met if there is a clearance between the spring and the stud with the 133A gauge inserted between the armature and the end of the stud which rests against the armature.

Gauge by eye.

(1) The use of the 510C test lamp equipped with the 561A straight tip or the 562B curved tip to illuminate the stud gap will facilitate gauging this requirement. Do not attempt to check the stud gaps by moving the armature toward the core manually since, when the armature is released, it may not restore to its position against the front ends of the yoke, thus causing false contact operation. To check the stud gaps, place the 510C test lamp so the gap is illuminated on the side away from the eye, and sight through the stud gap toward the light as shown in Fig. 15 or 16, depending upon whether the straight or curved tip is used.

(b) **Stud Gaps Designated S:** With the relay unoperated, there shall be a slight clearance between the spring studs and the spring at the points designated S on Fig. 101 through 350. [See (a)(1).]

Gauge by eye.

(c) **Stud Gaps Designated R:** With the armature moved toward the core so the make contacts designated P are just making with at least one pair of contacts, there shall be a slight clearance between the spring studs and the springs at the points designated R on Fig. 300 through 350. When contacts designated P are present in both top and bottom spring combinations of the relay, the corresponding stud gaps designated R shall be present when **both** P contacts have closed with at least one pair of contacts each.

Gauge by eye. [See (a)(1).]

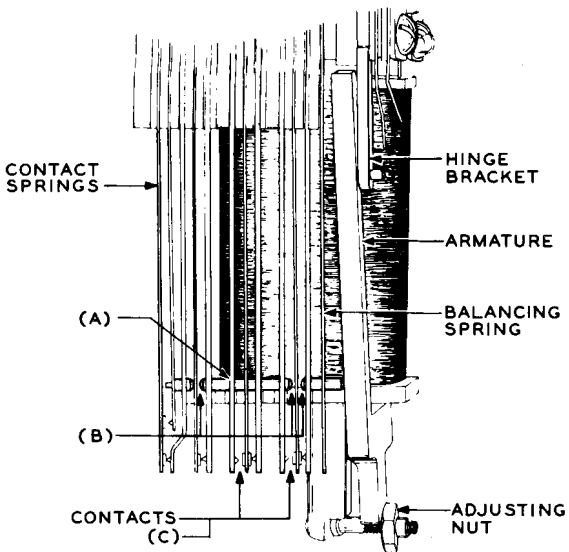


Fig. 14—U-Type Relay—Top View

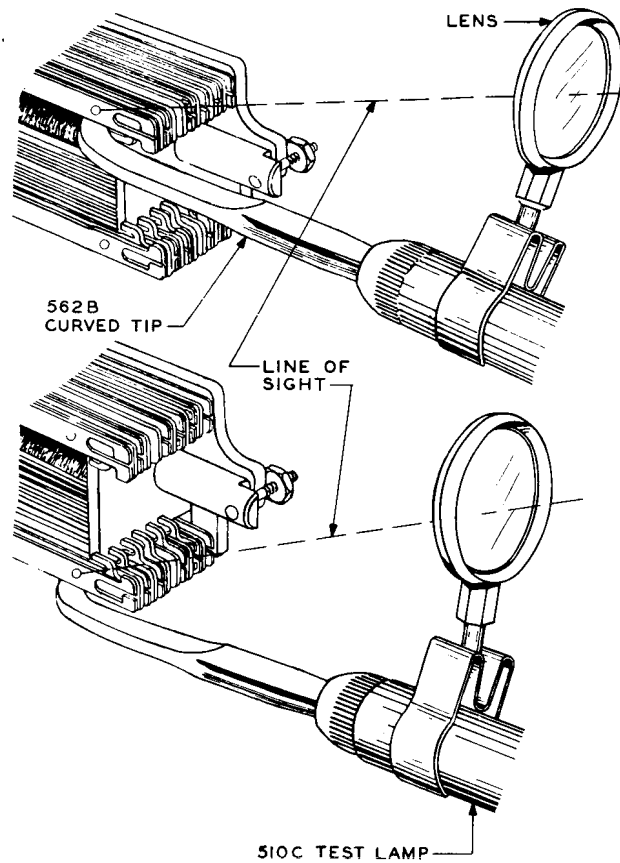


Fig. 16—Method of Gauging Stud Gap Using 562B Curved Tip

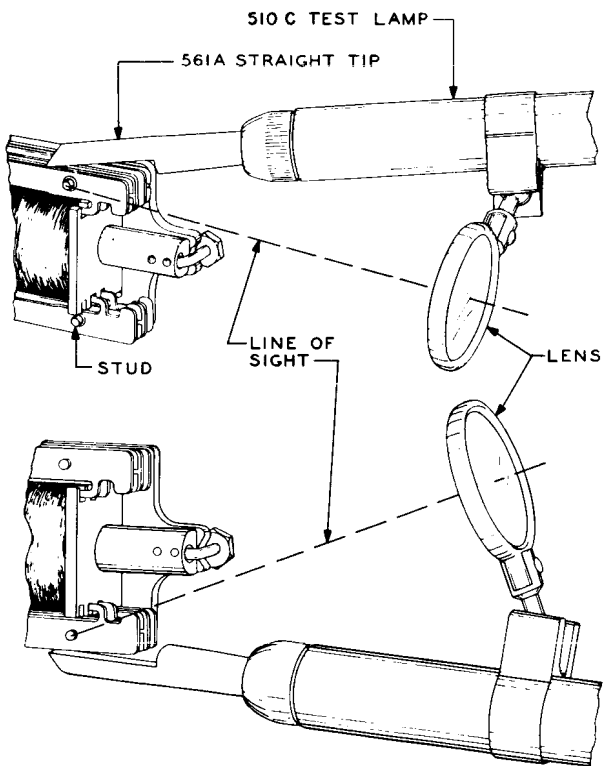


Fig. 15—Method of Gauging Stud Gap Using 561A Straight Tip

### 2.21 Contact Make

- (a) Both contacts on the bifurcated spring shall make with their associated contacts with the relay in the electrically operated position for normally open contacts and in the unoperated position for normally closed contacts.

Gauge by eye and feel.

- (b) With a gauge of the thickness indicated below inserted in the armature gap and with the relay electrically energized, normally open contacts shall meet the following conditions:

CONTACTS	CONTACTS SHALL NOT MAKE	AT LEAST ONE PAIR OF CONTACTS SHALL MAKE
All contacts except those designated J, K, M, and U	<i>Test</i> 0.018 Inch <i>Readj</i> 0.015 Inch	<i>Test</i> 0.008 Inch <i>Readj</i> 0.010 Inch
Contacts designated K	<i>Test</i> No Reqt <i>Readj</i> No Reqt	<i>Test</i> 0.013 Inch <i>Readj</i> 0.015 Inch
Contacts designated J and U	<i>Test</i> No Reqt <i>Readj</i> No Reqt	<i>Test</i> No Reqt <i>Readj</i> No Reqt
Contacts designated M	<i>Test</i> No Reqt <i>Readj</i> No Reqt	<i>Test</i> 0.008 Inch <i>Readj</i> 0.010 Inch

Use the 131A gauge.

(1) To check that the requirement is met, operate the relay electrically. Release the relay and insert a 131A gauge of the proper thickness in the armature gap, taking care that the long axis of the gauge is in the position as shown in Fig. 10 or 11 when an attachable separator is used. Energize the relay and note whether the contacts close. In case of doubt as to whether a contact is closed, apply the KS-6320 orange stick to the tip of the solid spring and attempt to move the spring *toward* its associated contact spring as indicated in Fig. 17. A perceptible movement of the solid spring without a corresponding movement of the bifurcated spring indicates that the contact is not closed. In case of doubt as to whether the requirement is met, release and reoperate the relay with the gauge in place and recheck for contact closure as covered above.

(2) When the circuit requirements table specifies insulating individual contacts on the relay being tested or adjusted, it will be satisfactory when checking for contact make to remove the insulating paper when checking the individual contact. In this case it may be necessary to open the contact manually

using the KS-6320 orange stick to release the relay.

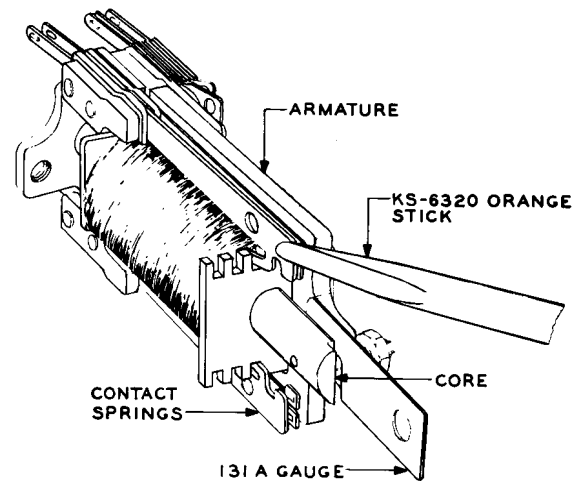


Fig. 17—Method of Checking Contact Make

(c) **Readjust Only (After Turnover):** Whenever a particular contact requires cleaning or buildup removal or when readjustments are made on a contact spring, the following requirements shall be met, in addition to (b), on the contacts affected by the cleaning or the adjustment.

(1) **Normally Open Contacts:** Both contacts on the bifurcated spring shall make when the relay is energized against a 0.004-inch gauge inserted as covered in (b).

Use the 131A gauge.

(2) **Normally Closed Contacts:** Both contacts on the bifurcated spring shall break from their associated contacts at approximately the same time.

Operate the relay manually and gauge by eye.

## 2.22 Contact Separation: Fig. 14(C)

(a) **All Contacts Except Those Designated U:**

The separation between each pair of contacts normally open or between each pair of contacts that are opened when the relay is electrically operated shall be

Min 0.005 inch

Gauge by eye.

On normally closed contacts, the requirement is met if the contacts break when the relay is electrically energized against a 0.004-inch blade of the 131A gauge inserted into the armature gap.

To check contact separation on relays on which the contacts are pitted, move the spoolhead spring manually toward its associated spring. A perceptible movement of the spring (at least 0.005 inch) before the contacts make indicates a satisfactory minimum contact separation.

(b) **Contacts Designated U:** The contact separation of the normally open contacts designated U on Fig. 101 through 350 shall be

Min 0.010 inch

Use the 134A gauge as shown in Fig. 18.

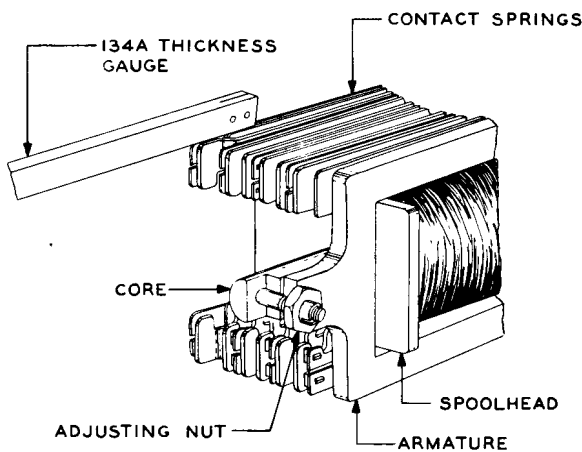


Fig. 18—Method of Gauging Contact Separation on Make-Before-Break Units

**2.23 Contact Sequence:** Fig. 19—With the exception of the E and H spring units, the break contacts of spring units equipped with make and break contacts as shown in Fig. 19 shall break before any make contact makes. On E and H units, make contacts shall be make before the break contact breaks.

Gauge by eye.

**Note:** There is no sequence between the break contacts of J unit nor between the make contacts of K unit; however, there is a sequence between the make contacts of F unit.

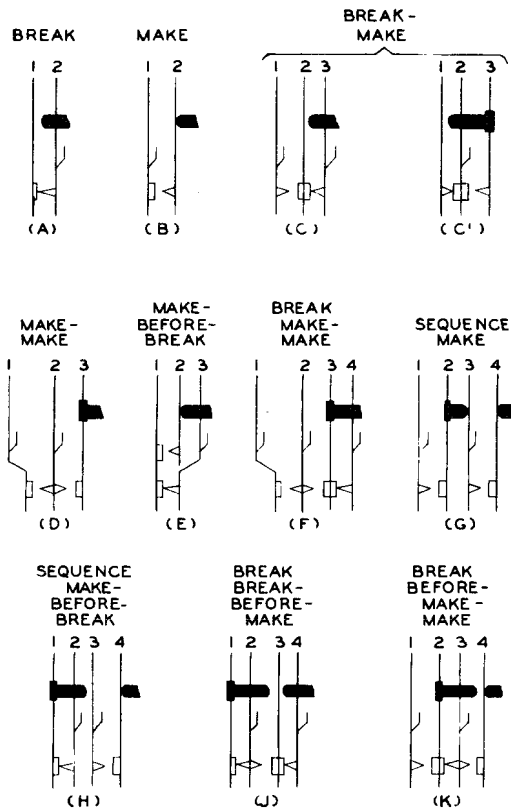


Fig. 19—Units of Relay Spring Combinations

**2.24 Electrical Requirements**

- (a) The relay shall meet the electrical requirements specified on the circuit requirements table.
- (b) **Relays for Which Release Requirements Are Specified:** Release requirements are specified to meet circuit and timing conditions. They are also specified for relays having smaller spring combinations to insure sufficient spring load so they will release on open circuit. Since the current flow values are necessarily low, magnetic interference from adjacent relays has a critical effect on the adjustment.
- (c) Where the following note appears on the circuit requirements table, "Adjacent relays

shall not be energized. See BSP," the adjacent uncovered relays, as discussed herein, shall not be energized. In this case, all the electrical requirements shall be met under the following conditions.

- (1) The cover removed from the relay.
- (2) The horizontal magnetic shields (if provided) removed from above and below the relay.
- (3) Individual or common covers (if provided) removed from relays directly above and below the relay. (This applies to E-, U-, and similar-type relays.)
- (4) Adjacent uncovered relays, as defined in Fig. 20, not energized except as noted below.

**Note:** A relay may be considered not energized if, without mechanical blocking, its armature remains against the backstop.

- (5) Where the relay under test (position 5 as shown in Fig. 20) is equipped with an individual magnetic shield (flat metal plate mounted at right of relay), the uncovered adjacent relays in positions 3, 6, and 9 may be energized. Also, when testing the relay in position 5, if the relay in position 4 is equipped with an individual magnetic shield, uncovered relays in positions 1, 4, and 7 may be energized.
- (6) When adjacent relays on either side (positions 1, 4, and 7 or 3, 6, and 9) are equipped with individual covers or vertical common covers, these covers need not be

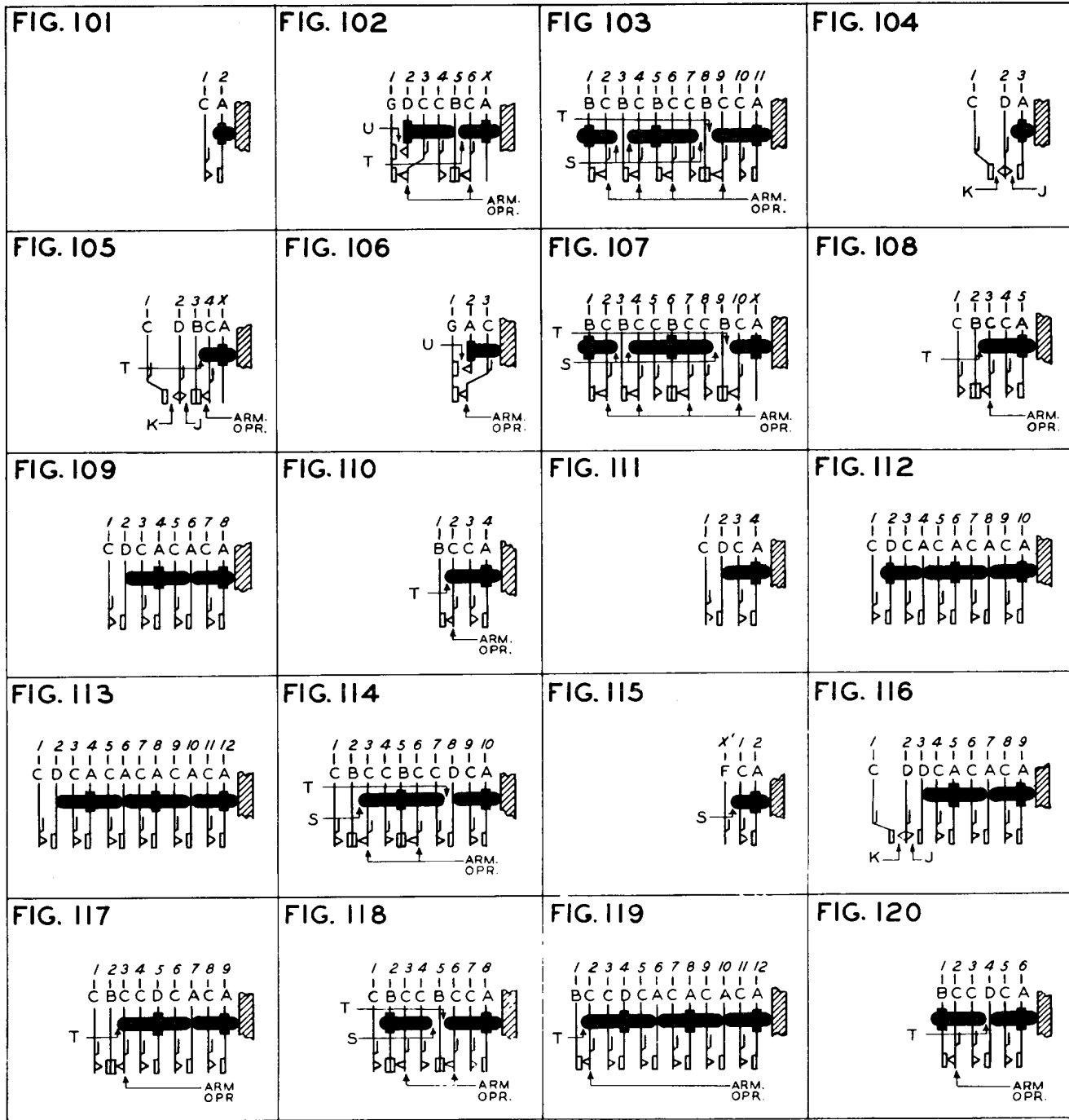
removed, except where necessary to permit the adjustment of the relay under test. When such covers are not removed, only the uncovered adjacent relays shall not be energized.

- (7) If one or more positions adjacent to the relay under test (position 5 as shown in Fig. 20) are unequipped, the unequipped positions shall be disregarded.

**2.25 Pulse-Repeating Requirement:** When specified on the circuit requirements table, the relay shall meet the percent break limits specified when checked under the conditions outlined in the section covering pulse-repeating requirements for these relays.

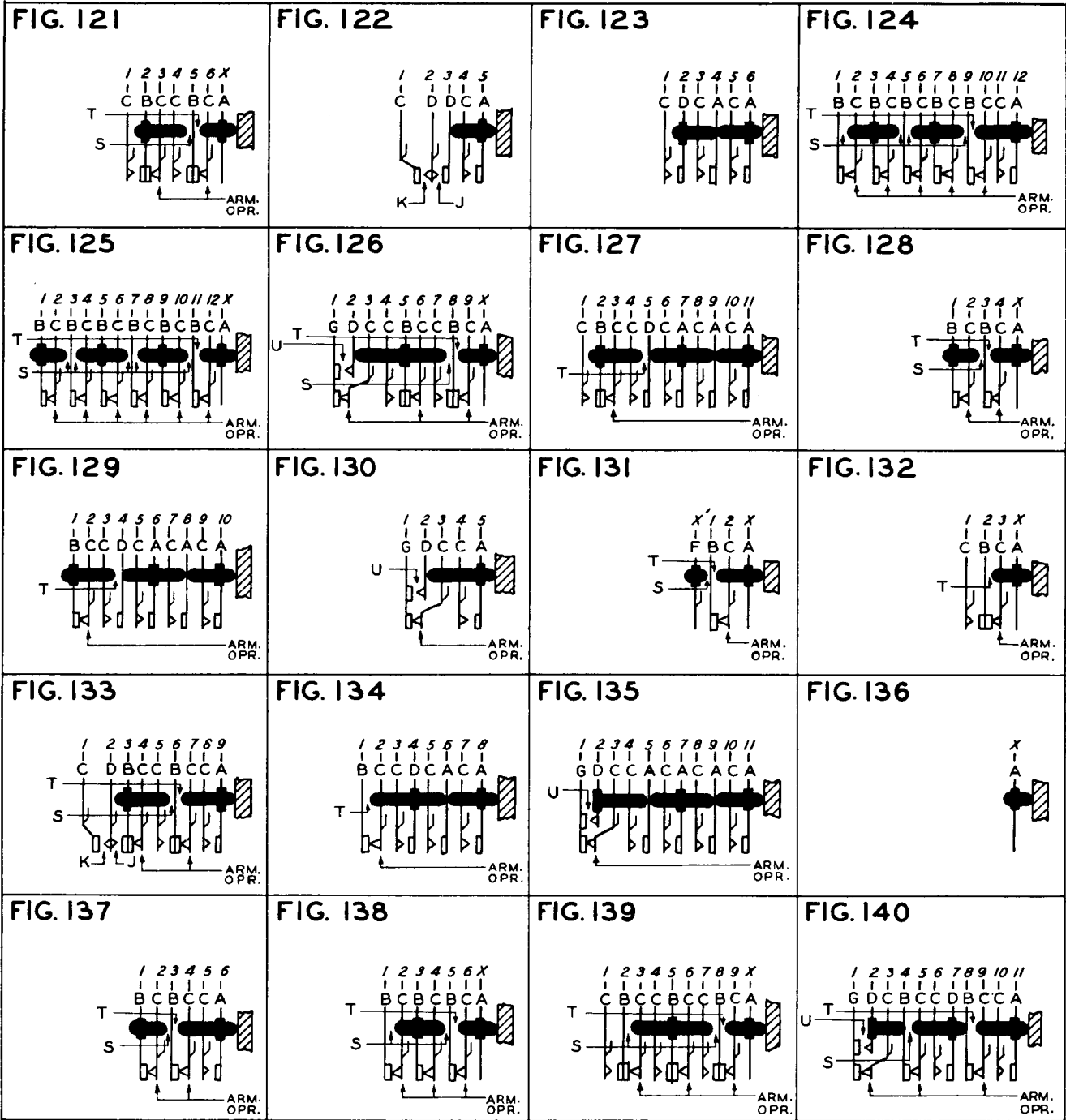
1	2	3
4	TEST 5 RELAY	6
7	8	9

**Fig. 20—Position 5 Indicates Relay Under Test—Positions 1, 2, 3, 4, 6, 7, 8, and 9 Indicate Adjacent Relays to Be Considered When Readjusting a U- or UA-Type Relay**



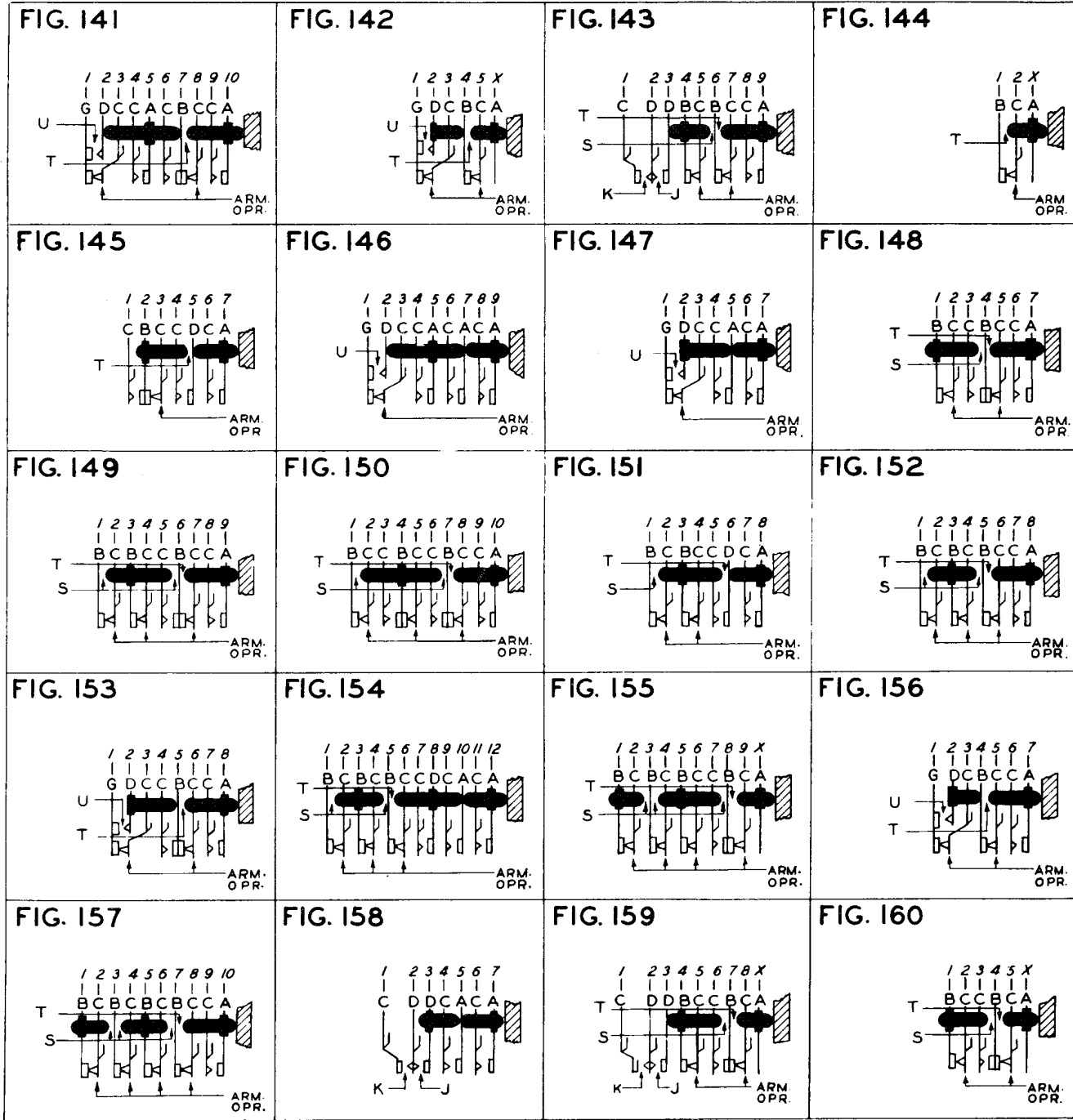
All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	J, K, and U — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		μ — Spoolhead springs
F =	—	—	See Reqt 2.14(e)	X — Balancing springs
G =	35	40		X' — Buffer springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	J, K, and U — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		μ — Spoolhead springs
F =	—	—	See Reqt 2.14(e)	X — Balancing springs
G =	35	40		X' — Buffer springs



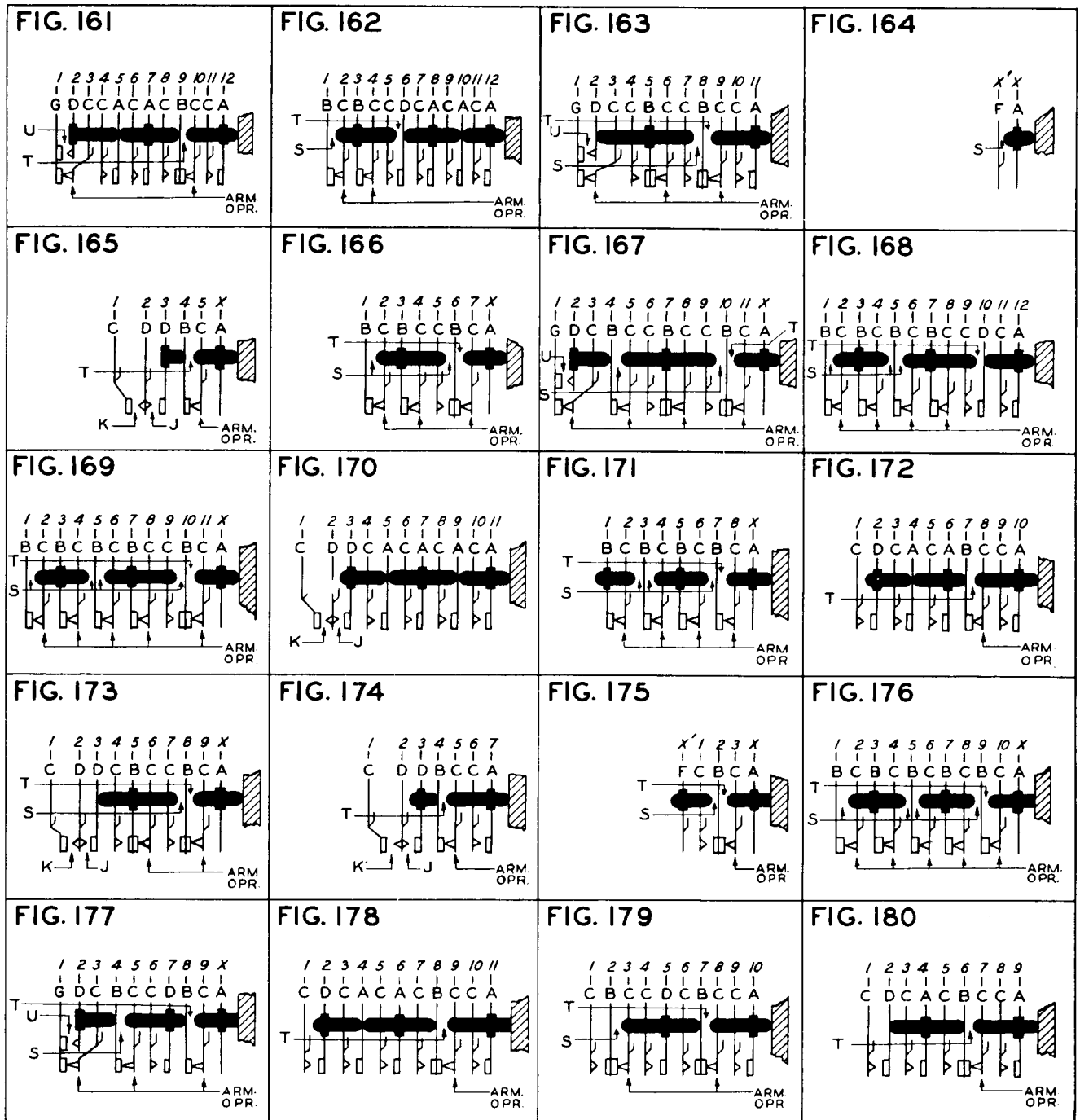
All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ
A =	—	—
B =	—	—
C =	25	30
D =	5	6
G =	35	40

See Reqt 2.14(c)  
 See Reqt 2.14(d)

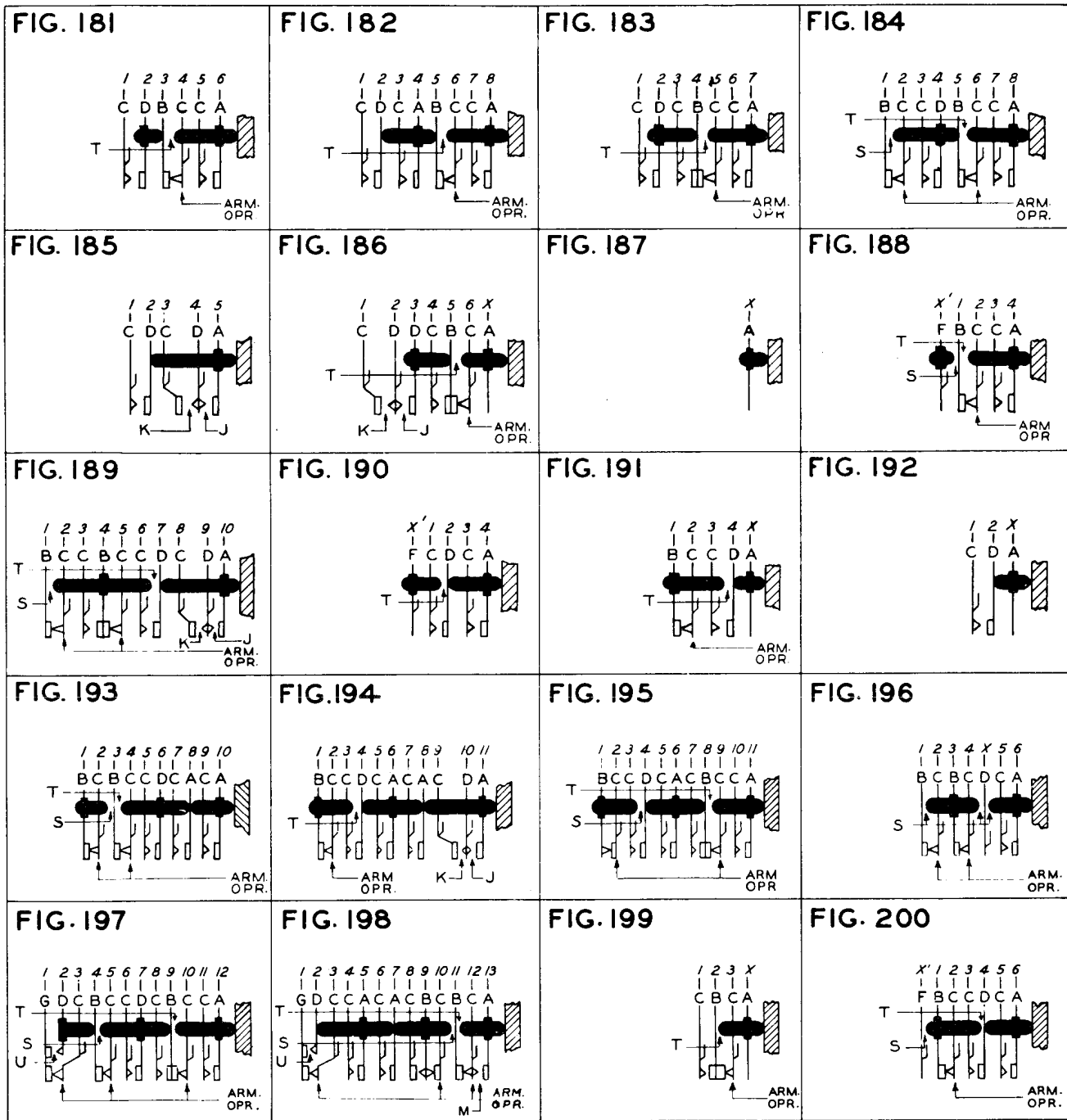
J, K, and U — See Reqt 2.21(b)  
 T — Stud Gap — See Reqt 2.20(a)  
 S — Stud Gap — See Reqt 2.20(b)  
 μ — Spoolhead springs  
 X — Balancing springs





All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

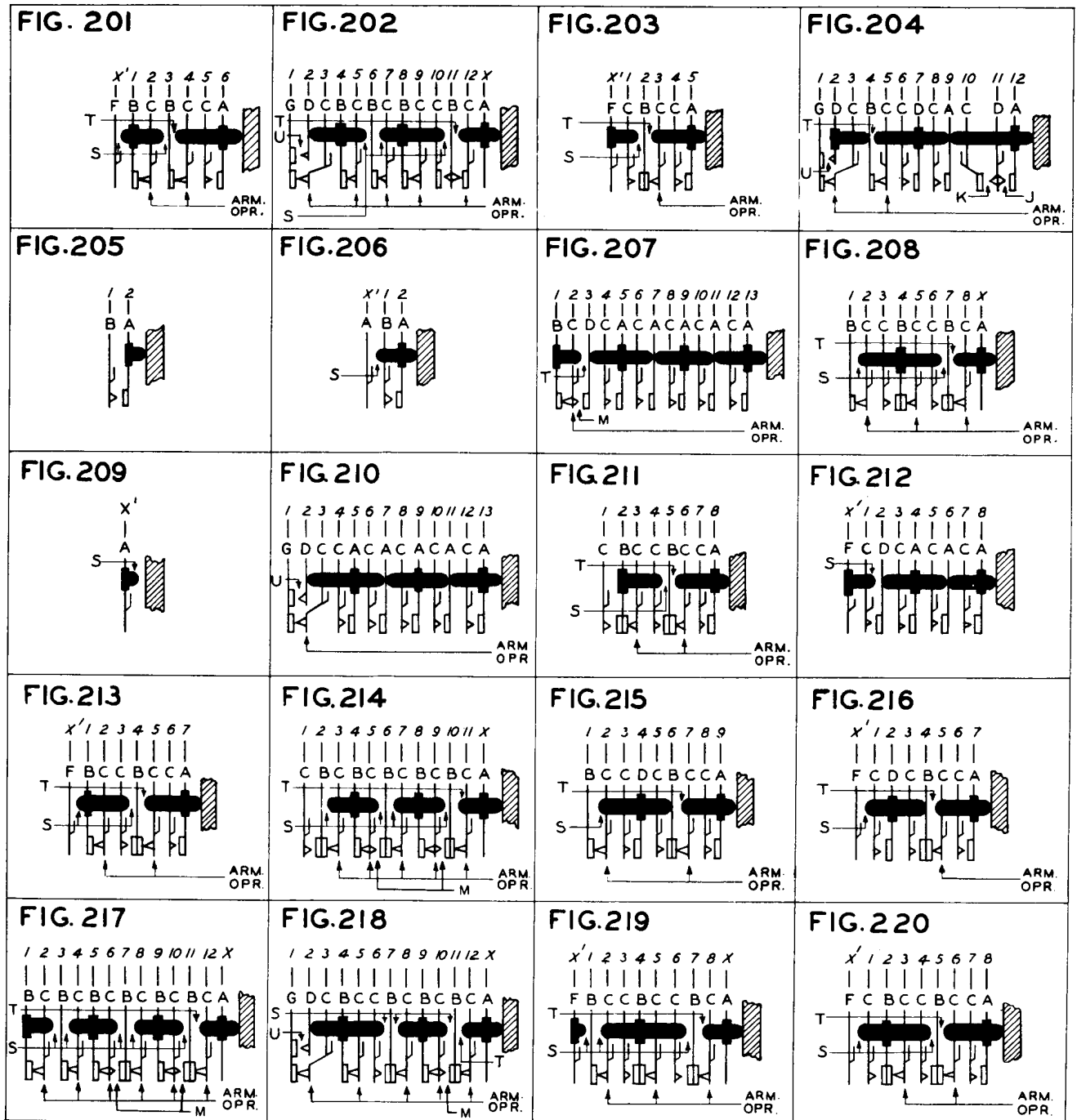
	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	J, K, and U — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		μ — Spoolhead springs
F =	—	—	See Reqt 2.14(e)	X — Balancing springs
G =	35	40		X' — Buffer springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

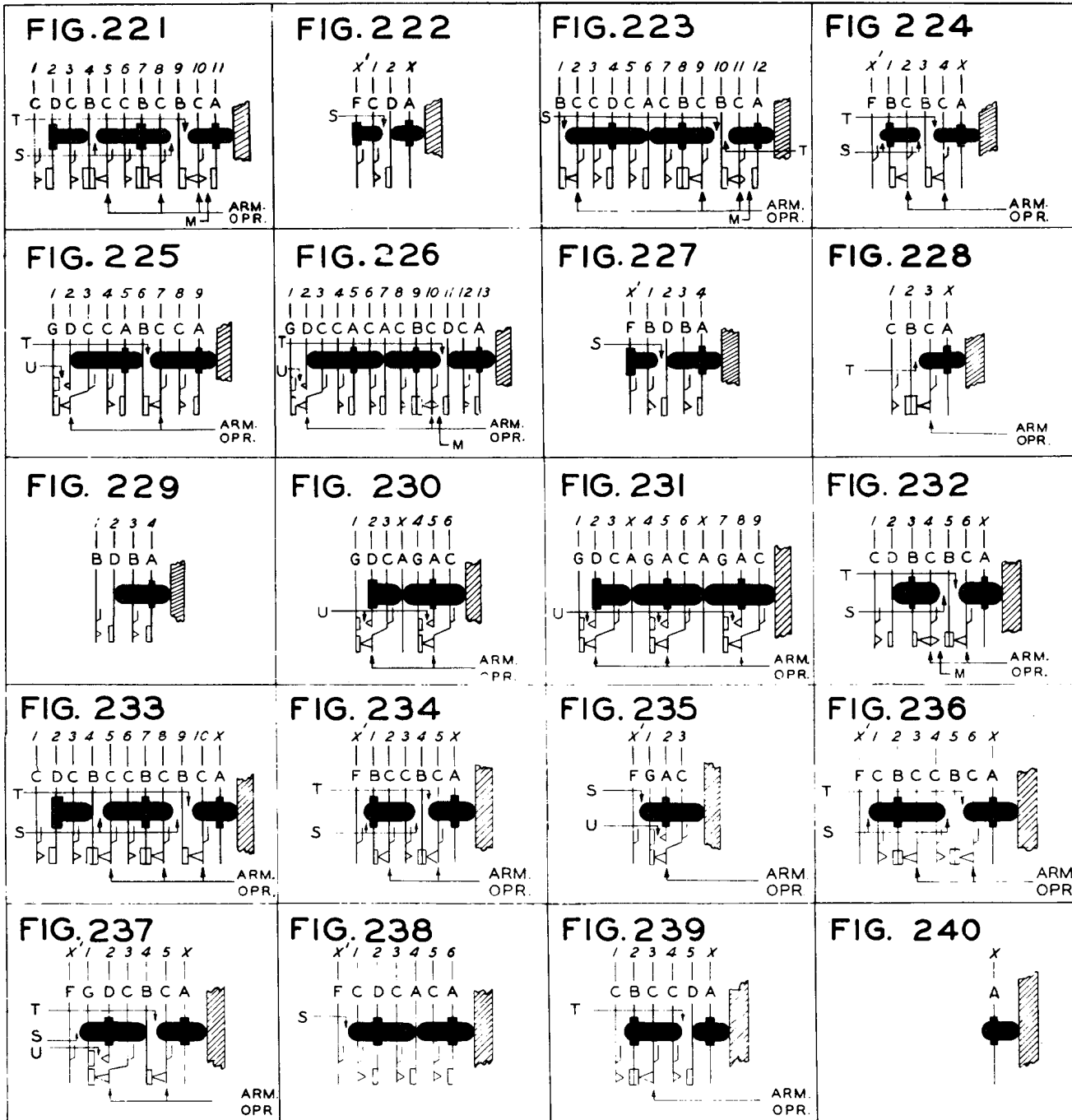
	TEST	READJ	
A =	—	—	See Reqt 2.14(c)
B =	—	—	See Reqt 2.14(d)
C =	25	30	
D =	5	6	
F =	—	—	See Reqt 2.14(e)
G =	35	40	

J, K, M, and U — See Reqt 2.21(b)  
 T — Stud Gap — See Reqt 2.20(a)  
 S — Stud Gap — See Reqt 2.20(b)  
 μ — Spoolhead springs  
 X — Balancing springs  
 X' — Buffer springs



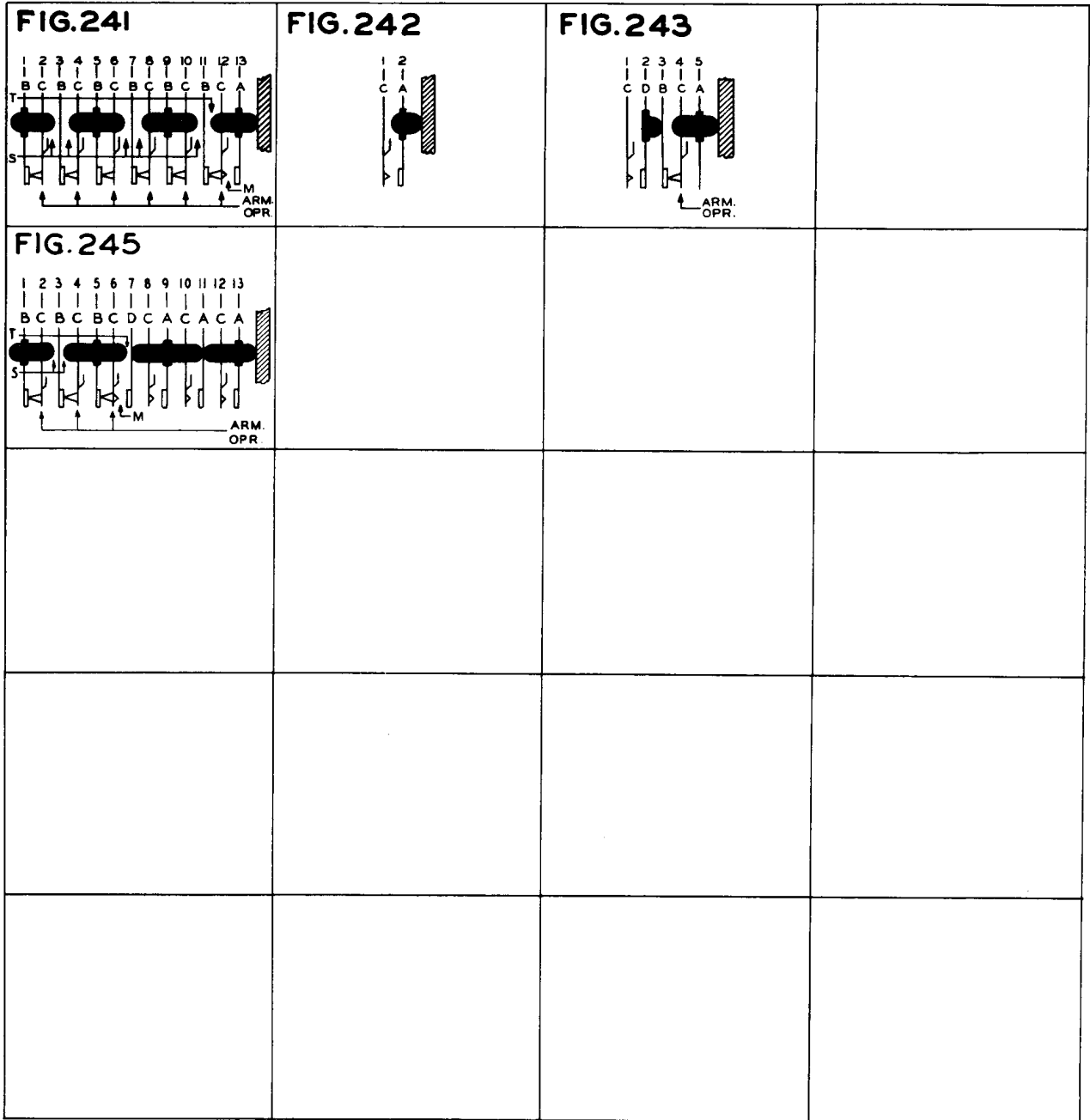
All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	J, K, M, and U — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		μ — Spoolhead springs
F =	—	—	See Reqt 2.14(e)	X — Balancing springs
G =	35	40		X' — Buffer springs



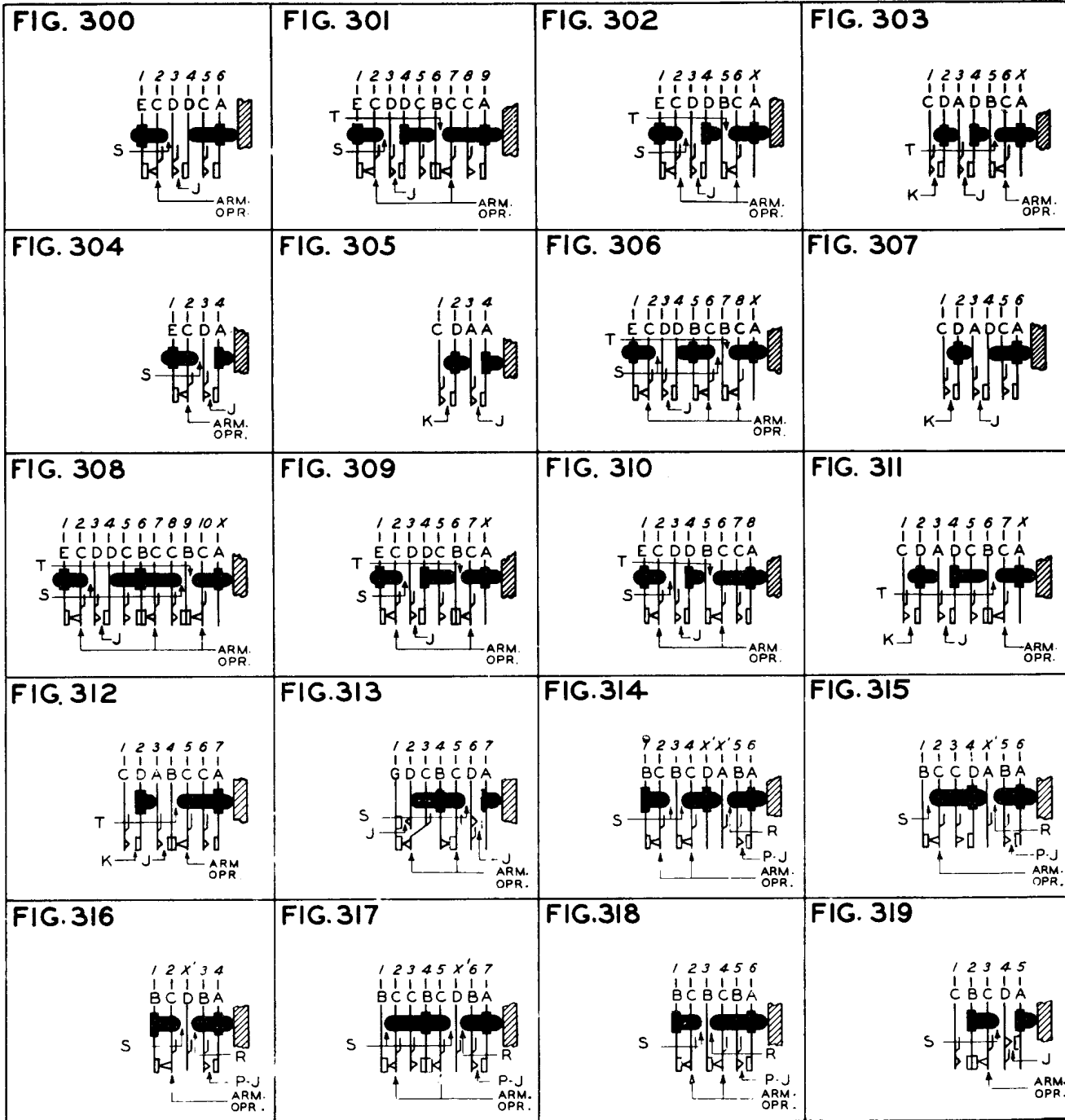
All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	M and U — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		μ — Spoolhead springs
F =	—	—	See Reqt 2.14(e)	X — Balancing springs
G =	35	40		X' — Buffer springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

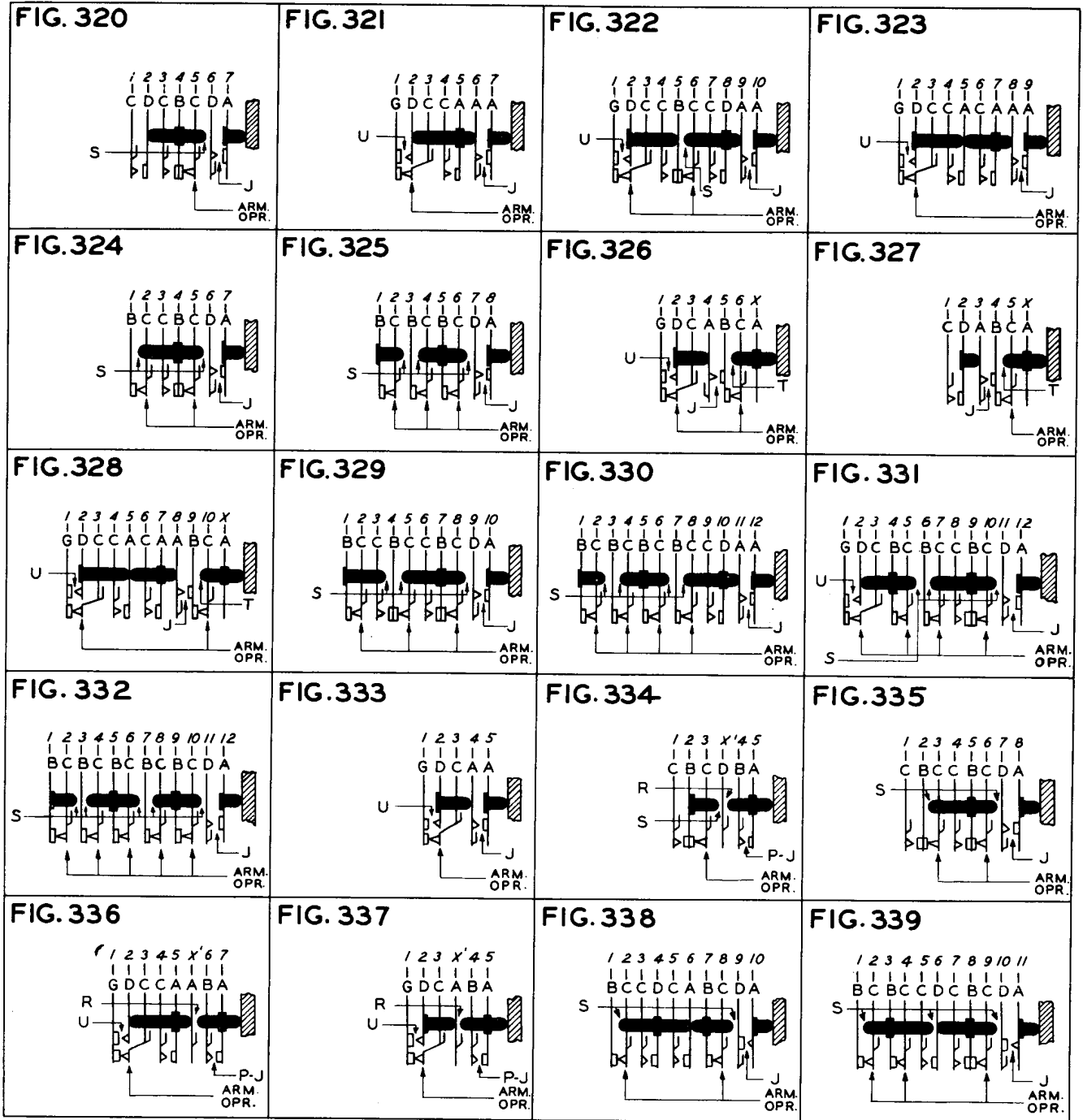
	TEST	READJ		
A =	—	—	See Reqt 2.14(c)	M — See Reqt 2.21(b)
B =	—	—	See Reqt 2.14(d)	T — Stud Gap — See Reqt 2.20(a)
C =	25	30		S — Stud Gap — See Reqt 2.20(b)
D =	5	6		$\mu$ — Spoolhead springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ	
A =	—	—	See Reqt 2.14(c)
B =	—	—	See Reqt 2.14(d)
C =	25	30	
D =	5	6	
E =	28	30	
G =	35	40	

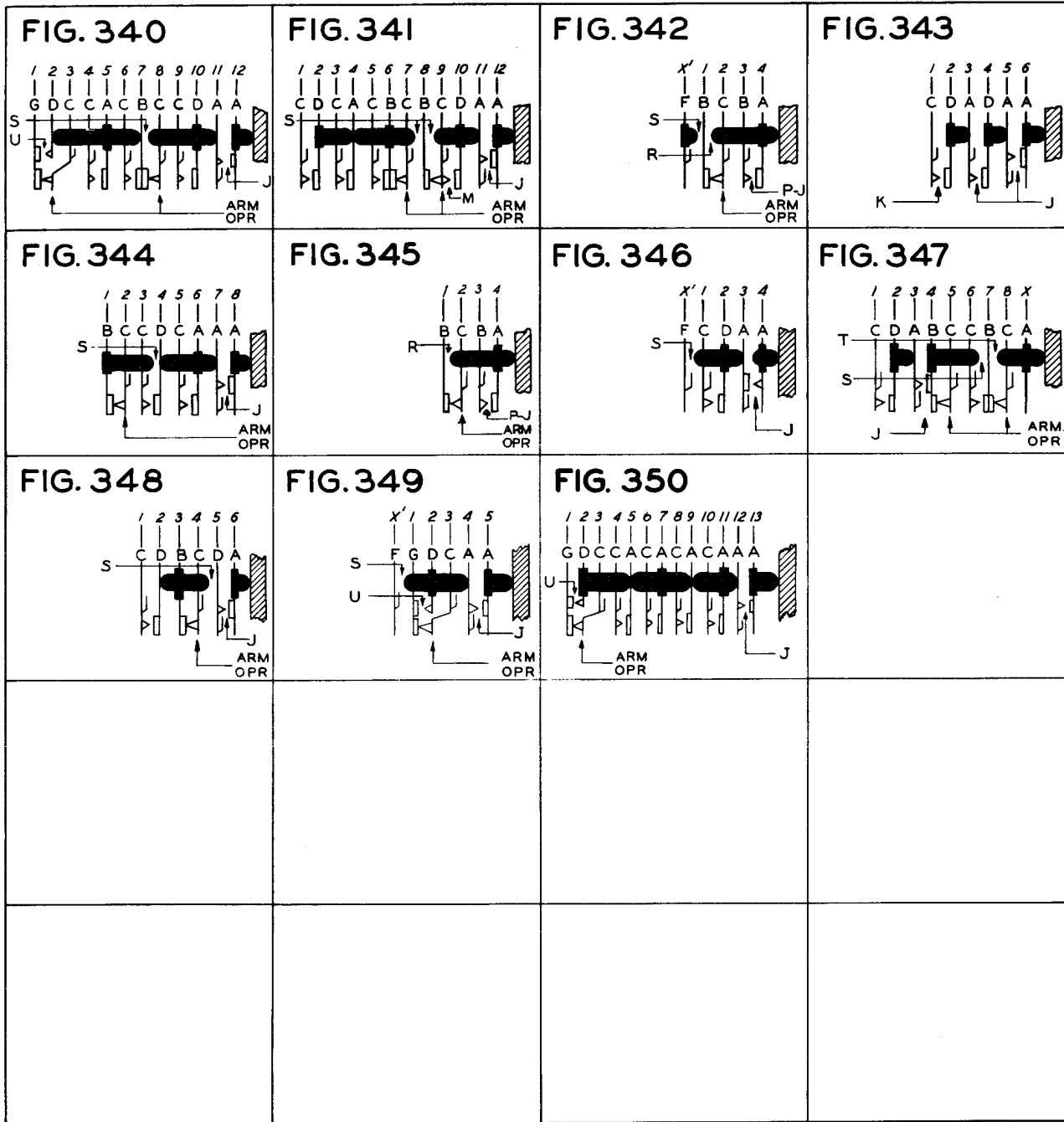
J and K – See Reqt 2.21(b)  
 T – Stud Gap – See Reqt 2.20(a)  
 S – Stud Gap – See Reqt 2.20(b)  
 P and R – Stud Gap – See Reqt 2.20(c)  
 μ – Spoolhead springs  
 X – Balancing springs  
 X' – Buffer springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ	
A =	—	—	See Reqt 2.14(c)
B =	—	—	See Reqt 2.14(d)
C =	25	30	
D =	5	6	
G =	35	40	

J and U — See Reqt 2.21(b)  
 T — Stud Gap — See Reqt 2.20(a)  
 S — Stud Gap — See Reqt 2.20(b)  
 P and R — Stud Gap — See Reqt 2.20(c)  
 μ — Spoolhead springs  
 X — Balancing springs  
 X' — Buffer springs



All Springs Tensioned Toward Armature  
 Min Tension in Grams – H Cont Pressure

	TEST	READJ	
A =	—	—	See Reqt 2.14(c)
B =	—	—	See Reqt 2.14(d)
C =	25	30	
D =	5	6	
F =	—	—	See Reqt 2.14(e)
G =	35	40	

J, K, M, and U — See Reqt 2.21(b)  
 T — Stud Gap — See Reqt 2.20(a)  
 S — Stud Gap — See Reqt 2.20(b)  
 P and R — Stud Gap — See Reqt 2.20(c)  
 μ — Spoolhead springs  
 X — Balancing springs  
 X' — Buffer springs



**3. ADJUSTING PROCEDURES****3.001 List of Tools, Gauges, Materials, and Test Apparatus**

<b>CODE OR SPEC NO. TOOLS</b>	<b>DESCRIPTION</b>		
		—	B long-nose pliers
		—	Diagonal pliers
		<b>GAUGES</b>	
		62B	0-700 gram gauge
		66D	Thickness gauge nest (consists of a nest of 67-type gauges)
300	Spring adjuster	70D	50-0-50 gram gauge
303	Spring adjuster	70H	0-30 gram gauge
363	Spring adjuster	70J	0-150 gram gauge
474A	3/16- by 1/4-inch hex. closed-end offset wrench (two required)	131A	Thickness gauge nest (consists of a nest of 132-type gauges)
505A	Spring adjuster (for 0.013-inch springs)	133A	Stud gap gauge
506A	Spring adjuster (for 0.018- and 0.023-inch springs)	134A	0.010-inch offset thickness gauge
		<b>MATERIALS</b>	
507A	Spring adjuster (for 0.030-inch springs) (two required)	D-178259	0.005-inch separator (attachable separator)
510C	Test lamp [Must be equipped with 561A straight tip or the 562B curved tip W2CB (24V) or W2BL (48V) cord.]	D-178260	0.010-inch separator (attachable separator)
		D-178261	0.015-inch separator (attachable separator)
582A	Spring adjuster (for 0.030-inch spring tangs next to core—UA-type relays)	D-180479	0.005-inch armature stop assembly
		D-180480	0.010-inch armature stop assembly
611A	Hinge bracket adjuster	KS-14666	Cloth
612A	Relay core holder	P-10F137	0.009-inch cap
768A	Armature blocking tool	P-10F138	0.012-inch cap
KS-6320	Orange stick	P-10F548	0.006-inch cap
◆KS-8511	Tweezers◆	P-11A706	Armature plate (lower armature plate)
KS-21034	Stud cap applicator tool	P-11A707	Armature plate (upper armature plate)
KS-21258	Backstop adjuster	<b>TEST APPARATUS</b>	
—	B scissors	35 type	Test set
—	3-inch C screwdriver	<b>3.01 Cleaning:</b>	(Reqt 2.01)—Clean the contacts and other parts of the relay in accordance with the section covering cleaning and reconditioning relay contacts. After cleaning, check that requirement
—	4-inch E screwdriver		

2.21(c) is met and, if necessary, adjust as covered in 3.21.

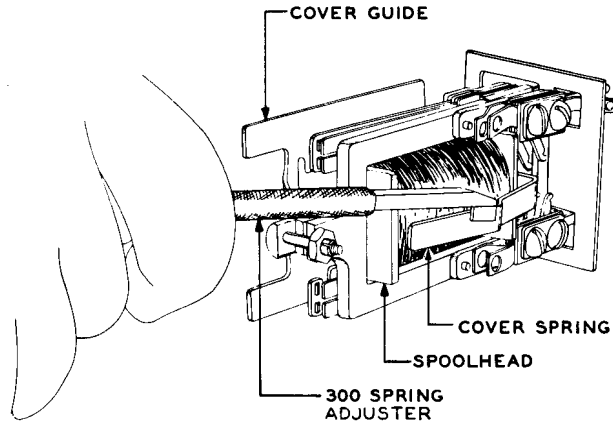
**3.02 Relay Mounting:** (Reqt 2.02)

**3.03 Vertical Clearance:** (Reqt 2.03)—To tighten mounting screws, use the 4-inch E screwdriver. To position the relay on the mounting plate, slightly loosen the mounting screws of the relay affected and shift the relay as required. Tighten the screws securely, taking care that the relay is in proper alignment and that there is the specified clearance both above and below the relay.

**3.04 Cover Spring and Cover Guide Pressure and Cover Cap Tightness:** (Reqt 2.04)

- (1) If the cover spring does not rest on the spoolhead or if the cover is not held securely on the relay, adjust the spring with the 300 spring adjuster, applying it near the crook in the spring as shown in Fig. 21. If it is not possible to correct the condition in this manner, proceed as covered in (2).
- (2) Remove the relay from the mounting plate and remove the screws which hold the cover guide and cover spring in position using the 3-inch C screwdriver. Adjust the cover spring manually by bowing it at the crook in the spring. To adjust the cover guide after it has been removed, bend the part that is secured by the screws as required using the B long-nose pliers. Remount the cover guide and the cover spring and tighten the mounting screws securely. If a 1/4-inch core UA relay with core and bracket secured by a screw is equipped with a U6, U7, or U8 cover, take care to tighten the cover guide mounting screws evenly and not too tight. If a 1/4-inch core UA relay of the welded core and bracket design is equipped with a UA3, UA4, or a UA5 cover, take care that the cover guide mounting screws are not tightened too tight.
- (3) If a metal cover cap does not fit properly, adjust the cover cap prongs as required using the B long-nose pliers.
- (4) If a plastic cover cap does not fit properly, replace the cap.

**3.05 Contact Alignment:** (Reqt 2.05)



**Fig. 21—Method of Adjusting Cover Spring Pressure**

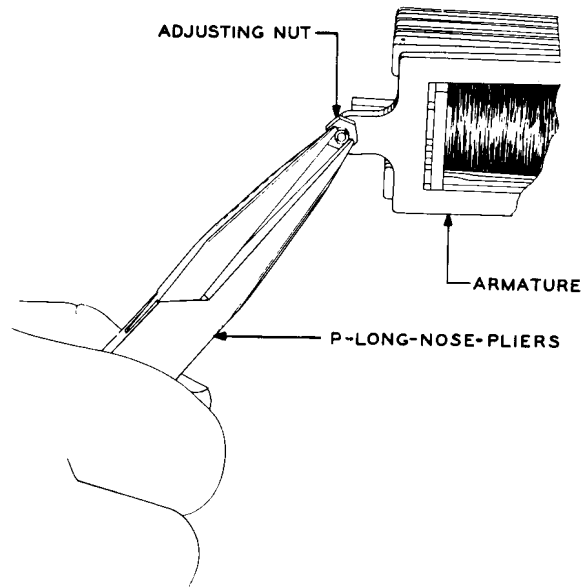
**3.06 Spring Tang Position:** (Reqt 2.06)—If the contacts do not line up properly or if the tang does not overlap the spoolhead sufficiently, it is probably due to the springs having shifted in the assembly. In this case refer the matter to the supervisor.

**3.07 Adjusting Stud Clearance:** (Reqt 2.07)—If the armature rubs against the adjusting stud, grasp the adjusting nut with the B long-nose pliers and bend the adjusting stud as required. In this operation, exercise care not to damage the threads on the stud or to loosen the stud. If the stud cannot be adjusted to provide the proper clearance in this manner or if the stud is loose in the core, refer the matter to the supervisor.

**3.08 Adjusting Nut Tightness:** (Reqt 2.08)—To tighten loose adjusting nuts, back off the adjusting nut from the adjusting stud using the 474A wrench until its slotted portion is free of the stud. Then force the slotted parts of the nut closer together using the B long-nose pliers as shown in Fig. 22.

**3.09 Adjusting Nut Locknut Tightness:** (Reqt 2.09)—To tighten loose adjusting nut locknuts, hold the adjusting nut in position with a 474A wrench and tighten the locknut against the adjusting nut with another 474A wrench. Exercise care not to tighten the locknut beyond the tension specified in requirement 2.09.

**3.10 Application of D-178259, D-178260, and D-178261 Attachable Separators:** (Reqt 2.10)



**Fig. 22—Method of Tightening Adjusting Nut on Stud**

- (1) Where an attachable separator has previously been used and is to be replaced, use a 3-inch C screwdriver to remove the separator from the core. To mount a separator, proceed as covered in (2) for relays having an adjusting stud and (3) for relays having a welded backstop.
- (2) Insert the 132AF (0.004 inch) gauge into the armature gap as shown in Fig. 10 to guide the flap of the attachable separator into position. This is done to prevent the flap of the separator from snagging on the stop discs. Hold the cardboard strip of separators in the left hand with the flap of the first separator toward the core of the relay and the free edge of the flap downward. Straighten the right-hand end of the strip. Using the index finger of the left hand, slide the separator approximately 1/8 inch over the end of the strip and insert the free edge of the flap between the gauge and the core. Take care that the flap is entirely behind the adjusting stud and that the front and rear corners of the flap enter the armature gap at the same time. Slide the flap into position, and while holding the separator in place with the index finger of the left hand as shown in Fig. 23, withdraw the strip. Turn the metal clip in a counterclockwise direction until the ears are in a vertical position. Snap the metal clip over the core so the ears rest against the step

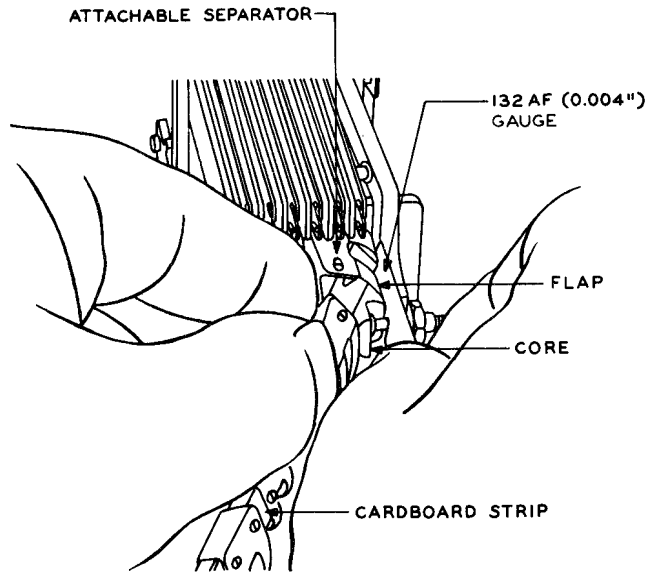
on the later type of core or against the front end of the earlier type of core, and then remove the gauge. Proceed as covered in (4).

- (3) Using the B scissors or the diagonal pliers, remove the ears of the attachable separator after removing the separator from the cardboard strip. Remount the separator on the cardboard strip, and proceed as follows. Insert the 132AF (0.004 inch) gauge into the armature gap as shown in Fig. 10 to guide the flap of the attachable separator into position. This is done to prevent the flap of the separator from snagging on the stop discs. Hold the cardboard strip of separators in the left hand with the flap of the first separator toward the core of the relay and the free edge of the flap downward. Straighten the right-hand end of the strip. Using the index finger of the left hand, slide the separator approximately 1/8 inch over the end of the strip and insert the free edge of the flap between the gauge and the core. Take care that the flap is entirely behind the welded backstop and that the front and rear corners of the flap enter the armature gap at the same time. Slide the flap into position, and while holding the separator in place with the index finger of the left hand as shown in Fig. 23, withdraw the strip. Turn the metal clip in a counterclockwise direction until the side of the metal clip having the stamped designation (thickness of separator) is in the vertical position. Snap the metal clip over the core, and then proceed as covered in (4).

- (4) With the separator in place, make sure that the edges of the window of the flap do not touch the stop discs and that there are no wrinkles or snags in the flap. If there are wrinkles or snags, remove the separator as covered in (1) and replace it.

### **3.11 Application of D-180479 and D-180480**

**Armature Stop Assemblies:** (Reqt 2.11)—Preform the plastic armature stop to a U shape by bending both tabs at the coined grooves on the tabs. Grasp the stop by one tab with the ♦KS-8511♦ tweezers, and with the formed tabs pointing toward the relay core, guide the stop into a position above the core and between the top spring pileup and the armature. Using the KS-6320 orange stick, slide the stop downward between the core and armature until the lower tab of the stop projects below the core. Release the stop,



**Fig. 23—Method of Applying Attachable Separators on Core**

and wrap both of its tabs around the core with the KS-6320 orange stick. Pick up the retaining clip at its midsection with the ♦KS-8511♦ tweezers and, holding it vertically in the plane of the armature, insert the lower tab of the clip downward through the slot in the stop. Using the KS-6320 orange stick, bend the lower end of the clip upward to form a bend line approximately 1/8 inch from the midsection and flatten the end against the clip. Hold the clip against the core with the KS-6320 orange stick, and use the ♦KS-8511♦ tweezers to guide the upper end of the clip through the slot on the upper tab of the stop. Bend the end of the clip downward to form a bend line approximately 1/8 inch from the midsection of the clip, and flatten the clip firmly against the core with the KS-6320 orange stick. Manually operate the armature to ensure proper relay operation.

**Caution:** Only light tension is required to retain the armature stop assembly. Excessive tightening of the clip will result in either buckling or tearing of the plastic stop.

### 3.12 Armature Position: (Reqt 2.12)

- (a) If the armature does not rest against the front ends of the hinge bracket after the relay has been electrically operated and released,

check that the tensions of the A springs to the top and bottom spring combinations meet requirement 2.14 and, if they do not, adjust as covered in 3.14 through 3.19(7). If, when the relay is not energized, one leg of the armature leaves the bracket, preventing the armature from returning to its unoperated position, the combined operated tensions of the springs in the top and bottom spring combinations are excessively unequal. In this case recheck the individual spring tensions, and readjust to more nearly equalize the top and bottom spring tension. If, after making this adjustment, the requirement is not met in both the operated and unoperated positions of the relay, it is an indication that front ends of the hinge bracket are not properly positioned or that the armature spring hinges or the armature hinge pins are bent. In these cases refer the matter to the supervisor.

(b) Where the relay is equipped with hinge pins and the holes in the hinge brackets are worn so the armature rubs on the spoolhead, reposition the armature as follows. If the relay is equipped with an attachable separator, remove it as covered in 3.10. Slide the 612A relay core holder over the end of the core as far as possible. Then slide the 611A hinge bracket adjuster over the upper hinge bracket as far as possible so the adjuster is between the armature bracket and winding terminal and the hinge pin is in the hole in the adjuster. While holding the relay stationary with the holder, apply a slight upward pressure on the handle of the adjuster. Carefully bend the hinge bracket upward in this way until the armature clears the top edge of the spoolhead. Check that the armature also clears the bottom edge of the spoolhead. If the armature does not clear the bottom edge, bend the upper hinge bracket down slightly. Check that the electrical requirements are met. If the electrical requirements are not met, it may be due to the lower hinge pin binding in the associated hinge bracket. To correct this, bend the lower hinge bracket upward slightly using the 612A holder and the 611A adjuster as described above.

**Caution:** Take care in making these adjustments to avoid bending the brackets more than necessary since this may weaken or break them. After completing the adjustments, make sure that the winding terminals on multiwinding relays are not shorted.

(c) Where the relay was equipped with an attachable separator, mount a new attachable separator on the core as covered in 3.10. If the armature cannot be satisfactorily repositioned as described in (a) or (b), refer the matter to the supervisor.

### 3.13 *Armature Travel:* (Reqt 2.13)

(a) **Relays Having Adjusting Stud:** To adjust the armature travel, insert into the armature gap as shown in Fig. 24 the 131A gauge corresponding to the armature travel specified on the circuit requirements table. Where an attachable separator is used, insert the gauge into the armature gap as shown in Fig. 11. Take care that the long axis of the gauge is parallel to the horizontal center line of the core. Turn the adjusting nut with the 474A wrench until friction is felt against the gauge. Remove the gauge and check that requirement 2.08 is met. If the relay is equipped with an adjusting nut locknut, it will be necessary to loosen the locknut with a 474A wrench before adjusting for armature travel. After the armature travel requirement is met, hold the adjusting nut in place with a 474A wrench and tighten the locknut against the adjusting nut with another 474A wrench. Exercise care not to tighten the locknut beyond the tension specified in requirement 2.09.

(b) **Relays Having 0.032-Inch Thick Welded Backstop:** To adjust the armature travel, adjust the welded backstop with the 303 spring adjuster applied as shown in Fig. 24.

(c) **Relays Having 0.050-Inch Thick Welded Backstop:** To adjust armature travel, place the slot in the KS-21258 adjuster over the backstop and engage it to its full depth. Support the bend in the tool with the thumb and forefinger as shown in Fig. 24 so that torque applied causes the backstop to bend at the tool slot edge. Depending on the direction of adjustment, push or pull on the tool to prevent bending at the core edge or the weld.

3.14 **Spring Tension:** (Reqt 2.14)

3.15 **Position of X' Buffer Springs Designated F:** (Reqt 2.15)

3.16 **Armature Back Tension:** (Reqt 2.16)

3.17 **Spring Stud Clearance:** (Reqt 2.17)

3.18 **Straightness of Springs:** (Reqt 2.18)

3.19 **Separation Between Springs:** (Reqt 2.19)

#### (a) *Spring Tension*

(1) Spring tensions are specified on a minimum basis. They have, however, in the case of moving springs, a direct bearing on the electrical performance of the relay, and if they are greatly in excess of the specified minimum, the relay may fail to meet its electrical requirement, in which case it will be necessary to reduce the tensions. Attempt

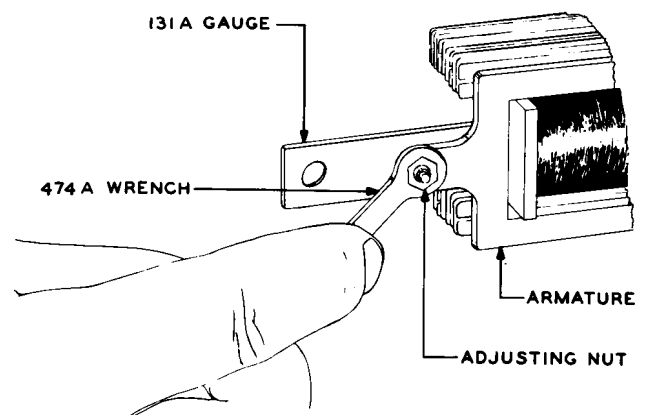


Fig. 24A—Relay Having Adjusting Stud

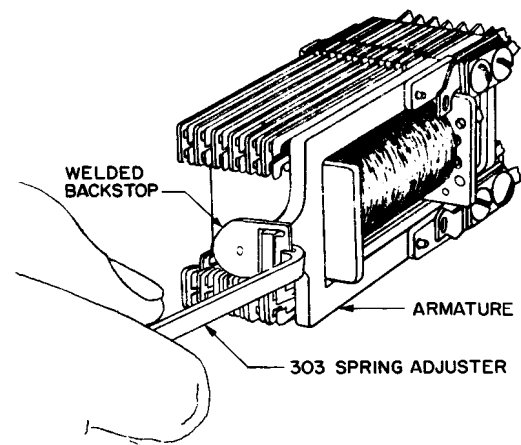
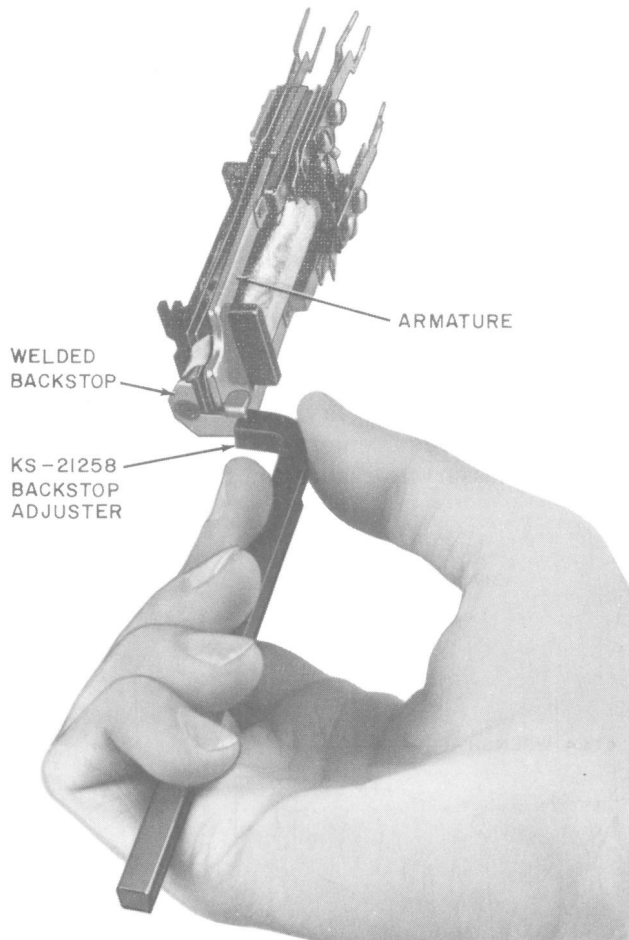


Fig. 24B—Relay Having 0.032-Inch Thick Welded Backstop



**Fig. 24C—Relay Having 0.050-Inch Thick Welded Backstop**

**Fig. 24—Method of Adjusting for Armature Travel**

to distribute the tensions of the moving springs proportionately between the top and bottom spring combinations.

(2) To adjust the springs for tension, use the 505A spring adjuster for 0.013-inch springs, the 506A spring adjuster for 0.018- and 0.023-inch springs, and the 507A spring adjuster for 0.030-inch springs. It is especially

important to use the 505A spring adjuster on 0.013-inch springs since the use of any adjuster having a wider slot may result in unsatisfactory adjustment and may affect the adjustment of the adjacent springs.

#### **Pretensioned Springs (See 1.11 and 1.12.)**

(3) When the springs have been pretensioned, do not attempt to remove the bends since the adjustment will be destroyed. Exercise care not to slide or draw the spring adjuster over a bend in a pretensioned spring.

(4) To adjust a pretensioned spring for tension, place the slotted portion of the spring adjuster against the spring to be adjusted on the side toward the mating spring just behind the contacts. Tilt the adjuster so it rests on the mating spring and, using this spring as a guide, slide the adjuster back to the base of the spring. Roll the adjuster over the spring to be adjusted so the spring fits into the slot in the adjuster. When adjusting a balancing spring or a buffer spring, use an adjacent spring as a guide. Adjust the spring to the right or left as required taking care not to tilt the spring or disturb adjacent springs. If the requirements cannot be met in this manner, refer the matter to the supervisor.

(5) If the studs touch the springs through which they pass, this may be due to a twist in the spring to which the stud is attached. To correct this, apply the proper spring adjuster to the spring at fault as covered in (4), except that in this case do not slide the adjuster to the base of the spring. Adjustment should be made at a point at least 1/4 inch forward from the insulators but not over a pretensioned bend. Adjust the spring so there is the required clearance between the stud and the springs.

#### **Nonpretensioned Springs**

(6) To adjust a nonpretensioned spring for tension, place the spring adjuster on the spring just back of the operating stud and slide it back to the base of the spring as indicated in Fig. 25. Adjust the spring to the right or left as required, exercising care not to disturb adjacent springs. Do not adjust the spring any more than is necessary since

repeated adjustment may injure the spring. Take care when adjusting the springs to adjust them in line with their movement and to avoid tilting. Tilted springs cause unequal contact separation of the two pairs of contacts and may result in the failure of one of the contacts on the bifurcated spring to close.

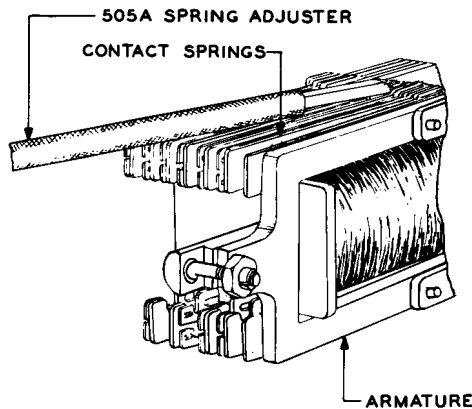


Fig. 25—Method of Adjusting Spring Tension

(7) If the spring is excessively bowed or bent or if there is not the proper clearance between springs, straighten the spring before adjusting to meet the spring tension requirement. To straighten the spring, apply the proper spring adjuster to the spring just back of the bow or bend and, while exerting pressure to the right or left as required, draw the spring adjuster forward the length of the bow. Repeat this operation as required until the spring is approximately straight. Take care when making this adjustment to avoid tilting the springs.

(8) If the desired tension cannot be obtained by adjusting as outlined in (6) without bowing the spring beyond its permissible limit or reducing the clearance between the springs below the specified minimum, apply the proper spring adjuster to the spring just back of the operating stud and slide it back to the base of the spring as indicated in Fig. 25. Then draw the adjuster forward the length of the spring, meanwhile applying pressure as required so that the spring is formed into a slight gradual bow with the concave surface facing the armature as indicated

in Fig. 26. Then move the adjuster to the base of the spring, and adjust as covered in (6). The magnitude of the bow to be formed in the spring must be learned by experience and should be such that, when the final tension adjustment is made at the base, the spring will be approximately straight.

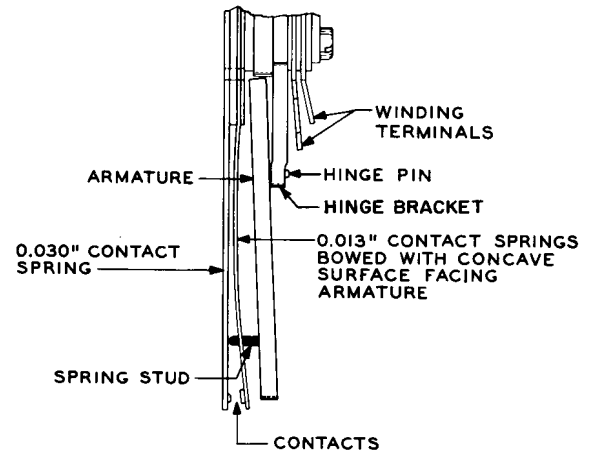


Fig. 26—Position of Bowed Spring Before Final Tension Adjustment

(9) If the studs touch the spring through which they pass, it is probably due to a twist in the spring to which the stud is attached as a result of adjustment. To correct this, apply the proper spring adjuster to the spring at fault and adjust it so there is the required clearance between the stud and the springs.

(b) **Kinked Springs:** Do not straighten kinked springs unless the kink interferes with proper adjustment of the spring assembly. Removing kinks tends to weaken the spring and to shorten its life. Normally straight springs that have been adjusted should have no sharp bends due to adjustment, except that a kink near the base of thin (0.013 and 0.018 inch) springs is permissible when necessary to obtain required tension. A gradual bow, however, is permissible.

(c) **Adjustment for Pressure of Armature Against the Backstop:** If the armature is not held against the backstop with the specified pressure, or where the relay is equipped with a pin-type hinge and the portion of this pressure in one spring combination is more than 2-1/2

times that of the other spring combination, alter the tension of the D and A springs which are tensioned against the armature as necessary. Use the 505A or 506A spring adjusters as covered in (4) and (6), depending on whether the relay is equipped with pretensioned or nonpretensioned springs, respectively. In making this adjustment, first increase the tension of the D or A spring farthest from the armature whose tension is transmitted to the armature through one or more studs. If the requirement cannot be met by this means alone, adjust the other springs which hold the armature against the backstop as required. For example, in the case of a relay equipped with a 170-146 spring combination, first adjust spring 3 of the top combination or spring 2 of the bottom combination or both as required. If sufficient tension is not obtained by adjusting these springs, increase the tension of springs 5, 7, 9, and 11 of the top combination and springs 5, 7, and 9 of the bottom combination. It is not necessary to distribute the tensions of the A and D springs equally, but the combined pressure of the studs against the top and bottom legs of the armature should meet the specified requirement.

(d) **Position of X' Buffer Springs Designated**

**F:** When it is necessary to adjust the tension of a buffer spring having F tension, check it for position in accordance with requirement 2.15 and adjust it as required in accordance with 3.20 through 3.23(a).

**3.20 Stud Gap:** (Reqt 2.20)

**3.21 Contact Make:** (Reqt 2.21)

**3.22 Contact Separation:** (Reqt 2.22)

**3.23 Contact Sequence:** (Reqt 2.23)

(a) Failure to meet these requirements is due to contact and stud wear. Three means are available to compensate for this wear.

(1) Adjustment of individual movable springs and spoolhead spring tangs. This should be done where only minor adjustments are required.

(2) Use of a spring stud cap (0.006, 0.009, or 0.012 inch thick) on spring studs adjacent to armature legs as shown in Fig. 28. These

caps should be used in preference to making other than minor spring or spring tang adjustments.

(3) Use of an armature plate (0.030 inch thick) on armature legs as shown in Fig. 29. These plates should be used when considerable bending of the springs and spring tangs has been done during prior adjustment. This plate is intended for use only on U-type relays. Use of a spring stud cap in conjunction with an armature plate is permissible if necessary to meet the requirements.

(b) **Minor Adjustment of Springs and Spring Tangs**

(1) **Stud Gap and Contact Make:** If only minor adjustment is needed to meet these requirements, adjust the spring tang to the right or left as required using the 507A spring adjuster, while holding the spring with another 507A spring adjuster as shown in Fig. 27. It is satisfactory if, in making this adjustment, the spring tang does not rest flat against the spoolhead. Exercise care, however, to see that requirement 2.06 covering spring tang position is met. If failure to meet the contact make requirement is due to misalignment of the prongs of the bifurcated spring, adjust the individual prongs with the 363 spring adjuster so both prongs are approximately in the same vertical plane. Adjust so that there are stud gaps at the points indicated on spring combination Fig. 101 through 350 in this section. The use of the 510C test lamp equipped with the 561A straight tip or the 562B curved tip to illuminate the stud gap will facilitate making this adjustment. Where it is necessary to check the stud gaps by moving the armature toward the core manually, operate the relay electrically two or three times after checking the stud gaps to restore the armature to its position against the front ends of the hinge bracket (Fig. 26), thus preventing false contact operation.

**Note:** On UA-type relays, use the 582A spring adjuster for adjusting tangs of springs adjacent to the armature instead of the 507A spring adjuster.

(2) **Contact Separation:** To correct the contact separation, adjust the spring tang



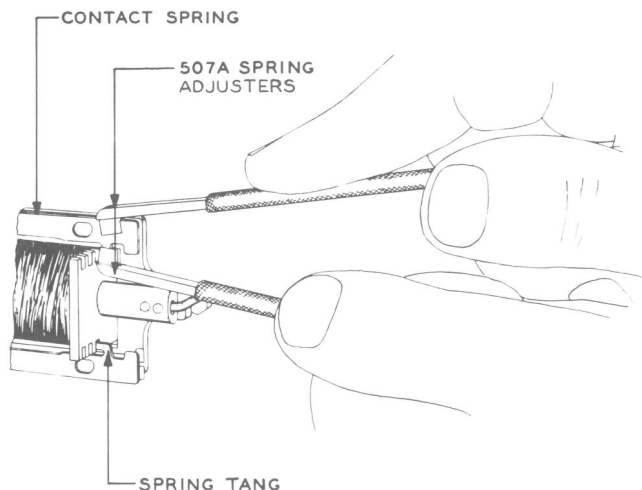


Fig. 27—Method of Adjusting Spring Tang

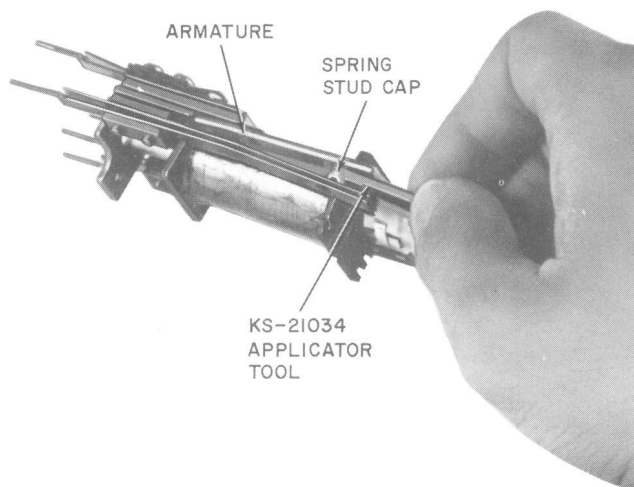


Fig. 28—Method of Mounting Spring Stud Cap

on spoolhead springs as covered in (1) or adjust the moving springs with a 505A spring adjuster. In adjusting the front contact separation on break-make units of the spring combination, adjust the spring tangs on the spoolhead springs so the contact separation is sufficient to insure that the spring sequence requirement will be met under operating conditions. If the requirement is not met due to the misalignment of the prongs of the bifurcated spring, adjust the individual prongs with the 363 spring adjuster so that the contact

separation at both prongs is approximately the same and so that the two prongs of the bifurcated spring are approximately in the same vertical plane.

(3) **Contact Sequence:** To adjust for contact sequence, change the spring tension, contact make, stud gap, and contact separation adjustments as required.

(c) **Mounting Spring Stud Caps**

(1) Before mounting spring stud caps, place a KS-14666 cloth over the apparatus mounted below the relay on which work is being done. This will prevent caps which may be dropped from lodging on springs or other parts of the apparatus.

(2) Select the cap which, when mounted, will necessitate only minor spring and spring tang adjustment. A comparison of stud cap thickness to the reduction in contact separation provided by the caps is shown in Table A.

TABLE A — SPRING STUD CAP

SPRING STUD CAP	COLOR OF CAP	NOMINAL VALUE OF CAP THICKNESS (inches)	APPROXIMATE CHANGE IN CONTACT SEPARATION (inches)
P-10F548	White	0.006	0.008
P-10F137	Red	0.009	0.012
P-10F138	Green	0.012	0.016

(3) Place the stud cap open side up in the recess in the end of the KS-21034 applicator tool. Position the tool between the armature and the adjacent spring (Fig. 28), and push the cap over the stud. Remove the applicator tool.

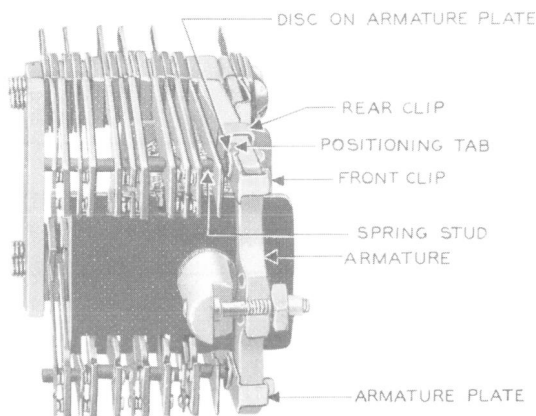
(4) After mounting a spring stud cap, check the relay to all requirements covering the springs and also to the electrical requirements.

(d) **Mounting Armature Plates**

(1) To mount a P-11A706 armature plate on the lower leg of the armature or the P-11A707 armature plate on the upper leg,

proceed as follows. Insert the KS-6320 orange stick between the armature leg and the adjacent spring until the tip of the orange stick rests against the spring stud. Move the spring away from the armature to provide stud clearance for mounting the armature plate. Holding the armature plate with the disc toward the relay springs, place the rear clip of the plate over the leg of the armature. Slide the plate toward the rear of the relay until the front clip fits snugly against the front edge of the armature leg. Withdraw the orange stick, and check that the end of the spring stud rests against the armature plate within the circumference of the disc on the plate. Also check that the positioning tab and the rear clip of the plate rest against the inner edge of the armature leg as shown in Fig. 29. If necessary properly position the plate on the armature leg with the orange stick.

(2) After mounting the armature plate, check the relay to all requirements covering the springs and also to the electrical requirements.



**Fig. 29—Armature Plates Mounted on Armature Legs of U-Type Relay**

**3.24 Electrical Requirements:** (Reqt 2.24)

**3.25 Pulse-Repeating Requirement:** (Reqt 2.25)

(a) To meet the operate and hold requirements, decrease the tension of the moving springs (including balancing springs) toward the minimum. If the requirements cannot be met in this manner, increase the stud gaps as covered in 3.20 through 3.23(a). If the requirements still cannot be met, check that the armature rests against the hinge bracket in the operated position, and if it does not, refer the matter to the supervisor.

(b) To meet the nonoperate requirement when specified, increase the tension of the balancing and other springs which are tensioned to hold the armature against the adjusting nut.

(c) To meet the release requirements, increase the tensions of moving springs. Adjust the relays to release on as high a current as possible consistent with meeting the operate and hold requirements. Where the relay is equipped with buffer springs, it is desirable to obtain this higher release by using the buffer springs in conjunction with the moving springs, rather than attempting to overtension the moving springs. When buffer springs are not provided, adjust the tension of the moving springs as high as possible consistent with meeting the operate and hold requirements.

(d) If, after making the adjustment covered in (c), the release requirement is still not met, check that there is a clearance between the armature and the core at all points outside the stop pin. If there is no clearance, it is an indication that the legs of the armature are not properly positioned on the hinge bracket. In this case refer the matter to the supervisor.