211- AND 212-TYPE SWITCHES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 211- and 212-type switches.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

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

1.04 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department handbook.

1.05 The normal (unoperated) position is that in which the lever is fully seated in its upward position with the normally open contacts open and the normally closed contacts closed.

1.06 The operated position is that in which the lever is fully seated in its downward position with the normally open contacts closed and the normally closed contacts open.

2. REQUIREMENTS

2.01 Cleaning

(a) Contacts shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts and parts.

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

2.02 Cover Fit The cover shall fit snugly but not so tightly as to prevent placing or removing it with the fingers. Gauge by feel.

2.03 Tightness of Screws and Nuts All screws and nuts shall be tightened sufficiently to hold the associated parts in their adjusted positions. Gauge by feel.

2.04 Shaft and Roller Movement The shaft and roller shall move freely in their bearings when relieved of the load. Gauge by feel. To relieve the shaft of the load insert a 4" regular screw-driver between the backstop strip support at the end further from the lever, and the draw bar strip, and force the draw bar strip towards the lever.

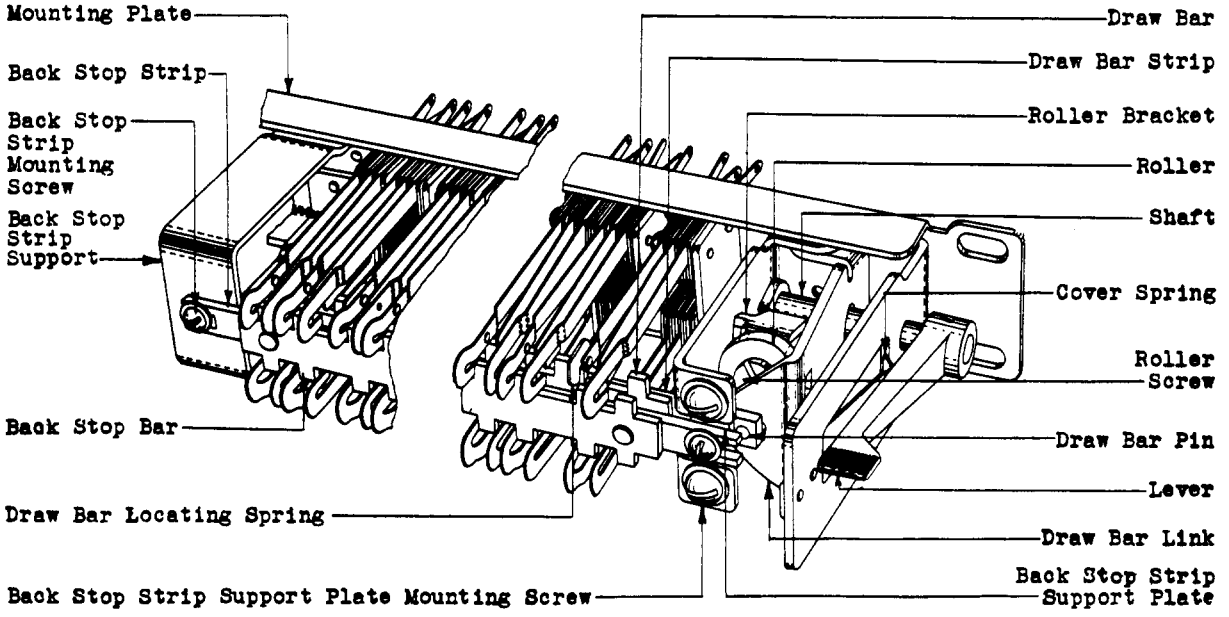


Fig. 1 - General View of Switch

2.05 Contact Alignment - Fig. 2 (A) - Contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact. Gauge by eye.

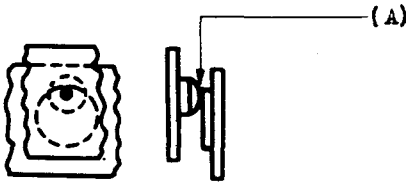


Fig. 2

2.06 Spring Tang Position

(a) Fig. 3 (A) - The spring tangs shall engage vertically with the sides of the notches in the draw bar and back stop bar.
Test - Min. 1/32"
Readjust - Min. 1/16"
Gauge by eye.

(b) Fig. 3 (B) - The spring tangs shall clear the bottoms of the notches in the draw bar and back stop bar. Gauge by eye.

2.07 Tang Clearance - Fig. 3 (C) - When the long contact springs are made with the short contact springs, the clearance between the tangs of the long contact springs and the sides of the notches in the back stop bar shall be
Test - Min. .020"
Readjust - Min. .025"
Gauge by eye.

2.08 Straightness of Springs All springs shall be free from sharp bends or kinks due to adjustment. A gradual bow in a spring is permissible. Gauge by eye.

2.09 Contact Separation - Fig. 3 (D) - The contact separation between any pair of contacts normally open or between any pair of contacts that are opened when the switch is operated shall be
Test - Min. .013"
Readjust - Min. .015"
Gauge by eye.

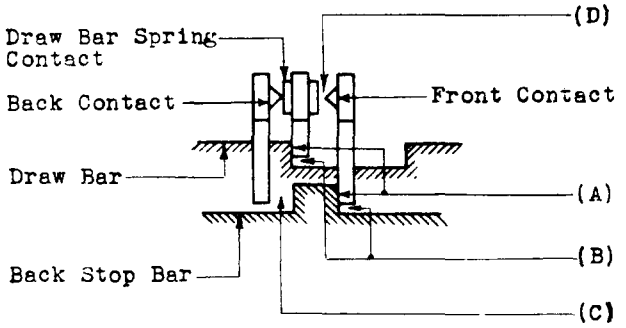


Fig. 3

2.10 Contact Spring Clearance

(a) Fig. 4 (A) - The clearance between all contact springs for all positions of the lever shall be
Test - Min. .013"
Readjust - Min. .015"
Gauge by eye.

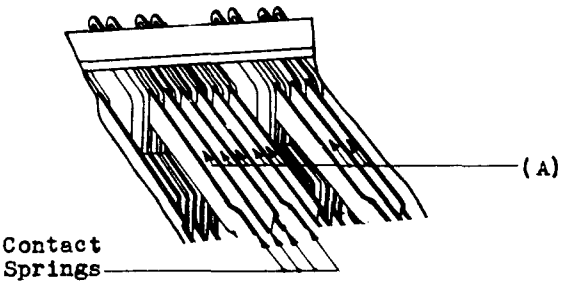


Fig. 4

(b) The clearance between the contact springs and the edges of the slots in the mounting plate shall be
Min. 1/64 inch
Gauge by eye.

2.11 Draw Bar Locating Spring Tension - Fig. 5 (A) - The tension of each arm of the draw bar locating springs against the draw bar shoulders, when the switch is in the unoperated position shall be
Min. 5 grams
Use the No. 68-B gauge.

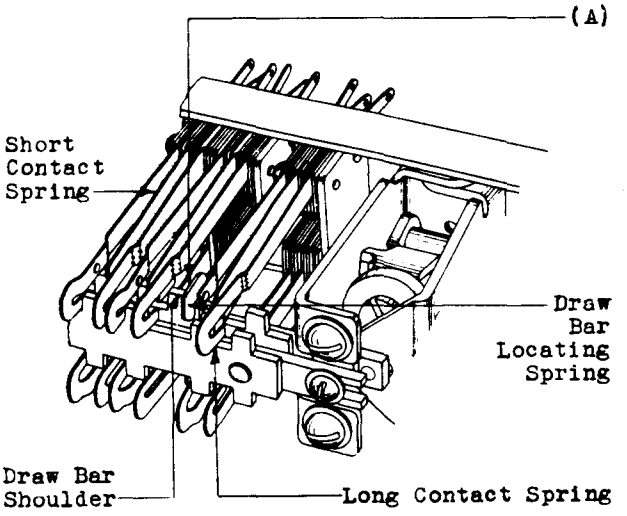


Fig. 5

2.12 Tang Pressure - Fig. 6

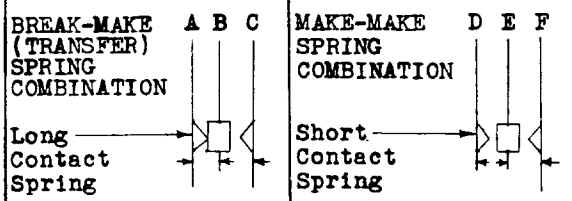
(a) The tension of the contact spring tangs shall be in accordance with the table below. The shorter springs shown are those which are tensioned against the draw bar. The longer springs are tensioned against the back stop bar.

(b) The arrows in this figure indicate the direction in which the springs are tensioned. In measuring the tension specified, apply the gauge to the spring at the contact. A spring tensioned against the back stop bar or draw bar shall register the required tension when the tang of the spring is lifted slightly off the back stop bar or the draw bar associated with it. Use the Nos. 68-B and 70-E gauges.

(c) The tension of spring "B" shall be measured with the spring "A" lifted away from the spring "B".

(d) When the switch is in the unoperated position, the combined tension of contact springs and draw bar locating springs shall be sufficient to exclude all end play between the roller and the large opening in the draw bar link. Gauge by feel.

DIRECTION OF SWITCH OPERATION »→



SPRINGS	POSITION OF SWITCH	TENSION IN GRAMS			
		Test		Readjust	
		Min.	Max.	Min.	Max.
A	Operated	10	30	15	25
B	Non-Operated	45	75	50	65
C	Non-Operated	10	30	15	25
D	Non-Operated	20	40	25	35
E	Non-Operated	5	15	5	15
F	Non-Operated	10	30	15	25

Fig. 6

2.13 Contact Sequence - Break-Make (Transfer) Spring Combinations Fig. 7 (A) - The back contact shall break from the draw bar spring contact before the front contact makes with it. Gauge by eye.

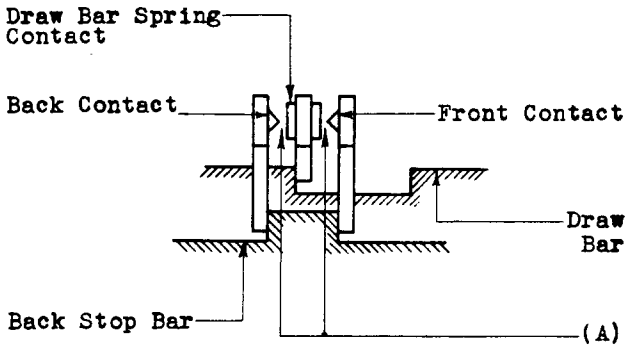


Fig. 7

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges and Materials

Code No.	Description
Tools	
412-A	Spring Adjuster (Drawbar locating springs)
416-A	Spring Adjuster (Contact springs)
417-A	Wrench 1/4" and 3/8" Hex. Open Double-End Flat
KS-6320	Orange Stick
-	Bell System Regular Screwdriver 4" per A.T.& T.Co. Drawing 46-X-34
-	Bell System P-Long Nose Pliers 6-1/2" per A.T.& T.Co. Drawing 46-X-56
Gauges	
68-B	70-0-70 Gram Gauge
70-E	150-0-150 Gram Gauge
Materials	
KS-2423	Cloth
KS-7860	Petroleum Spirits

3.002 Direct battery is connected to some of the contact springs of the switch. In order to avoid operating fuses, exercise care when adjusting the switch to prevent the crossing of springs.

3.01 Cleaning (Rq.2.01)

(1) Clean the contacts in accordance with the section covering cleaning procedures for relay contacts and parts. Clean other parts in accordance with procedure 3.04, (3).

3.02 Cover Fit (Rq.2.02)

(1) To increase or decrease the tension of the cover springs against the cover, adjust them to the right or left as required with a screw-driver.

3.03 Tightness of Screws and Nuts (Rq.2.03)

(1) Contact Spring Assembly Screws If the springs in an assembly are loose tighten the contact spring assembly screws. To do this it will be necessary to remove the contact spring assembly from the mounting plate. Remove the back stop strip mounting screws using the 4" regular screw-driver and remove the back stop strip by pulling it forward.

(2) Remove the two screws which fasten the back stop strip support plate to the support, using the 4" regular screwdriver.

(3) See that the switch is in the unoperated position. Move the left draw bar locating spring to the right, and press the extreme left end of the draw bar backwards as far as it will go. Release the right draw bar locating spring from the draw bar shoulder by moving the spring to the right. Press the left end of the draw bar slightly in and to the right, so as to release the draw bar link from the draw bar pin. While still pressing on the left end of the draw bar with one hand, move the link as far as it will go to the right, and with the other hand press the right end of the draw bar back against the locating springs. Rotate the draw bar from a vertical to a horizontal position and draw it free from the switch.

(4) Unsolder the wires from the terminals of the spring assembly requiring adjustment. Remove the spring assembly mounting screws using the 4" regular screw-driver and remove the spring assembly. Tighten the spring assembly screws using the 4" regular screw-driver.

(5) Before remounting the spring assembly on the mounting plate, see that the contact alignment requirement is met on all the spring assemblies of the switch.

(6) Mount the contact spring assembly on the mounting plate and tighten the contact spring assembly mounting screws securely, using the 4" regular screwdriver, making sure that the terminal ends of the contact springs clear the mounting plate in all positions and that the springs of each assembly line up with the springs in every other spring assembly.

(7) The technique used in placing the draw bar of each switch in its proper position is radically different, depending on whether the switch has make-make or break-make (transfer) spring combinations. In the event that the switch has only break-make (transfer) spring combinations proceed as outlined in (8). In all other cases proceed as outlined in (9).

(8) Switches having Break-Make (Transfer) Spring Combinations See that the link is as far as possible to the right. Insert the draw bar strip in a horizontal position so that the locating springs will fit into the notches to the right of the shoulders of the strip against which it is normally tensioned. Rotate the draw bar strip to a vertical position, moving the strip slightly to the right or left to facilitate this operation. Press the left end of the draw bar strip against the locating spring as far

3.03 (Continued)

as it will go. This will allow the right end of the draw bar strip to extend outward. Allow the right end to spring out until the link can be swung back of the pin. Press the draw bar strip to the right and inward until the pin drops into the hole in the link. Pull the draw bar forward until the locating springs snap into position raising or lowering the draw bar strip slightly to facilitate this operation.

(9) Switches having Make-Make Spring Combinations See that the link is as far as possible to the right. Hold the draw bar at both ends in its normally mounted position, insert it through the opening in the back stop springs, lining up the shoulders in the draw bar approximately with the locating springs so as to obtain the proper position. It may be necessary to move the back stop springs to the right or left to facilitate inserting the draw bar. With the draw bar inserted past the tangs of the back stop springs, move the locating springs to the right or left so that they rest in the draw bar notches associated with the shoulders. Draw the right end of the draw bar forward enough to allow the link to pass behind the pin and move the link to the left and the draw bar to the right until the end of the pin engages the hole in the link. With the right hand, press the right end of the draw bar against the link and the locating spring. Then, with the left hand, push the draw bar springs to the right or left into their proper notches, working from the right end of the draw bar toward the left. Move the middle spring to the left, and the left spring to the right in order to guide them into their proper notches. If the switch has break-make (transfer) spring combinations also, move the draw bar spring to the right. Proceed to the left of the switch, gradually changing the position of the fingers of the right hand, working them more and more to the left. Continue fitting the draw bar springs into their proper notches until all the springs have been inserted, when the draw bar will snap into its proper position in the locating springs. Move the draw bar up or down slightly to allow the locating springs to take their proper position on the shoulders of the draw bar. If the draw bar does not snap into position after all the springs are inserted in their proper notches, press it slightly to the right while moving the link to facilitate the complete engagement of the pin in the hole.

(10) Mount the back stop strip support plate in position, fastening it to the support by securely tightening the screws, using the 4" regular screw-driver. Make sure that the washers associated with the screws are placed in their proper position against the frame.

(11) Replace the back stop strip so that the contact springs engage the proper notches. If difficulty is found in placing the strip in this position, facilitate the insertion of the strip between the springs by first resting the left end of the strip on the support at the left of the spring assemblies. Hold the strip to the support and with the right hand move the springs to the right or left of the notches, gently pushing the strip into position between the springs. Replace the back stop strip clamping screws holding the strip in position while tightening the screws with the 4" regular screw-driver. Solder the wires which were previously removed, to the proper terminals.

(12) Locating Spring Screws To tighten the screws holding the locating spring to the mounting bracket, it will be necessary to remove the contact spring assembly associated with the locating spring, as covered above. See that the locating spring is in its proper adjustment by observing that it is centrally located with respect to the upper and lower contact springs closest to it.

(13) Tighten the locating spring mounting screws securely, using the 4" regular screw-driver.

(14) Replace the apparatus which was removed as covered above. Resolder the wires to the proper terminals. Check the requirements covering the clearance of the contact springs and contact spring tangs, and, if necessary, readjust the apparatus involved.

(15) Back Stop Bar and Strip Mounting Screws and Back Stop Strip Support Plate and Support Mounting Screws Tighten any loose mounting screws using the 4" regular screw-driver. Check that the proper relation exists between the back stop bar and the contact spring tangs and contact springs and adjust the apparatus as covered above to bring about this condition.

(16) Spring Assembly Bracket Mounting Screws To fasten loose spring assemblies to the mounting plate, tighten the mounting screws with the 4" regular screw-driver. Make sure that the requirement covering the clearance between the terminal ends of the contact springs and the mounting plate is met, and that the spring assembly as a whole is lined up to the right and left of it.

3.03 (Continued)

(17) Roller Bracket Mounting Screw Operate the switch and tighten the screw which fastens the roller bracket to the shaft, using the 4" regular screwdriver. Check that no play exists between the shaft and the roller bracket. Due to the proximity of adjacent apparatus, it may be necessary, before tightening the screw, to first remove the back stop strip, support plate and draw bar strip as covered above, and the link and support assembly.

(18) Remove the link and support assembly by removing the screws which hold these parts to the mounting plate, using the 4" regular screw-driver. Draw these parts forward and tighten the roller bracket mounting screw, using the 4" regular screw-driver. Remount the link and support assembly, tightening these parts to the mounting plate. Remount the draw bar strip, support plate and back stop strip, as covered above, and readjust if necessary for the proper location of these parts.

(19) Roller Screw and Roller Screw Lock Nut Remove the link and support assembly as covered above. Loosen the roller bracket mounting screw, using the 4" regular screw-driver, and withdraw the shaft. Remove the roller bracket. Holding the lock nut with the No. 417-A wrench, tighten the roller screw, using the 4" regular screw-driver. Remount the roller bracket assembly and insert the shaft into its proper position in the link and support assembly. Tighten the roller bracket mounting screw, using the 4" regular screw-driver. Remount the link and support assembly. Replace the draw bar strip, support plate, and back stop strip, and readjust, if necessary, for the proper location of these parts.

3.04 Shaft and Roller Movement (Rq.2.04)

(1) To determine if the shaft or roller moves freely in its bearings raise the lever to a position between the non-operate and operate positions so that the roller rests on the link between the two openings. Then place the blade of the 4" regular screw-driver against the left end of the draw bar strip, using the support at the left of the switch as a fulcrum as shown in Fig. 8. Move the draw bar to the right by moving the screwdriver handle to the left enough to remove the spring load from the roller. Raise and lower the lever while the load is thus removed and spin the roller using an orange stick. If a bind is noticed, proceed as follows:

(2) Remove the back stop strip, the support plate and the draw bar strip, the link and support assembly, as covered in procedure 3.03.

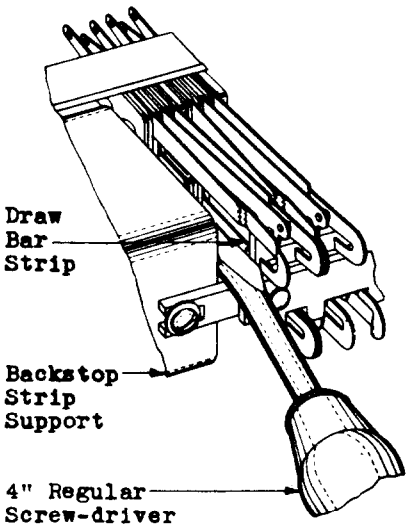


Fig. 8 - Method of Relieving Draw Bar Link of Spring Load

(3) Loosen the roller bracket mounting screw and draw the shaft from its bearings. If the screw is not accessible loosen the mounting plate mounting screws and draw the plate forward so as to make the screw accessible. Clean the shaft with a KS-2423 cloth moistened with KS-7860 petroleum spirits and the bearings in the same way, using a KS-6320 orange stick, if necessary, to force the cloth into the bearings. Wipe off these parts with a clean, dry KS-2423 cloth. If the roller binds also, loosen the roller screw lock nut with the No. 417-A wrench and remove the roller screw, using the 4" regular screw-driver. Clean the roller screw and the part of the roller which bears against the roller screw with a KS-2423 cloth moistened with KS-7860 petrolenm spirits using a KS-6320 orange stick if necessary to force the cloth into the hole in the roller. Wipe off these parts with a clean, dry KS-2423 cloth. Assemble the roller, roller screw, and lock nut. Replace the shaft in its proper position and tighten the roller bracket mounting screw against the flat section of the shaft.

(4) Replace the other parts which were removed as covered in procedure 3.03. Check and readjust, if necessary, for any requirements which are not now met, due to the removal and replacement of the parts listed above.

3.05 Contact Alignment (Rq.2.05)
3.06 Spring Tang Position (Rq.2.06)
3.07 Tang Clearance (Rq.2.07)

(1) Contact Alignment If the contacts do not line up properly, attempt to correct the trouble by applying pressure to the end of the springs, exercising care not to disturb or otherwise damage them. If the springs cannot be shifted in this manner, remove the spring assembly at fault from the mounting plate as outlined in procedure 3.03. Loosen the spring assembly screws with the 4" regular screwdriver sufficiently to shift the springs so as to correct the fault. Tighten the screws securely and replace the spring assembly on the mounting plate.

(2) When individual spring tangs do not have the proper engagement, shift the spring at fault in the spring assembly as covered in (1), taking care not to alter the adjustment for contact alignment.

(3) If individual tangs do not have the required clearance from the back stop bar, adjust the tang in the spring at fault using the long nose pliers, while holding the spring with the No. 416-A adjuster as shown in Fig. 9. Recheck the spring tension and contact separation requirements and readjust, if necessary.

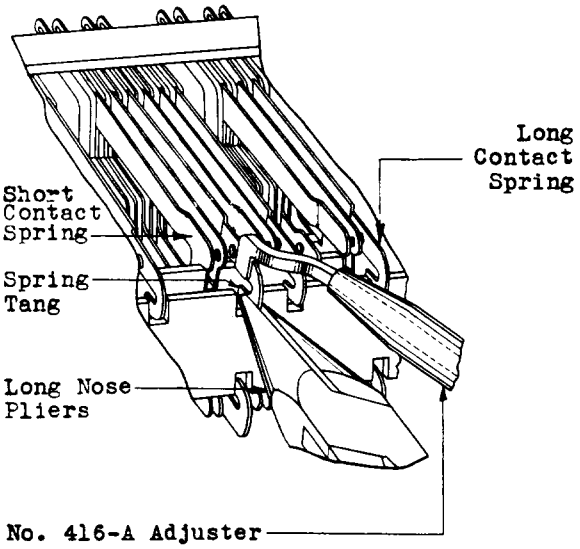


Fig. 9 - Method of Adjusting Spring Tang for Contact Separation and Tang Clearance

(4) Spring Tang Position and Clearance If the tangs of most of the springs are not positioned properly with respect to the sides and bottoms of the notches in the draw bar and the back stop bar, correct as follows.

(5) If the trouble appears to lie in the vertical location of the bars, correct this condition, in the case of the back stop bar by loosening the support plate mounting screws, using the 4" regular screw-driver. Raise or lower the back stop strip as required. If the fault still remains loosen the support, and link and support assembly mounting screws which are located at the rear of the mounting plate, using the 4" regular screw-driver and raise or lower the supports until the desired result is obtained. Retighten securely any screws which are loosened. In the case of the draw bar, note that the draw bar locating springs fit correctly over the shoulders of the draw bar. In the event that the draw bar still is out of position shift the link and support assembly or the locating springs up or down as required. Do not readjust the locating springs until it is found that the readjustment of the link and frame assembly will not give the desired result. Then, if necessary, shift the locating springs as covered in procedure 3.03. If any of the above adjustments have been made, check that the bars have not been moved in a sidewise direction so as to cause a change in their horizontal relation to the contact springs.

(6) If the trouble appears to lie in the horizontal location of the back stop bar, correct this condition by loosening the back stop bar mounting screws using the 4" regular screw-driver, and slide the back stop bar to the right or left as required. If this adjustment is made, check that the vertical relation between the bar and the contact springs is not disturbed. Readjust for this, if necessary, as covered in (3).

3.08 Straightness of Springs (Rq.2.08)

(1) If the springs are not straight due to maladjustment remedy this condition by adjusting the springs, using the No. 416-A adjuster. Do not straighten kinked springs unless the kink interferes with the proper adjustment of the switch. Removing kinks tends to weaken the spring and shorten its life. After adjusting the spring, check for the requirement covering tang pressure and readjust, if necessary.

3.09 Contact Separation (Rq.2.09)
3.10 Contact Spring Clearance (Rq.2.10)

(1) Contact Separation If failure to meet this requirement is general, it is an indication that the back stop bar has shifted from its proper position.

3.09-3.10 (Continued)

In this event, loosen the back stop bar mounting screws, using the 4" regular screw-driver, and shift the back stop bar to its correct location, making sure, if the combination is a break-make (transfer), that approximately the same clearance exists between the back stop bar and the back and front contacts, when the switch is in the unoperated and operated positions, respectively. Tighten the mounting screws securely.

(2) If it is found that failure to meet the contact separation is limited to a few individual cases, check and if necessary readjust for the spring tension of the springs involved. If this does not remedy the fault, adjust the tang of the spring at fault with the long-nose pliers, holding the contact spring with the No. 416-A adjuster as shown in Fig. 9 or Fig. 10. In the case of break-make (transfer) spring combinations check that after the spring is adjusted, approximately the same distance exists between the back stop bar, and the back and front contacts, when the switch is in the unoperated and operated positions, respectively. In the case of the short springs of make-make combinations, it is first necessary to determine approximately the amount of adjustment necessary and remove the back stop strip and draw bar strip as outlined in procedure 3.03 before adjusting the spring tang. After any spring tang has been adjusted, recheck the spring tension and readjust, if necessary.

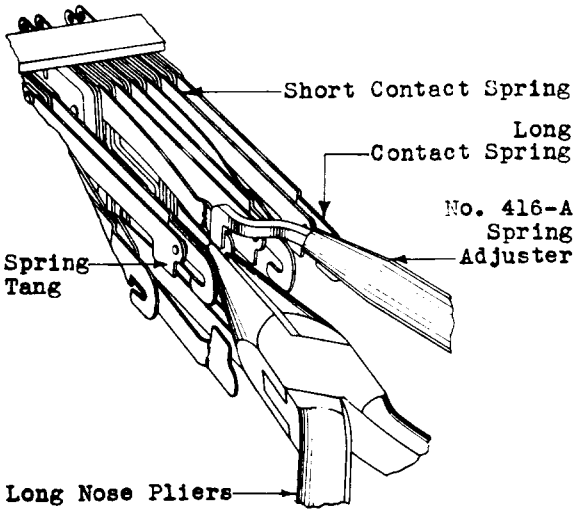


Fig. 10 - Method of Adjusting Short Spring Tang for Contact Separation

(3) Contact Spring Clearance With the switch in the non-operated position, check the clearance between adjacent springs at all points along their length. If the lack of clearance is due to a bowed spring, straighten it, using the No. 416-A adjuster. After making this adjustment, check and readjust, if necessary, for the spring tension requirement for the spring involved. Operate the switch and note, if the combination is a break-make (transfer), that the extreme end of the front contact spring in one spring assembly does not make contact with the end of the back contact spring in the adjacent spring assembly to the right. If it does, adjust the end of the faulty spring with the long-nose pliers, holding the spring just in back of the contact with the No. 416-A adjuster. If the spring has been adjusted in this manner, check and readjust, if necessary, for the requirement covering tang clearance.

(4) If the proper clearance does not exist between the terminal ends of the contact springs and the slots in the mounting plate, loosen the screws which mount the associated contact spring assembly bracket to the mounting plate and shift the whole assembly until the proper clearance is obtained. Take care not to destroy the adjustments for spring tang position and tang clearance. Before tightening the screws, make sure that the contact springs line up with those in the assemblies to the right and left. Recheck and adjust if necessary for spring tension and contact separation.

3.11 Draw Bar Locating Spring Tension (Rq.2.11)
3.12 Tang Pressure (Rq.2.12)

(1) Draw Bar Locating Spring Tension If the draw bar locating springs do not have sufficient tension away from the lever end of the switch to keep them against the draw bar shoulders, thereby insuring that the draw bar will be held in position, increase the tension of the springs using the No. 412-A spring adjuster. Place the adjuster on the spring directly in back of the pronged section and slide it back to a point approximately 1/4" from the spring assembly bracket as shown in Fig. 11 and then adjust the spring slightly away from the lever.

(2) Contact Spring Tension If the tension of the contact springs is not satisfactory, correct it by using the No. 416-A adjuster as follows. Place the adjuster on the front end of the spring, but back of the contact, and then slide it back to a point approximately 1/4" from the spring assembly insulators as shown in Fig. 12. Adjust the spring slightly to the right or left as required, exercising care not to disturb adjacent springs.

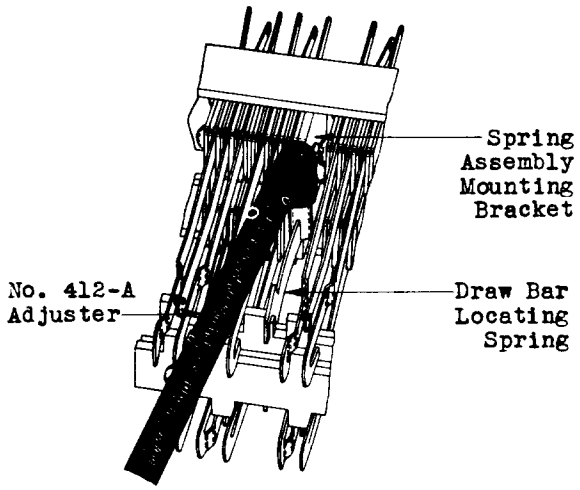


Fig. 11 - Method of Tensioning Draw Bar Locating Spring

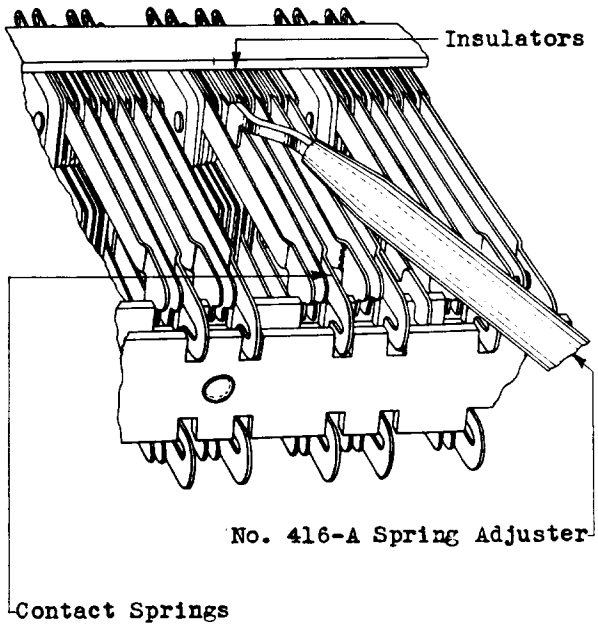


Fig. 12 - Method of Tensioning Contact Springs

3.13 Contact Sequence -- Transfer Spring Combinations (Rq.2.13)

(1) If this requirement is not met, adjust for it by changing the location of the tang of either the back or front contact spring. Do this as covered in procedure 3.07. Make sure that the correct contact separation and spring tension are maintained.