

Bulletin No. 141
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TELETYPE

PRINTING TELEGRAPH SYSTEMS

1

DESCRIPTION AND ADJUSTMENTS
TRANSMITTER DISTRIBUTOR

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CORPORATION

SUBSIDIARY OF

Western Electric Company

CHICAGO, U.S.A.

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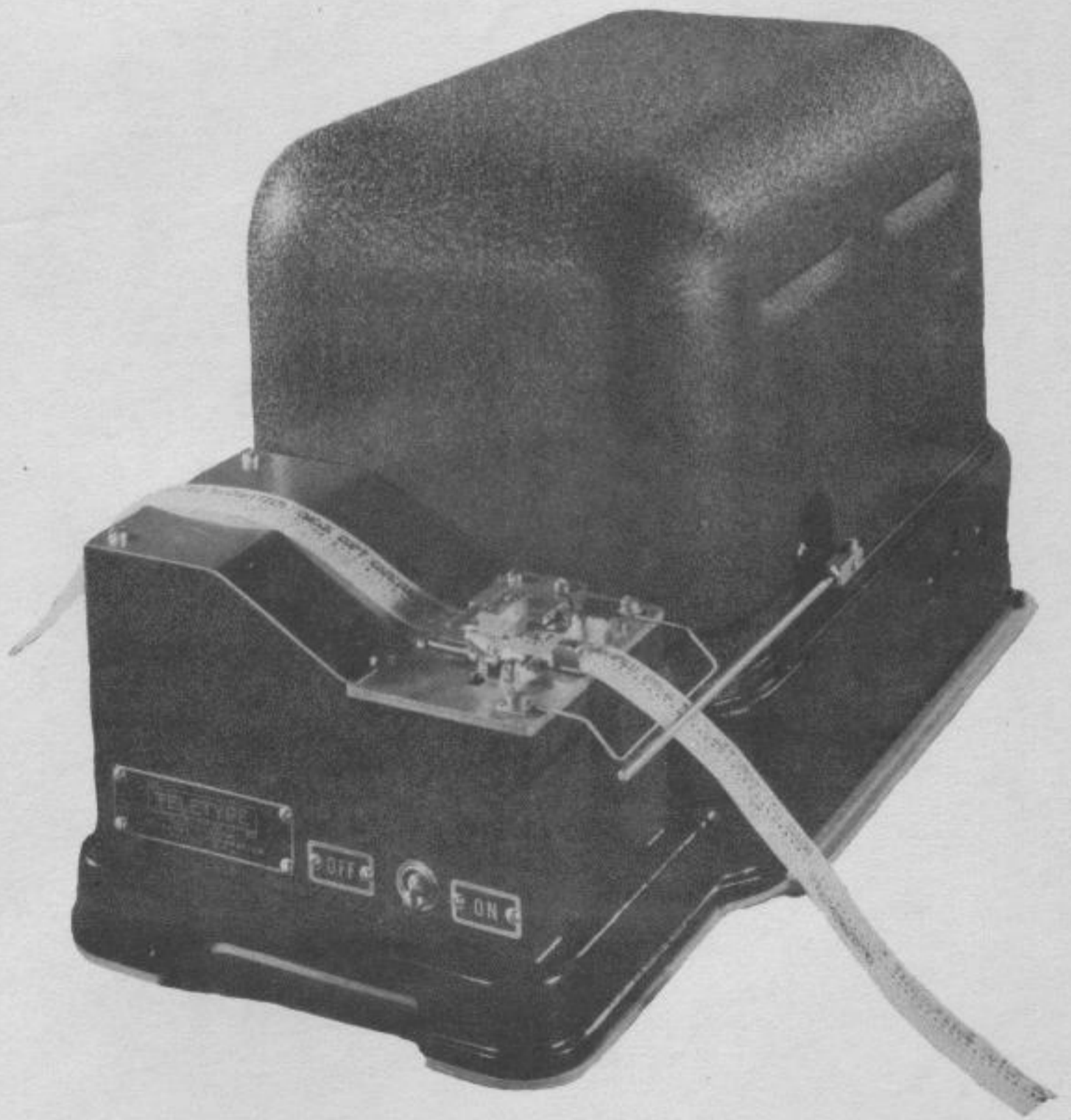


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DESCRIPTION OF THE
TRANSMITTER DISTRIBUTOR

General

The transmitter distributor is a motor driven device which translates code combinations, perforated in a paper tape, into electrical impulses and transmits these impulses to one or more receiving stations. The tape may be perforated by any one of several models of Teletype perforating or reperforating machines.

There are two kinds of transmitter distributors; one for transmitting five unit code, and the other for transmitting six unit code. These two kinds are identical except that the six unit code machine accommodates a wider tape and provides for the transmission of an additional impulse. The following description pertains specifically to the five unit transmitter distributor.

NOTE: In all the figures of this bulletin, end views of fixed pivot points are designated by solid black circles.

Theoretical Transmitting Circuits

The portion of the unit through which the perforated tape feeds is known as the transmitter (figure 3). The transmitter prepares electrical paths from the signal line battery to the commutator segments of the distributor. (See figure 4.) These paths are controlled by tape pins which sense the perforations in the tape and thereby determine the positions of the contact tongues (figure 5) with relation to their upper and lower contact screws.

The distributor (figure 3) completes the connections to the signal line. Connections are made in sequence at a constant rate of speed by brushes which traverse the segments and the collector ring.

The Tape Sensing Mechanism

The contact levers (figure 5) are positioned vertically in the transmitter. They pivot on a shaft S and have extensions to the right C, left A, and downward B. The right-hand extensions project upward at the ends and have tape pins embedded in them. An opening is provided in a tape guide, located above the right-hand extensions of the contact levers, to permit the tape pins to enter the code holes in the tape. The left-hand extension of each contact lever carries a contact tongue which is attached to the contact lever by a pivotal mounting. Each contact tongue is positioned to move between two contact screws, a spacing contact screw above, and a marking contact screw below. A contact lever spring is attached to the mounting end of each contact and tends to hold it against the lower contact screw. A contact lever bail, pivotally mounted just below contact lever lower extensions, has an arm extending downward engaging a transmitter operating lever. This transmitter operating lever (figure 2) has a central pivot screw and moves in a horizontal plane. A roller on the rear end of the lever rides a transmitter operating cam mounted on the lower end of the distributor shaft. The motion imparted to the transmitter operating lever by the operating cam causes the contact lever bail to rotate the contact levers on their shafts sufficiently to move the contact tongues up and down between the marking and spacing contact screws. After the tongues strike the upper screws, any additional clockwise rotation of the contact levers is absorbed by the contact lever springs.

When the distributor brush comes to rest on the stop segment (figure 3) the transmitter operating lever roller is on the peak of its cam, thereby holding the tongues against the spacing contacts and also holding the tape pins, located in the right-hand extensions of the contact levers, below the holes in the tape. As the transmitter operating lever roller rides to the low part of its cam, the tape pins rise. If tape perforated with code combinations is in the tape guide at this time, the contact lever pins will project through the tape wherever the tape is perforated and permit the associated contact tongues to rest on the marking contacts, while the pins will be blocked at the unperforated portions and the associated contact tongues will be held against the spacing contacts. The tape will be held stationary and the contact tongues will maintain their positions as determined by the code perforations while the distributor brush is traversing segments one to five inclusive. The inner distributor brush will transmit marking impulses to the line from segments associated with tongues that rest on the lower contacts, and spacing impulses (for polar signal transmission) from segments associated with tongues that are on the upper contacts. When "make-break" signal transmission is used (battery applied only to the lower contacts), a no-current interval occurs when the contact tongues are against the spacing contacts.

The Distributor Mechanism

The distributor (figure 3) is made up of two concentric conducting rings mounted on a fiber disc. The outer ring is divided into seven segments. Segments Nos. 1 to 5, inclusive, correspond to the five intelligence intervals of the five unit code and are connected to the five contact tongues shown in figure 4.

Immediately preceeding No. 1 segment is the start segment. The segment following No. 5 segment is the stop segment. The stop segment and the lower contact screws are permanently connected to marking line battery. The start segment and the upper contact screws are connected to spacing line battery only when it is desired to transmit polar signals; otherwise, the upper contact screws and the start segment have no battery connections. When the distributor brush passes over the start segment, a spacing impulse is always transmitted, whereas a marking impulse always results when the brush traverses the stop segment. These two invariable impulses cause the receiving mechanism to operate in unison with the distributor brush arm.

Tape Feeding Mechanism

Positioned to the rear of the contact levers and pivoted on the contact lever shaft is a feed lever (figure 6) which is similar in shape to a contact lever. The feed lever has a spring attached to its left-hand extension and a feed pawl mounted on its right-hand extension C. A feed pawl spring holds the feed pawl in contact with a feed wheel ratchet. Pins on the circumference of the feed wheel (figure 5) project through an opening in the tape guide and mesh with the feed holes in the tape. A retaining lid, under which the tape passes, holds the tape in contact with the feed wheel pins. When the action of the contact lever bail on the contact lever moves the tape pins downward, the feed lever responds in a similar manner, causing the feed pawl to engage a tooth on the feed wheel ratchet and rotate the feed wheel. With each downward motion of the feed pawl, the tape will be advanced from right to left, the distance required to bring the succeeding code combination over the tape pins. The setting of the feed pawl is such that it does not start to rotate the feed wheel until the tape pins have moved clear of

the tape. A feed wheel detent is provided to insure alignment of the code perforations with the tape pins. The position of the operating cam with relation to the distributor brush is such that the contact tongues are not moved from the lower contacts until after the brush has reached the stop segment. While the brush is passing over the stop segment, the tape is advanced.

Starting and Stopping Transmission

* (The main shaft is driven by a motor through the medium of gears and a friction clutch. When the motor is running, transmission is stopped by blocking the rotation of the main shaft and started by unblocking it.) This is done through the medium of a stop arm which is under the control of a tape stop magnet and a spring (figure 3). The magnet, when energized, holds the stop arm clear of the lug. The spring holds the stop arm in the path of the lug when the magnet is deenergized. The circuit to the magnet may be opened or closed by means of the tight-tape stop contacts, tape stop switch, or the end-of-tape stop mechanism contacts which are described in the three paragraphs that follow.

Tight-Tape Stop Mechanism (Auto-Stop Mechanism)

When the slack in the tape between the tape perforator and the transmitter is taken up, the tape raises the tight-tape stop lever which opens the circuit to the tape stop magnet allowing the stop arm to engage the lug on the stop cam (figure 3). A tape guide wire may also be employed to guide slack tape within close proximity of the tight-tape stop lever so as to raise the lever and stop transmission if the tape feeding into the transmitter becomes tangled, thus preventing mutilation of the tape feed wheel perforations.

Tape Stop Switch

Transmission can also be stopped by manually operating the tape stop switch (figure 3). This switch controls the release magnet in a manner similar to that of the mechanism described in the preceding paragraph.

NOTE: On some types of distributors, this switch is connected in the motor circuit and is then used to start or stop the motor.

End-of-Tape Stop Mechanism

Another means may be provided for automatically stopping transmission when a length of tape has passed through the transmitter. This is accomplished by another pair of contacts located beneath the tape guide which are operated by a pin that projects through the tape guide (figure 3). When the tape retaining lid is closed, the end-of-tape stop pin is depressed and the contacts are held closed so long as there is tape between the pin and the lid. When the end of the tape passes the pin, the tension of the contact spring raises the pin and opens the contacts, stopping transmission.

Bell-on-Blank Signal Mechanism

NA
The transmitter distributor may be equipped with bell-on-blank signal mechanism for use when the receiving printers associated with the transmitter distributor on the circuit are equipped to select the bell signal on the blank combination.

The bell-on-blank signal mechanism consists of a slow acting break relay, a set of contacts, and a contact operating lever. This mechanism enables the operator to send a blank signal while a perforated tape is in the transmitter. This is accomplished by allowing the commutator brush to rotate while the contact tongues that transmit the code are held against the spacing contact, and the transmitter operating lever is prevented from following the operating cam (figure 7). When it is desired to send a blank signal, the tape stop lever should be lifted and the contact operating lever should be moved manually to the operated position, once for each blank signal.

When the contact operating lever is operated, a latch engages the transmitter operating lever, preventing the latter from following the transmitter operating cam. This causes the contact tongues to remain against the spacing contacts and also prevents feeding of the tape. At the same time that the transmitter operating lever is being latched, a finger on the contact operating lever closes contacts "A" and "B" (figure 8). The closing of contacts "A" and "B" connects the tape stop magnet in parallel with the winding of the break relay (break relay contacts closed) and applies battery to both parallel circuits. The circuit of the tape stop magnet is in series with contact "C" of the break relay. The slow acting break relay responds more slowly to the closing of its circuit than the tape stop magnet, allowing time for the tape stop magnet to operate the stop arm and allow the commutator brush to start rotating before contact "C" opens. Before the commutator brush has completed one revolution, however, the slow acting relay will have opened contact "C" causing the tape stop magnet to release the stop arm which will stop the commutator brush at the end of the revolution. If the contact operating lever is held operated, the break relay will remain energized, thus holding contact "C" open. Additional blank signals may be transmitted by releasing and reoperating the contact operating lever.

Synchronous and Governed Motors

Where regulated A.C. power is available, a synchronous motor may be used, otherwise governed motors must be used. Governed motors are available for operation on either A.C. or D.C. The speed is controlled by a centrifugal contact mechanism having commutator rings or discs. In general, motors are mounted directly to the base casting and the resistors and condenser used with governed motors are mounted on the base and in the base cavity. However, some governed motors are mounted to a base plate having governor resistors and a condenser mounted on it so as to form a complete motor unit assembly.

When an A.C. governed motor is used, a contact assembly is provided which is operated by the tape stop magnet stop arm (figure 9). The purpose of the contact assembly is to provide better speed control by introducing a resistor in series with the motor when the distributor shaft is rotating, and by shunting the resistor when the load of the friction clutch is added to the motor.

ADJUSTMENTS

General

The following adjustments are arranged in a sequence that would be followed if a complete readjustment of the unit were undertaken. This fact should be kept in mind when a single adjustment is to be made because a change in one adjustment may affect other adjustments. If one adjustment is changed, related adjustments should be checked. The adjustments up to and including "Main Shaft Clutch Torque Adjustment" (page 13) are common to all transmitter distributors but subsequent adjustments pertain to mechanisms which are not common to all units. These adjustments are preceded by a brief description to assist in the identification of the mechanism.

The spring tension values given in this bulletin were derived from measurements made with Teletype spring scales. These scales are calibrated for use in a vertical "pull" position. When used in any other position, the reading is an indicated value. Therefore, in order to obtain the specified scale readings, the spring scales which are included in the Teletype parts bulletin tool list should be used. Springs which do not meet the requirements specified and for which no adjusting procedure is given should be replaced with new springs. Ordering information may be obtained from the Teletype parts bulletin.

Before proceeding to adjust, remove the following parts: (See figure 1). Distributor cover, tape transmitter snap panel, tape transmitter top cover, and the transmitter distributor base plate. Also remove the left bracket from the transmitter unit. (See figure 3).

Do not rotate the distributor shaft in a counterclockwise direction, viewed from above, as this may mutilate the distributor brushes (figure 3). A precaution which may be exercised to avoid mutilation of the brushes is to loosen the brush holder clamp screw (figures 27, 28, or 29) and turn the brush holder so as to lift the brushes from the commutator.

Main Shaft Adjustment (Figure 10)

Rotate the main shaft until the operating lever roller just starts to ride up the high part of the operating cam. There should then be .002" to .010" clearance between the lower surface of the cam and the upper surface of the operating lever when all the play of the operating lever is taken up in a direction to make the clearance a minimum. To adjust, loosen the main shaft bearing cap screws and raise or lower the main shaft. Tighten the screws. See figure 3 for location of parts.

Motor Position Adjustment

There should be a minimum amount of backlash between the motor pinion and the main shaft gear throughout a complete revolution of the main shaft. (Figure 3). To adjust, loosen the motor mounting screws and position the motor. Tighten the screws.

* * *

NOTE: Before making any adjustments, see "General," page 5.

Tape Stop Magnet Bracket Adjustment

A. Universal Magnet (Figure 11) This adjustment applies to transmitter distributors equipped with a tape stop magnet having only one coil designed for operation on either A.C. or D.C.

- (a) The air gap between both the upper and lower pole faces of the magnet yoke and the face of the armature should be approximately equal and from .010" to .020" when the magnet armature is resting against the magnet core. To adjust for equal air gap, increase or decrease the number of shims on the magnet yoke mounting screws between the magnet yoke and the magnet bracket. To adjust for the .010" to .020" gap, increase or decrease the number of shims between the magnet core and the yoke.
- (b) When the armature is resting against the magnet core and the stop cam lug is opposite the end of the stop arm, there should be .004" to .012" clearance between the stop cam lug and the end of the stop arm. Also, both upper and lower pole faces of the magnet yoke should be parallel to the face of the armature, and the pole faces should not extend beyond either side of the armature. To adjust, position the magnet bracket by means of its mounting screws.

NOTE: If the magnet hums when energized with A.C., turn the bracket in a counterclockwise direction slightly to decrease the clearance between the armature and that part of the center pole encircled by the copper slug.

B. D.C. Magnet (Figure 12) This adjustment applies to transmitter distributors equipped with a tape stop magnet having two coils designed for D.C. operation only.

- (a) When the magnet armature is held against the magnet cores and the stop cam lug is opposite the end of the stop arm, there should be .004" to .012" clearance between the stop cam lug and the end of the stop arm. To adjust, loosen the bracket mounting screws and position the bracket. Tighten the screws.

NOTE: When making this adjustment, see that the magnet cores do not extend beyond the sides of the armature. Also, when the armature is resting on one magnet core, there should not be more than .010" space between the armature and the other magnet core.

Stop Arm Pilot Screws Adjustment (Figure 13)

With the stop cam lug against the end of the stop arm, the upper edge of the stop arm should overlap the upper edge of the stop cam .002" to .030". The stop arm should be free on its bearings, but it should not have perceptible play. To adjust, loosen the stop arm pilot screw lock nuts and position the arm by means of the pilot screws. Tighten the lock nuts.

Stop Arm Spring Tension (Figure 14)

With the stop arm resting on the low part of the stop cam, hook an 8 oz. scale over the end of the stop arm and pull at a right angle to the stop arm. It

* * *

NOTE: Before making any adjustments, see "General," page 5.

should require a pull of 5 to 7 ozs. to start the stop arm moving away from the stop cam on units having synchronous or D.C. motors. On units having A.C. governed motors (that employ the 86960 contact assembly, figure 9), the spring tension should be 1 to 1-3/4 ozs. The contact spring should be held away from the stop arm when this tension is measured.

THE FOLLOWING ADJUSTMENTS, UP TO AND INCLUDING "FEED LEVER SPRING TENSION ADJUSTMENT," ARE INTERRELATED AND MUST BE MADE IN THE ORDER GIVEN. THEREFORE, IF IT BECOMES NECESSARY TO CHANGE ANY ADJUSTMENT, ALL SUBSEQUENT ADJUSTMENTS IN THIS GROUP SHOULD BE CHECKED.

Tape Feed Pawl Spring Tension Adjustment (Figure 15) - See Note (A)

Rotate the motor shaft until the feed pawl is in its uppermost position. Apply the push end of an 8 oz. scale to the feeding tip of the tape feed pawl and push horizontally toward the left. It should require 1 to 2 ozs. to hold the pawl in a vertical position. To adjust, loosen the feed pawl mounting screw and position the spring. Tighten the mounting screw.

Detent Lever Spring Tension (Figure 16) - See Note (A)

Hold the transmitter top plate upside down and in a horizontal plane. Make sure that the detent roller is resting in the hollow between two teeth on the feed wheel ratchet. Hook a 32 oz. scale over the end of the detent lever and pull horizontally against the tension of the spring. It should require 15 to 18 ozs. to start the detent lever moving.

Feed Wheel Shaft Bearings Adjustment - See Note (A)

The feed wheel shaft should be free in its bearings and should have some end play, not over .002". To adjust, loosen the feed wheel shaft bearing mounting screws and position the bearings. Tighten the screws. See figure 16 for location of parts.

Tape Space Adjustment (Figure 18)

On transmitters designed to use chadless tape, the clearance between the tape guide and the retaining lid plate should be .012" to .014" throughout the area of the retaining lid plate when the retaining lid is latched closed. On transmitters designed to handle only the regular tape, this clearance should be .006" to .008". To adjust, increase or decrease the number of shims installed between the retaining lid and the retaining lid plate.

Tape Guide Adjustment (Figure 17)

When a piece of perforated tape is engaged with the pins of the feed wheel, there should be equal clearance between the edges of the tape and the tape guide. To adjust, loosen the tape guide mounting screws and position the guide. Tighten the screws.

* * *

(A) This adjustment should be checked with the tape transmitter top plate removed.

NOTE: Before making any adjustments, see "General," page 5.

REPLACE THE TAPE TRANSMITTER TOP PLATE. WHEN DOING THIS, HOLD UP THE FEED PAWL SO THAT IT ENGAGES THE FEED WHEEL RATCHET. IF THE UNIT IS EQUIPPED WITH THE END-OF-TAPE STOP CONTACT MECHANISM, HOLD THE CONTACT OPERATING PIN TO PREVENT IT FROM FALLING OUT OF ITS GUIDE.

NOTE: There should be at least .020" clearance between the side of the feed pawl spring and the tape contact lever guide. There should also be at least .025" clearance between the feed pawl spring and the feed wheel ratchet when the feed pawl is in its uppermost position. If these clearances do not exist, modify the "Tape Feed Pawl Spring Tension Adjustment" within its specified limits to obtain the required clearance.

Detent Bracket Adjustment (Figure 17)

Obtain a piece of tape with a series of "letters" perforations. Either regular tape or chadless tape may be used. Check the tape to determine if the spacing of the perforations meets the requirement of 10 to the inch. (If chadless tape is used, fold the lids of one set of 5 perforations backward so that the lids do not obstruct the holes.) Engage the feed perforations with the feed wheel so that the unobstructed perforations are directly over the tape pins. With the detent roller resting in an indent between two teeth of the feed wheel ratchet, rotate the main shaft backward until the tape pins are flush with the bottom of the tape. When the play of the tape on the feed wheel is taken up toward the left, the tape pin farthest to the right should just clear the right edge of its associated code hole. To adjust, loosen the detent bracket mounting screws and position the bracket. Tighten the mounting screws.

Tape Retaining Lid Plate Adjustment (Figure 19)

The three types of plates in use on transmitter tape retaining lids are shown in figure 19. Either regular or chadless perforated tape may be used with the types shown at A or B, but only regular perforated tape can be used with the type shown at C. Types A and B are interchangeable on units designed to use chadless tape. Type C can be used only on units designed to use regular perforated tape. Type A was designed to accommodate spliced chadless tape.

Type A and B should be positioned so that the edges of the plate are parallel to the tape guide and so that the plate does not interfere with the lids of chadless tape when the lids are raised by the tape pins. In checking the adjustment of type B, take up the play of the tape on the feed wheel pins toward the right with the feed wheel detent resting in an indent between two teeth on the ratchet.

If regular tape is to be used exclusively, type A, B, or C should be adjusted so that the edges of the plate are parallel to the guide and so that the openings in the plate are centrally located with respect to the tape pins when the pins are in their uppermost position. To adjust, loosen the retaining lid plate mounting screws and position the plate. Tighten the screws.

Retaining Lid Latch Spring Tension

With the slope on the latch resting against the top plate (not latched), hook an 8 oz. scale over the upper end of the latch and pull at right angles to the formed upper end of the latch. It should require $1\frac{1}{2}$ to 7 ozs. to start the latch moving on its pivot.

NOTE: Before making any adjustments, see "General," page 5.

Feed Lever Adjusting Screw Adjustment (Figure 20)

When the contact lever bail is slowly operated by hand, the feed pawl should engage the first tooth above the horizontal center of the feed wheel ratchet at the instant the tape pins are flush with the upper surface of the tape guide. To adjust, loosen the feed lever adjusting screw lock nut. Turn the adjusting screw clockwise if the tape pins are below the top surface of the tape guide when the feed wheel starts to move or counterclockwise if the tape pins extend above the top surface of the tape guide when the feed wheel just starts to move.

Operating Lever Adjusting Screw Adjustment (Figure 22)

When the operating lever roller is on the highest part of its cam and the detent roller rests between two teeth on the feed wheel ratchet, there should be some clearance, not over .010", between the face of a tooth on the ratchet wheel and the face of the feed pawl. To adjust, loosen the operating lever adjusting screw lock nut and position the adjusting screw. Tighten the nut and recheck the clearance.

Feed Lever Upstop Adjustment (Figure 21)

Transmitter distributors designed to handle chadless tape should be equipped with an operating cam identified by a letter "X" stamped in it (figure 10). When this cam is used, an upstop is provided for the feed lever which should be adjusted as follows:

With the operating lever roller on the low part of the operating cam and the detent roller resting in the notch between two teeth of the feed wheel ratchet, there should be .040" to .050" clearance between the face of the feed pawl and the face of the first tooth above the horizontal center line of the feed wheel ratchet. To adjust, loosen the feed lever upstop mounting screw and position the upstop. Tighten the mounting screw.

Tape Transmitter Contacts

The contacts require very little attention because no current is flowing through the contacts at the moment the contact tongues leave the contact screws. When periodic inspection is made, the contacts should be cleaned with a contact burnisher or a piece of fine carborundum cloth. Particles of grit should be carefully wiped away after this operation.

Lower Contact Screw Adjustment (Figure 23)

- A. For Units Designed to Use Chadless Tape Rotate the main shaft until the operating lever roller is resting on the low part of its cam and place a straightedge across the top of the tape guide directly over the tape pins. There should be a clearance of .020" to .025" between the bottom of the straightedge and the top of each tape pin. To adjust, loosen the set screws of the upper and lower contact screws and back off the upper contact screws. Then adjust the lower contact screws to meet the requirement. Tighten the lower contact screw set screws.

* * *

NOTE: Before making any adjustments, see "General," page 5.

NOTE: There should also be a clearance of at least .002" between the contact lever bail and the lobe of each contact lever. If this clearance does not exist, refine the lower contact screw adjustments within the specified limits to obtain the desired clearance.

- B. For Units Designed to Use Regular Tape Exclusively In order to check this adjustment it will be necessary to remake it. With the contact screw set screws loosened and the upper and lower contact screws backed off, rotate the main shaft until the operating lever roller is on the low part of its cam. Advance the lower contact screws until their contact points just touch the points on the contact tongues. To determine this point, use a test lamp. Then advance the lower contact screws an additional full turn and tighten their set screws.

Upper Contact Screw Adjustment (Figure 23)

With the operating lever roller on the low part of its cam, there should be a gap of .006" to .010" between the contact point of each upper contact screw and its associated contact tongue. To adjust, loosen the upper contact screw set screws and adjust the upper contact screws. Tighten the set screws.

Contact Lever Spring Tension Adjustment (Figure 23)

With the operating lever roller on the low part of its cam, hook an 8 oz. scale under the horizontal portion of a contact lever (the scale rod just clearing the contact tongue pivotal mounting) and pull vertically upward. The pull required to separate the contacts should be 3 to 3-3/4 ozs. on units designed for use with regular tape exclusively, and 6 to 6-1/2 ozs. on units designed to use chadless tape. Use a test lamp to determine when the contacts break. Measure all contact lever springs in the same manner. To adjust, loosen the contact lever spring anchor terminal screws and position the anchors. Tighten the terminal screws.

Feed Lever Spring Tension Adjustment (Figure 20)

With the operating lever roller on the low part of its cam, hook a 32 oz. scale over the end of the feed lever (just below the spring hole) and pull upward in line with the spring. It should require 17 to 19 ozs. to start the feed lever moving. To adjust, loosen the terminal screw and position the spring anchor. Tighten the terminal screw.

Tight-Tape-Stop or Auto-Stop Mechanism (Figures 24, 25, and 26)

These two names are used interchangeably to refer to the same mechanism. There are three types of this mechanism in use, however.

A. Adjust the Type Shown in Figure 24 to Meet the Following Requirements:

- (a) When the contacts are held closed by the contact operating post, the bottom of the tight-tape stop lever should be horizontal and the tight-tape stop shaft should protrude approximately 1/16" beyond the clamp (figure 24A). Make the adjustments simultaneously by positioning the clamp.

* * *

NOTE: Before making any adjustments, see "General," page 5.

- (b) When the contact operating post is held away from the left contact spring insulator, there should be .015" to .025" clearance between the contact points and .015" to .025" clearance between the right contact spring insulator and the tight-tape stop mechanism bracket. Adjust by bending the contact springs (figure 24B).

B. Adjust the Type Shown in Figure 25 to Meet the Following Requirements:

- (a) When the contact spring post is held away from left contact spring insulator, there should be .015" to .025" clearance between the contact points and .015" to .025" clearance between the right contact spring insulator and the contact spring bracket. Adjust by bending the contact springs.
- (b) When the auto-stop lever is held so that the contact spring post is in a horizontal position, the auto-stop lever spring should also be in a horizontal position. To adjust, loosen the auto-stop lever shaft collar set screw and position the collar. Tighten the set screw.

C. Adjust the Type Shown in Figure 26 to Meet the Following Requirements:

- (a) With the contact bracket in contact with its right-hand eccentric stop, hook a 32 oz. scale over the end of the contact bracket arm and pull at right angles to the arm. It should require 3 to 10 ozs. to start the bracket moving.
- (b) When the operating arm is held away from the left-hand contact spring insulator, there should be .015" to .025" clearance between the contact points and .015" to .025" clearance between the right-hand contact spring insulator and the extension on the contact bracket. Adjust by bending the contact springs.
- (c) When the contact bracket is up against the left-hand eccentric stop, the portion of the operating arm rod which is engaged by the tape should be 3/4" to 1-1/4" below the upper surface of the tape guide on the transmitter top plate (see figure 24A). To adjust, loosen the left-hand eccentric stop mounting screw and position the eccentric stop. Tighten the mounting screw.
- (d) The right-hand eccentric stop should be adjusted to suit the requirements of the user. The greater the amount of slack tape required between the perforator and the transmitter distributor, the higher the eccentric should be positioned, and vice versa. To adjust, loosen the right-hand eccentric stop mounting screw and position the eccentric stop. Tighten the mounting screw.

Distributor Brushes

Transmitter distributors are provided with either carbon brushes or braided copper wire brushes. The contact pressure of carbon brushes should be readjusted occasionally to compensate for brush wear. This is done by rotating

* * *

NOTE: Before making any adjustments, see "General," page 5.

the brush holder and resurfacing the brushes. When the contact pressure of braided brushes becomes inadequate due to wear, the brushes should be trimmed square and relocated. When trimming brushes, a piece of paper should be inserted between the brushes and the commutator disc.

There are two styles of brush arms. The latest design clears the commutator by about 1/16" as shown in figures 27 and 28. The older design clears the commutator by about 1/4" as shown in figure 29. Braided brushes are used exclusively with the high brush arm and brush stiffeners are employed. Either braided or carbon brushes may be used with the low brush arm and stiffeners are not required. The adjustment procedure and requirements for each style of brush and brush arm are as follows:

A. Carbon Brush Adjustment (Figure 27)

- (a) With the main shaft in the stop position (the lug on the stop cam against the blocking edge of the stop arm), the brushes should make contact with their associated segments at a point in line with the line impressed in the disc. The brushes should also be centrally located with respect to their associated segments. To adjust, loosen the brush spring clamp screw and position the brushes. Tighten the clamp screw.
- (b) Hook an 8 oz. scale under the end of each distributor brush spring and pull upward at a right angle to the end of the brush spring. It should require 2-1/2 to 3-1/2 ozs. to lift the brush from its segment. To determine this point, use a test lamp.

Adjust the spring tension in the following manner: Loosen the brush holder clamp screw so that the brush holder is friction tight. Rotate the brush holder counterclockwise until the brushes are lifted from their segments and adjust the brush springs by bending them slightly, if necessary, so that the contact surface of the brushes are equidistant from and parallel to the segments. Then rotate the brush holder clockwise until the brushes rest against the segments with a pressure of about 3-1/2 ozs. and tighten the clamp screw. Place a piece of fine sandpaper (approximately 1" wide) face up on the distributor disc and draw the brushes across it two or three times or until the bottoms of the brushes are parallel to the surface of the segments. Recheck the spring tension and readjust if it does not meet the requirements.

If it is found necessary to readjust the brush holder to obtain the proper spring tension, the brushes should be resurfaced in accordance with the foregoing instructions.

B. Braided Brush Adjustment - Low Brush Arm (Figure 28)

- (a) Loosen the brush holder clamp screw and rotate the brush holder so that the ends of the brushes just touch the commutator segment and ring. With the main shaft in its stop position (the lug on the stop cam against the stop arm), the brushes should be straight and the ends of the brushes should coincide with the line impressed in the commutator disc. To adjust, loosen the brush clamp screw and position the brushes. Tighten the screw.

* * *

NOTE: Before making any adjustments, see "General," page 5.

- (b) With the brushes straight and just touching the commutator rings, there should be .015" to .020" clearance between the brush holder stop post and the eccentric stop. To adjust, loosen the brush holder clamp screw so that the brush holder is friction tight. Then loosen the eccentric stop mounting screw and position the brush holder and eccentric stop. Tighten the eccentric stop mounting screw. Rotate the brush holder so that its stop post is in contact with the eccentric stop and tighten the brush holder clamp screw.

C. Braided Brush Adjustment - High Brush Arm (Figure 29)

- (a) Loosen the brush holder clamp screw and rotate the brush holder so that the ends of the brushes just touch the commutator segment and ring. With the main shaft in its stop position (the lug on the stop cam against the stop arm), the brushes and stiffeners should be straight and in contact with each other throughout their length, the ends of the brushes should coincide with the line impressed in the commutator disc, and the ends of the stiffeners should be $3/32$ " to $1/8$ " from the trimmed ends of the brushes. To adjust, loosen the brush clamp screw and position the brushes and stiffeners. Tighten the brush clamp screw and tighten the brush holder clamp screw so that the brush holder is friction tight.
- (b) With the brushes just touching the commutator rings, there should be .020" to .025" clearance between the brush holder stop post and the eccentric stop. To adjust, loosen the brush holder clamp screw so that the brush holder is friction tight. Then loosen the eccentric stop mounting screw and position the eccentric stop and brush holder. Tighten the eccentric stop mounting screw. Rotate the brush holder so that its stop post is in contact with the eccentric stop and tighten the brush holder clamp screw.

Operating Cam Adjustment

The operating cam should be positioned so that the No. 5 transmitter contact tongue leaves the lower (marking) contact screw when the distributor brush is on the "stop" segment and the trailing edge of the brush is $1/32$ " to $1/16$ " from the leading edge of the "stop" segment. To adjust, loosen the operating cam mounting screws and position the cam. Tighten the mounting screws.

Main Shaft Clutch Torque Adjustment (Figure 12)

With the motor running, it should require a pull of 28 to 32 ozs. to hold the brush arm stationary when a 32 oz. scale is hooked over the stop cam lug as shown in figure 12. This measurement should be made when the unit is warm from recent operation; otherwise, the unit should be operated for at least ten minutes with the friction clutch slipping before the measurement is made. The operating cam should be relieved of the operating arm load during torque measurement. This may be done by removing the base plate and removing the operating arm. To adjust the clutch torque, loosen the adjustable clutch disc lock nut and turn the disc clockwise to increase the torque or counterclockwise to decrease the torque. Hold the disc and tighten the lock nut against it. Use a 76289 spanner wrench. See figure 3 for location of parts.

* * *

NOTE: Before making any adjustments, see "General," page 5.

REPLACE THE TRANSMITTER LEFT BRACKET, TOP COVER, SNAP PANEL, AND THE TRANSMITTER DISTRIBUTOR BASE PLATE.

THE FOLLOWING TWO ADJUSTMENTS PERTAIN TO UNITS EQUIPPED WITH AN END-OF-TAPE STOP MECHANISM. THIS MECHANISM CONSISTS OF A PAIR OF CONTACTS MOUNTED UNDER THE TAPE GUIDE, WIRED IN SERIES WITH THE TAPE STOP MAGNET, AND OPERABLE BY A PIN WHICH PROJECTS THROUGH THE TAPE GUIDE.

End-of-Tape Stop Contact Pin Guide Adjustment (Figure 30) - See Note (B)

There should be .010" to .020" clearance between the end-of-tape stop pin and the shoulder of the tape guide plate when the side play of the pin is taken up in a direction to make this clearance a minimum. To adjust, loosen the stop pin guide mounting screws and position the guide. Locate the feed wheel shaft bearings so that the feed wheel shaft is free with not over .002" end play before tightening the screws.

End-of-Tape Stop Contact Spring Adjustment (Figure 30)

- (a) Place a straightedge across the top of the tape guide plate, directly over the end-of-tape stop pin. There should be .020" to .025" clearance between the bottom of the straightedge and the upper end of the stop pin. To adjust, bend the upper contact spring.
- (b) When the lower contact spring is resting against its stiffener, the contact points should be separated by .008" to .012". To adjust, bend the lower contact spring stiffener.
- (c) Place a piece of tape in the guide and close the tape retaining lid. It should require a pressure of 20 to 25 grams (applied at the contact point of the lower contact spring) to just open the contact points. To adjust, bend the lower contact spring. Remove the tape and recheck adjustment (b).

THE FOLLOWING ADJUSTMENT PERTAINS TO UNITS EQUIPPED WITH A TAPE GUIDE WIRE AS ILLUSTRATED IN FIGURE 24-A.

Tape Guide Wire Adjustment (Figure 24-A)

With the tight-tape stop (or auto-stop) lever resting in its horizontal position, the lower side of the right-hand portion of the tape guide wire should be even with the lower side of the lever, and there should be a clearance of .020" to .080" between them. To adjust, loosen the tape guide wire mounting screws and position the guide. Tighten the mounting screws.

THE FOLLOWING TEN ADJUSTMENTS PERTAIN TO UNITS EQUIPPED WITH THE BELL-ON-BLANK SIGNAL MECHANISM, A MECHANISM FOR TRANSMITTING THE BLANK SIGNAL COMBINATION WITHOUT SPACING TAPE. TRANSMITTER DISTRIBUTORS EQUIPPED WITH THIS MECHANISM HAVE A LEVER PROTRUDING FROM THE FRONT PANEL OF THE TRANSMITTER NEAR THE TOGGLE SWITCH. THE MECHANISM SHOULD BE ADJUSTED AS FOLLOWS:

* * *

- (B) To make this adjustment, remove the tape transmitter top plate.

Note: Before making any adjustments, see "General," page 5.

Contact Operating Lever Latch Adjustment (Figure 31-A)

The edges of the contact operating lever latch should be parallel to the edges of the contact operating lever. To adjust, loosen the contact operating lever latch mounting screws and position the latch. Tighten the screws.

Contact Operating Lever Bracket Adjustment (Figure 31-A) - See Note (C)

Move the transmitter operating lever to a position to bring the adjusting screw lock nut nearest the contact operating lever latch. There should be .015" to .025" clearance between the point on the latch and the adjusting screw lock nut. To adjust, loosen the contact operating lever bracket mounting studs and position the bracket. Tighten the studs.

Contact Operating Lever Latch Overtravel (Figure 31-B) - See Note (C)

With the main shaft in its stop position (lug on the stop cam engaged by the stop arm), the transmitter operating lever adjusting screw lock nut should overtravel the latch .010" to .015". To adjust, loosen the contact operating lever latch mounting screws and position the latch. Tighten the screws, making certain that the edges of the latch are parallel to the edges of the contact operating lever.

Contact Adjustments (Figure 32)

- (a) The insulator on the outer contact spring should rest against the finger on the contact operating lever with a very slight amount of tension. Adjust by bending the outer contact spring (with insulator).
- (b) There should be a gap of .010" to .015" between the contact points on the middle and outer (with insulator) contact springs. When checking this adjustment, the outer contact spring (without insulator) should not bear against the middle contact spring. Adjust by bending the middle contact spring.
- (c) There should be a gap of .010" to .015" between the contact points on the middle and outer (without insulator) contact springs. Adjust by bending the outer contact spring (without insulator).

Contact Operating Lever Spring Tension (Figure 32)

Hook an 8 oz. scale over the contact operating lever latch, just opposite the notch, and pull horizontally and as nearly as possible at right angles to the contact operating lever. Holding the contact spring insulator away from the finger on the contact operating lever, it should require 5 to 8 ozs. to start the lever moving.

Break Relay Armature Yoke Adjustment (Figure 33-A) - See Note (D)

Loosen the residual screw lock nut and back off the residual screw so that it will not touch the magnet core. There should be .002" to .004" clearance between the inner surface of the armature and the heel piece when the armature is against the magnet core. To adjust, loosen the armature yoke mounting screw and position the yoke. Tighten the mounting screw.

* * *

(C) These requirements should be checked with the contact bracket removed.

(D) These requirements should be checked with the relay removed.

NOTE: Before making any adjustments, see "General," page 5.

Residual Screw Adjustment (Figure 33-B) - See Note (D)

There should be .002" to .003" clearance between the armature and the magnet core when the armature is held operative. To adjust, loosen the residual screw lock nut and position the screw. Tighten the lock nut.

Break Relay Contact Adjustment (Figure 33-C) - See Note (D)

- (a) The wide contact spring should be parallel to the heel piece and the contact points should be evenly aligned. To adjust, loosen the contact pile-up mounting screws and position the contact springs. Tighten the screws.
- (b) Hook an 8 oz. scale over the upper end of the narrow contact spring and pull horizontally at right angles to the contact spring. With the armature arm held against the backstop, it should require 3/4 to 1-1/4 ozs. to start the narrow contact spring moving. To adjust, bend the narrow contact spring.

Armature Arm Adjustment

- (a) The contacts should open when the armature is held operated with a .004" gauge inserted between the residual screw and the magnet core.
- (b) The contacts should not open when the armature is held operated with a .006" gauge inserted between the residual screw and the magnet core.

Adjust for the above requirements by bending the armature arm.

Armature Arm Backstop Adjustment (Figure 33-C)

The armature arm should have a slight amount of play, not more than .004", between the backstop and the narrow contact spring. Adjust by bending the armature arm backstop.

Recheck the narrow contact spring tension. If it is necessary to re-adjust the tension, recheck the armature arm and backstop adjustments.

THE FOLLOWING TWO ADJUSTMENTS PERTAIN TO UNITS EQUIPPED WITH A.C. GOVERNED MOTORS PROVIDED WITH A GOVERNOR SPARK PROTECTION CONTACT ASSEMBLY MOUNTED ON THE DISTRIBUTOR SHAFT LOWER BEARING BRACKET. THE CONTACT ASSEMBLY SHOULD BE ADJUSTED AS FOLLOWS:

Stop Arm Contact Spring Tension Adjustment (Figure 34-A)

Hook an 8 oz. scale over the end of the contact spring and pull horizontally away from the stop arm. It should require 2 to 2-3/4 ozs. to just separate the contact points. When checking this adjustment, make sure that the bakelite extension on the contact spring does not touch the stop arm. Shift the contact bracket, if necessary. Adjust the tension of the contact spring by bending.

* * *

(D) These requirements should be checked with the relay removed.

NOTE: Before making any adjustments, see "General," page 5.

Stop Arm Contact Gap Adjustment (Figure 34-B)

The contact points should have a gap of .015" to .020" when the stop magnet armature is held against the magnet cores. To adjust, loosen the contact bracket mounting screws and position the bracket. Tighten the screws.

SYNCHRONOUS MOTORS - STARTING SWITCH ADJUSTMENTS

The following requirements should not be checked unless there is reason to believe that the starting switch is out of adjustment.

- (a) Remove the motor unit from the base and remove the motor fan and pinion.
- (b) Remove the switch end shield screws and the switch commutator mounting screws. Remove the switch end shield.
- (c) Pull out the rotor until the brush holder spring is accessible and remove the spring.
- (d) The tension of the spring for 60 cycle motors should measure 3 to 3-3/4 ozs. when extended to a length of five inches, using an 8 oz. scale. The tension of the spring for 50 cycle motors should measure 1-1/2 to 2-1/2 ozs. when extended to a length of five inches, using an 8 oz. scale.
- (e) The brush holders should be mounted by means of the center set of mounting holes and should be free.
- (f) The brush holder stop pins should be safely within the holes of the fibre disc when all the play in the brush holders has been taken up to make the engagement of the pins with the disc a minimum.
- (g) Replace the brush holder spring, making certain that the spring eyes are fully engaged with each other.
- (h) Replace the switch commutator screws and tighten the two screws alternately a little at a time until both screws are tight.
- (i) Replace the switch end shield screws, using the same precaution in tightening as above.
- (j) Apply the push end of a 12 lb. scale against the fan end of the shaft and push parallel to the shaft. It should require at least 7 lbs. pressure to start the shaft moving.
- (k) Replace the motor fan and pinion. Replace the motor unit on the base and remake the motor position adjustment.

GOVERNED MOTORS - GOVERNOR ADJUSTMENTS

There are two types of slip rings in use on governors, the peripheral ring and the end ring. The three adjustments immediately following are common to both types.

* * *

NOTE: Before making any adjustments, see "General," page 5.

Speed Adjusting Wheel Friction Washer Adjustment (Figure 35)

In order to check this adjustment, it is necessary that the speed adjusting spring be adjusted so that it requires a pull of 13 to 14 ozs. to separate the governor contacts. To measure, hook a 32 oz. scale over the contact spring next to the contact and pull parallel to the speed adjusting spring. Adjust to the proper tension by means of the speed adjusting wheel.

Insert a bank pin radially in the leather of the adjusting wheel, hook a 32 oz. scale over the pin at the periphery of the wheel and pull at right angles to the radius. It should require 16 to 20 ozs. to start the wheel moving. To adjust the friction, remove the friction washer and bend the large projections.

Speed Adjusting Lever Stop Plate Adjustment

There should be .006" to .050" clearance between the speed adjusting lever wearing strip and the governor shell when the speed adjusting lever is held against the stop plate. To adjust, loosen the stop plate mounting screws and position the plate. Tighten the screws. See figure 36 for location of parts.

Governor Shims Adjustment

With the governor speed adjusting lever in its unoperated position, there should be at least .006" clearance between the wearing strip and the adjusting wheel when the adjusting wheel is opposite the wearing strip and all the end thrust of the motor armature is taken up in a direction to make this clearance a minimum. Adjust by increasing or decreasing the number of shims on the armature shaft between the governor hub and the end frame casting of the motor. See figure 36 for location of parts.

Speed Setting

When governed motors are used, a tuning fork is supplied for the purpose of checking the motor speed. The fork is equipped with shutters attached to the ends of the tines. The governor is equipped with a target having alternate black and white spots (figure 36).

To check speed, the target should be well illumined. Tap the fork lightly to make it vibrate. Hold the fork so that the shutters are close to the eye, and view the target through the openings in the shutters. If the motor is running at the correct speed, the target will appear to be stationary. If the motor is running too fast, the spots will appear to be moving in the direction of motor rotation; if too slow, in the opposite direction.

NOTE: There is a possibility of setting the speed incorrectly due to getting a speed multiple; i.e., the speed could be half the desired speed, or twice the speed, or some other multiple, but the spots would appear to be stationary when viewed through the fork shutters. This fact should be kept in mind if trouble due to incorrect speed is experienced.

To adjust the speed, stop the motor and turn the governor adjusting wheel in one direction or the other a little at a time, checking the speed after each adjustment until the correct speed is obtained.

* * *

NOTE: Before making any adjustments, see "General," page 5.

THE FOLLOWING FOUR ADJUSTMENTS APPLY ONLY TO UNITS WITH END RING GOVERNORS (FIGURE 36):

Inner and Outer Disc Contact Spring Adjustments (Figure 37) - See Note (E)

- (a) The distance from the inner surface of the governor cover to the highest point on the contact springs should be $25/32$ " to $27/32$ ".
- (b) Place a "D" socket wrench over the nut located in the center of the governor cover. With a six inch scale, measure the radial distance from the vertical surface of the wrench to the point where the scale touches the curved surface of the inner disc contact spring. This distance should be $17/32$ " to $19/32$ ".
- (c) In a similar manner, measure the distance from the wrench to the point of contact on the outer disc contact spring. The distance should be $7/16$ " to $1/2$ ".

To adjust for the above requirements, bend the inner and outer disc contact springs.

Governor Brush Spring Plate Bracket Adjustment (Figure 36)

- (a) A line through the center of the outer disc should pass through the center of each carbon contact brush (figure 36-B).
- (b) The surface of the brush spring plate bracket on which the brush spring plate is mounted should be in line with the outer surface of that part of the governor cover on which the target is mounted (figure 36-A).
- (c) The brush spring plate bracket should be parallel to the edge of the motor base plate.

To adjust for the above requirements, loosen the brush spring plate bracket mounting screws and position the bracket. Tighten the screws.

Governor Brush Spring Pressure Adjustment (Figure 36)

- (a) The carbon brushes should exert a pressure of $4-1/2$ to $5-1/2$ ozs. against their associated discs. To measure, apply an 8 oz. scale to the spring near the carbon brush and push (or pull) horizontally until the brush starts to move away from the disc.
- (b) Both carbon brushes should lie flat against their associated discs and the outer edges of the brushes should be flush with, or not more than $3/64$ " inside of, the outer edge of the discs.

To adjust for these requirements, remove the brush springs and bend them if necessary. Reinstall springs and position them properly. Tighten the screws.

* * *

(E) This requirement should be checked with the governor guard, the brush spring plate, and the governor cover removed. See figure 36 for location of parts.

NOTE: Before making any adjustments, see "General," page 5.

Governor Guard Adjustment (Figure 36-A)

There should be at least 1/16" clearance between the governor guard and the edge of the target. Adjust by bending the governor guard if necessary.

THE FOLLOWING TWO ADJUSTMENTS APPLY ONLY TO UNITS WITH PERIPHERAL RING GOVERNORS (FIGURE 38-B):

Governor Brush Bracket Adjustment (Figure 38-A)

The governor brushes should be centrally located with respect to the governor collector rings, and the ends of the brushes should project .015" to .050" beyond the brush holder. To adjust, loosen the brush holder bracket mounting screws and position the bracket. Tighten the screws.

Governor Brush Spring Tension (Figure 38-A)

In order to check this requirement, it will be necessary to remove the brush holder from its bracket. Apply the push end of an 8 oz. scale to the end of each brush and push in line with the brush. It should require 3 to 4 ozs. to depress each brush to within .015" to .050" of the brush holder. After checking this requirement, replace the brush holder and recheck (a).

* * *

NOTE: Before making any adjustments, see "General," page 5.

LUBRICATION

Proper attention to lubrication is of the utmost importance. The lubricants listed in the supplement furnished with this bulletin should be used to lubricate the transmitter distributor. Unless otherwise specified, one or two drops of oil at each of the places indicated will be sufficient. Use oil for lubrication at all of the places listed except where the use of grease or oil-grease-oil is specified.

1. Clutch felt washers - saturate.
2. Main shaft - bearings.
3. Operating lever - bearing (oil hole which runs between top of base casting and operating lever bearing).
4. Tight-tape stop or auto-stop lever shaft - bearings.
5. Contact lever bail - bearings.
6. Contact levers - bearings.
7. Feed pawl - bearings.
8. Feed lever - bearings.
9. Feed wheel - bearings.
10. Detent lever - bearings.
11. Detent roller - bearings.
12. Retaining lid - bearings.
13. Stop cam - apply oil-grease-oil to periphery of cam.
14. Stop arm - apply oil-grease-oil to bearings and also to end of arm at point of engagement with cam.
15. Motor pinion - apply thin film of grease.
16. Main shaft gear - apply thin film of grease.
17. Operating cam - apply thin film of grease to periphery of cam.
18. Springs - oil both loops of all helical springs that exert a nominal tension of less than 2-1/2 pounds. Apply grease to both loops of all helical springs that exert a nominal tension of 2-1/2 pounds or more.
19. Operating lever adjusting screw - apply thin film of grease to head of screw.
20. Governor spark protection contact assembly (86960 on units with A.C. governed motors) - apply thin film of grease to engaging surface of bakelite buffer.
21. Bell-on-blank contact operating lever - bearing.
22. End-of-tape stop contact pin - at guide bracket (oil sparingly).
23. Motor bearings - oilers (two).

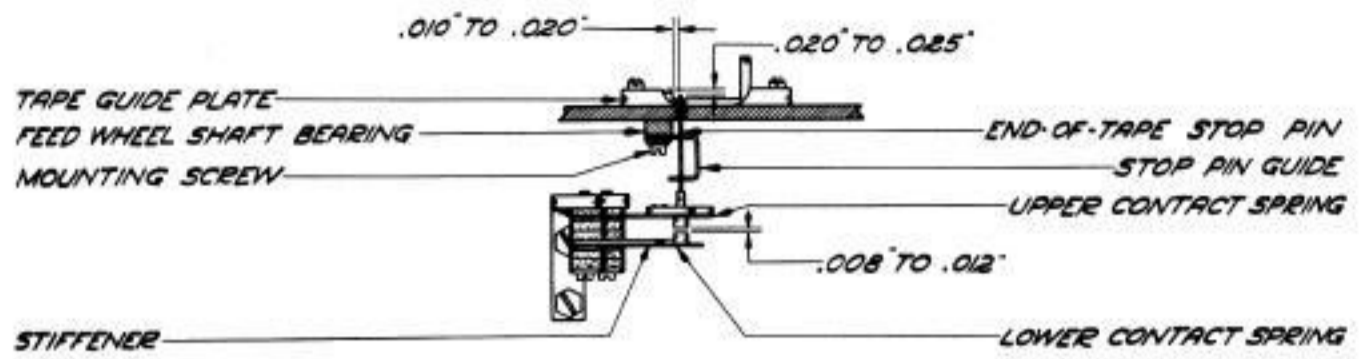


FIGURE 30

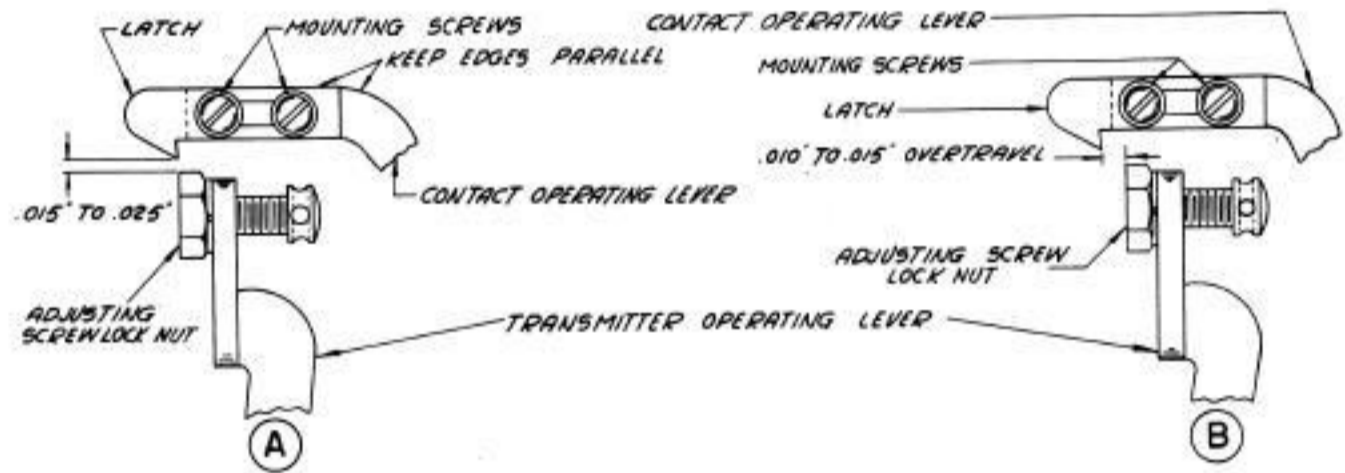


FIGURE 31

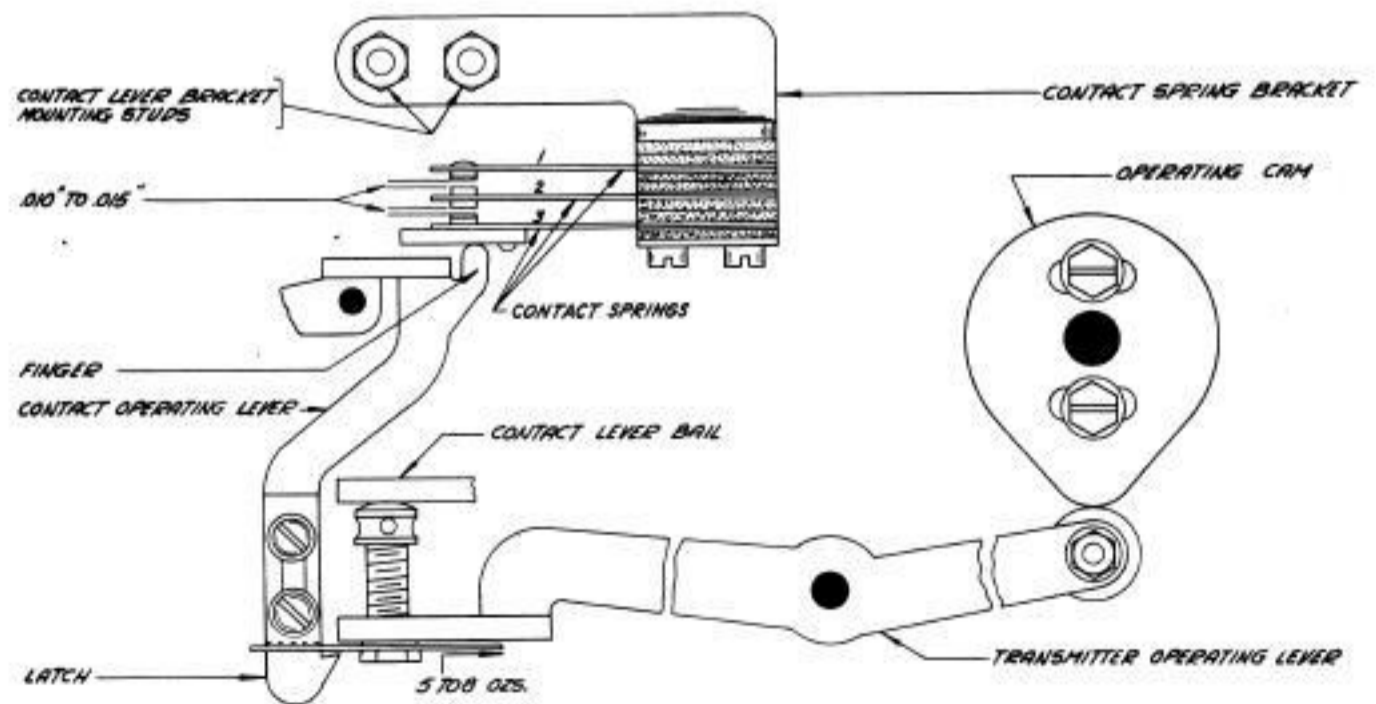
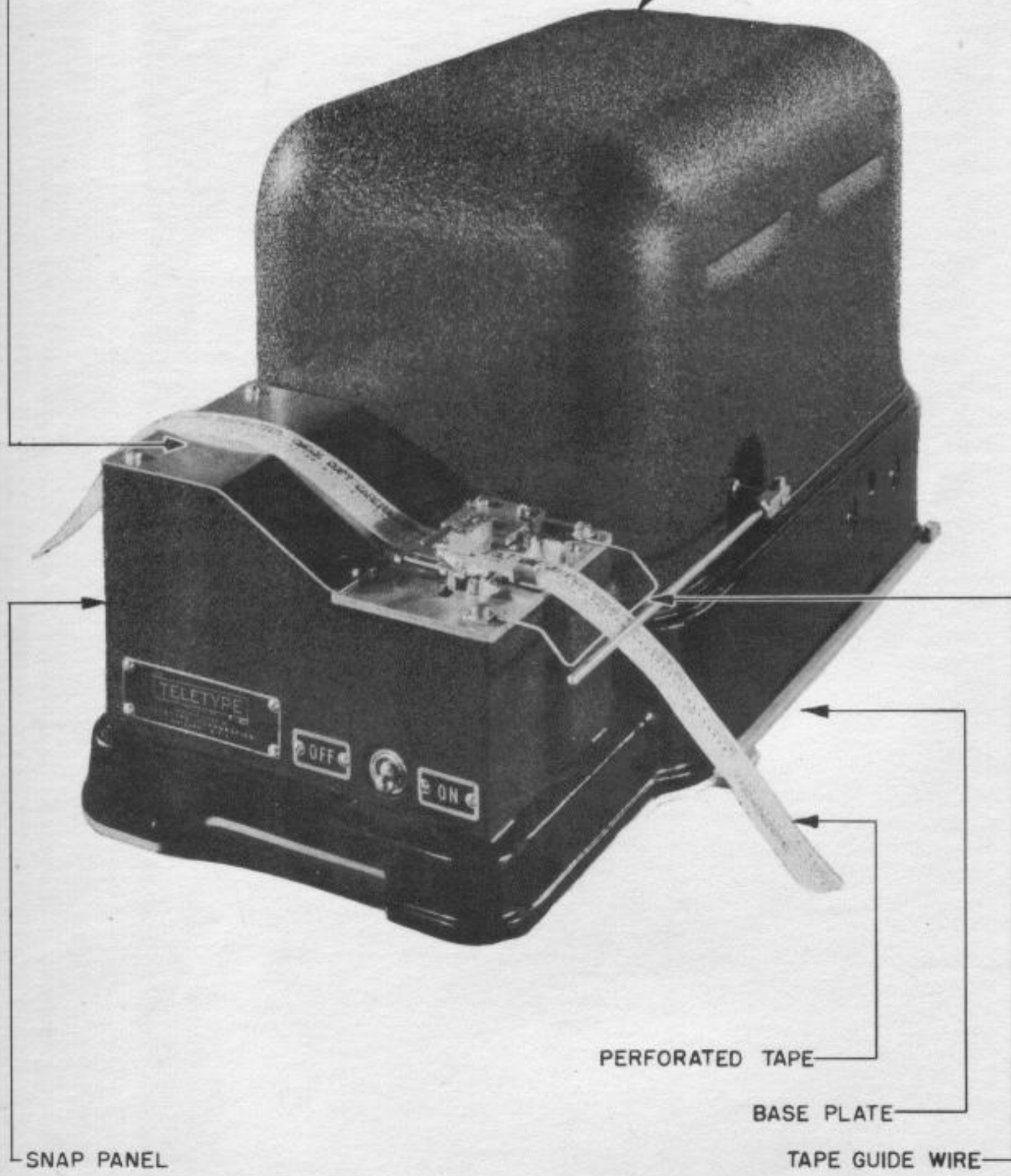


FIGURE 32

TOP COVER

DISTRIBUTOR COVER



SNAP PANEL

PERFORATED TAPE

BASE PLATE

TAPE GUIDE WIRE

FIGURE 1

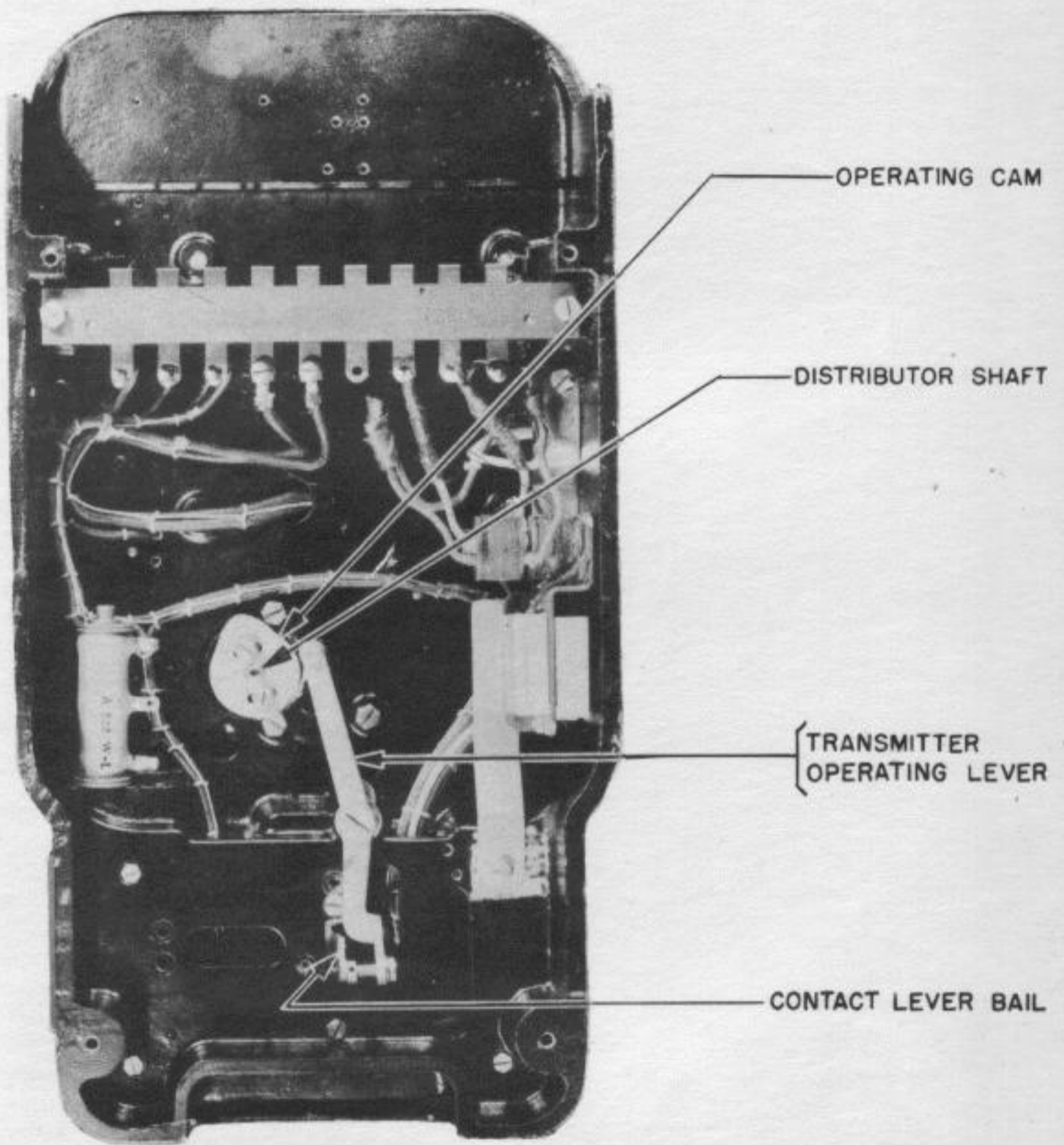


FIGURE 2

DISTRIBUTOR BRUSHES

ADJUSTABLE CLUTCH DISC

STOP ARM

TAPE STOP MAGNET

TAPE RETAINING LID

RETAINING LID PLATE

TRANSMITTER

LEFT BRACKET

UPPER (SPACING) CONTACT SCREWS

CONTACT LEVERS

TAPE PINS

FEED WHEEL

END-OF-TAPE STOP PIN

END-OF-TAPE STOP CONTACTS

TAPE GUIDE

CONTACT LEVER BAIL

TAPE STOP SWITCH

TAPE GUIDE WIRE

FEED PAWL

FEED WHEEL RATCHET

TAPE TRANSMITTER TOP PLATE

STOP CAM LUG

STOP CAM

FIGURE 3

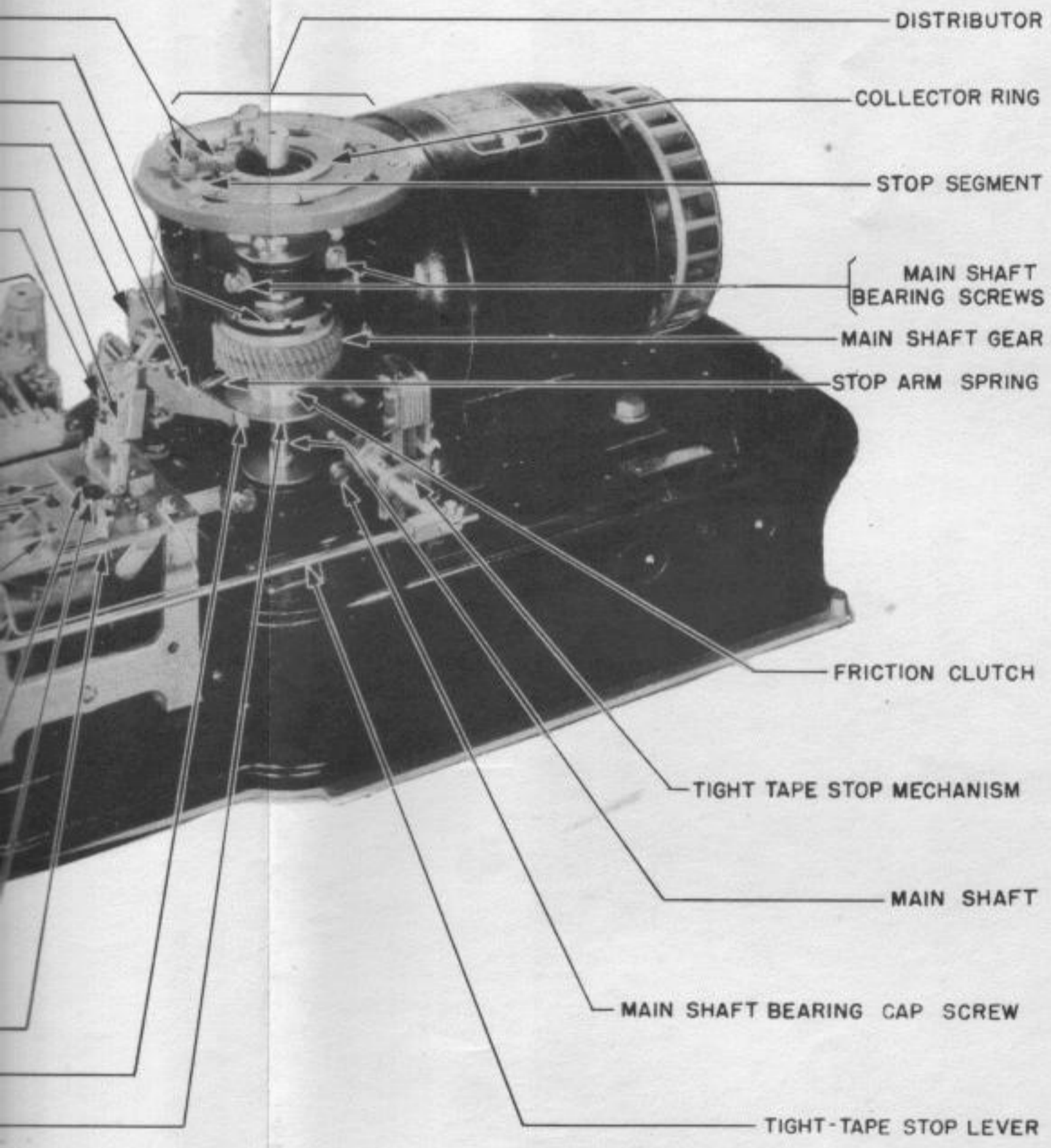


FIGURE 3

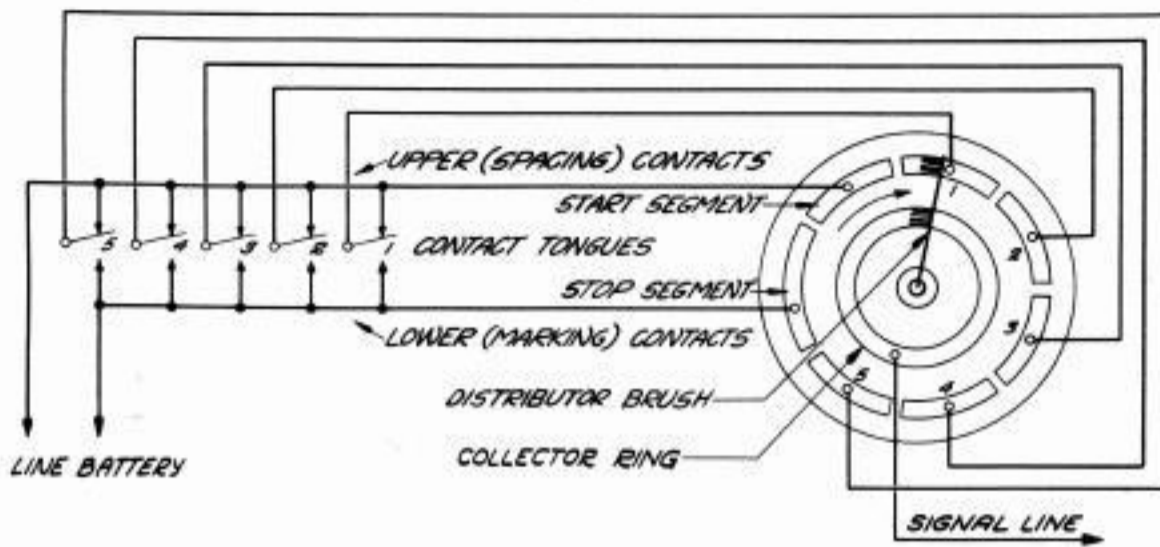


FIGURE 4

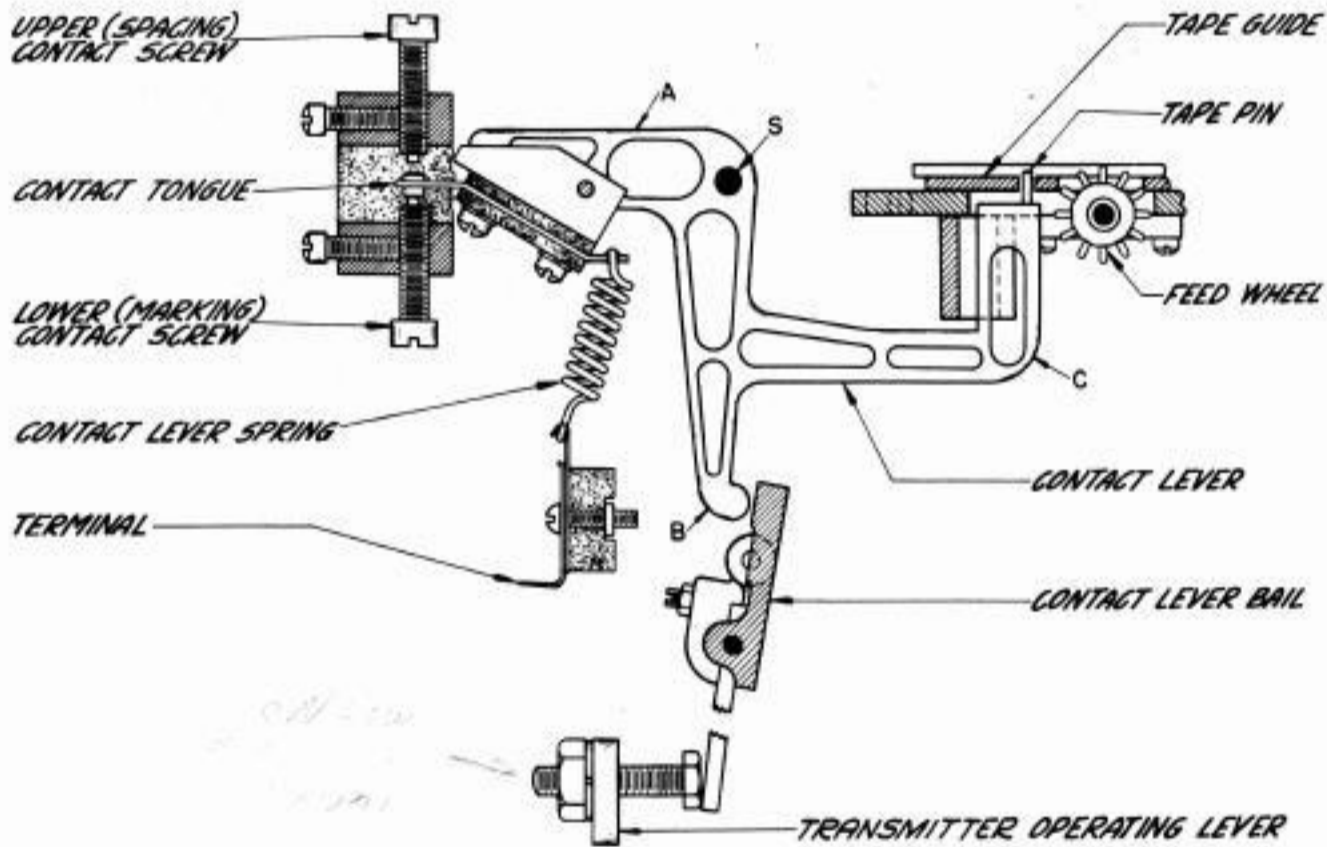


FIGURE 5

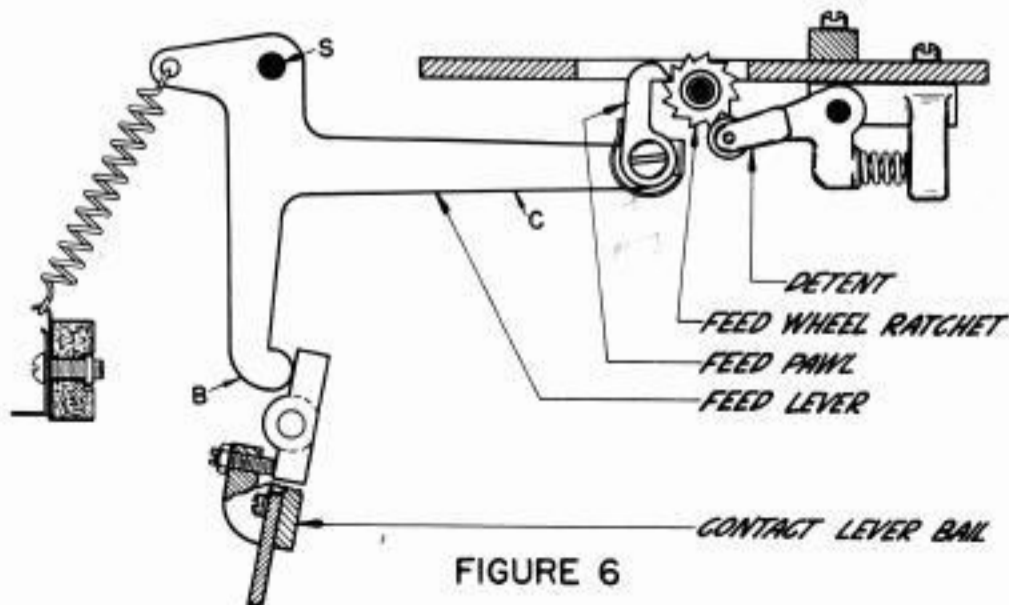


FIGURE 6

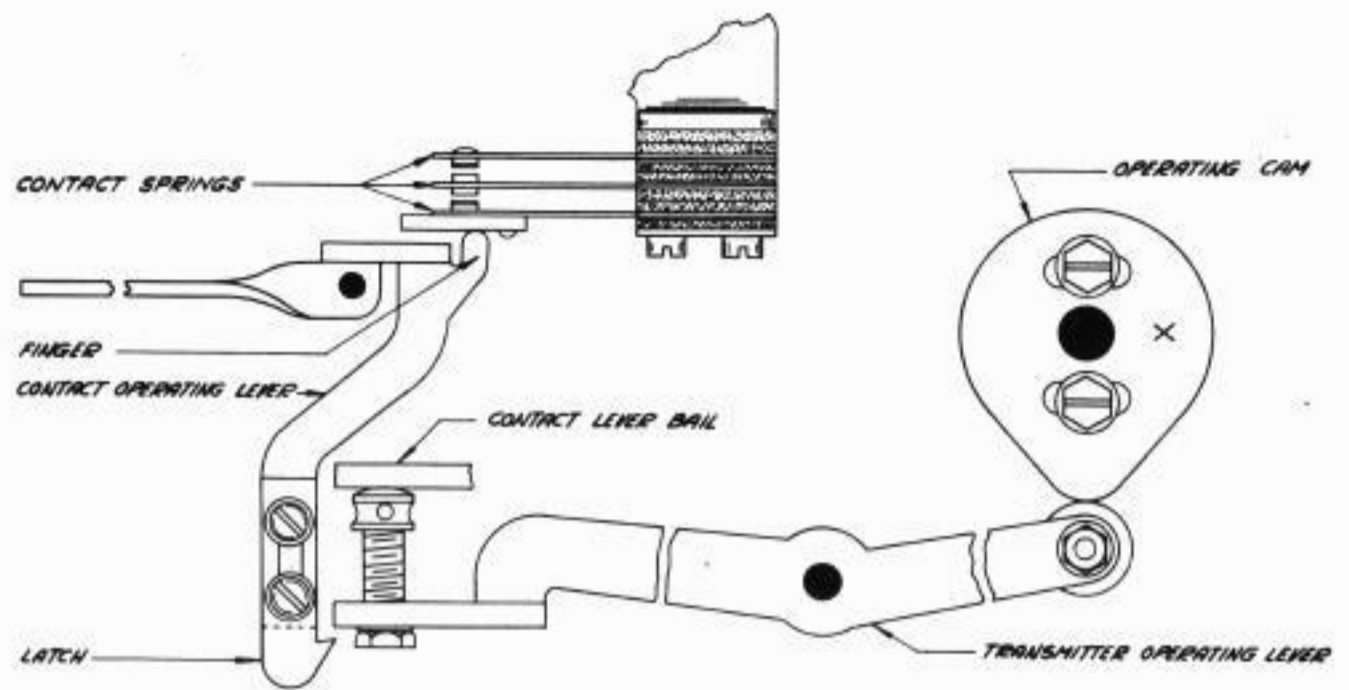


FIGURE 7

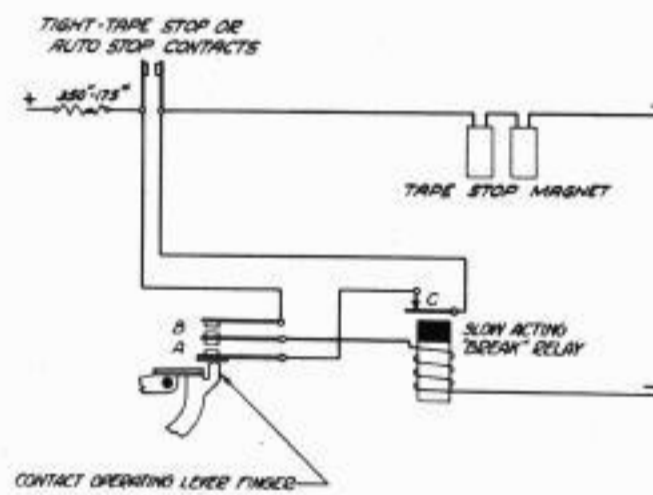


FIGURE 8

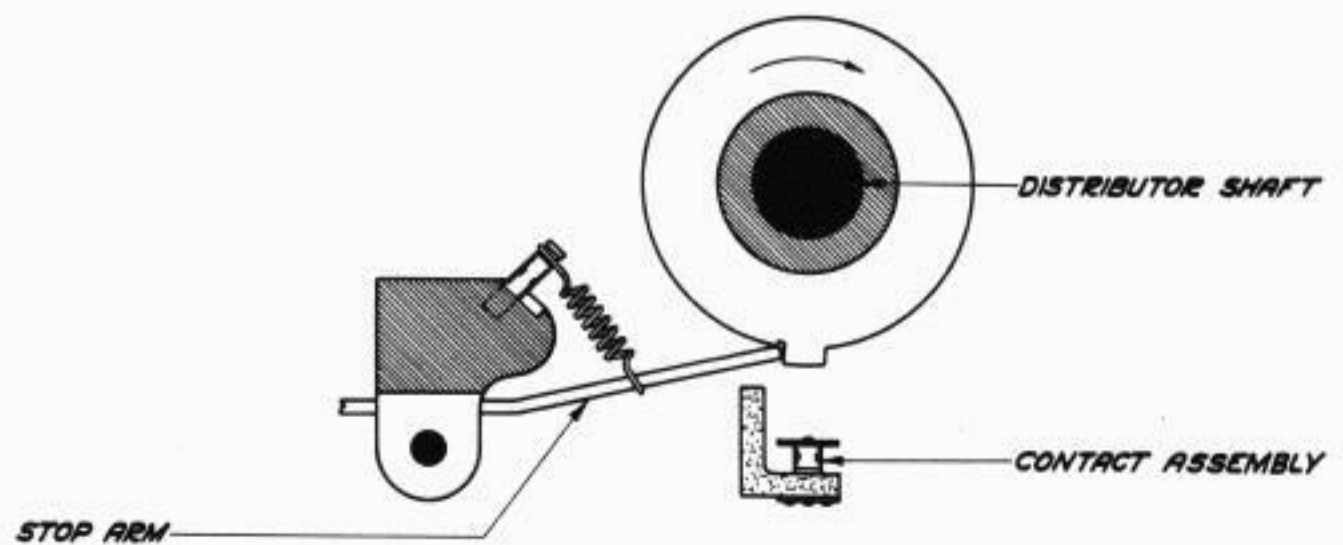


FIGURE 9

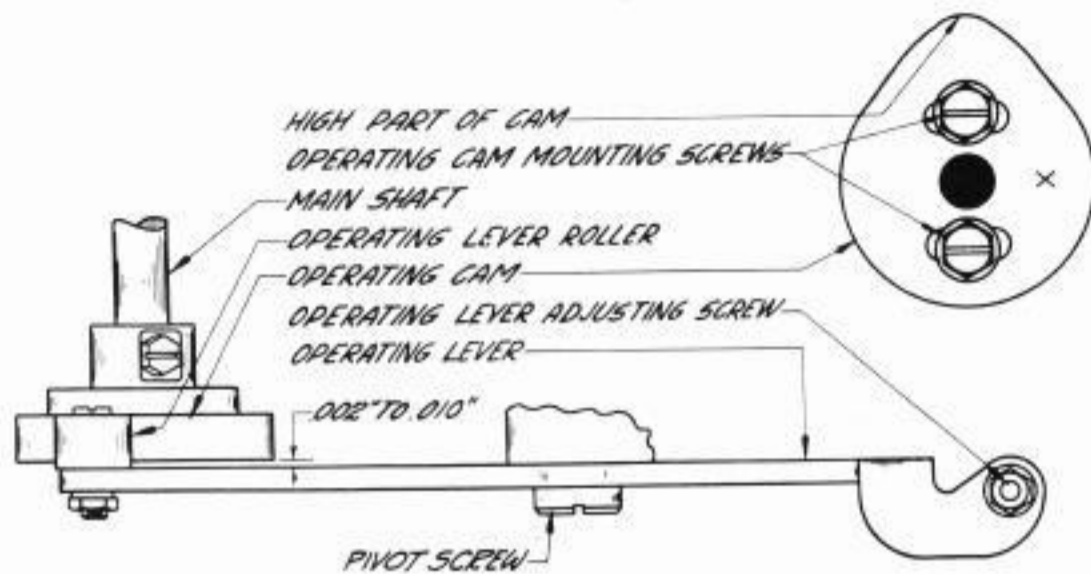


FIGURE 10

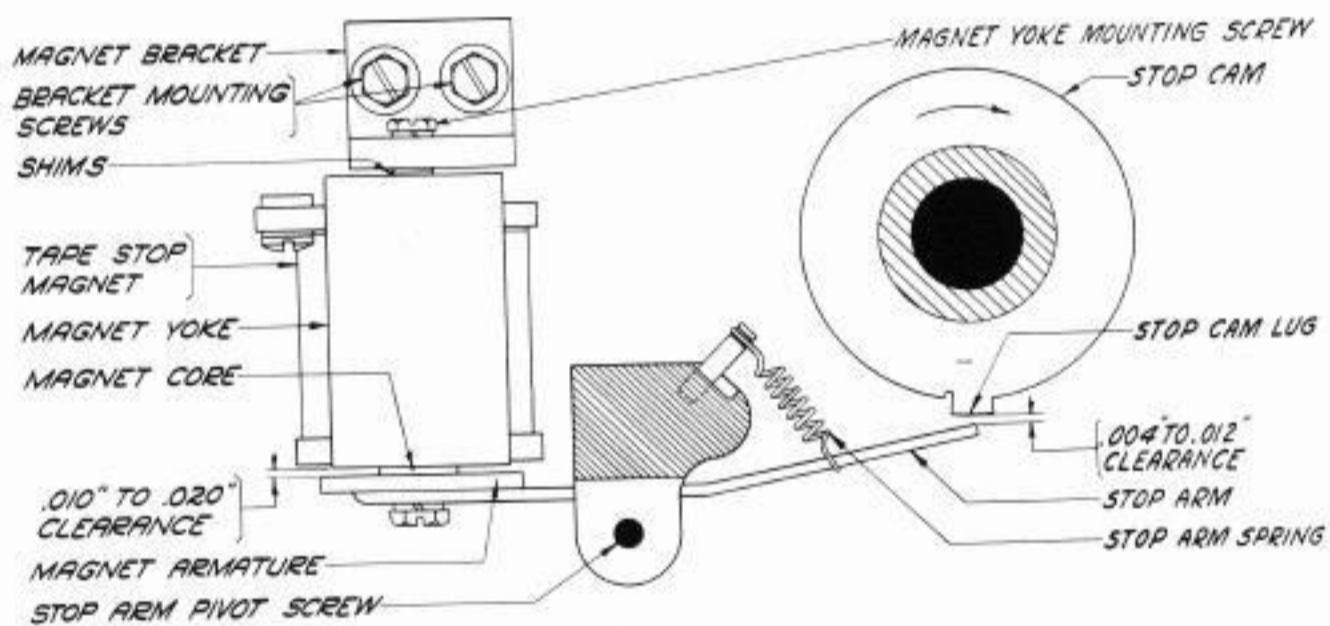


FIGURE 11

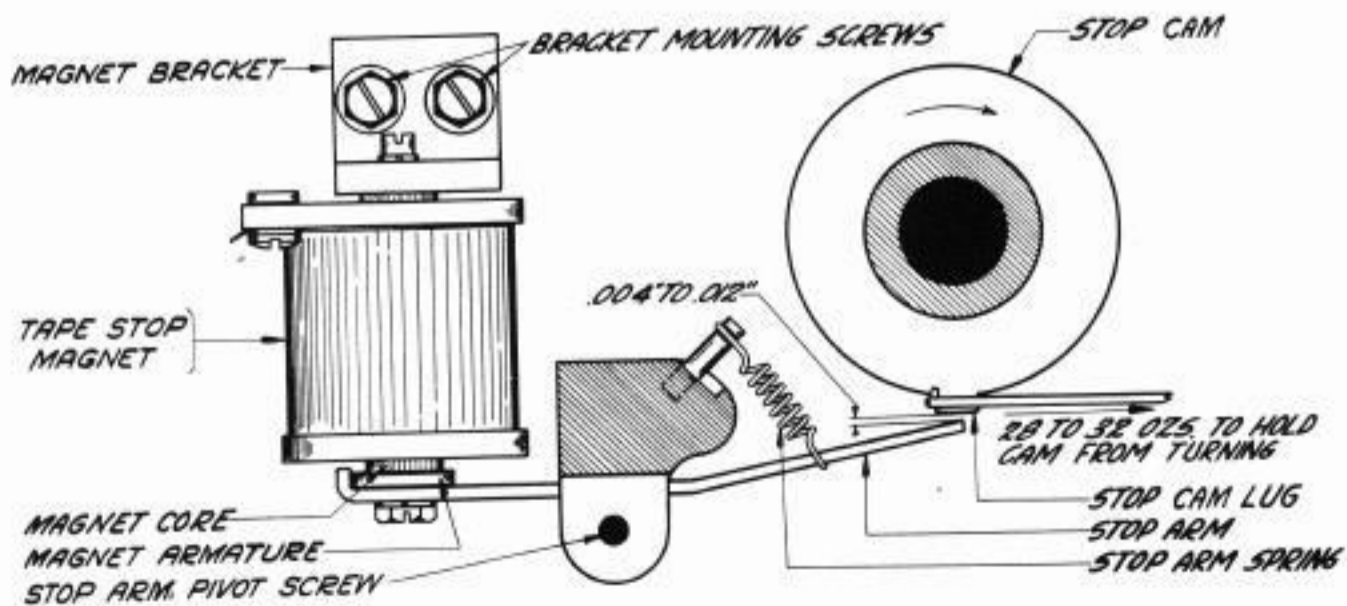


FIGURE 12

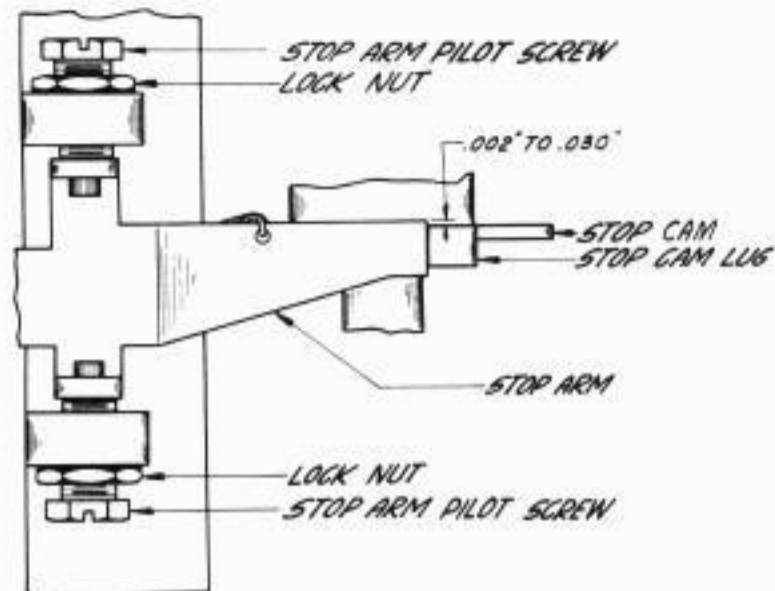


FIGURE 13

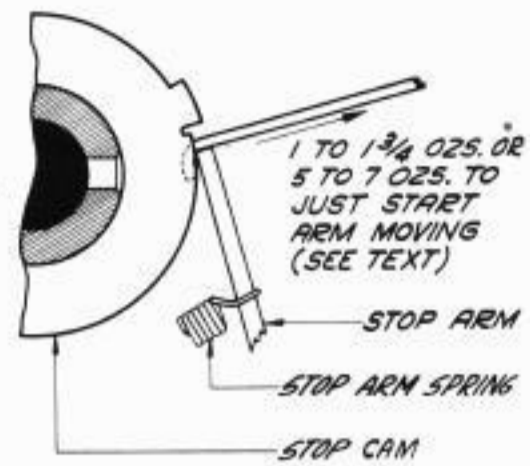


FIGURE 14

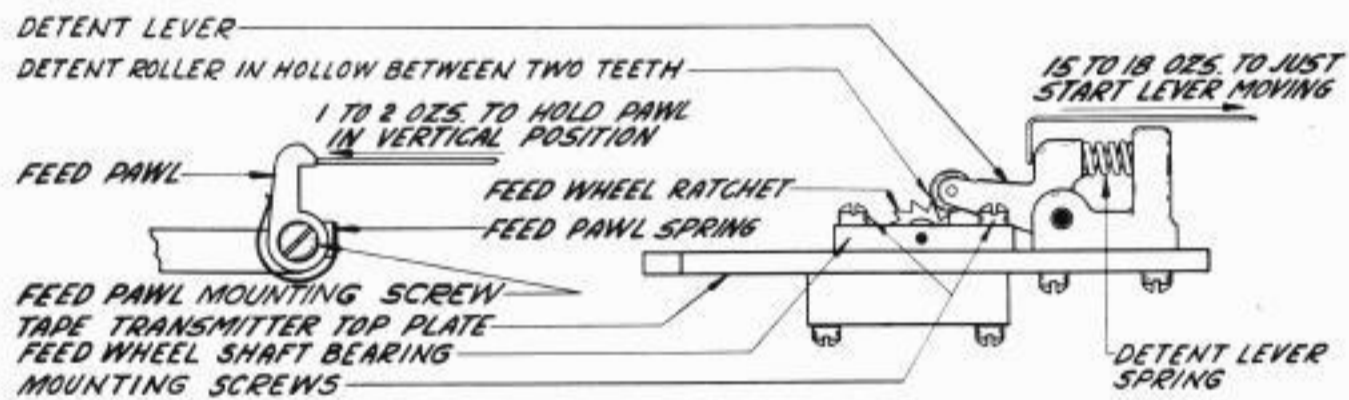


FIGURE 15

FIGURE 16

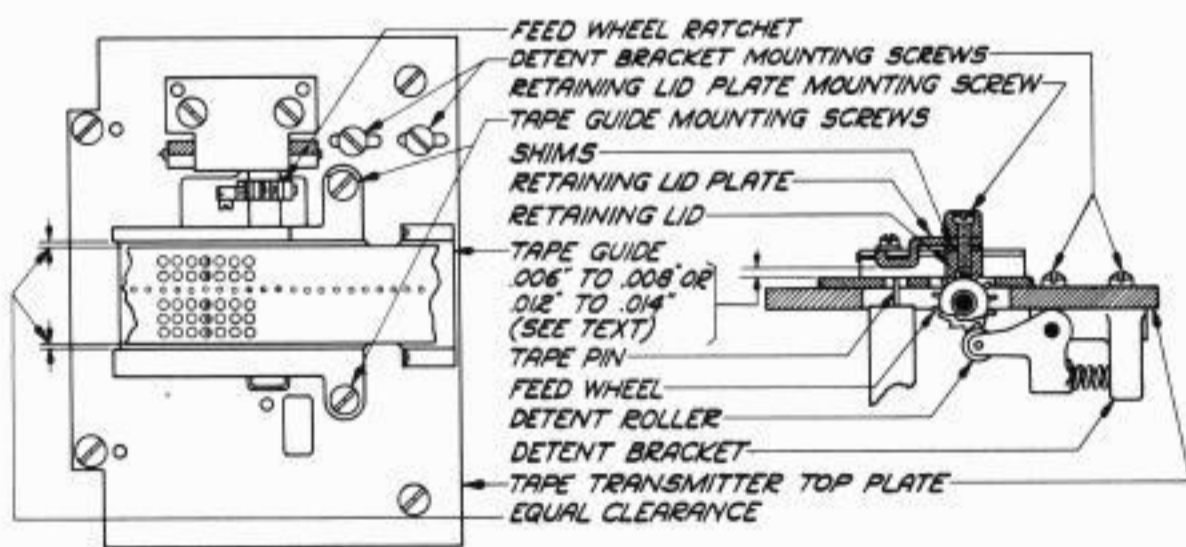
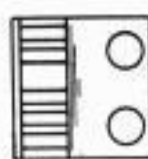
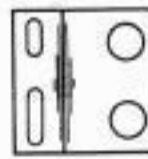


FIGURE 17

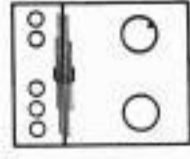
FIGURE 18



(A)



(B)



(C)

FIGURE 19

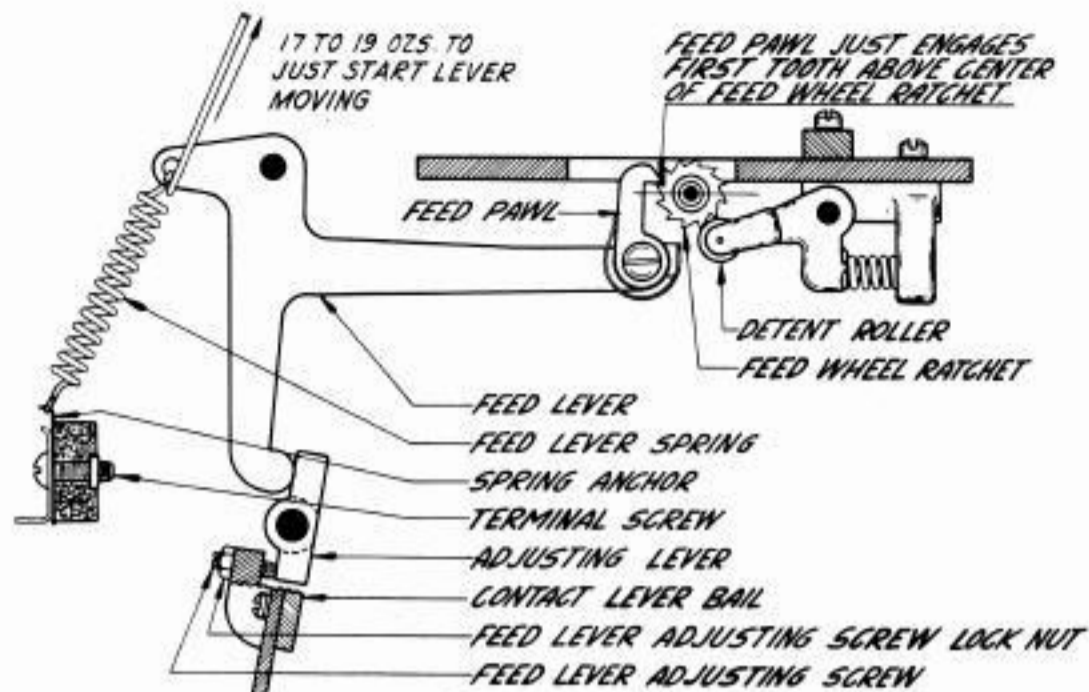


FIGURE 20

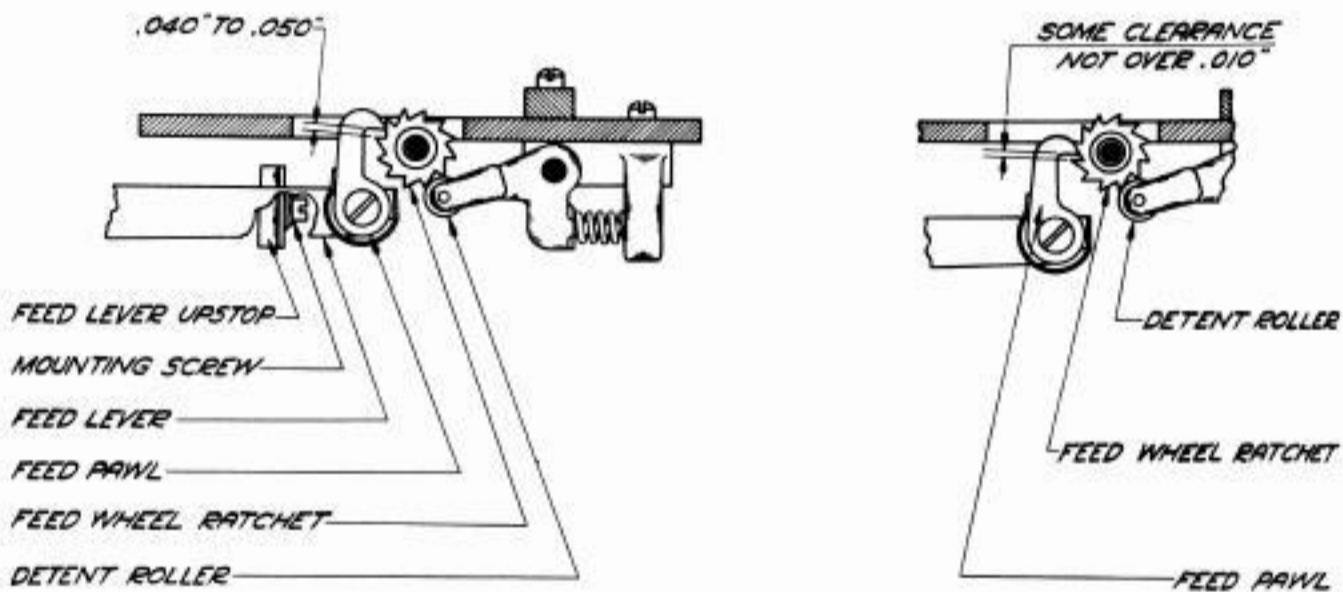


FIGURE 21

FIGURE 22

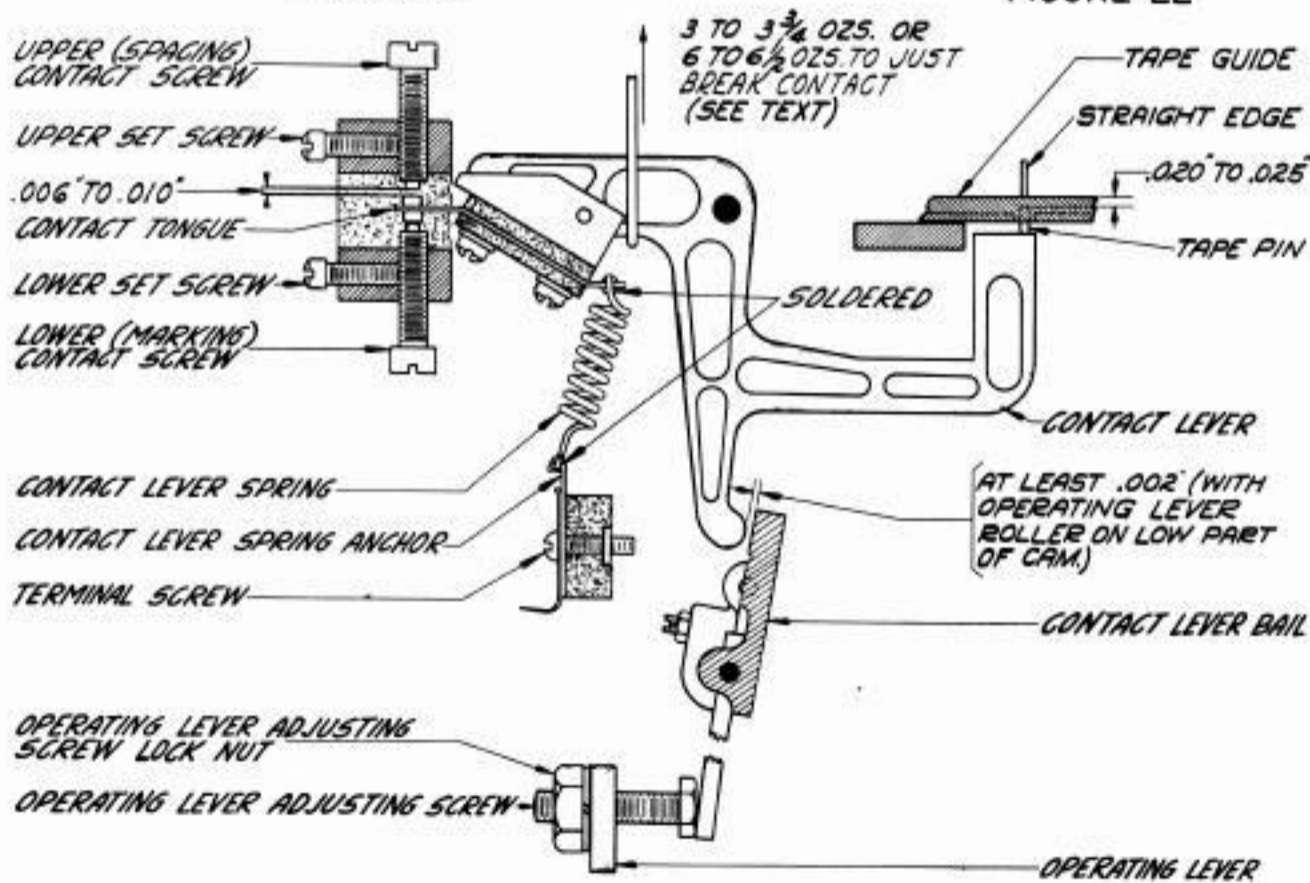


FIGURE 23

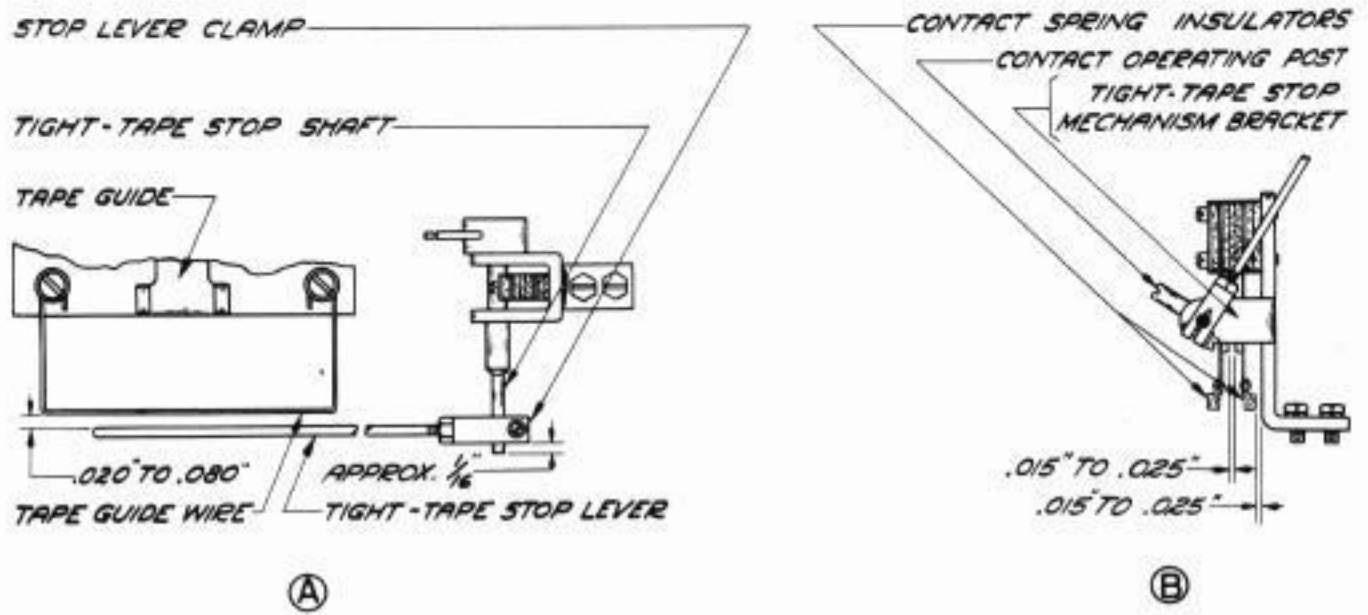


FIGURE 24

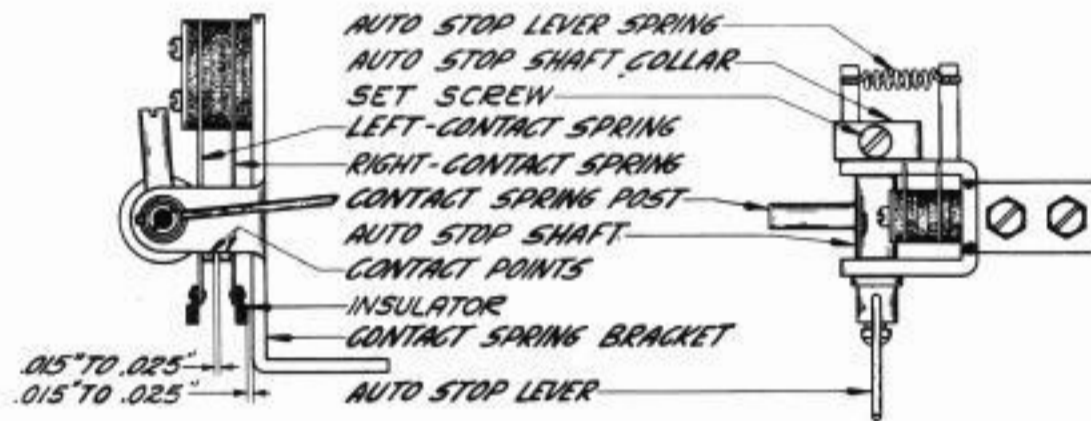


FIGURE 25

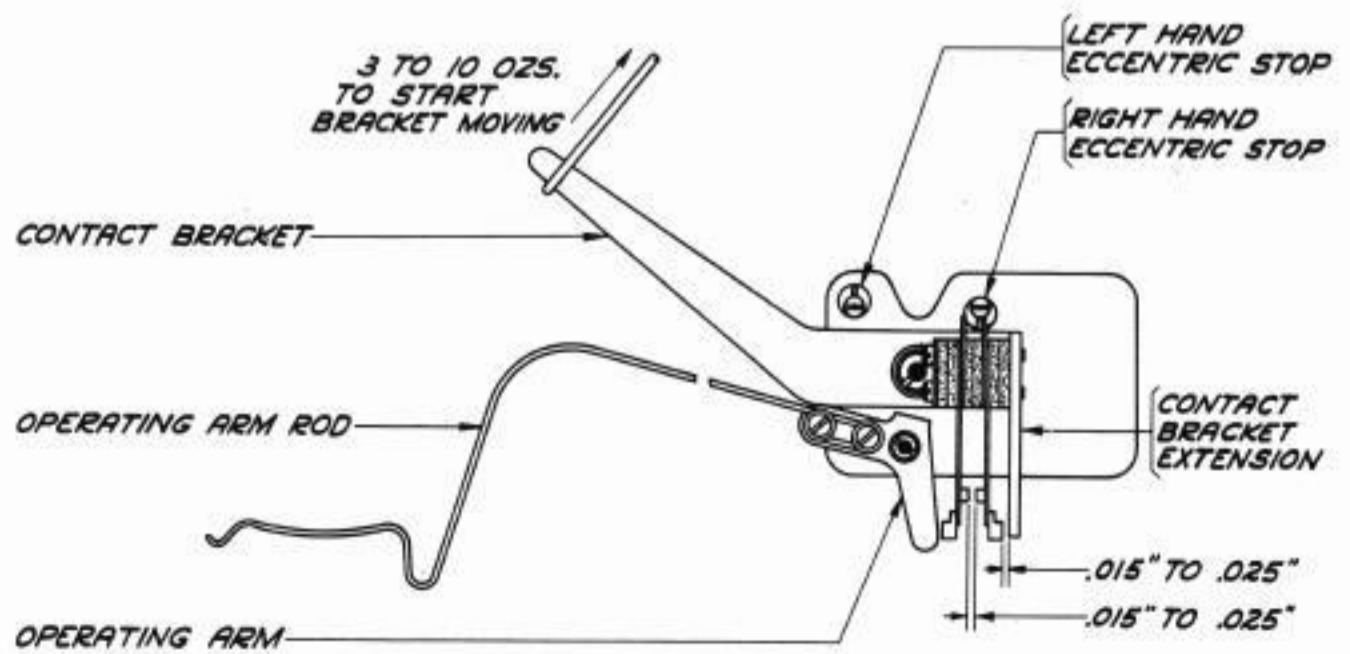
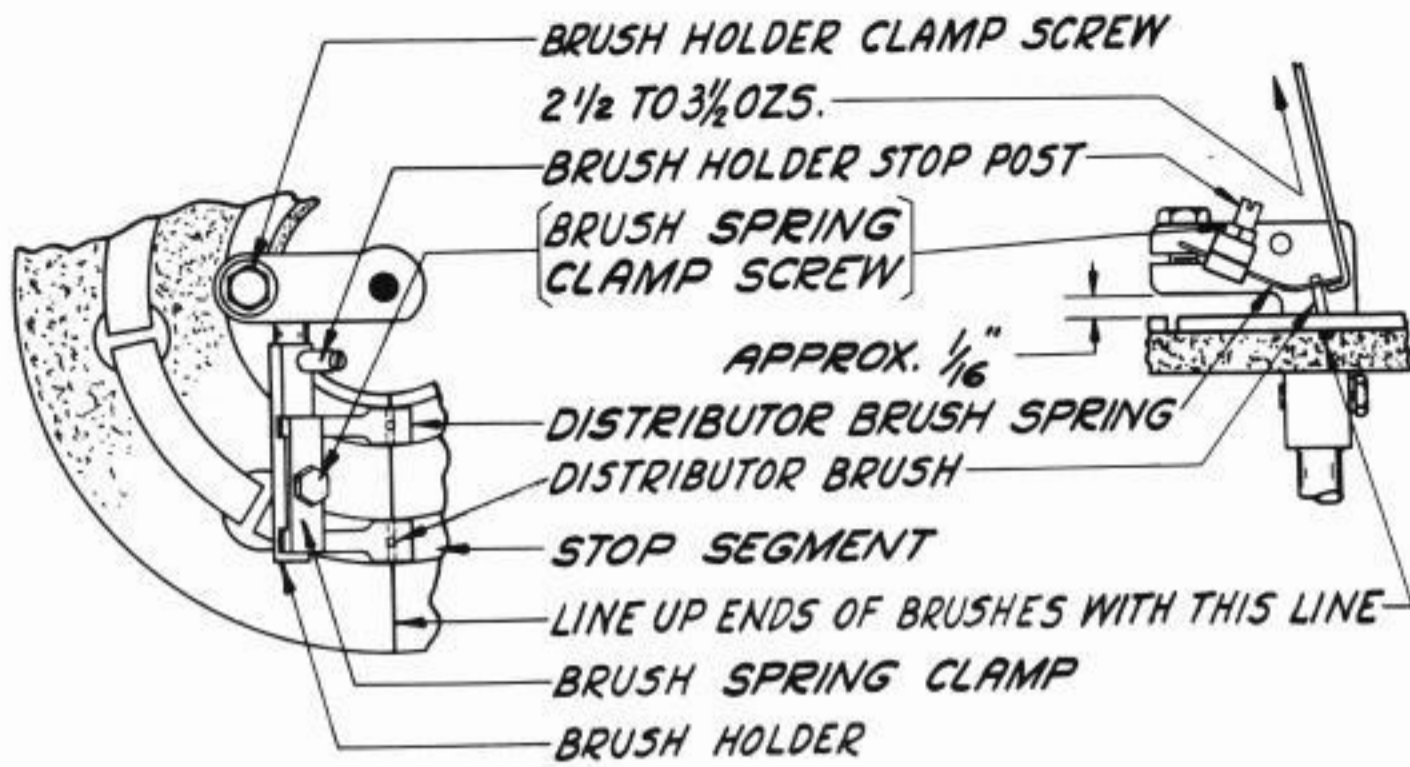


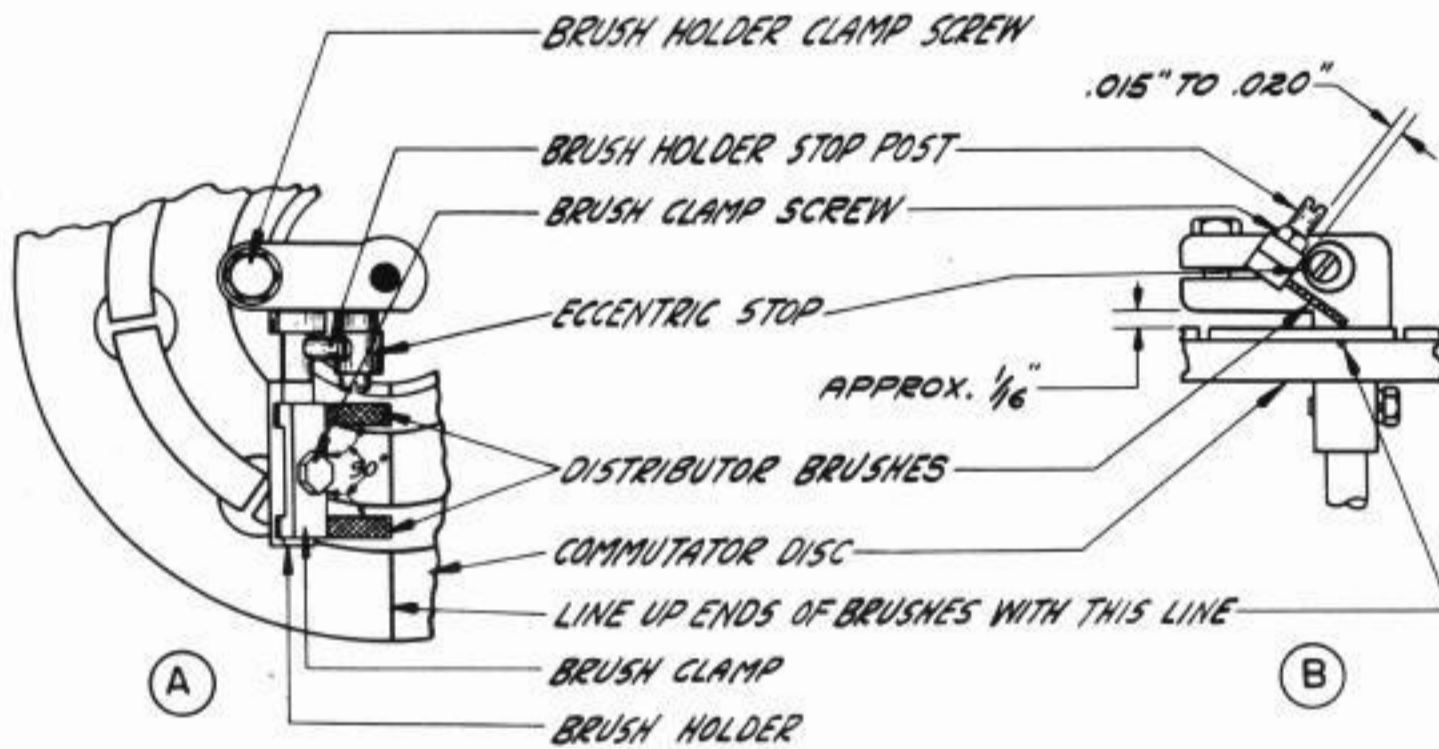
FIGURE 26



(A)

FIGURE 27

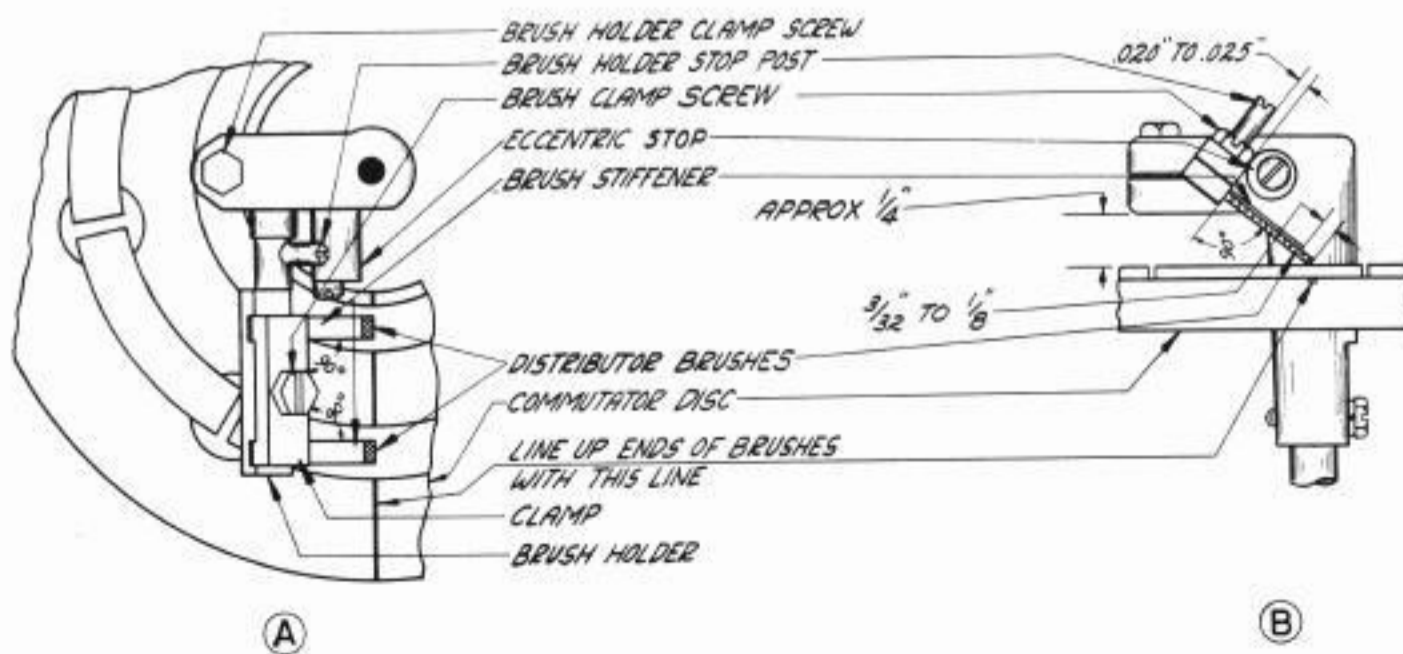
(B)



(A)

FIGURE 28

(B)



(A)

FIGURE 29

(B)

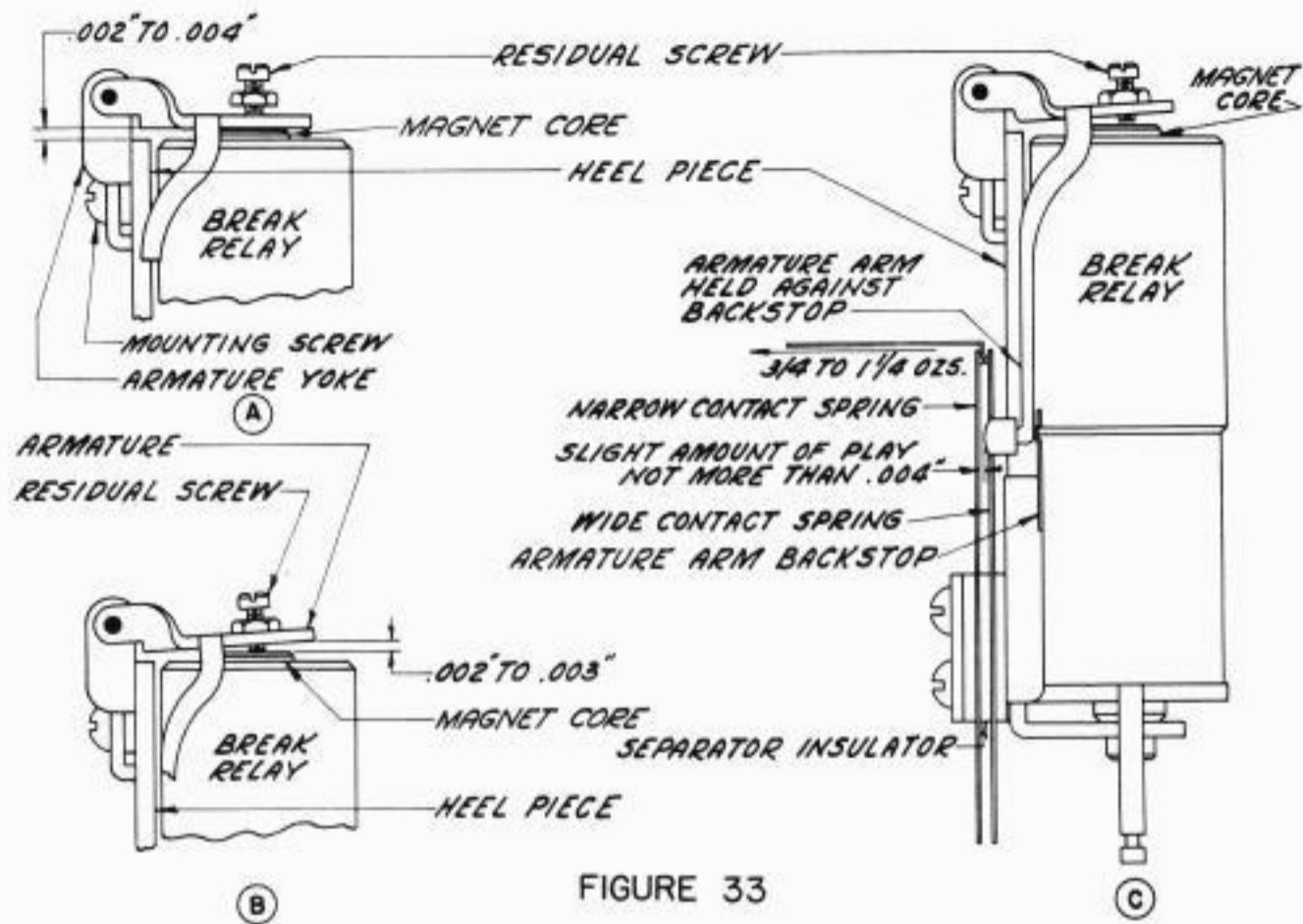


FIGURE 33

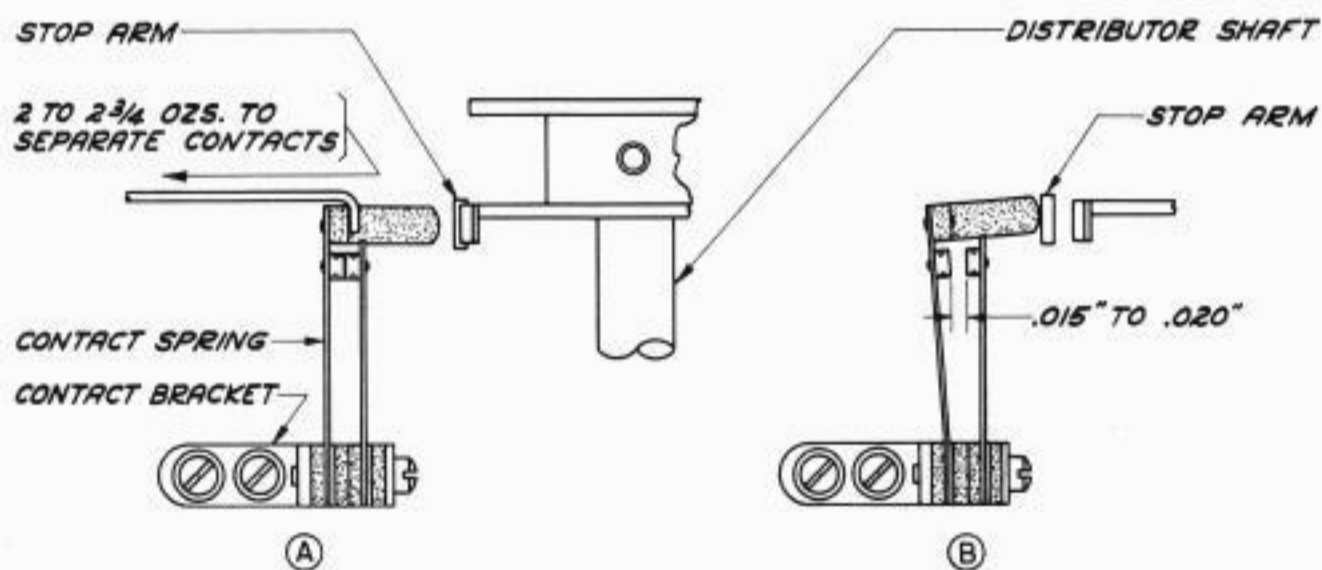


FIGURE 34

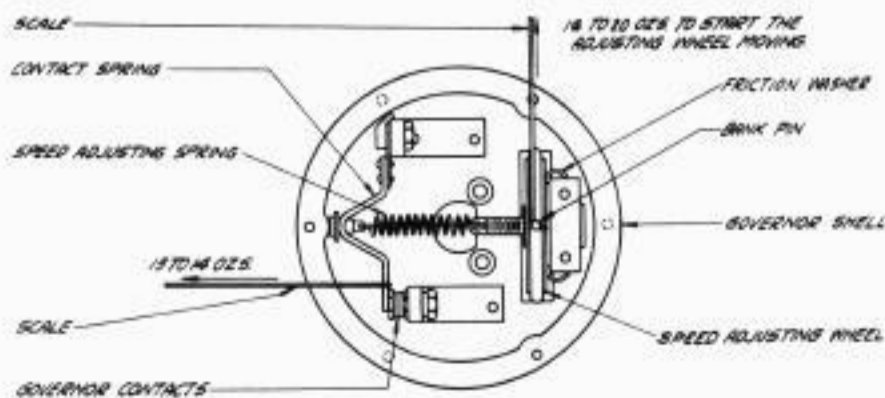


FIGURE 35

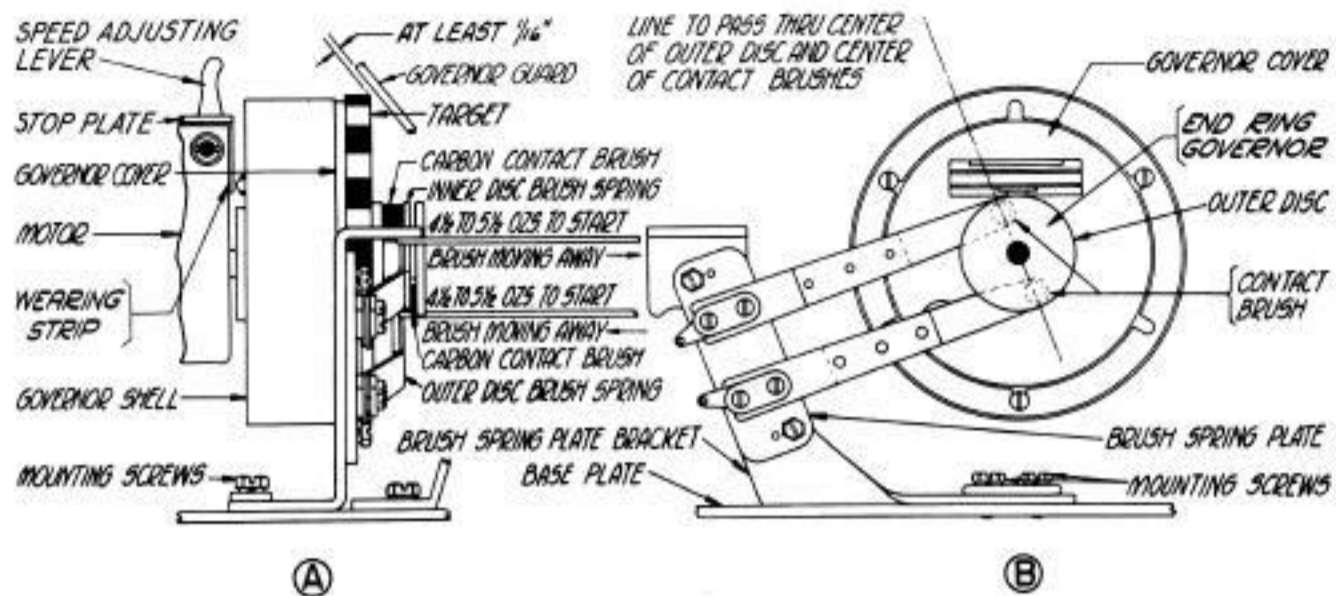


FIGURE 36

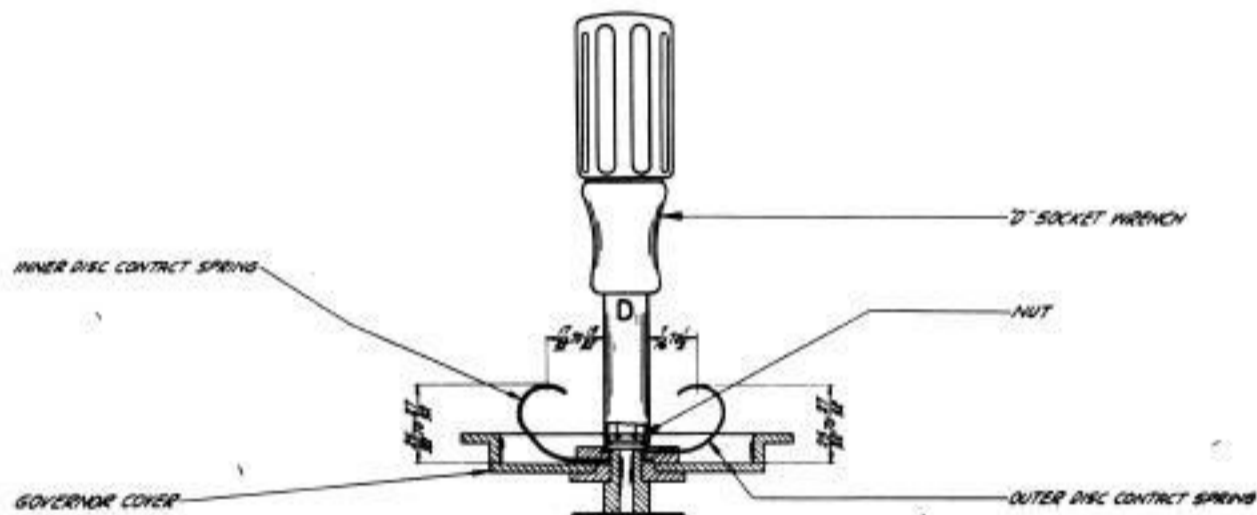


FIGURE 37

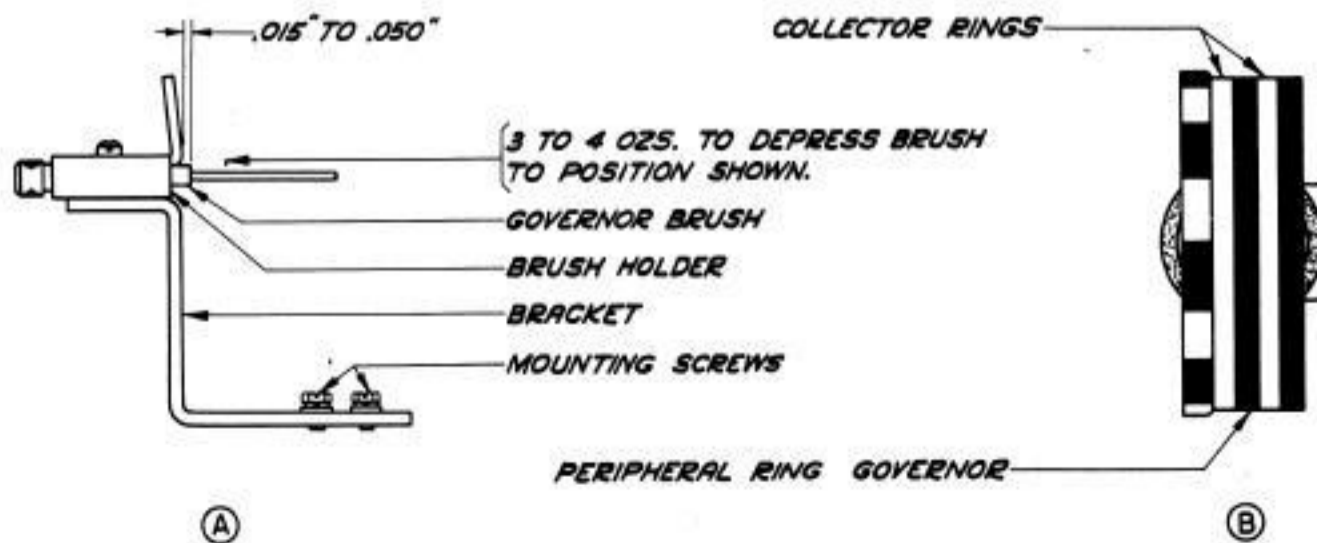


FIGURE 38