

**BELL SYSTEM PRACTICES**  
**Teletypewriter Stations**

**SECTION P32.004**  
**Issue 3, March, 1955**  
**AT&T Co Standard**

# **TELETYPEWRITER MOTOR UNITS AND GOVERNORS REQUIREMENTS AND PROCEDURES**

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## 1. GENERAL

1.01 This section contains the requirements and adjusting procedures for the maintenance of teletypewriter motor units and governors.

1.02 This section is reissued to: ↗

- (a) Add the two-speed governor.
- (b) Delete information on the speed-adjusting lever and wearing strip.
- (c) Specify the use of trichloroethylene per KS-8372 for cleaning in place of petroleum spirits.
- (d) Make minor editorial changes.

Marginal arrows indicate changes from Issue 2. ↘

1.03 For requirements and procedures for adjusting the relationship between the motor pinion and the fiber gear, refer to the particular section for the type of apparatus involved.

## 2. SYNCHRONOUS MOTORS

### A. General

2.01 **Rotor Thrust-Spring Tension:** It should require at least 7 lbs on motors other than those used with 26 TTY apparatus, 4 lbs on motors used with 26 TTY apparatus, to push the shaft endwise. Upon releasing the tension, the shaft should return to its normal position. See Fig. 1 for location of spring.

**Fig. 1**

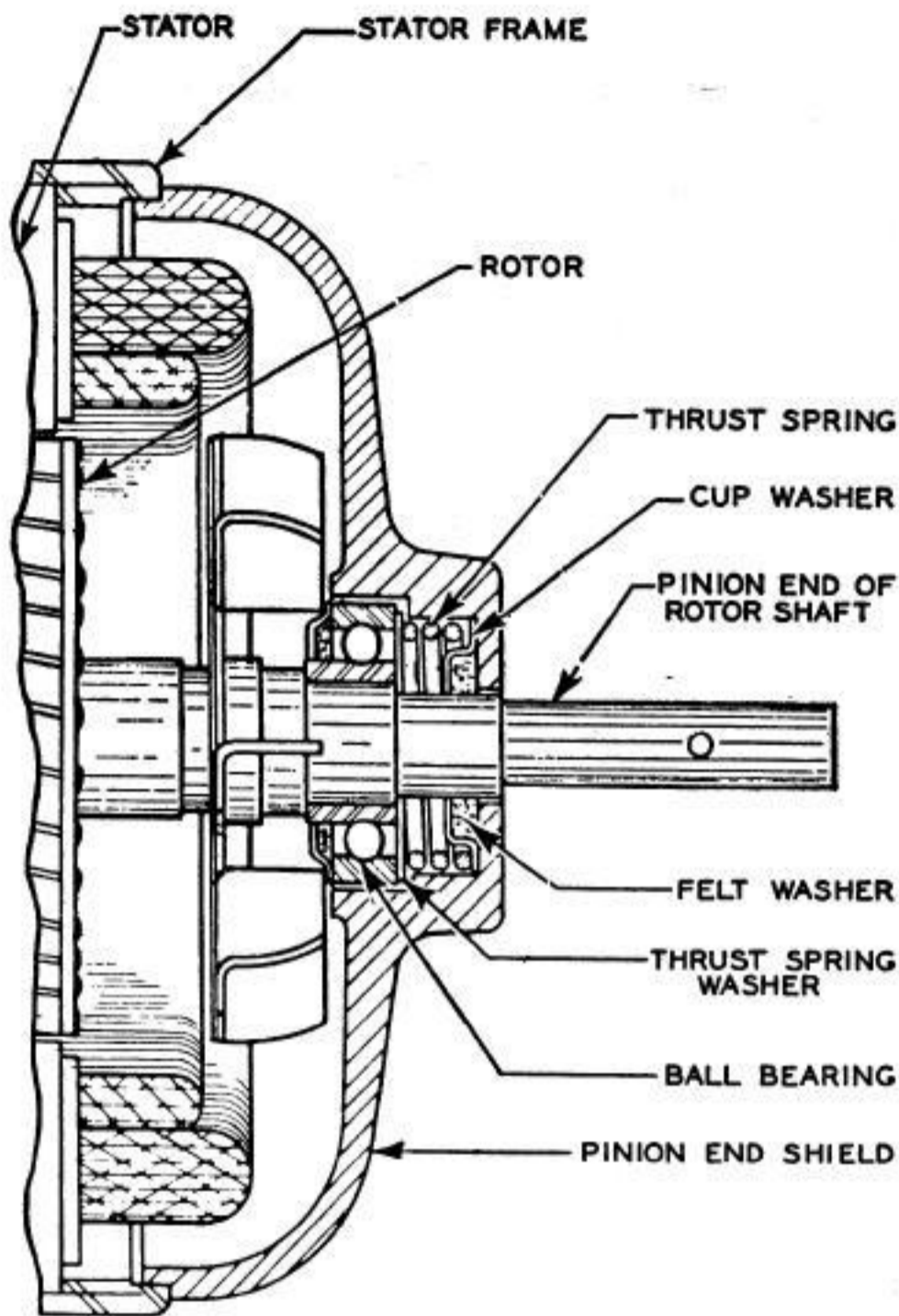


Fig. 1

**Note:** All General Electric motors have thrust springs, but some Holtzer-Cabot motors do not.

- (a) To gauge, remove the motor from the teletypewriter and place the push end of the 12-lb scale against the switch end of the rotor shaft and apply the pressure in line with the shaft.
- (b) If springs do not meet this requirement, remove the pinion end shield and clean the bearing housing. If necessary, replace the spring. Reassemble the end shield.

**Note:** Requirements contained in the following Paragraphs B to D, inclusive, need not be checked unless there is reason to believe the starting switch is causing trouble or the motor is disassembled for other reasons.

**B. Single-Contact Starting Switch (General Electric Motors)**

2.02 **Centrifugal Springs:** It should require min 3-3/4 oz, max 4-1/4 oz to extend the spring to a length of 1-3/4".

Fig. 2

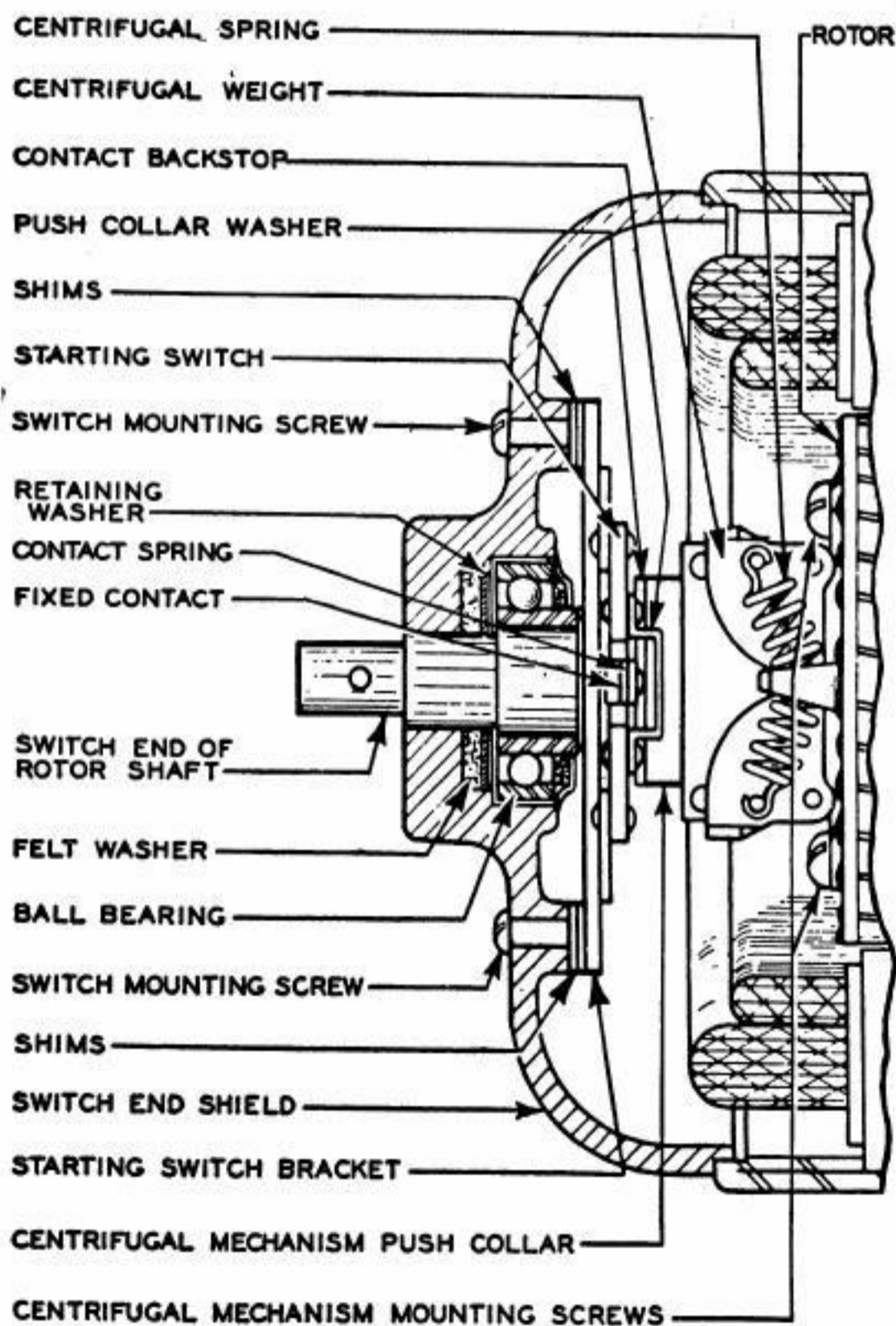


Fig. 2

(a) To gauge:

(1) Remove the motor unit from the teletypewriter on which it is mounted and remove the motor fan and pinion.

(2) At the starting-switch end of the motor, remove the switch-bracket mounting screws, the end-shield screws and remove the end shield. Care should be taken to note the number and thickness of the shims on each side of the shield between the shield and the switch bracket so that the parts may be reassembled correctly.

(3) Pull out the rotor until the centrifugal springs are easily accessible and unhook one end of each spring.

(4) Hook the pull end of the 8-oz scale in the free end of each centrifugal spring.

(b) Springs not meeting the requirement should be replaced.

**2.03 Centrifugal-mechanism push-collar and centrifugal weights** should operate freely and without bind.

**Fig. 2**

(a) Gauge by eye and feel.

(b) Indications of sluggishness may be caused by a collection of oily gum or foreign matter which should be removed with KS-8372 trichloroethylene. ←

**2.04 The starting-switch contact-spring** should clear the insulating bracket which supports the fixed contact by at least .010".

(a) To adjust, replace the starting switch. **Fig. 2**

**2.05 The starting-switch contact-spring tension** should be min 1/2 oz, max 1 oz when the spring is clear of the rotor shaft and the centrifugal-mechanism push-collar. **Fig. 2**

(a) To gauge, apply the push end of the 8-oz scale to the contact spring at the contact and push at right angles to the contact spring.

(b) To adjust, bend the contact spring at the secured end of the spring.

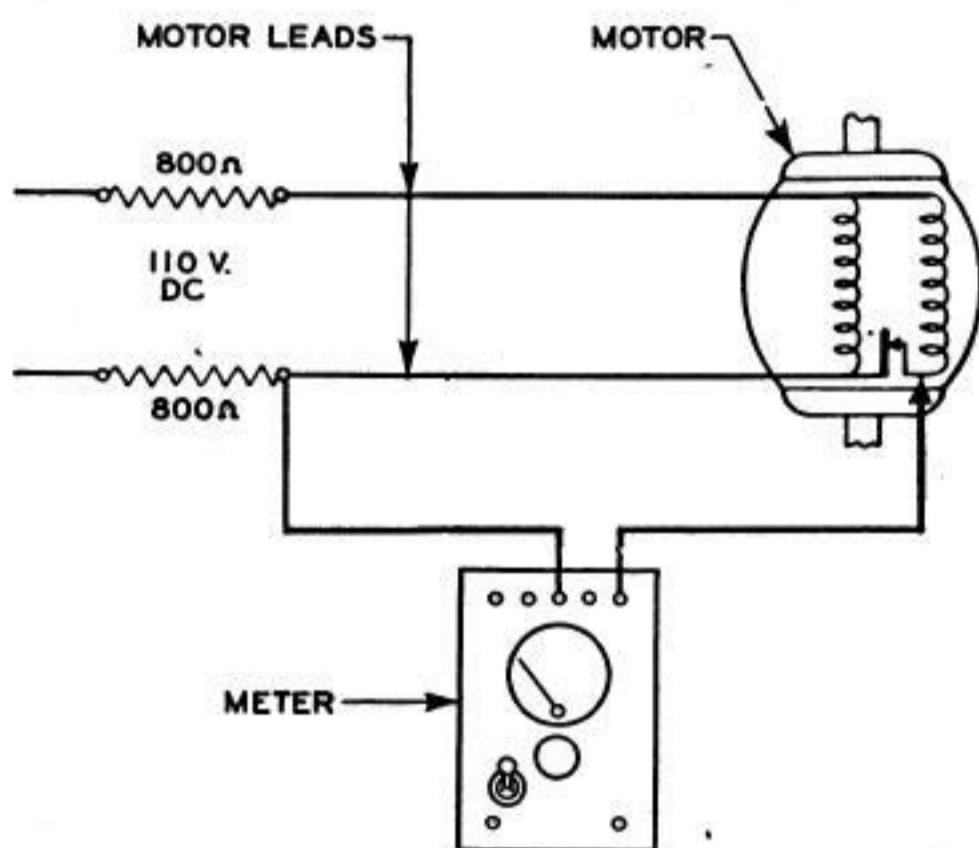
**Note: Care should be taken to avoid kinking the contact spring as this may cause the spring to function incorrectly.**

**2.06 Contacts** should be free from burns or pits.

(a) If contacts are pitted or burned, replace the starting switch.

(b) Slide the end shield on the rotor shaft. Check that the starting-switch bracket shim pileup is equal on both sides. If not, transfer the shims until equal. Mount the starting switch on the end shield, tightening the screws alternately, a little at a time, until both are tight. Reassemble the end shield and tighten its mounting screws in the same manner.

2.07 **Starting-switch operation** should be checked in the following sequence using the 0-75-milliampere scale of the KS-7468 or other suitable meter, two 800-ohm resistors connected as shown in Fig. 3 and a TP82862 collar which is a tool designed for making this test. **Fig. 3**



**Fig. 3**

(a) Slide the TP82862 collar on the starting-switch end of the rotor shaft so that there is 1/32" clearance between the collar and the end shield and secure the collar by means of its set screw.

(b) Apply pressure to the end of the rotor shaft until the collar is against the end shield and slowly turn the shaft one complete revolution, observing the needle of the milli-ampere meter. The meter should read zero throughout the entire revolution indicating that the contacts have remained closed.

(1) If the contacts open at any time during one revolution of the rotor shaft, shims should be added to each side between the starting-switch bracket and the end shield. (Shims are obtainable in 1/32", 1/16" and 3/32" thickness.)

(c) Reposition the TP82862 collar so that there is 1/16" clearance between the collar and the end shield. Apply pressure to the end of the rotor shaft until the collar is against the end shield and slowly turn the shaft one complete revolution, observing the needle of the milliamperemeter. The meter should read not less than .010 ampere, indicating that the contacts have remained open.

(1) If the contacts close at any time during one revolution of the rotor shaft, shims should be removed from between the starting-switch bracket and the end shield.

(d) Remove the TP82862 collar from the rotor shaft.

### C. Three-Brush Starting Switch (General Electric Motors)

2.08 **Brush holders** should be mounted by their center mounting holes with the retaining washers and fasteners securely in place and the brush holders should be free from bind.

**Fig. 4**

(a) To gauge:

(1) Remove the motor from the teletypewriter on which it is mounted and remove the motor fan and pinion.

(2) At the starting-switch end of the motor, remove the switch commutator mounting screws, the end-shield screws and remove the end shield.

(3) Pull out the rotor until the starting switch is easily accessible and remove the centrifugal-switch spring.

**Fig. 4**

(4) Gauge by eye and feel.

2.09 **Brush-holder stop-pins** should be safely within the elongated holes of the fiber disc on which the brush holders are mounted (at least .020"), when all the play has been taken up to reduce the engagement to a minimum.

(a) Gauge by eye.

(b) To adjust, replace the centrifugal-switch assembly.

2.10 **Centrifugal-Switch Spring Tension:** It should require min 1-1/2 oz, max 2-1/2 oz for 50-cycle motors, min 3 oz, max 3-3/4 oz for 60-cycle motors to extend the spring to a length of 5 inches.

**Fig. 4**

(a) To gauge, secure one end of the centrifugal-switch spring and hook the pull end of the 8-oz scale to the spring eye of the opposite end using a suitable ruler to measure the length.

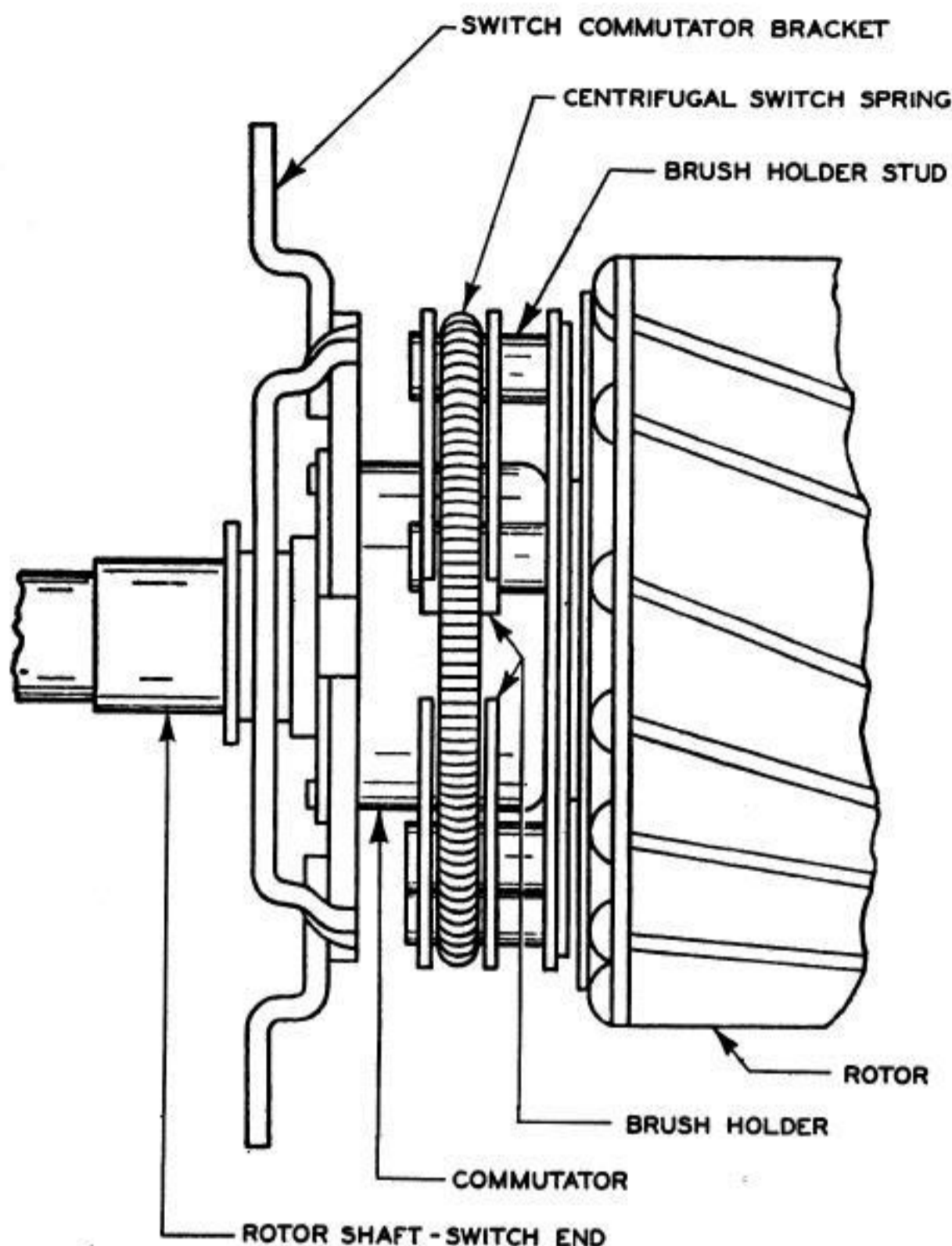


Fig. 4

2.11 **The fiber mounting-disc** should be securely fastened to the metal sleeve that secures the assembly to the rotor shaft. Loosening of the fiber disc on the metal sleeve may cause failure of the brushes to disengage from the commutator.

- (a) To adjust, replace the centrifugal-switch assembly.
- (b) Reassemble the centrifugal-switch spring, making certain that the spring eyes are fully engaged with each other.



2.12 **The starting-switch commutator** should be free from excessive burns or pits and its wires securely soldered in place and in good condition. **Fig. 4**

- (a) If the commutator is burned or pitted, remove the rotor bearing, unsolder the wires attached to the commutator and slip the commutator from the rotor shaft.
- (b) Wrap a piece of 400A Aloxite around the commutator and rotate back and forth until the burned spots or pits are removed.
- (c) If the burns or pits are too deep, replace the commutator.
- (d) Before reassembling, make sure that the gaps between the segments of the commutator are free from metal particles and dirt.
- (e) Slide the end shield on the rotor shaft and fasten the switch commutator to the end shield, tightening the screws alternately, a little at a time, until both are tight.
- (f) Reassemble the end shield, tightening the screws in the same manner as above.

#### **D. Three-Brush Starting Switch (Holtzer-Cabot Motors)**

2.13 **Brush-Arm Spring Tension:** It should require min 5 oz, max 8 oz to just pull the brush arm against its stop when the brushes are resting on the commutator and the rotor is held so that the spring being checked is in a horizontal position as shown in Fig. 5. **Fig. 5**

- (a) To gauge:
  - (1) Remove the motor from its base or if mounted on a 26 teletypewriter, remove the three mounting screws holding the motor to the typing unit and remove the motor.
  - (2) Remove the motor fan and pinion.
  - (3) At the starting-switch end of the motor, remove the starting-switch split-ring screws, the end-shield screws, the bearing-retainer screws and remove the end shield.
  - (4) Remove the bearing-retainer screws from the pinion end shield of the motor and pull out the rotor until the starting switch is easily accessible.
  - (5) Hook the 8-oz scale over the brush arm as shown in Fig. 5 and pull in line with the spring. Repeat check for each brush-arm spring. **Fig. 5**

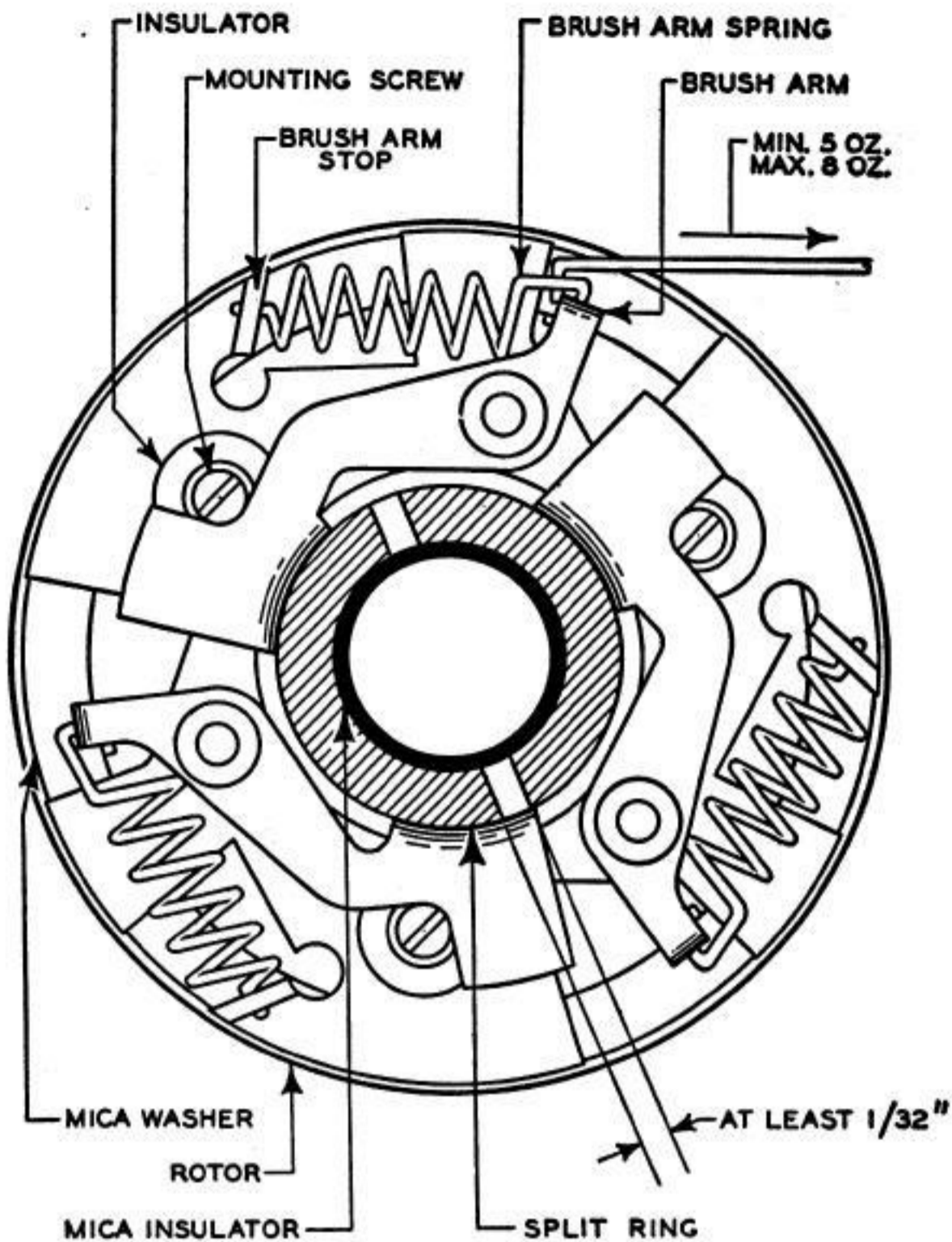


Fig. 5

2.14 **Brush arms** should be free and without bind, the retaining washers in place and the end of the brush-arm mounting-post safely riveted to secure the retaining washer.

**Fig. 5**

(a) Gauge by eye and feel.

(b) If retaining washers are missing or the mounting post is not safely flattened, do not attempt to flatten the mounting post but replace the assembly.

2.15 **The starting-switch split-ring** should be free from excessive pits or burns, the gap between its segments at least 1/32" and the mica insulator on its inner surface securely glued and intact. (See note below.) **Fig. 5**

**Note:** Holtzer-Cabot motors manufactured after May, 1946 are equipped with a newly designed TP86321 split ring having a mica insulator glued to its inner surface to prevent flash-over from the split ring to the rotor shaft. These motors also have a TP113947 mica washer mounted between the starting-switch brush-assembly and the rotor. When a motor manufactured prior to June, 1946 is being repaired, a new style TP86321 split ring containing the mica insulator and a TP113947 mica washer should be installed. Care should be taken while installing the mica washer to be sure that the fiber insulators on the brush-assembly mounting screws are within the holes in the mica washer before the mounting screws are tightened.

- (a) If the split ring is burned or pitted, remove the rotor bearing, unsolder the wires attached to the split ring and slip the split ring from the rotor shaft.
- (b) Wrap a piece of 400A Aloxite around the split-ring and rotate back and forth until the burned spots or pits are removed.
- (c) If burns or pits are too deep, the mica insulator is loose or mutilated or the gap between the segments is less than 1/32", replace the commutator.
- (d) Place the split ring on the rotor shaft and reassemble the rotor bearing.

2.16 **Starting-switch brush-assembly mounting screws** should be tight and their fiber insulators free of breaks or cracks.

- (a) Broken or cracked insulators should be replaced.

### 3. GOVERNED MOTORS

#### A. General

3.01 **Rotor Thrust-Spring Tension:** It should require at least 7 lbs on motors other than those used with 26 TTY apparatus, 4 lbs on motors used with 26 TTY apparatus, to push the shaft endwise. Upon releasing the tension, the shaft should return to its normal position. **Fig. 1**

**Note:** Electric Sprayitt motors are not equipped with thrust springs.

- (a) To gauge, remove the motor from the teletypewriter and place the push end of the 12-lb scale against the governor end of the armature shaft and apply the pressure in line with the shaft.
- (b) Springs not meeting this requirement should be replaced.

## **B. Motor Brushes**

**3.02 Motor-Brush Spring Tension:** It should require min 5 oz, max 8 oz to press the motor-brush spring to its normal position (about 1/8" inside the outer edge of the insulator on the brush holder).

- (a) To gauge:
  - (1) Remove the brush spring cap with a screwdriver.
  - (2) With the brush still in its holder, press the spring into its normal position and hold in that position with the push end of the 8-oz scale.
- (b) Springs not meeting this requirement should be replaced.

**3.03 Motor-Brush Requirements:** There should be at least 7/16" of the brush material remaining, the contact surface of the brush bearing on the commutator should constitute at least one-third of the brush face and should extend at least three-fourths of the long dimension.

- (a) To gauge, remove the brush from its holder, noting its position and the side from which it was removed and mark the brush so that it may be reassembled in the same position. Where the brush has a number stamped on the carbon, this may be used as a guide in putting the brush back in place.
- (b) Where it is necessary to reface the brush, the following method should be used:
  - (1) Wrap a piece of 400A Aloxite around a section of the commutator under the brush holder.
  - (2) Place the brush in its holder, identified side up, and put back the spring cap.
  - (3) Turn the armature and Aloxite back and forth by hand until the brush face has the proper curvature. The last turn should be in the normal direction of rotation.
  - (4) Remove the brush and bevel the edges slightly with the 400A Aloxite.
  - (5) Extreme care should be taken to remove all traces of grit and carbon from the motor after the above operation.

- (6) Wipe off the brush with a KS-2423 cloth slightly moistened with trichloroethylene. ←
- (7) Note that the stranded wire inside the brush spring is intact and free from kinks which may prevent the spring from extending properly and that the wire is securely fastened to the brush and the contact disc.
- (8) Clean out the brush holder with a KS-2423 cloth moistened with trichloroethylene and wrapped ← around a KS-6320 orange stick.
- (9) Insert the brush in its holder with the identified side up and, by grasping the spring, move the brush in and out. Note that the brush slides freely in the holder.

### C. Motor Armature

3.04 **Commutator.** A smooth, even, bronze-colored glaze is a desirable condition and the commutator should not be disturbed unless there is excessive sparking at the brushes under load or if it is noted that the commutator is grooved due to wear in excess of .010" deep, as gauged by eye. Avoid touching the commutator with the hand or fingers as grease and perspiration may cause burned spots or poor contact.

- (a) If excessive sparking under load is noticed, clean the commutator with a KS-2423 cloth moistened with trichloroethylene turning the shaft by hand with the brushes ← out.
- (b) If sparking is still excessive, remove the armature and wrap a piece of 400A Aloxite around the commutator and rotate the armature, holding the sandpaper lightly by hand.

**CAUTION:** Do not attempt to remove any grooves or pits from the commutator. If the commutator is pitted, or if it is grooved due to wear in excess of .010", it should be sent to a repair shop equipped to turn down the commutator on a lathe.

- (c) Blow out all cuttings and sand particles from the commutator and drench the ball races with trichloroethylene ← and blow dry. When thoroughly dry, apply a liberal amount of grease to the balls.
- (d) Reassemble the motor.

## 4. GOVERNORS

### A. General

- 4.01 This section covers 40-, 60-, 75-, and 100-speed gover- ←  
nors, either single-speed or two-speed. ←

## B. Requirements and Procedures Common to Single-Speed and Two-Speed Governors

### Governor Contacts

**Note:** The requirements for contacts need not be checked unless there is evidence that the governor contacts are causing uneven operation of the motor or when the governor is disassembled for other reasons.

4.02 **Contact Surface:** A uniformly roughened surface over the greater portion of the contact face is a desirable condition.

(a) Where the contact surfaces are deeply pitted or have buildups, no attempt should be made to remove pits or buildups, but the contacts should be replaced.

4.03 **Contact-Spring Block:** There should be at least .010" clearance between the contact-spring block and the inner rim of the governor shell. **Fig. 8**

(a) Gauge by eye.

(b) To adjust, position the contact-spring block by means of its mounting screws.

(1) On governors having slip rings, note that this gap is free of dirt and metal particles which may tend to short the rings and the governor contacts.

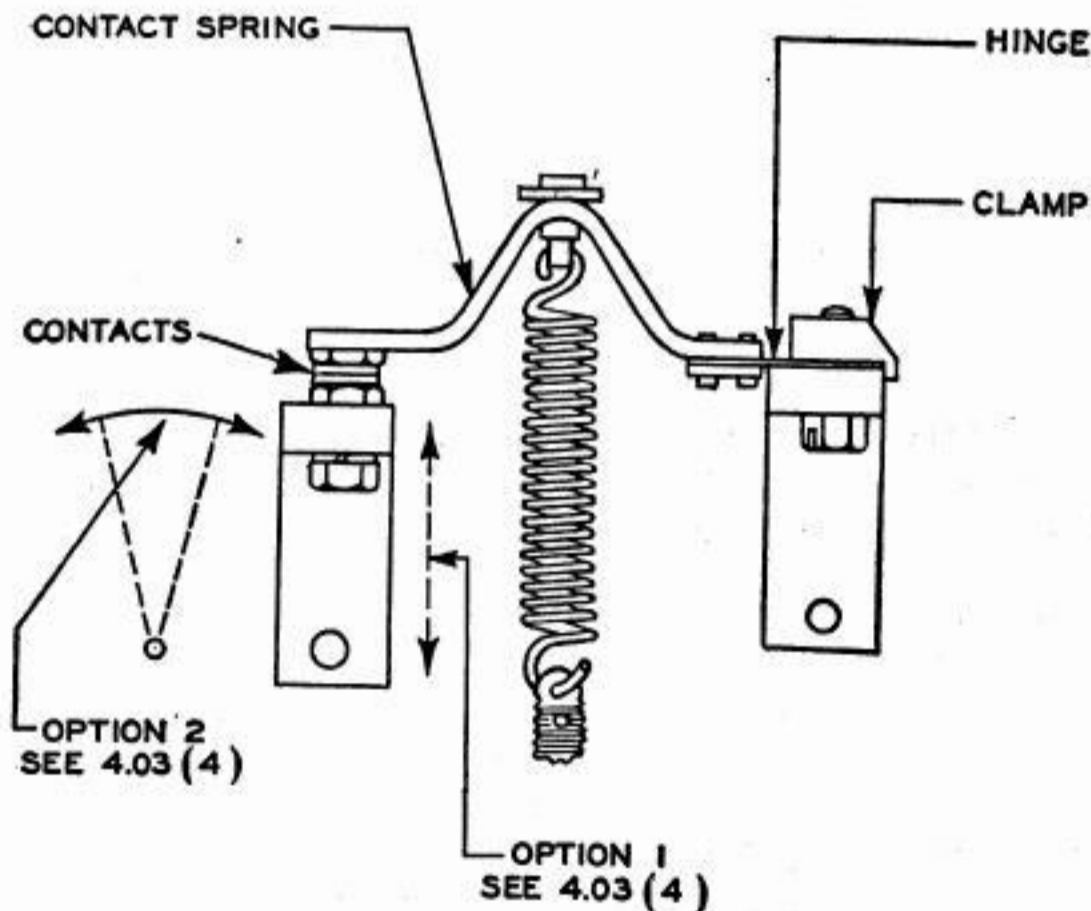


Fig. 6

4.04 **Governor Contact Alignment:** Governor contacts shall be in line and meet squarely so that the maximum contact surface is provided.

(a) Gauge by using a .002" gauge (or smaller, if available) on all sides of the contacts. If the contacts are adjusted correctly, the gauge should not enter between the contacts on any side.

(b) To adjust:

(1) Adjust the speed-adjusting spring until the contacts just make or to the minimum tension allowed by the adjusting wheel and its screw.

(2) Line up the edges of the contacts by loosening the screw in the contact-spring clamp and reposition the contact spring so that the edge of its contact coincides with the edge of the fixed contact.

(3) In order to align the contacts so that their faces are parallel from front to back as shown in Fig. 6, twist the contact-spring hinge with a pair of long nose pliers by applying pressure to the contact spring near the contact. **Fig. 6**

(4) In order to align the contacts so that their faces are parallel side to side as shown in Fig. 6, one of the two options given below should be used: **Fig. 6**

#### **Option 1**

Where the governor shell is provided with elongated holes for the fixed-contact block mounting screws, loosen the screws and move the block up or down as shown in Fig. 6 until the contact faces are parallel. Tighten the mounting screws. **Fig. 6**

#### **Option 2**

Where the governor shell does not have elongated holes for the fixed-contact block mounting screws, loosen the screws and move the block from side to side as shown in Fig. 6 until the contact faces are parallel. Tighten the mounting screws. **Fig. 6**

(5) If the contact faces cannot be made parallel by either of the two options given above, remove the contact spring and check with the TP95960 tape gauge used as a straightedge as shown in Fig. 7. When necessary, bend the contact spring at the first bend from the contact. Recheck 4.04 (b) (2). **Fig. 7**

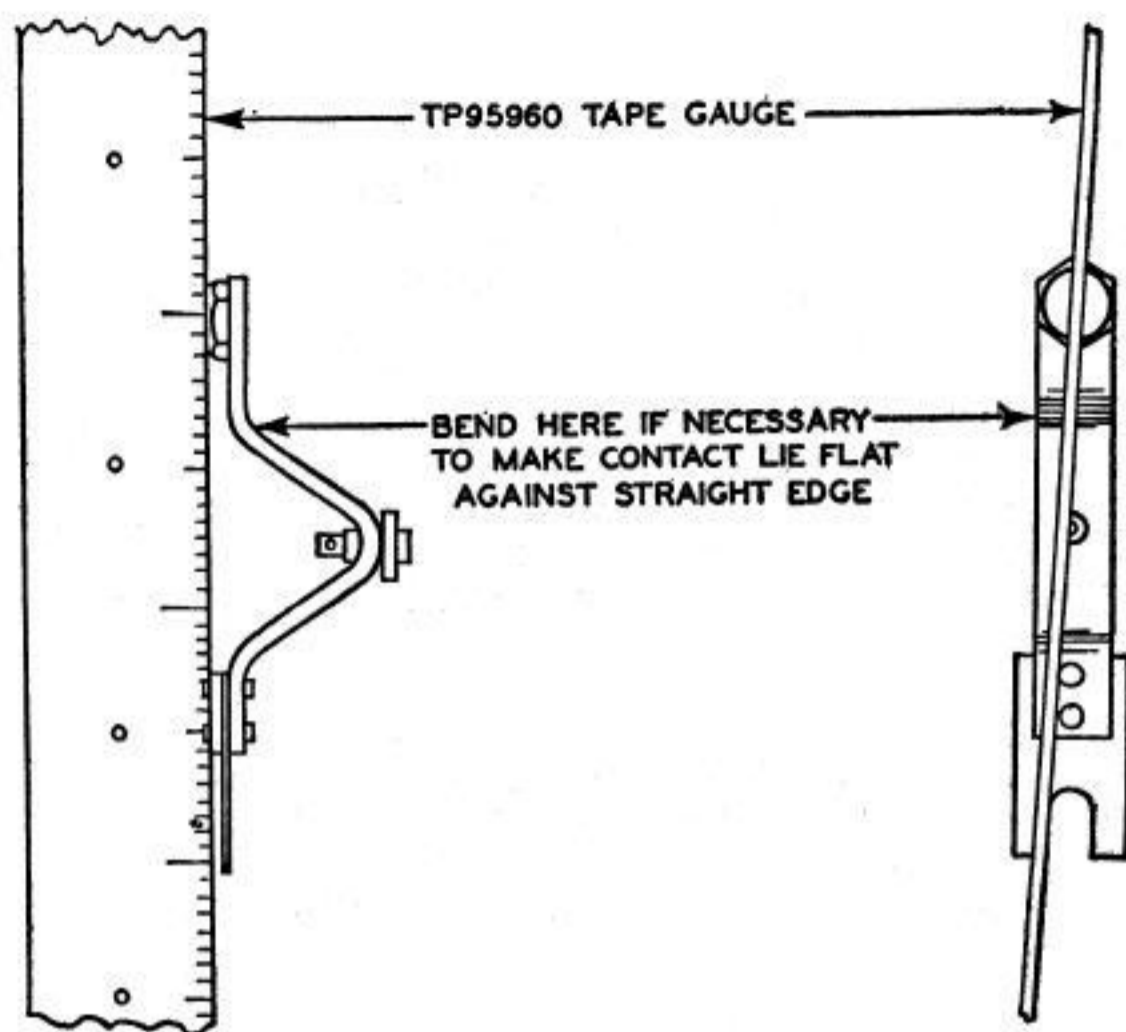


Fig. 7

### C. Single-Speed, Center-Contacting and Edge-Contacting-Type Governors

#### Requirements and Procedures

**Note:** Paragraphs 4.16 to 4.19 apply also to single-speed, edge-contacting-type governors now rated mfr. disc. Single-speed governors presently manufactured are the center-contacting-type.

#### Adjusting-Wheel Friction-Washer

**4.05 Adjusting-Wheel Friction-Washer Tension:** It should require min 16 oz, max 24 oz to start the friction wheel moving. **Fig. 8**

(a) To gauge:

(1) Rotate the adjusting wheel to a point where the governor-contact pressure is min 13 oz, max 14 oz when the pull end of the 32-oz scale is hooked over the contact spring at the contact and pulled parallel to the speed-adjusting spring and the contacts just opened.



- (2) Insert a common pin radially into the leather rim of the adjusting wheel and hook the pull end of the 32-oz scale over the pin at the leather and pull at a tangent to the circumference of the adjusting wheel.
- (b) To adjust, remove the friction washer and bend the large projections.

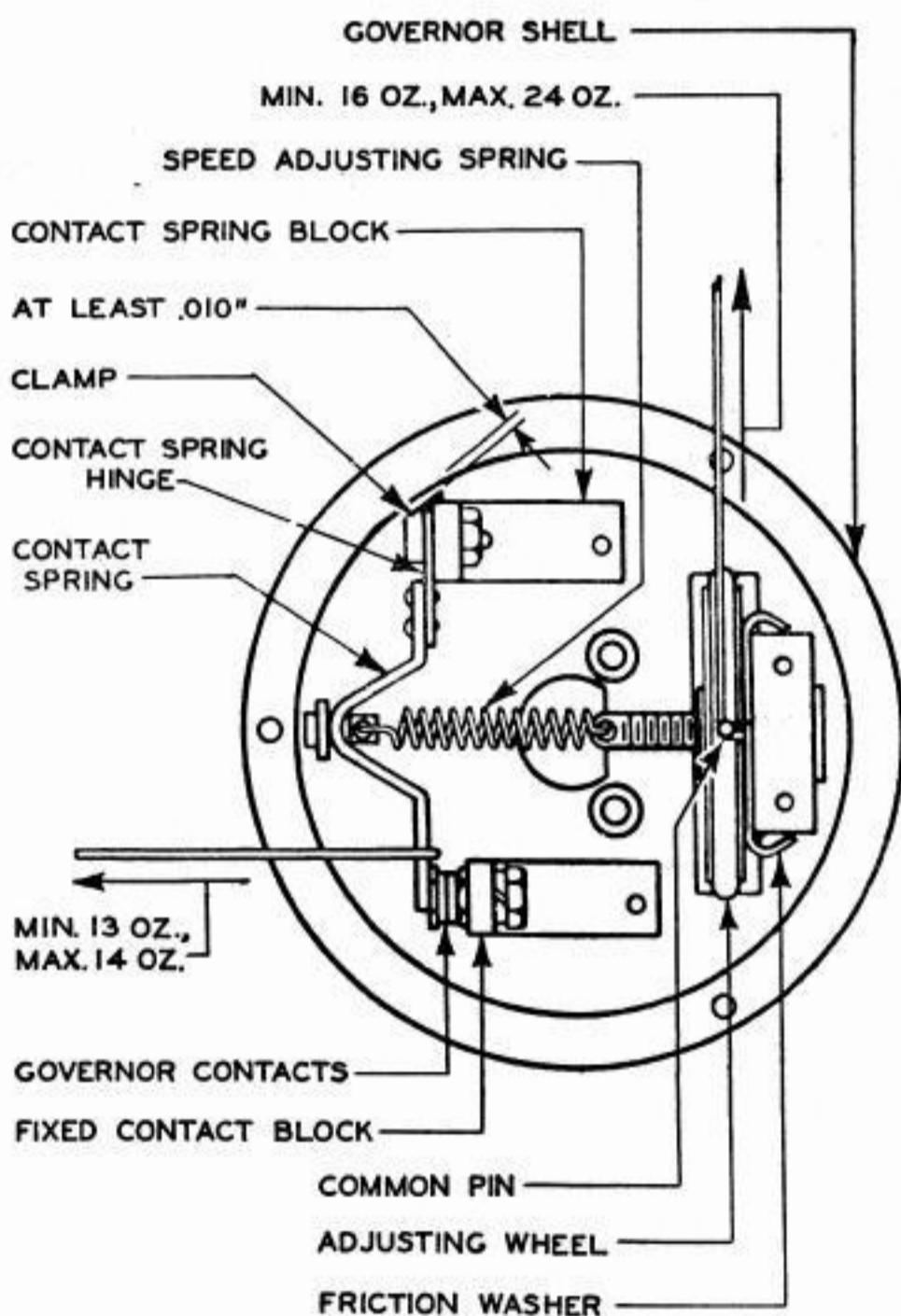


Fig. 8

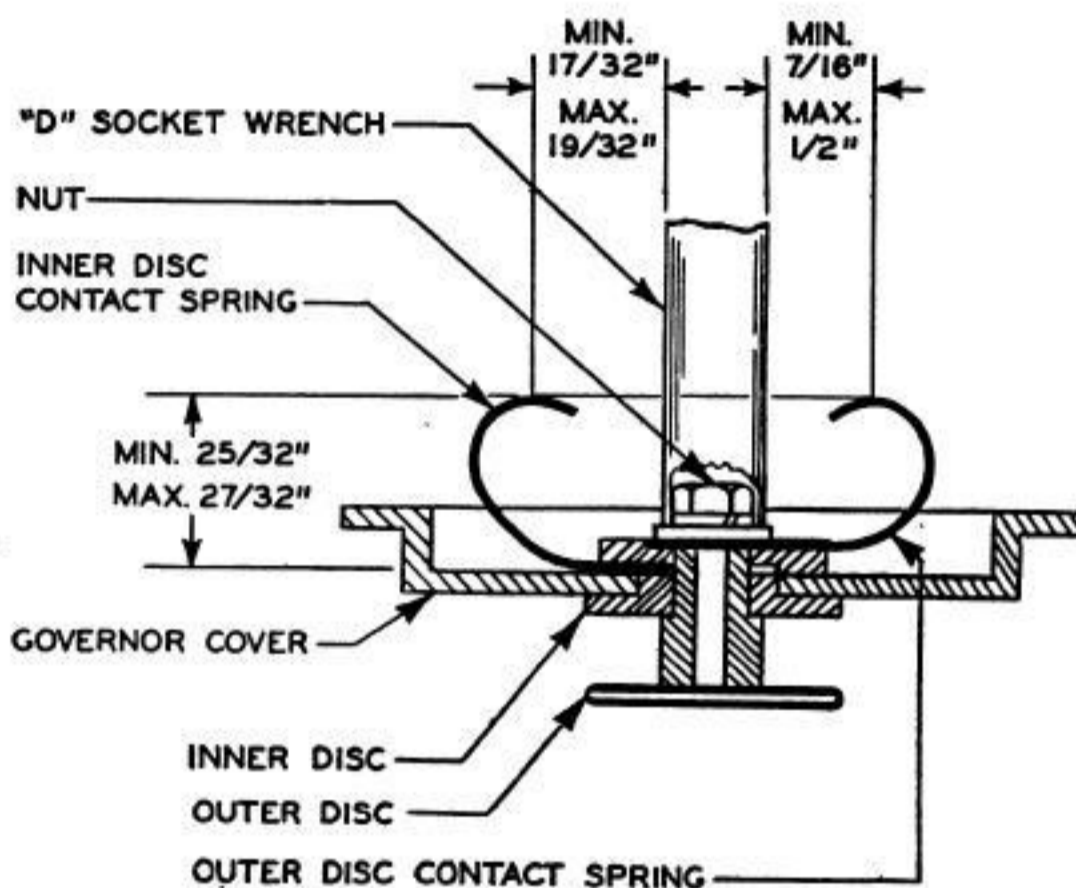
**Note:** Old-style adjusting-wheel friction-washers are round, and because of their shape, are difficult to adjust. The newer-style washers have projections that permit adjustment. Where the old-style friction washer is encountered and in need of adjustment, it is preferable that a new-style washer be installed.

### Center-Contacting-Type Governors

4.06 **Contact springs** should meet the following general requirements:

- (a) The distance from the inner surface of the governor cover to the highest point on the contact springs should be min  $25/32$ " , max  $27/32$ ".
- (b) To adjust, bend the springs.

**Fig. 9**



**Fig. 9**

4.07 **Inner-Disc Contact-Spring:** With the TP89955 D socket wrench placed over the nut which holds the contact springs in place, the distance from the outer surface of the wrench to a point where the TP95960 tape gauge, used as a ruler, touches the curved surface of the inner-disc contact-spring should be min  $17/32$ " , max  $19/32$ ".

**Fig. 9**

- (a) To gauge, place the end of the TP95960 tape gauge against the outer surface of the D wrench so that the edge of the  $1/32$ " scale is resting against the curved surface of the inner-disc contact-spring.
- (b) To adjust, bend the spring. Recheck 4.06 (a).

4.08 **Outer-Disc Contact-Spring:** With the D socket wrench in position as in 4.07, the distance from the outer surface of the wrench to a point where the tape gauge touches the curved surface of the outer-disc contact-spring should be min  $7/16"$ , max  $1/2"$ .

**Fig. 9**

(a) To gauge, place the end of the TP95960 tape gauge against the outer surface of the D wrench so that the edge of the  $1/32"$  scale is resting against the curved surface of the outer-disc contact-spring.

(b) To adjust, bend the spring. Recheck 4.06 (a).

4.09 **Governor Brush-Spring Plate Bracket:** The inner surface of the bracket should be parallel to the governor cover.

**Fig. 10**

(a) Gauge by eye.

(b) To adjust, loosen the brush-spring plate mounting screws and reposition the bracket. Tighten the screws.

4.10 **Contact Discs:** A smooth, even, bronze-colored glaze is a desirable condition for the contact surfaces of the discs and they should not be disturbed unless there is excessive sparking under the brushes.

(a) Gauge by eye.

(b) When it is necessary to clean the discs, a KS-2423 cloth, wrapped around a KS-6320 orange stick and moistened with trichloroethylene should be held on each disc while the motor is being rotated by hand and the brushes have been removed. If the discs are pitted, a piece of 400A Aloxite wrapped around a KS-6320 orange stick should be held against each disc while the motor is being rotated by hand. Badly grooved discs should be replaced.

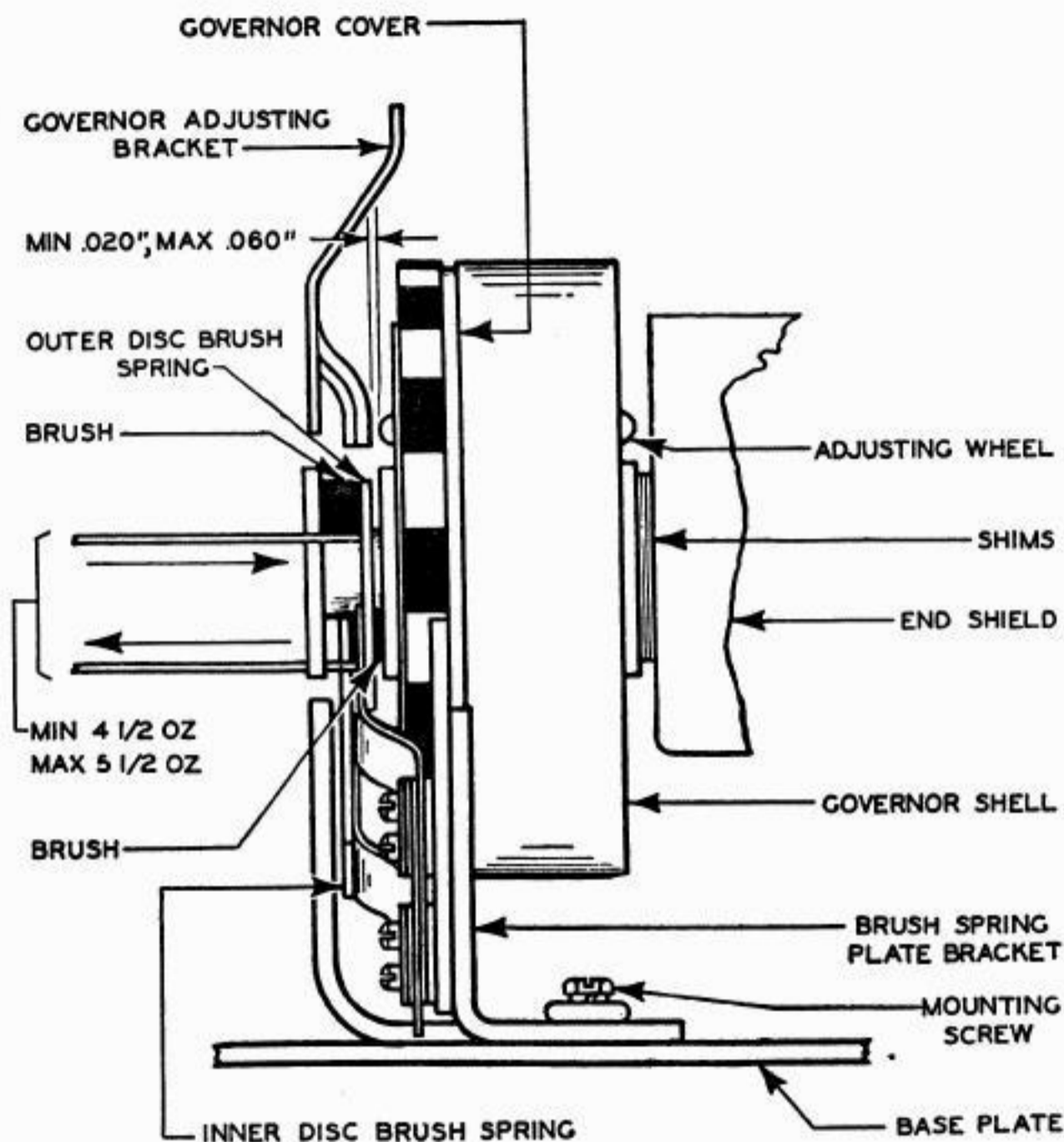


Fig. 10

4.11 **Governor brushes** should lie flat against their discs and there should be at least  $3/32''$  of the brush material remaining.

(a) Gauge by eye.

(b) To adjust, level off the brush by passing a piece of 400A Aloxite between the brush and the disc. If there is less than  $3/32''$  of the brush remaining, replace the brush.

4.12 **Inner-Disc Brush-Spring Tension:** It should require min 4-1/2 oz, max 5-1/2 oz to start the brush moving away from its disc. **Fig. 10**

(a) To gauge, hook the pull end of the 8-oz scale over the brush spring at the brush and pull horizontally away from the motor.

(b) To adjust, remove and bend the brush spring. Reassemble the spring and recheck 4.11.

4.13 **Outer-Disc Brush-Spring Tension:** It should require min 4-1/2 oz, max 5-1/2 oz to start the brush moving away from its disc. **Fig. 10**

(a) To gauge, apply the push end of the 8-oz scale to the brush spring at the brush and push horizontally toward the motor.

(b) To adjust, remove and bend the brush spring. Reassemble the spring and recheck 4.11.

4.14 **Governor-Brush Alignment:** The outer edge of the brushes should be within 3/64" of the outer edge of the discs throughout one revolution of the governor and a line established by the center of the outer disc and the center of one of the brushes should pass through some portion of the other brush. **Fig. 11**

(a) To gauge, remove the governor-adjusting bracket.

(b) To adjust, reposition the brush spring by means of its mounting slot. Reassemble the governor-adjusting bracket.

4.15 **Governor-Adjusting Bracket:** There should be a clearance of min .020", max .060" between the adjusting wheel and the governor-adjusting bracket. This requirement should be ignored if the bulge near the center of the adjusting bracket is omitted in manufacture. **Fig. 10**

(a) To gauge, rotate the governor until the adjusting wheel is opposite the adjusting surface of the governor-adjusting bracket.

(b) To adjust, bend the governor-adjusting bracket.

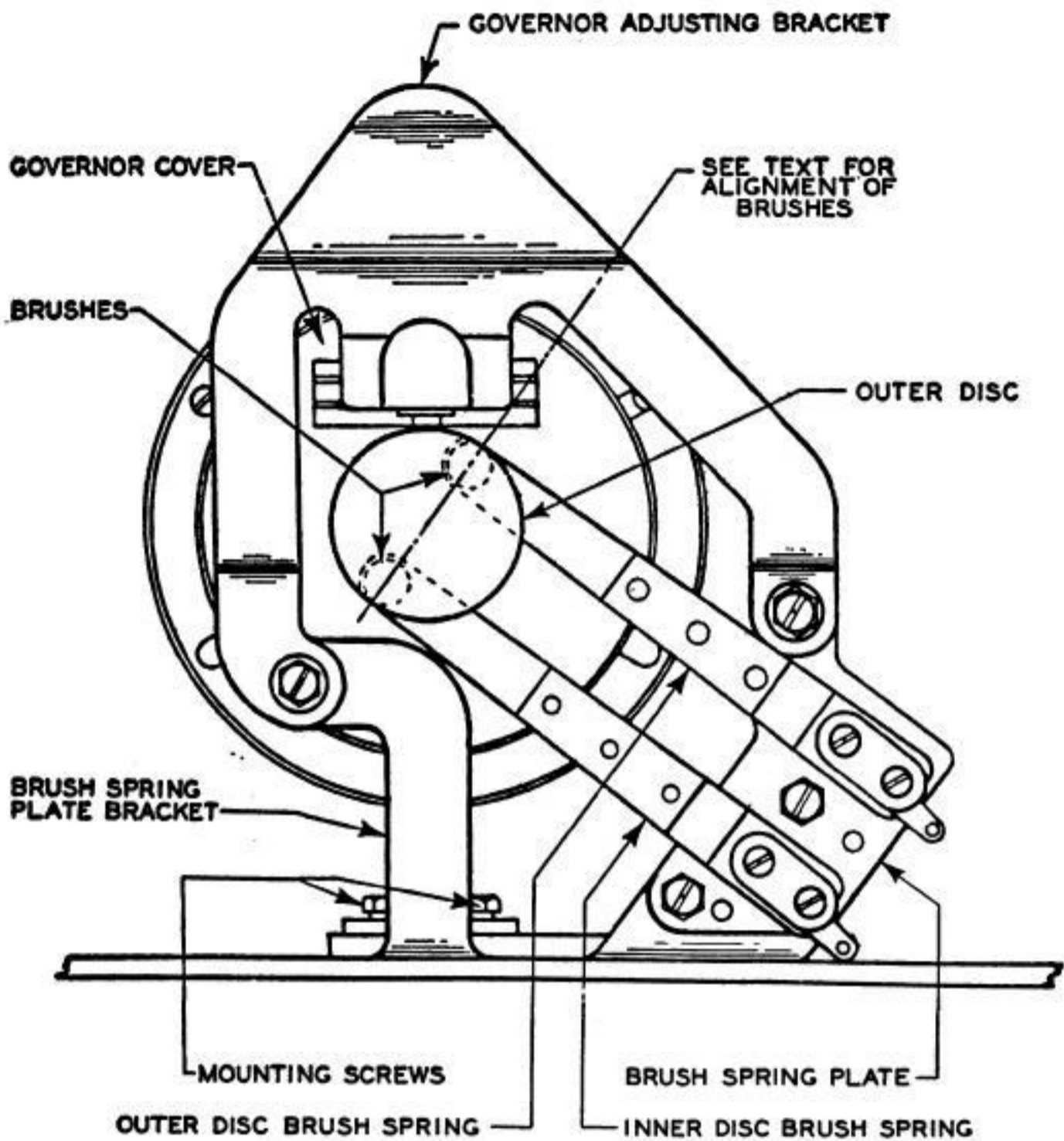


Fig. 11

## D. Two-Speed, Edge-Contacting-Type Governors Requirements and Procedures

Fig. 12

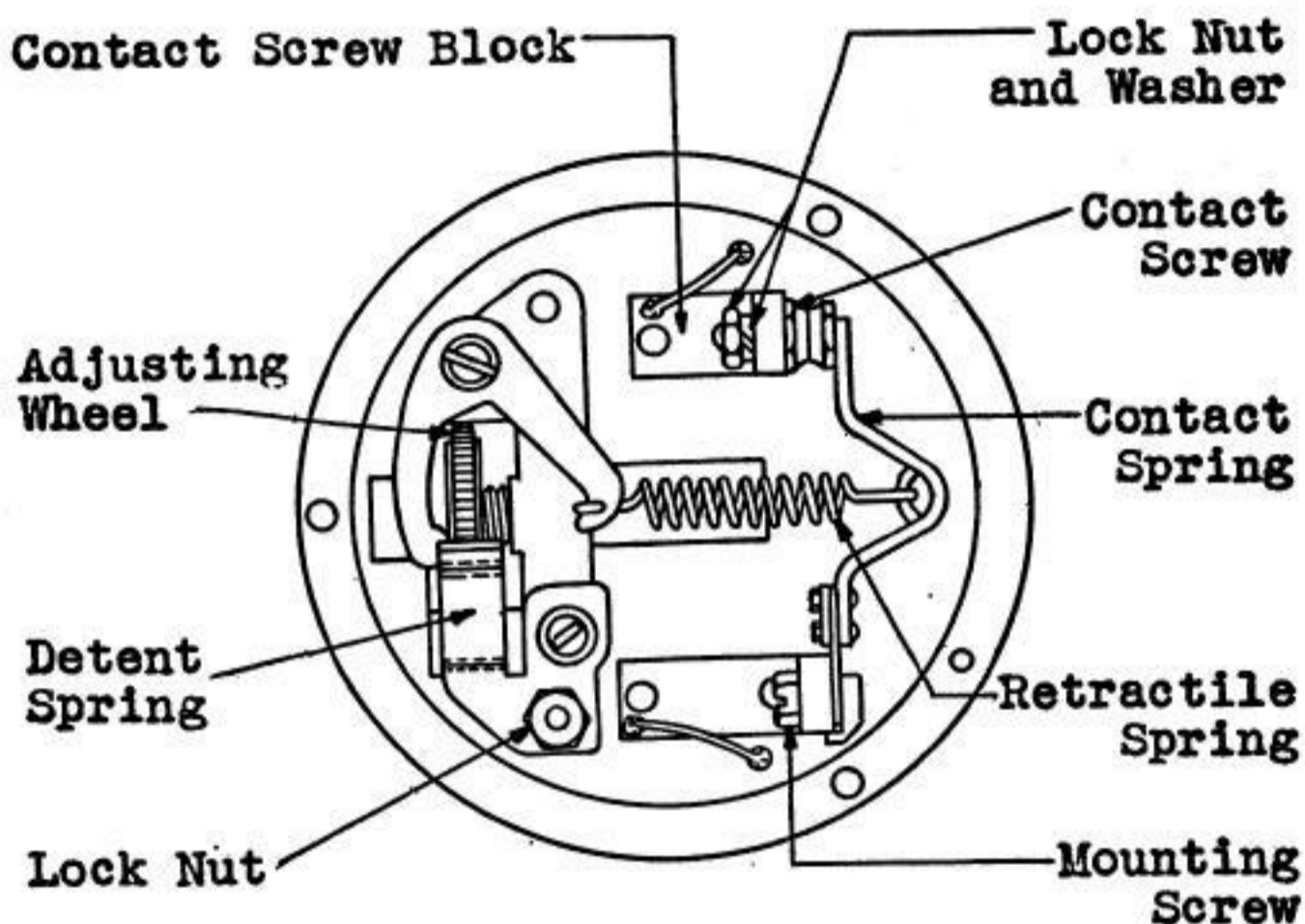


Fig. 12

4.16 **Governor Brushes:** There should be at least 1/4" of the brush material remaining on each brush and the stranded wire inside the brush spring should be free from kinks which may prevent the spring from extending properly and the wire should be securely fastened to the brush and the brass insert of the brush cap.

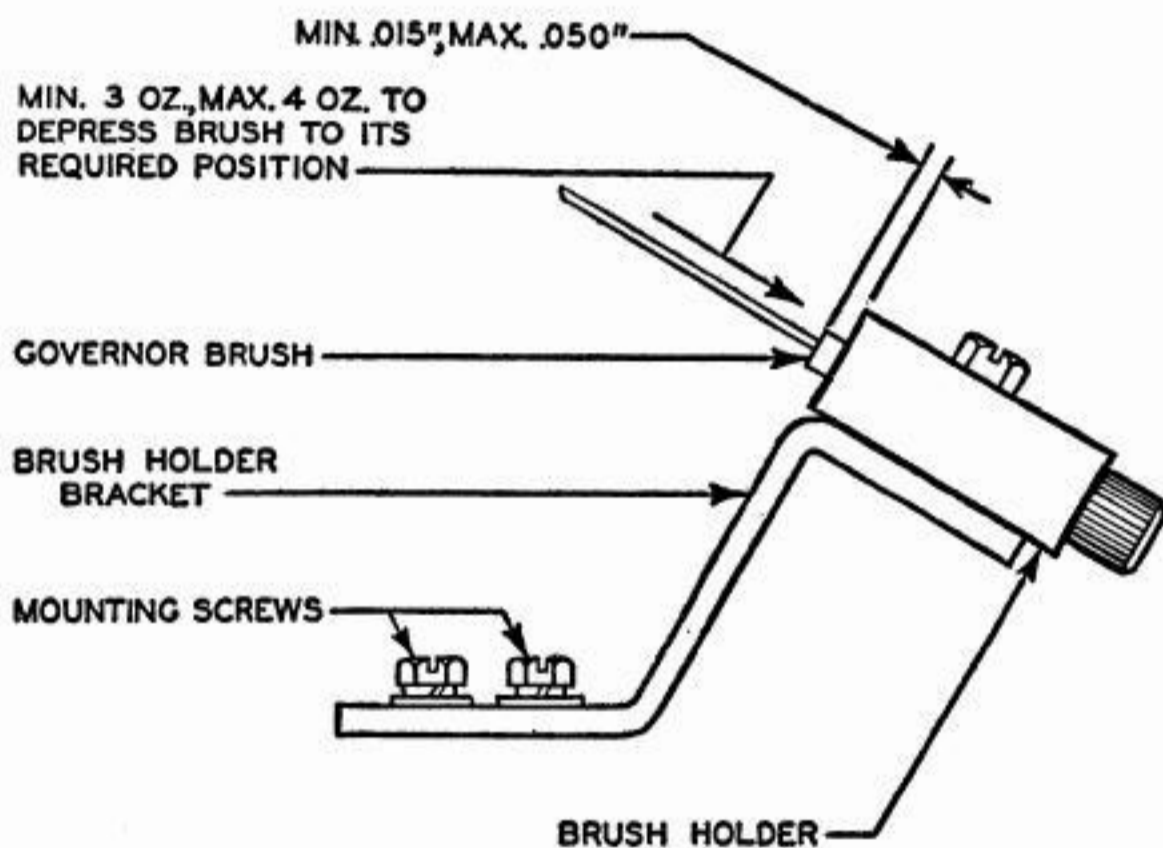
(a) Gauge by eye.

(b) If the brush has less than 1/4" of its material remaining or if the spring is mutilated, replace the brush.

4.17 **Alignment of Governor Brushes:** The governor brushes should ride approximately in the center of the governor rings.

4.18 **Governor-Brush Spring-Tension:** It should require min 3 oz, max 4 oz to hold the brush in its normal position (within min .015", max .050" of the brush holder). **Fig. 13**

(a) To gauge, remove the brush holder from the brush-holder bracket, remove the brushes from the holder and clean each brush with a KS-2423 cloth moistened with trichloroethylene. Clean out the holes in the holder into which the brushes are placed and reinsert the brushes making sure that the brushes move freely in the holder. Using the push end of the 8-oz scale, depress that portion of the brush which extends beyond the holder until the end of the brush is within min .015", max .050" of the holder.



**Fig. 13**

(b) Where springs do not meet the requirement, replace the governor-brush-spring assembly. Reassemble the brush holder.

4.19 **Brush Holder:** There should be min .015", max .050" clearance between the brush holder and the rings through one complete revolution of the governor. **Fig. 14**

(a) To adjust, loosen the brush-holder mounting screws and reposition the brush holder. Tighten the mounting screws.



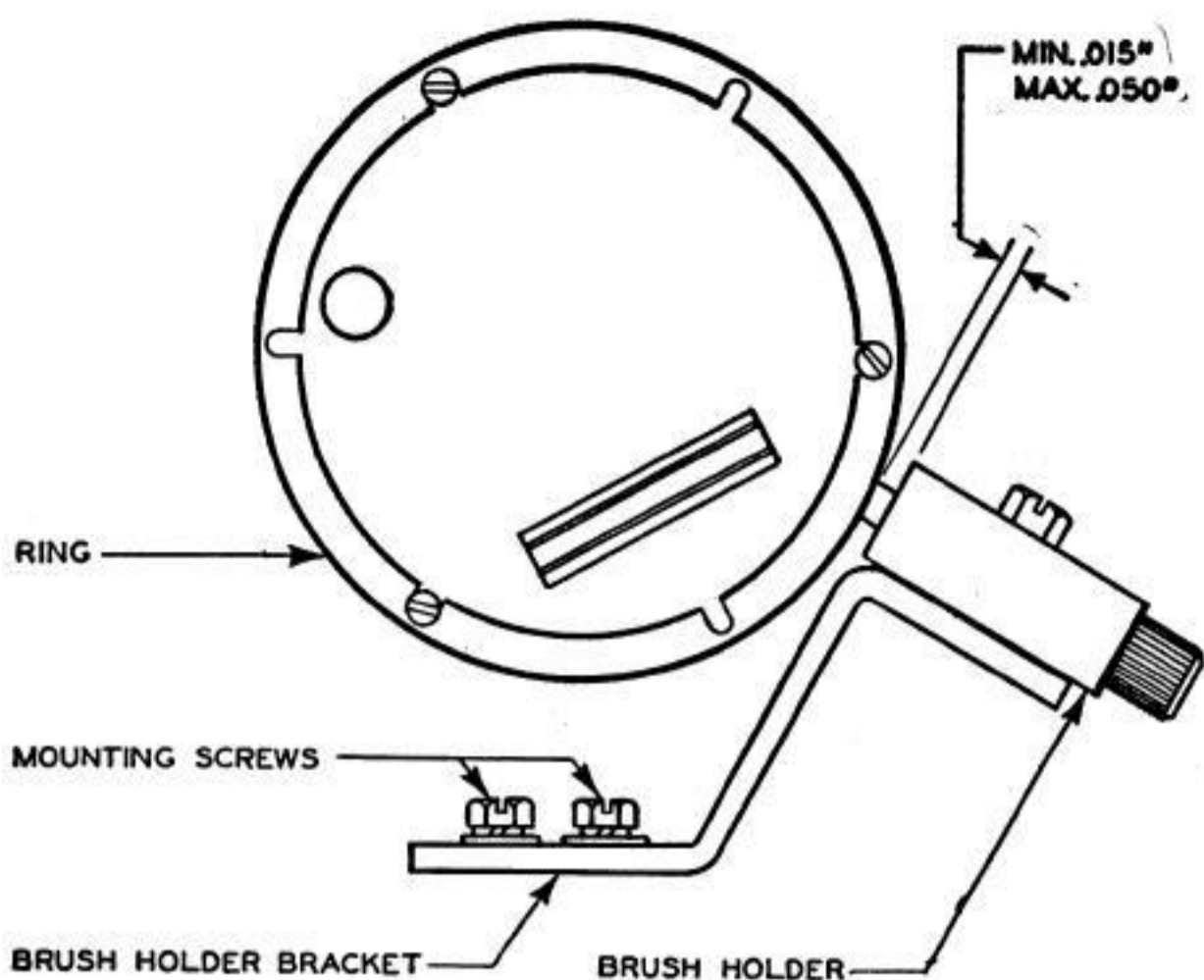


Fig. 14

4.20 **Governor Adjusting-Wheel Detent-Spring Pressure:**

The detent spring should rest on the adjusting wheel:

- (1) in all positions of the adjusting wheel
- (2) at the point of minimum pressure with a min 2 oz, max 4 oz pressure.

Fig. 15

(a) To gauge the pressure: With the detent spring resting between the notches on the adjusting wheel, hook the 8-oz scale to the spring near the adjusting wheel. With the scale in a horizontal position, pull at right angles to the spring. To determine the minimum pressure point, the check should be made at three points approximately equally spaced around the periphery with the wheel in its final revolution at each end of its travel.

(b) To adjust, loosen the clamping screw and locknut and shift the detent spring as required. Moving the spring higher up on the rim of the wheel increases the tension and shifting the spring lower on the wheel decreases the tension. If satisfactory pressure cannot be obtained in this way, remove the clamping screw and locknut and bend the detent spring as required. Position the spring on the wheel and tighten the screw and nut.

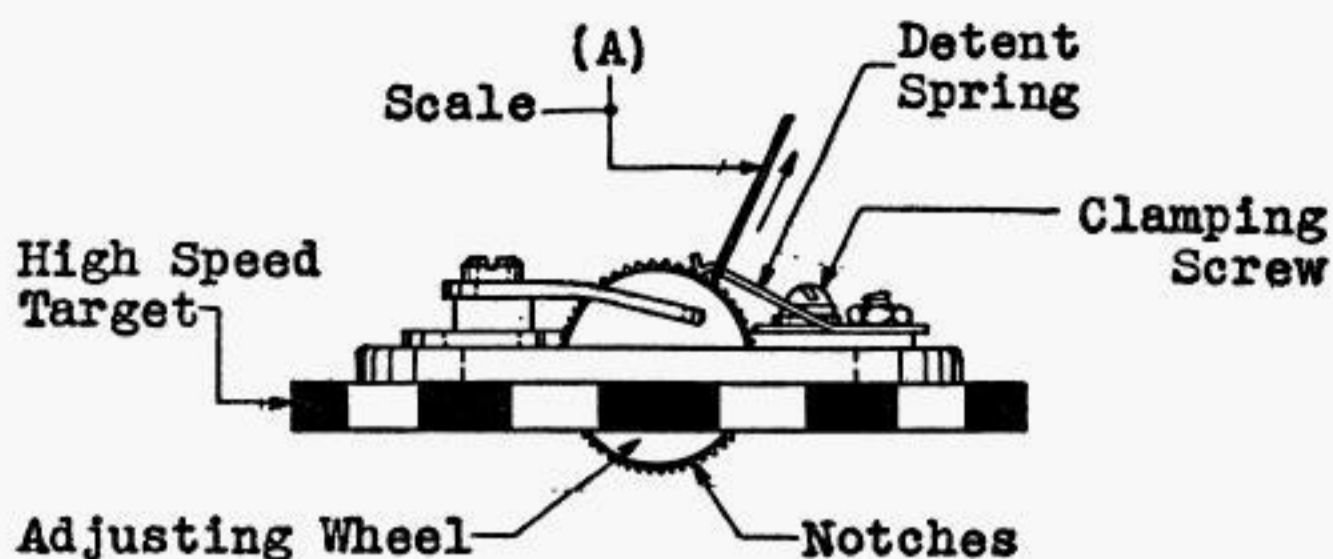


Fig. 15

4.21 **Governor Rings:** A smooth, even, bronze-colored glaze is a desirable condition for the contact surface of the rings and they should not be disturbed unless there is excessive sparking under the brushes.

(a) Gauge by eye.

(b) When it is necessary to clean the rings, a KS-2423 cloth moistened with trichloroethylene should be held against the rings while the motor is in motion. To remove burned spots from the rings, a piece of 400A Aloxite held lightly against the rings while the motor is in motion along with a KS-2423 cloth to immediately wipe off the cuttings and sand may be used.

4.22 **Governor-Brush contact surface** should be curved to fit the contour of the rings.

(a) Gauge by eye.

(b) To resurface the brushes, hold a piece of 400A Aloxite around the outer shell of the governor between the brushes and the shell and rotate the governor back and forth by hand. The last rotation should be in the normal direction of travel.