197- AND 198-TYPE SWITCHES
CONTACT SPRING ASSEMBLIES
REQUIREMENTS AND ADJUSTING PROCEDURES

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1. GENERAL

1.01 This section covers the requirements and adjusting procedures for contact spring assemblies associated with the rotary, vertical, and release mechanisms of 197- and 198-type switches.

1.02 The reasons for reissuing this section are listed below. Since this reissue is a general revision, no revision arrows have been used to denote significant changes. The Equipment Test List is not affected.

(1) To revise Table in 2.41

(2) To revise Table A

(3) To add notes for Table H

(4) To revise the List of Tools.

1.03 ***Vertical normal position of the shaft*** (197-type switches only) is that position in which the normal pin clamp rests on the upper shaft bearing.

1.04 ***Rotary normal position of the shaft*** is that position in which the normal pin is in contact with the shaft spring bracket.

1.05 ***Unoperated position of spring combinations*** is the position occupied by the springs when the switch mechanism is in its vertical normal position (197-type switches) or in its rotary normal position (198-type switches).

Warning: When checking any requirements involving the electrical operation of the vertical, rotary, and release magnets, do not operate these magnets more often than necessary. Repeated or prolonged operation causes the magnet temperature to rise sufficiently to adversely affect the checking of some requirements. The final check of such requirements shall be made when the magnet temperatures are not appreciably above room temperature.

1.06 When any adjustments are made which may affect the switch operation, the switch operation requirement specified in Section 030-705-704 shall be checked.

2. APPARATUS

2.01 *List of Tools and Gauges*

CODE OR SPEC NO. TOOLS	DESCRIPTION
179	Spring Adjuster
273	Adjuster
379A	Adjuster
415B	Spring Adjuster
416B	Spring Adjuster
417A	1/4- and 3/8-Inch Open Double-End Flat Wrench
476A	3/16-Inch Hex Offset Socket Wrench
563A	90-Degree Offset Screwdriver
564A	45-Degree Offset Screwdriver
KS-20266	Camtooth Adjuster
AECo	Switch Supporting Fixture

KS-7782	Parallel-Jaw Pliers
R-3159	Spring Adjuster
—	3-Inch C Screwdriver
—	4-Inch E Screwdriver
—	B Long-Nose Pliers

GAUGES

62B	0-700 Gram Gauge
68B	70-0-70 Gram Gauge
70D	50-0-50 Gram Gauge
70J	0-150 Gram Gauge
79C	0-200 Gram Push-Pull Tension Gauge
117A	Thickness Gauge
KS-6909	Thickness Gauge Nest
KS-6938	Thickness Gauge Nest

3. REQUIREMENTS

3.01 ***Cleaning and Lubrication:*** When necessary, the contacts shall be cleaned in accordance with the section covering cleaning of 197- and 198-type switches and the parts shall be lubricated in accordance with Section 030-705-706.

3.02 ***Straightness of Contact Springs:*** The springs shall be free from sharp bends or kinks due to adjustment and shall not have more than 1/32-inch bow in the free length of the spring.

Gauge by eye.

3.03 ***Contact Alignment:*** Fig. 1(A)—Contact points, when in contact, shall not be out of alignment more than 2/5 (40 percent) of their base diameter.

Gauge by eye.

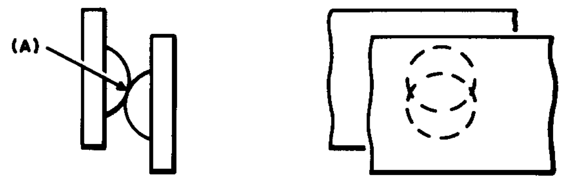


Fig. 1—Maximum Permissible Contact Misalignment

REQUIREMENTS FOR ROTARY INTERRUPTER SPRINGS (197-Type Switches Only)

3.04 ***Contact Pressure:*** Fig. 2(A)—The contact pressure between each pair of contacts closed when the rotary magnets are unoperated and between each pair of contacts closed when the rotary magnets are electrically operated shall be as shown in the figures referred to in Table A and shown in Table F.

Use the 62B, 68B, and 70J gauges.

3.05 ***Contact Separation:*** Fig. 2(B)—With the switch on the first and last rotary steps of the fifth level, the separation between each pair of contacts open when the rotary magnets are unoperated and between each pair of contacts open when the rotary magnets are electrically operated shall be as shown in the figures referred to in Table A and shown in Table F.

Use the KS-6909 and KS-6938 gauges.

> ***Warning: When checking any requirements involving the electrical operation of the vertical, rotary, and release magnets, do not operate these magnets more often than necessary. Repeated or prolonged operation causes the magnet temperature to rise sufficiently to adversely affect the checking of some requirements. The final check of such requirements shall be made when the magnet temperatures are not appreciably above room temperature.***

REQUIREMENTS FOR VERTICAL INTERRUPTER SPRINGS (197-Type Switches Only)

3.06 ***Interrupter Arm Play*** (assemblies per Fig. 3): Fig. 3(A)—The interrupter arm shall not bind.

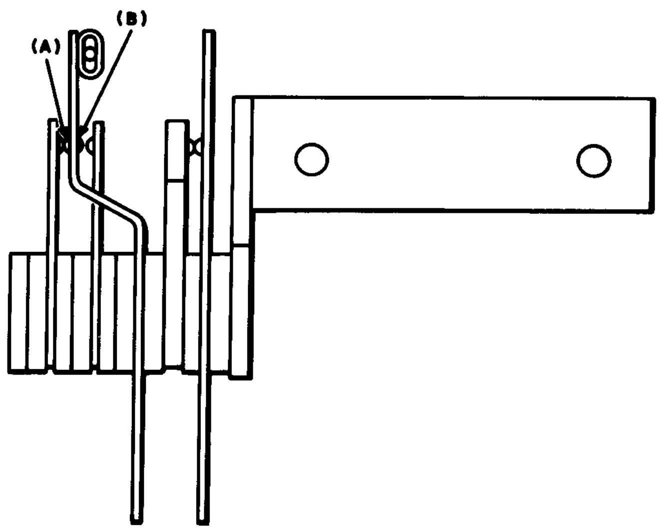


Fig. 2—Rotary Interrupter Spring Assembly with Offset Spring

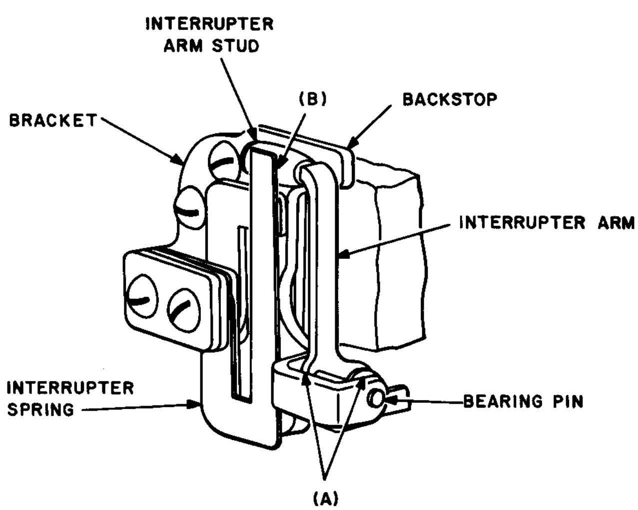


Fig. 3—Bell-Crank-Type Vertical Interrupter Spring Assembly

Gauge by feel.

3.07 ***Clearance Between Interrupter Arm Stud and Interrupter Spring*** (assemblies per Fig. 3): Fig. 3(B)—With the interrupter arm resting against the backstop, the interrupter arm stud shall clear the interrupter spring.

Gauge by eye.

3.08 ***Contact Separation*** (assemblies per Fig. 3 and 4): With the vertical magnets electrically operated, the separation between the contacts shall be

Min 0.020 inch

Max 0.030 inch

Use the KS-6909 and KS-6938 gauges.

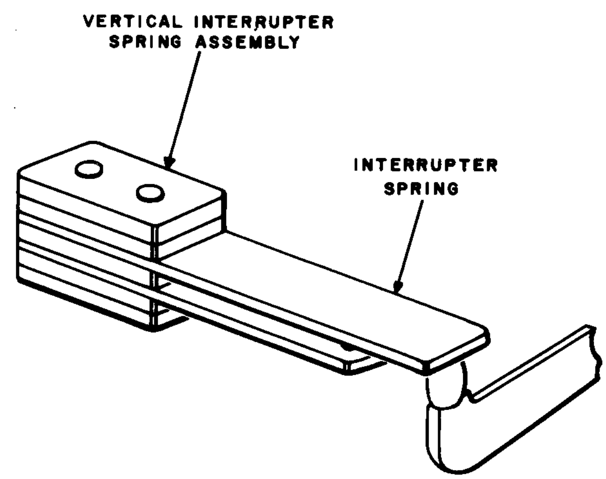


Fig. 4—Vertical Interrupter Spring Assembly of Type Operated by Vertical Armature Arm

3.09 ***Contact Pressure*** (assemblies per Fig. 3 and 4): The contact pressure with the spring combination in the unoperated position shall be

Min 150 grams

Use the 79C gauge for checking the pressure on assemblies per Fig. 4 and the 62B or 70J gauge for assemblies per Fig. 3.

To check this requirement, apply the specified gauge to the end of the interrupter spring.

REQUIREMENTS FOR VERTICAL OFF-NORMAL SPRINGS (197-Type Switches Only) (For Individual Spring Combinations, See Tables A and B)

3.10 ***Off-Normal Finger Clearance***

(a) ***First Rotary Step:*** Fig. 5(A)—With the shaft on the first rotary step of the first level, the clearance between the off-normal finger and the normal pin shall be

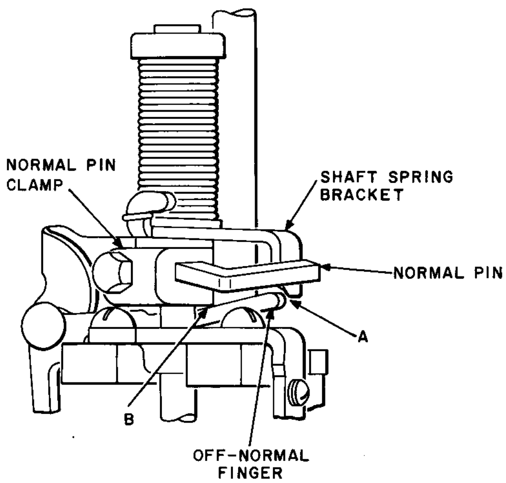


Fig. 5—Normal Pin Clamp and Associated Parts

Min 0.010 inch

Use the KS-6909 gauge.

(b) ***Last Rotary Step:*** Fig. 5(B)—With the shaft on the last rotary step of the first level, the normal pin clamp shall clear the off-normal finger.

Gauge by eye.

3.11 ***Contact Separation:*** The separation between each pair of contacts open when the shaft is at vertical normal and between each pair of contacts open when the shaft is up at least one step shall be

Min 0.008 inch

Gauge by eye.

3.12 ***Clearance Between Off-Normal Lever Stud and First Lever Spring*** (except Fig. 207, Table B): Fig. 6(A)—With the stop on the off-normal lever resting against the casting:

(a) There shall be a clearance between the stud on the off-normal lever and the first lever spring of 0.004 inch. Use the KS-6909 gauge.

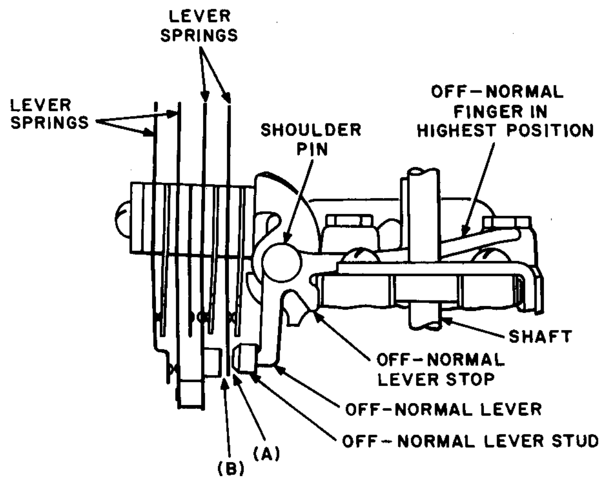


Fig. 6—Vertical Off-Normal Spring Assembly Having Pin-Mounted Off-Normal Lever

Gauge by eye.

(b) The clearance between the stud on the off-normal lever and the first lever spring shall not be great enough to cause a bind between the normal pin and the off-normal finger which will prevent the restoration of the shaft when it is released from the third rotary step of the first level.

Gauge by eye.

3.13 ***Clearance Between Lever Spring and Stud of Next Lever Spring:*** Fig. 6(B)—With the stop on the off-normal lever against the casting, the clearance between a lever spring and the stud on the next lever spring to the left, when the spring to the left is associated with a normally open contact, shall be

Min 0.002 inch

Use the KS-6909 gauge.

3.14 ***Contact Pressure***

Spring Assemblies Per Fig. 6 (With Pin-Mounted Off-Normal Lever)

(a) The contact pressure between each pair of contacts closed when the shaft is at vertical normal and between each pair of contacts closed when the shaft is up at least one step shall be

Test—Min 25 grams

Readjust—Min 30 grams

Use the 70D gauge.

Exception: On contacts 5 and 7, spring combination Fig. 201 (Table B), of the 197BG switch only, the contact pressure shall be

Test and Readjust—Min 30 grams

Use the 70D gauge.

(b) The combined tension of the vertical off-normal springs shall not be sufficient to prevent the complete restoration of the shaft to vertical normal when released from the first vertical step. On switches equipped with normal post springs operated on the first vertical step, remove the pressure of these springs. On switches equipped with a commutator wiper, this requirement shall be met with the wiper in contact with the commutator.

Gauge by eye.

To check this requirement, position the shaft on the first vertical step. If normal post springs are operated on this step, remove the pressure as follows: Cut a suitable wedge from a rubber eraser. Insert the wedge between the normal post and adjacent spring taking care to avoid excessive distortion of the springs and to keep the wedge clear of the normal post cam.

Spring Assemblies Per Fig. 7 (With Screw-Mounted Off-Normal Lever)

(c) These spring assemblies shall meet the following requirements:

Test: There shall be follow on each pair of contacts closed when the shaft is at vertical normal and on each pair of contacts closed when the shaft is up at least one step.

Gauge by eye.

To check this requirement, operate the springs by moving the shaft manually. Where one of the springs is a heavy spring, check the follow by moving the heavy spring and observing for follow of the lighter spring.

Exception: On contacts 5 and 7, spring combination Fig 201 (Table B), of the 197BG switch only and contacts 2 and 3, spring combination Fig. 207 (Table B), the contact pressure shall be

Min 30 grams

Use the 70D gauge.

Readjust: The contact pressure between each pair of contacts closed when the shaft is at vertical normal and between each pair of contacts closed when the shaft is up at least one step shall be

Min 20 grams

Use the 70D gauge.

Exception: On spring combination Fig. 207 (Table B), and on contacts 5 and 7, spring combination Fig. 201 (Table B), of the 197BG switch only, the contact pressure shall be

Min 30 grams

Use the 70D gauge.

(d) The combined tension of the vertical off-normal springs shall not be sufficient to prevent the complete restoration of the shaft to vertical normal when released from the first vertical step. On switches equipped with normal post springs operated on the first vertical step remove the pressure of these springs. On switches equipped with a commutator wiper, this requirement shall be met with the wiper in contact with the commutator.

Gauge by eye.

To check this requirement, position the shaft on the first vertical step. If normal post springs are operated on this step, remove the pressure as follows: Cut a suitable wedge from a rubber eraser. Insert the wedge between the normal post and adjacent spring taking care to avoid excessive distortion of the springs and to keep the wedge clear of the normal post cam.

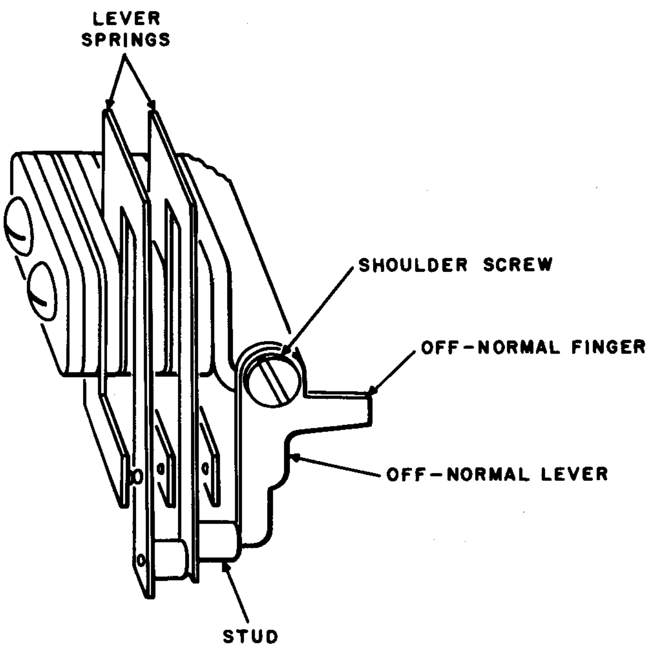


Fig. 7—Vertical Off-Normal Spring Assembly Having Off-Normal Lever Mounted by Shoulder Screw

REQUIREMENTS FOR TENTH OR ELEVENTH ROTARY STEP SPRINGS (197-Type Switches Only)

3.15 ***Lever Spring Stud Clearances with Rotary Ratchet and Cam Collar***

(a) Fig 8(A)—The clearance between the closest point of the cam collar and the lever spring stud which engages the cam shall be

Min, shall not touch

Max 5/64 inch

Gauge by eye.

(b) Fig. 8(B)—With the shaft in the vertical normal position, the clearance between the rotary ratchet and the lever spring stud which engages the cam shall be

Min, shall not touch

Max 1/16 inch

Gauge by eye.

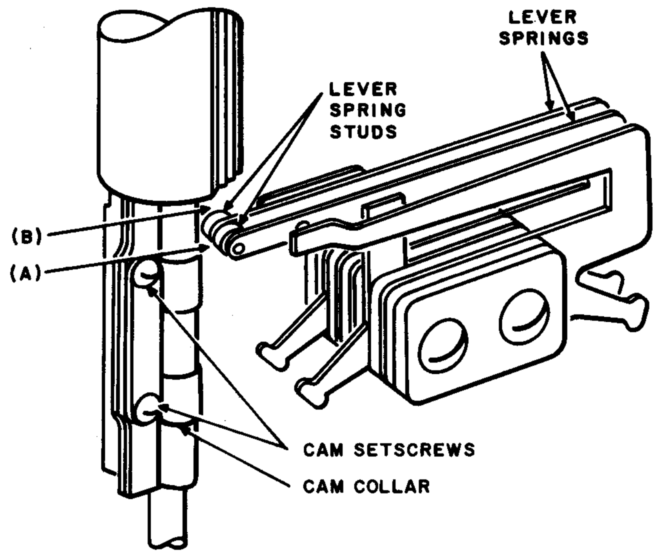


Fig. 8—Rotary Step Lever Spring Stud Clearances with Rotary Ratchet and Cam Collar

3.16 ***Clearance Between Cam and Lever Spring Stud:*** Fig. 9(A)—With the rotary armature in its unoperated position, there shall be clearance between the cam and the stud of the first lever spring when the shaft is on the rotary step preceding that on which the springs are to operate on the first and tenth levels.

Gauge by eye.

3.17 ***Contact Pressure:*** The contact pressure between each pair of contacts closed with the shaft at rotary normal and between each pair of contacts closed when the shaft is on the rotary step on which the springs are to operate shall be as shown in the figures referred to in Table A and shown in Table C and Table J.

Use the 68B and 79C gauges.

3.18 ***Contact Separation:*** The separation between each pair of contacts open with the shaft at rotary normal and between each pair of contacts open when the shaft is on the rotary step on which the springs are to operate shall be

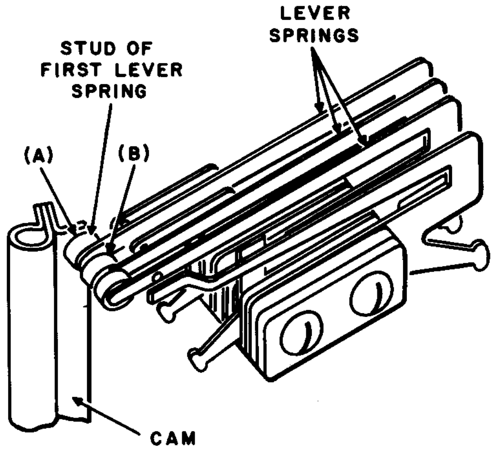


Fig. 9—Relation of Cam Spring Assembly to Cam

Test—Min 0.004 inch

Readjust—Min 0.006 inch

Use the KS-6909 gauge.

3.19 ***Clearance Between Lever Spring and the Stud of the Next Lever Spring:*** Fig. 9(B)—With the shaft up at least one step and at rotary normal, where a lever spring other than the first lever spring is associated with a break contact, there shall be a clearance between the stud on this lever spring and the adjacent lever spring to the left.

Gauge by eye.

REQUIREMENTS FOR ROTARY OFF-NORMAL SPRINGS

3.20 ***Clearance of Cam Collar:*** Fig. 10(A)—The clearance between the closest point of the cam collar and the adjacent lever spring stud shall be

Min, shall not touch

Max 5/64 inch

Gauge by eye.

3.21 ***Clearance of Rotary Ratchet***

(a) ***Switches on Which Lever Spring Stud Engages Cam:*** With the shaft in

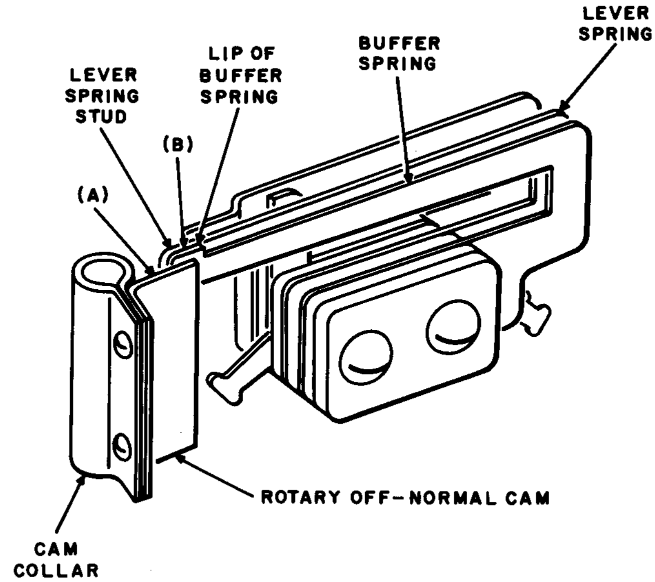


Fig. 10—Illustrating Rotary Off-Normal Spring Requirements

the vertical normal position, the clearance between the rotary ratchet and the lever spring stud which engages the cam shall be

Min, shall not touch

Max 1/16 inch

Gauge by eye.

(b) ***Switches on Which Buffer Spring With Lip Engages Cam:*** With the shaft in the vertical normal position, the clearance between the rotary ratchet and the lip of the buffer spring (Fig. 10) shall be

Min, shall not touch

Max 0.025 inch

Gauge by eye.

3.22 ***Relation of Buffer Spring to Adjacent Lever Spring:*** Fig. 10(B)—The buffer spring shall rest against the stud of the adjacent lever spring.

Gauge by eye.

3.23 ***Contact Sequence:*** Contacts shall make or break before the double dog drops in on the first rotary step as the shaft is rotated manually on the first level.

Gauge by eye.

3.24 ***Contact Separation:*** The separation between each pair of contacts open with the shaft at rotary normal and between each pair of contacts open with the shaft on the first rotary step shall be

Min 0.006 inch

Gauge by eye.

3.25 ***Contact Follow:*** There shall be follow on each pair of contacts closed with the shaft at rotary normal and on each pair of contacts closed with the shaft on the first rotary step.

Gauge by eye.

3.26 ***Contact Pressure:*** The contact pressure between each pair of contacts closed with the shaft at rotary normal and between each pair of contacts closed with the shaft on the first rotary step shall be as shown in the figures referred to in Table A and shown in Table D and Table J.

Use the 79C gauge.

3.27 ***Cam Clearance With Buffer Spring or Lever Spring Stud***

(a) ***Spring Combinations Fig. 400 through 403*** (Table D): There shall be a clearance between the cam and the buffer spring with the shaft on the first rotary step of the first and tenth levels.

Gauge by eye.

(b) ***Spring Combination Fig. 800*** (Table J): There shall be a clearance between the cam and the stud on the No. 7 spring with the shaft on the first rotary step of the first and tenth levels.

Gauge by eye.

REQUIREMENTS FOR RELEASE CONTACT SPRINGS (197-Type Switches Only) (For Individual Spring Combinations, See Tables A and E)

Spring Combinations Per Fig. 500 (Table E)

3.28 ***Clearance Between Release Armature Bushing and Lever Spring:*** Fig. 11(A)—With the shaft on the first rotary step of the first bank level and with the release armature pin just touching the double dog, the contacts shall not break but the gap between the closest point on the release armature bushing and its associated lever spring shall be

Test—Max 0.006 inch

Readjust—Max 0.004 inch

Use the KS-6909 gauge.

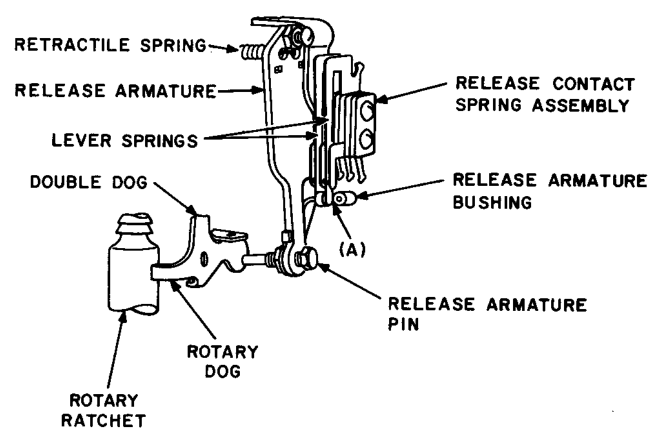


Fig. 11—Release Spring Assembly and Associated Parts Showing Release Armature With Retractile Spring Attached Directly to the Armature

3.29 ***Contact Pressure***

(a) The contact pressure shall be as shown in Fig. 500 (Table E). Use the 68B gauge.

(b) The maximum contact pressure shall not be sufficient to interfere with the release of the switch when the release armature is slightly retarded.

Spring Combinations Per Fig. 501 (Table E)

3.30 ***Contact Follow:*** With the release magnet electrically energized against a gauge of the value indicated below inserted between the armature and the closest point on the core, the normally open contacts shall

Use the KS-6909 gauge.

	NOT MAKE ON	MAKE ON
Test	0.020 inch	0.005 inch
Readjust	0.018 inch	0.007 inch

3.31 ***Contact Separation:*** The separation between each pair of normally open contacts shall be as shown in Fig. 501 (Table E).

Use the KS-6909 gauge.

3.32 ***Contact Pressure:*** The contact pressure between normally closed contacts shall be as shown in Fig. 501 (Table E).

Use the 68B gauge.

Spring Combinations Per Fig. 502, 503, 504, and 505 (Table E)

3.33 ***Contact Separation:*** The separation between each pair of normally open contacts and between each pair of contacts of make-before-break combinations that open when the release magnet is in its electrically operated position shall be as shown in Fig. 502, 503, 504, and 505 (Table E).

Use the KS-6909 gauge.

3.34 ***Contact Pressure:*** The contact pressure between each pair of normally closed contacts of make-before-break combinations and between each pair of contacts closed when the release magnet is in its electrically operated position, shall be as shown in Fig. 502, 503, 504, and 505 (Table E).

Use the 70D and 70J gauges.

Spring Combinations Per Fig. 506 (Table E)

3.35 ***Clearance Between Release Armature Bushing and Lever Spring:*** Fig. 11(A)—With the release armature in the unoperated position, the gap between the closest point on the release armature bushing and its associated lever spring shall be

Test—Min 0.003 inch

Readjust—Min 0.005 inch

Use the KS-6909 gauge.

3.36 ***Contact Separation:*** With the shaft on the first rotary step of the first bank level, the separation between the normally closed contacts when the release magnet is operated on the operate current specified in the circuit requirement table shall be as shown in Fig. 506 of Table E.

Use the 117A gauge.

3.37 ***Contact Pressure:*** The contact pressure between normally closed contacts shall be as shown in Fig. 506 of Table E.

Use the 68B gauge.

REQUIREMENTS FOR NORMAL POST SPRINGS (197-Type Switches Only) (For Individual Spring Combinations, See Tables A, G, and H)

Normal Post Spring Assemblies Per Fig. 12 and 13

3.38 ***Position of Normal Post Spring Assembly***

(a) ***Switches Without Normal Post Cams or With Cams Having No Bent-Out Teeth:*** The rollers on the roller springs shall clear the shaft spring bracket in its highest position.

Gauge by eye.

(b) ***Switches With Normal Post Cams Having Teeth Bent Out to Operate Springs on at Least One Level:*** All bent-out teeth shall strike approximately midway between the ends of the rollers.

Gauge by eye.

Before checking this requirement, raise and lower the shaft several times to permit the cam to assume its normal operating position.

3.39 ***Position of Normal Post Camteeth:*** Fig. 12(A) and 13(A)—On levels requiring the operation of normal post springs, the normal post camteeth shall be bent out approximately at right angles to the side surface of the cam which forms their base.

Gauge by eye.

Note: The particular levels on which the springs should operate are shown on the office record drawing or are covered in local records.

3.40 ***Normal Post Cam Play***

(a) There shall be play between the cam and the normal post.

Gauge by eye.

(b) Fig. 12(B) and 13(B)—There shall be vertical play between the cam and the shaft spring bracket, but this play shall not exceed

0.008 inch

Gauge by eye and feel.

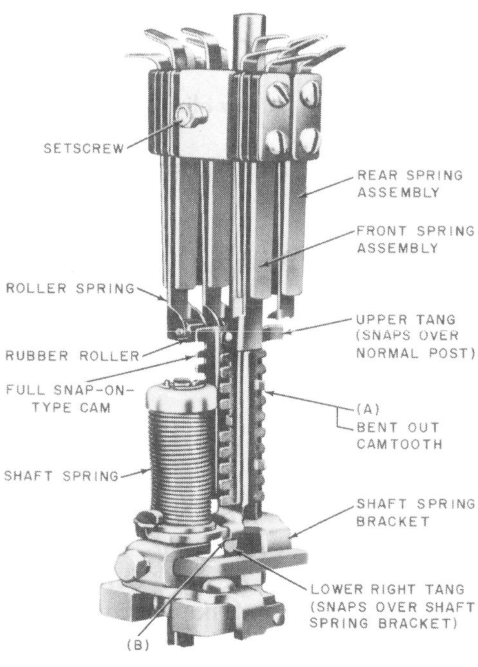


Fig. 12—Normal Post Springs Having Rubber Rollers Operated by Full Snap-On Type Cam

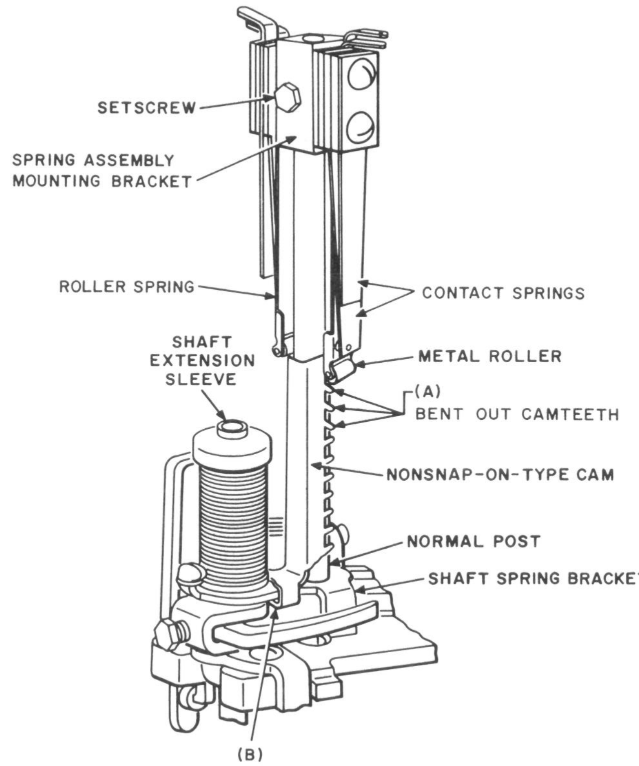


Fig. 13—Normal Post Spring Having Metal Rollers Operated by Nonsnap-On-Type Cam

3.41 ***Relation of Normal Post Cam to Rollers:*** The following requirements shall be met with the shaft on each vertical step preceding or succeeding that on which the contact springs are to operate. Where the springs are to operate on the tenth level, the requirement for this level shall be met with the shaft on the ninth level or the next lower level on which contact springs do not operate. Where teeth in the same vertical row are bent out on consecutive levels, the requirement with respect to this vertical row need be met only on the levels above the highest and below the lowest of these levels.

Gauge by eye unless otherwise stated.

SPRING COMBINATION FIGURES	PLAY BETWEEN CAM AND NORMAL POST	
	PLAY NOT TAKEN UP	PLAY TAKEN UP (SEE NOTE)
710, 711; Right Half of 714, 715, and 716; Rear Half of 752; Left Half of 717 (Table H)	Rollers may contact bent-out of non-bent-out camteeth	Contact separation (See 3.42)
712, 713, 750, 751; Left Half of 714, 715, and 716; Front Half of 752; Right Half of 717 (Table H)	Rollers shall clear bent-out and non-bent-out camteeth	Rollers may contact the bent-out or nonbent-out camteeth
700, 701; Right Half of 704 and 705 (Table G)	Rollers may contact bent-out or non-bent-out camteeth	No. 1 spring shall not move
702, 703; Left Half of 704 and 705 (Table G)	Rollers may contact bent-out or non-bent-out camteeth	There shall be a clearance between the roller spring and the stud of the No. 2 spring

Note: This play is taken up by applying light pressure to either side of the cam in the direction to decrease the contact separation of normally open contacts or the stud clearance of break-make contacts.

3.42 ***Contact Separation:*** With the shaft in every position in which contact closure is not specified, the contact separation shall be

(a) All springs on all spring combinations except make-before-break combinations

Min 0.008 inch

(b) Make springs on make-before-break spring combinations (Fig. 717 of Table G, Spring 1L and 3L)

Min 0.006 inch

Use the KS-6909 gauge.

3.43 ***Contact Pressure:*** With the shaft in every position in which the normal post springs are to make contact, the contact pressure shall be as shown in the figures referred to in Table A and Tables G and H.

Use the 70D gauge.

Note: The particular levels on which the springs should operate are shown on the office record drawing or are covered in local records.

3.44 ***Spring Tension***

Test: The combined tension of the normal post springs shall not prevent the shaft from restoring to normal by its own weight from the level immediately above each level at which camteeth are bent out to operate the springs. Where the teeth are bent out to operate springs on the tenth level, the shaft shall restore from its highest position.

This requirement shall be met with the off-normal finger fully depressed.

On switches equipped with a commutator wiper, the requirement shall be met when the switch is assembled with the associated commutator.

Gauge by eye.

To check, block the vertical off-normal springs in the unoperated position as covered in Section 030-705-701. Raise the shaft to the level immediately above a level at which one or more teeth are bent out. Manually operate the release magnet and observe that the shaft restores to normal. Repeat this check from the level immediately above each of the other levels at which teeth are bent out. Where teeth in the same vertical row are bent out on consecutive levels, this requirement with respect to this vertical row of teeth need be checked only from the level above the highest of the consecutive levels.

Readjust: The combined tension of the normal post springs shall not prevent the shaft from restoring to normal by its own weight from each level at which teeth are bent out to operate the springs when the shaft is brought to rest with at least one roller against the lower corner of the associated camtooth which is bent out. Where teeth are bent out to operate springs on the tenth level, the shaft shall restore from its highest position. This requirement shall be met with the off-normal finger fully depressed.

On switches equipped with a commutator wiper, the requirement shall be met when the switch is assembled with the associated commutator.

Gauge by eye.

To check, block the vertical off-normal springs in the unoperated position as covered in Section 030-705-701. Raise the shaft above a level on which one or more camteeth are bent out. Support the shaft with a finger, manually operate the release magnet, and lower the shaft until the lower corner of at least one of the bent-out teeth in the level is in contact with its associated roller. Remove the supporting finger and note that the shaft returns to normal. Repeat this check from above all other levels at which one or more camteeth are bent out. Where teeth in the same vertical row are bent out on consecutive levels, this requirement with respect to this vertical row of teeth need be checked only from above the highest of the consecutive levels.

3.45 ***Contact Sequence:*** When the switch is equipped with more than one break-make combination which operates on the same level, all normally closed contacts shall break before any of the normally open contacts make.

3.46 ***Roller Spring Position*** (Spring assemblies per Fig. 13 only, having spring combinations on Fig. 700, 701, and the right half of Fig. 704 and 705 of Table G): With the roller against a nonbent-out tooth on the cam, the stud on the No. 1 contact spring shall be in contact with the roller spring.

Normal Post Spring Assemblies Per Fig. 14

3.47 ***Normal Post Operating Spring Position***

(a) Fig. 14(A)—When the springs are in the normal (unoperated) position, there shall be a clearance between the normal post and the closest point on the offset portion of the normal post operating spring of

Min 1/64 inch

Gauge by eye.

(b) With the shaft in the vertical normal position, the first contact spring shall follow as the normal post operating spring is moved toward the normal post.

Gauge by eye.

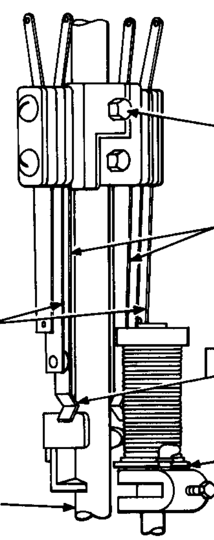


Fig. 14—Normal Post Springs Operated by Offset Shaft Spring Bracket

3.48 ***Clearance Between Normal Post Operating Spring and Shaft Spring Bracket:*** With the shaft on the vertical step preceding that on which the springs are to make contact, the normal post operating spring shall clear the shaft spring bracket. This requirement shall also apply on the vertical step succeeding that on which the springs are to make contact, except when the level on which the springs are to make contact corresponds to the tenth vertical step.

Gauge by eye.

3.49 ***Contact Pressure:*** With the shaft in any position in which the springs are in contact, the contact pressure shall be

Min 30 grams

Use the 68B gauge.

3.50 ***Contact Separation:*** With the shaft on any level where contact between the springs is not specified, the contact separation shall be

Min 0.008 inch

Use the KS-6909 gauge.

Normal Post Spring Assemblies Per Fig. 15

3.51 ***Normal Post Operating Spring Position***

(a) Fig. 15(A)—There shall be a clearance between the offset portion of the normal post operating spring and the normal post when the springs are in the normal (unoperated) position.

Gauge by eye.

(b) With the shaft in the vertical normal position, the first contact spring shall follow as the normal post operating spring is moved toward the normal post.

Gauge by eye.

3.52 ***Clearance Between Normal Post Operating Spring and Normal Post Collar:*** With the shaft on the vertical step preceding that on which the springs are to operate and the normal post operating spring pressed lightly against the normal post, the clearance between the normal post operating spring and the normal post collar shall be

Min 0.003 inch

Use the KS-6909 gauge.

3.53 ***Contact Follow:*** The follow of normally open contacts with the shaft in any position in which the contacts are closed shall be

Min 0.006 inch

Gauge by eye.

3.54 ***Contact Separation:*** The separation between each pair of contacts normally open or between each pair of contacts opened when actuated by the normal post collar shall be

Min 0.008 inch

Use the KS-6909 gauge.

Normal Post Spring Assemblies Per Fig. 16

3.55 ***Normal Post Operating Spring Position***

(a) Fig. 16(A)—There shall be clearance between the offset portion of the normal post operating spring and the normal post when the springs are in the normal (unoperated) position.

Gauge by eye.

(b) With the shaft in the vertical normal position, the first contact spring shall follow as the normal post operating spring is moved toward the normal post.

Gauge by eye.

(c) When the springs are required to make contact on one level only, the offset portion of the normal post operating spring shall center on the shaft spring bracket on that level.

Gauge by eye.

Note: If the springs are mounted to the right of the normal post, the normal pin stop is not to be considered as part of the shaft spring bracket.

(d) When the springs are required to make contact on two or more levels, the assembly shall be positioned so the shaft spring bracket is in the same relative position on the upper and lower angles of the normal post operating spring with the shaft in the highest and lowest positions, respectively, in which the springs operate.

Gauge by eye.

Note: If the springs are mounted to the right of the normal post, the normal pin stop is not to be considered as part of the shaft spring bracket.

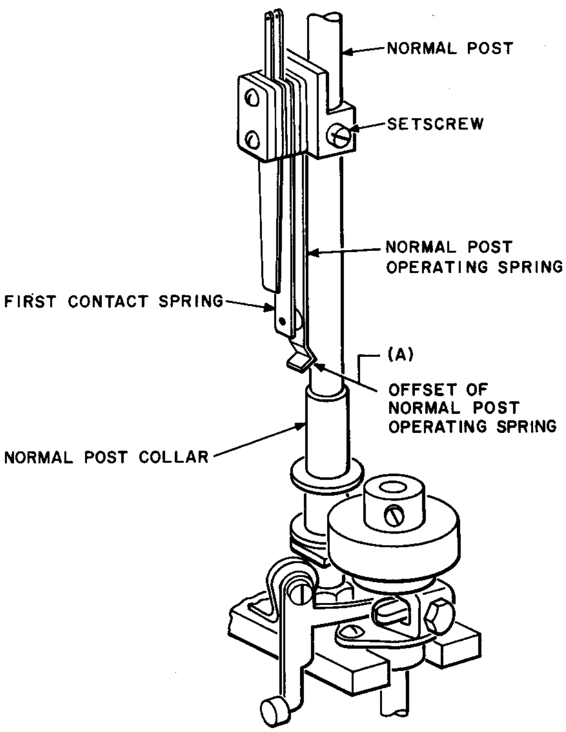


Fig. 15—Normal Post Springs Operated by Normal Post Collar

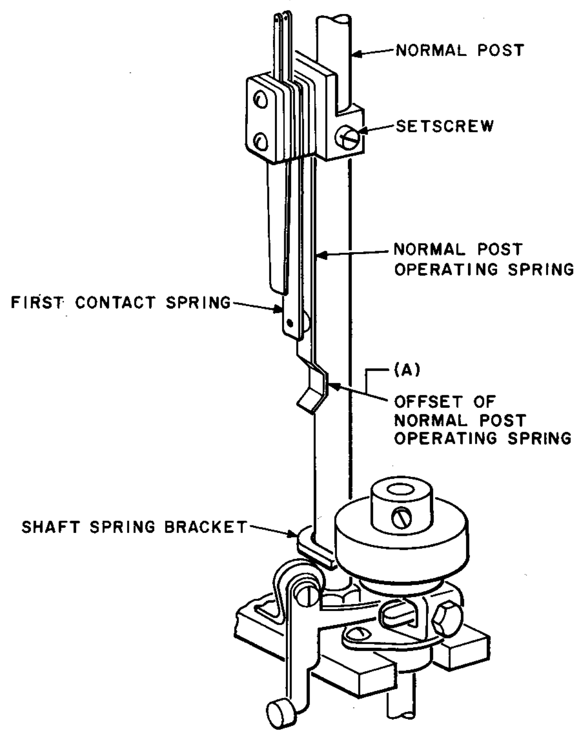


Fig. 16—Normal Post Springs Operated by Straight Shaft Spring Bracket

3.56 ***Contact Follow:*** With the shaft in each position in which contacts are made, the follow of make contacts shall be

Min 0.006 inch

Gauge by eye.

3.57 ***Contact Separation:*** The separation between each pair of contacts normally open, or between each pair of contacts opened when actuated by the shaft spring bracket, shall be

Min 0.008 inch

Use the KS-6909 gauge.

TABLE A

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
197A	Sel	200	—	300	—	—	600	—
197C	Test Distrib Sel	200	—	301	—	—	600	—
197D	Intermediate Toll Sel	200	—	302 or 306	—	—	600	—
197E	Comb. Conn.	201	—	—	—	—	—	—
197F	Toll Conn.	202	—	—	—	—	—	—
197G	Test Distrib	203	—	—	—	—	—	—
197H	Local Conn.	203	—	—	—	—	—	—
197J	Local Rot. Htg Conn.	203	—	—	—	—	600	—
197K	Test Conn.	203	—	—	—	—	—	—
197L	Toll Rot. Htg Conn.	202	—	—	—	—	600	—
197M	Toll Inc Sel	204	—	302 or 306	—	500	600	—
197N	Coin Control Sel	203	—	—	400	—	—	—
* 197P	Local Rot. Htg Conn.	203	—	—	—	—	600	700 or 710
* 197R	Comb. Conn.	201	—	—	—	—	—	700 or 710
* 197S	200-Pt Line Finder	205	—	302 or 306	—	—	601	—
* 197T	Digit-Absorbing Sel	204	—	300	—	—	600	—
* 197U	Local Level Htg Conn.	200	303	—	—	501	602	—
* 197W	Toll Level Htg Conn.	201	304	—	—	501	602	—
* 197AA	Digit-Absorbing Sel	200	—	300	—	501	600	—
197AB	Comb. Conn.	206	—	—	—	—	—	—
197AC	Local Level Htg Conn.	201	303	—	—	501	602	—
197AD	Sel Conn. (PBX)	207	—	305	—	—	600	701 or 711
197AE	Rot. Htg Sel Conn. (PBX)	207	—	305	—	—	600	701 or 711
197AF	Inc First Sel (PBX)	204	—	300	—	—	600	700, 710 or 714
* 197AG	Regular Inc Conn. (PBX)	201	—	—	—	—	—	700 or 710
* 197AH	Rot. Htg Inc Conn. (PBX)	201	—	—	—	—	600	700 or 710
197AJ	First Sel (PBX)	200	—	300	—	—	600	700 or 710
197AK	200-Pt Line Finder (PBX)	208	305	—	—	—	600	—
* 197AL	100-Pt Line Finder (PBX)	205	305	—	—	—	600	—
197AM	Four-Conductor Sel	200	—	300	—	—	—	—
* 197AN	Trunk Finder	204	304	—	—	—	601	—
* 197AP	Test Conn.	201	—	—	401	—	—	—
197AR	100-Pt Line Finder	205	305	—	—	—	601	—
* 197AS	200-Pt Line Finder	205	305	—	—	—	601	—
197AU	Local Level Htg Conn.	201	303	—	—	501	602	—

* Mfr Disc.

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
197AW	Toll Level Htg Conn.	201	304	—	—	501	602	—
†197AY	Sel Conn. (PBX)	207	—	305	—	502	600	701 or 711
†197BA	500-Pt Line Finder (PBX)	205	305	—	—	502	600	—
*†197BB	Sel Conn. (PBX)	207	—	—	—	502	600	701 or 711
197BC	Revtg Call Sel	203	—	—	—	—	—	—
197BD	Sel Conn. (PBX)	207	—	305	—	502	600	701 or 711
197BE	100-Pt Line Finder	205	305	—	—	502	600	—
197BF	Comb. Rot. Htg Conn.	203	—	—	—	—	600	—
197BG	Trunk Finder	201	307	—	—	—	600	—
* 197BH	Digit-Absorbing Sel	200	—	300	—	501	600	—
†197BJ	50-Pt Line Finder	205	305	—	—	—	601	—
197BM	Local Conn.	201	—	—	—	—	—	—
* 197BN	Toll Trans Sel	204	—	306	—	500	600	700 or 710
*†197BP	Sel Conn.	207	—	—	402	502	600	701 or 711
* 197BR	Sel Conn.	207	—	—	402	502	600	701 or 711
197BS	Sel	200	—	301	—	—	600	700 or 710
197BT	Sel Repeater	204	—	300	—	503	600	—
* 197BU	Digit-Absorbing Sel	204	—	300	—	504	600	—
197BW	Sel	204	—	302 or 306	—	500	600	—
197BY	Intertoll Sel	200	—	300	—	—	600	—
197CA	Local Rot. Htg Conn.	203	—	—	—	—	600	703 or 713
197CB	Comb. Conn.	201	—	—	—	—	—	703 or 713
†197CC	Conn. (PBX)	207	—	—	—	502	600	704 or 714
197CD	Intertoll Sel	200	—	308	—	—	600	703 or 713
* 197CE	Digit-Absorbing Sel	200	—	300	—	501	600	703 or 713
* 197CF	200-Pt Line Finder	209	—	310	—	500	600	700 or 710
* 197CG	200-Pt Line Finder	209	—	310	—	500	600	—
197CH	Comb. Conn.	206	—	—	—	—	—	—
* 197CJ	100-Pt Line Finder	209	—	310	—	—	600	—
* 197CK	100-Pt Line Finder	209	—	310	—	—	600	700 or 710
* 197CL	Comb. Rot. Htg Conn.	203	—	—	—	—	600	—
†197CM	Test Distrib	203	—	—	—	—	—	—
* 197CN	200-Pt Line Finder	205	—	306	—	—	601	700 or 710
* 197CP	Sel	200	—	300	—	501	600	700 or 710
* 197CR	100-Pt Line Finder	205	305	—	—	—	601	700 or 710

* Mfr Disc.

† Arranged to take five vertical steps only.

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
* 197CS	Sel	200	—	300	—	501	600	702 or 712
197CT	Rot. Htg Conn.	203	—	—	—	—	600	703 or 713
197CU	Intertoll Toll Trans Sel	204	—	308	—	500	600	703 or 713
* 197CW	200-Pt Line Finder	209	—	310	—	500	600	705 or 715
* 197CY	Intertoll Through Sel	201	—	309	—	—	600	703 or 713
197DA	Digit-Absorbing Sel	200	—	300	—	505	600	703 or 713
197DB	Comb. Rot. Htg. Conn.	206	—	—	—	—	600	—
197DC	Comb. Rot. Htg. Conn.	206	—	—	—	—	600	703 or 713
197DD	200-Pt Line Finder	202	—	310	—	500	600	700 or 710
197DE	200-Pt Line Finder	202	—	310	—	500	600	—
* 197DF	Code Ringing Conn.	201	—	—	—	—	—	—
* 197DG	100-Pt Line Finder	209	—	310	—	—	600	705 or 715
197DH	100-Pt Line Finder	202	—	310	—	—	600	705 or 715
197DJ	100-Pt Line Finder	202	—	310	—	—	600	—
* 197DK	100-Pt Line Finder	202	—	310	—	—	600	700 or 710
197DL	200-Pt Line Finder	202	—	310	—	500	600	705 or 715
* 197DM	Regular Inc. Conn.	206	—	—	—	—	—	700 or 710
197DN	Line Htg Inc Conn.	206	—	—	—	—	600	700 or 710
197DP	Sel Repeater	204	—	300	—	503	600	704 or 714
197DR	Digit-Absorbing Sel	204	—	300	—	505	600	702, 712 or 713
* 197DS	200-Pt Line Finder	205	—	306	—	—	601	—
197DT	Sel Repeater	201	—	300	—	504	600	701 or 711
197DW	200-Pt Line Finder	202	—	310	—	500	600	705 or 715
* 197DY	Line Finder or Trk Finder	205	—	306	—	—	601	702 or 712
197EA	2- or 4-Wire Sel	200	—	300 or 311	—	—	600	702 or 712
197EB	Comb. or Local Conn.	206	—	—	400	—	—	703 or 713
197EC	Comb. Conn.	201	—	—	400	—	—	—
197ED	Test Distrib	203	—	—	—	—	600	702 or 712
197EE	Rot. Htg Conn.	206	—	—	400	—	600	703 or 713
197EF	Intertoll Dialing Sel	200	—	308	—	505	600	703 or 713
* 197EG	Digit-Absorbing Sel	200	—	300	—	505	600	—
* 197EH	200-Pt Line Finder	205	—	306	—	—	601	705 or 715
197EJ	Trunk Finder	206	—	306	—	—	601	—
* 197EK	Trunk Finder	206	—	306	—	—	601	703 or 713
* 197EL	Dual Sel	204	—	300	—	505	600	703 or 713

* Mfr Disc.

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
* 197EM	Trunk Finder	205	—	305	—	—	601	703 or 713
197EN	Coin Control Conn.	203	—	—	401	501	—	701 or 711
197EP	Trunk Finder	204	—	305	—	—	601	—
197ER	100-Pt Line Finder	208	305	—	—	—	601	—
197ES	Sel	204	—	306	—	500	600	702 or 712
197ET	Sel Conn.	207	—	305	—	—	600	716
197EU	Digit-Absorbing Sel	208	—	300 or 311	—	502	600	713
197EW	100-Pt Line Finder	205	305	—	—	—	601	712
197EY	AB Toll Preceding Sel	200	—	311	—	505	600	713
197FA	Toll Trans Sel	204	—	305	—	500	600	711
197FB	Comb. Conn.	206	—	—	403	—	—	—
197FC	Toll Intermed Sel	200	—	306	—	501	600	—
197FD	Digit-Absorbing Sel	204	—	300	—	—	600	—
197FE	Inc Sel	200	—	311	—	—	600	—
197FF	Digit-Absorbing Sel	210	—	800	800	504	600	750
197FG	Intertoll Dialing Sel	200	—	308 or 313	—	505	600	750 or 751
197FH	Intertoll Toll Trans Sel	204	—	308 or 313	—	504	600	750 or 752
197FJ	Digit-Absorbing Sel	208	—	312	—	501	600	751
197FK	Toll Preceding Sel	200	—	311	—	—	600	—
197FL	Digit-Absorbing Sel	204	—	311	—	505	600	713
197FM	Digit-Absorbing Sel	210	—	311	—	502	600	713
197FN	Digit-Absorbing Sel	200	—	300	—	505	600	713
197FP	200-Pt Line Finder	205	—	306	—	—	601	—
197FR	200-Pt Line Finder	205	—	306	—	—	601	715
197FS	200-Pt Line Finder	205	—	306	—	—	601	—
197FT	200-Pt Line Finder	205	—	306	—	—	601	712
197FU	200-Pt Line Finder	205	—	306	—	—	601	715
197FW	Pair Ident Test Set	203	—	—	402	502	—	—
197FY	Line Finder & Trk Finder	205	—	306	—	—	601	712
197GA	200-Pt Local Conn.	211	—	—	401	506	—	—
197GB	200-Pt Rot. Htg Conn.	211	—	—	401	506	601	711
* 197GC	200-Pt Local Conn.	203	—	—	401	506	—	—
* 197GD	200-Pt Rot. Htg Conn.	203	—	—	401	506	600	710
197GE	200-Pt Comb. Conn.	211	—	—	400	506	—	—
* 197GF	200-Pt Comb. Conn.	201	—	—	401	506	—	—

* Mfr Disc.

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
197GG	200-Pt Test Conn.	203	—	—	—	—	600	710
197GH	Local Conn.	202	—	—	401	—	—	714
* 197GJ	Code Sel Local Level Htg Conn.	201	303	—	—	501	601	717
197GK	Local Incoming	200	—	311	—	505	600	750
197GL	Code Sel, Local Level Htg Conn.	201	303	—	—	501	602	717
197GM	Trunk, Position Finder	206	—	306	—	—	601	710
* 197GN	Local Rot. Htg Conn.	203	—	—	—	506	600	—
* 197GP	Comb. Toll & Local Conn.	201	—	—	—	506	—	—
* 197GR	Local Conn.	203	—	—	—	506	—	—
* 197GS	Coin Conn.	203	—	—	—	506	—	—
* 197GT	Comb. Conn.	206	—	—	—	506	600	—
197GU	Inc Sel	200	—	311	—	505	600	750
197GW	Local Conn.	201	—	—	—	506	—	—
197GY	Inc Sel	201	—	—	401	—	—	—
197HA	Test Group Sel	200	—	300	—	—	600	—
197HB	Test Group Sel	203	—	—	401	—	—	—
197HC	Comb. Conn.	201	—	—	400	506	—	—
197HD	Comb. Toll & Local Conn.	206	—	—	403	506	—	—
197HE	Test Distrib	203	—	—	—	—	—	752
* 197HF	Comb. Toll & Local Conn.	201	—	—	—	506	—	713
197HG	Trunk Finder	208	305	—	—	—	601	—
197HH	Intertoll Sel	200	—	312	—	—	600	713
197HJ	Intertoll Sel	200	—	312	—	505	600	750
* 197HK	Local Rot. Htg Conn.	203	—	—	—	506	600	713
* 197HL	Local Rot. Htg Conn.	203	—	—	—	506	600	713
* 197HM	Comb. Rot. Htg Conn.	206	—	—	—	506	600	713
* 197HN	Local Rot. Htg Conn.	203	—	—	—	506	600	—
197HP	Local Rot. Htg Conn.	203	—	—	403	506	600	—
197HR	Comb. Toll & Local Conn.	201	—	—	403	506	—	—
197HS	Local Conn.	203	—	—	403	506	—	—
197HT	Coin Conn.	203	—	—	403	506	—	—
197HU	Comb. Conn.	206	—	—	403	506	600	—
197HW	Comb. Toll & Local Conn.	201	—	—	403	506	—	713
197HY	Local Rot. Htg Conn.	203	—	—	403	506	600	713

* Mfr Disc.

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

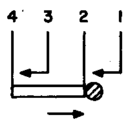
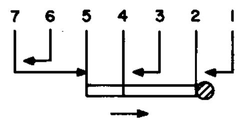
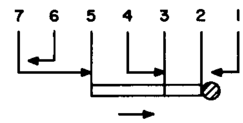
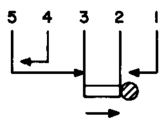
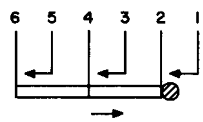
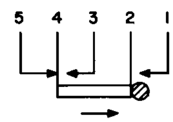
CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
197JA	Local Rot. Htg Conn.	203	—	—	403	506	600	713
197JB	Comb. Rot. Htg Conn.	206	—	—	403	506	600	713
197JC	Local Rot. Htg Conn.	203	—	—	403	506	600	—
197JD	200-Pt Local Conn.	203	—	—	402	506	—	—
197JE	200-Pt Rot. Htg Conn.	203	—	—	402	506	600	710
197JF	200-Pt Comb. Conn.	201	—	—	402	506	—	—
197JG	Perm Sig Finder	205	305	—	—	—	601	—
197JH	Control and Trunk Conn.	203	—	—	—	507	—	—
197JJ	Control and Trunk Conn.	203	—	—	—	—	—	—
197JK	Local Rot. Htg Conn.	203	—	—	403	—	600	—
197JL	Local Rot Htg Conn.	203	—	—	403	—	600	—
197JM	100-Pt Line Finder	208	305	—	—	—	601	—
197JN	Incom First Sel Cir.	204	—	300	—	—	600	751
197JP	PBX Sel Conn. Cir.	207	—	800	800	—	600	716
197JR	3A Auto. Finding Sys	204	305	—	—	—	601	750
197JS	Auto. Intercept Serv.	205	—	800	800	—	601	715
197JT	First Sel 701 PBX	200	—	300	—	504	600	701 or 711
197JU	Digit-Absorbing Sel	208	—	300	—	502	600	713
197JW	Digit-Absorbing Sel	208	—	300	—	502	600	713
197JY	Auto. Intercept for AN1-C, AN1-D	205	—	800	800	—	601	715
197KA	701 PBX Second Sel	208	—	300	—	502	600	713
197KB	Std Selector	200	—	300	—	—	600	701 or 711
D-90541	Message Rate Sel	208	—	300	—	—	600	—
D-91385	Inc First Sel (PBX)	204	—	300	—	501	600	700 or 710
D-96233	Mon Serv Dial Sel	203	—	—	—	—	600	—
D-96565	Inc First Sel (PBX)	208	—	300	—	501	600	—
D-141901	Digit-Absorbing Sel	204	—	300	—	—	600	—
D-141916	Second Sel (PBX)	200	—	300	—	—	600	—
D-141917	First Sel (PBX)	200	—	311	—	—	600	700 or 710
D-141922	Local Rot. Htg Conn. (PBX)	203	—	—	—	—	600	—
D-141943	Inc First Sel (PBX)	204	—	306	—	501	600	700 or 710

TABLE A (Contd)

VARIABLE FEATURES OF 197- AND 198-TYPE SWITCHES

CODE NO.	ORDINARILY USED AS	VERTICAL OFF-NORMAL SPRINGS SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 10 SEE FIG.	SPRINGS OPERATING ON ROTARY STEP 11 SEE FIG.	ROTARY OFF-NORMAL SPRINGS SEE FIG.	RELEASE CONTACT SPRINGS SEE FIG.	ROTARY INTER-RUPTER SPRINGS SEE FIG.	NORMAL POST SPRINGS SEE FIG.
D-141951	Local Conn. (PBX)	203	—	—	—	—	—	—
D-141952	Sel Conn. (PBX)	207	—	305	—	—	600	701 or 711
D-156214	First Sel (PBX)	204	—	300	—	504	600	704 or 714
D-156664	Test Distrib	203	—	—	—	—	600	700 or 710
D-159594	Comb. Toll & Local Conn.	206	—	—	403	—	—	—
D-160098	Sel	200	—	300	—	—	600	701 or 711
D-160731	First Sel (PBX)	204	—	300	—	501	600	701 or 711
D-161742	Sel Conn.	201	—	302	—	—	600	701or 711
D-162477	Trunk Finder	204	—	305	—	—	601	703 or 713
D-175728	Comb. Conn.	206	—	—	403	—	—	—
D-175849	Toll Trunk Finder	201	307	—	—	—	600	—
198A	Revtg Call Sel	—	—	—	401	—	—	—
198B	Revtg Call Sel	—	—	—	402	—	—	—
198C	Revtg Call Sel	—	—	—	402	—	—	—

Table B
Vertical Off-Normal Spring Combination

<table>
<tr>
<td>FIG. 200

(NOTE 1)</td>
<td>FIG. 201

(NOTE 1)</td>
<td>FIG. 202

(NOTE 1)</td>
</tr>
<tr>
<td>FIG. 203

(NOTE 1)</td>
<td>FIG. 204

(NOTE 1)</td>
<td>FIG. 205

(NOTE 1)</td>
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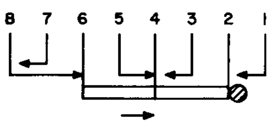
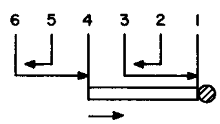
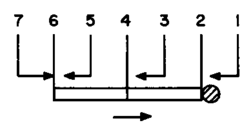
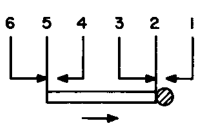
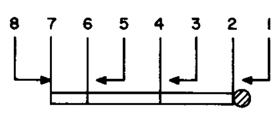
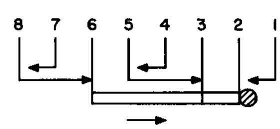
<tr>
<td>FIG. 206

(NOTE 1)</td>
<td>FIG. 207

(NOTE 1)</td>
<td>FIG. 208

(NOTE 1)</td>
</tr>
<tr>
<td>FIG. 209

(NOTE 1)</td>
<td>FIG. 210

(NOTE 1)</td>
<td>FIG. 211

(NOTE 1)</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</table>

Note

1. All of the above figures show the springs in the position occupied when the switch mechanism is in its vertical normal position. The arrows in the figures indicate the direction in which the springs operate when the shaft is raised.

Table C

Variable Requirements for Tenth or Eleventh Rotary Step Springs

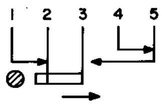


FIG. 300

(NOTES 1, 2, 3, 4, AND 7)

		SPRINGS				
		1 & 2	3 & 5	4 & 5		
MIN CONT PRES GRAMS	T	A	–	45		
	R	A	–	45		

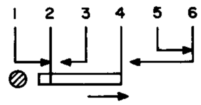


FIG. 301

(NOTES 1, 2, 3, 4, 7, AND 8)

		SPRINGS				
		1 & 2	2 & 3	4 & 6	5 & 6	
MIN CONT PRES GRAMS	T	A	A	–	45	
	R	A	20	–	45	

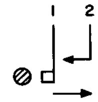


FIG. 302

(NOTES 1 AND 3)

		SPRINGS				
		1 & 2				
MIN CONT PRES GRAMS	T	A				
	R	A				

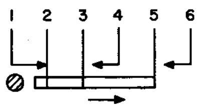


FIG. 303

(NOTES 1, 3, 4, 5, AND 6)

		SPRINGS				
		1 & 2	3 & 4	5 & 6		
MIN CONT PRES GRAMS	T	40	A	A		
	R	40	A	A		

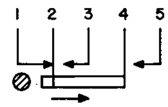


FIG. 304

(NOTES 1, 3, 4, 5, AND 6)

		SPRINGS				
		1 & 2	2 & 3	4 & 5		
MIN CONT PRES GRAMS	T	40	A	A		
	R	40	A	A		

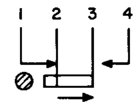


FIG. 305

(NOTES 1, 3, 4, 5, AND 6)

		SPRINGS				
		1 & 2	3 & 4			
MIN CONT PRES GRAMS	T	30	A			
	R	30	A			

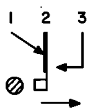


FIG. 306

(NOTES 1, 3, AND 9)

		SPRINGS				
		2 & 3				
MIN CONT PRES GRAMS	T	A				
	R	A				

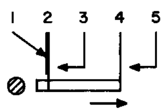


FIG. 307

(NOTES 1, 3, 4, AND 9)

		SPRINGS				
		2 & 3	4 & 5			
MIN CONT PRES GRAMS	T	A	A			
	R	A	A			

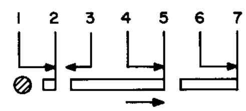


FIG. 308

(NOTES 1, 3, AND 5)

		SPRINGS				
		1 & 2	2 & 3	4 & 5	6 & 7	
MIN CONT PRES GRAMS	T	20	A	20	20	
	R	20	A	20	20	

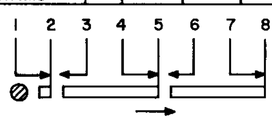


FIG. 309

(NOTES 1, 3, AND 5)

		SPRINGS				
		1 & 2	2 & 3	4 & 5	5 & 6	7 & 8
MIN CONT PRES GRAMS	T	20	A	20	A	20
	R	20	A	20	A	20

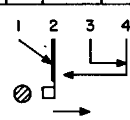


FIG. 310

(NOTES 2, 3, 7, AND 9)

		SPRINGS				
		2 & 4	3 & 4			
MIN CONT PRES GRAMS	T	–	45			
	R	–	45			

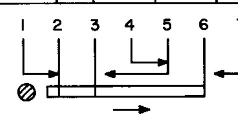


FIG. 311

(NOTES 1, 2, 3, 4, AND 7)

		SPRINGS				
		1 & 2	3 & 5	4 & 5	6 & 7	
MIN CONT PRES GRAMS	T	A	–	45	A	
	R	A	–	45	A	

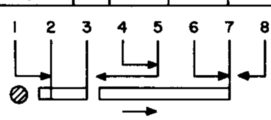


FIG. 312

(NOTES 1, 2, 3, 4, 5, AND 7)

		SPRING				
		1 & 2	3 & 5	4 & 5	6 & 7	7 & 8
MIN CONT PRES GRAMS	T	A	–	45	20	A
	R	A	–	45	20	A

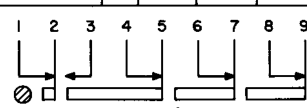


FIG. 313

(NOTES 1, 3, 4, AND 5)

		SPRINGS				
		1 & 2	2 & 3	4 & 5	6 & 7	8 & 9
MIN CONT PRES GRAMS	T	20	A	20	20	20
	R	20	A	20	20	20

Table D
Variable Requirements for Rotary Off-Normal Springs

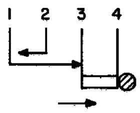


FIG. 400

(NOTES 1, 2, 3, AND 10)

		SPRINGS				
		1 & 2	1 & 3			
MIN CONT PRES GRAMS	T	A	–			
	R	20	–			

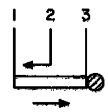


FIG. 401

(NOTES 3, AND 12)

		SPRINGS				
		1 & 2				
MIN CONT PRES GRAMS	T	30				
	R	30				

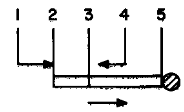


FIG. 402

(NOTES 3, 11, AND 13)

		SPRINGS				
		1 & 2	3 & 4			
MIN CONT PRES GRAMS	T	20	40			
	R	20	40			

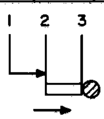


FIG. 403

(NOTE 3)

		SPRINGS				
		1 & 2				
MIN CONT PRES GRAMS	T	20				
	R	20				

Notes for Fig. 300 to 314, Inclusive (Table C) and Fig. 400 to 403, Inclusive (Table D)

1. When the letter "A" appears in a contact pressure column, it means that the springs shall have perceptible follow.

2. Where no limits are specified in the contact pressure column, the contact pressure is taken care of by other requirements.

3. All figures show the springs in the positions occupied when the switch mechanism is in the vertical normal position (197-type switches) or normal position (198-type switches). The arrows in the figures indicate the direction in which the springs operate when the shaft rotates.

4. Where no stud gap is shown, the stud on a lever spring shall rest against the preceding lever spring or buffer spring toward the cam.

5. The contact pressure of the normally closed contacts shall be measured on the lever spring at a point midway between the contact and the stud, with the shaft on the ninth rotary step (in the case of tenth rotary step springs) and with the shaft on the tenth rotary step (in the case of eleventh rotary step springs).

6. The contact pressure of normally closed contacts shall include the effect of the combined tension of all lever springs which are tensioned, through the associated studs, against the lever spring of the normally closed contacts.

7. The contact pressure of the normally closed contacts of the make-before-break combination shall be measured at the end of the common spring.

8. The contact pressure between the No. 2 and 3 springs shall be measured at the end of the No. 3 spring.

9. The No. 2 spring shall rest against the No. 1 spring.

10. The contact pressure between the No. 1 and 2 springs shall be measured at the offset in the No. 1 spring.

11. The tension of the No. 2 spring against the No. 3 spring shall be 20 grams measured opposite the contact of the No. 2 spring.

12. The contact pressure between the No. 1 and 2 springs shall be measured at a point on the No. 1 spring midway between the contact and the stud.

13. The contact pressure between the No. 3 and 4 springs shall be measured at a point on the No. 3 spring midway between the contact and the stud, with the stud on the No. 2 spring resting against the No. 3 spring.

Table E
Variable Requirements for Release Spring Assembly

FIG. 500

(NOTES 1, 2, AND 9)

			SPRINGS 1 & 2			
CONT PRES GRAMS	T	MIN	20			
		MAX	–			
	R	MIN	20			
		MAX	–			
CONT SEP INCHES	T	MIN	–			
		MAX	–			
	R	MIN	–			
		MAX	–			

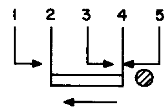


FIG. 501

(NOTES 1, 2, AND 3)

			SPRINGS 1 & 2	3 & 4	4 & 5	
CONT PRES GRAMS	T	MIN	–	–	20	
		MAX	–	–	–	
	R	MIN	–	–	20	
		MAX	–	–	–	
CONT SEP INCHES	T	MIN	0.005	0.005	–	
		MAX	0.015	0.015	–	
	R	MIN	0.007	0.007	–	
		MAX	0.013	0.013	–	

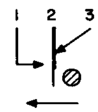


FIG. 502

(NOTE 2)

			SPRINGS 1 & 2			
CONT PRES GRAMS	T	MIN	25			
		MAX	110			
	R	MIN	35			
		MAX	100			
CONT SEP INCHES	T	MIN	0.006			
		MAX	0.035			
	R	MIN	0.008			
		MAX	0.030			

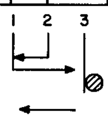


FIG. 503

(NOTES 2 AND 4)

			SPRINGS 1 & 2	1 & 3		
CONT PRES GRAMS	T	MIN	15	30		
		MAX	–	–		
	R	MIN	20	35		
		MAX	–	–		
CONT SEP INCHES	T	MIN	0.006	0.006		
		MAX	0.035	–		
	R	MIN	0.008	0.008		
		MAX	0.030	–		

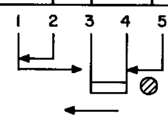


FIG. 504

(NOTES 1, 2, 4, 5, AND 6)

			SPRINGS 1 & 2	1 & 3	4 & 5	
CONT PRES GRAMS	T	MIN	15	30	–	
		MAX	–	–	–	
	R	MIN	20	35	–	
		MAX	–	–	–	
CONT SEP INCHES	T	MIN	0.006	0.006	–	
		MAX	0.035	–	–	
	R	MIN	0.008	0.008	–	
		MAX	0.030	–	–	

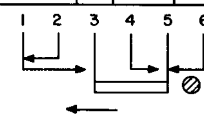


FIG. 505

(NOTES 1, 2, 4, 7, AND 8)

			SPRINGS 1 & 2	1 & 3	4 & 5	5 & 6
CONT PRES GRAMS	T	MIN	15	30	15	–
		MAX	–	–	–	–
	R	MIN	20	35	20	–
		MAX	–	–	–	–
CONT SEP INCHES	T	MIN	0.006	0.006	0.006	–
		MAX	0.035	–	–	–
	R	MIN	0.008	0.008	0.008	–
		MAX	0.030	–	–	–

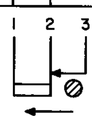


FIG. 506

(NOTES 2, 10, AND 11)

			SPRINGS 2 & 3			
CONT PRES GRAMS	T	MIN	50			
		MAX	–			
	R	MIN	50			
		MAX	–			
CONT SEP INCHES	T	MIN	0.006			
		MAX	–			
	R	MIN	0.008			
		MAX	–			

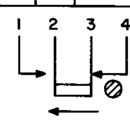


FIG. 507

(NOTES 2, 12, AND 13)

			SPRINGS 1 & 2	3 & 4		
CONT PRES GRAMS	T	MIN	–	20		
		MAX	–	–		
	R	MIN	–	–		
		MAX	–	–		
CONT SEP INCHES	T	MIN	0.007	–		
		MAX	0.013	–		
	R	MIN	–	–		
		MAX	–	–		

Notes for Fig. 500 through 506 (Table E)

1. Where no limits are specified in the contact pressure or contact separation columns, it means that they are automatically taken care of by other requirements.

2. All of the above figures show the springs in the position occupied when the switch mechanism is in the vertical normal position. The arrows in the figures indicate the direction in which the springs operate when the release magnet operates.

3. The contact pressure between the No. 4 and 5 springs shall be measured at the end of the No. 4 spring.

4. The contact pressure between the No. 1 and 2 springs shall be measured at the offset in the No. 1 spring.

5. With the stud of the No. 3 spring held away from the No. 4 spring, the No. 4 spring shall be in contact with the No. 5 spring.

6. The No. 3 spring shall have a tension against the No. 4 spring of minimum 25 grams measured opposite the contact on the No. 3 spring.

7. With the stud of the No. 3 spring held away from the No. 5 spring, the No. 5 spring shall be in contact with the No. 6 spring.

8. The tension of the No. 3 spring against the No. 5 spring shall be minimum 20 grams measured opposite the contact on the No. 3 spring.

9. Requirement 2.28 covers maximum clearance between the release armature bushing and lever spring and requirement 2.29(b) covers maximum contact pressure.

10. The contact pressure between the No. 2 and 3 springs shall be measured at the end of the No. 2 spring.

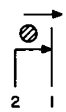
11. The stud of the No. 1 spring shall touch the No. 2 spring.

12. Contact pressure between the No. 3 and No. 4 springs shall be measured at the end of the No. 3 spring with the release armature at normal.

13. Springs No. 1 and No. 2 shall make contact and springs No. 3 and No. 4 shall break contact with the release magnet energized and a 0.007 inch gap between the release armature and the closest point on the core. Springs No. 1 and No. 2 shall not make contact with the release magnet energized and with a 0.018 inch gap between the release armature and the closest point on the core.

Table F
Variable Requirements for Rotary Interrupter Springs

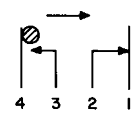
FIG. 600



(NOTES 1, AND 2)

			SPRINGS			
			1&2			
CONT PRES GRAMS	T	MIN	150			
		MAX	300			
	R	MIN	150			
		MAX	300			
CONT SEP INCHES	T	MIN	0.003			
		MAX	0.010			
	R	MIN	0.003			
		MAX	0.008			

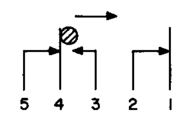
FIG. 601



(NOTES 1, 2, AND 3)

			SPRINGS			
			1&2	3&4		
CONT PRES GRAMS	T	MIN	150	30		
		MAX	300	60		
	R	MIN	150	30		
		MAX	300	60		
CONT SEP INCHES	T	MIN	0.003	0.010		
		MAX	0.010	0.020		
	R	MIN	0.003	0.010		
		MAX	0.008	0.020		

FIG. 602



(NOTES 1, 2, 3, AND 4)

			SPRINGS			
			1&2	3&4	4&5	
CONT PRES GRAMS	T	MIN	150	40	25	
		MAX	300	70	–	
	R	MIN	150	40	25	
		MAX	300	70	–	
CONT SEP INCHES	T	MIN	0.015	0.020	0.015	
		MAX	0.025	0.030	–	
	R	MIN	0.015	0.020	0.015	
		MAX	0.025	0.030	–	

Notes

1. All of the above figures show the springs in the position occupied when the switch mechanism is in the vertical normal position. The arrows in the figures indicate the direction in which the springs operate when the rotary magnet operates.

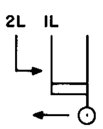
2. The contact pressure between the No. 1 and 2 springs shall be measured at the end of the No. 1 spring.

3. The contact pressure between the No. 3 and 4 springs shall be measured at the end of the No. 4 spring.

4. The contact pressure between the No. 4 and 5 springs shall be measured at the end of the No. 5 spring.

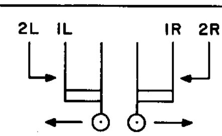
Table G
Variable Requirements for Normal Post Springs Having Metal Rollers (Fig. 13)

FIG. 700



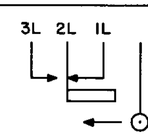
	SPRINGS			
	1L & 2L			
MIN CONT PRES GRAMS	25			

FIG. 701



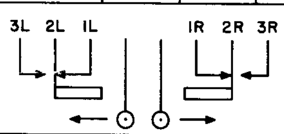
	SPRINGS			
	1L & 2L	1R & 2R		
MIN CONT PRES GRAMS	25	25		

FIG. 702



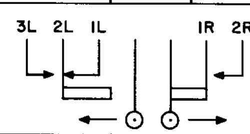
	SPRINGS			
	1L & 2L	2L & 3L		
MIN CONT PRES GRAMS	20	20		

FIG. 703



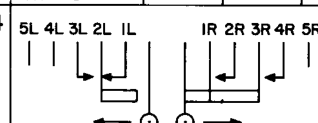
	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	2R & 3R
MIN CONT PRES GRAMS	20	20	20	20

FIG. 704



	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	
MIN CONT PRES GRAMS	20	20	25	

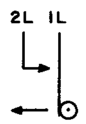
FIG. 705



	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	3R & 4R
MIN CONT PRES GRAMS	15	15	15	15

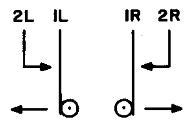
Table H
Variable Requirements for Normal Post Springs Having Rubber Rollers

FIG. 710



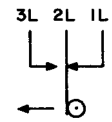
	SPRINGS			
	1L & 2L			
MIN CONT PRES GRAMS	25			

FIG. 711



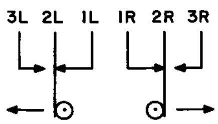
	SPRINGS			
	1L & 2L	1R & 2R		
MIN CONT PRES GRAMS	25	25		

FIG. 712



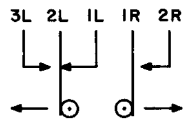
	SPRINGS			
	1L & 2L	2L & 3L		
MIN CONT PRES GRAMS	20	20		

FIG. 713



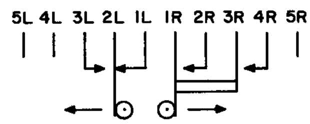
	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	2R & 3R
MIN CONT PRES GRAMS	20	20	20	20

FIG. 714



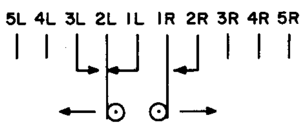
	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	
MIN CONT PRES GRAMS	20	20	25	

FIG. 715



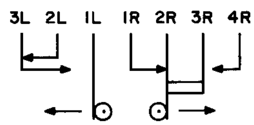
	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	3R & 4R
MIN CONT PRES GRAMS	15	15	15	15

FIG. 716



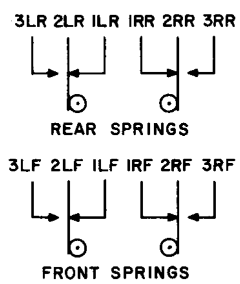
	SPRINGS			
	1L & 2L	2L & 3L	1R & 2R	
MIN CONT PRES GRAMS	20	20	25	

FIG. 717



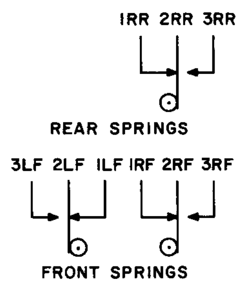
	SPRINGS			
	1L & 3L	2L & 3L	1R & 2R	3R & 4R
MIN CONT PRES GRAMS	25	20	20	20

FIG. 750



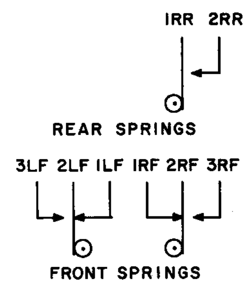
CONTACT PRESSURE
(NOTES 1, AND 2)

FIG. 751



CONTACT PRESSURE
(NOTES 1, AND 2)

FIG. 752



CONTACT PRESSURE-GRAMS
ALL CONTACTS MIN 20

Notes:

1. Contact pressure shall be minimum 20 grams except as covered in Note 2.
2. The contact pressure between the No. 1 and 2 springs of the rear spring assembly shall be minimum 15 grams measured at the end of the No. 2 spring.

Table J

Variable Requirements for Combined Rotary Off-Normal and Rotary Step Springs

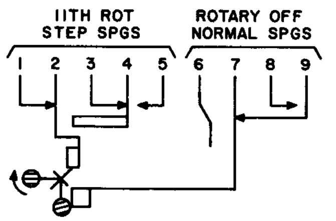


FIG. 800

(NOTES 1 TO 8 INCLUSIVE)

		SPRINGS					
		1 & 2	3 & 4	4 & 5	6 & 7	7 & 9	8 & 9
MIN CONT PRES – GRAMS	T	30	30	A	–	20	20
	R	30	30	A	–	20	20

Notes

1. When the letter "A" appears in a contact pressure column, it means that the springs shall have perceptible follow.

2. The arrows in the figures indicate the direction in which the springs operate. All the figures show the springs in the position occupied when the switch mechanism is in its vertical normal position.

3. The contact pressure between the No. 1 and 2 springs shall be measured on the No. 2 spring approximately midway between the contact and the stud.

4. The contact pressure between the No. 3 and 4 springs shall be measured on the No. 4 spring approximately midway between the contact and the stud.

5. With the shaft in the first rotary step of the first and tenth levels, the No. 7 spring shall rest against the No. 6 spring with minimum 20 grams tension measured at the bend on the long straight portion of the No. 7 spring.

6. The contact pressure between the No. 8 and 9 springs shall be measured on the No. 9 spring adjacent to the contact.

7. The eleventh rotary step spring part of the combination (springs 1 through 5) shall meet requirements 2.15 through 2.19.

8. The rotary off-normal spring part of the combination (springs 6 through 9) shall meet requirements 2.20 through 2.27 which may apply.

4. ADJUSTING PROCEDURES

4.01 ***Cleaning and Lubrication*** (Reqt 3.01)

(1) Clean the contacts in accordance with the section covering cleaning of 197- and 198-type switches.

(2) Lubricate the parts in accordance with Section 030-705-706.

4.02 ***Straightness of Contact Springs*** (Reqt 3.02)

(1) Do not straighten kinked springs unless the kink interferes with the proper adjustment of the spring assembly. Removing kinks tends to weaken the spring and shorten the life of the spring assembly.

(2) Normally straight springs that have been adjusted should have no sharp bends due to adjustment. A gradual bow, however, is permissible.

(3) Where sharp bends or kinks interfere with the proper adjustment, they may be removed on U-shaped springs as follows: Grasp the long leg of the spring firmly with the KS-7782 pliers, while holding the short leg with the 415B or 416B spring adjuster as shown in Fig. 17. In some cases it may be necessary to tilt forward the spring adjuster applied to the short leg of the spring to prevent interference with the bank or wiper of the switch above. Draw the pliers toward the end of the spring. To remove sharp bends or kinks on other lever springs, apply the KS-7782 pliers at the point where the spring meets the insulator and draw the pliers toward the end of the spring.

(4) If the springs are bowed excessively, apply the KS-7782 pliers at the far end of the bow and draw the pliers forward the length of the bow, applying a slight pressure in the direction opposite the bow. If the spring is bent, follow the same procedure as described for a bowed spring. In this case, however it will be necessary to adjust the spring from approximately 1/4-inch beyond the bend to approximately 1/4-inch in front of the bend.

4.03 ***Contact Alignment*** (Reqt 3.03): If contacts are misaligned, refer the matter to the supervisor.

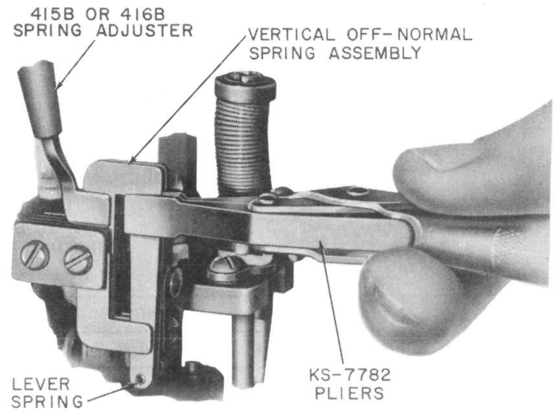


Fig. 17—Method of Adjusting U-Shaped Springs on Vertical Off-Normal Spring Assembly

PROCEDURES FOR ROTARY INTERRUPTER SPRINGS (197-Type Switches Only)

4.04 ***Contact Pressure*** (Reqt 3.04): To change the contact pressure, adjust the lever springs (U springs) as follows: Hold the short leg of the spring with the KS-7782 pliers so that the long leg passes through the recess in the jaws of the pliers. Then grasp the long leg of the spring with a second pair of KS-7782 pliers as shown in Fig. 18 and adjust it to the right or left as required. If a satisfactory adjustment cannot be obtained by adjusting the long leg of the spring, adjust the short leg near the insulators with the pliers.

4.05 ***Contact Separation*** (Reqt 3.05)

(1) To change the contact separation, adjust the stationary springs toward or away from their associated lever springs as required. Adjust the springs near the insulators with the KS-7782 pliers. In the case of extra heavy springs, proceed as follows: Loosen the rotary interrupter and cam spring bracket mounting screws with the 4-inch E screwdriver. Hold the cam spring assembly in position and shift the rotary interrupter bracket as far as possible in the required direction. Tighten the mounting screws enough to hold the brackets in position and check that the associated requirements are satisfactorily met. Then tighten the mounting screws securely.

(2) If the contact separation is still unsatisfactory, remove the switch from the frame as described in Section 030-705-701. While holding the rotary armature arm stationary with a 379A adjuster

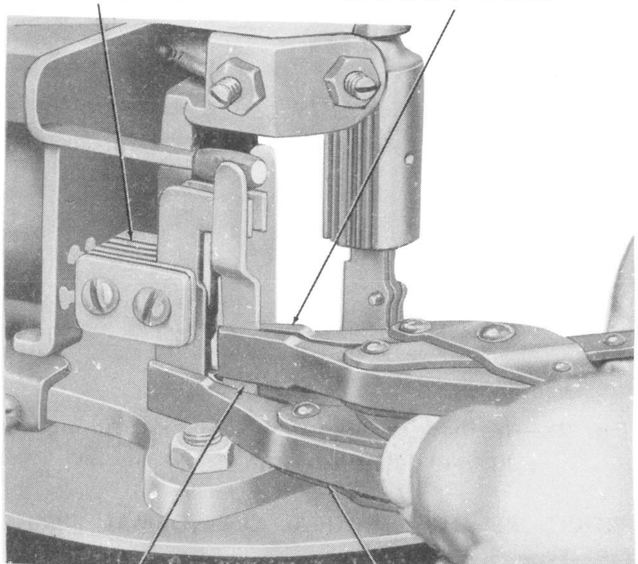


Fig. 18—Method of Adjusting U-Shaped Springs on Rotary Interrupter Spring Assembly

placed as near to the base of the arm as possible, adjust the arm as required with another 379A adjuster placed near the stud on the arm. Where the arm is to be adjusted toward the left, the adjuster nearer the base of the arm should be placed on the arm from below and the adjuster nearer the stud should be applied from above. Remount the switch in place on the frame as covered in Section 030-705-701.

Warning: Do not bend the arm more than necessary for proper adjustment, since excessive bending may cause breakage.

PROCEDURES FOR VERTICAL INTERRUPTER SPRINGS (197-Type Switches Only)

4.06 ***Interrupter Arm Play*** (Assemblies per Fig. 19) (Reqt 3.06): The sideplay of the interrupter arm is set at the factory and no adjustment is practical in the field. If the interrupter arm binds or has excessive sideplay, replace the entire bracket and spring assembly in accordance with Section 030-705-803.

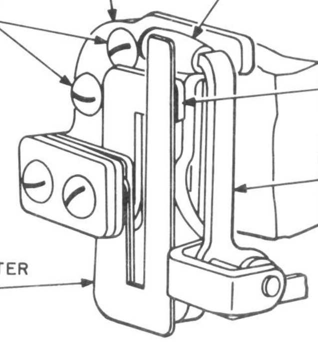


Fig. 19—Bell-Crank-Type Vertical Interrupter Spring Assembly

4.07 ***Clearance Between Interrupter Arm Stud and Interrupter Spring*** (Assemblies per Fig. 19) (Reqt 3.07): To adjust the clearance between the interrupter arm stud and the interrupter spring, mount the switch on the H-26221 switch supporting fixture. Adjust the stationary spring at a point near the insulators with the 179 adjuster or the KS-7782 pliers, toward the frame to decrease the clearance, and away from the frame to increase the clearance.

4.08 ***Contact Separation*** (Reqt 3.08)

(1) ***Assemblies per Fig. 19:*** For small changes in contact separation, loosen the two bracket mounting screws with the 4-inch E screwdriver and shift the assembly slightly. For large changes in contact separation, change the relation between the horizontal and vertical arms of the bell crank with two 273 adjusters applied to the horizontal and vertical arms of the bell crank as shown in Fig. 20. When making this adjustment, hold one 273 adjuster on the horizontal arm in the position shown in Fig. 20 and then bend the vertical arm with the other adjuster as required to obtain the desired adjustment.

(2) ***Assemblies per Fig. 21:*** To change the contact separation, adjust the lower or stationary spring upward or downward as required with the KS-7782 pliers applied at a point near the insulators.

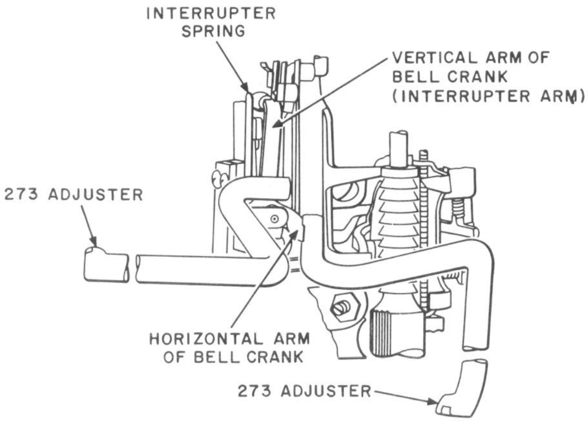


Fig. 20—Method of Adjusting for Contact Separation of Vertical Interrupter Springs per Fig. 19

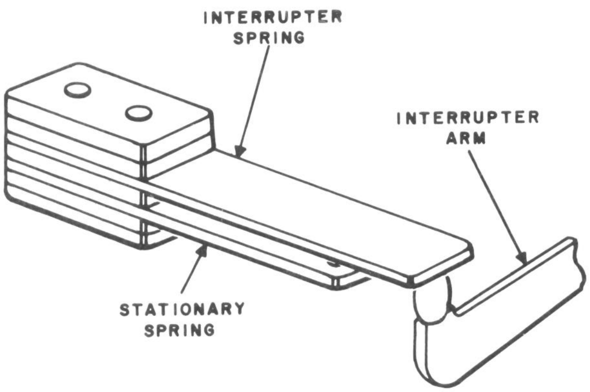


Fig. 21—Vertical Interrupter Spring Assembly of Type Operated by Vertical Armature Arm

4.09 ***Contact Pressure*** (Reqt 3.09)

(1) ***Assemblies per Fig. 19:*** To change the contact pressure, adjust the U springs as follows: Hold the short leg of the spring with the 416B spring adjuster and apply the KS-7782 pliers to the long leg near the U as shown in Fig. 22. Adjust the long leg to the right or left as required. If the springs cannot be satisfactorily adjusted in this manner, adjust the short leg of the operating spring near the insulators with the spring adjuster.

(2) ***Assemblies per Fig. 21:*** Adjust the interrupter spring at a point near the insulators with the 415B or 416B spring adjuster.

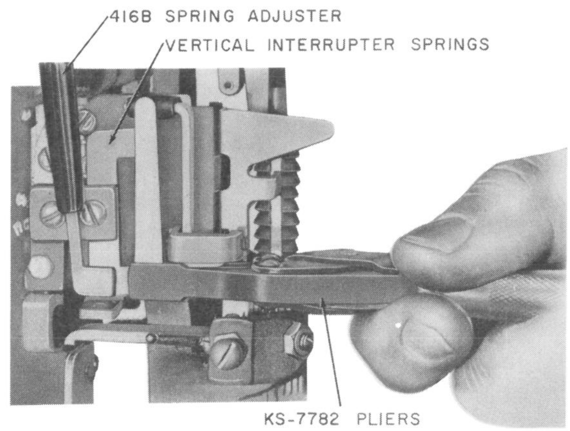


Fig. 22—Method of Adjusting U-Shaped Springs on Vertical Interrupter Spring Assembly

PROCEDURES FOR VERTICAL OFF-NORMAL SPRING (197-Type Switches Only)

4.10 ***Off-Normal Finger Clearance*** (Reqt 3.10)

(1) If either of these clearance requirements is not met, check that the first lever spring is approximately parallel to the shaft with the shaft in the normal position. If it is not, adjust it as necessary with the KS-7782 pliers.

(2) If the first lever spring is approximately parallel to the shaft, and there is insufficient clearance between the normal pin and the off-normal finger on the first rotary step, or between the normal pin clamp and the off-normal finger on the last rotary step, adjust the off-normal finger downward with the KS-7782 pliers as shown in Fig. 23. Do not adjust the off-normal finger more than is necessary to insure adequate clearance, since the adjustment of this finger affects the contact separation, contact pressure, and clearance requirements for the off-normal spring assembly. After the off-normal finger has been adjusted, check that requirements 3.11 through 3.14 are met and, if not, readjust for these requirements as necessary.

4.11 ***Contact Separation*** (Reqt 3.11)

4.12 ***Clearance Between Off-Normal Lever Stud and First Lever Spring*** (Reqt 3.12)

4.13 ***Clearance Between Lever Spring and Stud of Next Lever Spring*** (Reqt 3.13)

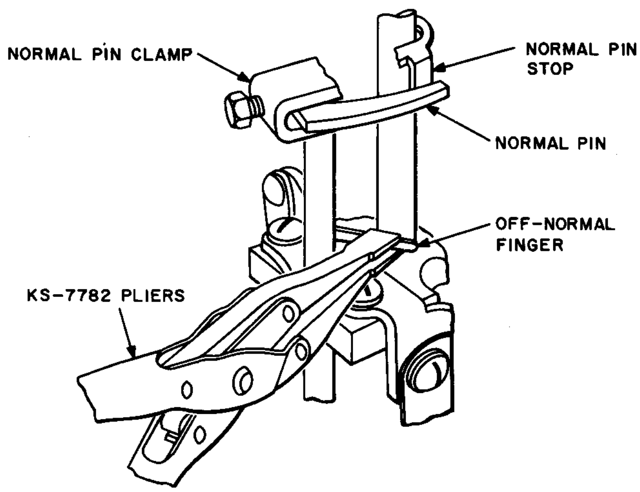


Fig. 23—Method of Adjusting the Off-Normal Finger

4.14 ***Contact Pressure*** (Reqt 3.14)

(1) Check that the first lever spring is approximately parallel to the shaft and, if necessary, adjust it with the KS-7782 pliers.

(2) Check whether requirement 3.10 is met and, if necessary, adjust the off-normal finger as described in 4.10. If this requirement is met and if the off-normal finger in its highest position interferes with the restoration of the switch when it is released from the third contact of the first level, proceed as follows: Loosen the vertical off-normal spring assembly mounting screws with the 563A and 564A offset screwdrivers or the 417A wrench, and shift the spring assembly in the direction to decrease the clearance between the off-normal lever and the casting. However, do not move the assembly so far in this direction as to prevent proper operation of the spring assembly. If the off-normal finger still interferes with the restoration of the switch, adjust the off-normal finger downward with the KS-7782 pliers as shown in Fig. 23. In shifting the off-normal spring assembly, make sure that requirement 3.10 is still met.

(3) To change the contact separation, the clearance between the stud on the off-normal lever and the first lever spring or the clearance between the first lever spring and the stud of the next lever spring, adjust the stationary springs toward or away from their respective lever springs as required using the 416B adjuster applied near the bend in the spring. If these requirements cannot be met by adjusting the individual springs, shift the off-normal spring assembly slightly as described in (2). Recheck that requirement 3.10 is still met.

(4) To change the contact pressure, adjust the U-shaped springs as follows: Hold the 415B or 416B spring adjuster on the short leg of the spring as close to the insulators as possible and apply the KS-7782 pliers to the long leg near the U as shown in Fig. 17. In some cases, it may be necessary to tilt forward the spring adjuster applied to the short leg of the spring to prevent interference with the bank or wiper of the switch above. Adjust the long leg to the right or left as required. If the springs cannot be satisfactorily adjusted in this manner, adjust the short leg of the lever spring near the insulators with the spring adjuster.

(5) To change the position of stationary springs, adjust the springs as required with the 416B spring adjuster applied to the short leg of the spring. When adjusting the springs, exercise care that the contact separation is not below the specified minimum and that the combined tension of the lever springs is not so great as to prevent the shaft from returning to vertical normal.

(6) If the contact pressure or follow requirements cannot be met, it will be necessary to shift the off-normal spring assembly slightly as covered in (2). If this is done, recheck requirements 3.10 through 3.14.

(7) After making the above adjustments, check the requirement for the freedom of the shaft to return to normal as covered in Section 030-705-702.

PROCEDURES FOR TENTH OR ELEVENTH ROTARY STEP SPRINGS (197-Type Switches Only)

4.15 ***Lever Spring Stud Clearances With Rotary Ratchet and Cam Collar*** (Reqt 3.15): To adjust for clearance between the lever spring stud and the cam collar or the rotary ratchet, loosen the spring assembly mounting screws with the 4-inch E screwdriver and shift the entire assembly as required.

4.16 ***Clearance Between Cam and Lever Spring Stud*** (Reqt 3.16): To change the clearance between the cam and the lever spring stud, loosen the cam setscrews with the 3-inch C screwdriver and shift the position of the cam as required.

4.17 ***Contact Pressure*** (Reqt 3.17)

4.18 ***Contact Separation*** (Reqt 3.18)

4.19 ***Clearance Between Lever Spring and the Stud of the Next Lever Spring*** (Reqt 3.19)

(1) To increase or decrease the contact separation or the clearance between the first lever spring and the stud of the next lever spring, apply the 416B spring adjuster to the stationary spring as near the insulators as possible. Adjust the spring to the right or left as required.

(2) To change the contact pressure, adjust the lever spring as follows: Hold a 416B spring adjuster on the short leg of the U as near the insulators as possible and apply another 416B spring adjuster to the long leg near the U as shown in Fig. 24. Adjust the long leg to the right or left as required.

PROCEDURES FOR ROTARY OFF-NORMAL SPRINGS

4.20 ***Clearance of Cam Collar*** (Reqt 3.20)

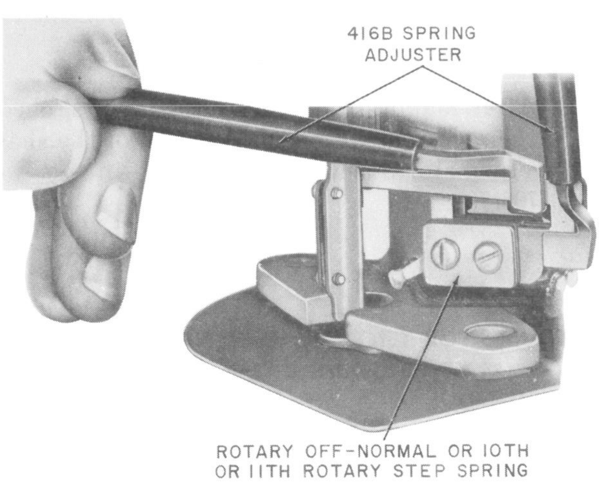


Fig. 24—Method of Adjusting U-Shaped Springs on Rotary Off-Normal or Tenth or Eleventh Rotary Step Spring Assemblies

4.21 ***Clearance of Rotary Ratched*** (Reqt 3.21): To adjust for clearance between the lever spring stud and the cam collar or the rotary ratchet, loosen the bracket mounting screws with the 4-inch E screwdriver and shift the entire spring assembly as required.

4.22 ***Relation of Buffer Spring to Adjacent Lever Spring*** (Reqt 3.22): If the buffer spring does not touch the stud of the adjacent lever spring, adjust the buffer spring toward the lever spring with the 416B spring adjuster.

4.23 ***Contact Sequence*** (Reqt 3.23)

4.24 ***Contact Separation*** (Reqt 3.24)

4.25 ***Contact Follow*** (Reqt 3.25)

4.26 ***Contact Pressure*** (Reqt 3.26)

(1) If the contacts do not make or break before the double dog drops in on the first rotary step, loosen the cam setscrews with the 3-inch C screwdriver and change the position of the cam.

(2) To change the contact separation, adjust the stationary springs toward or away from their associated lever springs as required. Do this with the 416B spring adjuster applied to the vertical portion of the spring as near the insulators as possible.

(3) To change the contact follow or contact pressure, apply the 416B spring adjuster to the stationary spring as near the insulators as possible and adjust the spring toward or away from the associated lever spring. Take care not to reduce the contact separation below the specified minimum. If the contact pressure cannot be met in this manner, adjust the lever springs as follows: Hold the spring adjuster on the short leg of the U as near the insulators as possible. Apply another 416B spring adjuster to the long leg near the U as shown in Fig. 24 and adjust the long leg to the right or left as required.

4.27 ***Cam Clearance With Buffer Spring or Lever Spring Stud*** (Reqt 3.27)

(1) ***Spring Combination Fig. 400 through 403*** (Table D): To adjust for clearance

between the cam and the buffer spring with the shaft on the first rotary step, loosen the cam setscrews with the 3-inch C screwdriver and shift the position of the cam as required.

(2) ***Springs per Fig. 800*** (Table J): To adjust for clearance between the cam and the lever spring stud, adjust the buffer spring (No. 6 spring) with the KS-7782 pliers as required.

PROCEDURES FOR RELEASE CONTACT SPRINGS (197-Type Switches Only)

Spring Combinations Per Fig. 500 (Table E)

4.28 ***Clearance Between Release Armature Bushing and Lever Spring*** (Reqt 3.28)

4.29 ***Contact Pressure*** (Reqt 3.29)

Spring Combinations Per Fig. 501 (Table E)

4.30 ***Contact Follow*** (Reqt 3.30)

4.31 ***Contact Separation*** (Reqt 3.31)

4.32 ***Contact Pressure*** (Reqt 3.32)

Spring Combinations Per Fig. 502, 503, 504, and 505 (Table E)

4.33 ***Contact Separation*** (Reqt. 3.33)

4.34 ***Contact Pressure*** (Reqt 3.34)

Spring Combinations Per Fig. 506 (Table E)

4.35 ***Clearance Between Release Armature Bushing and Lever Spring*** (Reqt 3.35)

4.36 ***Contact Separation*** (Reqt 3.36)

4.37 ***Contact Pressure*** (Reqt 3.37)

(1) To adjust the springs to meet the clearance between the release armature bushing and lever spring, the contact pressure, and contact follow requirements, proceed as follows: Apply the 416B spring adjuster to the short leg of the spring as near the insulators as possible and apply the KS-7782 pliers to the long leg near the U as shown in Fig. 25. Adjust the spring to the right or left as required.

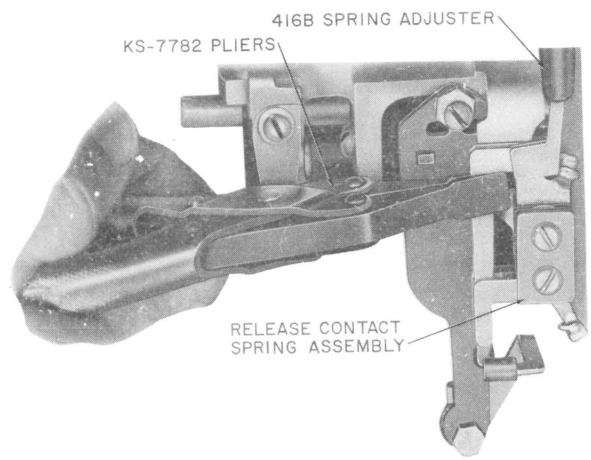


Fig. 25—Method of Adjusting U-Shaped Springs on Release Contact Spring Assemblies

(2) To adjust the springs to meet the contact separation requirement, apply the 416B spring adjuster to the stationary spring and adjust the spring toward or away from the lever spring as required.

(3) Note that the release armature bushing on the release armature arm clears the stationary springs. If it does not, adjust the arm with the KS-7882 pliers to obtain sufficient clearance.

PROCEDURES FOR NORMAL POST SPRINGS (197-Type Switches Only)

Normal Post Spring Assemblies Per Fig. 26 through 29

4.38 ***Position of Normal Post Spring Assembly*** (Reqt 3.38)

(1) If the rollers on the roller springs do not clear the shaft spring bracket, loosen the spring assembly setscrew with the 476A wrench and shift the spring assembly as necessary. Retighten the setscrew securely.

(2) If the rollers on the roller springs are not properly centered with respect to the camteeth, loosen the spring assembly setscrew with the 476A wrench and rotate the spring assembly as necessary to properly center the rollers. Retighten the setscrew securely.

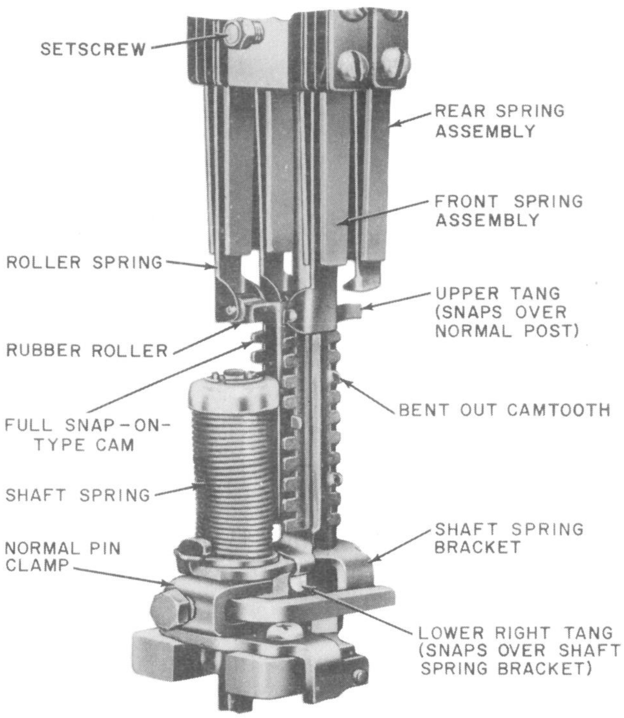


Fig. 26—Normal Post Spring Assembly Having Rubber Rollers Operated by Full Snap-On-Type Cam

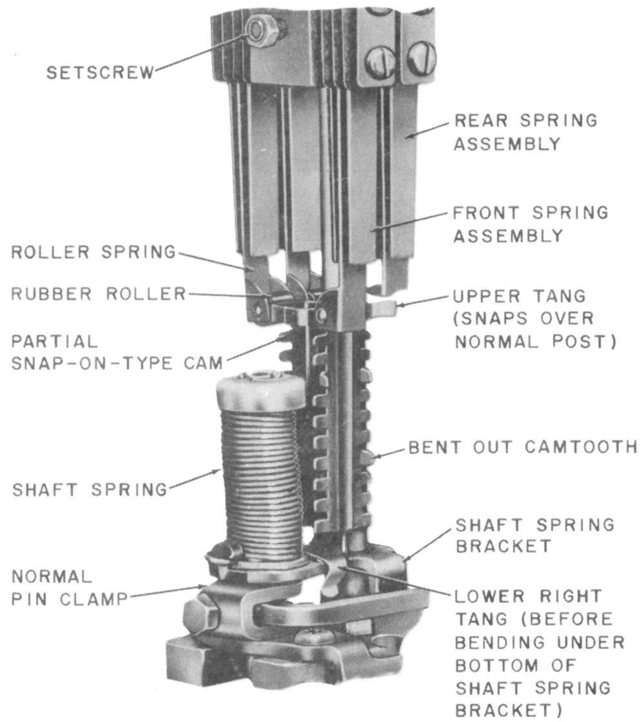


Fig. 27—Normal Post Spring Assembly Having Rubber Rollers Operated by Partial Snap-On-Type Cam

4.39 ***Position of Normal Post Camteeth*** (Reqt 3.39)

(1) To adjust the teeth of the normal post cam, proceed in accordance with (2) if the switch has a full snap-on-type cam per Fig. 26; in accordance with (3) if the switch has a partial snap-on-type cam per Fig. 27; or in accordance with (4) if the switch has a nonsnap-on-type cam per Fig. 28 or 29.

Warning: In removing the snap-on-type cams, the tangs may be distorted even if the cam is removed carefully, so that requirement 3.40 may not be met when the cam is remounted; therefore, it is important to check this requirement after remounting the cam.

(2) ***Full Snap-On-Type Cam per Fig. 26***

(a) Remove the cam as follows: Carefully pry the lower right tang of the cam free from the shaft spring bracket by inserting

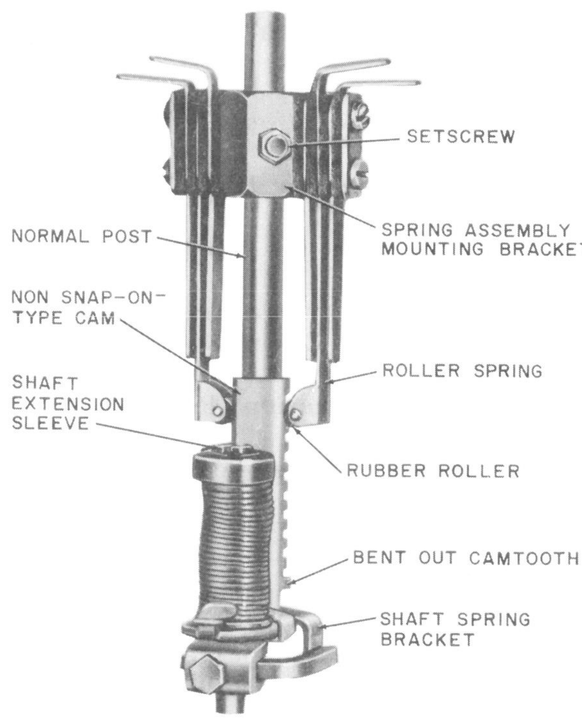


Fig. 28—Normal Post Spring Assembly Having Rubber Rollers Operated by Nonsnap-On-Type Cam (Single Cam Illustrated)

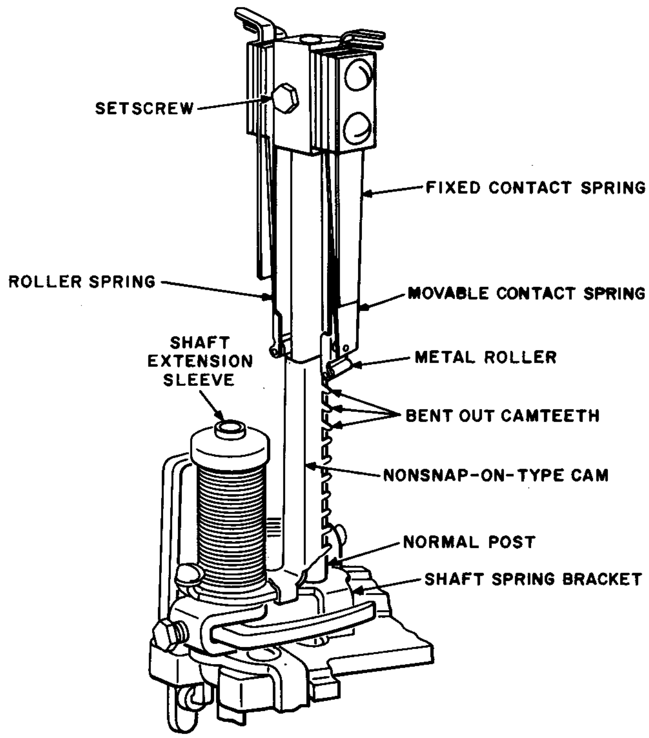


Fig. 29—Normal Post Spring Assembly Having Metal Rollers Operated by Nonsnap-On-Type Cam

the 3-inch C screwdriver behind the end of the tang under the bracket. Pivot the screwdriver on the right rear corner of the upper lug of the normal pin clamp. Raise the cam until it is above the shaft spring. Then grasp the lower right tang of the cam with the B long-nose pliers and pull the lower part of the cam forward until the upper part is forced from the normal post.

(b) Bend out the teeth of the normal post cam as covered in (5).

(c) After the teeth have been bent out, snap the cam onto the upper part of the normal post. Then slide the cam downward until the lower tangs span the shaft spring bracket.

(d) If the cam does not slide freely on the normal post, remove the cam as covered in (a) and correct the condition as covered in 4.40. Remount the cam as covered in (c).

(e) Press the cam downward and to the left using a finger or the KS-6320 orange stick to snap the lower right tang under the lower edge of the shaft spring bracket.

(f) Check the vertical play between the cam and the shaft spring bracket (Reqt 3.40). If the requirement is not met, correct the condition as covered in 4.40(3).

(g) Remount the cam as covered in (c) and (e).

(3) ***Partial Snap-On-Type Cam per Fig. 27***

(a) Remove the cam as follows: Bend outward slightly with the B long-nose pliers the lower right tang which is bent under the shaft spring bracket. To avoid breaking the tang, do not bend it any more than necessary. Then remove the cam from the switch as covered in (2)(b) and bend out the teeth of the cam as covered in (5).

(b) After the teeth have been bent out, proceed as covered in 2(c) through (g). However, in this case bend the lower right tang of the cam under the bottom edge of the shaft spring bracket using the B long-nose pliers.

(4) ***Nonsnap-On-Type Cam per Fig. 28 and 29***

(a) Remove the cam as follows: Place a pencil mark on the normal post above the normal post spring assembly to indicate the vertical position of the assembly. Then loosen the spring assembly setscrew with the 476A wrench and remove the spring assembly from the top of the normal post.

(b) Place a vertical pencil mark approximately 1/2-inch long on the shaft spring to facilitate remounting the spring. Grasp the spring cap with the fingers and turn the cap in a clockwise direction as far as the bayonet slot will permit. Then lift the cap so the crossbar is free of the slot and allow the spring to unwind slowly. Disengage the lower loop of the spring from the lug on the shaft spring bracket and remove the spring from the shaft extension sleeve.

(c) Remove the cam and shaft spring bracket from the top of the normal post. Disengage the cam from the bracket. Bend out the teeth of the cam as covered in (5).

(d) After the teeth have been bent out, remount the cam on the shaft spring bracket. Check the vertical play between the cam and the shaft spring bracket. (Reqt 3.40). If the requirement is not met, remove the cam from the bracket and correct the condition as covered in 4.40(3).

(e) Remount the shaft spring bracket and cam on the normal post and shaft extension sleeve. If the cam does not slide freely on the normal post, remove the cam and bracket from the normal post and correct the condition as covered in 4.40(2). Remount the cam and shaft spring bracket on the normal post and shaft extension sleeve.

(f) Lubricate the shaft extension sleeve as covered in Section 030-705-706. Place the shaft spring over the sleeve and engage the lower loop of the spring with the lug on the shaft spring bracket. Turn the shaft spring cap in a clockwise direction. After each quarter turn, the crossbar in the spring cap may be placed into the slots in the sleeve to maintain the tension while a new hold is secured on the cap. Continue to turn the shaft spring until the pencil mark placed on the spring forms a vertical line. The shaft spring will then have the same tension as it did prior to its removal. Make sure that the crossbar in the spring cap is engaged in the bayonet slots to lock the spring firmly in position. Check that the shaft spring tension requirement is met.

(g) Remount the normal post spring assembly on the normal post, aligning the top of the assembly with the pencil mark placed on the normal post. Tighten the setscrew securely. Check requirements 3.40 through 3.45.

(5) ***Method of Adjusting Camteeth:*** Hold the cam with the KS-7782 pliers and place the slot of the KS-20266 adjuster over the tooth to be adjusted, with the bottom of the slot against the outer end of the tooth. Center the adjuster on the tooth. Bend the tooth as required until it is at right angles to the side of the cam, maintaining pressure against the tooth at all times to avoid burning.

Note: The teeth of normal post cams are designated as follows:

Tooth Number: The teeth are numbered from one to ten, beginning at the top of the cam.

Tooth Row: The rows are designated L (left) and R (right) as viewed from the front of the cam.

Front or Rear: (double cam only) The two rows of teeth at the front are designated F; the two rows at the rear, R.

Examples of Tooth Designations

(a) 2L indicates the second tooth from the top in the left row of a single cam.

(b) 3RR indicates the third tooth from the top in the right rear row of a double cam.

Teeth numbered one (at the top of the cam) are associated with level No. 1 (bottom level) on the switch. Teeth numbered ten (at the bottom of the cam) are associated with No. 0 (top) level on the switch.

4.40 ***Normal Post Cam Play*** (Reqt 3.40)

(1) If the cam binds on the normal post, check whether there is play at the lower right tang. If there is insufficient play at this point, proceed as covered in (2). If the cam binds at the upper tangs, remove the cam and adjust the tangs as covered in (3). If the play between cam and shaft spring bracket is excessive, adjust the lower right tang as covered in (4).

(2) If there is insufficient vertical play between the lower right tang of the cam and the shaft spring bracket, remove the cam as covered in 4.39. Adjust the tang as necessary using the B long-nose pliers. Remount the cam as covered in 4.39 and recheck the requirement.

(3) If there is insufficient play between the upper tangs of the cam and the normal post, remove the cam as covered in 4.39 and bend the tangs slightly outward using the B long-nose pliers. Remount the cam as covered in 4.39 and recheck the requirement.

(4) If the maximum limit of vertical play is exceeded, proceed as follows: With the cam in position on the shaft spring bracket, engage

the horizontal portions of the lower right tang of the cam between the jaws of the B long-nose pliers and squeeze the pliers to reduce the play between tang and bracket. Recheck the requirement.

4.41 ***Relation of Normal Post Cam to Rollers*** (Reqt 3.41)

4.42 ***Contact Separation*** (Reqt 3.42)

4.43 ***Contact Pressure*** (Reqt 3.43)

4.44 ***Spring Tension*** (Reqt 3.44)

4.45 ***Contact Sequence*** (Reqt 3.45)

4.46 ***Roller Spring Position*** (Reqt 3.46)

(1) To adjust a normal post spring, apply the KS-7782 pliers or the R-3159 adjuster to the spring at the point where the spring leaves the insulators. Use the pliers on all except the rear springs of assemblies having both front and rear springs. Use the R-3159 adjuster to adjust the rear springs of these assemblies. Adjust the springs to the right or left as required.

(2) To change the relation between the roller and the camteeth, adjust the roller spring toward or away from the camteeth as required. On assemblies per Fig. 29 where a No. 2 spring which is a movable contact spring moves when play is taken up between the cam and the normal post, adjust the No. 1 contact spring in the direction away from the roller spring. This increases the clearance between the stud on the No. 2 spring and the roller spring.

(3) To change the contact separation, contact pressure, spring tension, or the contact sequence between springs on either side of the normal post, adjust the fixed contact springs toward or away from their associated roller springs (or movable springs on assemblies per Fig. 29). Increasing the contact pressure decreases the contact separation.

(4) If the proper contact pressure, contact separation, or sequence between contact springs cannot be obtained by adjusting the springs, check whether the camteeth meet requirement 3.39. Where necessary, adjust the camteeth as described in 4.39. If adjusting the teeth does not clear the trouble, replace the normal post cam as described in Section 030-705-803.

(5) Where difficulty is experienced in meeting the spring tension requirement, adjust the clearance between the roller spring and the camteeth toward the maximum and the contact pressure of normally open contacts toward the minimum consistent with meeting the other requirements.

Note: Failure of the switch to return to vertical normal when checking the spring tension requirement may also be due to one or more of the following conditions:

(a) Bind in the rollers of the normal post roller springs. If metal rollers bind, lubricate them in accordance with Section 030-705-706. If this does not clear the trouble, replace the spring assembly. If rubber rollers bind, replace the spring assembly.

(b) Inadequate lubrication of the normal post camteeth associated with spring assemblies having metal rollers. Lubricate the teeth if necessary in accordance with Section 030-705-706.

(c) Failure to meet the requirement for freedom of the shaft to return to vertical normal as covered in Section 030-705-702.

Normal Post Spring Assembly Per Fig. 30

4.47 ***Normal Post Operating Spring Position*** (Reqt 3.47)

4.48 ***Clearance Between Normal Post Operating Spring and Shaft Spring Bracket*** (Reqt 3.48)

4.49 ***Contact Pressure*** (Reqt 3.49)

4.50 ***Contact Separation*** (Reqt 3.50)

Normal Post Spring Assembly Per Fig. 31

4.51 ***Normal Post Operating Spring Position*** (Reqt 3.51)

4.52 ***Clearance Between Normal Post Operating Spring and Normal Post Collar (Reqt 3.52)***

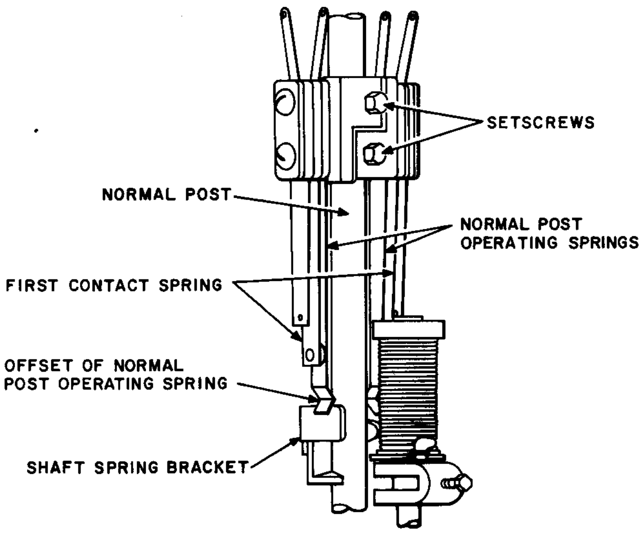


Fig. 30—Normal Post Spring Assembly Operated by Offset Shaft Spring Bracket

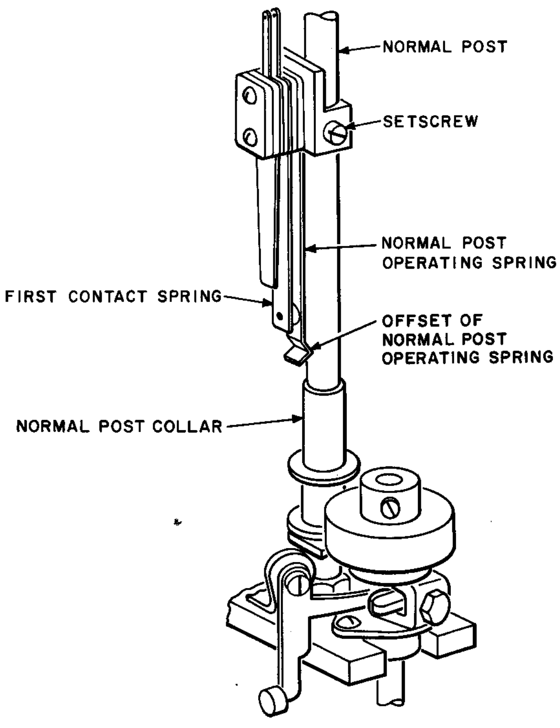


Fig. 31—Normal Post Spring Assembly Operated by Normal Post Collar

4.53 *Contact Follow* (Reqt 3.53)

4.54 *Contact Separation* (Reqt 3.54)

Normal Post Spring Assembly Per Fig. 32

4.55 *Normal Post Operating Spring Position* (Reqt 3.55)

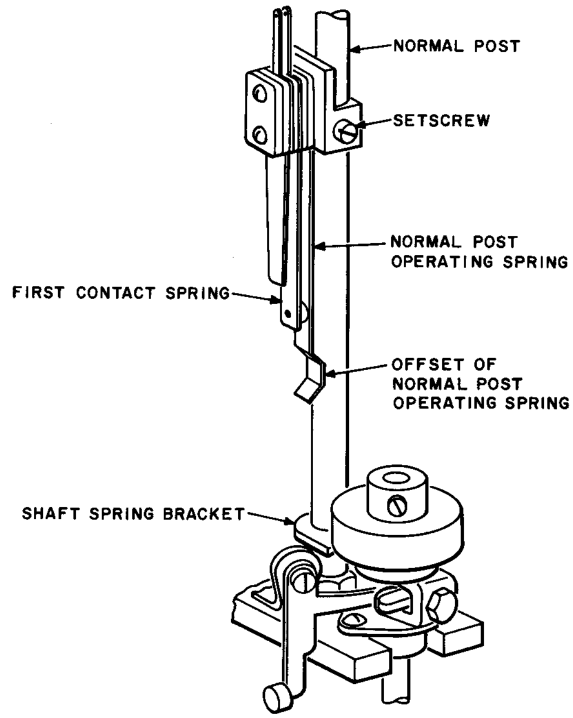


Fig. 32—Normal Post Spring Assembly Operated by Straight Shaft Spring Bracket

4.56 *Contact Follow* (Reqt 3.56)

4.57 *Contact Separation* (Reqt 3.57)

(1) To adjust the clearance between the off-set portion of the normal post operating spring and the normal post, change the relative tension of the normal post operating spring and the first contact spring against each other. Change the tension of the springs by adjusting them toward each other to increase the tension, or away from each other to decrease the tension. Adjust the springs near the insulators with the KS-7782 pliers.

(2) To change the clearance between the normal post operating spring and the shaft spring bracket or normal post collar or to change the position of the normal post springs, loosen the setscrew or screws in the normal post spring assembly with the 4-inch E screwdriver and move the assembly up or down on the normal post as required.

(3) To adjust for contact pressure, contact separation, or contact follow, adjust the stationary springs toward or away from their associated lever springs as required. Adjust the springs near the insulators with the KS-7782 pliers.