206-TYPE SELECTORS AND 26-TYPE BANKS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the apparatus requirements and adjusting procedures for the Nos. 206L, 206AL, 206BA, 206BE, and 206BJ selectors and associated banks.

1.02 This section is reissued to incorporate material from the addendum in its proper location.

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 **Asterisk:** Requirements are marked with an asterisk (*) when to check for them would necessitate the dismantling or dismounting of apparatus, or would affect the adjustment involved or other adjustments. No check need be made for 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 **One dip of KS-8370 oil or KS-8559 lubricant,** for the purpose of this section, is the amount of lubricant retained on the KS-14164 No. 4 artists show card brush after being dipped into the lubricant to a depth of approximately 3/8 inch and scraped once against the side of the container as the brush is removed.

1.06 **A column of grease** for the purpose of this section is a cylindrical-shaped quantity of KS-7471 grease discharged from the nozzle of the No. 353C grease gun of the length specified in the requirements.

1.07 **Make-busy Information:** Before making any of the inspections or readjustments specified herein, ascertain whether or not it is necessary to make any of the circuits busy. Circuits which are so affected should be made busy in the approved manner, and the necessary relays should be held operated or nonoperated to isolate the selector circuit.

1.08 **Steady and Uniform Operation:** A selector operates steadily and uniformly when it operates regularly under self-interruptions for not less than ten revolutions. If the selector is wired so it cannot be rotated under self-interruptions, it shall be rotated under control of the relay wired to its interrupter contacts for at least ten revolutions. A slight hesitation or momentary change of speed at or about the time the rotor brushes engage the feeder brushes is not objectionable if it recurs regularly. A distinctive click indicating the failure of the pawl to latch up over a tooth shall not be present. It is satisfactory to rotate the selector for approximately one minute and to judge its operation by ten consecutive revolutions thereafter.

1.09 **Selector Circuit:** The selector circuit referred to herein ordinarily consists of the selector magnet coil. However, when apparatus such as a resistor, or relay, or combinations thereof, is wired into the circuit so as to be in series with the selector coil during normal circuit operation, it shall be considered as a part of the selector circuit. For requirements 2.29, 2.30, and 2.31, the selector circuit shall be etxended to include the interrupter contacts with spark protection.

1.10 **High or low voltage** refers to the potential drop or closed circuit voltage across the selector circuit with the test set connected to the interrupter spring which is wired to the magnet coil. The specified potential drop must be regulated as far as possible by the use of the auxiliary battery used with the selector test set. A series resistance may be used to obtain the correct potential when necessary, but this resistance must always be less than that which would be sufficient to correct for a difference of one cell.

1.11 **Numbering of Rotor Brushes:** The rotor brush pairs are numbered from the left to right, facing the front of the selector, beginning with No. 1 pair, which is the nearest to the ratchet wheel.

1.12 **Numbering of Interrupter Contact Springs:** The interrupter contact springs are numbered consecutively, starting with the interrupter spring nearest the spring stop, which is spring No. 1.

1.13 **Bank feeder brushes** are those feeder brushes which are part of the bank.

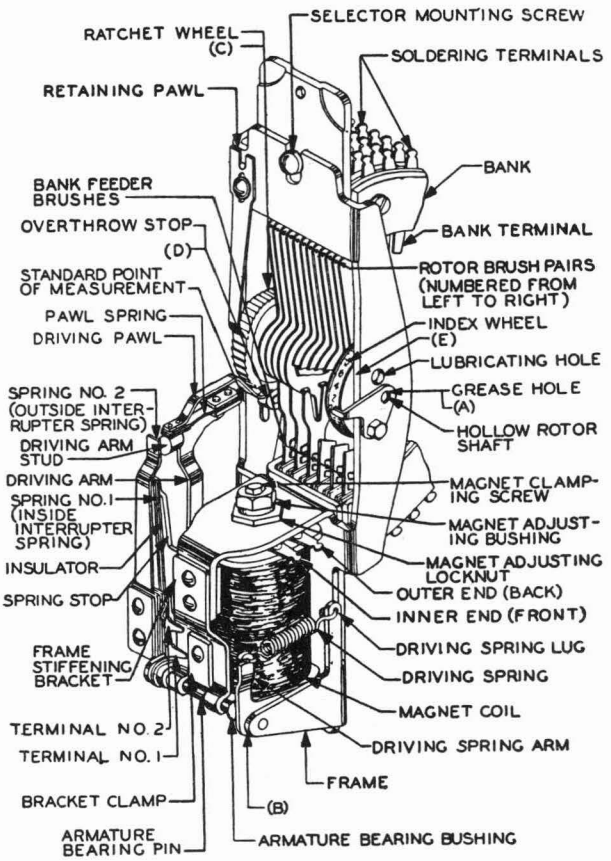

Fig. 1—206-type Selector and 26-type Bank

1.14 **Detachable feeder brushes** are those feeder brushes which are mounted as a detachable unit by a stud used in place of the top selector mounting screw.

1.15 **The standard point of measurement** is a point on the driving arm beneath the pawl spring to which the driving pawl is fastened, as shown in Fig. .1.

1.16 **Selectors** which do not meet the test requirements for requirement 2.28, 2.29, 2.30, or 2.31 shall be exercised for approximately one minute and then, if necessary, they shall be cleaned and relubricated and then retested for these requirements.

1.17 **Position of Selector When Requirements Are Met:** Unless otherwise specified, all requirements shall be met

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with the parts in the position which they assume after being operated electrically.

1.18 **All rotor brush requirements** shall be met on both ends of the rotor brush assembly.

1.19 **Running and Stepping:** In the circuit requirement table, test clip data is given to indicate the method of connecting the test set to the selector in checking and readjusting to meet the requirements specified herein. For Running (previously Requirements for Running) and For Stepping (previously Requirements for Stepping) appears in the Remarks column and is associated with the test clip data. The data, For Running, is for use in cleaning and lubricating the selector and for checking requirements 2.29, 2.30, and 2.31 on those selectors where these requirements apply or wherever it is necessary to rotate the selector under self-interruptions or under control of the relay wired to its interrupter contacts. The data, For Stepping, is for use in cleaning and lubricating in case the selector is not wired for operation on self-interruptions, and in checking requirement 2.22, 2.27, 2.28, or whereever it is necessary to operate the selector step by step.

1.20 **Use of Test Lamp and Dental Mirror:** The No. 510C test lamp and No. 376A dental mirror may be used in connection with the visual inspections specified in Part 2, Requirements. In using the No. 510C test lamp, make sure that the proper cord is used for the available voltage.

1.21 **Moving Rotor Brushes by Hand:** In all cases where it is necessary to move the rotor brushes by hand, do this by manually holding the armature against the core and grasping the free ends of the rotor brushes between the contact portion and the hub.

1.22 **To step the selector manually,** apply sufficient pressure to the bottom of the armature, as shown in Fig. 2, to force it upward against the core and then release the armature. In some cases it may be necessary to apply the force with a snap in order to obtain a slight whip of the driving arm so that the driving pawl will engage a tooth of the ratchet wheel. Never step the selector manually by means of the driving arm.

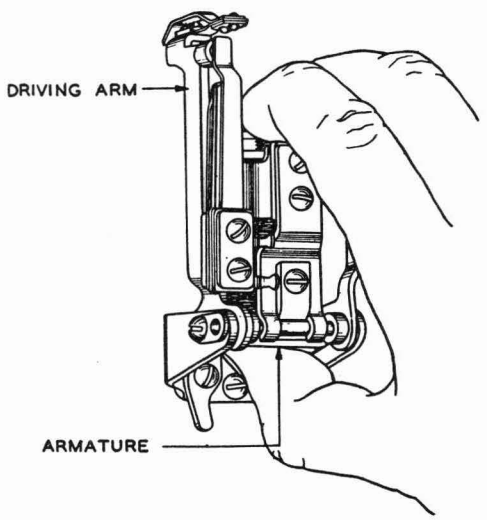


Fig. 2—Method of Stepping a Selector Manually

2. REQUIREMENTS

2.01 **Cleaning**

(a) The ratchet wheel and armature bearings and the surfaces of the magnet core and armature adjacent to each other shall be cleaned, when necessary, in accordance with approved procedures.

(b) The interrupter contacts shall be cleaned, when necessary, in accordance with Section 022-100-811.

(c) If the rotor bearings were last lubricated with KS-8496 lubricating compound and are to be relubricated with KS-7471 grease, KS-8370 oil, or KS-8559 lubricant, the rotor bearings shall be cleaned in accordance with approved procedures before applying the new lubricant.

2.02 **Treating of Banks and Rotors** (Applies After Turnover Only)

(a) **Bank Terminals:** Bank terminals shall be cleaned and treated when necessary in accordance with approved procedures. The first treatment shall consist of cleaning with No. 29 aloxite sleeving followed by treating with No. 30 oiled sleeving. Subsequently the bank terminals shall be treated with No. 30 oiled sleeving.

(b) **Rotors:** Rotors shall be cleaned with No. 32 aloxite sleeving followed by treating with No. 33 oiled sleeving.

(c) **Recommended Interval for Treatment of Banks and Rotors:** Ordinarily, banks and rotors treated with oiled sleeving should not require treatment more frequently than at yearly intervals. This interval may be extended if local conditions are such as to insure that the parts are satisfactory during the extended interval.

2.03 **Lubrication**

(a) **Location Where Room Temperature Never Goes Below 50F:** The rotor bearings, armature bearings, ratchet wheel teeth, and overthrow stop shall be adequately lubricated. When lubrication is necessary, the following amounts of lubricant shall be applied.

Part	Lubricant and Amount	Recommended Lubrication Interval
Rotor Bearings—Fig. 1(A)—(Drilled rotor shaft type or hollow rotor pivot nuts)	KS-7471 grease as required (See note 1)	2 years
Rotor Bearings—Fig. 1(E) — (Solid rotor shaft type or pivot-screw type)	6 dips of KS-8559 lubricant (See 1.05) (3 at each side of rotor)	2 years
Armature Bearings—Fig. 1(B)	4 dips of KS-8559 lubricant (See 1.05) (1 at each side of each bearing)	2 years
Ratchet Wheel Teeth—Fig. 1(C)	A 3/4- to 1-in. column of KS-7471 grease (See 1.06) distributed evenly over the ratchet wheel teeth	2 years
Overthrow Stop—Fig. 1(D)	Approximately 1/8-in. column of KS-7471 grease (See 1.06) applied to surface of overthrow stop adjacent to the driving pawl	2 years

Note

1. The lubricant shall be added until grease is barely forced out at one or both sides of the rotor.

(b) **Location Where Room Temperature May Go Below 50F:** The rotor bearings, armature bearings, ratchet wheel teeth, and overthrow stop shall be adequately lubri-

cated. When lubrication is necessary, the following amounts of lubricant shall be applied.

Part	Lubricant and Amount	Recommended Lubrication Interval
Rotor Bearings—Fig. 1(E)—(Drilled, solid, or pivot-screw type or hollow rotor pivot nuts)	6 dips of KS-8370 oil (See 1.05) (3 at each side of rotor)	6 months
Armature Bearings—Fig. 1(B)	4 dips of KS-8370 oil (See 1.05) (1 at each side of each bearing)	6 months
Ratchet Wheel Teeth—Fig. 1(C)	3 dips of KS-8370 oil (See 1.05) applied while selector is operating	6 months
Overthrow Stop—Fig. 1(D)	1 dip of KS-8370 oil (See 1.05) between driving pawl and overthrow stop	6 months

(c) **Recommended Lubrication Intervals:** The above intervals may be extended if periodic inspections have indicated that local conditions are such as to insure that the selectors will be adequately lubricated during the extended interval.

2.04 **Record of Lubrication:** During the period of installation, a record shall be kept, by date, of the lubrication of the selector, and this record shall be turned over to the telephone company with the equipment. If no lubrication has been done, the record shall so state.

2.05 **Alignment of Tips of Rotor Brushes**

(a) Fig. 3(A)—The trailing edges or tips of all nonbridging brush members shall be in approximate (±0.010 inch) alignment. The reference line used as a basis for this measurement shall be parallel to the axis of the rotor shaft. Gauge by eye.

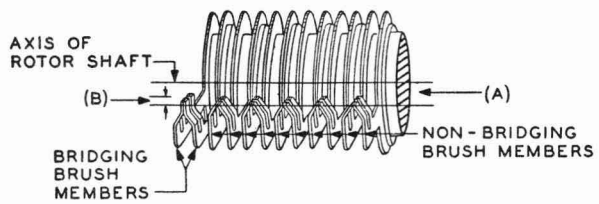


Fig. 3—Alignment of Tips of Rotor Brushes

(b) Fig. 3(B)—The tips of the bridging brushes shall overlap those of the nonbridging brushes by 0.025 inch (±0.015 inch).

Gauge by eye.

(The rotor brush members are 0.013 inch thick.)

2.06 **Armature Backstop Position:** Fig. 4(A)—At the time of turnover, the armature backstop shall be positioned on the selector so that the straight portion of the stop designated (B) in Fig. 4 inclines upward to the right.

Gauge by eye.

2.07 **Position of Rotor Brushes on Bank Terminals**

(a) **Bridging Brushes:** Fig. 5(A)—With the armature against the backstop, the retaining pawl disengaged, and the play of the rotor assembly taken up alternately in the backward and forward directions, bridging brushes shall not touch adjacent terminals. See (c).

Gauge by eye.

(b) **Nonbridging Brushes:** Fig. 6(A)

Test: With the armature against the backstop, the retaining pawl disengaged, and the play of the rotor assembly taken up alternately in the backward and forward directions, the tips (trailing edges) of nonbridging brushes shall be

Min 1/64 inch

from the respective edges of the bank terminals. See (c).

Gauge by eye.

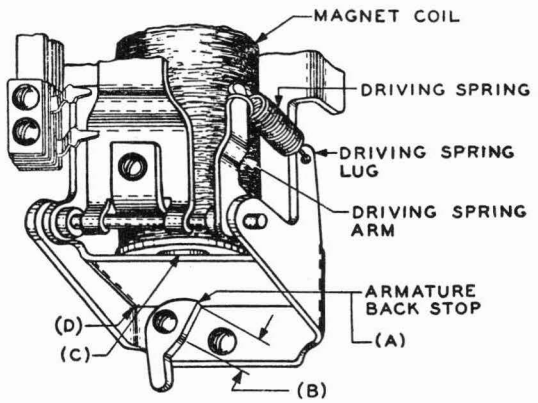


Fig. 4—Armature Backstop Position

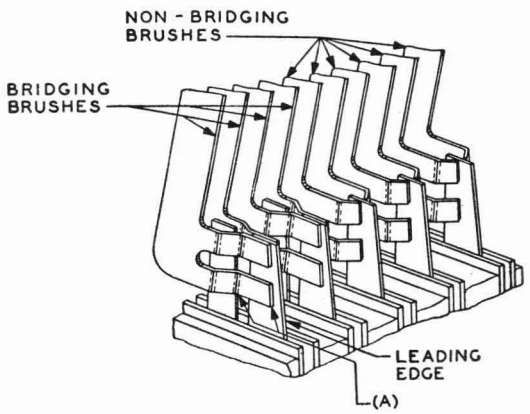


Fig. 5—Position of Bridging Brushes on Terminals

Readjust: With the armature against the backstop, the retaining pawl disengaged, and the rotor assembly rotated in a backward direction to take up the play between the driving pawl and any ratchet wheel tooth, the tips (trailing edges) of all nonbridging brushes shall be

1/32 inch

from the leading edges of their respective bank terminals. See (c).

Gauge by eye.

(The bank terminals are approximately 1/64 inch thick.) This requirement shall be checked on all nonbridging brushes when the brushes are on the bottom terminals and also on the pair of nonbridging brushes nearest the index wheel when these brushes are at the middle and uppermost positions of the bank.

(c) In checking, apply pressure against the driving spring arm where the driving spring is attached to insure that the armature is against the backstop.

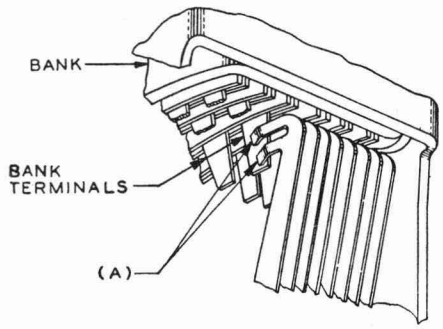


Fig. 6—Positioning of Nonbridging Brushes on Terminals

2.08 **Overthrow Stop Position:** Fig. 7(A)—With the armature against the backstop [see requirement 2.07(c)] and the rotor assembly rotated in a backward direction to take up the play between the driving pawl and any ratchet tooth:

(a) The driving pawl shall not bind between the ratchet wheel and the overthrow stop.

Gauge by eye.

This requirement shall be checked at four positions of the ratchet wheel with the rotor brushes in a vertical position and horizontal position in each half cycle of the rotor. Operate the selector (step by step) to the required positions. Take up the play between the driving pawl and any ratchet tooth by moving the rotor in a backward direction and then releasing it. Grasp the upper end of the driving arm between the thumb and forefinger and move the driving arm gently from side to side. Binding will be indicated if the driving pawl does not return to approximately its original position.

(b) The clearance between the driving pawl and the overthrow stop shall be such that the motion of the rotor brush assembly at the brush tips is

Max 1/32 inch

Gauge by eye.

This requirement shall be checked as follows. Disengage the retaining pawl, and with the rotor brush assembly in a convenient position, rotate the rotor brush assembly back and forth. Repeat this check with the opposite ends of the brushes contacting the bank terminals.

2.09 **Retaining Pawl Position and Tension**

(a) Fig. 7(B)—The retaining pawl shall just drop over the radial face of the ratchet wheel teeth when the armature is operated manually and slowly released against the backstop. See requirement 2.07(c).

Gauge by eye.

This requirement shall be checked in at least four positions of the ratchet wheel approximately 90 degrees apart.

(b) Fig. 7(C)—The tension of the retaining pawl against the ratchet wheel teeth measured at the bend in the pawl shall be

Test —Min 40 grams, Max 80 grams
Readjust—Min 50 grams, Max 70 grams

Use the No. 79C gauge.

The application of the gauge may be facilitated by using a small loop of twine looped around the pawl and the end of the gauge.

2.10 **Rotor Brush Alignment:** Fig. 8(A)—The junction between each pair of rotor brush springs shall line up with the center line of the associated bank feeder brush within 0.014 inch when the brushes are in the position in which they are about to pass onto the feeder brushes. In case the bank feeder brushes have been cut away, this requirement shall apply to the first row of bank terminals.

Gauge by eye.

(Bank terminals and single-piece type feeder brushes are 0.014 inch thick.)

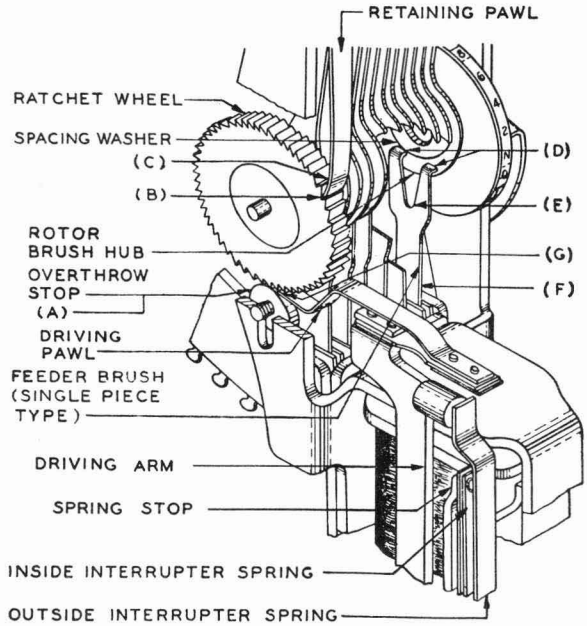


Fig. 7—Ratchet Wheel and Associated Parts

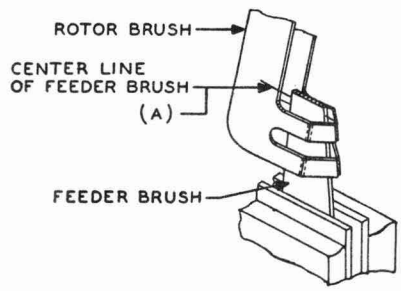


Fig. 8—Rotor Brush Alignment

2.11 **Feeder Brush Position:** Each feeder brush shall meet the requirement listed in Table A for the particular type of feeder brushes involved:

TABLE A

Bank Feeder Brushes			Detachable Feeder Brushes		
Single-piece Type (Fig. 9)	Single-piece Type (Fig. 10)	2-piece Type (Fig. 11)	Single-piece Type (Fig. 9)	Single-piece Type (Fig. 10)	2-piece Type (Fig. 11)
(a)	(a)	(a)	(a)	(a)	(a)
	(b)			(b)	
			(c)	(c)	(c)
(d)	(d)	(d)	(d)	(d)	(d)
(e)	(e)	(e)			
(f)	(f)	(f)	(f)	(f)	(f)
			(g)	(g)	(g)

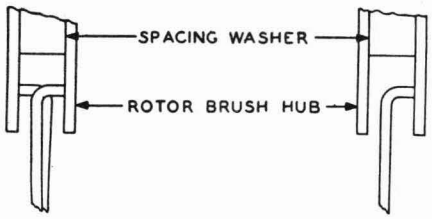


Fig. 9—Single-piece Type Feeder Brush (Balanced Type)

Fig. 10—Single-piece Type Feeder Brush

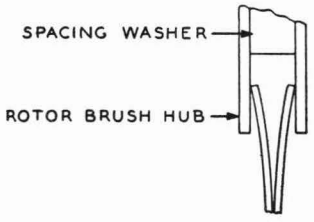


Fig. 11—2-piece Type Feeder Brush

(a) Fig. 7(D)—The prongs of the feeder brush shall not touch the spacing washers on the rotor at any point in the revolution of the rotor.

Gauge by eye.

(b) Fig. 7(E)—When the feeder brush is pushed away from the rotor with pressure applied on the center line of the feeder brush and close to the crotch, the two prongs shall leave the rotor at the same time.

Gauge by eye.

(c) Fig. 12(A)—The points of contact between the feeder brushes and the rotor brush hub shall be

Min 0.015 inch

within the outside edge of the rotor brush hub.

Gauge by eye.

The single-piece type feeder brushes are 0.014 inch thick. Each spring of the chromium-plated, 2-piece type feeder brush is approximately 0.009 inch thick, and each spring of the nonchromium-plated, 2-piece type feeder brush is 0.007 inch thick.

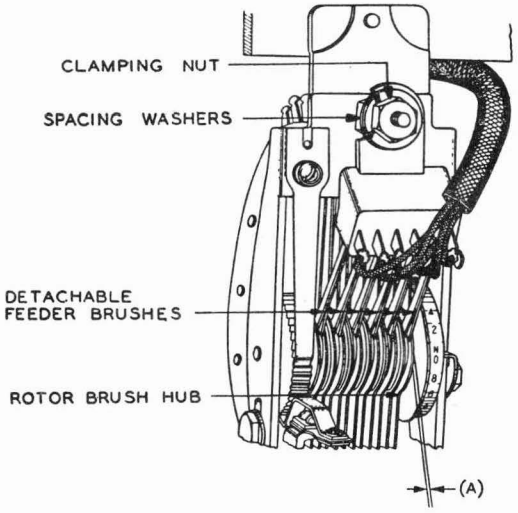


Fig. 12—Detachable Feeder Brushes

(d) The unformed portions of the feeder and rotor brushes shall clear each other at all positions of the rotor by

Min 0.010 inch

Gauge by eye.

(e) Fig. 7(F)—That part of the feeder brush over which the rotor brushes pass shall be in alignment with the bank terminals within 0.010 inch.

Gauge by eye.

(f) The contacting portion of the feeder brushes shall make contact with and be approximately parallel to the face of the rotor brush hub, and shall not extend beyond the periphery of the hub, throughout the revolution of the rotor brushes.

Gauge by eye.

(g) With one end of the rotor brushes resting on the fifth row of bank terminals, the center line of that part of the feeder brush over which the rotor brush passes shall line up with the junction of the associated pair of rotor brush springs within 0.010 inch.

Gauge by eye.

The single-piece type feeder brushes are 0.014 inch thick. Each spring of the chromium-plated, 2-piece type feeder brush is approximately 0.009 inch thick and each spring of the nonchromium-plated, 2-piece type feeder brush is 0.007 inch thick.

2.12 **Feeder Brush Tension**

Single-piece Type Feeder Brush per Fig. 9

(a) Fig. 13(A)—The tension of the front prong of the feeder brush against the associated rotor brush hub, measured just below the tip, shall be

Test —Min 20 grams, Max 45 grams
Readjust—Min 25 grams, Max 40 grams

Use the No. 70J gauge.

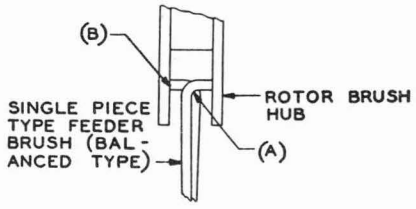


Fig. 13—Single-piece Type (Balanced Type) Feeder Brush Tension

To check this requirement, step the selector electrically to a position where the rotor brushes are approximately 60 degrees from the upper vertical part of the frame. Block the rotor brush assembly by placing the 0.012-inch blade of the No. 74D gauge between the right side of the selector frame and the end of the rotor projecting beyond the nut and a toothpick between the left side of the frame and the ratchet wheel just above the rotor shaft. Measure the tension of the front prong. Remove the gauge blade and the toothpick, step the selector electrically 180 degrees, and repeat the check.

(b) Fig. 13(B)—The rear prong shall reliably contact the rotor brush hub.

Gauge by eye and feel.

To check this requirement, block the rotor brush assembly as covered in (a) and apply the KS-6320 orange stick to the rear prong to check that the prong is making contact with the hub.

Single-piece Type Feeder Brush per Fig. 10

(c) Fig. 7(E)—The tension of each feeder brush against the associated rotor brush hub measured at a point on the center line of the feeder brush and close to the crotch shall be

Test —Min 65 grams, Max 90 grams
Readjust—Min 70 grams, Max 90 grams

Use the No. 70J gauge.

To check this requirement, step the selector electrically to a position where the rotor brushes are approximately 60 degrees from the upper vertical part of the frame. Block the rotor brush assembly by placing the 0.012-inch blade of the No. 74D gauge between the right side of the selector frame and the end of the rotor projecting beyond the nut and a toothpick between the left side of the frame and the ratchet wheel just above the rotor shaft. Measure the tension. When checking the tension of the No. 1 brush, the No. 70J gauge cannot be used. Therefore, the requirement on this brush is met if the tension as determined by feel, using the KS-6320 orange stick, is approximately the same as the tension of another brush which meets the requirement when checked with the No. 70J gauge. Remove the gauge blade and toothpick, step the selector electrically 180 degrees, and repeat the check.

Two-piece Type Feeder Brush per Fig. 11

*(d) With adjacent brushes held away, the spread of the contact ends of the 2-piece type brushes shall be approximately 3/8 inch.

Gauge by eye.

The clamped part of the retaining spring is 3/8 inch wide.

2.13 **Rotor Brush Tension:** Fig. 14(A)—The tension of each member of a brush pair, measured at a point approximately midway between the prongs of the brush member with the brushes on the topmost row of terminals, shall be within the limits specified in the following table.

Use the No. 70J gauge.

	No. 206L Sel No. 26D Bank				No. 206AL Sel No. 26F Bank			
	Test		Readj		Test		Readj	
	Min	Max	Min	Max	Min	Max	Min	Max
Br No. 1	20	40	25	40	20	40	25	40
Br No. 2	20	40	25	40	20	40	25	40
Br No. 3	20	40	25	40	20	40	25	40
Br No. 4	20	40	25	40	20	40	25	40
Br No. 5	20	40	25	40	20	40	25	40
Br No. 6	20	40	25	40				

	No. 206BA Sel No. 26A Bank				No. 206BE Sel No. 26A Bank			
	Test		Readj		Test		Readj	
	Min	Max	Min	Max	Min	Max	Min	Max
Br No. 1	25	45	30	45	25	45	30	45
Br No. 2	25	45	30	45	25	45	30	45
Br No. 3	25	45	30	45	25	45	30	45
Br No. 4	25	45	30	45	25	45	30	45
Br No. 5	30	50	35	50	25	45	30	45
Br No. 6	30	50	35	50	25	45	30	45

	No. 206BJ Sel No. 26C Bank			
	Test		Readj	
	Min	Max	Min	Max
Br No. 1	20	40	25	40
Br No. 2	20	40	25	40

To check this requirement, step the selector electrically so that the brushes are on the topmost row of terminals. Block the rotor brush assembly by placing the 0.012-inch blade of the No. 74D gauge between the right side of the selector frame and the end of the rotor projecting beyond the nut and a toothpick between the left side of the frame and the ratchet wheel just above the rotor shaft. Apply the No. 70J gauge between the prongs of each brush member. Remove the blade and toothpick, step the selector 180 degrees, and repeat the check. On selectors equipped with detachable feeder brushes, it will be satisfactory to check this requirement with the rotor brushes on the detachable feeder brushes instead of on the topmost row of terminals.

2.14 **Rotor Brush Prong Contact:** Fig. 14(B)—At least one of the two prongs of each individual brush member shall make contact with the associated bank feeder brush. The

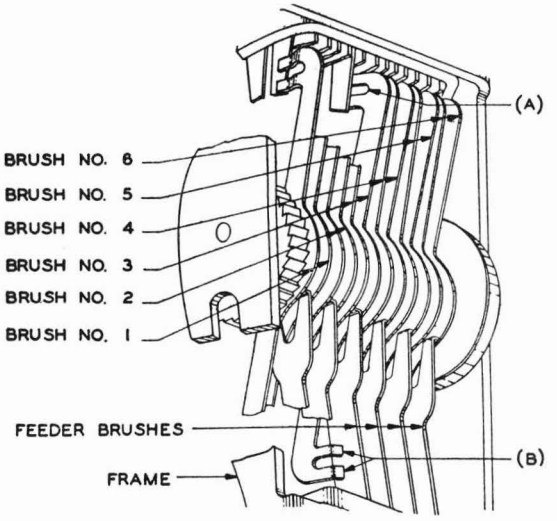


Fig. 14—Rotor and Feeder Brushes

other prong shall not be away from the feeder brush more than 0.005 inch. In case the bank feeder brushes have been cut away, this requirement shall apply to the first row of bank terminals.

Gauge by eye.

In doubtful cases, touch the prongs of the brushes with the end of the KS-6320 orange stick and note whether or not both prongs make contact with the bank feeder brush or bank terminal in cases where the feeder brushes are cut away. The feel of the tool will be an aid to the visual check for the requirement.

2.15 **Toeing of Bridging Brushes:** Fig. 15(A)—When a bridging rotor brush is not contacting with the feeder brush or bank terminals, both pairs of trailing edges of tips of the brush shall toe out, but the maximum separation between each pair of tips shall not exceed 0.010 inch when the brush members are making contact with each other.

Gauge by eye.

Note: At least one pair of contacting surfaces of the brush shall make contact with each other.

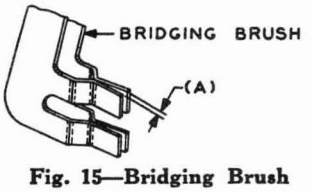


Fig. 15—Bridging Brush

2.16 **Heel Spacing**

(a) Fig. 16(A)—The clearance between brush members of adjacent pairs when the brushes are in contact with the bank terminals shall be

Min 0.030 inch

Gauge by eye.

The bank terminals are 0.014 inch thick.

This requirement shall be checked on the topmost row of terminals. On selectors equipped with detachable feeder brushes it will be satisfactory to check for this requirement on the detachable feeder brushes.

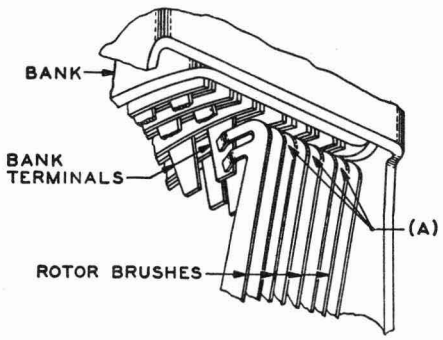


Fig. 16—Heel Spacing Between Brush Members of Adjacent Pairs

(b) Fig. 17(A)—The heels of the rotor brush members shall clear the sides of the bank feeder brushes just before the rotor brushes engage the feeder brushes by

Min 0.015 inch

Gauge by eye.

The bank terminals are 0.014 inch thick.

In case the bank feeder brushes have been cut away, this requirement shall apply to the first row of bank terminals.

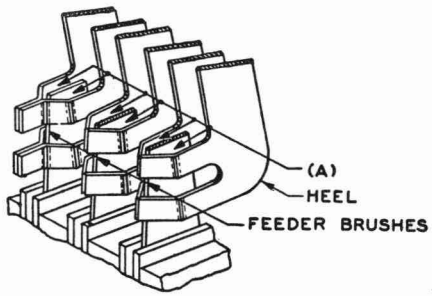


Fig. 17—Heel Spacing Between Brush Members and Bank Feeder Brushes

2.17 **False Contacting**

(a) **Nonbridging Brushes:** Fig. 18(A)—The clearance between the heels of nonbridging brush members and their associated bank terminals, when their contacting edges are in contact with each other between the bank feeder brush and the first bank terminal, the eleventh and twelfth terminals, and the second and third terminals from the top of the bank shall be

Min 0.015 inch

Gauge by eye.

The bank terminals are 0.014 inch thick.

In case the bank feeder brushes have been cut away, this requirement shall apply between the first and second bank terminals.

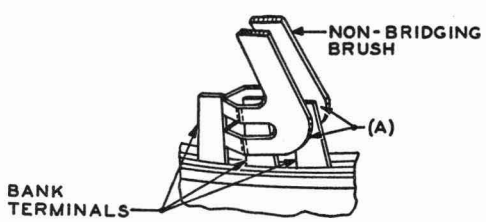


Fig. 18—Nonbridging Brush

(b) **Bridging Brushes:** Fig. 19(A)—The heels of bridging brushes shall clear the first bank terminal just before the rotor brushes engage the feeder brushes by

Min 0.015 inch

Gauge by eye.

The bank terminals are 0.014 inch thick.

In case the bank feeder brushes have been cut away, this requirement shall apply to the second row of terminals.

2.18 **Clearance Between No. 1 Rotor Brush and Driving Arm:** The clearance between the No. 1 brush and the driving arm with the rotor brush assembly in the position it assumes after being operated electrically and with the side play of the armature taken up toward the right, as viewed from the front, shall be

Min 0.015 inch

Gauge by eye.

The rotor brush members are 0.013 inch thick.

To check this requirement, operate the selector electrically until the No. 1 rotor brush is adjacent to the top edge of the driving arm. Take up the side play of the armature to the right as viewed from the front. Observe the clearance of the No. 1 rotor brush and the top edge of the driving arm. The requirement should be checked on both halves of the rotor brush assembly.

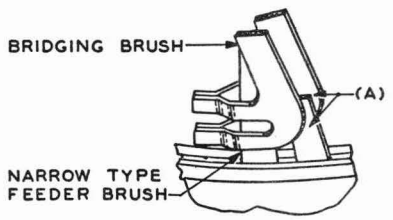


Fig. 19—Bridging Brush

2.19 **Driving Spring Tension:** Fig. 20(A)—The driving spring tension, measured at the standard point of measurement as the driving pawl drops over a ratchet wheel tooth, shall be

	Grams	
Selector	**Min**	**Max**
No. 206L	800	—
No. 206AL	800	—
No. 206BA	800	—
No. 206BE	900	—
No. 206BJ	650	750

Use the No. 79B gauge.

Note: Fig. 20(B)—The outside interrupter spring shall not be in contact with the driving arm stud when the above requirement is met.

To check this requirement, place a toothpick between the interrupter springs just below the contact point to force the outside interrupter spring away from possible contact with the driving arm stud when the armature is fully operated. Apply the No. 79B gauge to the standard point of measurement and hold the gauge horizontally. Measure the tension at the instant the driving pawl drops over the next tooth of the ratchet wheel. It is advisable to check the measurement two or three times because of the possibility of the gauge twisting at the point where it is attached to the driving arm.

2.20 **Armature End Play:** The armature shall have an end play on its shaft of

Min. 0.005 inch

Gauge by eye and feel.

To check this requirement, move the armature from one side to the other and observe the clearance between the armature bearing bushings and the lugs of the frame.

2.21 **Clearance Between Rear Corners of Armature and Lugs of the Frame:** Fig. 4(D)—The clearance between the rear corners of the armature and the lugs of the frame shall be

Test —Min 0.003 inch
Readjust—Min 0.005 inch

Use the No. 74D gauge.

To check this requirement, move the armature toward one lug as far as possible and insert the No. 74D gauge in the gap between the armature and this lug to measure the clearance at the rear corner. Using the No. 376A dental mirror, observe the clearance. Move the armature toward the other lug and recheck at that lug.

2.22 **Armature Airgap:** Fig. 4(C)—

(a) With the magnet electrically operated on the voltages shown in the table below and the overthrow or whip removed, the gap between the armature and the magnet core shall be such that the driving pawl will engage all ratchet wheel teeth throughout a complete revolution. This requirement shall be checked in all positions of rotation.

Gauge by eye and eliminate the overthrow or whip as follows.

Apply sufficient pressure against the outside interrupter spring above the offset to prevent the armature from operating when the magnet is electrically energized. Remove the finger pressure gradually, permitting the armature to operate slowly and thereby eliminating overthrow or whip of the armature arm. The requirement is met if the selector steps when the finger pressure has been removed and the magnet de-energized.

(b) Fig. 4(A)—With the magnet electrically operated on the voltages shown below, the gap between the armature and the backstop shall not exceed

0.030 inch

Use the No. 92J gauge.

	Max Volts	
Selector	**Test**	**Readjust**
No. 206L	45	44
No. 206AL	45	44
No. 206BA	20	19
No. 206BE	20	19
No. 206BJ	15	14

2.23 **Contact Alignment:** The point of contact shall fall wholly within the boundary of the opposing contact.

Gauge by eye.

2.24 **Position of Inside Interrupter Spring** (Spring No. 1): The long insulator shall be held against the offset end of the bracket by the pressure of the No. 1 contact spring.

Gauge by feel and eye.

2.25 **Tension of the Outside Interrupter Spring** (Spring No. 2): Fig. 20(C)—The tension of the outside interrupter spring (spring No. 2) measured in line with the outside interrupter spring contact shall be

	Grams	
Selector	**Min**	**Max**
No. 206L	100	400
No. 206AL	100	300
No. 206BA	100	300
No. 206BE	100	300
No. 206BJ	100	300

Use the No. 79B gauge.

A small loop of twine may be used to attach the end of the gauge to the outside interrupter spring.

2.26 **Driving Pawl Tension and Position**

Driving Pawl Tension

(a) The tension of the driving pawl against the ratchet wheel, measured at the bend near the ratchet wheel end of the pawl with the armature in the electrically operated position, shall be

Test —Min 90 grams, Max 150 grams
Readjust—Min 100 grams, Max 140 grams

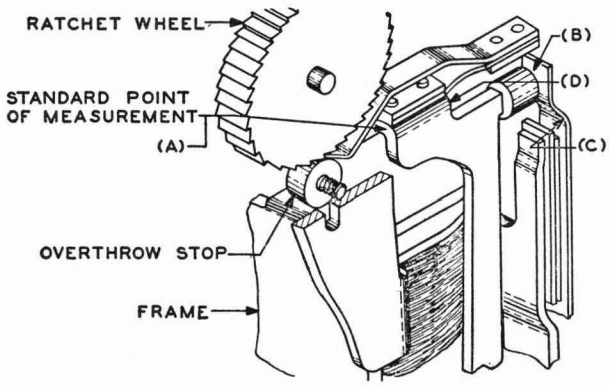


Fig. 20—Driving Pawl and Associated Parts

Use the No. 70J gauge applied at the right-hand side of the pawl.

Driving Pawl Position

(b) The sides of the driving pawl along its length shall be parallel with the sides of the ratchet wheel.

Gauge by eye.

(c) Fig. 7(G)—The driving edge of the pawl shall be parallel to the axis of the rotor brush assembly.

Gauge by eye.

Check this requirement by observing the motion of the pawl as it is clamped between the ratchet wheel tooth and the overthrow stop by intermittently forcing the rotor brush assembly in the direction of rotation and noting whether or not there is twisting motion of the pawl.

(d) The tip end of the driving pawl shall in no case extend beyond either edge of the ratchet wheel.

To check this requirement, operate the selector electrically for a complete revolution and then check at four positions approximately 90 degrees apart after being stepped electrically to these positions.

2.27 **Magnet Pull Test:** Fig. 20(D)—When the following voltages are applied

	Max Volts	
Selector	**Test**	**Readjust**
No. 206L	45	44
No. 206AL	45	44
No. 206BA	20	19
No. 206BE	20	19
No. 206BJ	15	14

the selector magnet shall be capable of drawing up the armature so that the driving pawl falls into the next tooth when the pull of the driving spring is supplemented by a pressure of

Selector	**Min Grams**
No. 206L	50
No. 206AL	50
No. 206BA	50
No. 206BE	50
No. 206BJ	100

applied horizontally with a push gram gauge at a point opposite the standard point of measurement.

Use the No. 79C gauge.

2.28 **Step Test:** Fig. 20(A)—The selector shall be capable of taking a full step where the rotor brushes step onto the feeder brushes when the load on the driving spring is increased by the application of the following tensions

Selector	Min Grams Test	Min Grams Readjust
No. 206L	150	300
No. 206AL	150	300
No. 206BA	150	300
No. 206BE	150	300
No. 206BJ	125	250

applied at the standard point of measurement in a horizontal direction opposed to the pull of the driving spring. This requirement shall be met at both ends of the rotor brushes.

Use the No. 79B or 79C gauge.

2.29 **Speed** (No. 206AL Selector Only) When

Test —Max 45 volts
Readjust—Max 44 volts

is applied across the selector circuit, the rotor brushes shall pass over not less than 20 terminals per second. Determine the speed of the selector by timing five complete revolutions (220 steps) of the rotor brush assembly with a KS-3008 stop watch or equivalent.

2.30 **High-voltage Interrupter Contact Test** (Nos. 206L, 206AL, and 206BJ Selectors Only)—The selector shall start from its normal position and continue to operate steadily and uniformly under self-interruptions when the voltage specified below is applied across the selector circuit

Selector	Min Volts Test	Min Volts Readjust
No. 206L	50	51
No. 206AL	50	51
No. 206BJ	21	22

and when a 0.003-inch gauge is held between the micarta insulator and the spring stop directly behind the contact on the No. 1 interrupter spring.

Use the No. 74D gauge.

2.31 **Low-voltage Interrupter Contact Test** (Nos. 206L, 206AL, and 206BJ Selectors Only)

(a) The selector shall start from the normal position and continue to operate steadily and uniformly when the voltage specified below is applied across the selector circuit and

Selector	Max Volts Test	Max Volts Readjust
No. 206L	45	44
No. 206AL	45	44
No. 206BJ	15	14

when a 0.003-inch thickness gauge is held between the lip of the No. 2 interrupter spring and the driving arm stud.

Use the No. 74D gauge.

Take care to hold the gauge parallel to the lip of the interrupter spring and not to apply any pressure which would tend either to lift the spring away from the stud or to impede its action.

(b) All interrupter operation requirements 2.29, 2.30, and 2.31(a) shall be met with the same interrupter adjustment.

2.32 **Clearance Between Driving Arm Stud and Interrupter Spring** (Applies Only to Nos. 206BA and 206BE Selectors)

(a) Fig. 20(B)—Where the interrupter spring (spring No. 2) is connected in a circuit, the clearance between the driving arm stud and this spring shall be

Test —Min 0.035 inch, Max 0.056 inch
Readjust—Min 0.041 inch, Max 0.050 inch

Use the No. 131A gauge.

(b) The selectors covered in (a) above shall rotate step by step for two complete revolutions on

Test —Max 20 volts
Readjust—Max 19 volts

3. ADJUSTING PROCEDURES

3.001 **List of Tools, Gauges, Materials, and Test Apparatus**

Code or Spec No.	Description
Tools	
243	3/16- and 5/8-inch Hex. Closed Double-end Flat Wrench
303	Spring Adjuster
325B	Adjuster
344	Offset Screwdriver
ϕ353C	Grease Gun (Must be equipped with No.571A curved nozzle)
359	Magnet Core and Armature Cleaning Tool
363 (2 Required)	Spring Adjuster
376A	Dental Mirror
379A	Adjuster
417A	1/4- and 3/8-inch Hex. Open Double-end Flat Wrench
425A	Selector Holder
456A	Adjuster
485A	Smooth-jaw Pliers
510C (or Replaced 510B)	Test Lamp [Must Be Equipped with No. 561A Straight Tip and W2CB (24V) or W2BL (48V) Cord]
541A	1/4-inch, 12-point Double-end Box Wrench
622A	Selector Holder
R-1760	Frame and Armature Adjuster
KS-6320	Orange Stick
KS-7782	Parallel-jaw Pliers
KS-8097	7/16- and 5/8-inch, 12-point Offset Box Wrench
KS-14164	No. 4 Artist's Show Card Brush
KS-14250, L1	Flashlight (Equipped with 2 Dry Cells)
—	3-inch Cabinet Screwdriver
— (2 Required)	P-long-nose Pliers

ϕPart of the No. 1003A tool kit.

Gauges	
70J	0-150 Gram Gauge
74D	Thickness Gauge Nest (Consists of a nest of 75-type gauges)
79B	0-1000 Gram Push-pull Tension Gauge
79C	0-200 Gram Push-pull Tension Gauge
92J	0.030-inch Nonmagnetic Offset Thickness Gauge
112A	0.040- and 0.050-inch Double-end Thickness Gauge
131A	Thickness Gauge Nest (Consists of a nest of 132-type gauges)
KS-3008	Stop Watch (or equivalent watch with second hand)
KS-6909	Thickness Gauge Nest

Materials

KS-7471	Grease
KS-7860	Petroleum Spirits
KS-8370	Oil
KS-8559	Lubricant
KS-14666 (or Replaced D-98063)	Cloth
—	Pipe Cleaner
—	Hardwood Toothpick, Flat at One End, Pointed at Other
KS-6542 (6 Required)	Dry Cell

Test Apparatus

32A	Test Set
35D or 35F or J94706	Test Set 200- and 206-type Selector Test Set per SD-90013-01
W3B	Cord
1W7A	Cord
1W13B (2 Required)	Cord (Must be equipped with one No. 364 tool and one No. 365 tool)

Code or Spec No.	Description
Test Apparatus	
2P9B	Cord
2P10B	Cord
2W17A (3 Required)	Cord (Must be equipped with two No. 365 tools. For use with 35-type test set)
—	Weston Model No. 931 DC Voltmeter with 300/150/75/30 Scale (or replaced No. 280 or No. 281 dc voltmeter with 150/60/3 scale)

3.002 **Use of No. 425A and No. 622A Selector Holders:** In general, when making adjustments on selectors which are nonrigidly mounted, necessitating placing an excessive strain on the mounting, such as in adjusting the driving spring lug for requirement 2.19, use the No. 425A selector holder on flat-type mounting plates or the No. 622A selector holder on channel-type mounting plates to hold the selector by putting the selector holder in place as shown in Fig. 21 or Fig. 22 and tightening the thumbscrew on the wing nut.

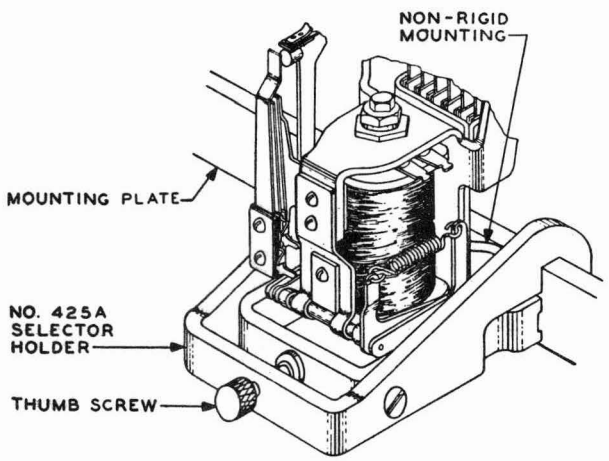


Fig. 21—No. 425A Selector Holder in Place on Nonrigidly Mounted Selector on Flat-type Mounting Plate

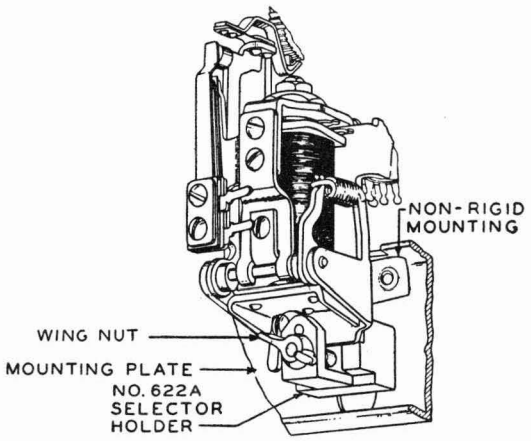


Fig. 22—No. 622A Selector Holder in Place on Nonrigidly Mounted Selector on Channel-type Mounting Plate

3.003 **Method of Connecting J94706 Portable Test Set—G/V Preparation** (Where Battery is Permanently Connected to One Terminal of the Magnet Coil)—Place all keys of the test set in their normal positions, set the rheostats in their "off" positions, and connect the patching cords to the test set in accordance with Fig. 23. In making the connections and tests, observe the points covered in (a) to (f), inclusive, below.

(a) **Connection of PBX Battery and Ground to Test Set:** Connect PBX battery and ground to the test set in either of the following manners: (1) Plug one end of the 2P9B cord into the BAT-G jack of the test set and the other end into the frame battery and ground supply jack: or (2) Connect battery and ground to the respectively labeled BAT and G binding posts of the test set with the 1W13B cords.

(b) **Connection of Auxiliary Battery to Test Set:** The auxiliary battery is used to facilitate providing the required voltage across the selector circuit. Provision is made for connecting this battery into the selector circuit so it may either aid or oppose the PBX battery voltage. It consists of sufficient dry cells to produce a total voltage on the selector circuit which either equals or slightly exceeds the required voltage. Check the condition of the dry cells in the auxiliary battery at the start of the work to insure that they are in satisfactory condition for testing selectors. [See (g) for method of testing dry cells.] Connect the red, white, and blue conductors of one end of the W3B cord to the respectively labeled binding posts of the test set. Connect the white conductor of the other end of this cord to the positive(+) terminal of the auxiliary battery and the red and blue conductors to points on the battery as described below in (d) and (e).

(c) **Connection of Selector to Test Set:** Connect the clip end of the 1W7A cord to the interrupter spring which is wired to the selector magnet coil to check the voltage across the selector circuit and also to check those requirements where it is necessary that the selector be rotated step by step. In checking those requirements where it is necessary that the selector rotate under control of its interrupter contacts, connect the clip or socket end of this cord to the interrupter spring terminal which is not wired to the selector magnet. Plug the other end of this cord into the TST jack.

(d) **Obtaining High Voltage:** Operate the HV and VM keys of the test set to obtain the high voltage used in checking requirement 2.30. Connect the red conductor of the W3B cord to the auxiliary battery at a point such that the voltage of the auxiliary battery, when aiding the PBX battery, will give a voltage equal to or slightly above the required voltage. Where this voltage exceeds the required voltage, obtain the exact voltage required by means of the HV rheostat, exercising care to keep the resistance of the

rheostat as low as possible because if the resistance is excessive it will have a decided effect upon the operation of the selector. If the required voltage can be obtained without using the auxiliary battery, connect the red conductor to the positive pole of the auxiliary battery at the same point as the white conductor is connected. Restore the VM key. When making a running test, leave the HV key operated.

(e) **Obtaining Low Voltage:** Operate the LV and VM keys of the test set to obtain the low voltage used in checking requirements 2.27, 2.29, 2.31, and 2.32. Connect the blue conductor of the W3B cord to the auxiliary battery at a point such that the voltage of the auxiliary battery, when opposing the PBX battery, will give a voltage equal to or slightly above the required voltage. Where this voltage exceeds the required voltage, obtain the exact voltage required by means of the LV rheostat, exercising care to keep the resistance of the rheostat as low as possible because, if the resistance is excessive, it will have a decided effect upon the operation of the selector. If the required voltage can be obtained without using the auxiliary battery, connect the blue conductor to the positive pole of the auxiliary battery at the same point as the white conductor is connected. Restore the VM key. When making a running test, leave the LV key operated. When making a stepping test, operate and release the LV key for each step of the selector.

(f) **Use of No. 32A Test Set in Testing Selectors at a Distance From the Test Set:** When testing selectors on the top of the frame, or at a distance from the selector test set, the No. 32A test set may be used in place of the LV and HV keys. Do this by inserting the plug of the No. 32A test set in the EXT KEY jack of the test set. Depress the white button for low voltage and the red button for high voltage.

(g) **Checking Condition of Individual Dry Cells Used in Auxiliary Battery:** To check the condition of the dry cells used in the auxiliary battery, restore to normal all keys of the test set. With the W3B cord connected to the test set as covered in (b), connect the white conductor to the positive (+) terminal of an individual dry cell and connect the red conductor to the negative (—) terminal of the cell. Operate the BAT TST key of the test set and observe the reading of the voltmeter. If the reading is less than 0.55 volt, the dry cell is unfit for further use.

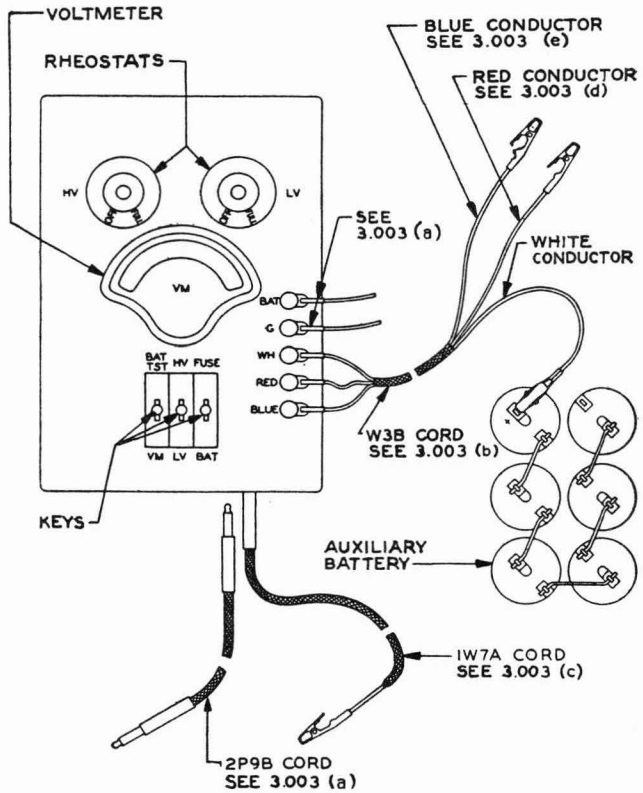


Fig. 23—Method of Connecting J94706 Portable Test Set

3.004 **Using the Nos. 35D and 35F Test Sets**

Preparation

(a) **Connection of PBX Battery and Ground:** Connect PBX battery and ground to the test set shown in Fig. 24 by inserting the No. 310 plug on one end of the 2W17A cord into the SIGNAL BATT & GRD jack in the test set and connecting the No. 360B tool (black shell) and No. 360C tool (white shell) on the other end of the cord to ground and battery supplies, respectively, on a test connecting block or fuse panel by means of No. 365 tools inserted in the 360-type tools. If a jack having a battery and ground supply is available, use a 2P10B cord and insert the No. 309 plug into this jack and the No. 310 plug into the SIGNAL BATT & GRD jacks in the test set. Two 1W13B cords with No. 364 tools at one end and No. 365 tools at the other end may be used instead of the 2W17A or 2P10B cords, in which case, connect battery and ground to the BATT and GRD terminals, respectively, of the test set.

Note: To avoid possible grounding of the battery supply lead, connect the cord to the test set first and when disconnecting remove the cord from the test set last.

(b) **Connection of Selector to Test Set to Check Voltage and Step-by-Step Operation:** Plug a 2W17A cord into the TEST T&R jack of the test set and connect the black (ring) conductor to the interrupter spring wired to the magnet.

(c) **Connection of Selector to Test Set to Check Running Operation:** Plug a 2W17A cord into the TEST T&R jack of the test set and connect the black (ring) conductor to the interrupter spring that is not wired to the magnet.

(d) **Preparation of Keys, Switches, and Sliders:** Operate the G knife switch to GRD and operate the BATT & GRDCO key. Move the sliders of the No. 3 and No. 4 rheostats to the extreme left to remove all resistance.

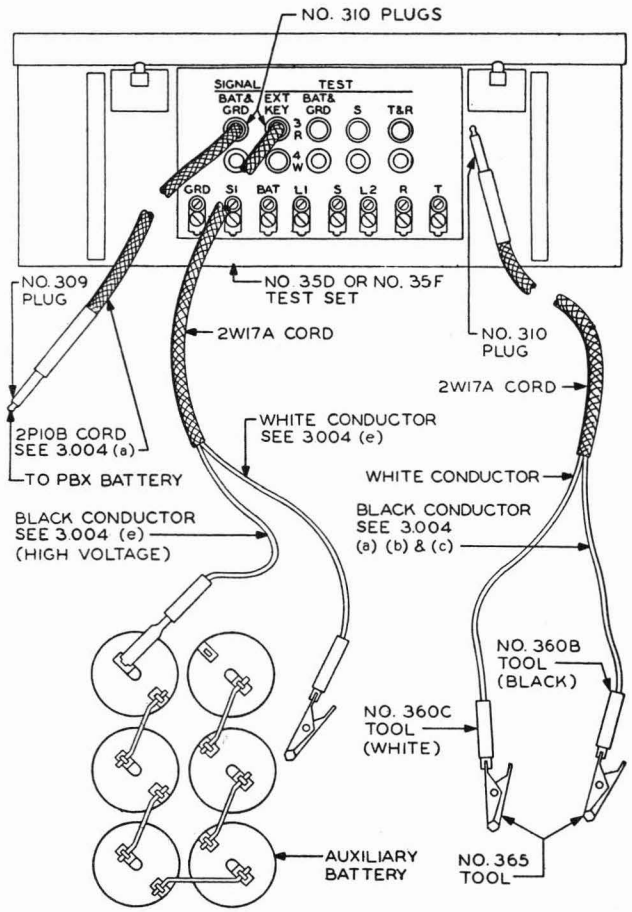


Fig. 24—Method of Connecting No. 35D or No. 35F Test Set

(e) **Connection of Auxiliary Battery to Cord and Jack**

For High Voltage: Connect the black (ring) conductor of the 2W17A cord to the positive (+) terminal of the auxiliary battery and insert the cord into the TEST EXT KEY 3R jack.

For Low Voltage: Connect the black (ring) conductor of the 2W17A cord to the negative (—) terminal of the auxiliary battery and insert the cord into the TEST EXT KEY 4W jack.

Connect the white (tip) conductor to the other terminal of the auxiliary battery, negative (—) in the case of high voltage and positive (+) in the case of low voltage. It may be necessary to later shift this conductor from cell to cell to obtain the proper voltage.

Method

(f) **Stepping and Running—High Voltage:** With the test set and selector connected as described in (a), (b), and (d) and with the auxiliary battery connected as described in (e) for checking on high voltage, operate the VM, 75 volts, and No. 3 key and read the voltage. Release the No. 3 key and shift the white conductor on the dry cell terminals as required until the voltage is equal to or not more than 1.5 volts more than the specified high voltage. Reoperate the No. 3 key and adjust the sliders of the No. 3 rheostat, as required, to obtain the exact voltage. Operate and release the No. 3 key several times. The selector should step on each release of the key. With the No. 3 key released, change the connection of the 2W17A cord as described in (c). Operate and hold the No. 3 key or close the locking switch and the selector should rotate under control of its interrupter contacts.

(g) **Stepping and Running—Low Voltage:** With the test set and selector connected as described in (a), (b), and (d) and with the auxiliary battery connected as described in (e) for checking on low voltage, operate the VM, 75 VOLTS, and No. 4 key and read the voltage. With the No. 4 key released, shift the white conductor on the dry cell terminals as required until the voltage is equal to or not more than 1.5 volts more than the specified low voltage. Reoperate the No. 4 key and adjust the sliders of the No. 4 rheostat as required to obtain the exact voltage. Operate and release the No. 4 key several times. The selector should step on each release of the key. With the No. 4 key released, change the connection of the 2W17A cord as described in (c). Operate and hold the No. 4 key or close the locking switch and the selector should rotate under control of its interrupter contacts.

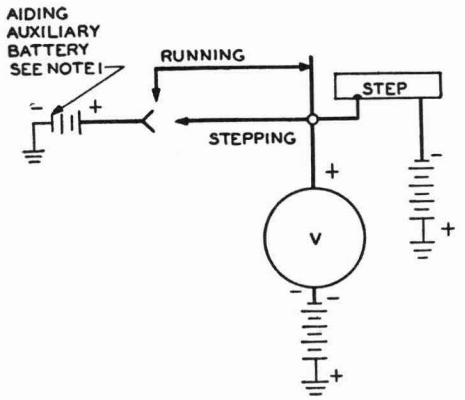
(h) **Checking Condition of Individual Dry Cells Used in Auxiliary Battery:** To check the condition of the individual dry cells used in the auxiliary battery, operate the BATT & GRDCO key and the VM key. Place the REV key in normal position and the G switch in open position. Move all sliders to the extreme right. Plug the 2W17A cord into the T & R jack. Connect the black conductor of the 2W17A cord to the positive (+) terminal and the white conductor of the cord to the negative (—) terminal of the individual dry cell. Operate the telegraph key and read the voltage. If the voltage is less than 0.55 volt, the dry cell is unfit for further use.

3.005 **Using the Voltmeter**

Preparation

(a) **General:** Where the current through the selector exceeds 750 milliamperes or where the J94706, No. 35D, or No. 35F test set is not available, selectors may be tested by use of the model No. 280, No. 281, or No. 931 voltmeter as shown in Fig. 25. In making these connections, use two 1W13B cords with No. 364 tools on one end and No. 365 tools on the other end.

(b) **Connection of Voltmeter to Selector and to Battery and Ground:** Connect the No. 365 tool on the end of one of the 1W13B cords to battery and connect the No. 364 tool attached to the other end of the same cord to the 75-volt negative (—) terminal of the No. 931 voltmeter or the 60-volt negative (—) terminal of the No. 280 or No. 281 voltmeter. Connect the No. 365 tool attached to one end of the other 1W13B cord to the interrupter spring wired to the selector magnet and connect the No. 364 tool attached to the other end of this cord to the positive (+) terminal of the voltmeter.



NOTE I: FOR OPPOSING BATTERY, REVERSE CONNECTIONS TO AUXILIARY BATTERY.

Fig. 25—Voltmeter Connections

(c) **To Check High Voltage and Step-by-Step Operation:** Connect battery and ground and auxiliary battery to the selector as follows. Connect the No. 365 tool on the end of one of the 1W13B cords to ground and connect the No. 364 tool on the other end of the same cord to the negative (—) terminal of the auxiliary battery. Connect the No. 364 tool of the other 1W13B cord to the positive (+) terminal of the auxiliary battery and the No. 365 tool of the same cord to the interrupter spring wired to the magnet.

(d) **To Check Low Voltage and Step-by-Step Operation:** Connect battery and ground and auxiliary battery to the selector as follows. Connect the No. 365 tool on the end of one of the 1W13B cords to ground and connect the No. 364 tool on the other end of the same cord to the positive (+) terminal of the auxiliary battery. Connect the No. 364 tool of the other 1W13B cord to the negative (—) terminal of the auxiliary battery and the No. 365 tool of the same cord to the interrupter spring wired to the magnet.

(e) **To Check Running Operation:** Make connection described in (c) for high voltage or in (d) for low voltage except that the No. 365 tool is connected to the interrupter spring that is not connected to the magnet.

Method

(f) **To Check Stepping and Running on High Voltage:** Connect the voltmeter and selector as described in (b), (c), and (e) and read the voltage. Shift the connections on the dry cells as required until the voltage is not over 0.5 volt less or 1.0 volt more than the high voltage specified. Disconnect and reconnect the connection to the terminal of the selector several times in order to test the stepping operation of the selector. To check the running operation of the selector, change the connection to the selector as described in (e).

(g) **To Check Stepping and Running on Low Voltage:** Connect the voltmeter and selector as described in (b), (d), and (e) and read the voltage. Shift the connections on the dry cells as required until the voltage is not over 0.5 volt more or 1.0 volt less than the low voltage specified. Disconnect and reconnect the connection to the terminal of the selector several times in order to test the stepping operation of the selector. To check the running operation of the selector, change the connection to the selector as described in (e).

(h) **To Check the Condition of Individual Dry Cells Used in Auxiliary Battery:** Measure the voltage of the individual dry cells using the 1W13B cords and the Weston model 931 voltmeter (30-volt scale) or the Weston model No. 280 or No. 281 voltmeter (3-volt scale). If the voltage is less than 0.55 volt, the dry cell is unfit for further use.

3.01 **Cleaning** (Rq 2.01)

(1) **Ratchet Wheel and Armature Bearings:** If upon inspection there is found to be an accumulation of gummy oil or foreign matter on the ratchet wheel or armature bearings,

apply KS-7860 petroleum spirits very sparingly with the KS-14164 No. 4 artist's show card brush to soften this matter so that it may be removed. Take care to keep the petroleum spirits from coming in contact with the spoolheads of the magnet or with any part of the bank or rotor brush assemblies other than the ratchet wheel. Allow the wearing parts of the selector, such as the ratchet wheel or armature bearings, to dry and then lubricate them.

(2) **Magnet Core Gap:** Insert the No. 359 cleaning tool between the armature and the core and apply sufficient pressure to the bottom of the armature to force it upward against the cleaning tool, as shown in Fig. 26. Then forcibly withdraw the cleaning tool. Repeat this operation several times, using first one flat surface of the tool and then the other, so as to remove dust and loose galvanizing scales that may have accumulated between the armature and the core.

Note: If a new No. 359 cleaning tool is to be used, check whether the tool is covered with a protective film of oil. If this condition exists, remove the film with KS-7860 petroleum spirits applied on a KS-14666 cloth.

(3) **Interrupter Contacts:** Clean the interrupter contacts as covered in Section 022-100-811.

Rotor Bearings

(4) Remove the rotor brush assembly as covered in Section A508.201.

(5) Clean the rotor shaft or hollow rotor pivot nut by wiping it with a clean KS-14666 cloth moistened with KS-7860 petroleum spirits.

(6) Remove the old lubricant from the bearing hole in the rotor as follows, using a common pipe cleaner. Dip one end of the pipe cleaner in KS-7860 petroleum spirits and, after allowing the excess to drain off, insert the saturated

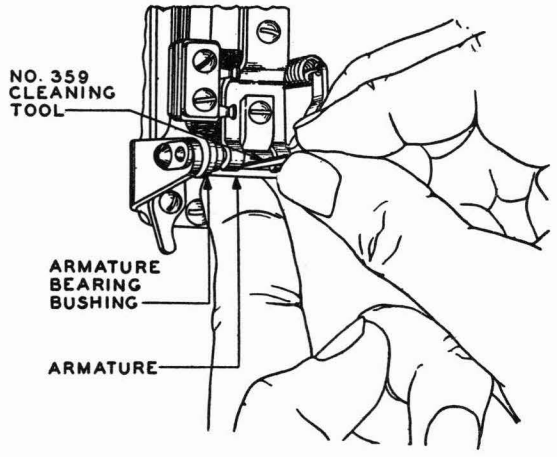


Fig. 26—Method of Cleaning Adjacent Surfaces of Magnet Core and Armature

end of the cleaner into the hole. Work the cleaner back and forth a few times to loosen the old lubricant, then draw the entire cleaner slowly through the hole so that the dry portion of the cleaner will remove the excess petroleum spirits. Remove any lint left in the hole by blowing through it.

(7) Reassemble the rotor shaft and associated parts as covered in Section A508.201. Lubricate the rotor bearings as covered in 3.03.

3.02 **Treatment of Banks and Rotors** (Rq 2.02) (Applies After Turnover Only)

(1) If necessary, clean and treat the rotor and bank terminals as outlined in Section A503.626.

3.03 **Lubrication** (Rq 2.03)

Rotor Bearings Where Lubricant is KS-7471 Grease

(1) If KS-7471 grease is to be used to lubricate the rotor bearings, clean the rotor bearings as covered in 3.01 if KS-8496 lubricating compound No. 3 was used the last time the selector was lubricated.

(2) Insert the tip of the nozzle of the No. 353C grease gun into the grease hole in the end of the rotor shaft or hollow rotor pivot nut and apply grease as required. Take care not to apply more grease than necessary to barely force grease out of the bearing at the one side of the rotor. In some cases, the grease may start out at both sides of the rotor at the same time.

Rotor Bearings Where Lubricant is KS-8496 Lubricating Compound No. 3 or KS-8370 Oil

(3) If KS-8370 oil is to be used to lubricate the selector, clean the rotor bearings as covered in 3.01 if KS-8496 lubricating compound No. 3 was used the last time the selector was lubricated.

(4) Shift the rotor on the shaft so as to take up the end play of the rotor toward one side of the selector and apply the specified quantity of lubricant through the hole in the side of the frame. Press the rotor from side to side a few times to aid the lubricant in reaching the bearing surfaces. On selectors not provided with this hole, apply the lubricant as shown in Fig. 27.

(5) Take up the end play of the rotor in the opposite direction and similarly apply the specified quantity of lubricant to the other bearing.

(6) **Armature Bearings:** Apply the specified quantity of lubricant to each side of each bearing.

(7) **All Bearings:** After lubricant has been applied, rotate the selector several revolutions under self-interruptions or step-by-step, depending upon the wiring arrangement of the selector circuit, in order to distribute the lubricant more evenly over the bearings.

Surfaces of Ratchet Wheel Teeth Where Lubricant Is KS-7471 Grease

(8) Before lubricating the ratchet wheel teeth, clean them if necessary as covered in 3.01.

(9) Apply about one quarter of the specified quantity of grease to the ratchet wheel, placing the grease vertically on the teeth. (The ratchet wheel is 3/16 inch wide.) Step the selector about 1/4 revolution and apply a similar quantity of grease. Continue in this manner until the specified quantity of grease is applied. This will insure that the grease is evenly distributed over the ratchet wheel teeth.

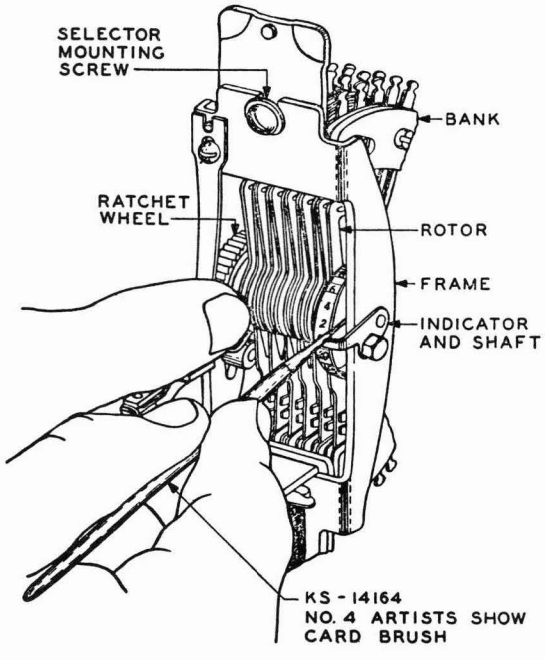


Fig. 27—Method of Lubricating Rotor Bearing When Lubricating Hole Is Not Provided

Surfaces of Ratchet Wheel Teeth Where Lubricant Is KS-8370 Oil

(10) Before lubricating the ratchet wheel teeth, clean them if necessary as covered in 3.01.

(11) Apply the specified quantity of lubricant to the surfaces of the ratchet wheel teeth just below the retaining pawl while the selector is rotating. If cleaning in accordance with 3.01 is unnecessary, less lubricant may be sufficient. Exercise care in applying the lubricant, as an excessive amount in one spot on the ratchet wheel may splash onto the brushes or bank terminals.

(12) **Overthrow Stop:** Electrically energize the selector and apply the specified quantity of lubricant to the overthrow stop.

3.04 **Record of Lubrication** (Rq 2.04) (No procedure)

3.05 **Alignment of Tips of Rotor Brushes** (Rq 2.05)

(1) If the requirement is not met, the indications are that the rotor brushes are loose in the assembly. In this case, replace the rotor brush assembly with a new one as outlined in Section A508.201.

3.06 **Armature Backstop Position** (Rq 2.06)

(1) If the armature backstop is incorrectly mounted on the selector, remove the mounting screw, using the 3-inch cabinet screwdriver and remount the backstop correctly. Then check that requirements 2.07, 2.08, 2.09, 2.22, 2.27, 2.29, 2.30, 2.31, and 2.32, inclusive, are met.

3.07 **Position of Rotor Brushes on Bank Terminals** (Rq 2.07)
3.08 **Overthrow Stop Position** (Rq 2.08)

(1) **General:** With the armature against the backstop and the retaining pawl disengaged, the two extreme positions of the rotor brushes on the bank terminals are determined by the positions of the backstop and the overthrow stop. The armature backstop determines the extreme backward positions of the brushes on their respective terminals, and the overthrow stop determines their extreme forward positions. When an adjustment is made to meet any of these requirements, the other requirements should be checked, and readjustment made if necessary.

(2) To change the position of the rotor brushes with respect to the leading edge of their respective terminals, adjust the position of the armature backstop as follows. For a slight change in the position of the armature backstop, tap the bottom of the backstop with the R-1760 adjuster to move it in the required direction. If considerable movement of the backstop is required, loosen the backstop mounting screw slightly with the 3-inch cabinet screwdriver and reposition the backstop. Tighten the mounting screw securely and recheck the requirement.

(3) If the back and forth motion of the rotor brush assembly or the position of the overthrow stop is unsatisfactory, reposition the overthrow stop as follows. Loosen the overthrow stop mounting screw with the No. 417A wrench. Reposition the overthrow stop as required. Tighten the mounting screw securely and recheck the requirement.

3.09 **Retaining Pawl Position and Tension** (Rq 2.09)

(1) Adjust the retaining pawl position by slightly loosening the retaining pawl mounting screw with the 3-inch cabinet screwdriver and moving the pawl up or down as required. Tighten the mounting screw. Make sure that the end of the pawl falls wholly within the face of the ratchet wheel.

(2) Adjust the retaining pawl tension by applying the No. 303 adjuster to the base of the pawl as near as possible to the point where the pawl is fastened to the selector frame and then recheck the retaining pawl position.

3.10 **Rotor Brush Alignment** (Rq 2.10)
3.11 **Feeder Brush Position** (Rq 2.11)
3.12 **Feeder Brush Tension** (Rq 2.12)
3.13 **Rotor Brush Tension** (Rq 2.13)
3.14 **Rotor Brush Prong Contact** (Rq 2.14)

Rotor Brush Alignment

(1) In case the majority of the rotor brushes are found to be out of alignment in the same direction with respect to the bank feeder brushes or bank terminals, loosen the selector mounting screws with the 3-inch cabinet screwdriver and shift the selector to the right or left as required, and then retighten the screws.

(2) Adjust an individual rotor brush spring as required with the No. 363 adjuster. Exercise care not to produce any sharp bends or kinks or otherwise to distort the brushes.

(3) Advance the rotor brush assembly electrically for a half revolution, or until the opposite ends of the rotor brushes are about to pass onto the bank feeder brushes or bank terminals, and repeat the above adjustment.

Feeder Brush Position

(4) Adjust the feeder brushes as required with the No. 363 adjusters or with the KS-7782 parallel-jaw pliers.

(5) In the case of detachable feeder brushes, it may be necessary to loosen the detachable feeder brush unit mounting nut with the No. 417A wrench and shift the unit, making use of play in the mounting hole. If this does not permit the required adjustment, remove the detachable feeder brush assembly from the mounting stud and change the number of spacing washers as required.

Feeder Brush Tension

(6) **Single-piece Type Feeder Brush per Fig. 9** (Balanced Type): If necessary, to adjust the brush, apply the No. 363 adjuster to the front prong just above the crotch and adjust as required. In case the rear prong does not make contact with the rotor brush hub, insert the No. 456A adjuster between the feeder brushes and adjust the rear prong. Then recheck the tension of the front prong. Make an effort to have the pressure of the two prongs approximately equal. This may be accomplished if the feeder brush is kept free of bows or kinks.

(7) **Single-piece Type Feeder Brush per Fig. 10:** Place the No. 363 adjuster close to the base of the brush and apply a turning motion, taking care not to distort the brush. Make sure that the part of the bank feeder brush over which the rotor brush passes is not out of alignment with the first row of bank terminals by more than the specified amount, and if necessary, readjust with the KS-7782 pliers by grasping the brush above the point at which the rotor brushes make contact. Move the pliers toward the top, at the same time giving them a twisting motion in the direction of the desired tension.

(8) **Two-piece Type Feeder Brush per Fig. 11:** Place the No. 363 adjuster on one of the individual springs of the feeder brush to be positioned as near to the base of the spring as possible and with an upward wiping movement of the adjuster toward the tip of the spring, tension the spring in the proper direction. Repeat for the other spring of the feeder brush.

Rotor Brush Tension

(9) To adjust an individual rotor brush spring, apply the No. 363 adjuster to the base of the brush spring close to the shaft of the rotor brush assembly. In the case of detachable feeder brushes, it may be necessary to advance the selector one or two steps to adjust the springs close to the shaft of the rotor brush assembly; then restore the rotor brush assembly to its previous position to check the adjustment. Take care in adjusting the brush springs not to change the alignment of the brush contact edges. This is especially important in bridging brushes where such improper adjusting would shorten the contact surfaces. Also, take care in meeting this requirement to hold the tension of each brush as close as possible to the minimum pressure specified, in order that the friction of the brush load will not prevent the selector from meeting requirements 2.28, 2.29, 2.30, 2.31, and 2.32. In making adjustments of brush spring tensions, give the adjuster a turning motion, not a side motion.

(10) When adjustments have been completed on one brush end of the rotor brush assembly, step the selector electrically (step by step) to a position where the opposite brush end is in the proper position and make the necessary readjustments as covered in (9).

Rotor Brush Prong Contact

(11) Set the rotor brush assembly approximately in a horizontal position. Apply a No. 363 adjuster near the base of the prongs to hold the brush steady, and adjust the outer

prongs as required with another No. 363 adjuster and the inner prongs with the No. 456A adjuster. Make an effort to adjust the prongs of the individual brush member so that both prongs contact the feeder brush.

3.15 **Toeing of Bridging Brushes** (Rq 2.15)

(1) Set the rotor brush assembly approximately in a horizontal position. Then hold the heel of the brush with one No. 363 adjuster and use a second No. 363 adjuster on the contact portion of the brush to produce the required toeing out. Take care not to distort the brush when applying this adjustment.

3.16 **Heel Spacing** (Rq 2.16)
3.17 **False Contacting** (Rq 2.17)

(1) Step the selector electrically to each of the specified positions.

(2) Adjust the brushes close to the heels as required with the No. 363 adjuster. When detachable feeder brushes are installed, it will be necessary to advance the selector beyond these brushes to adjust the springs; then return the rotor assembly to its previous position and recheck the adjustment. Recheck requirements 2.10, 2.13, and 2.15.

3.18 **Clearance Between No. 1 Rotor Brush and Driving Arm** (Rq 2.18)

(1) If the No. 1 rotor brush meets requirement 2.10, failure to meet requirement 2.18 is probably due to a bent driving arm. Adjust the driving arm with the R-1760 adjuster applied to the driving arm directly beneath the point where the pawl spring is attached to the driving arm. After adjusting the driving arm, make sure that the end of the driving pawl will strike the overthrow stop squarely.

3.19 **Driving Spring Tension** (Rq 2.19)

(1) Adjust the driving spring lug on the selector frame with the No. 379A adjuster. (Do not adjust the driving spring arm.) Exercise care in adjusting this lug, as it is possible to spring the whole selector frame, thereby affecting many of the other adjustments. Also take care not to throw the lug out of alignment with the arm on the armature to which the other end of the driving spring is attached and thus cause unnecessary friction in the armature bearings. Make sure that requirements 2.27, 2.28, 2.29, 2.30, and 2.31 are met.

3.20 **Armature End Play** (Rq 2.20)
3.21 **Clearance Between Rear Corners of Armature and Lugs of Frame** (Rq 2.21)

(1) If the armature end play is not satisfactory or if there is insufficient clearance between either rear corner of the armature and a lug of the frame, proceed as follows:

Armature End Play

(a) Before adjusting a lug to correct for unsatisfactory end play, check the clearance between the rear corners of the armature and the frame lugs as follows. Move the armature to one side until the armature bushing touches the lug. Using the No. 376A dental mirror, note the clearance between the rear corner and the lug at that side. If the clearance is approximately the same at both corners, adjust both lugs equally. If, however, one clearance is greater than the other, adjust the lug on the side having the greater clearance. To do this, place the R-1760 adjuster on the lug as far back as possible and bend the lug outward. After making this adjustment, check that the clearance as covered by requirement 2.21 is met.

Clearance Between Rear Corners of Armature and Lugs of Frame

(b) To increase the clearance between a rear corner and the adjacent lug, adjust inwardly the lug on the side with insufficient clearance, using the R-1760 adjuster as covered in (a). Adjusting the lug in this manner will reduce the armature end play. If the end play is less than 0.010 inch, adjust the opposite lug outwardly and recheck for clearance.

3.22 **Armature Airgap** (Rq 2.22)

(1) To adjust the armature air gap, loosen the magnet clamping screw with the No. 541A wrench where the screw has a hexagonal head, otherwise use the No. 344 offset screwdriver. Then loosen the magnet adjusting locknut with the No. 243 wrench. Adjust the airgap as required by moving the magnet adjusting bushing up or down with the KS-8097 wrench. Hold the bushing with the KS-8097 wrench and then tighten the locknut with the No. 243 wrench. Retighten the magnet clamping screw. Recheck the adjustment. Repeat the operation, if necessary, until the required adjustment is obtained. After tightening the magnet, make sure there is clearance between the magnet spoolhead and the driving arm. Make sure requirements 2.27, 2.29, 2.30, and 2.31 are met.

(2) To adjust the gap between the armature and backstop, loosen the backstop screw with the 3-inch cabinet screwdriver, adjust the position of the backstop and securely tighten the screw. Then check that requirements 2.07, 2.08, 2.09, 2.27, 2.29, 2.30, and 2.31 are met.

3.23 **Contact Alignment** (Rq 2.23)

(1) If the contacts do not line up properly, slightly loosen the spring pile-up screws with the 3-inch cabinet screwdriver, adjust the position of the contact springs, and then securely tighten the pile-up screws.

3.24 **Position of Inside Interrupter Spring** (Spring No. 1) (Rq 2.24)

(1) To adjust the inside interrupter spring (spring No. 1), loosen the spring assembly screws with the 3-inch cabinet screwdriver sufficiently to permit the application of the No. 303 adjuster as near the base of the spring as possible. Adjust the spring as required, taking care not to damage the insulator. Tighten the screws securely, taking care that the long insulator is lined up with the interrupter spring and that the contact point falls wholly within the boundary of the opposing contact.

3.25 **Tension of the Outside Interrupter Spring** (Spring No. 2) (Rq 2.25)

(1) Readjust the tension of the outside interrupter spring with the No. 303 adjuster applied close to the base of the spring.

3.26 **Driving Pawl Tension and Position** (Rq 2.26)

Driving Pawl Tension

(1) Hold the portion of the driving pawl which is riveted to the pawl spring with the No. 485A pliers. Apply the No. 325B adjuster to the sloping portion of the driving pawl adjacent to the reed spring as shown in Fig. 28. Adjust the driving pawl until the required tension is obtained. Adjusting the pawl upward increases the tension, and downward decreases the tension. Recheck requirements 2.06 and 2.08.

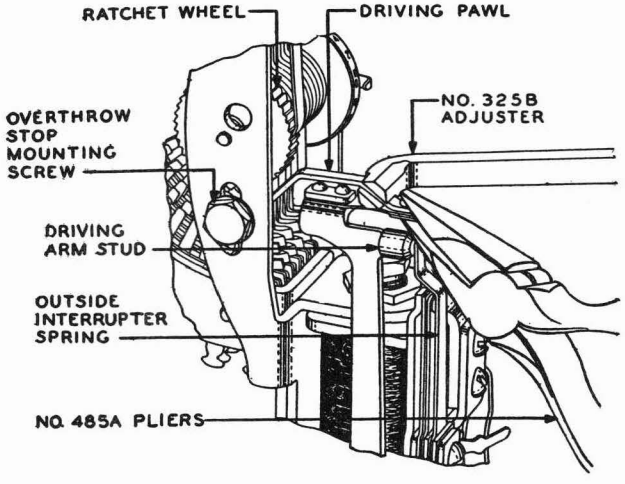


Fig. 28—Method of Adjusting Driving Pawl Tension

Driving Pawl Position

(2) If the sides of the driving pawl along its length are not parallel with the sides of the ratchet wheel or if the

tip end of the driving pawl extends beyond either edge of the ratchet wheel, apply the R-1760 adjuster to the driving arm beneath the point where the pawl spring is attached to the driving arm and adjust the driving arm so that this part of the requirement is met.

(3) If the driving edge of the pawl is not parallel with the bottom of the tooth, hold the driving pawl and the pawl spring at the rivets with a pair of P-long-nose pliers and apply another pair of P-long-nose pliers to the horizontal portion of the pawl spring and adjust this portion with a rotary motion of the pliers.

3.27 **Magnet Pull Test** (Rq 2.27)

(1) If the requirement is not met, it indicates that either the armature air gap is too large or the spring tension is too high, in which case adjust the driving spring tension as covered in 3.19 or the armature air gap as covered in 3.22.

3.28 **Step Test** (Rq 2.28)

(1) Failure to meet this test is an indication that the driving spring tension is too close to the specified minimum or that the brush load is excessive.

(2) When necessary, check and readjust for requirements 2.13 and 2.19.

3.29 **Speed** (Rq 2.29)
3.30 **High-voltage Interrupter Contact Test** (Rq 2.30)
3.31 **Low-voltage Interrupter Contact Test** (Rq 2.31)
3.32 **Clearance Between Driving Arm Stud and Interrupter Spring** (Rq 2.32)

(1) When a considerable amount of adjusting is required, adjust the spring stop with the No. 379A adjuster, but when a slight adjustment is required, adjust the interrupter spring with the No. 303 adjuster. To use the No. 379A adjuster, apply it to the spring stop from the side nearest the magnet coil as shown in Fig. 29 and adjust the spring stop as required. In making this adjustment, exercise care to keep from throwing the lip perceptibly out of parallel with the face of the driving arm stud.

(2) When adjusting the spring stop, attempt to obtain the correct adjustment with the least number of adjusting operations because the spring stop has a tendency to lose its adjustment if it is subjected to too many adjusting operations.

Caution: The position of the interrupter spring will be affected when the outside spring is adjusted as specified in (1) and (2) above. Do not attempt to readjust the interrupter spring, but make sure that it rests flat against its insulator.

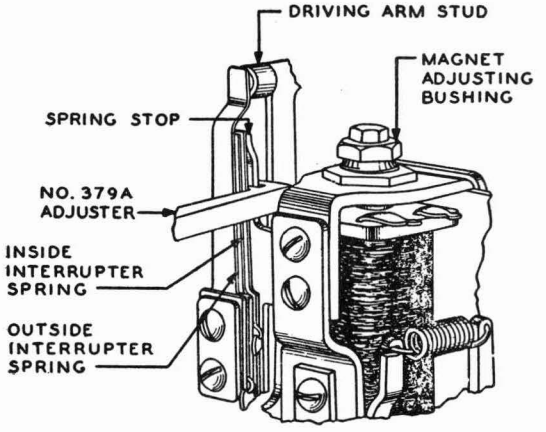


Fig. 29—Method of Adjusting Spring Stop