

197- AND 198-TYPE SWITCHES
BANKS, COMMUTATORS, WIPERS, JACK SPRINGS
AND SWITCH OPERATION
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers requirements and adjusting procedures for banks, commutators, wipers, jack springs, and switch operation for 197- and 198-type switches.

1.02 This section is reissued to add paragraph 1.04, to revise requirements of cleaning, to revise list of tools and gauges, and to revise procedures covering centering of wipers with bank levels.

1.03 *Make-Busy Information:* Before checking or adjusting for any requirements covered in this section, make the switch busy in accordance with Section 030-705-701.

1.04 *Asterisk (*):* Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of apparatus, or would affect the adjustment involved, or other adjustments. No check need be made of these requirements unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.

1.05 *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.

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

1.07 When any adjustments are made on the switch which may affect the switch operation, requirement 2.26 shall be checked.

1.08 The following index lists the requirements covered in this section:

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2. REQUIREMENTS

2.01 Cleaning: The parts shall be cleaned when necessary in accordance with Section 069-501-801 covering cleaning and treating of 197- and 198-type switches.

BANKS AND BANK WIPERS

2.02 Position of Banks: The bank rod collars shall secure all banks firmly, and the topmost bank shall be in contact with at least one of the two bank rod assembly locating shoulders.

Gauge by eye and by feel.

2.03 Wiper Position: Bank wipers shall set at approximately right angles to the shaft.

Gauge by eye.

2.04 Tightness of Wiper Springs on Hub: The wiper springs shall be tight on the wiper hub.

Gauge by feel.

2.05 Vertical Alignment of Wiper Springs:

Fig. 1(A) — As viewed facing the end of the wiper springs, the wiper spring tips shall be within 0.012 inch of vertical alignment.

Gauge by eye.

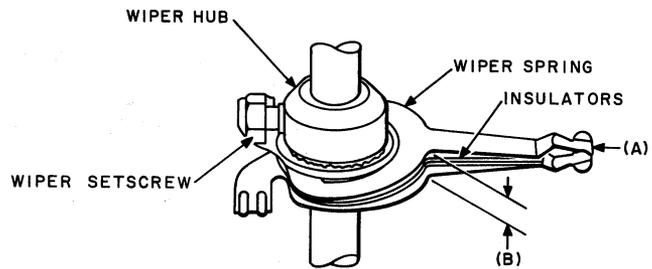


Fig. 1 — Bank Wiper

2.06 Wiper Spring Forming: Fig. 1(B) — The wiper springs shall be approximately 1/8 inch apart where the straight portion of the spring forms into the hub end. From that point, the two springs shall converge in approximately straight lines to the free end of the insulator.

Gauge by eye.

2.07 Position of Wiper Tips on Bank Contacts

(a) **Fig. 2(A):** The wipers shall rest on the bank contacts on their tips only and the upper and lower tips shall rest on the bank contacts at approximately equal angles.

Gauge by eye.

(b) **Fig. 2(B):** The wiper tips shall overlap the end of each associated bank contact by at least 3/64 inch.

This requirement shall be gauged by eye on the first and tenth contacts of the lowest bank level with which the wiper makes contact.

2.08 Normal Position of Wiper Tips

(a) **Single Conductor Wipers (197-type switches only):** Fig. 1(A)

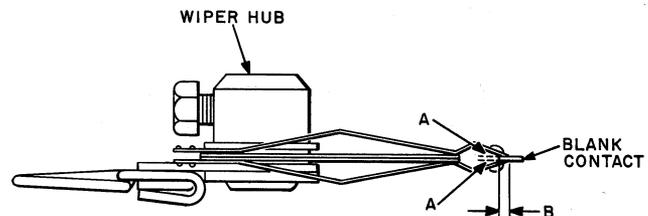


Fig. 2 — Wiper Tips on Bank Contact

- (1) The springs of all single conductor wipers shall touch at their tip ends.

Gauge by eye.

- (2) **Wipers Having One Insulator:** There shall be a clearance between at least one wiper spring and the end of the insulator.

Gauge by eye.

This requirement is met if, with the insulator pressed lightly against one spring, there is a clearance between the other spring and the free end of the insulator.

- (3) **Wipers Having Two Insulators:** There shall be a clearance between at least one wiper spring and the ends of the insulators with the insulators held together.

Gauge by eye.

This requirement is met if, with the insulators pressed lightly against one spring, there is a clearance between the other spring and the free end of the nearer insulator.

- (b) **Two Conductor Wipers:** Fig. 1(A) — The separation between the tip ends of the springs of all two conductor wipers when not contacting the banks shall be

Test	Min 0.008 inch	Max 0.020 inch
Readjust	Min 0.008 inch	Max 0.018 inch

Use the 92D, 92G, and 92W gauges.

- 2.09 Wiper Spring Tension:** Wiper springs shall be so tensioned that when the pressure of one spring in the pair is removed its mate will follow 1/8 inch.

Gauge by eye.

On 197-type switches, this is approximately the distance between two adjacent bank levels.

2.10 Alignment of Wipers With Bank Levels:
Fig. 3

- (a) **197-Type Switches Only:** With the play between the shaft spring bracket and the left side of the normal post taken up by applying a light pressure to the shaft spring bracket near the normal post, the wipers shall not touch the banks when moving vertically.

Gauge by eye.

- (b) The horizontal centerline between the tips of the wiper springs shall coincide with the centerline of the bank contact levels within 0.020 inch when the wiper is about to cut in on the bank.

The thickness of the bank contacts is 0.016 inch.

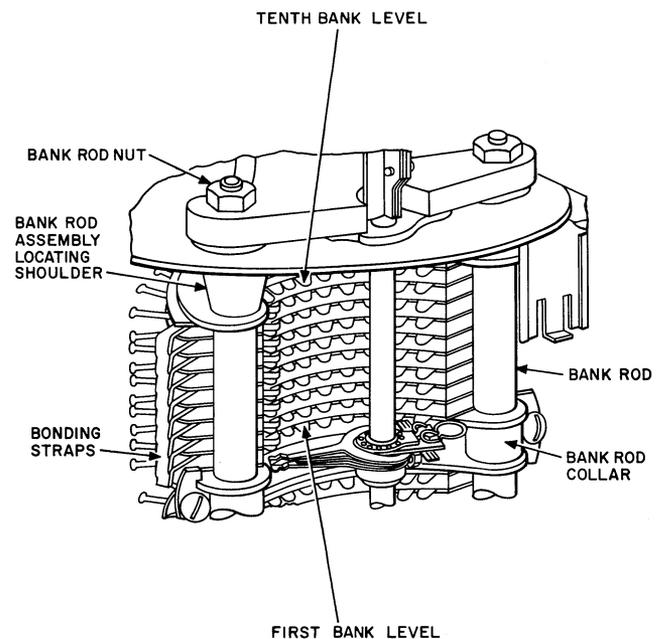


Fig. 3 — Alignment of Wipers With The Bank Levels

Gauge by eye as covered in the following table.

TYPE OF SWITCH	SWITCH ARRANGED TO TAKE		CHECK REQUIREMENT ON	
	VERTICAL STEPS	ROTARY STEPS	CONTACTS	BANK LEVELS
†197	10	11	1 & 10	1 & 10
197	10	10	1	1 & 10
†197	5	11	1 & 10	1 & 5 6 & 10
197	5	10	1	1 & 5 6 & 10
198	—	—	1	Operating

† On 200-point banks having the insulators extending to the eleventh rotary position, the requirement shall be checked on the first contact only.

2.11 Centering of Wipers on Bank Contacts:

Fig. 4(A) — The upper springs of the wipers shall center within 1/64 inch on the sixth contacts of the first and tenth levels. If, when placed on the first and tenth contacts of these levels, the springs do not so center, they shall rest either approximately as far to the right of the center on the tenth as they do to the left of the center on the first or approximately as far to the left of the center on the tenth as they do to the right of the center on the first.

Gauge by eye.

COMMUTATOR WIPERS (197-TYPE SWITCHES ONLY)

2.12 Tightness of Wiper Spring on Hub: The wiper spring shall be tight on the commutator hub.

Gauge by feel.

2.13 Horizontal Alignment of Wiper: The centerline of the wiper spring shall be approximately at right angles to the shaft.

Gauge by eye.

2.14 Centering of Wiper on Commutator Contacts: Fig. 5(A) — With the shaft in position to cut in on any level, the centerline of the wiper spring shall line up with the centerline of the commutator contact corresponding to that level within the limits of

Max 1/32 inch above, Max 1/64 inch below.

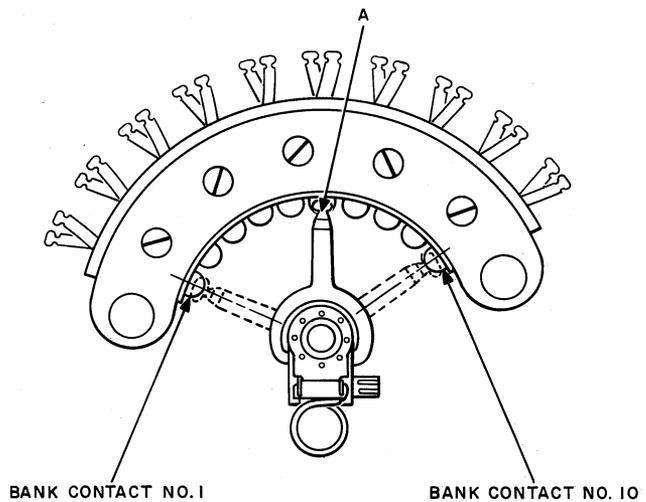


Fig. 4 — Centering of Wipers on Bank Contacts

This requirement shall be met on all levels.

Gauge by eye. (The distance between commutator terminals is approximately 1/32 inch.)

2.15 Wiper Spring Tension: Fig. 5(B) — The tension of the wiper spring against the bottom commutator contact measured at the offset in the wiper spring between the straight portion and the tip shall be

Test Min 25 grams, Max 50 grams
Readjust Min 30 grams, Max 50 grams

Use the 79C gauge.

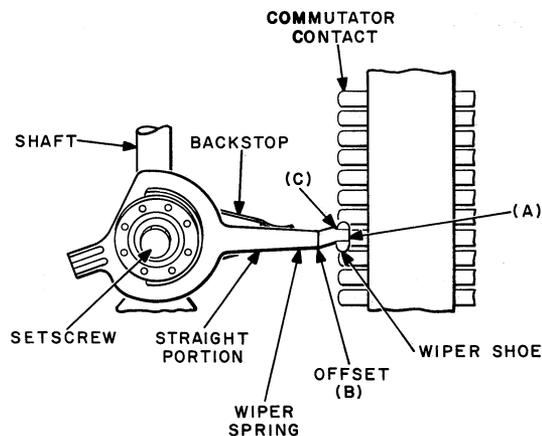


Fig. 5 — Commutator Wiper and Associated Parts

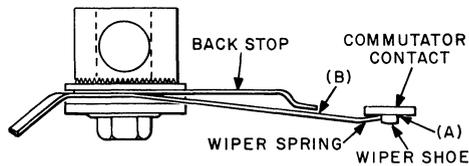


Fig. 6 — Clearance Between Back Stop and Wiper Spring and Position of Wiper Shoe on Commutator Contact

2.16 Clearance Between Wiper and Associated Commutator Contact: With the shaft cut in one step, there shall be clearance between the wiper and the associated commutator contact. This requirement shall be met on all levels.

Gauge by eye.

2.17 Relation of Wiper Tip to Commutator Contacts

(a) **Fig. 6(A):** With the switch shaft at vertical normal, the wiper shoe shall rest approximately flat against the associated commutator contact with its tip edge touching. In no case shall only the heel of the shoe touch the contact.

Gauge by eye.

(b) **Fig. 5(C):** With the shaft on the first vertical step and held in the rotary position in which the wiper back stop just lifts the wiper spring from the associated commutator contact, the wiper spring and the commutator contact shall overlap.

Min 1/16 inch

Gauge by eye. (The wiper shoe is approximately 5/64 inch wide.)

When rotating the shaft by hand, it should be held at a point above the upper bearing.

2.18 Clearance Between Back Stop and Wiper Spring: Fig. 6(B) —

When a wiper spring is equipped with a back stop, there shall be clearance on all levels between the wiper and the end of the back stop with the shaft at rotary normal.

Gauge by eye.

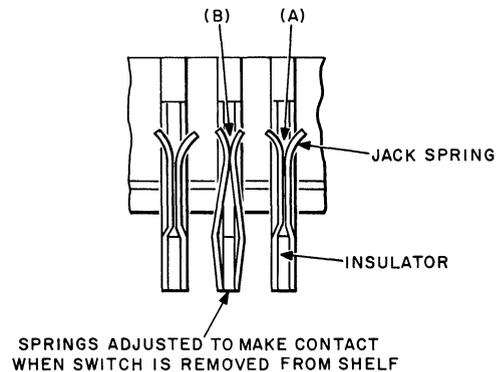


Fig. 7 — Shelf Jack Spring Assembly

SHELF JACK SPRINGS

***2.19 Spring Alignment:** The jack springs shall be so aligned that the associated plug will enter the jack without snagging on the tips of the springs, and each spring shall make contact with its corresponding plug spring without interfering or making contact with any other jack spring.

Gauge by eye.

***2.20 Clearance Between the Contact Surfaces of Springs**

(a) **Fig. 7(A):** With the plug removed from the jack, the clearance between the contact surfaces of each pair of jack springs, unless otherwise specified, shall be

Min 0.020 inch
Max 0.050 inch

Use the KS-6909 gauge for checking the minimum value and the 112A gauge for checking the maximum value.

(b) **Fig. 7(B):** When the circuit requirement table specifies that certain springs shall make contact when the switch is removed from the shelf, the springs required to make contact shall be tensioned against each other so that, when the pressure of one spring of a pair is removed, there shall be follow on its mating spring of

461A jack — 0.010 inch
(1/2 the thickness of the contact spring)
344, 345, and 346 jacks — 1/32 inch (The

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insulator between contact springs is 3/64 inch thick.)

Gauge by eye.

SLEEVE CUT-OFF JACKS (197-TYPE SWITCHES ONLY)

2.21 Clearance Between Springs and Mounting Bracket: There shall be a clearance between the flared end of the springs and the mounting bracket of

Min 5/64 inch

Gauge by eye.

2.22 Contact Separation: With a 240A plug inserted into the jack, there shall be a contact separation of

Min 0.010 inch

Gauge by eye.

2.23 Contact Pressure: Fig. 8(A) — The contact pressure measured at the bend near the end of spring No. 2 shall be

Min 150 grams

Use the 62B gauge.

TEST JACKS

2.24 Contact Pressure: With the rounded end of a 477A make-busy tool or its equivalent inserted between jack springs 3 and 4, the contact pressure between contact springs 5 and 6 shall be

Test Min 70 grams

Readjust Min 75 grams

To check this requirement, apply the tip of the 70J gauge to the end of the spring at a point just in front of the contacts.

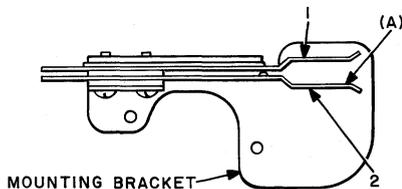


Fig. 8 — Sleeve Cut-Off Jack Assembly

2.25 Contact Separation: With the contact springs unoperated, the separation between the contacts shall be

Test Min .008 inch

Readjust Min .010 inch

Gauge by eye.

SWITCH OPERATION

2.26 Switch Operation: After the requirements in Sections 030-705-702, 030-705-703, and 030-705-704 have been met, the switch shall meet the tests described in the sections covering the type of circuit involved. The vertical and rotary armature springs shall be tensioned as necessary to meet these tests.

3. ADJUSTING PROCEDURES

3.001 List of Tools and Gauges

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
363 (2 reqd)	Spring Adjuster
416B	Spring Adjuster
417A	1/4- and 3/8-Inch Hex Open Double-End Flat Wrench
477A	Make-Busy Tool
485A	Smooth-Jaw Pliers
555A	3/16-Inch Hex Single-End Socket Wrench
563A	90-Degree Offset Screwdriver
564A	45-Degree Offset Screwdriver
A.E. Co. H-7057	Wiper Wrench
KS-7782 (2 reqd)	Parallel Jaw Pliers
P-220366	Dental Mirror
→ —	3-Inch C Screwdriver
→ —	4-Inch E Screwdriver
GAUGES	
62B	0-700 Gram Gauge
70J	0-150 Gram Gauge

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
79C	0-200 Gram Push-Pull Tension Gauge
92D	0.018-Inch Nonmagnetic Offset Thickness Gauge
92G	0.020-Inch Nonmagnetic Offset Thickness Gauge
92W	0.008-Inch Nonmagnetic Offset Thickness Gauge
112A	0.040- and 0.050-Inch Thickness Gauge
KS-6909	Thickness Gauge Nest

3.01 *Cleaning* (Reqt 2.01)

- (1) The parts shall be cleaned when necessary in accordance with Section 069-501-801, covering cleaning and treating of 197- and 198-type switches.

BANKS AND BANK WIPERS

3.02 *Position of Banks* (Reqt 2.02)

- (1) To change the position of the banks, loosen the clamping screws on the bank rod collars with the 3-inch C screwdriver or the 555A wrench and shift the banks on the bank rods as required. Then tighten the clamping screws securely. Observe that the bank rod collars are turned on the bank rods as far as possible in a direction away from the wipers, so that each bank rod collar engages with the bank above and below it.

3.03 *Wiper Position* (Reqt 2.03)

- (1) If the wiper does not set at approximately right angles to the shaft, adjust the springs by placing the index finger against one spring as near to the hub as possible. Press upward or downward as required until the springs set at approximately right angles to the shaft. When aligning the springs in this manner, exercise care not to introduce sharp bends into the springs.

3.04 *Tightness of Wiper Springs on Hub* (Reqt 2.04)

3.05 *Vertical Alignment of Wiper Springs* (Reqt 2.05)

- (1) Where wiper springs are assembled to the hub with a clamping nut, align the wiper springs vertically by loosening the locknut at the top of the wiper with the 417A wrench. Place the A.E. Co H-7057 wiper wrench over the wiper with the springs of the wiper in the slot designed to hold them. Then retighten the locknut. See Fig. 9.

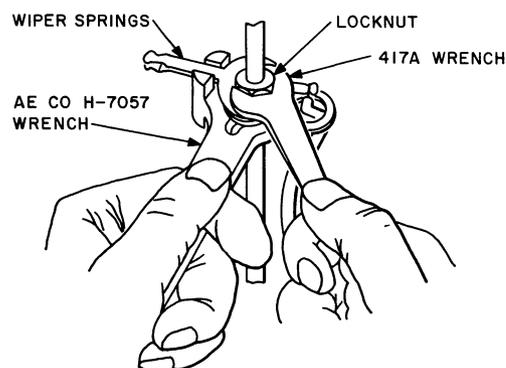


Fig. 9 — Method of Aligning The Wiper Springs Vertically

- (2) Where the wiper springs are permanently fastened during manufacture, the springs cannot be realigned. Where the wiper springs are not in proper vertical alignment, replace the wiper assembly with one that meets the requirement as described in Section 030-705-804.

3.06 *Wiper Spring Forming* (Reqt 2.06)

3.07 *Position of Wiper Tips on Bank Contacts* (Reqt 2.07)

3.08 *Normal Position of Wiper Tips* (Reqt 2.08)

3.09 *Wiper Spring Tension* (Reqt 2.09)

- (1) Where the wiper springs are not badly deformed, they may be reformed with the 363 spring adjuster to their proper form as described in (2) and (3) using, as model, a bank wiper known to be in good condition. If the wiper springs have been badly deformed

so that a satisfactory adjustment cannot be obtained with the spring adjuster, replace the wiper springs with springs of the replaceable type as covered in Section 030-705-804.

(2) To adjust the distance between the wiper springs at the point where the straight portion forms into the hub end, proceed as follows. On springs that are not of the replaceable type, apply the spring adjuster to the spring as shown in Fig. 10. On springs of the replaceable type, apply the KS-7782 pliers to the same point.

(3) If the position of the wiper tips on the bank contacts or the separation between the wiper tips is not satisfactory, adjust the tips of the springs with the spring adjusters as shown in Fig. 11.

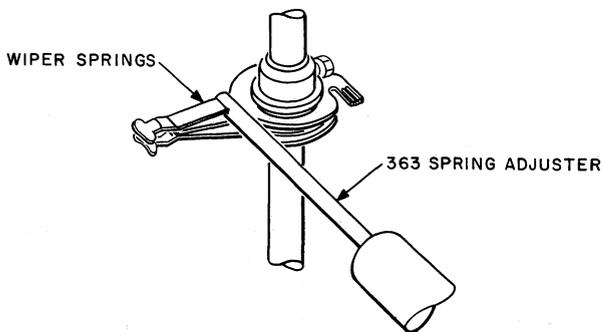


Fig. 10 — Method of Adjusting for Clearance Between Wiper Springs

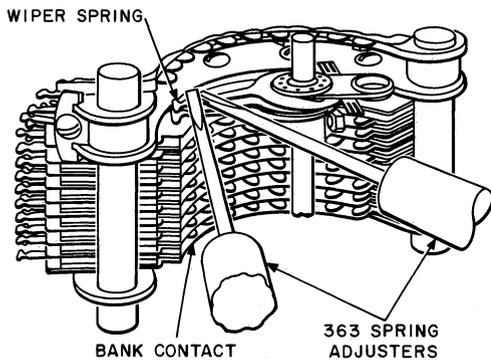


Fig. 11 — Method of Adjusting Wiper Springs

(4) To adjust the wiper spring tension, first loosen the wiper spring assembly on the shaft with the 3-inch C screwdriver or the 555A wrench. Rotate the springs into the space opposite the bank so that they are accessible.

(5) To increase the tension of the wiper springs, apply the pliers to the circular part of the spring first on one side, as shown in Fig. 12, and then on the opposite side. Twist the pliers in a direction to force the wiper springs toward its opposing spring. Repeat this operation on the other spring of the pair, equalizing the adjustment so that the follow on both springs of the pair will be the same when checked in accordance with requirement 2.09. Reset the wipers in their proper positions as described in 3.10 and 3.11.

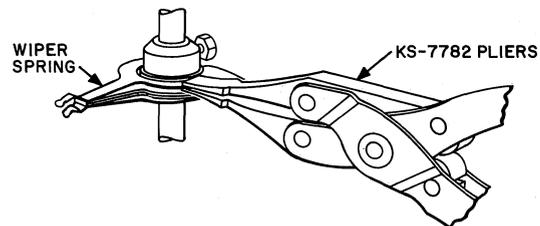


Fig. 12 — Method of Adjusting Tension of Wiper Springs

(6) If the wiper tips do not overlap the bank contacts as specified, loosen the bank rod nuts with the 417A wrench, shift the banks toward the front of the switch, and tighten the bank rod nuts securely. Then check the centering of the wipers on the bank contacts in accordance with requirement 2.11. If this procedure does not correct the trouble, remove the bank rod nuts with the wrench and carefully lower the banks. Loosen the bank rod collar clamping screws of the left-hand bank rod with a 3-inch C screwdriver and remove the bank rod. Place the rod on an anvil or similar metal surface so that the tapered surface of the shoulder rests flat as shown in Fig. 13. Then strike the flat portion of the shoulder close to the upper edge a light blow with the riveting hammer. Repeat this operation if necessary until a bump of approxi-

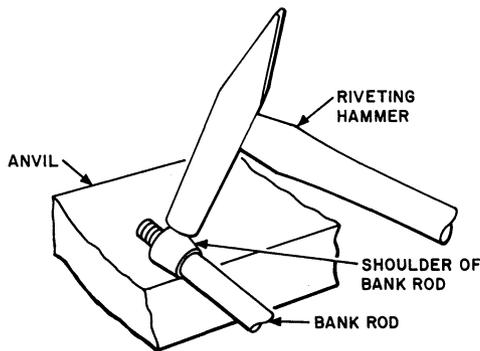


Fig. 13 — Method of Bumping Bank Rod

mately 0.010 inch is raised on the edge of the bank rod shoulder. Then remount the rod so that the bumped edge is toward the rear of the switch and remount the banks on the switch. Tighten all parts securely. Note whether a satisfactory overlap is obtained. If the overlap is satisfactory at the end nearest the bumped rod but not at the other end, remove the banks and repeat the operation on the other rod. After reassembling the parts, recheck for alignment of wipers with bank levels and also check centering of wipers on bank contacts. Also check requirements 2.14 through 2.18.

3.10 Alignment of Wipers With the Bank Levels (Reqt 2.10)

3.11 Centering of Wipers on Bank Contacts (Reqt 2.11)

(1) If the cut-in is slightly out from the specified value, adjust the wiper springs up or down with the fingers as required at the level that is not in alignment with the wiper. Check that the requirement is met at the other specified level.

(2) If the cut-in is more than slightly out from the specified value, adjust the wiper springs in accordance with (a) or (b).

(a) *In the case of switches stepping ten bank levels*, raise the shaft to the fifth level. Loosen the setscrew in the wiper hub with the 3-inch C screwdriver or the 555A wrench and raise or lower the wiper assem-

bly until the wipers center with the fifth level. Then tighten the setscrew with the fingers and rotate the shaft to the fifth contact. Make sure that both wiper tips rest on the bank contacts at equal angles. If necessary, raise or lower the wiper assembly slightly to obtain this condition. Check the requirement at the first and tenth levels and, if it is not met, adjust the wiper springs as covered in (1).

(b) *For switches stepping only five bank levels*, raise the shaft to either specified level not in alignment with the wiper. Loosen the setscrew in the wiper hub with the 3-inch C screwdriver or the 555A wrench and raise or lower the wiper assembly until the wipers centered with the level. Then tighten the setscrew with the fingers and rotate the shaft to the fifth contact. Make sure that both wiper tips rest on the bank contacts at equal angles. If necessary, raise or lower the wiper assembly slightly to obtain this condition. Check the requirement at the other specified level and if it is not met, adjust the wiper springs as covered in (1).

(3) Center the wipers on the sixth contact.

To do this, loosen the setscrew in the wiper hub and turn the wiper to the right or left as required. It is advisable to support the shaft and hold the wiper firmly while loosening or tightening the wiper setscrew. After the wipers have been centered properly, carefully restore the shaft to rotary normal and see that the vertical alignment has not changed. If any change is required in the vertical alignment, exercise care not to disturb the horizontal alignment. Check the horizontal alignment. Tighten the wiper setscrew. Take care to limit the force exerted in tightening the screw since excessive force may cause bending of the shaft.

(4) After aligning an upper wiper whose hub is turned up, operate the switch to the tenth level and note whether or not the wiper strikes against the lower shaft bearing. If the wiper strikes against the bearing, it will be necessary to invert the wiper so that the hub will be below the springs. In certain cases it may also be necessary to invert the wiper adjacent to the commutator wiper.

(5) Where wipers cannot be centered properly, it will be necessary to loosen the bank rod nuts and shift the bank slightly to meet these requirements. If this is done, recheck requirements 2.14, 2.15, 2.16, 2.17, and 2.18.

COMMUTATOR WIPERS (197-TYPE SWITCHES ONLY)

3.12 Tightness of Wiper Spring on Hub
(Reqt 2.12)

3.13 Horizontal Alignment of Wiper
(Reqt 2.13)

(1) Where commutator wiper springs are assembled to the hub with an assembly clamping nut, as shown in Fig. 14, align the commutator wiper horizontally as follows. Loosen the assembly clamping nut with the 417A wrench and move the tip of the wiper spring up or down until the center line of the spring is at right angles to the shaft. Then tighten the clamping nut securely. On the later type of commutator wipers, the position of the wiper spring with respect to the hub is not adjustable; therefore, where the wiper is not in proper horizontal alignment, replace the wiper as covered in Section 030-705-804.

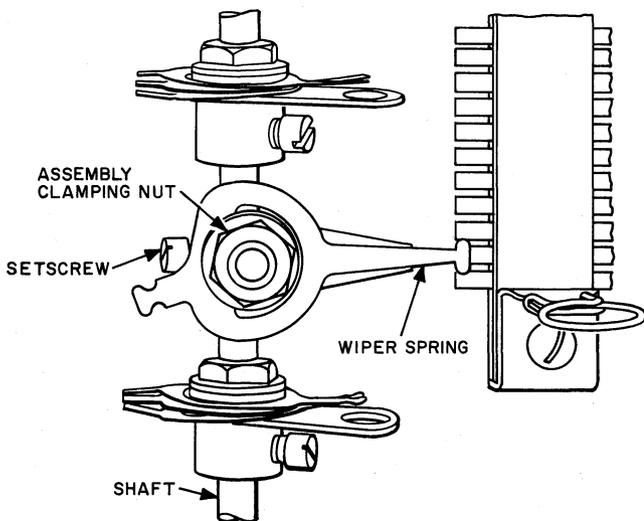


Fig. 14 - Commutator Wiper Alignment

3.14 Centering of Wiper on Commutator Contacts (Reqt 2.14)

3.15 Wiper Spring Tension (Reqt 2.15)

3.16 Clearance Between Wiper and Associated Commutator Contact (Reqt 2.16)

3.17 Relation of Wiper Tip to Commutator Contacts (Reqt 2.17)

3.18 Clearance Between Back Stop and Wiper Spring (Reqt 2.18)

(1) To change the position of the commutator wiper spring, loosen the setscrew in the wiper hub with the 3-inch C screwdriver or the 555A wrench. Move the wiper upward or downward as required.

(2) To adjust the tension of the wiper spring against the commutator contacts, proceed as follows. Step the switch manually to the third or fourth rotary position. Apply the 416B spring adjuster to the upper circular part of the wiper spring, as shown in Fig. 15, and twist the tool to the right or left as required. Then apply the tool to the lower circular portion of the spring and twist the tool an equal amount to the right or left as required. Where lack of tension between the wiper spring and the commutator contacts is due to improper location of the wiper on the switch shaft, loosen the setscrew in the wiper hub with the 3-inch C screwdriver or the 555A wrench. Turn the wiper assembly on the shaft, moving the tip of the wiper spring toward the commutator to increase the tension. After making this adjustment, recheck the centering of the wiper spring on the commutator contacts.

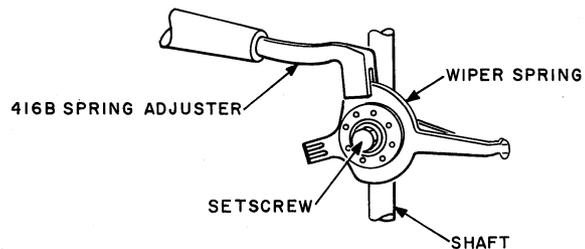


Fig. 15 - Method of Adjusting Spring Tension Commutator Wiper

(3) If the commutator wiper is not equipped with a back stop, increasing the tension of the wiper spring, as described in (2), may result in failure of the commutator wiper to clear the associated commutator contact when the switch is on the first rotary step. Decrease the tension of the wiper spring slightly to obtain the necessary clearance.

(4) Insufficient overlap between the wiper spring and the commutator contact is usually due to excessive kinks or bows in the wiper spring. These may be corrected by straightening the spring with KS-7782 pliers. Where there are no excessive bows or kinks in the wiper spring, the overlap may be increased by loosening the two screws by which the commutator is attached to the banks with the 4-inch E screwdriver and shifting the commutator closer to the commutator wiper. Where the commutator mounting bracket is mounted on the base plate, loosen the bracket mounting screws with the 563A and 564A offset screwdrivers and shift the bracket as required.

(5) To adjust the clearance between the wiper spring and the back stop, adjust the back stop near the wiper hub toward or away from the spring as required with the 416B spring adjuster. (See Fig. 16.)

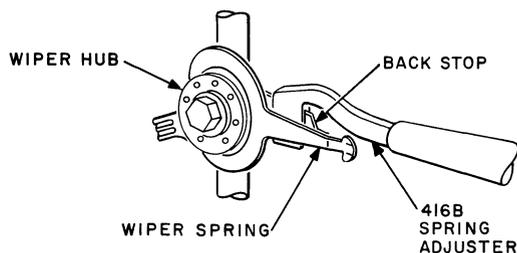


Fig. 16 — Method of Adjusting Commutator Wiper Back Stop

(6) When finally adjusted, the shape of the commutator wiper spring and its position on the commutator contacts should be as shown in Fig. 17. Adjust the wiper spring on the associated commutator contacts by changing the offset near the end of the spring with two 363 spring adjusters applied as shown in Fig. 18.

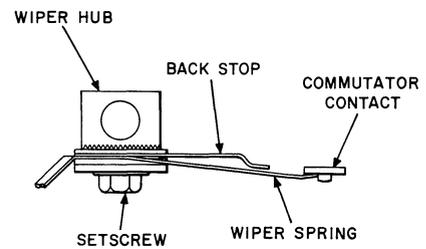


Fig. 17 — Position of Commutator Wiper Spring on Commutator Contacts

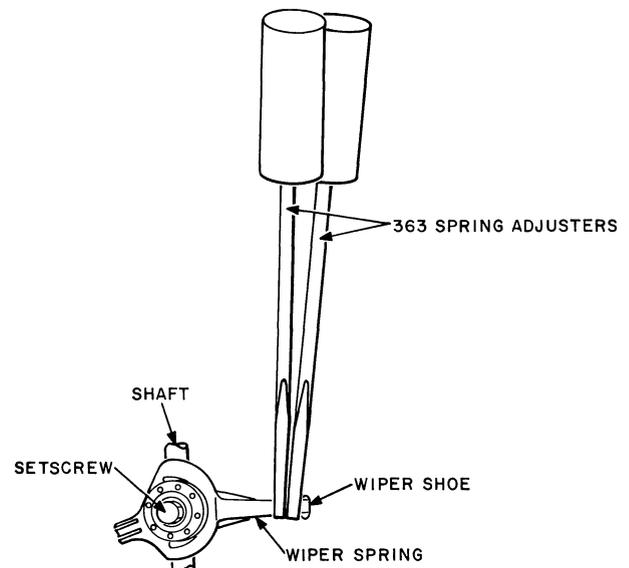


Fig. 18 — Method of Adjusting Wiper Shoe to Rest Approximately Flat on Commutator Contact

SHELF JACK SPRINGS

3.19 Spring Alignment (Reqt 2.19)

- (1) Realign the springs as necessary to meet this requirement using the 485A and KS-7782 pliers. When finally adjusted, the straight portions of each pair of springs should be approximately parallel to each other.

3.20 Clearance Between the Contact Surfaces of Springs (Reqt 2.20)

- (1) Adjust the clearance between the springs with the KS-7782 pliers applied to the springs just above the offset.

(2) Adjust the springs to make contact and to follow within the specified limits with two pairs of pliers applied to the spring as shown in Fig. 19.

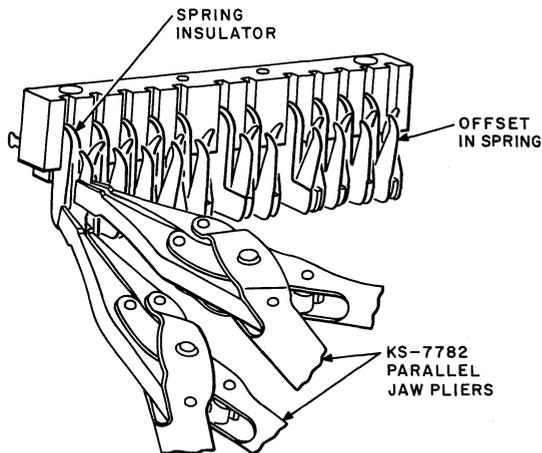


Fig. 19 — Method of Adjusting Springs to Make Contact With the Switch Removed From the Shelf

Grasp the spring just below the offset with one pair of pliers to hold it stationary and then adjust the upper portion of the spring toward its mate with the other pair of pliers applied to the spring just above the offset. Adjust the opposing spring of the pair in the same manner so that, when finally adjusted, a vertical line through the line of contact of the two springs will coincide with the approximately center of the spring insulator. The form of the springs under this condition should be as shown in Fig. 20.

SLEEVE CUT-OFF JACKS (197-TYPE SWITCHES ONLY)

- 3.21** *Clearance Between Springs and Mounting Bracket* (Reqt 2.21)
- 3.22** *Contact Separation* (Reqt 2.22)
- 3.23** *Contact Pressure* (Reqt 2.23)

(1) Before making any adjustment of the sleeve cut-off jacks, it will be necessary to remove the switch from the shelf as described in Section 030-705-701.

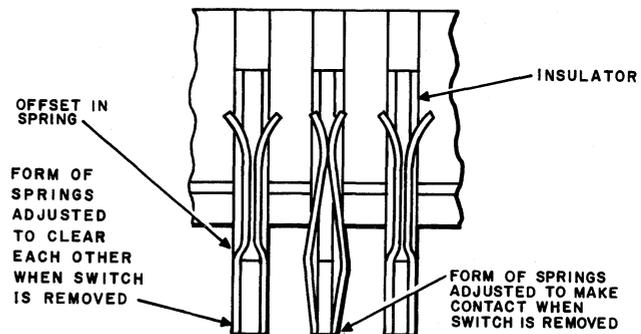


Fig. 20 — Method of Obtaining Clearance or Contact Between a Pair of Shelf Jack Springs

(2) To change the clearance between the flared ends of the springs and the mounting bracket, loosen the spring assembly mounting screws with the 4-inch E screwdriver and shift the springs as required.

(3) To change the contact separation, adjust the flared portion of the springs closer together with the KS-7782 pliers. When finally adjusted, the flared ends of the springs should be far enough apart to permit the insertion of a 240A plug in the jack. Also, the straight portions of the No. 1 and No. 2 springs just back of the flared tips should contact sufficient area of the plug to prevent the plug from slipping out of the jack.

(4) To change the contact pressure, adjust the No. 2 spring at a point near the insulators with the KS-7782 pliers.

TEST JACKS

- 3.24** *Contact Pressure* (Reqt 2.24)
- 3.25** *Contact Separation* (Reqt 2.25)

(1) Adjust the spring, as necessary, with the KS-7782 pliers until the requirements are met.

SWITCH OPERATION**3.26 Switch Operation** (Reqt 2.26)

(1) If the switch meets all of the requirements covered in Sections 030-705-702, 030-705-703, and 030-705-704, tension the vertical and rotary armature springs so that the switch meets the tests described in the sections covering the type of circuit involved. To obtain the best switch operation, adjust the vertical and rotary armature spring tensions as follows. On switches having vertical interrupter springs, adjust the vertical and rotary armature spring tension between 300 and 550 grams. On switches having rotary interrupter springs only, adjust the vertical armature spring tension between 100 and 300 grams and the rotary armature spring tension between 300 and 450 grams. On switches not equipped with vertical or rotary interrupter springs, adjust the vertical and rotary armature spring tension between 100 and 300 grams. Do not increase the tensions of these springs more than necessary to insure proper rotary and vertical operation. The tensions of these springs can readily be adjusted by turning the T-head retractile spring adjusting screws.

(2) If the switch fails to step uniformly, recheck all the vertical and rotary requirements to see that these are met. Check that the rotary and vertical armature spring tensions are sufficient to restore the armatures to normal against the back stops. If the armature springs are in proper adjustment, apply the magnet pulsing test to the vertical and rotary magnets. Refer to the sections for the application of the magnet capability tests. Failure of a magnet to operate properly is an indication of a defective magnet winding. In this case, replace the magnet as covered in Section 030-705-802. If the magnet operates but the switch does not step properly, check for a defective pawl spring and also the alignment of the armature and the core. If the armature is bowed or does not have a flat face, replace it. If the pawl spring is defective, replace it.

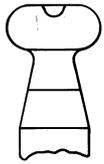
(3) If the switch still fails to meet the vertical pulsing test, loosen the upper and lower bearing mounting screws using the 3-

inch C screwdriver and shift the shaft as far to the rear of the switch as the holes in the shaft bearing permit. Tighten the bearing mounting screws securely and recheck requirements involved.

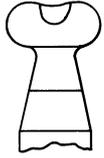
(4) If the switch meets the magnet pulsing tests but still does not step uniformly when tested by approved test apparatus, check the associated relays. Even if the relays are in satisfactory adjustment, it may be necessary to tune them within requirements to insure that the switch steps uniformly when tested by approved test apparatus. If the switch still does not meet the rotary timing test (9 steps in 0.375 second), check the timing requirements of the associated C relay as specified on the circuit requirement table. If necessary, replace the heelpiece on the rotary magnet by a larger heelpiece and recheck the timing test. For further information on the analysis and correction of pulsing failures and rotary stepping failures, see sections covering rotary and pulsing tests for this apparatus.

4. GENERAL INFORMATION**REPLACEMENT OF WORN BANK WIPERS**

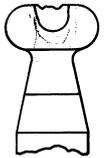
4.01 Service Hazards of Worn Wipers: The condition of the bank wipers has an important effect upon the quality of service of the office. As a wiper wears, a larger area of the tip comes into contact with the bank contacts, decreasing the contact pressure per unit of area and making contact noise more likely. As the contact area increases, the danger of interference with switch release due to snagging increases. A badly worn line wiper will also bridge contacts and cause clicks in talking circuits as it passes across the contacts. For these reasons it may be advisable to check the condition of the wiper tips periodically as determined by local conditions, type of circuit, and previous experience in the office. Examination of wiper tips will be facilitated by using the P-220366 dental mirror.



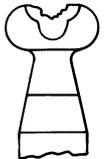
A. SLIGHT WEAR, SATISFACTORY FOR SERVICE.



B. MORE WEAR BUT STILL SATISFACTORY FOR SERVICE.



C. WORN TO FEATHER EDGE - REPLACEMENT RECOMMENDED.



D. BADLY WORN - A SERVICE HAZARD.

Fig. 21 — Typical Wear of Brass or No. 1 Metal Wiper Tips

4.02 Permissible Wear of Wiper Tips: Wiper tips showing small amounts of wear similar to conditions A and B of Fig. 21 and condition A of Fig. 22 are not service hazards. Such wipers need not be replaced unless the wear is thought likely to approach or exceed the degree of wear illustrated by condition C of Fig. 21 before the next check is made. Conditions D of Fig. 21 and B of Fig. 22 are service hazards.



A. WAVY APPEARANCE OF TIP SURFACE WHICH MAY OCCUR EARLY IN LIFE OF WIPER - NOT AN INDICATION OF UNSATISFACTORY PERFORMANCE.

B. FAILURE OF PORTION OF TIP - A SERVICE HAZARD.

Fig. 22 — Conditions Sometimes Found on No. 1 Metal Wiper Tips