

## 197- AND 198-TYPE SWITCHES

PLEASE NOTE:

### CORDS, CORD HOLDERS, COMMUTATORS, WIPER SPRINGS, AND PARTS ASSOCIATED WITH THE COVERPLATE PIECE-PART DATA AND REPLACEMENT PROCEDURES

1.01 This section covers the piece-part data and replacement procedures for cords, cord holders, cord holder brackets, commutators, wiper springs, and parts associated with the coverplate of 197- and 198-type switches.

1.02 This section is reissued to remove all instructions relating to the replacement of individual wiper springs. Since this is a general revision, arrows ordinarily used to indicate changes are not shown.

1.03 Part 2 of this section covers the piece-part numbers and corresponding names of the parts which it is practicable to replace in the field in the maintenance of the switches. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts. This information is called Piece-Part Data.

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2. This information is called Replacement Procedures.

1.05 **Make-Busy Information:** Before replacing any parts covered in this section, make the switch busy in accordance with Section 030-705-801.

## 2. PIECE-PART DATA

2.01 The method of ordering parts for replacement purposes is covered in Part 2 of Section 030-705-801.

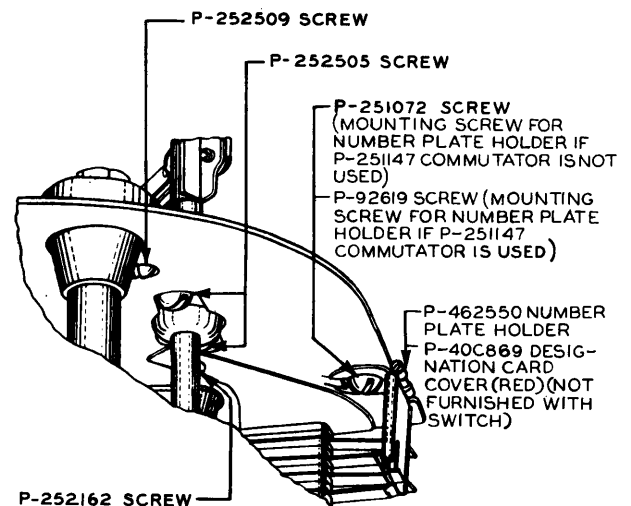
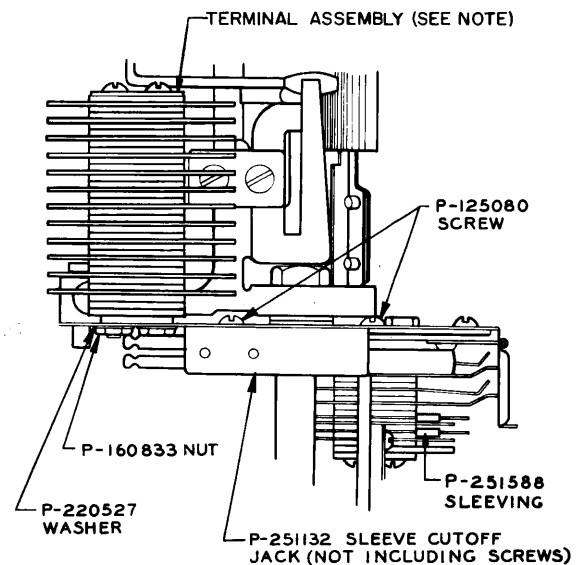


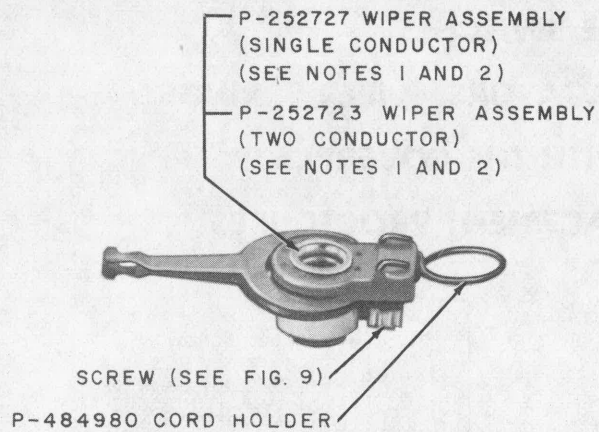
Fig. 1—Parts Associated With Coverplate



NOTE: ORDER TERMINAL ASSEMBLY CORRESPONDING TO SWITCH CODE AS LISTED BELOW.

SWITCH CODE	TERMINAL ASSEMBLY
197AU, AW, ET, GJ, GL	P-251138
197FN	P-15A923

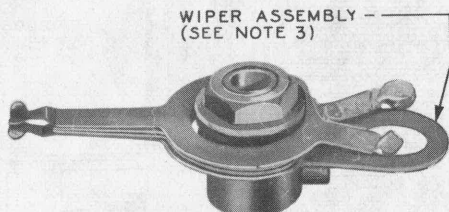
Fig. 2—Sleeve Cutoff Jack and Terminal Assembly



**Fig. 3—Wiper Assembly and Detachable Cord Holder**



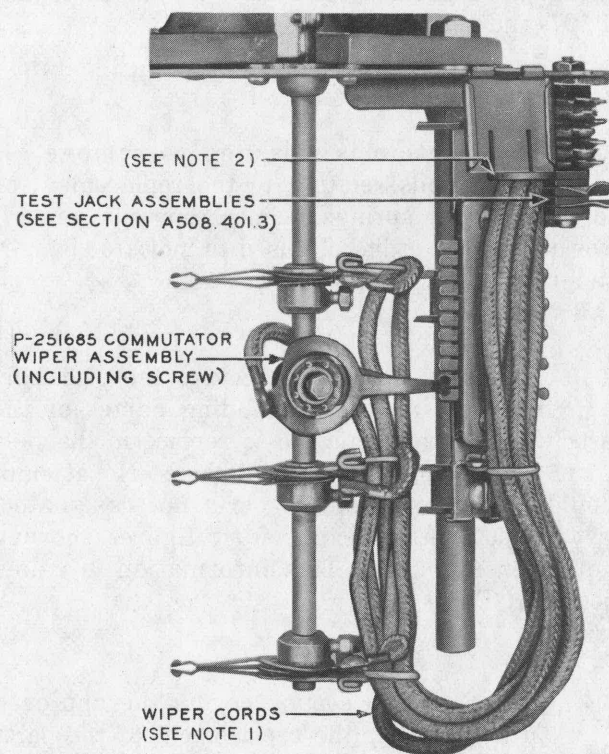
**Fig. 4—Wiper Assembly With Nondetachable Cord Holder Terminals at Right Angles to Assembly**



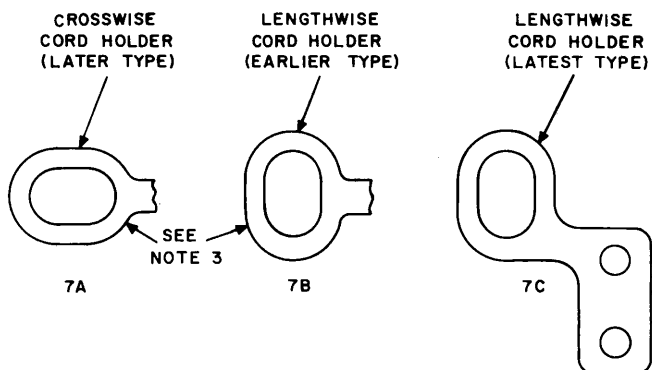
**Fig. 5—Wiper Assembly With Assembly Clamping Nut**

**Notes for Fig. 3, 4, and 5**

1. Wiper assembly includes the mounting screw but not the cord holder.
2. When replacing a wiper assembly on the top bank of a 197K switch, order P-252723 wiper assembly (2-conductor) and connect the lead to the lower terminal. (See Fig. 21C.)
3. For replacement of the wiper assembly, order wiper assembly and cord holder (if required) per Fig. 3.



**Fig. 6—Wiper Cords, Commutator Wiper Assembly, and Associated Parts**



**Fig. 7—Types of Cord Holders Which Are Part of Test Jack Assembly**

**Notes for Fig. 6 and 7**

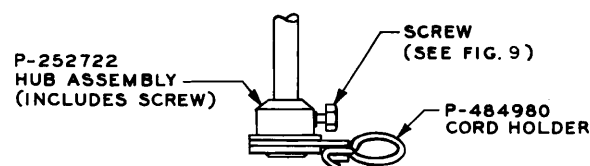
1. Order M1R cords for all replacements. The length of M1R cord required depends on its use as covered in Table A. The length given is that of the tinsel conductor. In ordering cords give both length and code number; for example, 4-3/4 inch M1R cord.
2. When replacing M1G by M1R cords on switches equipped with a test jack assembly having a cord holder per Fig. 7B or 7C, order parts listed below. Where test jack assemblies are equipped with a cord holder per Fig. 7A, these parts need be ordered only if the cord holder requires replacement.

*Switch Without Commutator*

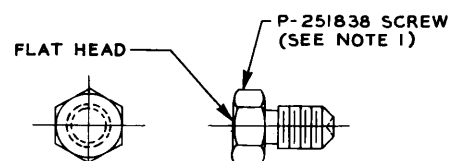
Order: Parts per Fig. 11

*Switch With Commutator*

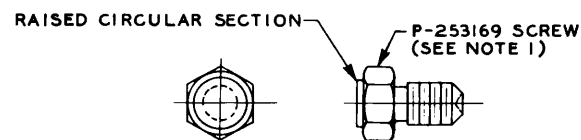
Order: P-483343 Bracket (cord holder bracket)  
P-484980 Cord Holder  
P-125043 Screw (upper clamping screw) (not required on 9B commutator)



**Fig. 8—Hub Assembly and Cord Holder**



**Fig. 9A—Screw Without Raised Circular Section**



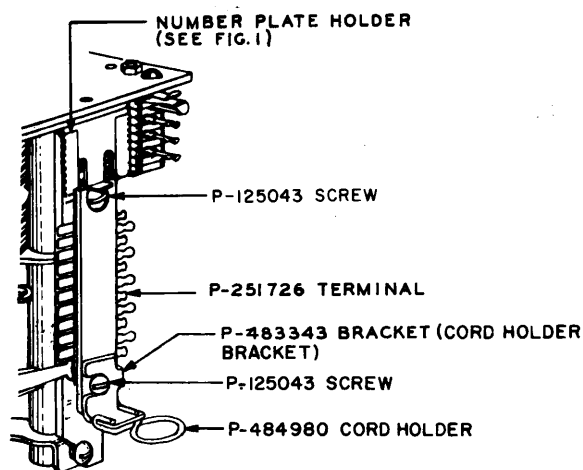
NOTE 1—WHEN REPLACING A MISSING OR DAMAGED SCREW, A FILLISTER HEAD SCREW, OR A SCREW WITH A FLAT HEAD AS SHOWN IN FIG. 9A, USE THE P-251838 SCREW IF IT CAN BE TURNED IN THE ASSOCIATED PART WITHOUT UNDUE PRESSURE. IF NOT, USE THE P-253169 SCREW.

**Fig. 9B—Screw With Raised Circular Section**

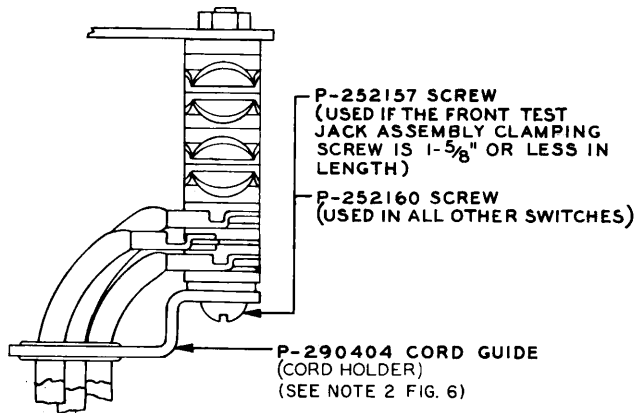
**Fig. 9—Clamping Screws for Wipers, Cord Holder Brackets, and Commutator Wipers**

TABLE A

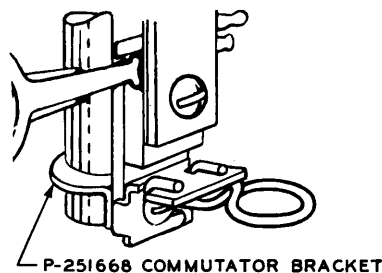
SWITCHES EQUIPPED WITH	LENGTH REQUIRED FOR M1R CORDS TERMINATING ON TERMINALS OF TEST JACK ASSEMBLY AND:				
	LOWER WIPER ASSEMBLY	MIDDLE WIPER ASSEMBLY		UPPER WIPER ASSEMBLY	COMMUTATOR WIPER ASSEMBLY
One Bank And A Commutator	9 inches	—		9 inches	7 1/2 inches
One or Two Banks But No Commutator	4 3/4 inches (where equipped)	4 3/4 inches (where equipped)		4 inches	—
Two Banks And A Commutator	6 3/4 inches	—		9 inches	9 inches
Three Banks And A Commutator	7 1/2 inches	9 inches		11 1/4 inches	11 1/4 inches
Three Banks But No Commutator	6 3/4 inches	4 3/4 inches		4 inches	—
Four Banks And A Commutator	7 1/2 inches	Lower 7 1/2 inches	Upper 9 inches	11 1/4 inches	11 1/4 inches



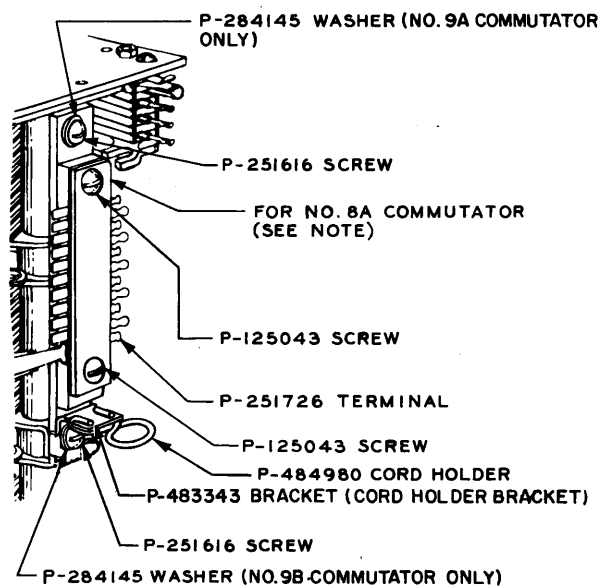
**Fig. 10—Parts Associated With P-25147 Commutator  
Mounted on the Lower Coverplate**



**Fig. 11—Cord Holder Attached to Test Jack Assembly**



**Fig. 12—Commutator Bracket Used to Mount Bottom of Commutator to Bank Rod on Switches Equipped With a 9A Commutator and One Bank**



NOTE: FOR REPLACEMENT OF A NO. 8A COMMUTATOR, SEE 3.42 (3).  
FOR REPLACEMENT OF NO. 8A COMMUTATOR CONTACTS, SEE 3.43 (2).

**Fig. 13—8A, 9A, and 9B Commutators and Associated Parts (9A Commutator Shown)**

### 3. REPLACEMENT PROCEDURES

#### 3.01 *List of Tools and Materials*

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
418A	5/16- and 7/32-inch hex. open double-end flat wrench
485A	Smooth jaw pliers
555A	3/16-inch hex. single-end socket wrench
KS-14439	Cut-nippers
—	Modified B splicer's scissors—prepared locally (See 3.51.)
—	B long-nose pliers (or the replaced P long-nose pliers) (two required)
—	5-inch diagonal pliers
—	3-inch C screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-inch E screwdriver (or the replaced 4-inch regular screwdriver)
<b>MATERIALS</b>	
KS-7851	Sleeving
—	Duco* household cement
—	No. 25 gray linen thread
—	Toothpicks, hardwood, flat at one end and pointed at the other
—	Orange shellac varnish

\*Registered trademark of DuPont, E.I. de Nemours & Company, Inc.

#### REPLACEMENT OF M1R CORDS

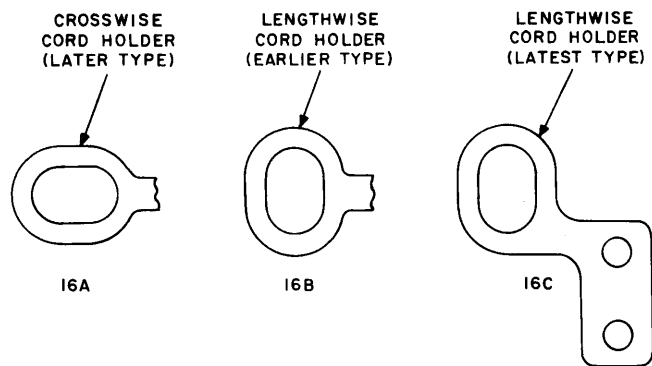
**3.02** Unsolder and remove the cords to be replaced. If the wiper terminals are inaccessible when the shaft is at rotary normal, step the wiper to the eleventh rotary position of the first bank level.

## SECTION 030-705-804

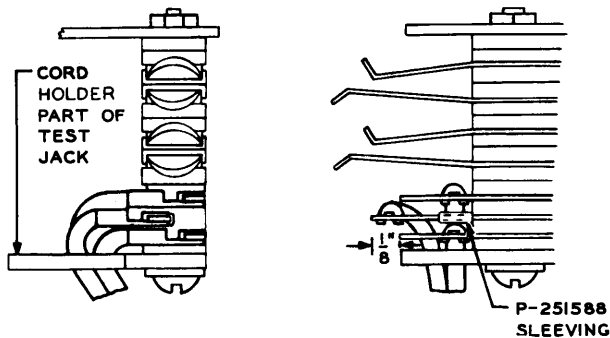
**3.03** To connect new cords, attach one end of the cords to terminals of the test jack as shown in Fig. 17 through 20 and Fig. 22. Pass the cords through the cord holder at the test jack assembly, through the cord holder or cord holders on the commutator (on switches so equipped), and through the cord holder or cord holders (where furnished) on the wiper assemblies to similarly numbered wiper terminals as indicated by the numbers (1), (2), etc, on the above figures. Dress the cords at the test jack end as shown in Fig. 14 or 15.

**3.04** Take extreme care to avoid twisting cords as they are passed through the cord holders. (See 3.06.)

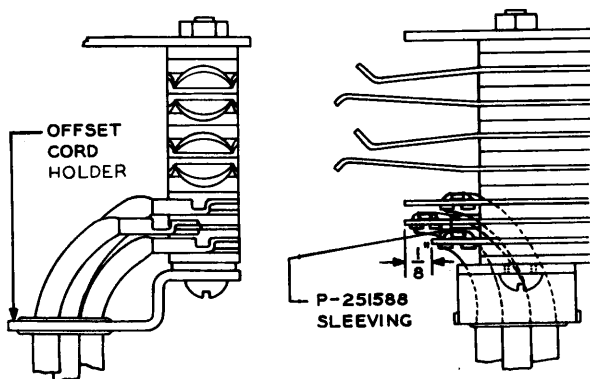
**3.05** Cord tips may be connected to the wiper or test jack terminals with the single prong either up or down.



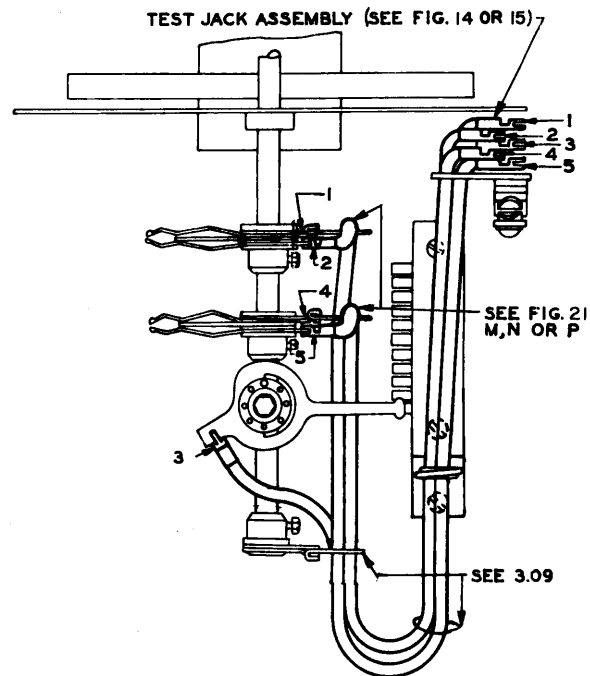
**Fig. 16—Types of Cord Holders Which Are Part of Test Jack Assembly**



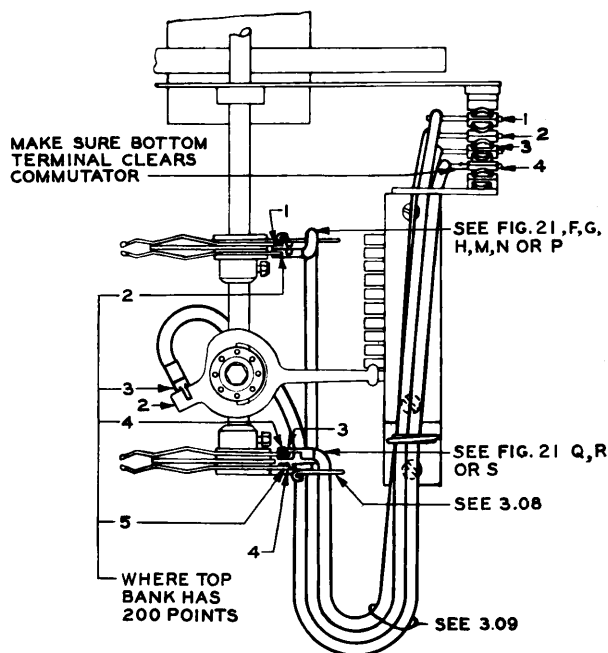
**Fig. 14—Method of Dressing and Connecting Wiper Cords at Test Jack Assembly**



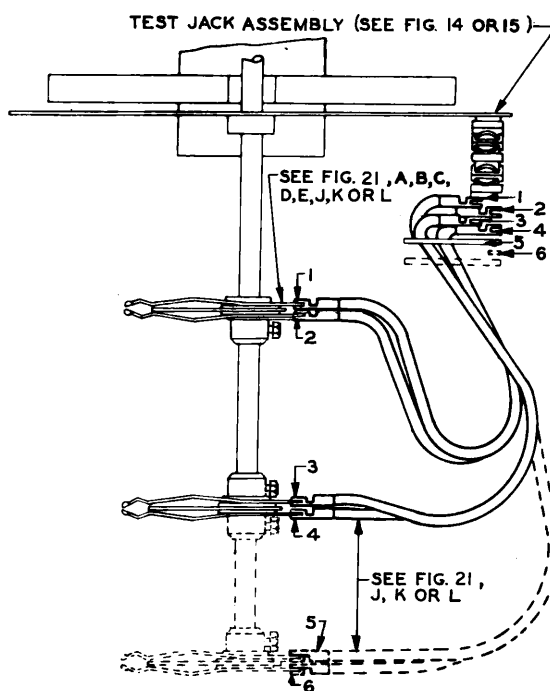
**Fig. 15—Method of Mounting Offset Cord Holder on Test Jack Assembly With Cord Holder per Fig. 16B—Switches Not Equipped With Commutator**



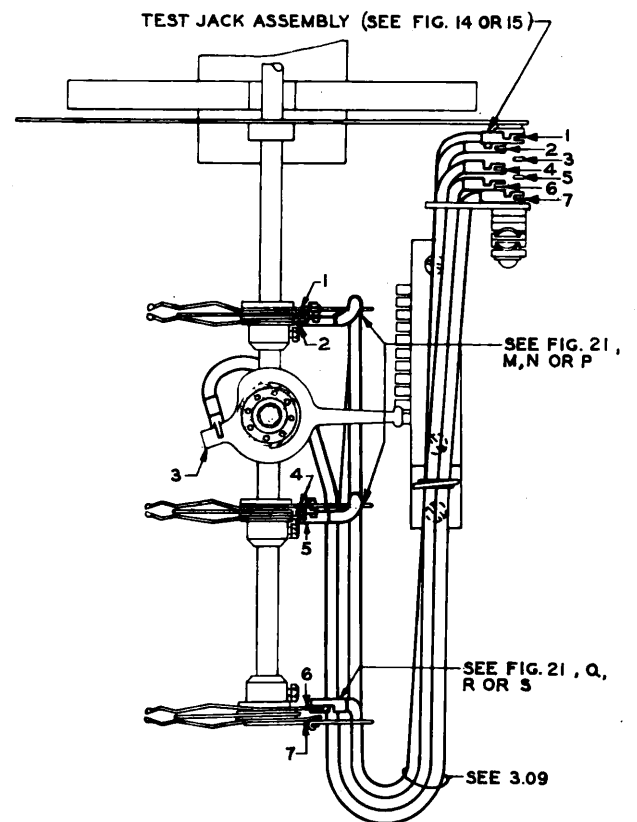
**Fig. 17—Method of Attaching M1R Wiper Cords to Switches Equipped With One Bank and a Commutator**



**Fig. 18—Method of Attaching M1R Wiper Cords to Switches Equipped With Two Banks and a Commutator**

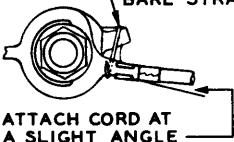
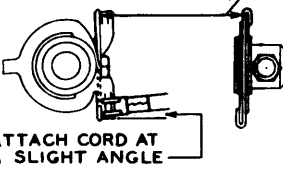
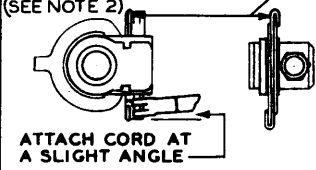
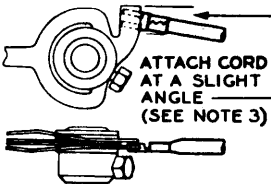
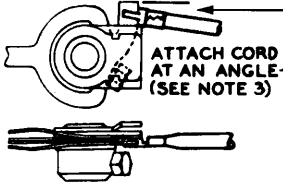

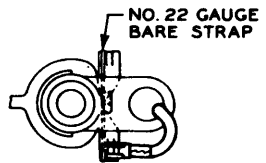
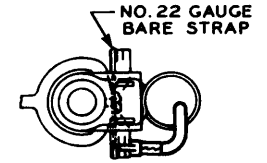
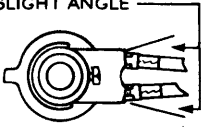
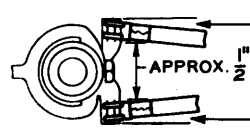
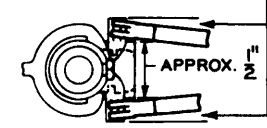
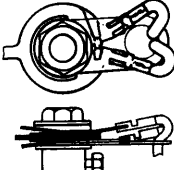
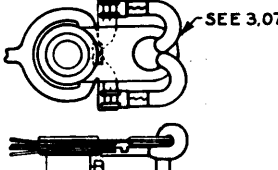
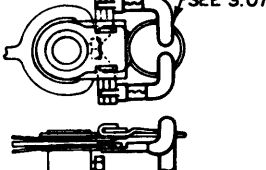
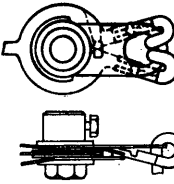
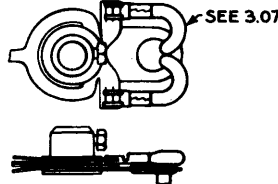
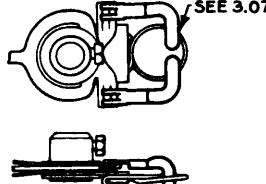


**Fig. 19—Method of Attaching M1R Wiper Cords to Switches Equipped With One, Two, or Three Banks But No Commutator**



**Fig. 20—Method of Attaching M1R Wiper Cords to Switches Equipped With Three Banks and a Commutator**

**3.06** Dress and connect the cords to the wiper terminals as shown in Fig. 21. In the case of a wiper assembly equipped with a cord holder, it is very important to minimize the twist in the cord when it is attached to the wiper terminal since a twist may place the wiper end of the cord under stress and result in the cord climbing upward through the cord holder during subsequent operation of the switch. If this occurs on cords connected to the inner terminals of the top two wiper assemblies (usually designated S and T1), the loop may strike the commutator, resulting in an abrasion of the cord covering. Therefore, in connecting the wiper cord tip to the wiper terminal, take care to turn the cord tip so there will be a minimum twist.

NUMBER OF CONDUCTORS	CORD GUIDE	POSITION OF HUB ON SHAFT	WIPER ASSEMBLY WITH CLAMPING NUT (FIG. 5) (TERMINALS ARE SHORTENED AS NOTED IN 3.14)	WIPER ASSEMBLY WITH OR WITHOUT NON-DETACHABLE CORD GUIDE (FIG. 4)	WIPER ASSEMBLY WITH OR WITHOUT DETACHABLE CORD GUIDE (FIG. 3)
ONE	NO	HUB BELOW WIPER SPRINGS (SEE NOTE 1) (TOP VIEW OF ASSEMBLY SHOWN)	CORD GUIDE CUT-OFF (SEE 3.14)  NO. 22 GAUGE BARE STRAP ATTACH CORD AT A SLIGHT ANGLE FIG. A	 NO. 22 GAUGE BARE STRAP ATTACH CORD AT A SLIGHT ANGLE FIG. B	 NO. 22 GAUGE BARE STRAP (SEE NOTE 2) ATTACH CORD AT A SLIGHT ANGLE FIG. C
		HUB BELOW WIPER SPRINGS (SEE NOTE 1) (TERMINALS EXTEND IN SAME DIRECTION)		 ATTACH CORD AT A SLIGHT ANGLE (SEE NOTE 3) FIG. D	 ATTACH CORD AT AN ANGLE (SEE NOTE 3) FIG. E
	YES	HUB BELOW WIPER SPRINGS (SEE NOTE 1) (TOP VIEW OF ASSEMBLY SHOWN)	 NO. 22 GAUGE BARE STRAP FIG. F	 NO. 22 GAUGE BARE STRAP FIG. G	 NO. 22 GAUGE BARE STRAP FIG. H
	NO	HUB ABOVE WIPER SPGS. ON BOTTOM ASSEMBLY; BELOW SPRINGS ON OTHER ASSEMBLIES	CORD GUIDE CUT OFF (SEE 3.14) ATTACH CORDS AT A SLIGHT ANGLE  TOP VIEW-BOTTOM ASSEMBLY BOTTOM VIEW-OTHER ASSEMBLIES FIG. J	ATTACH CORDS AT A SLIGHT ANGLE  APPROX. 1/2" TOP VIEW-BOTTOM ASSEMBLY BOTTOM VIEW-OTHER ASSEMBLIES FIG. K	ATTACH CORDS AT A SLIGHT ANGLE  APPROX. 1/2" TOP VIEW-BOTTOM ASSEMBLY BOTTOM VIEW-OTHER ASSEMBLIES FIG. L
TWO	YES	HUB BELOW WIPER SPRINGS	 FIG. M	 SEE 3.07 FIG. N	 SEE 3.07 FIG. P
		HUB ABOVE WIPER SPRINGS	 FIG. Q	 SEE 3.07 FIG. R	 SEE 3.07 FIG. S

FOR NOTES 1, 2, AND 3 SEE FOLLOWING PAGE

Fig. 21—Method of Attaching M1R Cords to Wiper Assemblies



**Notes for Fig. 21**

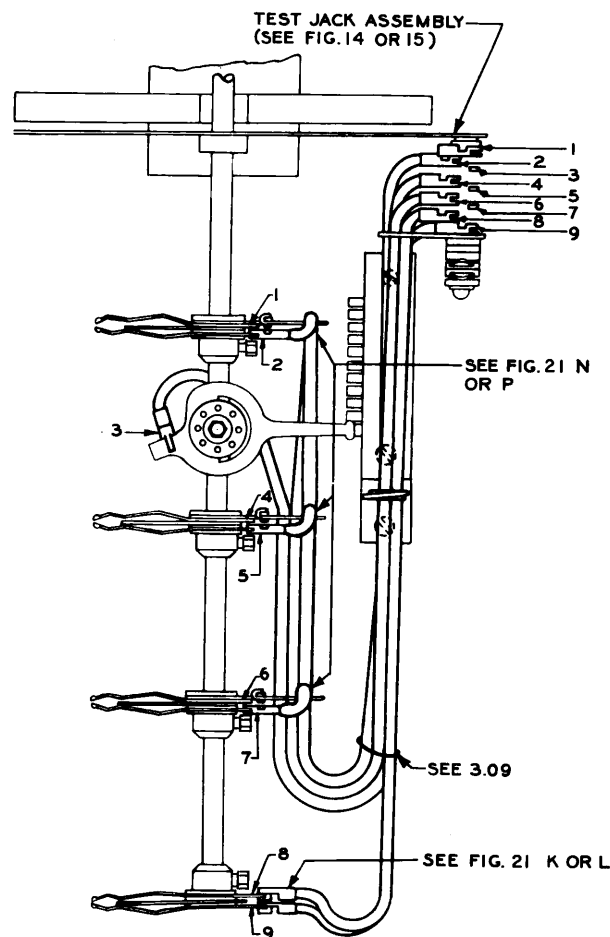
1. On the 197CM switch, all wiper assemblies are mounted with the hub above the wiper springs. For this switch, the associated figures show the bottom view of the wiper assembly.
2. Omit strap on 197K switch associated with 4-wire banks where the wiper assembly is adjusted as a 2-conductor wiper.
3. Flow solder between both wiper terminals except on 197K switches associated with 4-wire banks where the assembly is adjusted as a 2-conductor wiper. In such cases bend the upper terminal to avoid contact with the lower terminal.

**3.07** Solder the cords in position at the wiper and test jack assemblies. On switches equipped with wiper cord holders, dress the cords down and operate the switch a few times to make sure that the cords do not climb. In some cases it may be desirable to pinch the cord around the cord holder to help hold it in position.

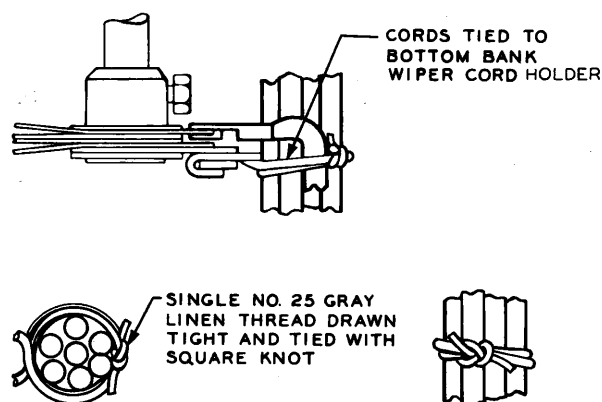
**3.08** Where switches with two bank wiper assemblies and a commutator are mounted above and sufficiently close to relays to other equipment as to cause the bottom loops of the wiper cords to strike against this equipment, tie the wiper cords at the cord holders of the lowest wiper and commutator, as shown in Fig. 23, to prevent the cords from working up through the cord holder and coming in contact with or snagging on the commutator contacts. Make certain that there is always sufficient slack in the cords to permit the wipers to reach all steps of all levels without strain on the cords.

**3.09** It is permissible to tie the cords in a bundle with a single strand of No. 25 gray linen thread at the points indicated in Fig. 17, 18, 20, and 22 in cases where the cords are likely to snag on the bank rods or bank rod collars. On switches equipped with a commutator not having a cord holder at the lower end, tie the cords in a bundle at this point.

**Note:** To prevent leakage between cords, do not tie them too tightly.



**Fig. 22—Method of Attaching M1R Wiper Cords to Switches**



**Fig. 23—Method of Tying M1R Wiper Cords to Bank Wiper Cord Holders**

**Correction for Climbing Cords**

**3.10** Where a climbing cord, as described in 3.06, is encountered on a switch and the cord is still in good condition, unsolder it from the wiper terminal and withdraw it from the cord holder. It is not necessary to unsolder the cord at the test jack end. The cord may have taken a set in such a manner that it has assumed a curved shape or spiral twist toward the cord tip. Where this has occurred, work the end of the cord with the fingers as required until the cord remains straight. It may be necessary in some cases to twist the cord in a direction opposite to that in which it had been previously set to insure that it will remain straight.

**3.11** After the cord has been straightened, thread the cord through the cord holder from which it was removed. In order to minimize twisting of cords, the solderless cord tips may be connected to the wiper terminal with the single prong either up or down. Solder the wiper cord tip to the wiper terminal, taking care to position the cord tip so there will be a minimum of twist. In some cases, it may be helpful to pinch the cord around the cord holder to help hold it in position.

**3.12** Dress the cords down, and operate the switch a few times to make sure that the climbing condition has been corrected.

**REPLACEMENT OF M1G BY M1R CORDS**

**3.13 General:** When replacing M1G by M1R cords, remove the M1G cords from the wiper assemblies as described in 3.14, and then remove them from the test jack assemblies as described in 3.15. If the switch is equipped with a semicircular coverplate (no right angle at the corner), proceed as described in 3.20. On switches where the test jack cord holder has a hole lengthwise, as shown in Fig. 16B or 16C, it will be necessary to cut off the cord holders in the test jack assembly as described in 3.15 before connecting the M1R cords. It will then be necessary to mount a substitute cord holder on the test jack assembly as described in 3.16 or to mount a cord holder at the top of the commutator as described in 3.17. It may also be necessary to relocate a cord holder at the bottom of the commutator or to add a new cord holder as described in 3.18. Substitute the M1R cords, soldering them to the proper connecting points as described in 3.03. Dress and connect the cords as described in 3.03 through 3.09.

**3.14 Removing M1G Cords From Wiper**

**Terminals:** On wiper assemblies without a clamping nut (Fig. 3 and 4), unsolder the cord from the wiper terminals. If the wiper terminals are inaccessible when the shaft is at rotary normal, step the wiper to the eleventh rotary position of the first bank level. Where the wiper assembly has a clamping nut (Fig. 5), cut off the wiper terminals using the diagonal pliers. Take care in doing this not to cut off all of the tinned portion of the terminals. When the switch is not equipped with a commutator, cut off the cord holder as close to the hub as practicable without removing the assembly.

**3.15 Removing M1G Cords From Test Jack**

**Assembly:** Where the test jack terminals are of unequal length, or where the assembly has test jack and cord terminals in separate pileups, unsolder the cords from the terminals. Where the terminals are of equal length, cut off approximately 1/8 inch from each terminal in the outer row with the diagonal pliers. Unsolder the cords from the inner row of terminals, and place a sleeve over each of these terminals as shown in Fig. 14. Where the test jack assembly is equipped with a cord holder having the hole lengthwise, as shown in Fig. 16B or 16C cut off the cord holder using the diagonal pliers. Then substitute a new cord holder at the bottom of the test jack assembly as described in 3.16 when the switch is not equipped with a commutator. When the switch is equipped with a commutator, mount a cord holder on the commutator as described in 3.17.

**3.16 Mounting Cord Holder on Test Jack Assembly When Switch Is Not Equipped With a Commutator:**

Remove the test jack assembly mounting nut with the 418A wrench, and remove the test jack assembly front clamping screw using the 3-inch C screwdriver. Place an offset cord holder under the test jack, as shown in Fig. 15, and fasten it in position with the clamping screw. Remount the mounting nut. If the clamping screw is not long enough to accommodate the cord holder, replace the screw with a longer one. If the replacing screw is too long, cut it to the proper length with the KS-14439 cut-nippers. With the nut securely mounted in position, touch up the end of the screw with orange shellac varnish.

**3.17 Mounting Cord Holders on Commutator on Switches Equipped With Commutator:**

Cut off the cord holder in the test jack assembly using the diagonal pliers. Mount a cord holder

bracket under the upper clamping screw, using the 4-inch E screwdriver, with the cord holder mounting lug of the bracket below the screw as shown on the P-251147 commutator in Fig. 29A. Except in the case of the P-251147 commutator, the cord holder bracket may be mounted under the upper mounting screw as shown in Fig. 29B if the cords cannot be dressed properly with the bracket under the upper clamping screw. Mount the cord holder on the cord holder bracket. To do this, hook the left hook of the holder over the left lug of the bracket. Slide the right hook around the front of the bracket until the right hook snaps over the right lug of the bracket. The hooks of the cord holder should be up.

### **3.18 *Substitution of Detachable One-Piece Cord Holder Mounted Under Lower Clamping Screw of Commutator Mounted on Banks:***

When replacing M1G cords by M1R cords, replace a one-piece cord holder mounted under the lower clamping screw of commutators mounted on the bank. This is done to facilitate the removal of the switch from the bank. Loosen the lower clamping screw under which the cord holder is mounted using the 4-inch E screwdriver, and remove the cord holder. Replace this holder by a cord holder bracket and detachable cord holder. To do this, mount the bracket under the lower clamping screw with the cord holder mounting lug below the screw as shown in Fig. 29A. Mount the cord holder on the lug of the bracket as described in 3.17. Tighten securely all screws which were loosened. If preferable for cord dressing or other reasons, the cord holder bracket may be mounted under the lower mounting screw as shown in Fig. 29B.

**3.19 *Toll Level Hunting Connectors Having Wiper Terminals in a Separate Pileup at the Left of the Test Jack Assembly:*** Replace the entire terminal and test jack assembly with the latest type test jack assembly in accordance with Table A in Section 030-705-803.

### **3.20 *Switches With a Semicircular Coverplate (No Right Angle at the Right Corner):***

When replacing M1G by M1R cords, relocate the number plate holder as follows to prevent the M1R cords from snagging on it. Loosen the number plate mounting screw using the 3-inch C screwdriver, and remove the number plate. Loosen the test jack assembly mounting screw at the left, and

insert the number plate between the coverplate and the test jack assembly. Tighten the test jack assembly mounting screw securely.

## **REPLACEMENT OF DETACHABLE CORD HOLDERS**

### **Removing Green Detachable Cord Holders**

**3.21** Remove green cord holders in the following manner. Block the switch in the off-normal position, as covered in Section 030-705-801, and rotate it to the fifth rotary step of the first level.

### **3.22 *Wiper Assembly With Hubs Mounted Down:***

Dismount the holder by snapping one of the hooks off the wiper lug with the fingers. Slide the holder down along the wiper cords far enough to perform the following operations. Hold the holder firmly between the thumb and forefinger of the right hand, with the hooks at the left, and rotate it so the open ends of the hooks are away from the switch.

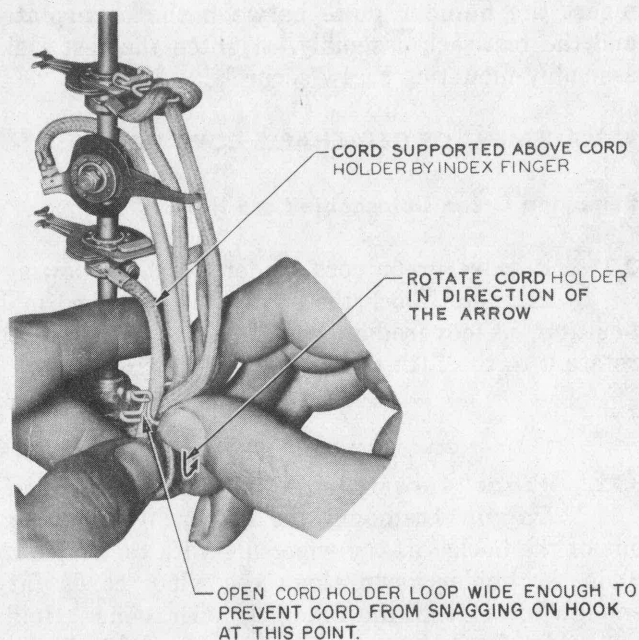
**3.23** Grasp the cord nearest the opening just below the holder with the thumb and middle finger of the left hand, at the same time supporting the cord above the holder with the index finger, as shown in Fig. 24, to avoid bending the wiper lug. While holding the cord taut, twist the upper part of the holder away from the switch and snap the cord out of the holder by moving the holder to the right. In doing this, twist the cord holder far enough to prevent snagging the braid of the wiper cord on the lower hook. Repeat this procedure until all of the cords have been removed.

### **3.24 *Wiper Assembly With Hubs Mounted Up:***

Dismount the holder by snapping one of the hooks off the wiper lug with the fingers, and slide the holder along the cords to a convenient point directly below the commutator. Then proceed to remove the cords as covered in 3.22 and 3.23.

### **Removing Other Than Green Detachable Cord Holders**

**3.25** Block the switch in the off-normal position, as covered in Section 030-705-801, and rotate the switch to the fifth rotary step of the first level.



**Fig. 24—Method of Removing Detachable Cord Holder From Cord**

**3.26** Support the shaft with one hand, and remove one of the cord holder hooks from its associated lug with the B long-nose pliers. Where readily applicable, follow the method described in 3.22 through 3.24 for removing green cord holders. Otherwise proceed as follows.

**3.27** Where the cord holder is too stiff or where the loop of the cord holder opens in the opposite direction from that for which procedures are given in 3.22 through 3.24, proceed as follows. Slide the cord holder down along the cords, and position the holder with the open end of the hooks away from the switch. Then using two pairs of B long-nose pliers, grasp each hook with the pliers and bend the loop permanently open so the cords can be readily removed. Discard holders removed in this manner.

#### **Installing Cord Holders**

**3.28** Install green cord holders as covered below.

**Note:** Most cord holders other than green in color can be installed by this method. Where a holder is considered too stiff or where the loop opens in the opposite direction to that for which the description is given, it is recommended that the holder be discarded.

**3.29** Block the switch in the off-normal position, as covered in Section 030-705-801, and rotate the switch to the fifth rotary step of the first level.

**3.30** Hold the holder between the thumb and forefinger of the right hand with the holder loop horizontal, with the hooks of the holder at the left, and with the open ends of the hooks turned down.

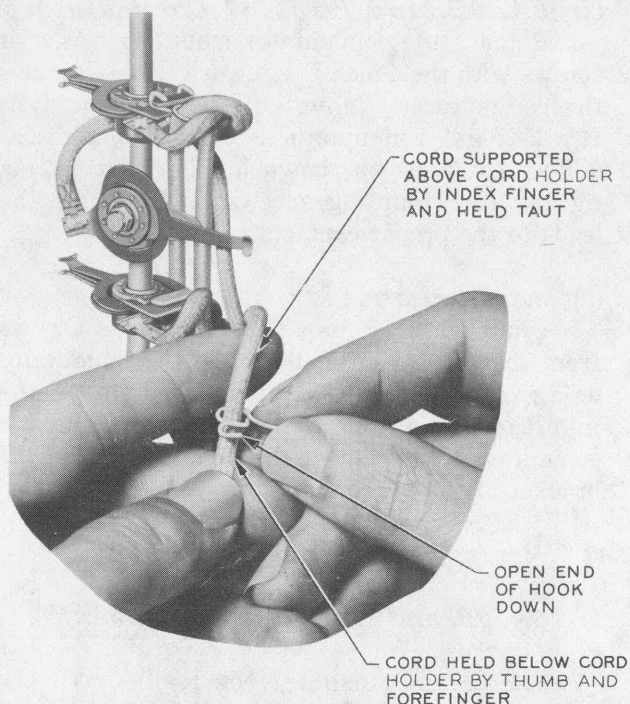
#### **3.31 Wiper Assembly With Hubs Mounted Down:**

Grasp the cord below the wiper assembly with which the cord holder is to be associated, with the thumb and middle finger of the left hand as shown in Fig. 25. To avoid bending the wiper lug, support the cord with the index finger at a point far enough above the holding point to permit inserting the cord holder as shown in that figure. Then start a cord into the holder by moving the cord holder to the left as shown in this figure. While holding the cord taut, twist the holder in a direction such that the cord forces the loop open. Move the holder toward the left, thus causing the cord to enter the loop as shown in Fig. 26. Push the cord toward the back of the holder to avoid interference with the next cord. Repeat this procedure for the other cords.

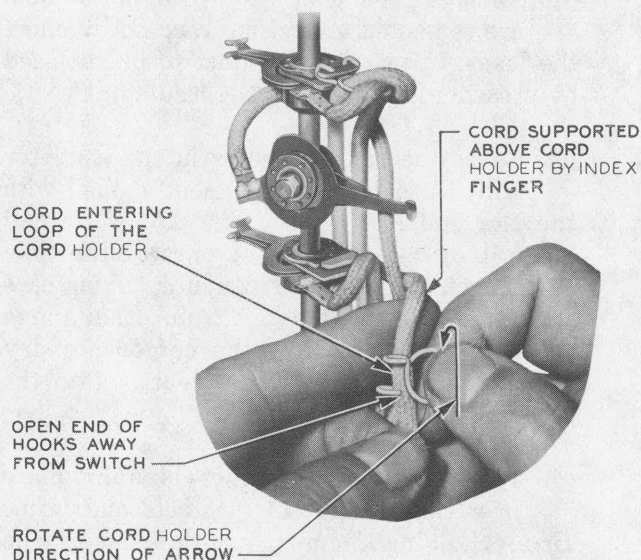
**3.32** When all of the wiper cords have been inserted into the holder, slide the holder up along the cords to a position opposite the lug of the wiper assembly with which the holder is to be associated so that one of the hooks of the holder is opposite the left ear of the lug and the other hook is opposite the right ear of the lug. Place the left hook over the left ear of the lug, and while holding the shaft in position to prevent the possibility of damaging the shaft, slide the other hook of the holder around the front edge of the wiper lug until that hook snaps over the associated ear of the lug as shown in Fig. 27. When mounted as described, the hooks of the cord holder will be up.

**3.33** Dress the cords that are connected to the wiper as shown in Fig. 27. After dressing the cord, make sure that there is appreciable clearance between the detachable holder and the cord tips. If the clearance is not satisfactory, adjust the cord tip or soldering lug as required with the 485A pliers.

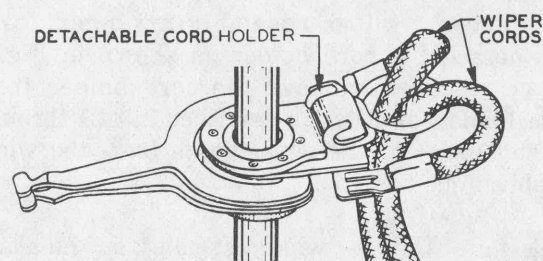




**Fig. 25—Detachable Cord Holder Being Placed in Position Preparatory to Mounting on Cord**



**Fig. 26—Method of Mounting Detachable Cord Holder on Cord**



**Fig. 27—Method of Dressing Wiper Cords When Detachable Cord Holder is Used**

### 3.34 *Wiper Assembly With Hubs Mounted Up:*

Hold the cord holder and grasp the cord, as described in 3.30 and 3.31, at a convenient point directly below the commutator. Proceed to insert the cords in the cord holder as described in 3.31. When all of the cords have been inserted, slide the holder along the cords to the wiper assembly; then mount the holder on the wiper lugs as described in 3.32 and 3.33. When this procedure has been followed, the hooks of the cord holder will be down instead of up.

## REPLACEMENT OF WIPER ASSEMBLIES

**3.35 *General:*** To replace a wiper assembly, proceed as follows.

**3.36** Unsolder the wiper cords from the bank or commutator wiper assembly to be replaced. If the wiper terminals are inaccessible when the shaft is at rotary normal, step the wiper to the eleventh rotary position of the first bank level. Loosen the wiper assembly setscrew with the 3-inch C screwdriver or the 555A wrench. Remove the wiper assembly from the shaft. It may be necessary to remove one or more of the other wiper assemblies from the shaft in order to remove the wiper assembly to be replaced. In such cases, do not unsolder the wiper cords from any of the assemblies except the one to be replaced. If the wiper assembly is equipped with an integral cord holder, proceed as follows. Using the 5-inch diagonal pliers, cut through the metal ring or insulator on the cord holder of the assembly to be replaced. Cut the holder at two points, one on either side of the holder, near the wiper soldering terminals. Remove the cords from the holder. When this procedure is followed, it will be necessary to unsolder only the wiper cords from the wiper assembly to be replaced.

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**3.37** Where a wiper assembly arranged for a detachable cord holder as shown in Fig. 3 is to be replaced, remove the cord holder from the cord holder bracket as described in 3.21 through 3.27, and unsolder the wiper cords from the wiper assembly to be replaced.

**3.38** Mount the new wiper assembly on the shaft. Thread the cords through the cord holder, and mount the holder on the wiper assembly as described in 3.28 through 3.34.

**3.39** When replacing the wiper assembly on switches having three or four banks (Fig. 22), mount the upper and middle assemblies with the hub turned down and mount the bottom assembly with the hub turned up. When replacing assemblies on switches having one bank (Fig. 17), mount both assemblies with the hubs turned down. When replacing the assemblies on switches having two banks (Fig. 18), mount the upper assembly with the hub turned down and the lower assembly with the hub turned up, except on the 197CM switch where all assemblies shall be mounted with the hubs up. Place the new assembly in position, tighten the hub setscrew firmly, and reconnect the wiper cords to the wiper terminals.

**3.40** When replacing wiper assemblies on switches equipped with the M1G-type wiper cords, place the tip of the cord on the top of the wiper terminal and solder it directly to the terminal. Dress the cords similarly to those shown in Fig. 28.

**3.41** When replacing bank wiper assemblies on line finders, trunk finders, and level hunting connectors having nonlubricated banks, first clean and treat the bank terminals.

## REPLACEMENT OF COMMUTATORS AND ASSOCIATED PARTS

### Commutators

#### **3.42 Replacing Complete Commutator**

- (1) Tag and unsolder the leads to the commutator contacts.

#### **(2) 9A, 9B, and P-251147 Commutators:**

Remove the commutator mounting screw or screws with the 4-inch E screwdriver, and remove the commutator. Mount the new commutator. If a P-251147 commutator is being mounted, use a P-92619 screw as shown in Fig. 1. Securely tighten the mounting screws, and connect the leads to the proper contacts.

- (3) **8A Commutator:** To replace an 8A commutator, remove the clamping screws from the contact assembly of a 9A commutator using the 4-inch E screwdriver. Remove the insulator to which the contacts of the 9A commutator are cemented, and mount it on the bracket of the 8A commutator.

#### **3.43 Replacing Individual Contacts Only**

##### **(1) 9A, 9B, and P-251147 Commutators**

- (a) Tag and unsolder the leads from the contacts to be replaced. Remove the clamping screws using the 4-inch E screwdriver, and remove the commutator clamping plate and front insulator which clamp the commutator contacts in position. Take care to avoid jarring the commutator to prevent the other contacts from being loosened.

- (b) Remove the insulator to which the contacts are cemented, exercising care not to short the leads. Loosen the contact to be replaced by pressing it away from the insulator.

- (c) Cover the contact recess in the insulator with Duco household cement applied with the flat end of a toothpick. Apply a small amount of cement to that part of the new contact which fits in the insulator, taking care to keep the cement away from other parts of the contact. Allow the cement to dry slightly, and then press the contact into the insulator recess by hand.

- (d) Place the insulator and clamping plate over the commutator contacts and, while firmly holding them in position, insert the clamping screws and tighten them securely. Connect and solder the leads.

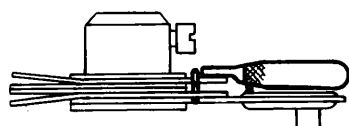
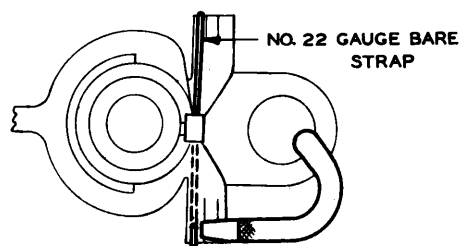


Fig. 28A—Single-Conductor Wipers

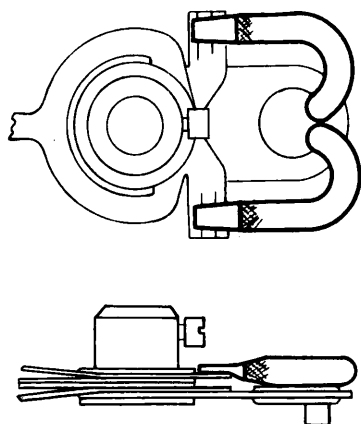


Fig. 28B—2-Conductor Wipers

Fig. 28—Method of Connecting M1G Cords to Wiper Assemblies Designed for M1R Cords

- (2) **8A Commutator:** To replace contacts of the 8A commutator, use contacts from a 9A commutator and follow the procedures covered in (1).

#### Commutator Cord Holder Bracket

- 3.44** Cord holder brackets with horizontal mounting slots may be mounted under either the commutator clamping or mounting screws. (See

Fig. 29.) When replacing cord holder brackets, mount the new bracket in the same position as the bracket being replaced.

- 3.45** On switches having a commutator not provided with a cord holder bracket at the lower end of the commutator, mount a bracket at this end as described in 3.46 through 3.48.

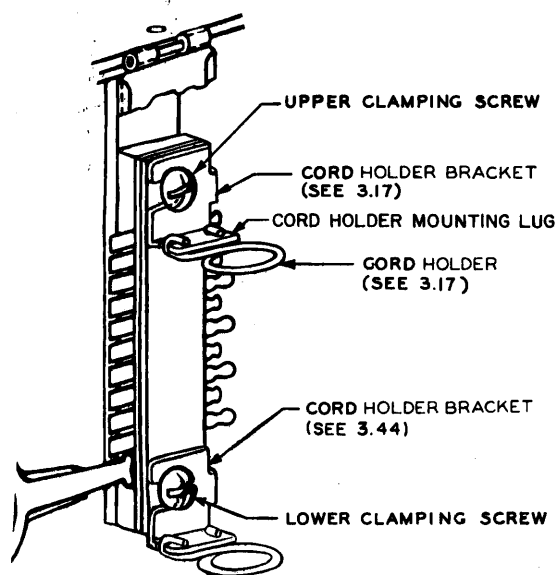
- 3.46** *On switches where the commutator is mounted on the coverplate* (Fig. 29A), loosen the lower commutator clamping screw with the 4-inch E screwdriver and mount a commutator cord holder bracket under the head of the clamping screw with the cord holder mounting lug of the bracket below the clamping screw. Securely tighten the clamping screw. If the clamping screw is not long enough, it may be necessary to order a new screw.

- 3.47** *On switches where the commutator is mounted on the bank*, loosen the lower commutator mounting screw with the 4-inch E screwdriver and mount a commutator cord holder bracket under the head of the mounting screw with the lug of the bracket above the mounting screw.

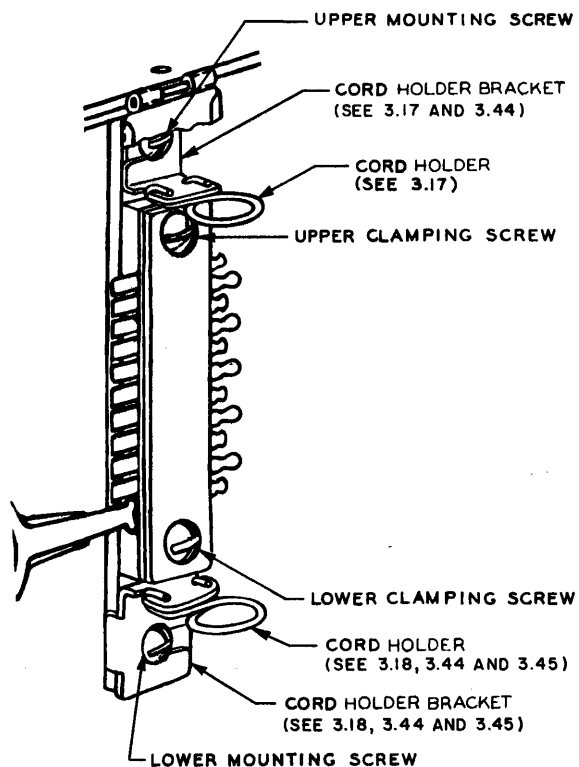
- 3.48** Insert the cords in the detachable cord holder, and mount the cord holder on the lug of the cord holder bracket as described for the wiper assembly in 3.34. The hooks of the cord holder will be up.

#### Detachable Commutator Cord Holders

- 3.49** Remove detachable commutator cord holders which are the same as the detachable wiper cord holder shown in Fig. 27 as described in 3.22 and 3.23 or 3.26 and 3.27, and install them as covered in 3.28 and 3.34, except that the cord holder is mounted on a commutator cord holder bracket and that the hooks of the cord holder will be up.



**Fig. 29A—P-251147 Commutator**



**Fig. 29B—9A or 9B Commutator**

**Fig. 29—Method of Mounting Commutator Cord Holder Bracket and Cord Holder**