

CHANGES IN BULLETIN 147, ISSUE 2  
ADJUSTMENTS OF THE SINGLE MAGNET REPERFORATOR  
(MODELS 14 AND 20)

Page 12

Figure 16

The method of checking the "Tape Feed Roll Detent Spring Tension" as shown in Figure 16 has been changed. The scale should be hooked over the end of the detent lever, as close to the spring hole as possible. Then, pulling in line with the spring, the requirement specified in the text for this adjustment should be met.

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Starting Switch Adjustment (Figure 26)

Add the following to paragraph (C):

Note the number and thickness of the shims at each end of the switch bracket so that later they may be reassembled properly. Remove the end shield.

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Starting Switch Contact Spring Tension

Change this adjustment to read as follows:

With the starting switch contact spring resting against the contact backstop and the bracket held so that the contact spring clears the rotor shaft and the centrifugal mechanism push collar, hook an 8 oz. scale over the contact spring just below the backstop and pull at right angles to the spring. It should require 1/2 to 1 oz. to start the contact spring moving away from the backstop. Adjust by bending the contact spring to meet this requirement. Care should be taken to avoid bending this spring excessively.

Replace the centrifugal weight springs.

Omit paragraphs (f) and (g) and substitute the following:

Replacing the Starting Switch

Replace the switch end shield on the shaft. Remount the starting switch on the switch end shield, making certain that the shim pile-up is equal on both sides of the switch bracket. Tighten the two switch mounting screws by alternately tightening each one a little at a time until both are tight.

See that there is a fibre washer between the rotor and the pinion end shield. Replace the switch end shield mounting screws and employ the same procedure as used in tightening the switch mounting screws.

Omit the last sentence in paragraph (j) and substitute the following:

If the shims are removed, recheck paragraph (i).

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Omit paragraph (1) and substitute the following:

Remove the No. 82862 collar from the rotor shaft.

- (1) Apply the push end of a 12 lb. scale against the fan end of the shaft and push parallel with the shaft. It should require at least 7 lbs. pressure to start the shaft moving.

Replace the motor pinion and the fan (or handwheel, if the motor is equipped with a handwheel).

Replace the motor unit on the base and check the "Motor Unit Adjustment."

Omit the entire information under "Removing and Replacing Starting Switch or Centrifugal Mechanism (Figure 26)" and substitute the following:

IF IT IS NECESSARY, FOR ANY REASON, TO REMOVE THE STARTING SWITCH OR CENTRIFUGAL MECHANISM, PROCEED AS FOLLOWS:

Removing the Starting Switch or Centrifugal Mechanism (Figure 26)

- (a) Remove the motor unit from the base and remove the motor pinion and motor fan (or handwheel, if the motor is equipped with a handwheel).
- (b) Take out the switch end shield mounting screws.
- (c) Pull out the switch end shield slightly and remove the switch mounting screws, taking the same precautions as noted in paragraph (c) of the starting switch adjustment.
- (d) Unsolder the stator leads connected to the starting switch.
- (e) Remove the ball bearing. A bearing puller should be used, and care should be taken so as not to dent the brass covering that encloses one face of the bearing, or to burr the shaft. Never use a hammer, chisel, or any tool of that nature, directly against the face of the inner or outer ring.

NOTE: When handling the bearing, it is of the utmost importance that no dirt be allowed to enter the bearing. Dirt, grit, dust, or foreign matter of any kind acts as an abrasive, which, when ground between the revolving balls, will wear out the races. Before replacing, it is well to wash the bearing in kerosene or gasoline and then spin the bearing to remove the dirt. When laying a bearing down, lay it on a clean piece of paper - never on a dirty bench or table top. New bearings should not be unwrapped until ready to be used.

- (f) The starting switch may now be removed. To remove the centrifugal mechanism, remove the two mounting screws.

Assembling the Starting Switch or Centrifugal Mechanism (Figure 26)

- (a) Assemble the centrifugal mechanism to the rotor by means of the two centrifugal mechanism mounting screws, making certain that the insulator has been mounted properly between the mechanism and the rotor.
- (b) Place the fibre push collar washer on the switch end of the rotor shaft in front of the centrifugal mechanism push collar.
- (c) Insert the rotor partly in the stator with the switch end partly out of the frame.
- (d) Place the starting switch on the shaft against the push collar washer, with the contact spring toward the rotor. With the contact points of the starting switch in the upward position, solder the two wires that are tied together, to the upper terminal of the starting switch.



- (e) Before replacing the bearing, wipe the shaft clean and examine for burrs or corrosion. If necessary, use emery cloth, dressing down the shaft just enough to remove inequalities of the surface and any burr on the shoulder of the shaft to insure proper seating of the bearing. Now wipe the shaft clean and apply a trace of machine oil to the part of the shaft that seals the bearing.

Replace the ball bearing on the switch end of the rotor shaft with the shielded side of the bearing facing the rotor. The bearing has what is known as a "light tap" fit, that is, the bearing fits on the shaft so that a series of light taps will drive it in place. The best tool to use is a piece of pipe or tubing, preferably of brass, which is just large enough to slip over the shaft and to bear only on the inner ring. Never apply pressure of any kind to the outer ring, the balls, or the retainer, as this is likely to injure the bearing. It is absolutely essential that the bearing be started straight and that the blows be light. See that the bearing is solidly up against the shaft shoulder. Pack the bearing with approved lubricant.

- (f) Place a felt washer and a retaining washer in the order given in the switch end shield.
- (g) Slide the switch end shield over the switch end of the rotor shaft, inserting the ball bearing in the machined recess of the switch end shield.
- (h) Adjust the starting switch, following the instructions given under "Starting Switch Adjustments."

To remove or replace the ball bearing on the pinion end of the rotor, proceed as follows:

- (a) Remove the motor unit from the base and remove the motor pinion and motor fan (or handwheel, if the motor is equipped with a handwheel).
- (b) Take out the pinion end shield mounting screws and remove the end shield.
- (c) Proceed as in paragraph (e) of "Removing the Starting Switch or Centrifugal Mechanism."

To replace the bearing on the pinion end of the rotor, proceed as follows:

- (a) Proceed as in paragraph (c) "Assembling the Starting Switch or Centrifugal Mechanism."
- (b) Assemble in the pinion end shield the following, in the order given: felt washer, cup washer, thrust spring, and thrust spring washer.
- (c) Replace the end shield mounting screws, tightening alternately each screw a little at a time until they are tight.

ON SYNCHRONOUS MOTORS HAVING A THREE BRUSH STARTING SWITCH, THE SWITCH SHOULD MEET THE FOLLOWING REQUIREMENTS:

NOTE: These requirements should not be checked unless there is reason to believe 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 5 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 5 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 with 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 check the "Motor Unit Adjustment."

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Add the following before "Selector Unit":

General

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.

Selector Unit

Add the following:

- 6. Selector Cam - each cam peak.
- 7. Locking wedge - at point of engagement with the locking lever.
- 8. Armature locking lever - pivot.
- 9. Selector lever - pivot.

Main Shaft

Change No. 5 as follows: Ball bearing (front).

Add the following:

- 6. Ball bearing (rear) - grease.
- 11. Clutch - camming surface.

Punch Arm Shaft

Change No. 2 as follows: Cam roller - oil-grease-oil.



LINE AND SELECTOR CIRCUITS  
CLOSING JACK ADJUSTMENTS

\*Supplement to: Bulletin 138, Adjustments of the  
Type Bar Page Printer (Model 15)  
and  
Bulletin 147, Adjustments of the  
Single Magnet Reperforator

Contact Gap Adjustments

A. When the jack plunger is held flush with the relay connection block mounting plate, there should be a gap of .010" to .015" between the contact points of No. 3 and No. 4 contact springs. See Figure 1-B.

Adjust by bending No. 3 contact spring.

B. When the jack plunger is held flush with the relay connection block mounting plate there should be .020" to .025" clearance between the contact points of No. 1 and No. 2 contact springs. See Figure 1-B.

Adjust by bending No. 2 contact spring.

Contact Spring Tension Adjustment

When an 8 oz. scale is hooked to contact springs No. 1 or No. 4 at right angles to the springs it should require a pull of 5 to 7 ozs. to separate the contact points of contact springs No. 1 and 2 or of contact springs No. 3 and 4 respectively. See Figure 1-A.

Adjust by bending No. 1 and No. 4 contact springs.

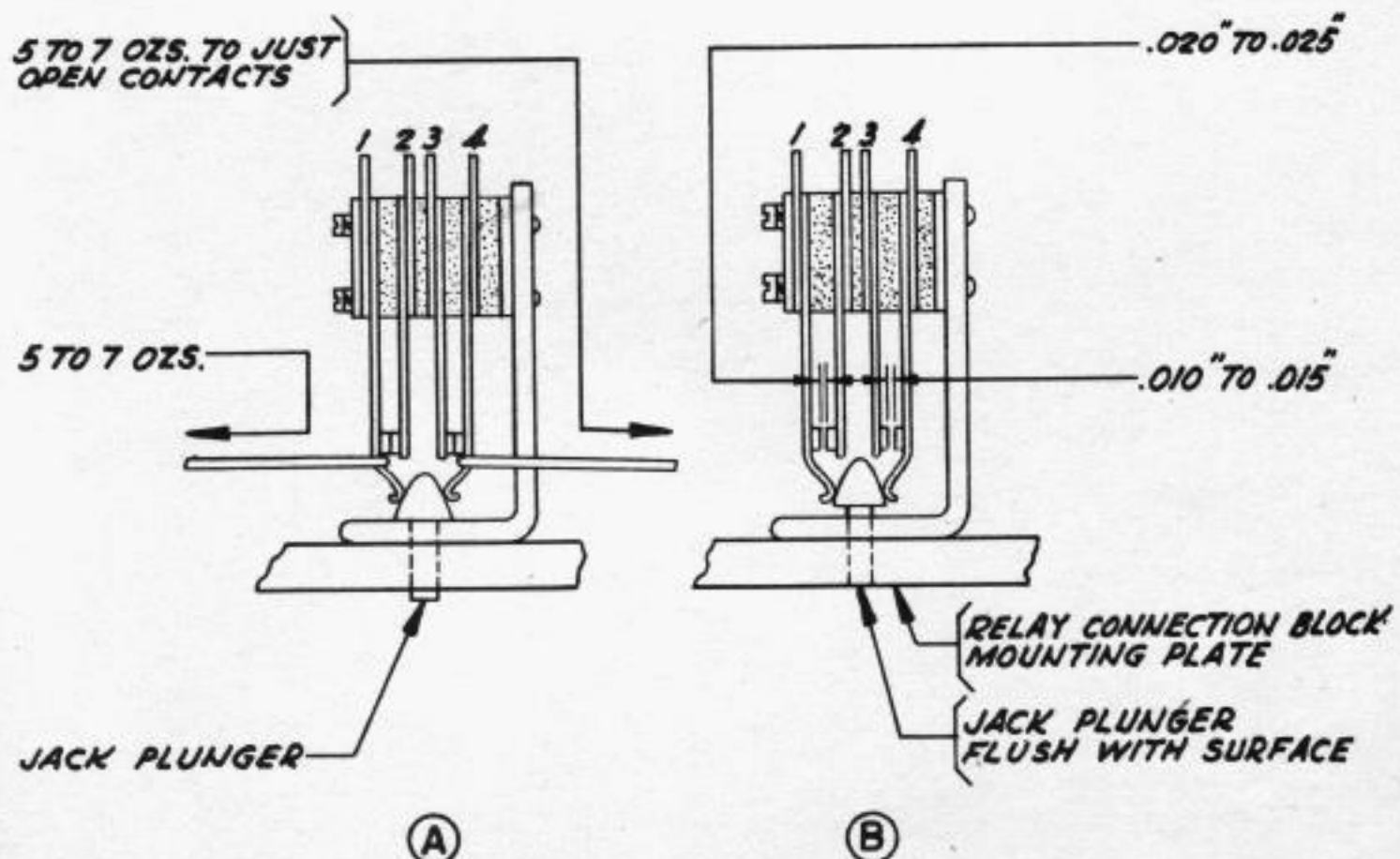


FIGURE 1

\* Denotes Change

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Book 6

# TELETYPE

PRINTING TELEGRAPH SYSTEMS

ADJUSTMENTS  
OF THE  
SINGLE MAGNET REPERFORATOR

**TELETYPE**

CORPORATION

SUBSIDIARY OF

*Western Electric Company*

CHICAGO, U.S.A.

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# TELETYPE

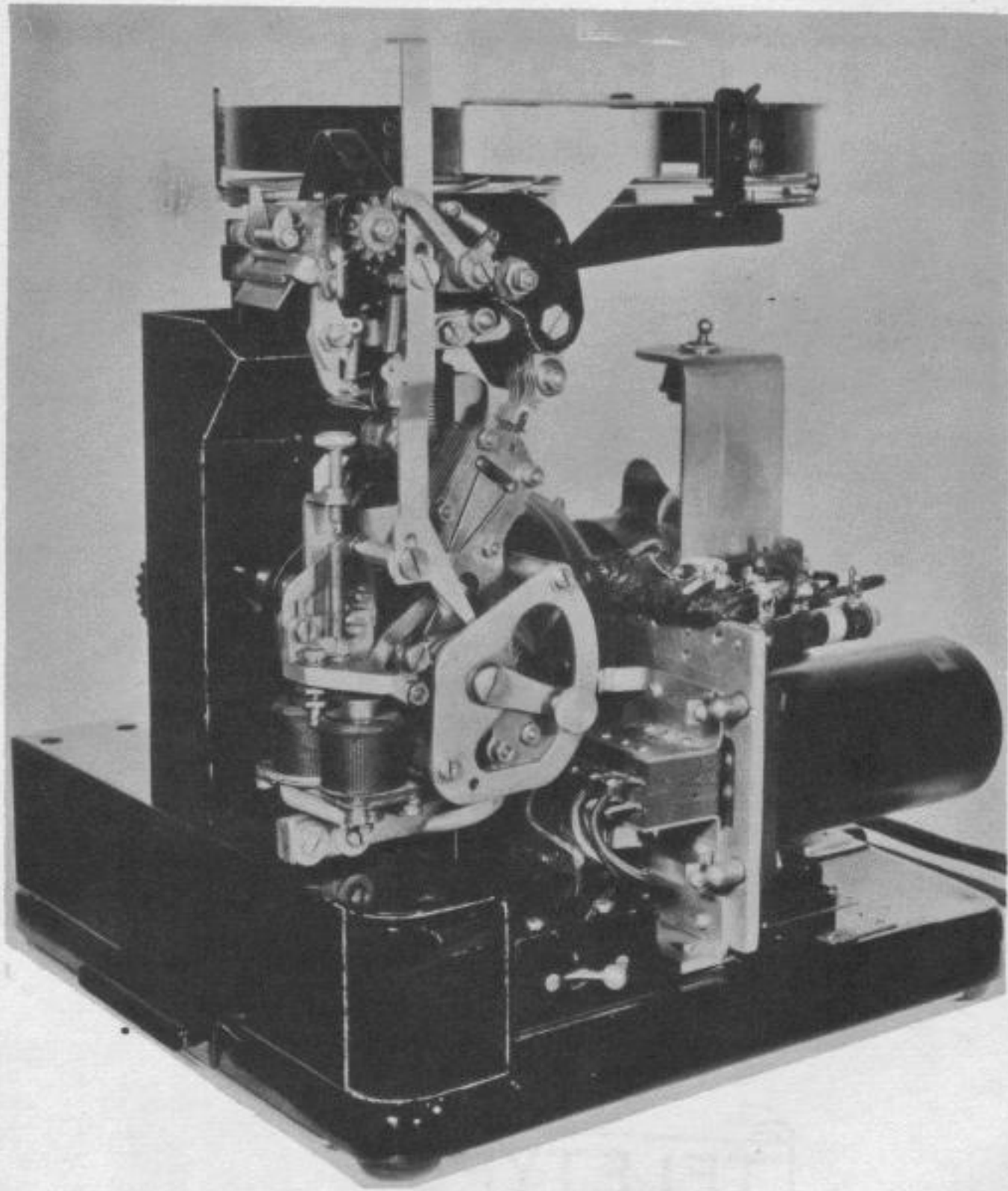
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ADJUSTMENTS OF THE SINGLE MAGNET REPERFORATOR  
(14 AND 20 TYPE)

The following adjustments are arranged in a sequence that would be followed if a complete readjustment of the reperforator were undertaken. This fact should be kept in mind when a single adjustment is to be made.

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 proper spring value readings, the spring scales which are included in the Teletype catalog tool list should be used.

In all the figures of this bulletin, fixed pivot points are noted by solid black circles.

Selector Separator Plate Adjustment (Figure 1)

The leaf springs of the separator plates should exert a light pressure upon the swords. In order to make this adjustment, it is necessary to remove the separator plates. The leaf springs should be bent at the narrow portions, so that the ends will be from .045" to .055" below the under surface of the straight portions.

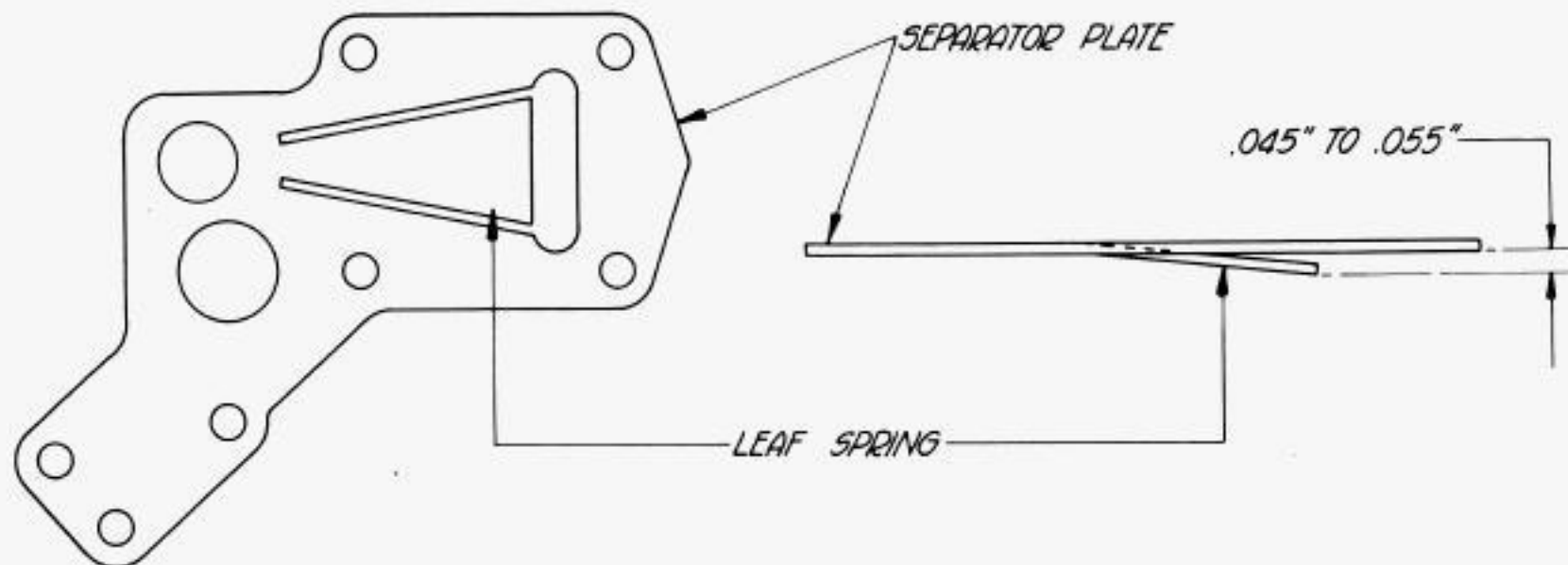


FIGURE 1

Main Shaft Adjustment

Set the reperforator on its back. When the main shaft is rotated, the selector cams on the selector cam sleeve should line up with their respective selector levers. To adjust, loosen the four screws that hold the main shaft bearing brackets, and set the position of the main shaft.

Selector Lever Spring Tension (Figure 2)

Rotate the main shaft until the selector cam sleeve is in its stopped position. With the transfer levers in the spacing position, hook an 8 oz. scale over the top of the #5 transfer lever and pull horizontally to the right. It should require from 1 1/2 to 3 ozs. to move the lever to the marking position. The lever should start back at not less than 1/2 oz. Check all levers in the same manner.

Selector Armature Adjustment (Figure 3)

The armature should be free on its pivot screws, with barely perceptible end play. There should be some clearance, not more than .008", between the inner surface of

NOTE: After making a single adjustment, check related adjustments.

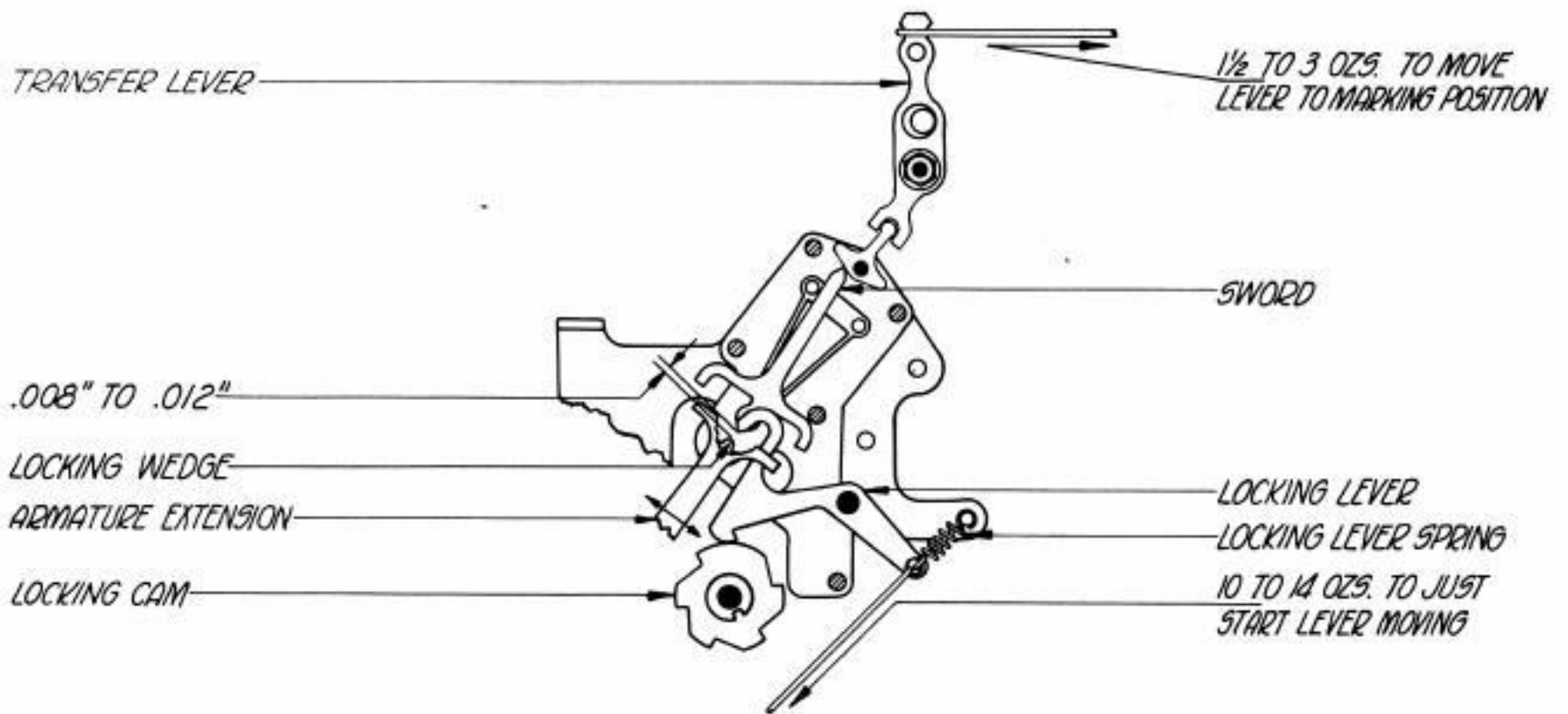


FIGURE 2

the armature locking wedge and the No. 5 sword, under the following conditions:

- (a) No. 5 selector lever resting on the peak of its cam.
- (b) No. 5 sword held against the outer separator plate without bending latter.
- (c) Armature end play taken up in a direction to reduce the specified clearance to a minimum.

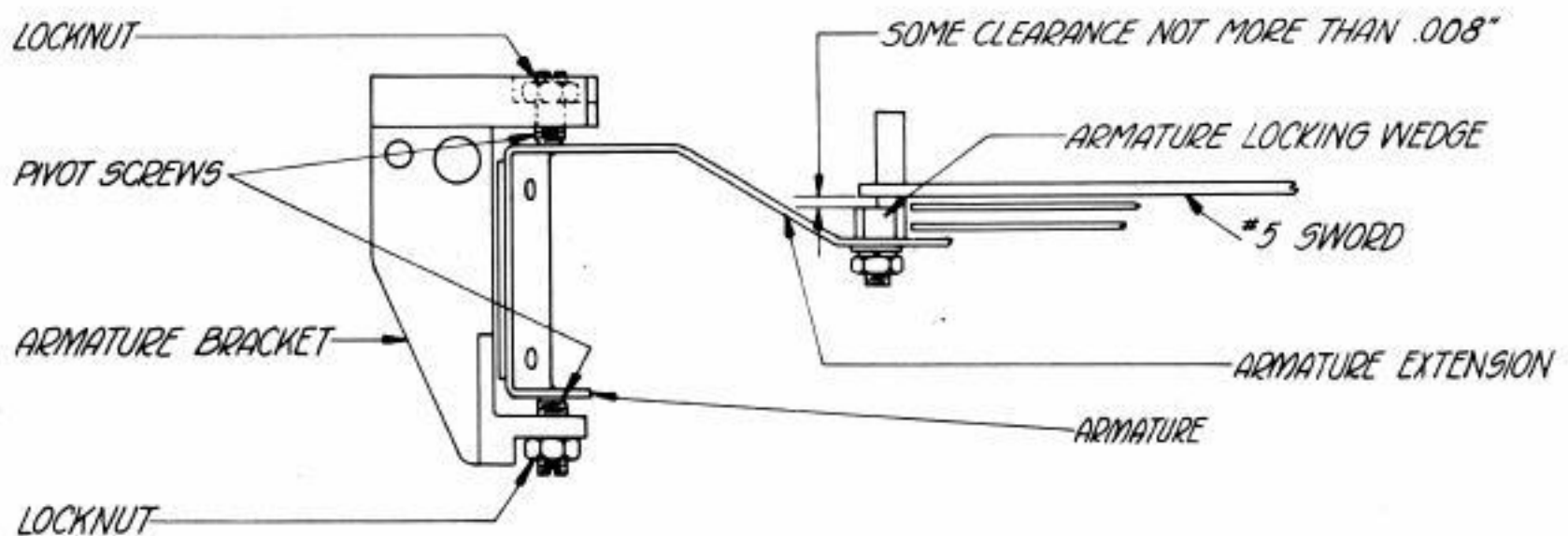


FIGURE 3

- (d) Locking lever spring removed.

To adjust, proceed as follows:

If there is no clearance between the armature locking wedge and the No. 5 sword, loosen the lock nut on the outer pivot screw and adjust to obtain the clearance, noting that a quarter-turn of the screw is equivalent to approximately .006". Remove the armature bracket and adjust the inner pivot screw to obtain the proper armature end play. Replace the armature bracket. If there is more than .008"

NOTE: After making a single adjustment, check related adjustments.



clearance, remove the armature bracket and adjust inner pivot screw. Replace the bracket and adjust the armature end play by means of the outer pivot screw.

### Selector Armature Bracket Link Adjustment (Figures 4 and 5)

The position of the armature bracket should be such that a line through the center of the No. 5 sword extends approximately through the center of the armature pivot screw, when the swords are held midway between the stop posts by means of the No. 72581 gauge pins. To adjust, proceed as follows:

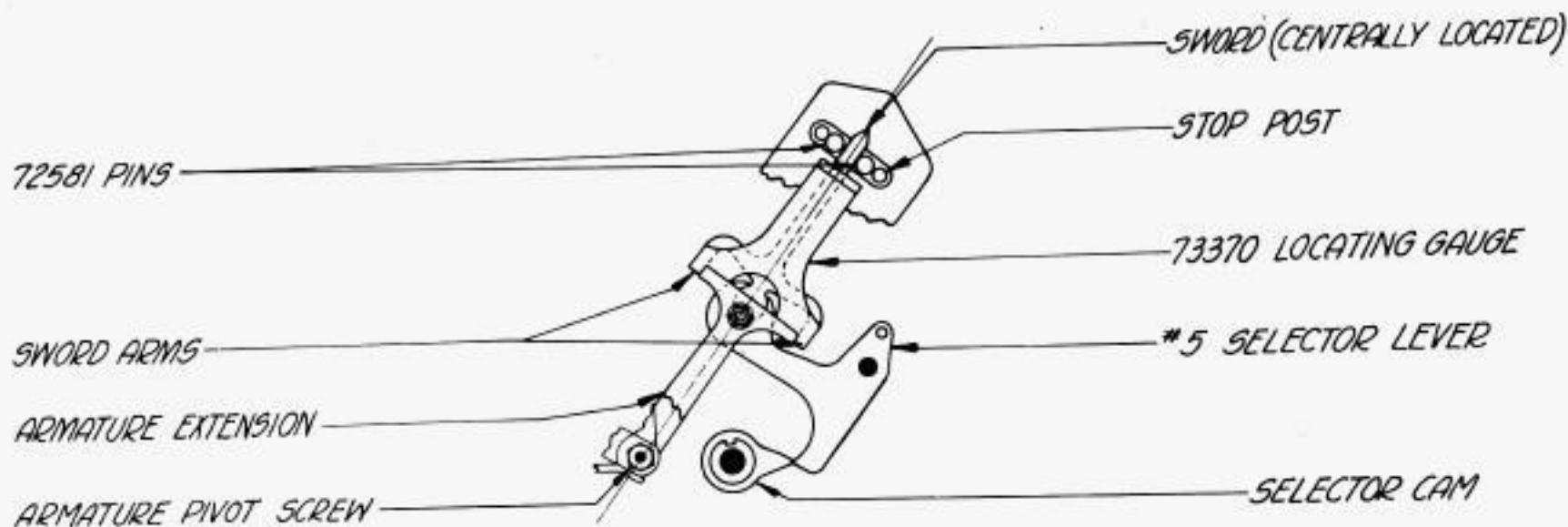


FIGURE 4

Remove the range finder, unhook the locking lever spring, loosen the magnet bracket mounting screws, and move the bracket to its lowest position. Loosen the armature bracket mounting screws, the guide post lock nut, and back off the armature stops. Move the bracket eccentric out of the way, so that it will not interfere with the adjustment. Rotate the main shaft until the No. 5 selector lever rests on the peak of its cam.

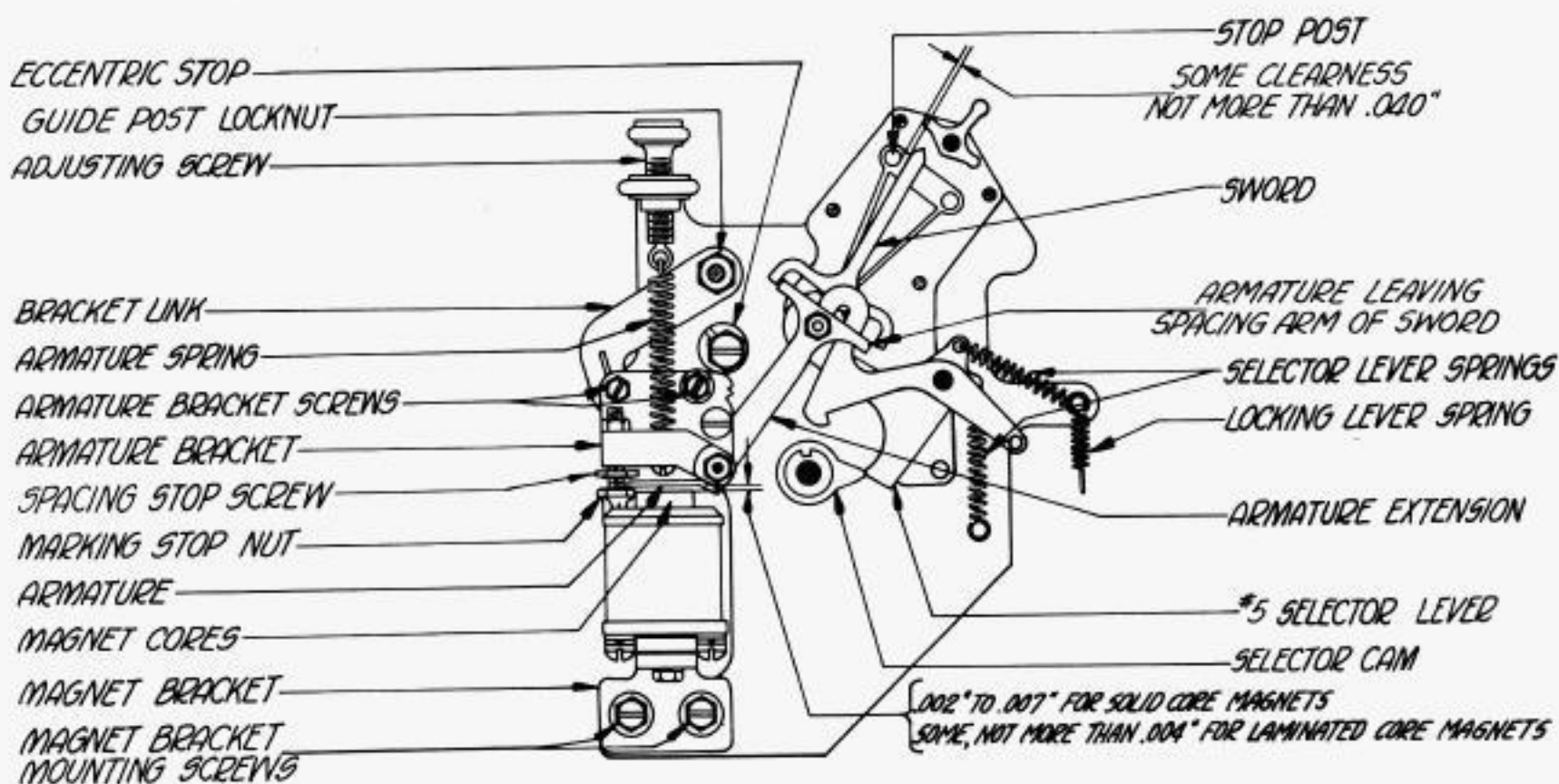


FIGURE 5

NOTE: After making a single adjustment, check related adjustments.

Hold the swords in a position midway between the two stop posts, by means of the (No. 72581) gauge pins inserted between the stop posts and the swords. Be sure that both the armature extension arms are between the arms of the swords. With the swords held in this position, place the (No. 73370) locating gauge over the ends of the No. 5 sword, so that the two legs of the gauge are against the ends of the two sword arms. Move the bracket to a position where both the armature extension arms are against the flat surface between the legs of the gauge.

Hold the bracket in this position and tighten the guide post lock nut. Remove the locating gauge and the two gauge pins.

Selector Armature Bracket Adjustment (Figure 5) - See Note (A)

The position of the armature bracket should be such as to provide some clearance, not more than .040", between each sword and either stop post under the following conditions:

Rotate the main shaft until the No. 5 selector lever is resting on the peak of its cam. With the armature in its unoperated (spacing) position, move the spacing arm of the No. 5 sword against the armature extension. Then rotate the armature slowly toward the marking position until the armature just leaves the spacing arm of the No. 5 sword. Check the clearance between the No. 5 sword and the spacing stop post.

Unhook the armature spring at its adjusting screw and with the selector armature in its operated (marking) position, move the marking arm of the No. 5 sword against the selector armature extension. Then rotate the armature slowly toward the spacing position until the armature just leaves the marking arm of the No. 5 sword. Check the clearance between the No. 5 sword and the marking stop post. With each selector lever on the peak of its cam, each associated sword should be tried for the foregoing requirement of some clearance, not more than .040" between each sword and the stop posts.

To adjust, tighten the armature bracket mounting screws just enough so that the bracket may be moved by tapping it lightly. By rotating the bracket on its pivot, the clearance between the swords and the stop posts may be regulated. If this clearance is more than .040", move the bracket in a direction to bring the armature toward the sword. If there is no clearance, move the bracket in the opposite direction to bring the armature away from the sword. After the bracket is set and both screws are tightened, move the eccentric stop against the bracket and tighten its screw.

The eccentric and link will, therefore, determine the position of the bracket. The bracket may be removed by simply removing the two bracket screws. In replacing, the bracket should be held against the eccentric stop, while the two bracket screws are tightened. Replace the armature spring.

Armature Stops Adjustment for Five-Unit Reperforators (Figures 5 and 6) - See Note (A)

The No. 5 sword arms (spacing and marking) should clear their associated arms of the selector armature extension by from .040" to .042" when the engaging face of an opposite sword arm is against the engaging face of its armature extension arm and the No. 5 selector lever is on the high part of its cam.

To adjust the clearance between the side of the marking extension of the armature and the marking arm of the sword, reposition the armature stop screw with the armature in its unoperated position. To adjust the clearance between the spacing extension of the armature and the spacing arm of the sword, reposition the armature stop nut with the armature in the operated position. If necessary, pinch the nut to make it tight on its screw. Recheck the clearance between the marking extension of the armature and marking arm of the sword. Replace the locking lever spring.

- (A) These requirements should be checked with the range finder assembly removed.

NOTE: After making a single adjustment, check related adjustments.



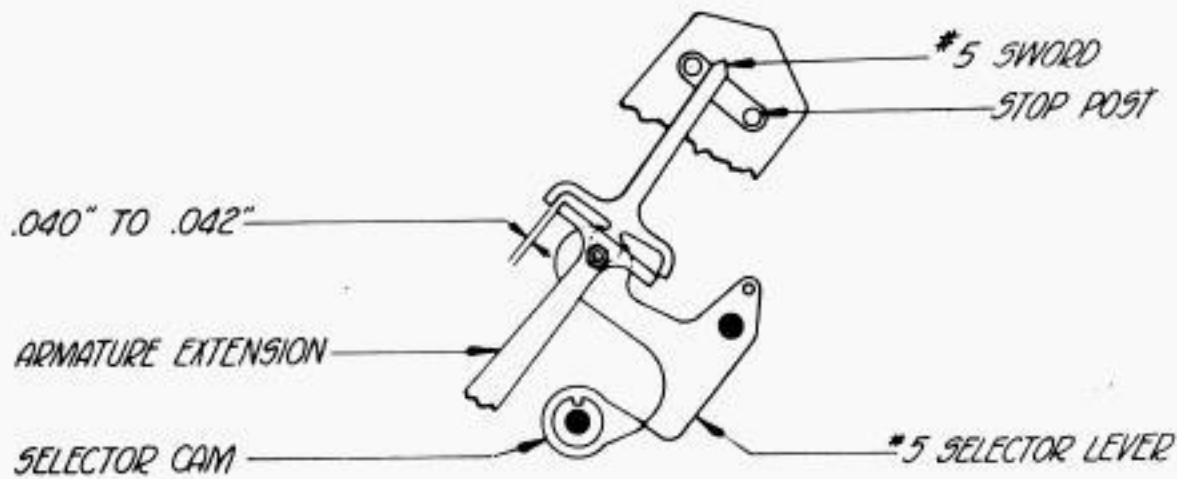


FIGURE 6

Armature Stop Adjustment for Six-Unit Reperforators (Figures 7-A and 7-B) - See Note (A)

NOTE: When the reperforator is operated at a speed less than 318 operations per minute, the armature stop adjustment for five-unit reperforators should be used, and the armature stop plate positioned so that it is ineffective.

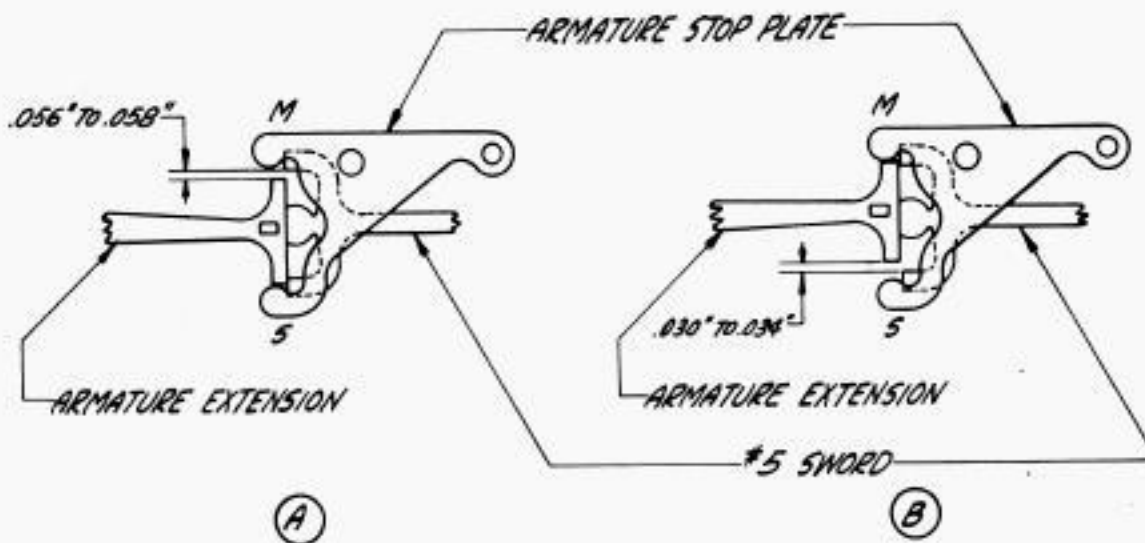


FIGURE 7

Turn the main shaft until the No. 5 selector lever (outer) is on the peak of its cam. With the spacing arm of the No. 5 sword against the spacing side of the armature extension, there should be from .056" to .058" clearance between the sides of the armature extension and the No. 5 sword on the marking side (See Figure 7-A). Now place the armature and sword in the marking position. There should be from .030" to .034" clearance between the sides of the armature extension and the No. 5 sword on the spacing side (See Figure 7-B). To obtain these requirements, adjust the position of the armature stop plate by means of its mounting screw.

Armature Locking Wedge Adjustment (Figure 2)

There should be from .008" to .012" clearance between the point of the armature locking wedge and the point of the locking lever when the locking lever is on the long high part of the locking cam and the two points are in line. To adjust, move the locking wedge forward or backward in its slot in the armature extension by means of the locking wedge lock nut.

- (A) These requirements should be checked with the range finder assembly removed.

NOTE: After making a single adjustment, check related adjustments.



Armature Locking Lever Spring Tension (Figure 2)

With the locking lever on a high part of the locking cam, hook a 32 oz. scale in the spring hole of the locking lever and pull in line with the spring under the magnet bracket. It should require from 10 to 14 ozs. to start the lever moving.

Stop Lever Eccentric Screw Adjustment (Figure 8) - See Note (A)

The stop lever on the range finder assembly should overtravel the latching surface of the trip latch by from .004" to .006". Adjust the stop lever eccentric screw to obtain this overtravel, making certain that the tightening of the eccentric screw nut does not disturb the adjustment.

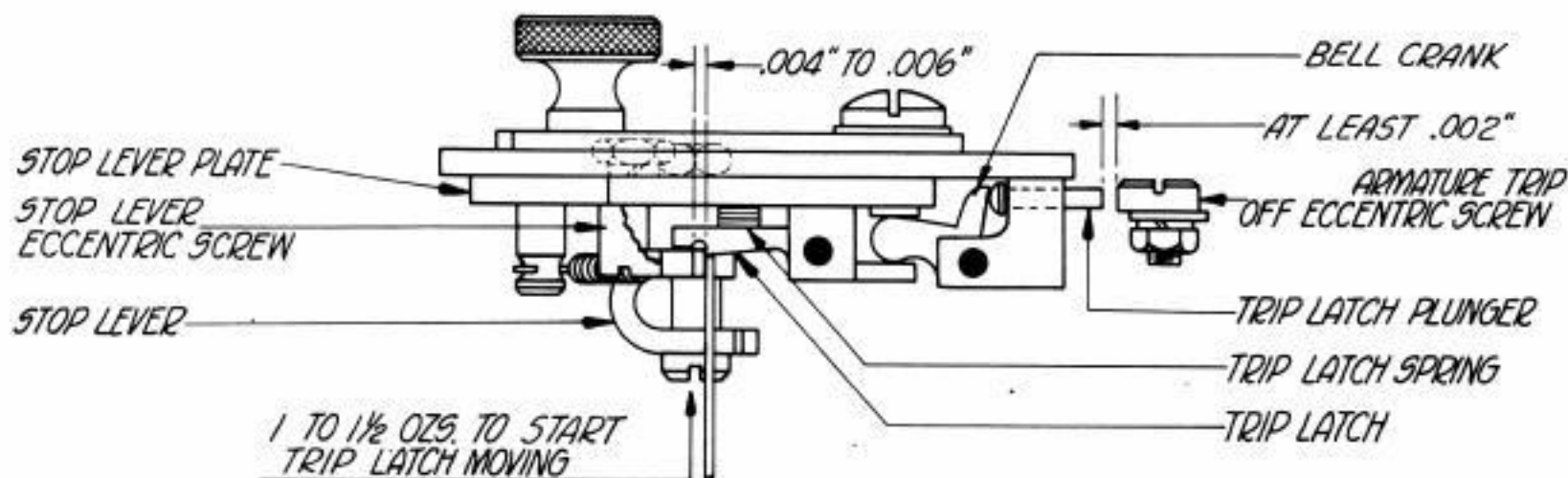


FIGURE 8

Stop Lever Spring Tension (Figure 9) - See Note (A)

With the trip latch plunger held operated, hook an 8 oz. scale at the end of the stop lever on the range finder assembly. It should require from 3/4 to 1 1/4 ozs. to start the lever moving.

NOTE: Be sure that the stop lever eccentric has been adjusted before taking this reading.

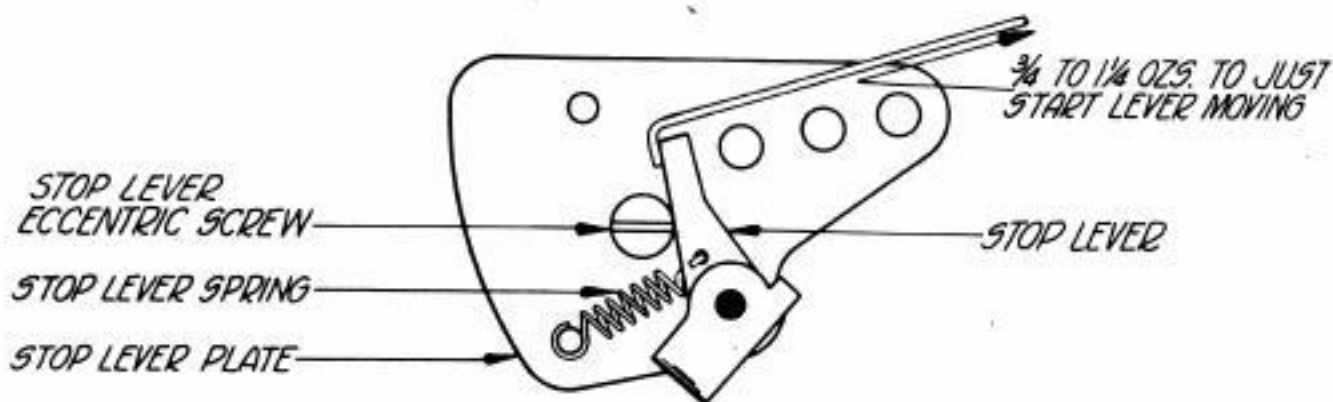


FIGURE 9

Trip Latch Spring Compression (Figure 8) - See Note (A)

When measuring this requirement, the range finder assembly should be held in a horizontal position. An 8 oz. scale should be held in a vertical position and applied to the step of the trip latch. It should require from 1 to 1 1/2 ozs. when pushing upward to start the trip latch moving.

(A) These requirements should be checked with the range finder assembly removed.

NOTE: After making a single adjustment, check related adjustments.

Replace the range finder assembly. Care should be taken that the trip latch plunger does not jam against the armature trip-off eccentric screw when remounting.

#### Armature Trip-Off Eccentric Screw Adjustment (Figure 10)

There should be some clearance, not more than .002", between the stop lever and the trip latch when the armature is in the unoperated position and the main shaft is rotated until the stopping edge of the stop lever is directly opposite the latching surface of the trip latch.

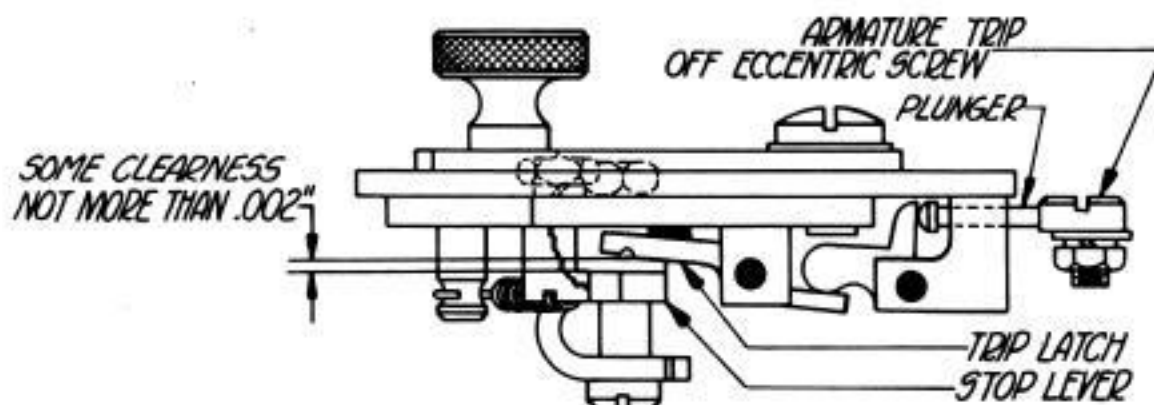


FIGURE 10

The trip latch plunger should have at least .002" end play (See Figure 8) when the armature is held against the marking stop and with the stop lever clear of the latching surface of the trip latch.

These requirements may be obtained by means of the armature trip-off eccentric screw.

#### Magnet Bracket Adjustment (Figure 5)

There should be from .002" to .007" space between each magnet core and the armature anti-freeze strip for solid core magnets and some, not more than .004", for laminated core magnets when the armature is against the operated stop (marking stop). The sides of the solid magnet cores should align with the edge of the armature. The ends of the cores of both style magnets should be parallel to the face of the armature.

Adjust by means of the magnet bracket mounting screws.

#### Magnet Coils Adjustment

The front edge of the solid magnet core of the front magnet coil should align, within  $1/64$ ", of the front edge of the armature. Adjust by means of the magnet coil mounting screws.

#### Motor Unit Adjustment

There should be a minimum backlash without binding between the motor pinion and the main shaft gear. Check this backlash for one complete revolution of the main shaft gear. To adjust, loosen the three mounting screws and position the motor unit, by means of the adjusting screw (which is located to the left of the right hand motor mounting screw).

#### Main Shaft Clutch Throw-Out Lever Adjustment (Figure 11)

The clutch teeth should be separated by from .010" to .020" when totally disengaged. To secure this clearance, adjust the clutch throw-out lever by means of its pivot screws. After the clearance is obtained, the clutch throw-out lever should be free in its bearings with no perceptible end play.

NOTE: After making a single adjustment, check related adjustments.

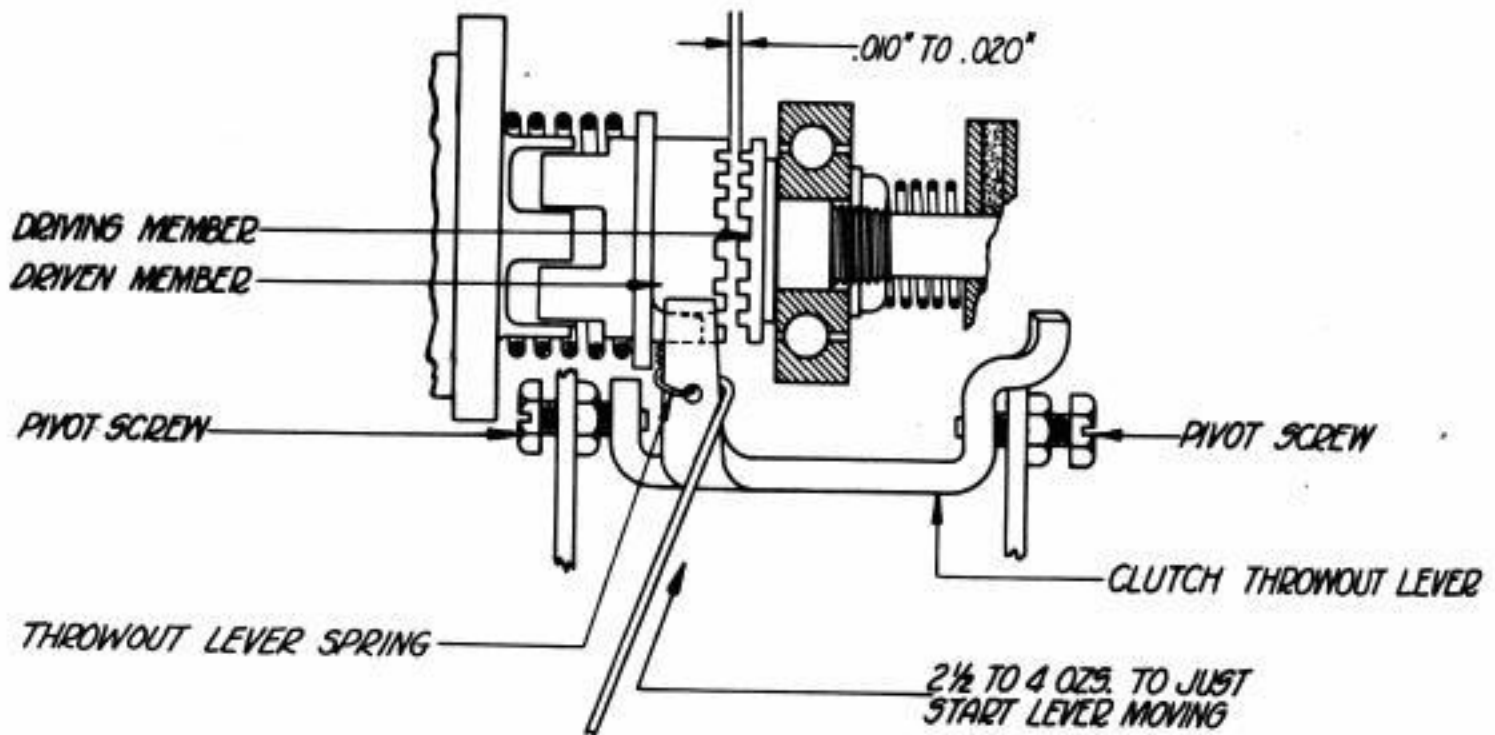


FIGURE 11

Selector Clutch Torque (Figure 12-B)

With the motor running at least 10 minutes, hook a 32 oz. scale to the selector cam sleeve stop arm. Pulling at right angles to the stop arm, it should require a pull of from 14 to 18 ozs. to hold the sleeve stationary.

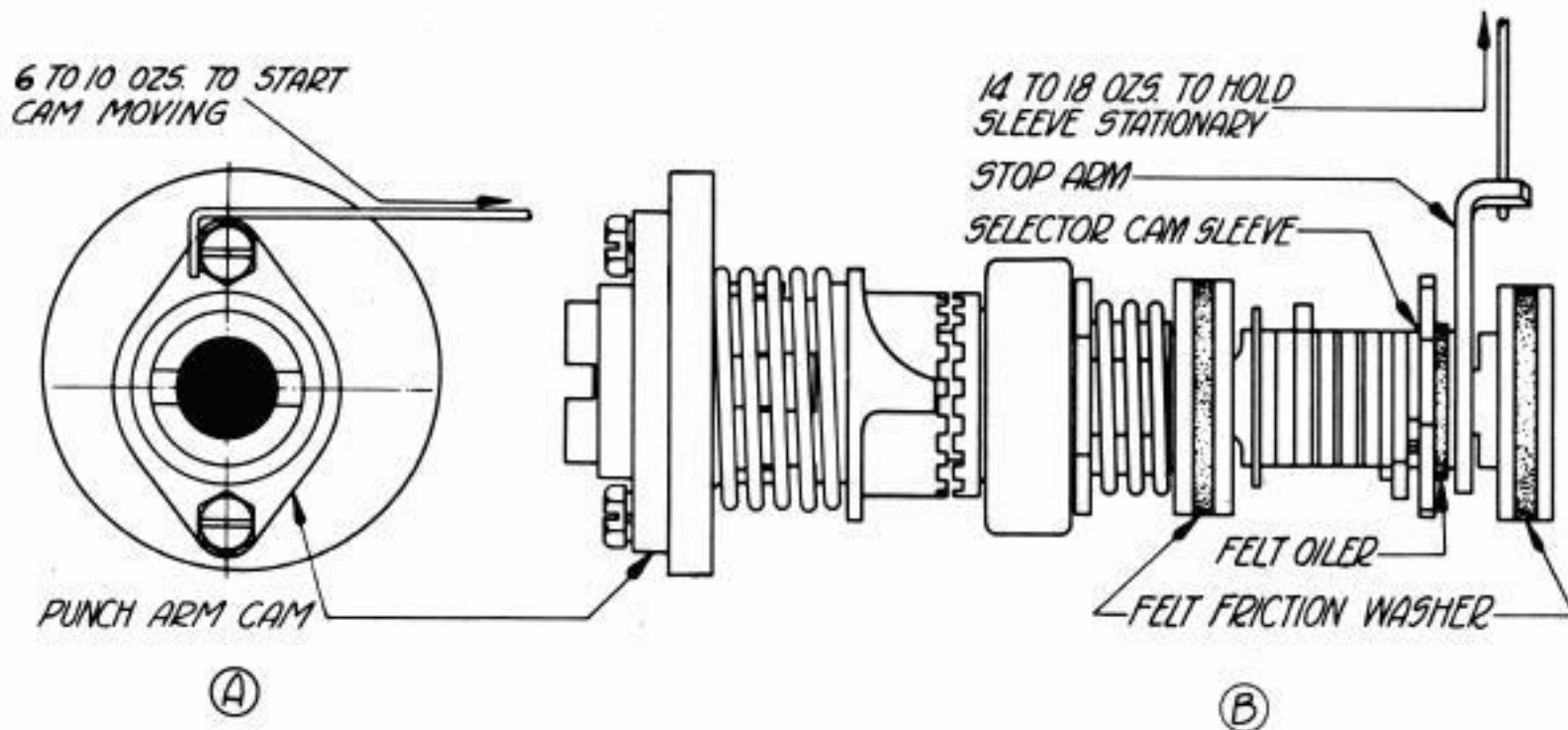


FIGURE 12

Clutch Throw-Out Lever Spring Tension (Figure 11)

With the clutch throw-out lever on a low part of its cam, hook an 8 oz. scale to the clutch throw-out lever at the spring hole and pull at right angles. It should require from 2 1/2 to 4 ozs. to start the lever moving.

Main Shaft Friction Clutch Torque (Figure 12-A)

Hold the punch arm away from its cam. With the motor running at least 10 minutes, and the selector magnets energized, hook a 32 oz. scale over the top screw on the

NOTE: After making a single adjustment, check related adjustments.



cam, and pull at right angles to a line drawn through the center of the two cam mounting screws. It should require from 6 to 10 ozs. to start the cam moving from its normal position.

#### Punch Arm Shaft Adjustment

With the punch arm held against the front bearing block, the end of the shaft should be flush with the front of the front bearing block. To adjust, remove the punch hammer spring and adjust the position of the punch arm on the shaft by means of the punch arm set screw.

The punch arm shaft should be free to turn with minimum end play. To obtain this requirement, position the collar at the rear bearing bracket by means of the collar set screws. Replace punch hammer spring.

#### Main Shaft Clutch Spring Tension (Figure 13)

Remove the large chad chute. With the clutch driven member teeth resting against the driving member teeth, but not engaged, hook a 32 oz. scale over the throw-out cam on the driven member. It should require from 22 to 30 ozs. to separate the teeth, when the pull is applied as nearly in line with the shaft as possible. Replace chad chute.

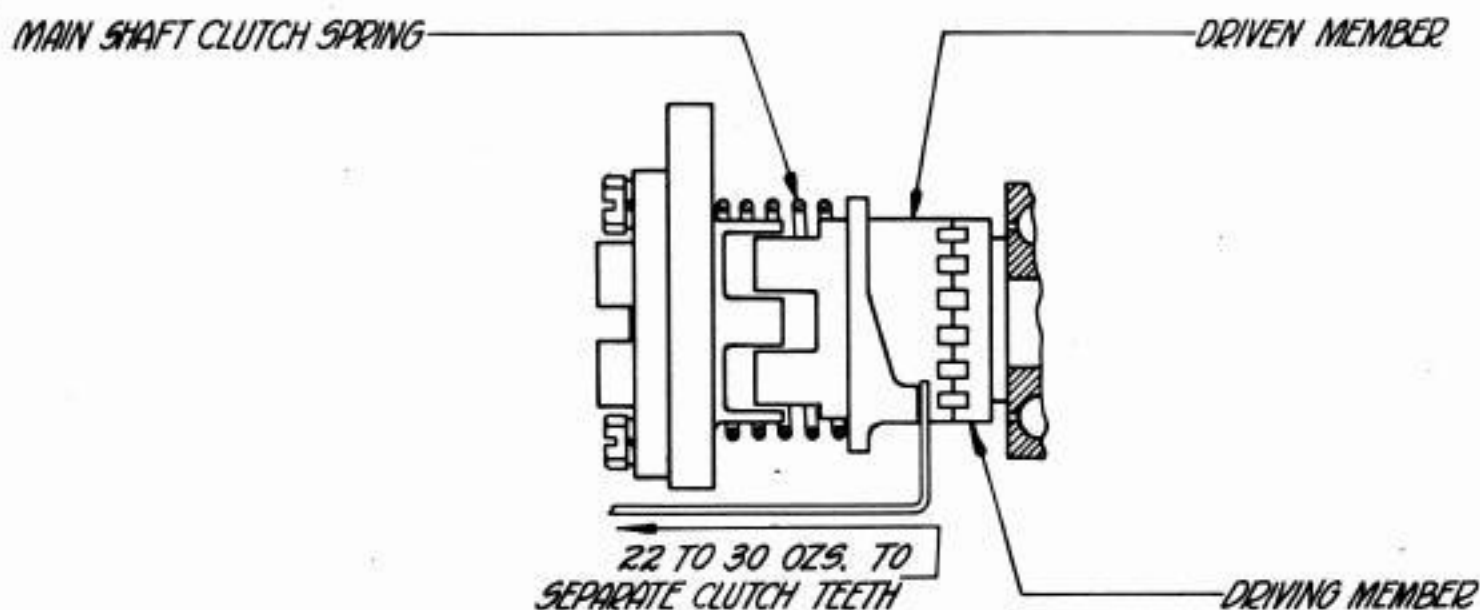


FIGURE 13

#### Transfer Lever Position (Figure 14)

With the No. 4 transfer lever in the spacing position and the No. 5 transfer lever in the marking position and the selector cam sleeve in the stop position, the clearance between the engaging surfaces of the No. 5 sword and the armature extension, with the armature in the spacing position "A", should be the same within .005" as the clearance between the No. 4 sword and the armature extension, with the armature in the marking position "B". To adjust, loosen the two screws holding the punch unit bracket to the frame, and adjust its position, using the rear screw as a pivot.

The transfer levers should be positioned so that they line up with the selector "T" levers. Adjust by means of the transfer lever stud lock nut.

#### Punch Hammer Adjusting Nut Adjustment

The punch hammer adjusting nut (See Figure 20) should be adjusted so that the punches are driven through the tape sufficiently to punch clearly. This adjustment may be made as follows:

NOTE: After making a single adjustment, check related adjustments.

Place a piece of tape in the die. Back off the punch hammer adjusting nut so that when the main shaft is rotated with the rub-out signal set up on the selectors, the punches will fail to punch holes in the tape. Adjust the adjusting nut, by advancing slowly until all the holes are just punched cleanly in the tape; then advance the adjusting nut an additional 1/4 turn, and tighten the lock nut.

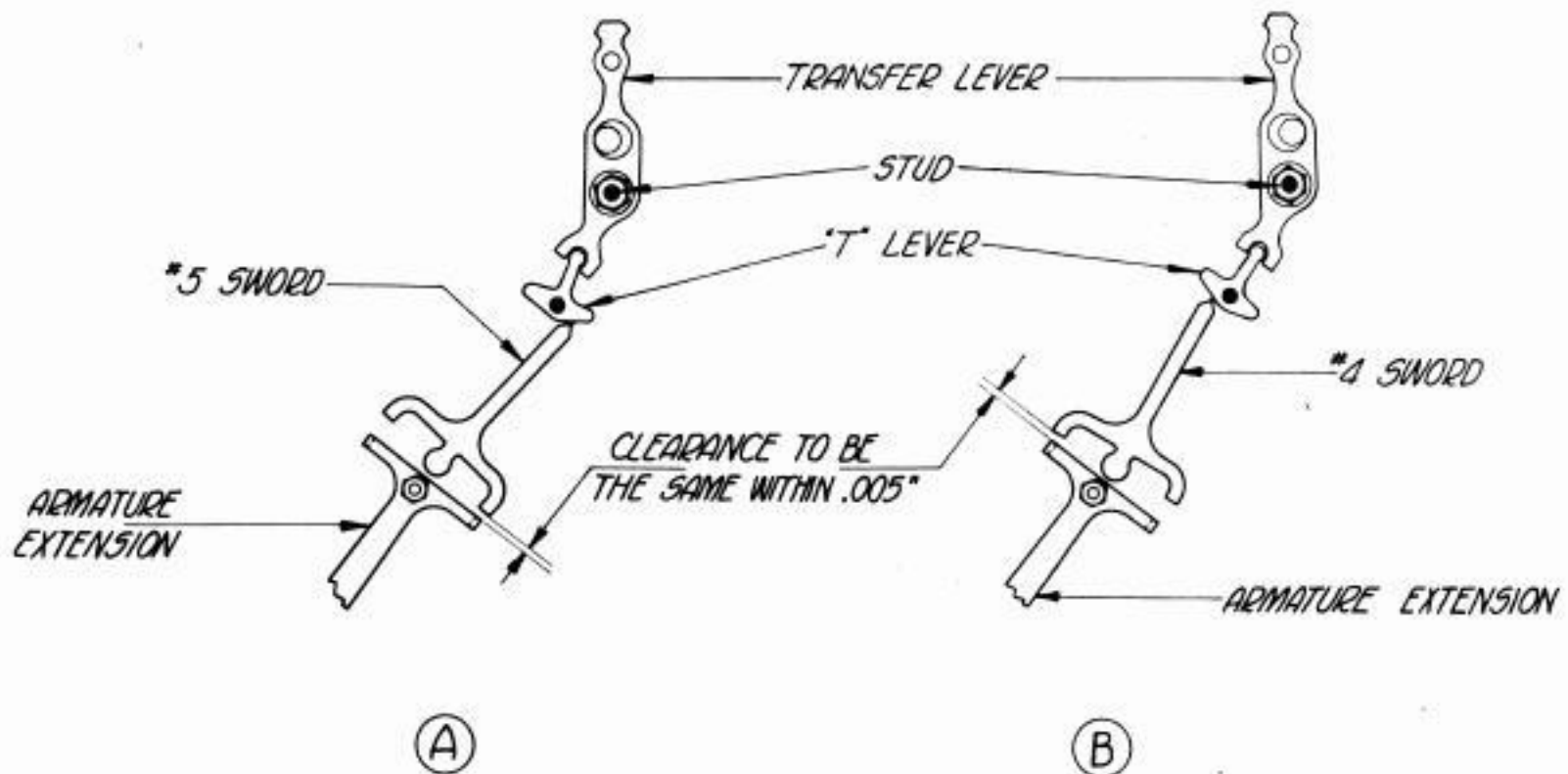


FIGURE 14

#### Lock Bail Position

Set up the "Y" combination and rotate the main shaft until the punch hammer is in its extreme upward position. The edge of the lock bail should be firmly seated between at least two transfer levers, one in the marking position and one in the spacing position. To adjust, position the lock bail, by means of the eccentric shaft using the upper semi-circle of the adjustment only (See Figure 15).

#### Roller Arm Position (Figure 15)

With the main shaft in its stopped position, and the transfer levers held in the center of their travel, there should be a clearance of from .025" to .040" between the top of any transfer lever and the edge of the lock bail. To obtain this clearance, adjust the position of the roller arm by means of its mounting screws.

#### Lock Bail Spring Tension

With the selector cam sleeve in its stop position, hook a 32 oz. scale at the center of the locking edge of the bail (See Figure 15) and pull upwards. It should require from 6 to 10 ozs. to start the bail moving.

#### Punch Hammer Pivot Screws Adjustment

With the punch hammer in its lower (unoperated) position, the punch levers should line up with their respective punch block tape pins, and the punch hammer should have some end play, not more than .004". Adjust the punch hammer pivot screws to obtain these requirements.

#### Feed Roll End Play Adjustment

The feed roll should have some end play, not more than .004". To adjust, add or

NOTE: After making a single adjustment, check related adjustments.

remove shims between the feed roll bearing plate and the punch block.

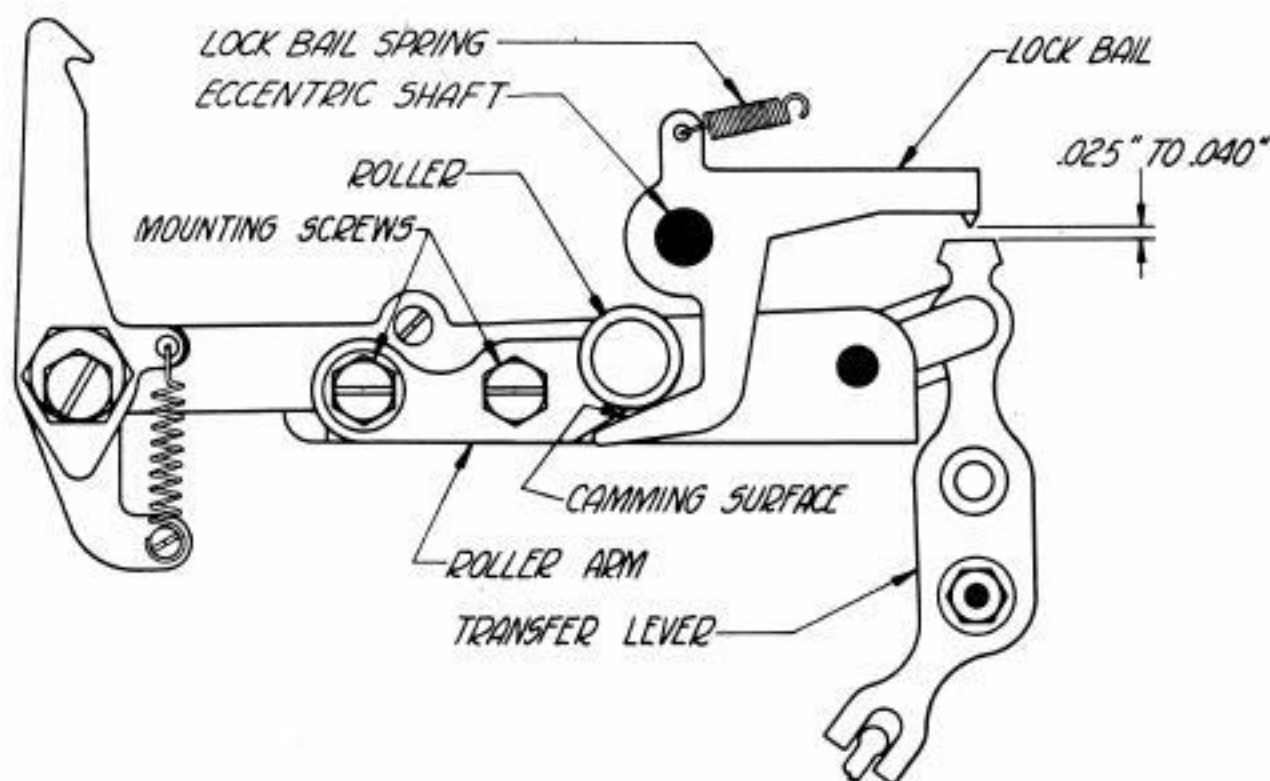


FIGURE 15

Tape Feed Roll Bearing Plate Adjustment

With the feed pawl, tape tension lever, and feed roll detent lever held away from the feed roll, the feed roll should be free to turn without any tendency to bind. To adjust, position the feed roll bearing plate by means of its mounting screws.

Tape Tension Lever Stud Adjustment (Figure 17)

The sides of the slot in the tape tension lever should not touch the pins on the tape feed roll when the play in both the feed roll and the tape tension lever is taken up in opposite directions. To adjust, position the tape tension lever stud by means of shims between the stud and the mounting bracket.

Tape Feed Roll Detent Spring Tension (Figure 16)

Hook a 32 oz. scale over the end of the detent lever at the spring hole, and pull in line with the spring. It should require from 24 to 32 ozs. to start the roller moving away from the star wheel.

Tape Stripper Plate Adjustment

There should be some clearance, not more than .010", between the upper edge of the tape stripper plate and the feed roll. Try one complete revolution of the feed roll. Adjust the tape stripper plate by means of its mounting screws to obtain this requirement.

Tape Tension Lever Spring Tension Adjustment (Figure 17)

With an 8 oz. scale hooked over the end of the tape tension lever, pulling at right angles, a tension of from 5 to 5 1/2 ozs. should be required to start the lever moving. To adjust, loosen the tape tension lever stud lock nut, and adjust the stud, by rotating it (clockwise to increase tension) to obtain the foregoing requirement. Tighten the stud lock nut.

Tape Feed Roll Detent Preliminary Adjustment (Figure 16)

With the punch arm roller on a high part of its cam, insert the feed roll position

NOTE: After making a single adjustment, check related adjustments.



gauge (catalog No. 84067 for six-unit, No. 73517 for five-unit) into the punch block so that the projection of the gauge stops against the punch block feed pin. Under this condition a pin of the feed roll should line up with the center hole on the gauge. To obtain this requirement, adjust the position of the feed roll, by means of the feed roll detent eccentric.

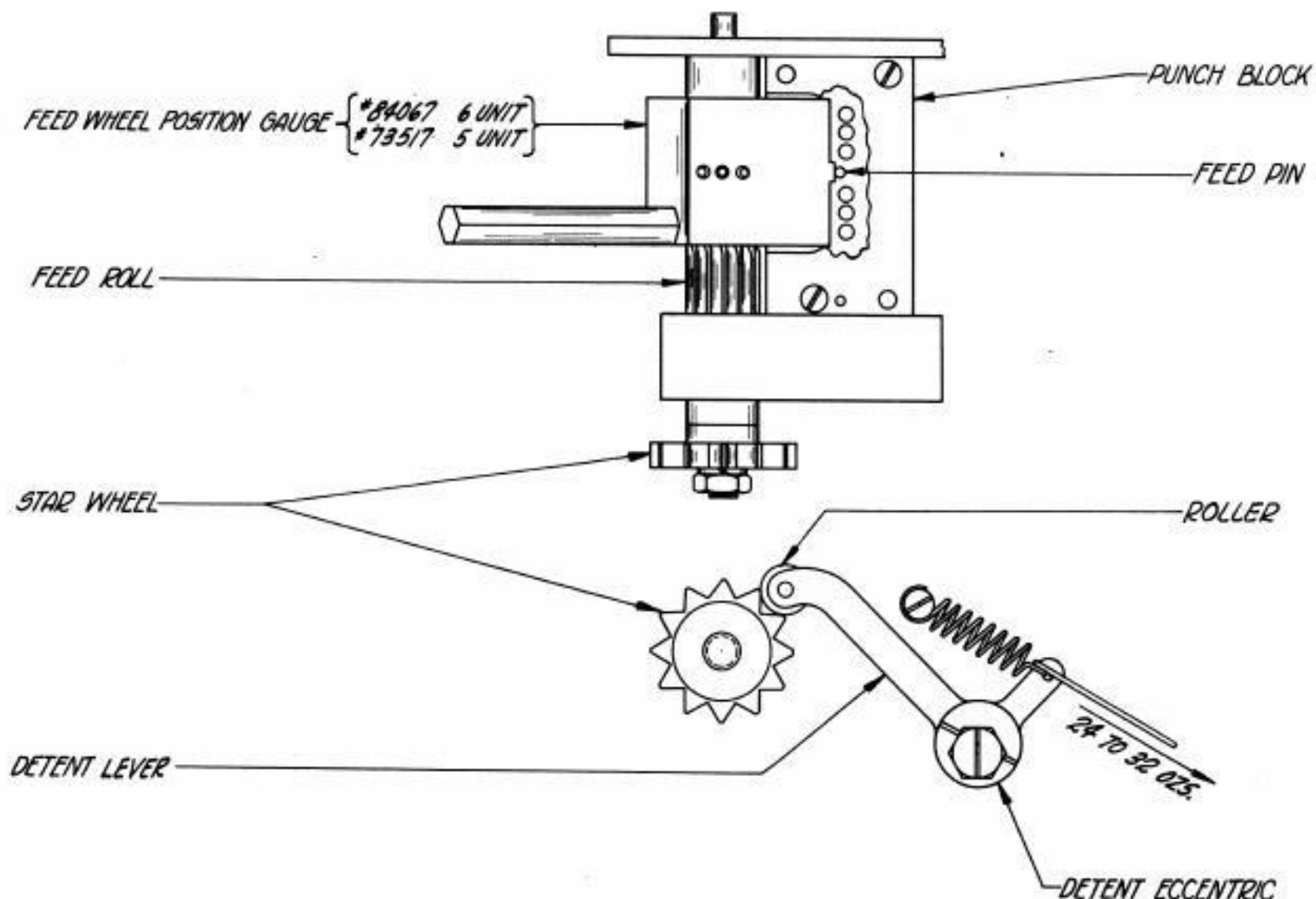


FIGURE 16

Tape Feed Pawl Eccentric Adjustment (Figure 18)

Rotate the main shaft until the selected punch levers just touch the ends of the punch pins. Under this condition the feed pawl should engage a tooth on the feed roll ratchet without overtravel. Adjust the feed pawl eccentric to meet this requirement.

Tape Feed Pawl Spring Tension (Figure 18)

Hook an 8 oz. scale in the notch in the feed pawl and pull horizontally to the left. It should require from 1 1/2 to 3 ozs. to start the feed pawl moving.

Tape Feed Roll Detent Final Adjustment (Figure 19)

The perforated tape should meet the standard spacing of ten feed holes to the inch. This may be checked by perforating a length of tape consisting of a series of nine "blanks" followed by a "rub-out" and checking it against the tape gauge (catalog No. 2215). Refine the adjustment of the feed roll detent eccentric to obtain this requirement.

NOTE: If this adjustment is changed, recheck the "Tape Feed Pawl Adjustment".

NOTE: After making a single adjustment, check related adjustments.

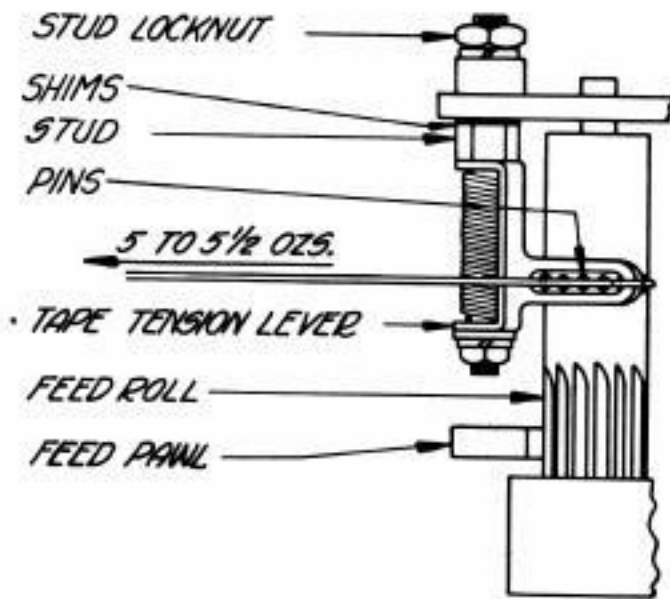


FIGURE 17

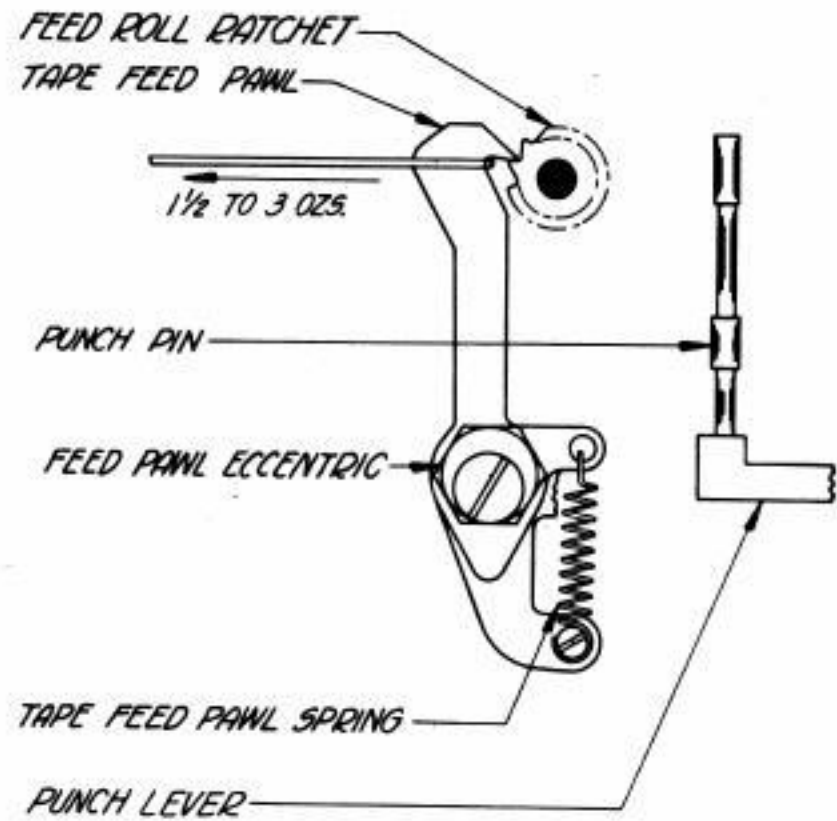


FIGURE 18

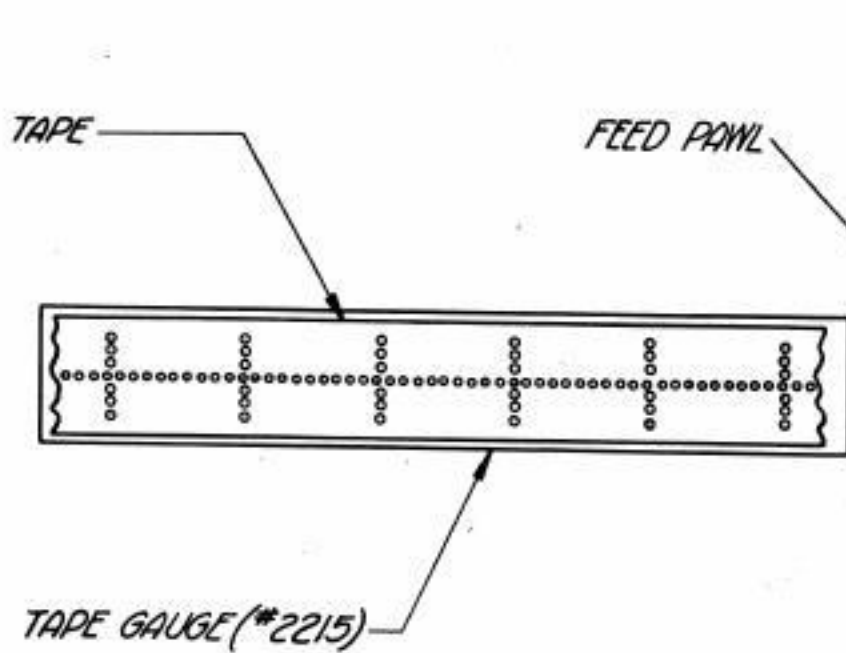


FIGURE 19

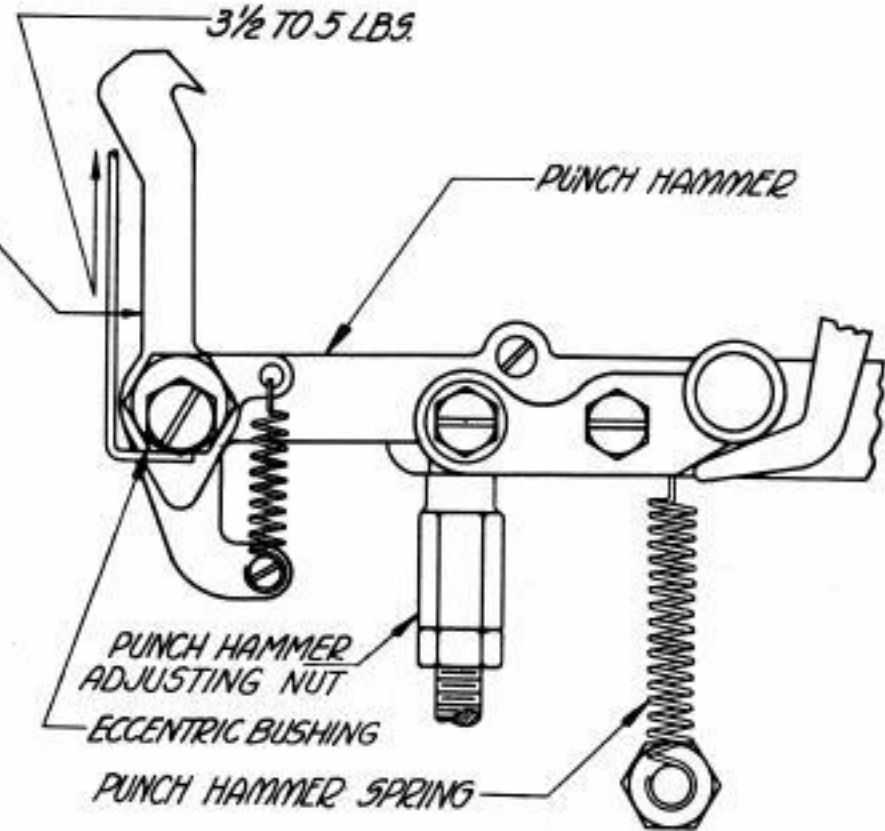


FIGURE 20

Tape Guide Adjustment

The tape guide should be positioned so that the tape may be readily inserted into the punch block. Adjust the tape guide by means of its mounting screws.

Punch Hammer Spring Tension (Figure 20)

With the main shaft clutch disengaged and the lock bail held away from the transfer levers, hook a 12 lb. scale under the eccentric bushing of the feed pawl and pull upwards. It should require from 3 1/2 to 5 lbs. to start the punch hammer moving.

NOTE: After making a single adjustment, check related adjustments.

### Space-Out Lever Adjustment

The space-out lever should move freely in its guides. To obtain this condition, adjust the space-out lever guide post by means of its lock nut.

With the space-out lever in the down position, the trip latch should clear the stop lever by from .005" to .015" (Figure 21). Adjust by bending the lower end of the space-out lever.

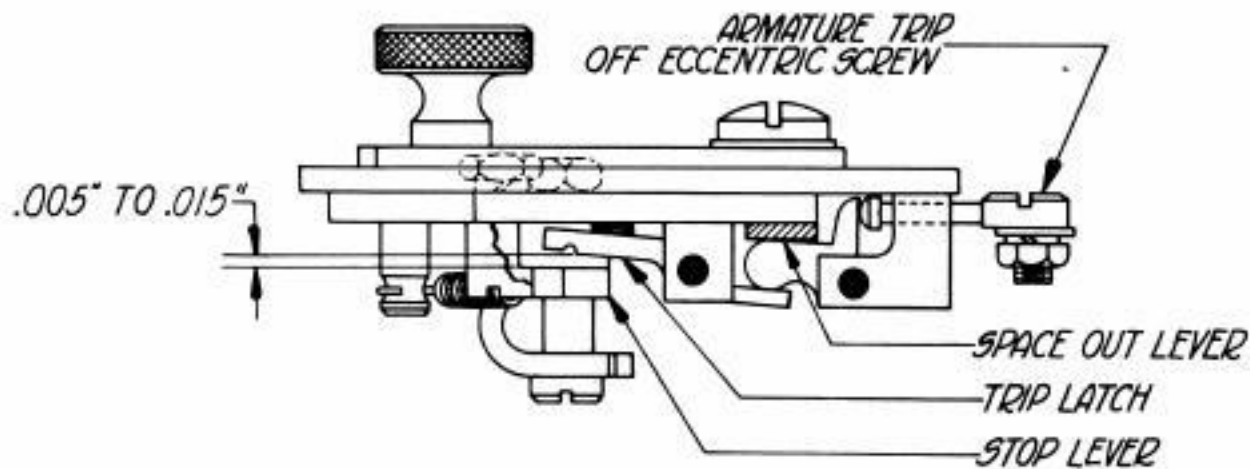


FIGURE 21

### Space-Out Lever Spring Tension

Push down on the top of the manual space-out lever with an 8 oz. scale. It should require a pressure of from 5 to 8 ozs. to start the lever moving.

## ADJUSTMENTS FOR THE CENTER CONTACT GOVERNOR

### Speed Adjusting Wheel Friction Washer Spring Pressure (Figure 22)

To measure this requirement, remove the governor adjusting bracket, the brush spring plate, and the governor cover. Rotate the speed adjusting wheel to a point where the governor contact pressure is from 13 to 14 ozs. as indicated by hooking a 32 oz. scale over the contact spring next to the contact point and pulling parallel to the speed adjusting spring. Then insert a bank pin (radially) in the leather rim of the speed adjusting wheel and hook a 32 oz. scale over the pin at the periphery of the adjusting wheel and pull horizontally at right angles to the pin. It should require from 8 to 16 ozs. to start the wheel moving. To adjust the friction, remove friction washer and bend the large projections.

### Inner and Outer Disc Contact Spring Adjustment (Figure 23)

The inner and outer disc contact springs should conform to the following requirements, which may be checked by removing the governor cover, target and brush spring plate:

- (a) The distance from the inside surface of the governor cover to the highest point on the contact springs should be from  $25/32$ " to  $27/32$ ".
- (b) Place a "D" (138-26) socket wrench over the nut, located in the center of the governor cover, that is used to hold the contact springs in place. With a 6" 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 should be from  $17/32$ " 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. This should be from  $7/16$ " to  $1/2$ ".

NOTE: After making a single adjustment, check related adjustments.



These requirements may be obtained by bending the contact springs. Replace the governor cover, target and brush spring plate.

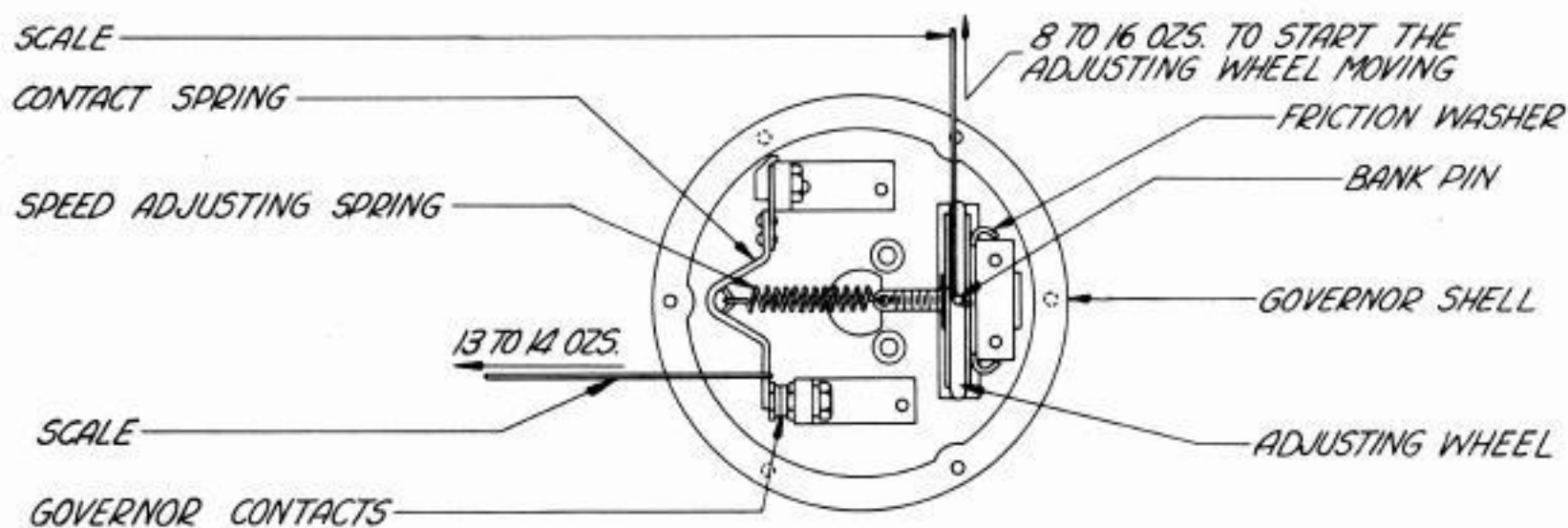


FIGURE 22

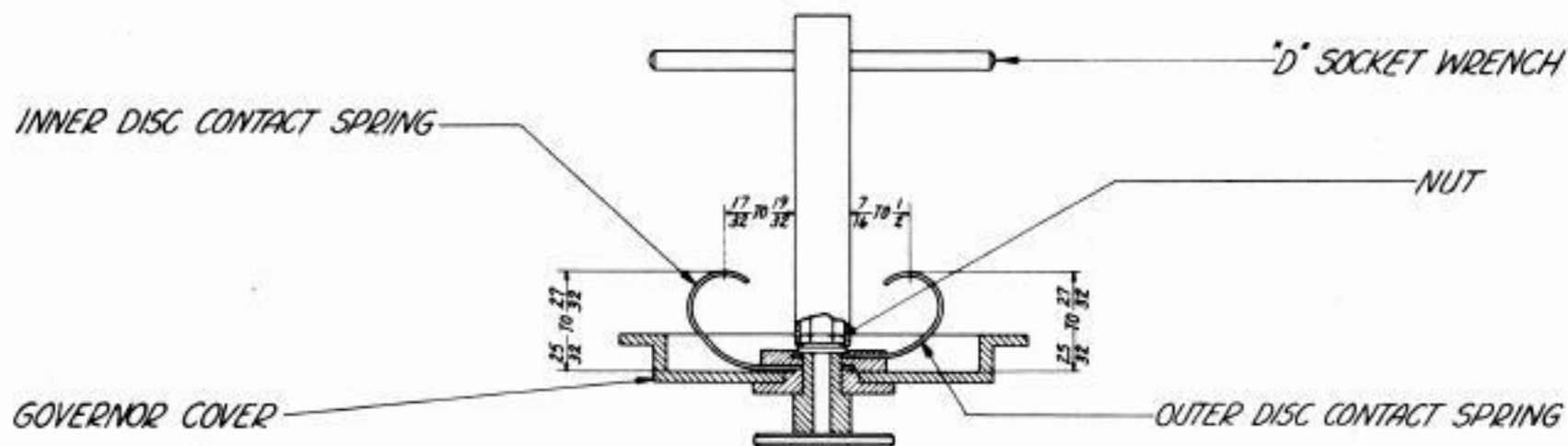


FIGURE 23

Governor Brush Spring Plate Bracket Adjustment

The governor brush spring plate bracket should be set so that:

- (a) A line through the center of the outer disc also passes through the centers of both contact brushes (Figure 24).
- (b) The surface of the brush spring plate bracket, on which the brush spring plate is mounted, aligns with the outer surface of that part of the governor cover on which the target is mounted (Figure 25).
- (c) The bracket is parallel to the edge of the motor base plate. Adjust the brush spring plate bracket by means of its enlarged mounting holes.

Governor Brush Spring Pressure (Figure 25)

- (a) Inner Disc Brush Spring: Hook an 8 oz. scale over the inner spring just in front of the carbon contact brush. Pulling horizontally away from the motor, it should require from 4 1/2 to 5 1/2 ozs. to start the brush moving away from the disc.

NOTE: After making a single adjustment, check related adjustments.

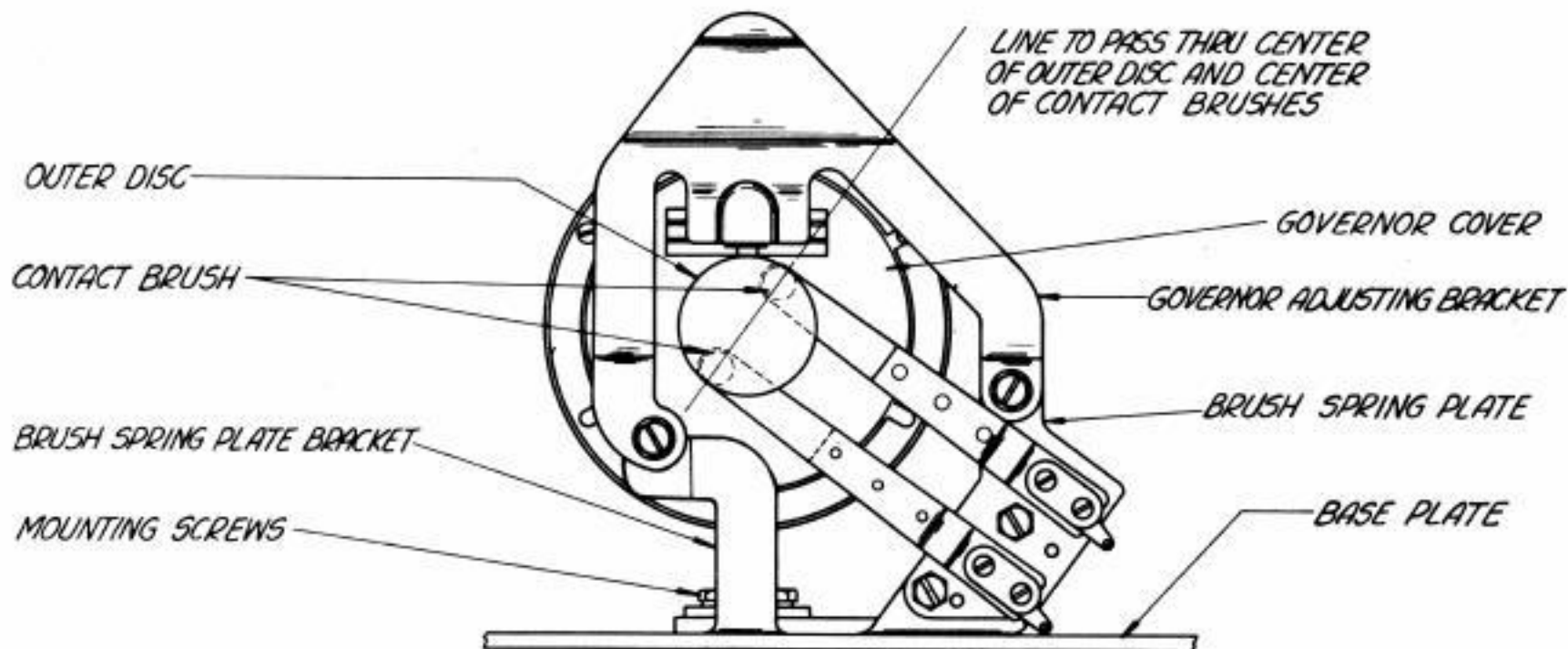


FIGURE 24

(b) Outer Disc Brush Spring: Apply an 8 oz. push scale against the outer brush spring, just in front of the carbon contact brush. Pushing horizontally toward the motor, it should require from 4 1/2 to 5 1/2 ozs. to start the brush moving away from the disc.

To obtain the correct brush spring pressure, remove and bend the brush springs. When the springs are replaced and the pressure obtained, take care that the contact brushes lie flat against their respective discs, and that the outer edges of the brushes are either flush with, or not more than 3/64" inside the outer edges of the discs.

Replace the governor adjusting bracket.

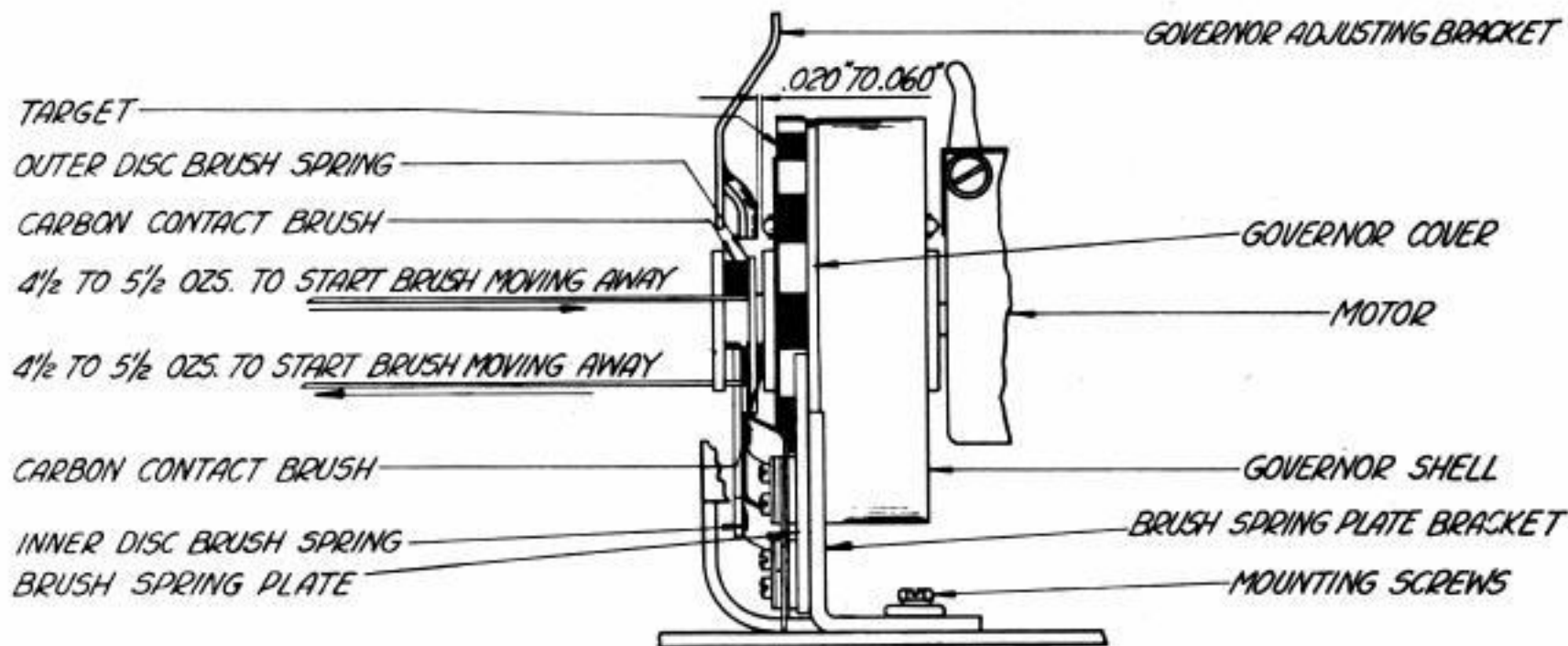


FIGURE 25

NOTE: After making a single adjustment, check related adjustments.

### Governor Adjusting Bracket Adjustment (Figure 25)

The adjusting surface of the governor adjusting bracket should clear the speed adjusting wheel by from .020" to .060". Bend the governor adjusting bracket if necessary to secure this clearance.

### SYNCHRONOUS MOTOR ADJUSTMENTS

NOTE: These adjustments should not be made unless there is reason to believe that the starting switch is out of adjustment.

#### Starting Switch Adjustment (See Figure 26)

It is important that the starting switch be properly adjusted, for if the starting switch fails to open, leaving the starting winding on continuously, the motor starting winding will burn out. If the starting switch fails to close altogether, the motor will not start. To adjust the starting switch, proceed as follows:

- (a) Remove the motor fan, or handwheel, if motor is equipped with handwheel.
- (b) Take out the switch end shield screws and pull out the switch end shield about half an inch.

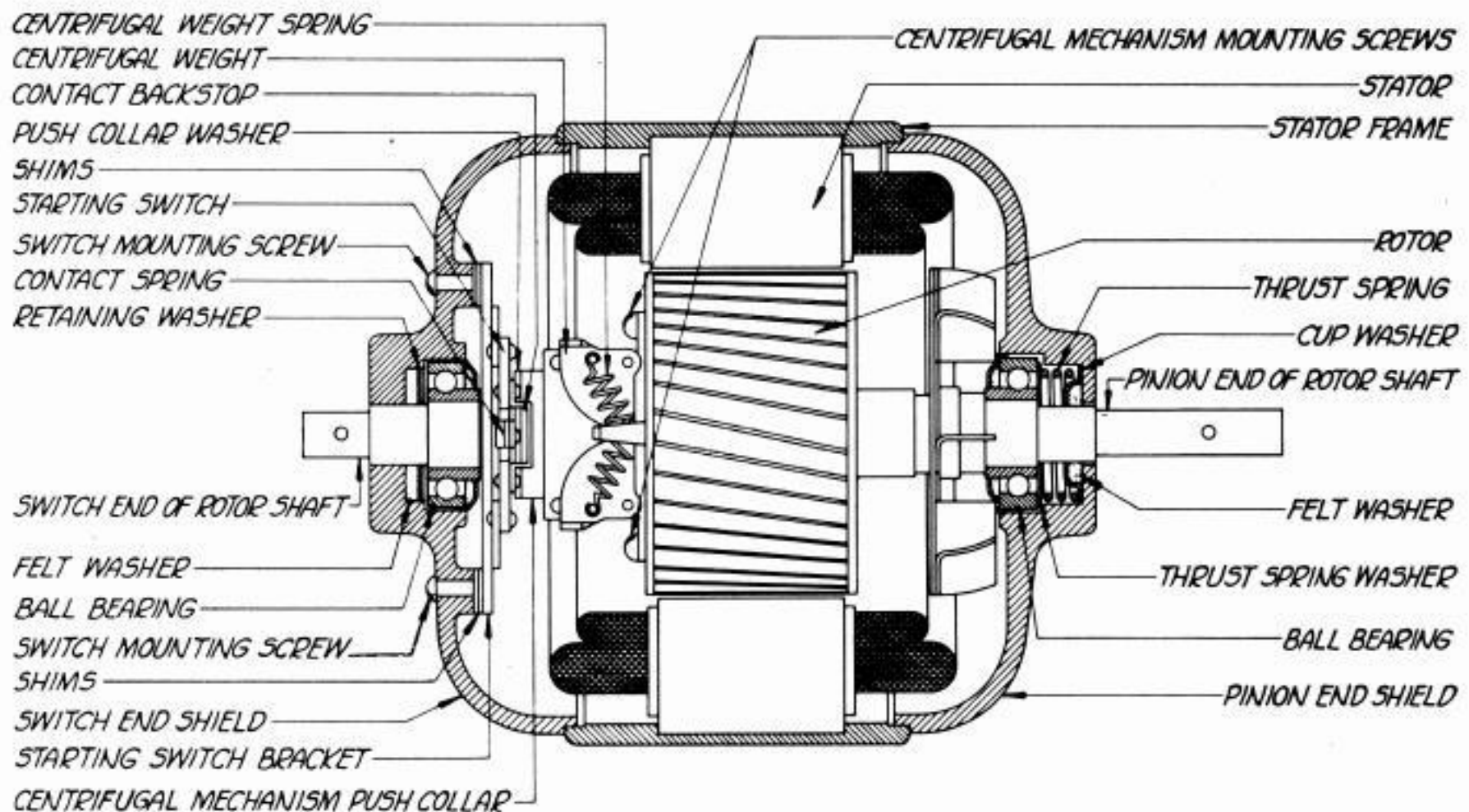


FIGURE 26

- (c) Remove the two switch mounting screws, taking care that the shims between the switch bracket and end shield are not lost.
- (d) Centrifugal Weight Springs Tension: Remove the centrifugal weight springs and check the weights and centrifugal mechanism push collar for freeness. Check the tension of these springs as follows: With one end of the spring held stationary, hook an 8 oz. scale in the other end and pull until the spring measures 1 3/4" over-all. The reading should be 3 3/4 ozs. to 4 1/4 ozs. Replace the springs.

NOTE: After making a single adjustment, check related adjustments.



- (e) Starting Switch Contact Spring Tension: With the starting switch contact spring resting against the contact backstop and the bracket held so that the spring clears the rotor shaft and the centrifugal mechanism push collar, apply a gram scale to the spring at the contact. It should require from 10 to 20 grams to start the contact spring moving away from the backstop.
- (f) Replace the switch end shield on the shaft.
- (g) Remount the starting switch on the switch end shield. Tighten the two switch mounting screws together so as to avoid the possibility of the bearing sticking in the end shield or bending switch parts.
- (h) Starting Switch Contact Bracket Adjustment: A test set consisting of resistors and a milliammeter wired as shown on Figure 27 is used in connection with this adjustment. With a 110 volt D.C. battery and motor connected as shown, it may be seen that when the starting switch contacts are closed, no current will flow through the meter. With the contacts open, however, battery will flow through the meter limited by the resistors and motor windings.

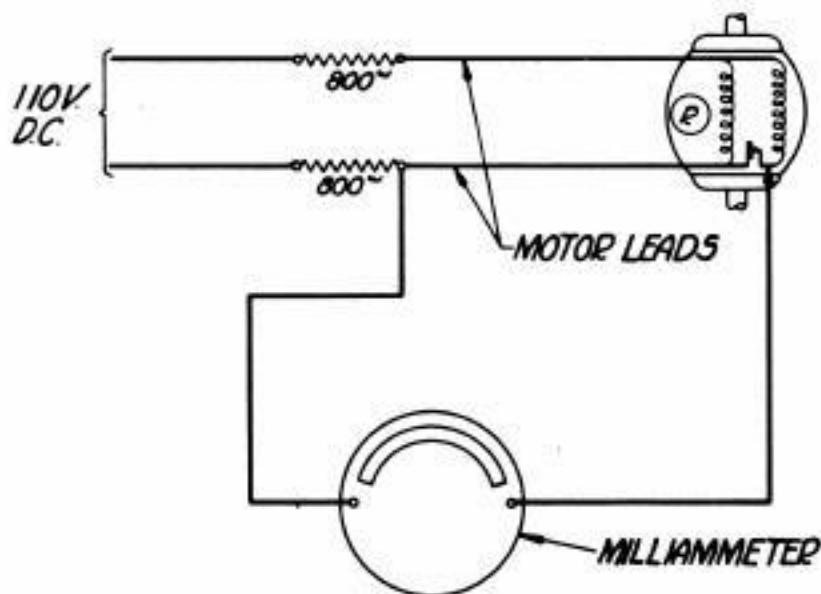


FIGURE 27

- (i) With the test set connected to the motor as shown in Figure 27, check the starting switch contact bracket adjustment as follows: Set the No. 82862 collar on the rotor shaft at the switch end of the motor, so that there is 1/32" clearance between the collar and the motor casting. (The No. 82862 collar is not a part of the motor, but is a tool for use in checking this adjustment.) Press against the end of the rotor shaft until the collar is against the end casting, and slowly turn the rotor one complete revolution, observing the meter on the test set. The meter needle should remain on zero indicating that the contacts remained closed. If the contacts opened, shims should be added between the starting switch bracket and the motor end shield.
- (j) Loosen the collar set screw and relocate the collar so that there is 1/16" clearance between the collar and the casting. The rotor shaft should again be pressed until the collar is against the casting and slowly turned one complete revolution. During this time the meter should read not less than .010 ampere, indicating that the contacts remain open. If the contacts close, shims should be removed from between the starting switch bracket and the motor end shield. Remove the No. 82862 collar from the rotor shaft.
- (k) NOTE: Care should be taken that the shim pile-up is equal on both sides of the switch bracket.

NOTE: After making a single adjustment, check related adjustments.

- (1) Check to see that the rotor shaft has end play and that the end play is taken up by the thrust spring.

#### Removing and Replacing Starting Switch or Centrifugal Mechanism (Figure 26)

It will be necessary to remove the ball bearing on the switch end of the rotor shaft in case the starting switch or the centrifugal mechanism has to be replaced.

When handling bearings, it is of the utmost importance that no dirt be allowed to enter the bearing. Dirt, grit, dust, or foreign matter of any kind acts as an abrasive, which, when ground between the revolving balls, will wear out the races. Before replacing, it is well to wash the bearing in kerosene or gasoline and then spin the bearing to remove the dirt. When laying a bearing down, lay it on a clean piece of paper - never on a dirty bench or table top. New bearings should not be unwrapped until ready to be used.

To remove the bearings, it is necessary to remove the motor from the reperfurator. Proceed as follows:

- (a) Remove the motor from the reperfurator and remove the fan (or handwheel, if motor is equipped with handwheel) and motor pinion.
- (b) Take out the end shield screws at both ends and remove the pinion end shield.
- (c) Pull out the switch end shield slightly and remove the switch mounting screws, being careful not to lose the shims.
- (d) Disconnect the stator leads connected to the starting switch.
- (e) Remove the bearings or the bearing which needs to be removed. A bearing puller should be used, and care should be taken so as not to dent the brass covering that encloses one face of the bearing, or burr the shaft. Never use a hammer, chisel or any tool of that nature directly against the face of the inner or outer ring.
- (f) Assemble one ball bearing on the pinion end of the rotor shaft (if this bearing was removed) with the enclosed face of the bearing facing towards the rotor. Before replacing the bearing, wipe the shaft clean and examine for burrs or corrosion. If necessary, use emery cloth, dressing down the shaft just enough to remove the inequalities of the surface and any burrs on the shaft shoulder, to insure proper seating of the bearing. Now wipe the shaft clean and apply a little machine oil to the part of the shaft that seats the bearing.

The bearing has what is known as a "light tap" fit. That is, the bearing fits on the shaft so that a series of light taps will drive it in place. The best tool is a piece of pipe or tubing, preferably of brass, which is just large enough to slip over the shaft and will bear on the inner ring. Never apply pressure of any kind to the outer ring, the balls, or the retainer, as this is likely to injure the bearing. It is absolutely essential that the bearing be started straight and the blows be light. See that the bearing is solidly up against the shaft shoulder.

- (g) Assemble the centrifugal mechanism to the shaft, mounting it on the rotor by means of the two centrifugal mechanism mounting screws.
- (h) Place the push collar washer on the switch end of the rotor shaft in front of the centrifugal mechanism push collar.
- (i) Insert the rotor partly in the stator with the switch end partly out of the frame.
- (j) Place the starting switch on the shaft, against the push collar washer with the contact spring towards the rotor. Solder the two wires that are tied together to the upper terminal on the starting switch (the contact points are at the upper end of the starting switch).

NOTE: After making a single adjustment, check related adjustments.



- (k) Press one ball bearing in place on the switch end of the rotor shaft with the enclosed end of the bearing facing the rotor. (Follow instructions under f.)
- (l) Assemble in the pinion end shield the following in the order given: felt washer, cup washer, thrust spring, thrust spring washer.
- (m) Place a felt washer and the retaining washer in that order in the switch end shield.
- (n) Slide the switch end shield over the switch end of the rotor shaft inserting the ball bearing in the machined recess of the switch end shield.
- (o) Adjust the starting switch - following the instructions given under Starting Switch Adjustments.
- (p) Replace the motor pinion and fan. Before remounting the motor on the reperforator, check the tension of the thrust spring by applying a 12 lb. push scale against the fan end of the shaft and parallel with the shaft. It should require at least 7 lbs. pressure to just start the shaft moving.

### Speed Setting

When reperforators are equipped with A.C. or D.C. governed motors, a tuning fork is used for the purpose of regulating the motor speed. The fork is equipped with shutters attached to the ends of the tines.

On the rim of the motor flywheel is attached a speed target of alternate black and white spots (Figure 24).

To check speed, tap the fork lightly to start it vibrating. Hold the fork close to the eye and view the moving spots on the flywheel through the fork shutters. If the motor is running at the correct speed, the spots will appear to be stationary. If the motor is running fast, the spots will appear to be moving in the direction in which the motor is rotating; if slow, in the opposite direction. The motor speed may be increased by pushing against the speed adjusting lever (Figure 24) (mounted on top of the motor next to the flywheel). The speed may be decreased by pressing the governor adjusting bracket (Figure 23) toward the flywheel, so that the finger on the bracket comes into contact with the adjusting wheel on the governor.

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 through the fork shutters. This fact should be kept in mind if trouble is experienced in the operation of the reperforator.

No speed setting is required on reperforators equipped with synchronous motors, since they are constant speed motors.

### Orientation

Before taking the orientation range, set the armature spring to a position where it will measure 6 to 6 1/2 ozs. tension on units equipped with solid core magnets, and exactly 8 ozs. with laminated core magnets.

Now "RY" for (five-unit) and "4Y" for (six-unit) should be transmitted to the reperforator (the characters "R" and "Y" or "4" and "Y" sent alternately) continually while the range is being taken.

While "RY" or "4Y" is being received, loosen the thumb screw and shift the range finder toward "zero" until errors begin to appear. Then move it back slowly until these errors disappear. This position indicates one limit of the orientation range. Note the position on the scale.

Repeat the same performance toward the opposite end of the scale to find the other limit.

---

NOTE: After making a single adjustment, check related adjustments.



After the two limits (or extreme positions of perfect perforating) have been found, the range finder should be set midway between these two points.

On six-unit reperforators, disregard the following two paragraphs:

Now turn the armature spring adjusting screw in a clockwise direction until errors show in the "RY". Then from this point count the number of turns in a counter-clockwise direction necessary to bring the spring to its high limit (where "RY" fails). Half this number of turns backward (in a clockwise direction) will position the adjusting screw midway between its two failing points or in the middle of the armature spring range. Lock the screw here.

The orientation range should be rechecked after the armature spring range has been taken.

#### Line Current

Between 50 and 60 milliamperes at 110 volts direct current is required for the operating coils.

#### Operating Coil Resistance

The 110 volt solid magnet core coils (M-177) measure 105 ohms each. The 110 volt laminated magnet core coils (M-197) measure 115 ohms each.

### LUBRICATION SPECIFICATION

The oil and grease specified in the supplement furnished with this bulletin should be used to lubricate the reperforator.

Unless otherwise specified, one or two drops of oil at each of the places indicated will be sufficient. Use oil for lubrication at all places listed below, except where the use of grease is specified.

#### Selector Unit

NOTE: Be careful not to get oil between the pole faces of the selector magnets and the armature.

1. Armature bearings - 2.
2. Trip latch plunger, trip latch, bell crank, and stop lever of range finder assembly.
3. Swords and selector levers - drop oil between separating plates.
4. Selector "T" levers - all points of contact.
5. Armature locking lever.

#### Main Shaft

1. Hold front of reperforator up several inches and fill shaft with oil.
2. Locking lever cam felt washer - saturate.
3. Selector cam friction washers - saturate.
4. Main cam friction disc - saturate.
5. Ball bearings - 2.
6. Clutch throw-out lever - 2 bearings.
7. Clutch - oil freely.

8. Compression springs (3) - allow oil to flow into prongs under springs.
9. Oil hole in cam bushing.

Punch Arm Shaft

1. Bearing blocks - 2 oil holes.
2. Cam roller - grease.
3. Adjusting screw.

Reperforator Bracket

1. Punch block oil hole.
2. Feed roll bearing - 2.
3. Detent roller and eccentric.
4. Lock bail - 2 bearings.
5. Punch hammer - 2 bearings.
6. Transfer levers - all points of contact.
7. Punch levers - all points of contact.
8. Lock bail roller.
9. Feed pawl.
10. Tape reel oil hole.
11. Tape retainer hinge.
12. Space-out lever guide screws - 2.
13. Punch hammer spring anchors - grease.
14. Detent lever spring anchors - grease.
15. All spring anchors except 13 and 14 - oil.

Motor Unit

1. Motor pinion - grease.
2. Motor bearings - two ball oilers - use grease according to instructions contained in the supplement furnished with this bulletin, or one drop of oil in each ball oiler.
3. Speed adjusting lever pilot screw.

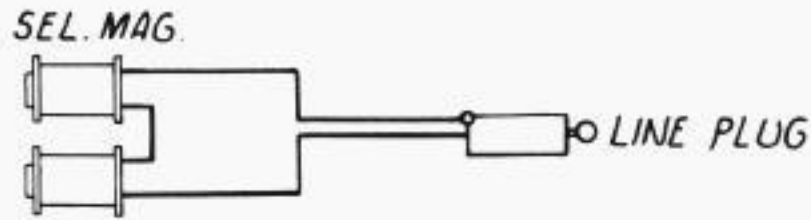
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REPERFORATOR ADJUSTMENTS

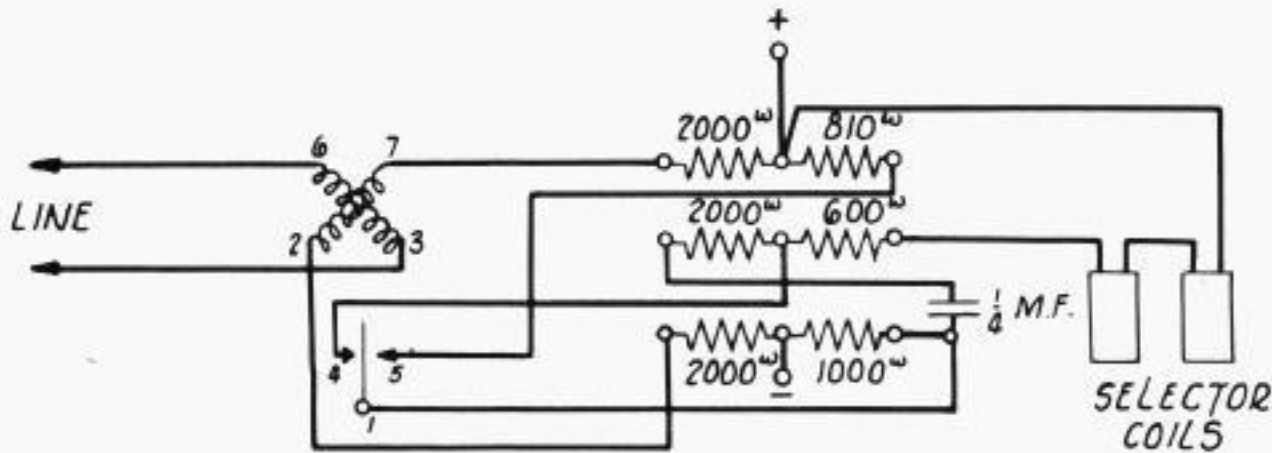
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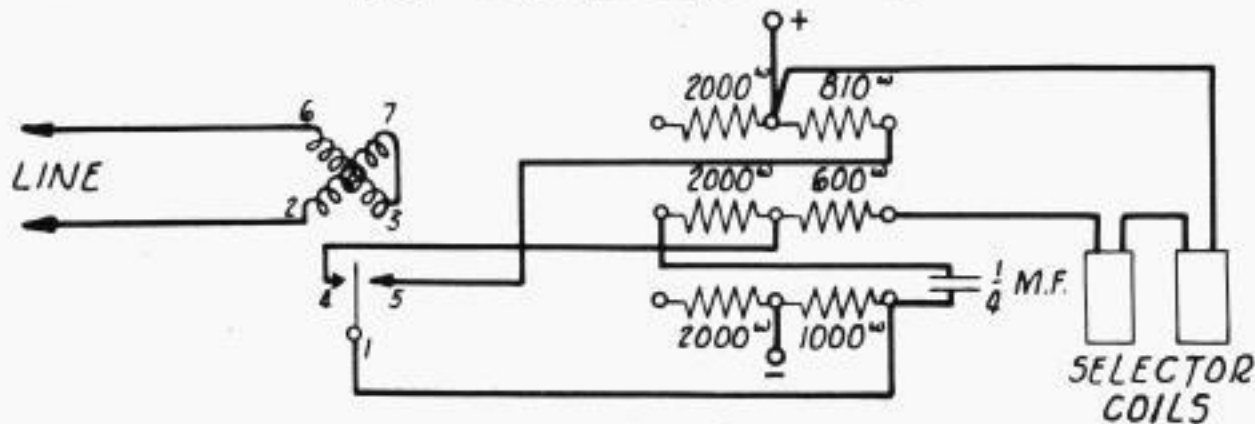
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THEORETICAL LINE CIRCUIT  
WITHOUT LINE RELAY



THEORETICAL RELAY CIRCUIT  
FOR NEUTRAL LINE SIGNALS



THEORETICAL RELAY CIRCUIT  
FOR POLAR LINE SIGNALS

TELETYPE  
CORPORATION

W.D. 1591  
JAN. 29, 1936

THEORETICAL  
WIRING DIAGRAM  
#14 AND #20  
TYPE  
REPERFORATORS

DRAWN H.W.H.  
TRACED E.W.  
CHECKED E.F.R.  
ENG'D. H.W.H.  
APPROVED

*J.P.*