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# TELETYPE

PRINTING TELEGRAPH SYSTEMS

DESCRIPTION AND ADJUSTMENTS

PERFORATOR TRANSMITTER  
(MODEL 15)



REG. U.S. PAT. OFF.  
CORPORATION  
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## DESCRIPTION

### GENERAL

The Model 15 perforator transmitter is a combination transmitter and perforator with an electrically operated character counter. It is inserted in the base of a Model 15 printer when the Model 15 printer is used in conjunction with a Model 19 table and a Model 14 transmitter distributor. When this combination of units is used together, it is known as a Model 19 printer set.

The perforator transmitter is furnished with the character counter mounted either to the left or to the right of the unit, as is illustrated in Figures 1 and 3. When the counter is mounted to the right of the unit, a separate cover is provided for it. When mounted to the left of the unit, the counter is covered by an extension of the printer cover. Two complete printer sets, with Model 15 perforator transmitters and covers, are illustrated in Figures 2 and 4.

A manually operated, three position keyboard control operating lever is mounted at the right-hand end of the unit. The selection of any one of the four methods of operation may be made by placing this operating lever and the line test key in one of the following positions:

(A) OPERATING LEVER IN UPPER OR "KEYBOARD" POSITION

Direct keyboard transmission to the line with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set.

(B) OPERATING LEVER IN MIDDLE OR "KEYBOARD AND TAPE" POSITION

Simultaneous direct keyboard transmission to the line and perforation of tape with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set.

(C) OPERATING LEVER IN LOWER OR "TAPE" POSITION

Perforation of tape only, with the associated printer either receiving messages from a distant station, or monitoring the message perforated in the tape as it is being transmitted to the line by a transmitter distributor.

The character counter registers each time a character or space key is depressed and returns to its zero position when the "Carriage Return" key is depressed. Operation of the "Letters," "Figures," or "Line Feed" key levers does not cause the character counter to register. The counter is provided with a signal lamp to indicate when the end of a line is being approached. The maximum speed of the keyboard in this case is not limited to the predetermined speed of the set and the operator may, therefore, perforate tape at speeds much higher than the speed at which a tape transmitter would send to the line.

(D) OPERATING LEVER IN MIDDLE OR "KEYBOARD AND TAPE" POSITION AND SET CONNECTED FOR LOCAL OPERATION

It is also possible to perforate tape and print a home record without transmitting directly to the line when the set is connected for local operation. This method is helpful in preparing perforated tape for use in connection with printed forms. The maximum speed of the keyboard is limited to the predetermined speed of the set.

SIGNALING CODE

The signaling code used to transmit characters is the "Start-stop" five-unit code, which consists of five selecting impulses used in various combinations of current and no-current intervals. Each group of five selecting impulses is preceded by a start impulse and followed by a stop impulse, which are used to maintain synchronism between stations on the circuit. Impulses which energize the selector magnets on the printer are known as marking, and those which do not are known as spacing. Figure 10 shows the five-unit code chart.

DIRECT KEYBOARD MECHANISM

The direct keyboard mechanism (Figures 5 and 6) is mounted on the keyboard casting, and consists essentially of a set of key levers, selector bars, "Y" levers, "Y" lever connecting links, and locking levers used in selecting the code combination to be transmitted; a transmitting cam sleeve assembly, contact levers and contact springs for transmitting the selected code; a universal bar, trip-off pawl, intermediate pawl, clutch throwout lever, and clutch used in starting and stopping transmission. The transmitting cam sleeve and its controlling clutch are supported by a transmitting shaft, which derives its motive force from a gear mounted on the main shaft of the typing unit. This gear engages a drive gear on the rear end of the transmitting shaft of the perforator transmitter. The transmitting cam sleeve assembly is normally held stationary due to disengagement of the clutch teeth by the clutch throwout lever.

Beneath the key levers are five pairs of parallel motion selector bars, a counter control contact operating mechanism, and a universal bar, which extends across the width of the keyboard. The selector bars are guided at both ends so that they may be moved upward or downward. They are provided with rectangular notches on their upper edges according to the requirements of the code. The notches in the front and rear selector bars of each pair are staggered so that there will always be a high portion on one of the pair in the path of each key lever. The ends of each pair of selector bars rest on the arms of "Y" levers; the front bar of each pair resting on the left arms of the "Y" levers and the rear bar of each pair resting on the right arms.

When a key lever is depressed, those selector bars having their high portions in line with that key lever are moved downward. This causes the "Y" levers to move the other bar of each pair upward. Should the rear bar of any pair be moved downward, the lower extensions of the corresponding "Y" levers will be moved to the left; similarly, they will be moved to the right when the corresponding front selector bars are moved downward. Thus, it may be seen that the "Y" lever connecting links which are attached to the ends of the lower extensions of the "Y" levers will be moved to the left when the rear

selector bar is moved downward, and to the right when the front selector bar is moved downward. Each of the first five "Y" lever connecting links engages a locking lever and positions it to correspond with the signal impulse to be transmitted. Each locking lever controls the motion of a contact lever, either by allowing the contact lever to rotate on its pivot (due to the pressure exerted by the contact spring upon the contact lever, permitting the contact to close), or by engaging the contact lever, thus preventing closure of the contacts. If the upper end of the locking lever is positioned to the left, corresponding to a spacing impulse, it engages the contact lever and prevents it from rising into the indent of its cam as the cam sleeve rotates, thus holding the circuit open for that interval. If the upper end of the locking lever is positioned to the right, corresponding to a marking impulse, it does not interfere with the movement of the contact lever. Then, as the cam sleeve revolves, the contact lever riding on the cam surface rises into the indent of the cam, permitting its contact to close and to send out a marking impulse.

The universal bar, which is connected to the trip-off pawl, controls the starting of the transmitting cam sleeve. It is pivoted at both ends in such a manner that the depressing of any key lever rotates it downward, and moves the trip-off pawl forward. This action releases the clutch throwout lever from the driven member of the clutch by means of the intermediate pawl, thus permitting the transmitting cams to start rotating. As the cams rotate, the impulses are transmitted in succession.

The start-stop cam (Figure 6) controls an additional contact lever which, in turn, actuates the start-stop contacts. These contacts are opened at the beginning of each revolution of the cam sleeve assembly to transmit the start impulse (spacing or no-current interval), and remain open during the transmission of the five code impulses. After the last code impulse has been transmitted, the start-stop contacts will again close, sending the stop impulse (marking or current impulse) to the line. At the end of the revolution of the cam sleeve assembly, the clutch driven member is cammed out of mesh with the driving member by the clutch throwout lever, which prevents the cams from rotating until the next key lever is depressed.

The keyboard is equipped with a space repeat device which permits the continuous transmission of "space" signals when the keyboard control operating lever is in either the upper or the middle position. When the space bar is held depressed, the repeat space rod, (Figure 6) attached to the space bar loop extension, will move the intermediate pawl forward, and hold the clutch throwout lever out of engagement with the projection on the driven clutch. Thus the transmitting cam sleeve will be permitted to revolve continuously until the space bar is released.

#### PERFORATOR MECHANISM

Attached to the left side of the keyboard casting is a bracket which mounts the perforator mechanism. This mechanism consists essentially of a set of punches for perforating the tape; a punch magnet and armature lever for operating the punches; a set of selector fingers, selector levers and "Y" lever connecting link extensions, used in selecting the punches; and a tape feed mechanism (Figure 5).

The selector fingers rest in a slotted guide mounted on the armature lever just below the punches and in line with them. The right end of each selector finger is attached to a selector lever that pivots on a mounting bracket at its lower end. A "Y" lever connecting link extension connects the left end of each "Y" lever connecting link to the central portion of its corresponding selector lever in such a manner that each selector finger will move to the right or left in accordance with the movements of the "Y" lever connecting links. It should be noted that both the selector fingers and the locking levers respond to the code selection whenever a key lever is depressed.

The magnet armature is mounted on a centrally pivoted armature lever. When the armature is attracted, the right end of the armature lever moves downward and the left end rises carrying the left ends of the selector fingers upward. If a selector finger is in its left or operated position when the armature lever rises, the corresponding punch will be pushed through the tape. If a selector finger is in its right or unoperated position, it will clear the corresponding punch as it moves upward, and that punch will not perforate the tape.

When any key lever is depressed, the punch magnet is operated either by means of a pair of punch contacts, mounted on the perforator bracket (Figure 1 or 3), or by means of a set of cam pulsing contacts, located above the transmitting cam sleeve (Figure 1), or it may remain unoperated, depending on the setting of the keyboard control operating lever and its associated keyboard control contacts (Figures 1, 3, and 9).

With the keyboard control operating lever in its upper "Keyboard" position, all circuits controlled by the keyboard control contacts will be open. With these contacts open, the punch magnet cannot be energized. Only direct keyboard transmission is possible with the lever in its upper position.

With the keyboard control operating lever in the middle or "Keyboard and Tape" position, only the lower pair of keyboard control contacts are closed. This permits the punch magnet to be energized by means of the cam pulsing contacts. These contacts, of which there are two pairs, are wired in parallel and close as a result of their operating springs riding into the indents on two of the transmitting cams (Figure 8). The sequence of this operation is such that the first pair of cam pulsing contacts closes the circuit through the punch magnet just as the start-stop contact is opened to transmit the start impulse. Just before the first pair of contacts opens, the second pair closes. Through this overlapping action of the contacts, the magnet is energized long enough to insure proper operation. With the keyboard control operating lever in this position, it is possible to transmit from the keyboard directly to the line and simultaneously to perforate tape.

With the keyboard control operating lever in the lower or "Tape" position, all of the keyboard control contacts are closed and the universal bar is held depressed; thus, no direct keyboard transmission is possible. The trip-off pawl is depressed by an extension of the keyboard control operating lever to prevent it from engaging the intermediate pawl when the operating lever is moved to its lower position. Also, the repeat space rod is cammed outward so that it will not strike the intermediate pawl when the space bar is depressed. The operation of any key lever, in addition to setting up combinations on the selector fingers, moves the punch contact operating bar



downward. This causes the "Y" lever connecting link and "Y" lever connecting link extension to move the upper end of the punch contact operating lever to the left, against the tension of its retracting spring, which will permit the punch contacts to close (Figure 7). It is to be noted that the operation of the punch contact operating lever is similar to the operation of the selector levers, except that a single punch contact operating bar is used, which is returned to normal by the operating lever retracting spring.

To insure a complete perforation of the code combinations in the tape when the punch contacts are closed, an anti-chatter mechanism is used. The latest design of this mechanism is shown in Figure 7. When the punch contacts are closed by depressing a key lever, the punch contact operating lever becomes latched in the operated position, energizing the punch magnet. The initial movement of the armature lever causes the anti-chatter lever to hold the left-hand punch contact firmly engaged with the right-hand contact. When the armature lever reaches the end of its travel, the latch screw disengages the latch allowing the contacts to separate.

#### TAPE FEED MECHANISM

The tape feed roll is located to the left of the punches (Figure 5). Spaced at equal intervals around the feed roll is a series of projecting pins which mesh with the feed holes punched in the tape. A tape tension lever holds the tape against the feed roll, keeping the feed holes in the tape in constant mesh with the tape feed pins.

During the upward movement of the armature lever, the feed pawl engages the next tooth on the feed roll. When the armature lever moves downward, the tape feed roll will revolve, advancing the tape one character space. A star wheel and detent insure equal spacing of the tape perforations.

#### BACK SPACE LEVER

The back space lever (Figures 1 and 3) is provided so that any error made by the operator may be corrected in the tape before it is used for transmission. The back space lever moves the tape backwards. The "Letters" key may then be depressed, causing five holes to be perforated in place of the erroneous combination.

#### CHARACTER COUNTER

The character counter (Figures 1, 3, and 11) consists, essentially, of a ratchet; a counter magnet and feed pawl for advancing the ratchet; a latch pawl used to retain the ratchet in its advanced position; a release magnet for disengaging both the feed and latch pawls from the ratchet; signal lamp operating contact springs; and a dial and indicator, when required.

The electrical circuit for the perforator transmitter is so arranged that the closing of the punch contacts may operate the character counter in addition to operating the punch magnet. The counter control contacts are located on top of the keyboard casting at the left, and consist of three springs which control two circuits (Figure 13). In early models these contacts were mounted on the perforator casting (Figure 12). The left pair (counter contacts) are normally closed, and the right pair (release contacts) are

normally open. Battery from the punch contacts is applied to the center counter control contact, which carries it to either the left or right control contact. The left contact is connected to the counter magnets, while the right contact is connected to the release magnets. Since the left pair of counter control contacts are normally closed, the counter magnets will be energized (advancing the counter ratchet one tooth) with each character or space operation of the perforator.

The operation of the counter magnet armature causes the feed pawl, which is pivoted to it, to engage the next tooth on the ratchet (Figure 11). As the armature is released, the feed pawl spring rotates the ratchet one tooth. The latch pawl then engages the ratchet and holds it in its advanced position. As previously described, the punch contacts are effective in their operation only when the keyboard control operating lever is in the lower or "Tape" position.

When any "Function" key lever is depressed, other than "Carriage Return," the movement of the counter control mechanism opens the left pair of counter control contacts. With both right and left counter control contacts open, no current reaches the counter unit, so the counter ratchet remains stationary.

When the "Carriage Return" key lever is depressed, the movement of the counter control mechanism opens the left pair of counter control contacts and closes the right pair. This connects the release magnet circuit in series with the punch contacts so that the magnet will operate when these contacts close. The operation of the release magnet armature causes the release lever, which is attached to it, to disengage both the feed and the latch pawls from the ratchet. The ratchet spring then returns the ratchet to its starting position. A release latch holds the release lever operated and holds the pawls disengaged until the start of the next counting operation. A dash pot cylinder and piston are provided to act as a buffer for the return of the ratchet.

A signal lamp is used in connection with the character counter to indicate when a predetermined number of characters are perforated in the tape. The signal lamp operating contacts are controlled by a contact lever which rides upon a cam attached to the ratchet shaft. The cam may be positioned on the shaft so as to close the lamp contacts when the desired number of combinations have been perforated in the tape.

#### LINE-TEST OR POLAR-NEUTRAL KEY

Mounted on the keyboard to the left of the transmitting contact assembly is the "Line-Test" or "Polar-Neutral" key (Figures 1 and 3). When wired to be used as a "Line-Test" key, its purpose is that of testing and operating the printer independently of the line circuit. When its knob is pulled outward, the line circuit is shunted and a local circuit is established for printer operation.

When wired to be used as a "Polar-Neutral" key, its purpose is that of opening the bias circuit so that polar signals may be received on the printer.

#### KEY PRESSURE ADJUSTING MECHANISM

The key pressure adjusting mechanism (Figure 1), located on the perforator unit, provides a means for adjusting the pressure required to depress the key levers to suit the preference of the operator. When the unit is covered the adjusting screw is accessible by raising the hinged lid on the perforator cover.

## 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.

Adjustments which have different requirements for various types of units are arranged with the requirements for the latest type of unit specified first.

The spring tension values given in this bulletin were derived from measurements made with Teletype spring scales. These scales are calibrated for use in an upright 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.

When an adjustment requires that the mechanism be operated electrically, rotate the transmitting cam to the stop position and connect a source of 110 volts D.C. to terminals No. 52 and No. 53, the second and third slip connection terminals from the perforator unit looking at the front of the keyboard. (See Figure 13). As a protective measure it is recommended that this source of current be provided with fuses of 2 or 3 ampere capacity. Use care to guard against shock or short circuit when handling the unit with power applied to it in this manner.

### TRANSMITTING SHAFT BEARING ADJUSTMENT (Figure 14)

The transmitting cam sleeve should have some end play, not over .002". To adjust, loosen the adjusting nuts of the bearing in the rear bearing bracket and position the bearing. Tighten the adjusting nuts.

### LOCK LOOP SPRING TENSION (Figure 15)

With the lock loop roller resting on the low part of its cam, it should require 4 to 5 ozs. to start the lock loop roller moving away from the cam. To measure, hook an 8 oz. scale in the lock loop spring hole and pull in line with the spring.

#### LOCKING LEVER BRACKET SHIM ADJUSTMENT (Figure 15)

NOTE: This is a factory adjustment which should not require attention. However, should it be found necessary to change the adjustment it will be necessary to remove the filters (if present) and the pulsing contact assembly by removing the two screws which mount them to the transmitter front bracket (Figure 1). Without disconnecting any wires, place the filters and the contact assembly to one side so that access to the locking lever bearing is unobstructed.

With the contact levers on the high parts of their cams, there should be some clearance, not over .010", between the contact levers and the locking levers, when the locking levers are pressed downward by hand to make this clearance a minimum. Adjust by means of shims placed between the locking lever bracket and the keyboard casting. Position the bracket toward the front or rear so that the locking levers line up with the contact levers and tighten the mounting screws. Remount the filters and the pulsing contact assembly on the transmitter front bracket.

#### SELECTOR BAR ASSEMBLY SHIM ADJUSTMENT (Figure 16)

NOTE: The following adjustment is made at the factory and should require readjusting only when the shim pile-up has been changed or a new selector bar assembly is being installed.

- (1) When the "Q" key lever is fully depressed, all other key levers should have some play between the leather upstop and the selector bars and there should be some clearance, not over .030", between the high portions of the first selector bar from the front (A-1) and the unoperated key levers in line with the high portions. These conditions should also exist when the "P" or "B" key levers are depressed.
- (2) When the "T" key lever is fully depressed, there should be some clearance, not over .020", between the rearmost code selector bar (E-2) and the unoperated key lever having the least clearance.

In the event that it is found necessary to change this adjustment, proceed as follows: Remove the left and right keyboard slide plates. Disconnect the "Y" lever connecting link extensions (Figure 5) from the "Y" lever connecting links, and remove the selector bar assembly.

CAUTION: Care must be exercised in handling the unit to avoid damaging the connecting link extensions when they are disconnected from their connecting links.

Adjust to meet the conditions in paragraph 1, by increasing or decreasing the number of shims mounted to the selector bar assembly bracket at the front corners. To adjust for the conditions in paragraph 2, add (or remove) an equal number of shims to the bracket at each of the rear corners. Tighten the mounting screws. Replace the "Y" lever connecting link extensions and the left and right keyboard slide plates.

#### SELECTOR BAR ASSEMBLY BRACKET ADJUSTMENT

The selector bar assembly should be parallel to the rear key lever guide (Figure 16) and the locking levers should be fully engaged by the locking lever forks (Figure 5). Also, there should be no interference between the sides of the locking levers and the selector bars. To adjust, remove the left and right keyboard slide plates, loosen the selector bar assembly mounting screws, and position the assembly. Tighten the mounting screws. Replace the keyboard slide plates.

#### LOCKING LEVER BRACKET POSITION ADJUSTMENT (Figure 15)

NOTE: To facilitate checking or making the following adjustment, remove the filters and the pulsing contact assembly.

When the locking lever bracket is positioned properly, the following requirements should be met:

- (1) With the lock loop roller on the high part of its cam and the "Ltrs" and "Blank" (or "R" and "Y") key levers alternately depressed, the locking levers should travel equally to either side of the lock loop blade. However, if the left-hand travel of the locking levers is limited by the contact levers, it will be satisfactory if the right-hand travel is greater than the left-hand travel.
- (2) With any of the foregoing key levers held depressed and the cam rotated so that the lock loop roller is on the low part of its cam, there should be at least .010" clearance between the side of any lock lever and the side of the lock loop blade.

To adjust, loosen the bracket mounting screws and position the bracket, being careful to keep the locking levers in alignment with the contact levers. Tighten the mounting screws. Replace the filters and pulsing contact assembly.

#### CLUTCH THROWOUT LEVER ADJUSTMENT (Figure 16)

When the clutch is fully disengaged, there should be .005" to .015" clearance between the clutch teeth. To adjust, increase or decrease the number of shims installed between the clutch throwout lever post and the mounting bracket.

#### CLUTCH SPRING COMPRESSION (Figure 17)

With the clutch teeth engaged, hook a 32 oz. scale over the projection on the clutch driven member and pull in line with the transmitting shaft. It should require 9 to 12 ozs. to separate the clutch teeth.

#### LOCK LOOP ROLLER ADJUSTMENT (Figure 18)

NOTE: This adjustment applies only to units equipped with a lock loop having an elongated mounting hole for the roller mounting screw.

Rotate the keyboard shaft until the clutch teeth are disengaged. Press the lock loop roller against its cam to fully disengage the clutch teeth and position the locking levers directly below the lock loop blade to make the clearance a minimum. Under these conditions there should be .008" to .015" clearance between the lock loop blade and the locking lever having the least clearance. To adjust, position the roller mounting screw by means of its elongated mounting hole. (On some keyboards a 107485 eccentric roller mounting screw is used which provides extra adjusting margin.)

#### KEYBOARD CONTROL OPERATING LEVER BRACKET ADJUSTMENT (Figure 16) (TRIP-OFF PAWL STOP PLATE ADJUSTMENT)

NOTE: In early models of the perforator transmitter, the trip-off pawl stop plate was separate from the keyboard control operating lever bracket. The two parts were combined in later models. In either case the adjustment requirement is the same.

With the screw driver slot of the intermediate pawl eccentric in a horizontal position and the high part of the eccentric screw head toward the front of the unit, there should be .070" to .080" clearance between the trip-off pawl and the intermediate pawl when the trip-off pawl is resting against the operating lever bracket (or trip-off pawl stop plate) and the intermediate pawl is against its eccentric. To adjust, loosen the operating lever bracket (or trip-off pawl stop plate) mounting screws and position it. Tighten the screws.

#### UNIVERSAL BAR BRACKET ADJUSTMENTS (Figure 16)

- (1) There should be .060" to .080" clearance between the universal bar and the key levers when the trip-off pawl is resting against the operating lever bracket (or trip-off pawl stop plate) and the key levers are resting against their upstop.
- (2) The trip-off pawl extension of the universal bar should be approximately equidistant from the sides of the key levers.
- (3) The universal bar brackets should be parallel to the selector bar assembly and as close to it as possible. The universal bar should be free from binds, and should not have over .008" end play.

Adjust the height of the universal bar by means of shims placed between the universal bar brackets and the casting. Conditions (2) and (3) may be obtained by loosening the mounting screws and utilizing the enlarged mounting holes in the brackets. Tighten the screws. After making adjustments (2) and (3), recheck adjustment (1) and refine adjustments if necessary.

#### INTERMEDIATE PAWL ECCENTRIC ADJUSTMENT (Figure 19)

There should be .050" to .060" clearance between the trip-off pawl and the intermediate pawl when the trip-off pawl is resting against the operating lever bracket (or trip-off pawl stop plate) and the intermediate pawl is resting against its eccentric. To adjust, loosen the intermediate pawl eccentric lock nut and position the eccentric. Tighten the lock nut.

#### CLUTCH THROWOUT LEVER ECCENTRIC ADJUSTMENT

With the transmitter shaft in the stop position and the clutch fully disengaged, hold the clutch throwout lever against the driven member. Under this condition the intermediate pawl should be held without perceptible play between the clutch throwout lever and the intermediate pawl eccentric. To adjust, loosen the clutch throwout lever eccentric lock nut and position the eccentric. Tighten the lock nut. See Figure 21 for location of parts.

#### TRIP-OFF PAWL ECCENTRIC ADJUSTMENT (Figure 20)

With the clutch throwout lever resting against the high part of the cam on the driven clutch member and the clutch throwout lever eccentric in contact with the clutch throwout lever, the point on the trip-off pawl should clear the point on the intermediate pawl by not over .004" when a key lever is depressed. To adjust, loosen the lock nut on the trip-off pawl eccentric screw and position the screw, keeping the center of the eccentric head to the rear of the center of the screw. Recheck "Universal Bar Bracket Adjustments." Tighten the lock nut.

#### TRIP-OFF PAWL SPRING TENSION (Figure 21)

Unhook the trip-off pawl spring from the bracket and hook an 8-oz. scale in the spring eye. With the trip-off pawl resting against the operating lever bracket (or trip-off pawl stop plate), it should require 3-1/2 to 4-1/2 ozs. to extend the spring to its installed length. Replace the spring.

#### CLUTCH THROWOUT LEVER SPRING TENSION

With the clutch teeth engaged and the throwout lever resting on the low part of the clutch driven member, hook an 8 oz. scale over the throwout lever just above the spring hole, and pull in line with the spring. It should require 1-1/2 to 2-1/2 ozs. to start the lever moving.

#### TRANSMITTING CONTACT SPRING ADJUSTMENTS (Figure 15)

With any contact lever on the high part of its cam, there should be a contact gap of \*.020" to .025". To adjust, bend the shorter contact springs.

(\*) .015" to .025" for start-stop contact only.

#### TRANSMITTING CONTACT SPRING PRESSURE (Figure 22)

With the contact levers in the indent of their respective cams, it should require 4-1/2 to 5-1/2 ozs. to separate the contacts. To measure, apply the push end of an 8 oz. scale to the longer spring just above the contact point and push toward the right. To adjust, bend the longer contact springs. Recheck the contact gap after adjusting the contact spring pressure.

#### KEY LEVER SPRING TENSION ADJUSTMENTS

The following paragraphs identify the key lever springs used in various models of the perforator transmitter. To check a spring, remove it from the keyboard. If necessary, bend the spring to make it conform to the



specification. Measure the opening as shown in Figure 23.

- (A) All perforator transmitters use the same spring on character key levers and the blank key lever. This spring is made of wire .035" in diameter and should have an opening of 1-3/16".
- (B) Perforator transmitters with the counter control contacts located on the forward left-hand portion of the keyboard base, as shown in Figure 13, employ function key lever springs made of .035" wire with an opening of 1-9/16". (Carriage Return, Line Feed, Letters, and Figures).
- (C) Units equipped with a 3-inch space bar employ a space key lever spring made of .039" wire with an opening of 1-3/4".
- (D) Units equipped with an 8-1/2 inch space bar and a centrally located space key lever employ a space key lever spring made of .049" wire with an opening of 1-5/8".

#### REPEAT SPACE ROD BRACKET ADJUSTMENT

- (A) Adjust the two-piece bracket illustrated in Figure 24 to meet the following requirement: With the keyboard control operating lever in the upper position, and the space bar fully depressed, there should be some clearance, not over .008", between the repeat space rod and the transmitter rear bracket. When checking this adjustment the repeat space rod slotted guide should be resting against its backstop screw and the play of the rod in the slot should be taken up in a direction to make the clearance a minimum. To adjust, loosen the repeat space rod bracket mounting screw and position the bracket. Hold the repeat space rod bracket so that it is approximately parallel to the transmitter rear bracket when tightening the mounting screw. Check the repeat space rod for freeness after tightening the bracket mounting screw.
- (B) Adjust the one-piece bracket illustrated in Figure 25 to meet the following requirement: With the keyboard control operating lever in the upper position, and the space bar depressed until the space key lever bottoms lightly on the A-1 and A-2 code selector bars, there should be some clearance, not over .008", between the formed end of the repeat space rod and the flat side of the transmitter rear bracket measured at the closest point, when the upper portion of the repeat space rod is resting against the repeat space rod bracket. To adjust, loosen the repeat space rod bracket mounting screw and position the bracket. When tightening the mounting screw, make certain that the front face of the repeat space rod bracket is parallel to the rear surface of the transmitter rear bracket.

#### REPEAT SPACE ROD ADJUSTMENT (Figure 26)

With the keyboard control operating lever in the upper position, and the space bar depressed until the space key lever rests lightly against the A-1 and A-2 code bars, there should be .010" to .020" clearance between the clutch

throwout lever and the high part of the throwout cam. Adjust by means of the repeat space rod adjusting nuts.

#### REPEAT SPACE ROD SPRING TENSION

(A) On units which have the repeat space rod spring attached to the slotted guide lever which guides the repeat space rod, hook an 8 oz. scale in the slot in this lever and pull in line with the spring. With the tape-keyboard key in the keyboard (up) position, it should require not less than 1 oz. to start the lever moving away from its backstop screw.

(B) On units which have the repeat space rod spring attached to the repeat space rod, hook an 8 oz. scale over the repeat space rod just in front of the spring hole and pull in line with the spring. It should require from 1 to 3 ozs. to start the rod moving with the tape-keyboard key in the keyboard (up) position.

#### REPEAT SPACE ROD CUTOUT ADJUSTMENT

NOTE: The repeat space rod cutout is a small formed part which is mounted to the keyboard control operating lever to the rear of the operating lever mounting screw. There are two designs of this part in use.

- (A) The cutout used with the two-piece repeat space rod bracket should be adjusted to meet the following requirements (Figure 28):
- (a) With the keyboard control operating lever in the lower position and the space bar fully depressed, there should be at least .010" clearance between the repeat space rod and the intermediate pawl.
  - (b) With the keyboard control operating lever in the center position of the detent bracket, the cutout should not engage the repeat space rod slotted guide. To adjust, position the cutout in its slot, utilizing the elongated mounting hole.
- (B) The cutout used with the one-piece repeat space rod bracket should be adjusted to meet the following requirement (Figure 29): With the keyboard control operating lever in the lower position and the space bar depressed until it rests lightly on its rubber downstops, there should be a clearance of .010" to .020" between the repeat space rod and the side of the intermediate pawl. To adjust, position the cutout in its slot utilizing the elongated mounting hole.

#### REPEAT SPACE ROD EXTENSION ADJUSTMENT

The repeat space rod extension should be centrally located between the adjacent key levers, and the horizontal part should be approximately parallel to the space bar rod. To adjust, position the repeat space rod extension by means of its mounting screws.

#### KEYBOARD CONTROL CONTACT ASSEMBLY ADJUSTMENTS (Figures 30, 31, and 32)

NOTE: All the contact tensions specified in this section should be measured with an 8 oz. scale applied to the spring at the contact point and at

a right angle to the contact spring. The contact springs are numbered from top to bottom of the contact assembly. To facilitate checking or adjusting, remove the keyboard control contact assembly cover.

- (1) The contact points should be in alignment with one another. To adjust, loosen the contact spring mounting screws and position the contact springs. Tighten the mounting screws.
- (2) Place the keyboard control operating lever in the upper position to make the following adjustments (See Figure 30):
  - (a) Both prongs of the keyboard control operating lever should engage the insulating tips of contact springs No. 3 and No. 5 approximately centrally. Make certain that neither prong touches the contact spring or insulator rivets. To adjust, loosen the contact assembly bracket mounting screws and position the bracket. Tighten the screws.
  - (b) There should be not less than .010" clearance between the keyboard casting and the insulating tip on contact spring No. 5. If necessary, a slight adjustment may be made by bending the spring between the contact point and the insulating tip.
  - (c) There should be .015" to .040" clearance between the contact points on springs No. 4 and No. 5. To adjust, bend contact spring No. 4.
- (3) Place the keyboard control operating lever in the center position to make the following adjustments (See Figure 31):
  - (a) There should be not less than .015" clearance between the lower prong on the keyboard control operating lever and the insulating tip on contact spring No. 5. If necessary to adjust for this clearance, bend contact spring No. 4. Recheck the contact gap specified in Section 2-c.
  - (b) With the insulating tip on contact spring No. 3 resting against the upper prong of the keyboard control operating lever, there should be .015" to .040" clearance between the contact points on springs No. 2 and No. 3. To adjust, bend the backstop of contact spring No. 2.
  - (c) There should be .015" to .025" clearance between the contact points of springs No. 1 and No. 2. To adjust, bend contact spring No. 1.
  - (d) It should require a pull of not more than 1-1/2 ozs. to raise contact spring No. 2 so that the points of springs No. 1 and No. 2 make contact. To adjust, bend contact spring No. 2. Recheck the contact gaps specified in Section 3-b and 3-c.
- (4) Place the keyboard control operating lever in the lower position to make the following adjustments (See Figure 32):

- (a) It should require a push of 2 to 3 ozs. to separate the contact points of springs No. 4 and No. 5. To adjust, bend contact spring No. 5. Recheck the contact gap specified in Section 2-c.
- (b) It should require a push of 3 to 3-1/2 ozs. to separate the contact points of springs No. 2 and No. 3 when spring No. 2 is held to prevent follow. To adjust, bend contact spring No. 3. Recheck the contact gap specified in Section 3-b.
- (c) It should require a pressure of at least 1/4 oz. to separate the contact points of springs No. 1 and No. 2. To measure this pressure, allow contact spring No. 3 to bear against contact spring No. 2, apply the push end of an 8 oz. scale to contact spring No. 2 at the contact point and push vertically downward. If it is necessary to readjust to meet this requirement, remake the adjustments specified in Sections 3-d and 4-b within limits, in a direction to increase the pressure between the contacts of springs No. 1 and No. 2.

Replace the keyboard control contact assembly cover.

#### KEYBOARD CONTROL CONTACT ASSEMBLY COVER ADJUSTMENT

The rear extremity of the cover should not project beyond the rear of the transmitting shaft rear bracket. To adjust, position the cover, utilizing its elongated mounting holes.

#### KEYBOARD CONTROL OPERATING LEVER DETENT BRACKET ADJUSTMENT (Figure 27)

With the keyboard control operating lever in its upper position, hook a 32 oz. scale under the rear extension of the operating lever just in front of the lobes and pull vertically upward. It should require a pull of at least 20 ozs. to move the operating lever from the upper (Keyboard) position to the center (Keyboard and Tape) position. To adjust, loosen the detent bracket mounting screws and position the bracket. Tighten the screws.

#### UNIVERSAL BAR CUTOUT LEVER ADJUSTMENT

With the keyboard control operating lever in the lower position, there should be some clearance, not over .025", between the universal bar and any key lever when the key lever is fully depressed. Check all key levers. (See Figure 34). Adjust by means of the eccentric stud on the universal bar cutout lever.

#### UNIVERSAL BAR CUTOUT LEVER RETURN SPRING ADJUSTMENT

With the keyboard control operating lever in the middle position and all key levers in the unoperated position, there should be some clearance, not over 1/16", between the universal bar and the cutout lever. To adjust, bend the universal bar cutout lever return spring. (See Figure 35.)

#### TRIP-OFF PAWL CUTOUT ADJUSTMENT (Figure 34)

When the clutch throwout lever is resting against the low part of its

cam and the keyboard control operating lever is moved slowly from the center position to the lower position, there should be .015" to .030" clearance between the trip-off pawl and the intermediate pawl at the point where the clearance is a minimum. To adjust, bend the trip-off pawl cutout. When the operating lever is in its lower position there should be clearance between the trip-off pawl cutout and the repeat space rod and between the trip-off pawl and the keyboard casting. If there is no clearance at these points, bend the cutout or refine the adjustment, within the specified tolerances, to obtain clearance.

#### CAM PULSING CONTACT ASSEMBLY ADJUSTMENTS (Figure 33)

NOTE: The cam operated pulsing contact assembly consists of two similar pairs of contact springs which require like adjustments. Apply the following adjustments to each pair independently.

- (1) Rotate the transmitting cam assembly until the tip on the contact operating spring, which bears on the cam, is on the high part of the cam to make the following measurements or adjustments: (See Figure 33A)
  - (a) The tip of the contact operating spring should ride centrally on the cam, and the contact points should be in alignment. To adjust, loosen the contact spring assembly mounting screws and position the assembly. Tighten the mounting screws.
  - (b) There should be .010" to .020" clearance between the contact points. To adjust, bend the lower contact spring.
  - (c) There should be at least .015" clearance between the lower contact spring and the contact operating spring at the closest point. To adjust, bend the left end of the contact operating spring upward and remake the preceding adjustment.
- (2) Rotate the transmitting cam assembly until the tip on the contact operating spring, which bears on the cam, falls into the cam indent. If the unit is equipped with filters which are mounted over the pulsing contact assembly, it will be necessary to remove the filters from their mounting bracket in order to make the measurements specified in Sections 2-a and 2-c.
  - (a) Hook an 8 oz. scale over the upper contact spring at the contact point and pull vertically upward. It should require a pull of 3-1/2 to 4-1/2 ozs. to separate the contact points. Also, the contact surfaces should meet squarely. To adjust, bend the contact springs. Recheck the clearance specified in Sections 1-b and 1-c.
  - (b) There should be .010" to .025" clearance between the curved tip on the contact operating spring and the insulating tip on the upper contact spring. To adjust, bend the backstop for the contact operating spring.

- (c) Hook an 8 oz. scale under the curved tip of the contact operating spring and pull vertically upward. It should require a pull of 2 to 3 ozs. to start the spring moving away from the end of the backstop. To adjust, bend the contact operating spring. Recheck the clearance specified in Section 2-b.
- (d) There should be at least .020" clearance between the wearing tip on the contact operating spring and the low part of the cam surface. If necessary to adjust, remake adjustment 2-b within the limits specified in order to obtain the required clearance. Recheck the clearance specified in Section 2-c.

#### TAPE FEED ROLL ADJUSTMENT

The tape feed roll should be free from binds and should not have over .003" end play. To check for binds, hold off the tape tension lever, the feed pawl, and detent lever. To adjust, increase or decrease the number of shims installed between the feed roll bracket and the casting. Utilize the play in the bracket mounting holes to position it so that the feed roll is free. Tighten the screws. See Figure 36 for location of parts.

#### TAPE TENSION LEVER STUD ADJUSTMENT (Figure 36)

The feed pins on the feed roll should not touch either side of the slot in the tape tension lever when the play in both the feed roll and tape tension lever is taken up in opposite directions. To adjust, increase or decrease the number of shims installed between the tape tension lever stud and the feed roll bracket.

#### TAPE TENSION LEVER SPRING TENSION ADJUSTMENT (Figure 37)

Hook an 8 oz. scale over the end of the slotted extension of the tape tension lever and pull at a right angle to the lever. It should require a pull of 5 to 5-1/2 ozs. to start the slotted extension of the lever moving away from the feed roll. To adjust, loosen the tape tension lever stud lock nut and rotate the stud in either a clockwise or counterclockwise direction. Tighten the lock nut.

#### BACKSPACER SPRING TENSION

(A) On units not equipped with a feed pawl release cam (Figure 38), it should require 4 to 6 ozs. to start the backspace lever moving when the push end of an 8 oz. scale is applied vertically downward to the upper end of the backspace lever.

(B) On units equipped with a feed pawl release cam (Figure 39), it should require 3-1/2 to 4-1/2 ozs. to pull the spring to position length when the backspace lever is held in the unoperated position and an 8 oz. scale is hooked in the spring eye and the spring is extended to its position length.

#### BACKSPACE PAWL SPRING TENSION

Hook an 8 oz. scale under the pawl below the spring hole and pull vertically upward. It should require 1 to 2 ozs. to start the feed pawl moving.

#### FEED ROLL DETENT PRELIMINARY ADJUSTMENT (Figure 40)

NOTE: To facilitate the following adjustment on units which have the counter unit on the left, remove the counter unit.

With the detent lever roller resting between two teeth of the star wheel and the armature lever in the operated position, insert the feed roll positioning gauge (No. 73517) in the punch block guide slot so that the projection of the gauge stops against the feed hole punch. Under these conditions a pin on the feed roll should line up with the center hole of the gauge.

To adjust, loosen the detent eccentric bushing mounting screw and position the bushing, keeping the center of the eccentric bushing below the center of the mounting screw. Tighten the mounting screw. Replace the counter unit.

#### FEED ROLL DETENT SPRING TENSION REQUIREMENT

- (A) Springs with an adjustable spring post, mounted as shown in Figure 40-A, should be measured as follows: Hook a 32 oz. scale over the detent lever at the roller and pull downward at a right angle to the lever. It should require 15 to 17 ozs. to start the roller moving away from the star wheel. To adjust, hold the adjusting thumb nut and loosen the lock nut. Then turn the thumb nut to obtain the proper tension. Hold the thumb nut when tightening the lock nut.
- (B) Springs mounted as shown in Figure 40-B should be measured as follows: Hook a 12 lb. scale over the end of the detent at the spring hole and pull in line with the spring. It should require 3 to 4 lbs. to start the roller moving away from the star wheel.

REMOVE THE TAPE STRIPPER PLATE AND THE TAPE KNIFE (FIGURE 3) TO FACILITATE MAKING OR CHECKING THE FOLLOWING ADJUSTMENTS:

#### SELECTOR LEVER BRACKET ADJUSTMENT

With the code bars in their neutral position, the engaging tips of all the movable selector fingers should be under the punches by not more than half the diameter of the punches, gauged by eye. To move the code bars to a neutral position, depress the Ltrs., Line Feed, and Blank key levers or the R, T, and Y key levers equally until they are stopped by the code bars. To facilitate this procedure, place an "R" wrench across the keytops and depress the key levers by applying pressure to the wrench. When checking this adjustment, hold the three key levers depressed and take up the play of the selector levers and fingers in a direction to make the engagement with the punches a maximum. To adjust, loosen the selector lever bracket mounting screws and position the bracket. Tighten the mounting screws. See Figure 41 for location of parts.

#### FEED PUNCH SELECTOR LEVER ADJUSTMENT

The left end of the uppermost section of the feed punch selector finger should line up with the left edge of the feed punch pin. Gauge by eye. See Figure 41 for location of parts. To adjust, position the feed punch selector lever by increasing or decreasing the number of shims between the formed-over ear and the selector lever bracket.

#### ARMATURE LEVER LEFT STOP SCREW ADJUSTMENT (Figure 42)

With the armature lever held firmly against its left stop and the left end of the uppermost section of the feed punch selector finger in line with the left edge of the feed punch pin, the clearance between the feed punch selector finger and the feed punch should be .025" to .030". To adjust, position the armature lever left stop by means of its locknut. See Figure 41 for location of parts.

#### ARMATURE LEVER RIGHT STOP SCREW ADJUSTMENT

In order to check this adjustment, it is necessary to remake it. To adjust, proceed as follows: Place all of the punch selector fingers under the punch pins so that the left end of each selector finger lines up with the left end of the feed punch selector finger. Adjust the armature lever right stop screw so that the punches fail to punch through the tape when the punch magnets are energized by closing the punch contacts by hand. Then back off the stop screw until all of the punches just punch through the tape when the punch magnet contacts are operated by hand. All of the punches should also perforate the tape when the selector fingers are positioned as far to the left as possible. Back off the right stop screw farther if necessary. Then back off the stop screw 1/4 turn more for margin. Make certain that there is some clearance between the armature and the magnet core when the armature lever is held firmly against its right stop. Tighten the lock nut.

#### SELECTOR FINGER RETAINER ADJUSTMENT

- (A) The retainer illustrated in Figure 41 should meet the following requirement: There should be some clearance, not over .005", between the retainer and the top of the feed punch selector lever when the armature lever is held in its operated position by the magnet. Also, the selector finger retainer should be equidistant (within .005") from the No. 1 and No. 5 selector fingers when the ends of all the selector fingers are in line. To adjust, loosen the retainer mounting screws and adjust the retainer. Tighten the screws.
- (B) The retainer illustrated in Figure 39 should meet the following requirement: Hook an 8 oz. scale under the roller as shown and pull vertically upward. It should require 3 to 3-1/2 ozs. to start the roller moving away from the selector fingers. To adjust, loosen the retaining bearing shaft lock nut and rotate the shaft. Tighten the lock nut.

#### TAPE GUIDE SPRING ADJUSTMENT

- (1) The edge of the spring should be parallel to the edge of the casting on which it is mounted.
- (2) The spring should hold the tape securely against the side of the guide in the die block adjacent to No. 1 punch without buckling the tape.

To adjust for requirement No. 1, position the spring. To check the latter requirement, take up the play of the tape in the die block toward the



spring and observe whether the spring returns the tape to the far side when the tape is released. To adjust, bend the spring.

#### PUNCH CONTACT BRACKET ADJUSTMENT

NOTE: This adjustment applies only to units with anti-chatter mechanisms like those illustrated in Figures 47 and 49.

In units which have an adjustable link connected to the contact operating lever, as shown in Figure 47, the punch contact bracket should be positioned so that its mounting screws are in the center of the elongated holes in the bracket. Remove one mounting screw at a time in order to determine whether the bracket is properly adjusted. To adjust, loosen both mounting screws, position the bracket, and tighten the mounting screws.

In units not provided with an adjustable link, the position of the bracket is determined by depressing the key lever which imparts the least movement to the punch contact operating lever and adjusting the bracket so that there is .015" to .030" clearance between the insulator on the contact operating lever and the right-hand contact spring. (See Figure 49.)

#### PUNCH CONTACT ADJUSTMENTS

- (1) With the anti-chatter contact lever resting against its adjusting screw, the armature lever against its left-hand stop, and the right-hand punch contact held away from the left-hand punch contact by the contact operating lever, hook an 8 oz. scale over the left-hand contact spring at the contact point and pull at a right angle to the spring. It should require 2 to 3 ozs. to separate the insulator from the anti-chatter lever (Figures 48 and 49). To adjust, bend the left-hand contact spring.
- (2) With any key lever depressed, hook an 8 oz. scale over the right-hand contact spring at the contact point and pull at a right angle to the spring. It should require 2 to 3 ozs. to separate the contacts on units having anti-chatter contact levers like the one illustrated in Figure 47. On units with anti-chatter contact levers like the one illustrated in Figure 50, the requirement is 3-1/2 to 4 ozs. with the armature in the operated position. To adjust, bend the right-hand contact spring.
- (3) Recheck the Punch Contact Bracket Adjustment.

#### KEY PRESSURE ADJUSTING MECHANISM ADJUSTMENT

The contact operating lever return spring adjusting assembly should be free from binds over the entire range of the adjusting screw, and the punch contact operating lever backstop screw should line up centrally (approximately) with the contact operating lever. To adjust, position the key pressure adjusting mechanism by means of its mounting screws. See Figure 45 for location of parts.

#### ANTI-CHATTER MECHANISM ADJUSTMENTS

- (1) With the armature lever resting firmly against its left-hand stop and the anti-chatter lever in contact with the adjusting screw in the armature, the edge of the uppermost portion of the anti-chatter contact lever should be approximately horizontal. (See Figure 47.) To adjust, position the adjusting screw.

NOTE: When adjusted in accordance with the foregoing requirement, the following conditions should also prevail:

- (a) With the armature lever resting firmly against its right-hand stop and the anti-chatter lever held against the magnet spool head, there should be at least .005" clearance between the anti-chatter lever and its operating screw (Figure 46.)
  - (b) With the armature lever resting firmly against its left-hand stop, the end of the anti-chatter lever should extend at least 1/32" to the left of the center of its operating screw. If necessary, refine the operating screw adjustment between these limits so that both conditions are met.
- (2) Unhook the anti-chatter contact lever spring from the bracket and hook an 8 oz. scale in the spring eye. It should require 2 to 3 ozs. to pull the spring to position length (Figure 47.)

#### PUNCH CONTACT OPERATING LEVER LINK ADJUSTMENT (Figures 44 and 47)

NOTE: This adjustment applies only to units with an adjustable link, as illustrated in Figures 44 and 47.

Determine the key lever (including the space key lever) which moves the punch magnet contact operating lever the least amount when fully depressed.

With this key lever (or space bar) completely depressed, there should be .015" to .030" clearance between the right-hand contact spring and the insulator on the contact operating lever. To adjust, loosen the two screws which clamp the adjustable link together and shorten or lengthen the link. Tighten the screws.

NOTE: With the foregoing adjustment, the punch contacts will not close until the key levers nearly reach the bottom of their travel. It is permissible to adjust the link so that the punch contacts will close on a shorter key lever stroke provided that all of the punch selector fingers engage their associated punch pins by the full diameter of the pin at the time the punch contacts close. To check this adjustment, position all of the punch selector fingers toward the right and then depress the "Letters" key lever slowly until the punch contacts close. Connect a test lamp across the contacts to determine when they close. To adjust for a shorter key lever stroke, lengthen the punch contact operating lever link.

#### PUNCH CONTACT OPERATING LEVER BACKSTOP ADJUSTMENT

With the unit connected to a source of 110 volts D.C., operate any key lever and then release the pressure on the keytop slowly until the contact points on the two punch operating contact springs are just separated by the contact operating lever as it is pulled toward the right by the contact operating lever return spring. With the key lever held in this position, there should be .010" to .020" clearance between the contact operating lever backstop and the right-hand edge of the contact operating lever.

To adjust units equipped with the backstop screw illustrated in Figure 46, loosen the backstop screw lock nut and position the screw. Tighten the lock nut.

To adjust units equipped with the backstop bracket illustrated in Figure 50, loosen the backstop bracket mounting screws and position the bracket. Tighten the screws.

Disconnect the power supply from the perforator.

#### PUNCH CONTACT OPERATING LEVER SPRING TENSION

Units with a spring adjusting lever as illustrated in Figure 45 should be adjusted as follows: In making this measurement, the right contact spring should be allowed to bear freely against the fibre on the contact operating lever. Apply the push end of an 8 oz. scale to the right contact spring at the contact point and push in a horizontal direction. It should require 1/2 to 1 oz. to just start the contact operating lever moving away from the backstop screw. To adjust, turn the spring adjusting screw to its highest position. Then position the extension on the adjusting lever by means of the elongated slot in the extension to meet the requirement.

#### FEED PAWL ECCENTRIC ADJUSTMENT - See Note (A)

The feed pawl should just engage a tooth on the feed roll, without overtravel, when the armature lever is raised slowly by hand until the feed punch selector finger just touches the feed punch. To adjust, loosen the feed pawl eccentric bushing mounting screw, and position the bushing. Tighten the bushing mounting screw. See Figure 41 for location of parts.

On units which have the feed pawl attached to the armature lever, the feed pawl should engage a tooth on the feed roll, without overtravel, when the tape stripper plate is removed and the high portions of the code selector fingers are under the punches and just touching their lower ends. To adjust, position the feed pawl by means of its eccentric.

\* \* \*

NOTE (A) In order to facilitate adjustment of units having the counter mounted on the left-hand side of the keyboard, remove the counter unit from its bracket by loosening its two mounting screws and sliding the unit from its mounting slots.

#### FEED PAWL SPRING TENSION (Figure 41)

(A) Units on which the feed pawl is attached to the armature lever may be tested by applying the push end of a 12 lb. scale vertically to the left end of the armature lever and pushing upward. It should require 4-1/2 to 5-1/2 lbs. to cause the armature to leave its stop.

(B) Units on which the feed pawl is not attached to the armature lever may be tested by unhooking the lower end of the spring from its post and hooking a 12 lb. scale into its eye. Pulling downward, it should require 3 to 4 lbs. to stretch the spring to position length.

#### FEED PAWL THROWOUT BRACKET ADJUSTMENT (Figure 41)

NOTE: This adjustment applies only to units in which the feed pawl is mounted separately from the armature lever as illustrated in Figure 41.

With the armature lever resting against its left-hand stop, there should be .005" to .015" clearance between the tip of the tooth on the feed pawl and the tips of the teeth on the feed roll throughout a complete revolution of the feed roll. To adjust, loosen the bracket mounting screw and the adjusting screw lock nut and set them both friction tight. Then, with the adjusting screw in contact with the punch block, advance or withdraw the screw until the desired clearance is obtained. Tighten the lock nut and the mounting screw.

#### FEED PAWL GUIDE ADJUSTMENT (Figure 43)

NOTE: This adjustment applies only to units in which the feed pawl is mounted separately from the armature lever as illustrated in Figure 41.

When the armature lever is held in its operated position by energizing the punch magnet, and the feed roll is rotated, there should be some clearance, not more than .005", between the feed pawl and the closest feed roll tooth. To adjust, position the feed pawl guide by means of its two mounting screws.

#### PUNCH MAGNET ADJUSTMENT

With the punch magnet energized and the armature lever resting against its right-hand stop, there should be .004" to .008" clearance between the magnet cores and the armature.

NOTE: In order to change this adjustment on units with counters mounted on the right-hand side, it will be necessary to remove the chad chute cover plate or punch contact filter unit (if the unit is so equipped). On units with counters mounted on the left-hand side, it will also be necessary to remove the counter unit and counter mounting bracket. Replace the parts after making the adjustment.

To adjust, loosen the two eccentric stop mounting screws and rotate the eccentrics away from the core. Loosen the magnet core mounting screws

and position the core. Tighten the mounting screws. Rotate the eccentrics so they make contact with the core and tighten the screws which mount the eccentrics.

REPLACE THE TAPE STRIPPER PLATE AND TAPE KNIFE IF THESE PARTS WERE PREVIOUSLY REMOVED (Figure 3).

#### TAPE STRIPPER PLATE ADJUSTMENT

There should be some clearance, not over .010", between the tape stripper plate and the feed roll throughout a complete revolution of the feed roll. To adjust, loosen the mounting screws and position the plate. Tighten the mounting screws.

#### TAPE KNIFE ADJUSTMENT

The tape knife should be approximately horizontal and there should be at least .015" clearance between the tape knife and the tape stripper at their closest point. To adjust, loosen the tape knife mounting screws and position the knife. Tighten the mounting screws.

#### FEED ROLL DETENT FINAL ADJUSTMENT - See Note (A)

The perforations in the tape should conform to the standard spacing of 10 holes to the inch. Check the tape against the tape gauge (#2215). To adjust, loosen the detent lever eccentric bushing mounting screw and position the bushing using the lower semi-circle of its adjusting range. Tighten the mounting screw.

NOTE: If it is found necessary to refine this adjustment, recheck the Feed Pawl Eccentric Adjustment, and the Feed Pawl Throwout Bracket Adjustment.

#### COUNTER CONTROL CONTACT OPERATING MECHANISM ADJUSTMENTS (Figures 51 and 52)

NOTE: These adjustments apply only to units with counter control contacts mounted on the forward part of the keyboard casting as illustrated in Figure 13.

- (1) With the "figures" key lever and any two other key levers depressed until they are stopped by the code selector bars, the relation between the key levers and the cam levers on the contact operating mechanism should be such that the cam levers are just completely displaced. To check this adjustment, depress the "figures" and any two other key levers until they are stopped by the code selector bars. Then, observing the counter control contact operating fibre

\* \* \*

NOTE (A) In order to facilitate adjustment of units having the counter mounted on the left-hand side of the keyboard, remove the counter unit from its bracket by loosening its two mounting screws and sliding the unit from its mounting slots.

extension, there should be very little or no further displacement as the "figures" key lever is depressed to its full depth of stroke. In a similar manner repeat this check, using the "carriage return" key lever. It is important that the full displacement of the cam lever is not reached until the function key lever just reaches its neutral position. Adjust by means of shims located between the contact operating mechanism casting and the two rear mounting ears of the condenser cover.

- (2) With the cam lever links against their backstops, (unoperated position) there should be approximately equal clearance between the "carriage return" and "line feed" key levers and the tips of their respective cam levers. To adjust, position the counter control contact operating mechanism laterally by means of the elongated holes in the mounting ears.

#### COUNTER CONTROL CONTACT ASSEMBLY ADJUSTMENTS

NOTE: Remove the contact cover by loosening its mounting nuts. The contact springs are numbered from left to right, with contact spring No. 3 nearest to the resistor. In measuring the spring tensions specified, apply an 8 oz. scale to the contact spring at the contact point and pull or push at right angles to the spring without power on the perforator circuit: (See Figure 53 for location of parts.)

- (1) Contact springs No. 1 and No. 2 should be approximately at right angles to the insulator pile-up in the assembly, and each contact point should have a follow of .005" to .010" when the other spring is moved away from it. Adjust by bending the stiffeners for contact springs No. 1 and No. 2.
- (2) It should require a force of 1 to 1-1/2 ozs. to just separate the contact points on contact springs No. 1 and No. 2. To adjust, bend contact spring No. 1 or No. 2 and recheck requirement (1).
- (3) The contact operating fibre extensions of the counter control contact mechanism should move freely in their guide slots, and there should be not more than .005" clearance between the contact spring No. 2 and the right edge of the fibre tip, when the rear contact operating fibre extension is held to the right against the backstop. To adjust, position the counter control contact assembly by means of the elongated mounting holes in the bracket.
- (4) Contact spring No. 3 should be held by its backstop so that when the "carriage return" key lever is depressed slowly, contact spring No. 3 will be moved .005" to .010" by the action of the contact point on contact spring No. 2. To adjust, bend the stiffener for contact spring No. 3.
- (5) With the "carriage return" key lever fully depressed, it should require a force of 3/4 to 1 oz. applied to contact spring No. 3 to just separate the contact points on contact springs No. 2 and No. 3. To adjust, bend the contact spring No. 3 and recheck requirement No. 4.

- (6) With the contact operating fibre extensions on the counter contact operating mechanism not touching contact springs No. 1 and No. 2, there should be at least .015" clearance between the contact points on contact springs No. 2 and No. 3. If this clearance does not exist, refine the preceding adjustments to obtain proper clearance.
- (7) When the "carriage return" key lever is depressed, contact spring No. 2 should move toward the right and should break contact with the contact point on contact spring No. 1 before it makes contact with the contact point on contact spring No. 3. If adjustment is necessary, refine the preceding adjustments to meet the break before make requirement.
- (8) Replace the contact cover. Hold the mounting screws with a screw driver when tightening the nuts to avoid loosening the contact pile-up mounting screws.

#### COUNTER ADJUSTMENTS

REMOVE THE COUNTER UNIT FROM ITS MOUNTING BRACKET AS FOLLOWS:

When the counter is mounted in front of the perforator it may be removed by loosening the two screws just below the counter unit and sliding the counter unit from its mounting bracket. If the counter is mounted at the right-hand side of the keyboard, remove the counter cover by removing the two cover mounting screws from the under side of the mounting plate. Place the counter unit face down to one side of the keyboard without disconnecting the wires.

#### FEED PAWL BRACKET ADJUSTMENT

With the counting magnet armature play taken up in an outward direction, the outer edge of the pawl should not extend more than .035" outside the outer surface of the ratchet. With the play taken up in the opposite direction, the outer surface of the pawl should not be more than .015" within the outer surface of the ratchet. To adjust, remove the armature assembly from the unit. Set the screws which hold the bracket to the armature so that the bracket is friction tight, and replace the armature assembly on the unit. Adjust the bracket for the correct position of the pawl, remove the armature assembly, and tighten the bracket mounting screw. Replace the armature assembly. See Figure 54 for location of parts.

#### RATCHET RETURN SPRING ADJUSTMENT (Figure 54)

The ratchet should be free throughout a complete revolution in a counterclockwise direction. To adjust, proceed as follows: Remove the dashpot, taking care to permit the ratchet spring to unwind slowly so as to avoid breaking the spring. Wind up the ratchet spring by turning the ratchet in a counterclockwise direction until the spring is tight. Then return the ratchet in a clockwise direction not less than one, nor more than two, complete revolutions. Position the ratchet so that the stop lug is in the approximate location of 45° in the lower left-hand quadrant as the ratchet is viewed from the rear. Engage the latch pawl to hold the ratchet in place. Replace the dashpot and position it so that the stop lug is in full engagement with the

plunger throughout the stroke of the plunger.

#### RATCHET SPRING TENSION (Figure 54)

Operate the release magnet armature and hold the dashpot plunger depressed. Hook an 8 oz. scale over the spoke of the ratchet that carries the stop lug at the point on the spoke nearest the periphery of the ratchet and pull in a counterclockwise direction at a right angle to the radius. It should require 1-1/2 to 3 ozs. to move the stop lug away from the end of the plunger.

#### RELEASE MAGNET ARMATURE ECCENTRIC STOP ADJUSTMENT (Figure 55)

With the feed pawl in full engagement with the teeth on the ratchet, there should be .010" to .020" clearance between the release lever extension and the feed pawl when the release magnet armature is against its stop. To adjust, loosen the eccentric stop mounting screw and position the eccentric. Tighten the mounting screw.

#### CHECK LATCH PAWL BRACKET ADJUSTMENT (Figure 56)

With the counting magnet armature against the magnet cores, the teeth on the feed pawl should overtravel the ratchet teeth .008" to .020". To adjust loosen the check latch pawl bracket mounting screws and position the bracket. Tighten the mounting screws.

NOTE: When making this adjustment, back off the release lever extension adjusting screw and hold the check latch pawl in full engagement with a tooth on the ratchet.

#### RELEASE LEVER EXTENSION ADJUSTING SCREW ADJUSTMENT (Figure 54)

NOTE: When checking this requirement, hold the release magnet armature attracted.

Hold the ratchet so that the teeth on the check latch pawl are not opposite the place on the ratchet where the teeth are missing. There should be .015" to .025" clearance between the check latch pawl and the ratchet. To adjust, loosen the release lever extension adjustment screw lock nut and position the screw. Tighten the lock nut.

#### COUNTING MAGNET ARMATURE ECCENTRIC STOP ADJUSTMENT (Figure 57)

When the counting magnet armature is operated, its feed pawl should rotate the ratchet one tooth and the check latch pawl should be in full engagement with a tooth on the ratchet, with slight overtravel not over .010", when the counting magnet armature is against its eccentric stop. Check this overtravel throughout a complete revolution of the ratchet. To adjust, loosen the eccentric stop mounting screw and position the eccentric. Tighten the mounting screw.

#### RELEASE LATCH BRACKET ADJUSTMENT (Figure 58)

With the release magnet armature against the magnet cores, the release lever extension should overtravel the notch in the release latch by .004" to .015". To adjust, loosen the release latch bracket mounting screws



and position the bracket. Tighten the screws.

#### CHECK LATCH PAWL SPRING TENSION (Figure 54)

With the release magnet armature against the magnet cores, hook an 8 oz. scale in the spring hole of the check latch pawl and pull in line with the spring. It should require 1-1/2 to 2-1/2 ounces to start the pawl moving.

#### RELEASE LATCH SPRING TENSION (Figure 56)

With the release latch in its unlatched position, hook an 8 oz. scale in the notch in the release latch and pull in a direction so that the scale wire passes over the spring post. It should require 3/4 to 1-3/4 ozs. to start the latch moving.

#### DASHPOT POSITION ADJUSTMENT

With the plunger completely depressed into the dashpot cylinder, the stop on the ratchet resting firmly against the end of the plunger shaft, and the check latch pawl in engagement with the ratchet, there should be some clearance, not over .004", between the engaging faces of the first tooth on the ratchet and the first (outer) tooth on the check pawl. See Figure 54 for location of parts. On units which have an indicator and a scale, under the foregoing conditions, the indicator should point to zero on the scale. Also, the point of contact of the plunger against the ratchet stop lug should be at least .040" from the edge of the stop lug throughout the stroke of the plunger. To adjust the dashpot, loosen the dashpot mounting screws and position the dashpot. Tighten the mounting screws. Then loosen the indicator set screws and position the indicator. Locate it so that the outer edge of the hub is flush with the end of the shaft before tightening the set screws.

#### FEED PAWL SPRING TENSION (Figure 54)

Hold the release magnet armature against the magnet cores, hook an 8 oz. scale over the feed pawl bearing screw, and pull as nearly parallel as possible to the feed pawl. It should require 5 to 7 ozs. to start the pawl moving.

#### CONTACT BRACKET ADJUSTMENT (Figure 59)

With the contact lever on the low part of the contact cam, there should be some clearance, not over .015", between the contact lever and the insulator. To adjust, loosen the contact bracket mounting screws and position the bracket. Tighten the screws.

#### CONTACT SPRING ADJUSTMENT (Figure 59)

With the contact operating lever on the low part of its cam, there should be .010" to .015" clearance between the contact points. To adjust, bend the short contact spring stiffener. The contact spring should make contact with the stiffener throughout its length.

#### SIGNAL LAMP CONTACT PRESSURE (Figure 60)

With the contact lever on the high part of the cam, hook an 8 oz. scale over the short contact spring between the contact and the stiffener and pull at a right angle to the spring. It should require 2 to 3 ozs. to separate the contacts. To adjust, bend the short contact spring.

#### CONTACT CAM ADJUSTMENT

Operate the release magnet armature and then operate the counting magnet armature sixty-four times. The contacts should close on the sixty-fifth operation. To adjust, loosen the contact cam set screw and position the cam simultaneously, locating it so that the ratchet shaft has some end play, not over .004". Tighten the set screw.

#### DASHPOT AIR VENT SCREW ADJUSTMENT

When the dashpot air vent is properly adjusted and the perforator transmitter is operated with power, the ratchet should return from its farthest advanced position to its zero position without bouncing; when it is returned from the eighth space, it should return quickly enough to prevent feeding of more than one tooth when a character key lever is depressed immediately after the ratchet has been released. To adjust, loosen the dashpot vent screw lock nut and position the vent screw. Tighten the lock nut.

#### DASHPOT PLUNGER SPRING TENSION

With the dashpot held in a vertical position and the ratchet rotated clockwise so as to move the ratchet stop arm away from the plunger, apply an 8 oz. scale to the end of the plunger and push upward. It should require from 1/2 to 1 oz. to move the plunger all the way.

#### REPLACE THE COUNTER UNIT

#### LUBRICATION

Proper attention to lubrication is of the utmost importance. Use the lubricants listed in the supplement furnished with this bulletin. Unless otherwise specified, one or two drops of oil at each of the places listed will be sufficient. Use oil unless the use of grease is specified.

Apply oil to both loops of all helical springs that exert a nominal tension of less than 2-1/2 lbs. Apply grease to both loops of springs that exert a nominal tension of 2-1/2 lbs. or more.

#### LOCATIONS ON THE BOTTOM SIDE OF THE PERFORATOR TRANSMITTER

- (1) Key levers - key lever shaft and rear comb slots.
- (2) Selector bar guide slots.
- (3) "Y" levers - bearing slots and arms.
- (4) "Y" lever connecting links - connections with extensions and "Y" levers.
- (5) Selector levers and contact operating levers - bearing shaft.
- (6) Universal bar bearings.

- (7) Locking levers - at point of engagement with "Y" lever links.
- (8) Counter control cam levers - at pivot points and at points of engagement with key levers.

LOCATIONS ON THE TOP SIDE OF THE PERFORATOR TRANSMITTER

- (1) Key lever front comb slots.
- (2) Space bar loop - bearings and at point of engagement with its key lever.
- (3) Transmitting shaft - fill two oil cups (grease on the gear).
- (4) Transmitting cam sleeve - a light film of grease on all cams.
- (5) Transmitting clutch - on sliding members, between teeth, and on cam surface.
- (6) Locking loop - bearings and roller.
- (7) Contact levers - bearing shaft and guide slots.
- (8) Locking levers - bearing slots and at points of engagement with the contact levers.
- (9) Clutch throwout lever bearings.
- (10) Intermediate pawl - pivot and lower extension.
- (11) Trip off pawl - joint and camming surface.
- (12) Keyboard control operating lever - pivot and detent.
- (13) Keyboard control operating lever extension - at point of engagement with repeat space rod or cutout.
- (14) Repeat space rod - at point of engagement with space bar loop extension and at the bracket.
- (15) "Y" lever connecting link extensions - left end connections.
- (16) Selector fingers - at selector lever connections, guide slots, and at point of engagement with punches and armature lever.
- (17) Armature lever - oil holes, two.
- (18) Selector finger retaining fork - bearings and roller.
- (19) Anti-chatter contact lever - pivot and point of engagement with the adjusting screw.
- (20) Anti-chatter lever latch (if unit is so provided) - at bearing and at point of engagement with latch screw and punch contact operating lever.
- (21) Punch contact operating lever back stop bracket slot (in units with slotted backstop bracket).
- (22) Punch block - rear oil hole, punches, guide pins.
- (23) Feed roll - bearings, ratchet teeth, star wheel.
- (24) Tape tension lever bearings.
- (25) Back space lever - shoulder screw bearings and point of engagement with release cam (in units equipped with a feed pawl release cam).
- (26) Back space pawl bearing screw.
- (27) Feed pawl release cam - bearing, cam surface (in units with a feed pawl release cam).
- (28) Feed roll detent - roller and pivot.
- (29) Feed pawl bearing.

LOCATIONS ON THE COUNTER UNIT

NOTE: Care should be exercised to prevent oil from getting between the pole faces of the magnets and the armatures.

- (1) Counter and release magnet armature bearings.
- (2) Feed pawl bearing screw.
- (3) Check latch pawl - bearing screw and at point of engagement with the adjusting screw.
- (4) Latch pawl - bearing screw and on latching surface.
- (5) Ratchet wheel - on teeth, outer bearings, and in drum.
- (6) Contact lever bearing and cam.
- (7) Dashpot plunger.

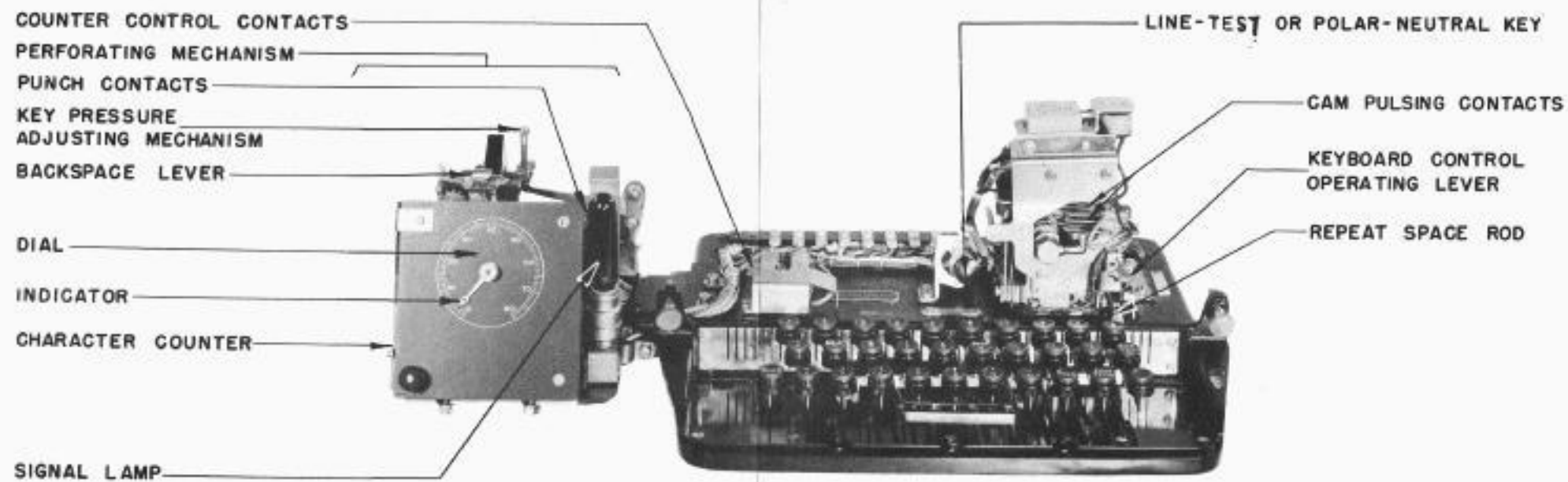


FIGURE 1  
(LEFT-HAND COUNTER)



FIGURE 2  
(LEFT-HAND COUNTER)

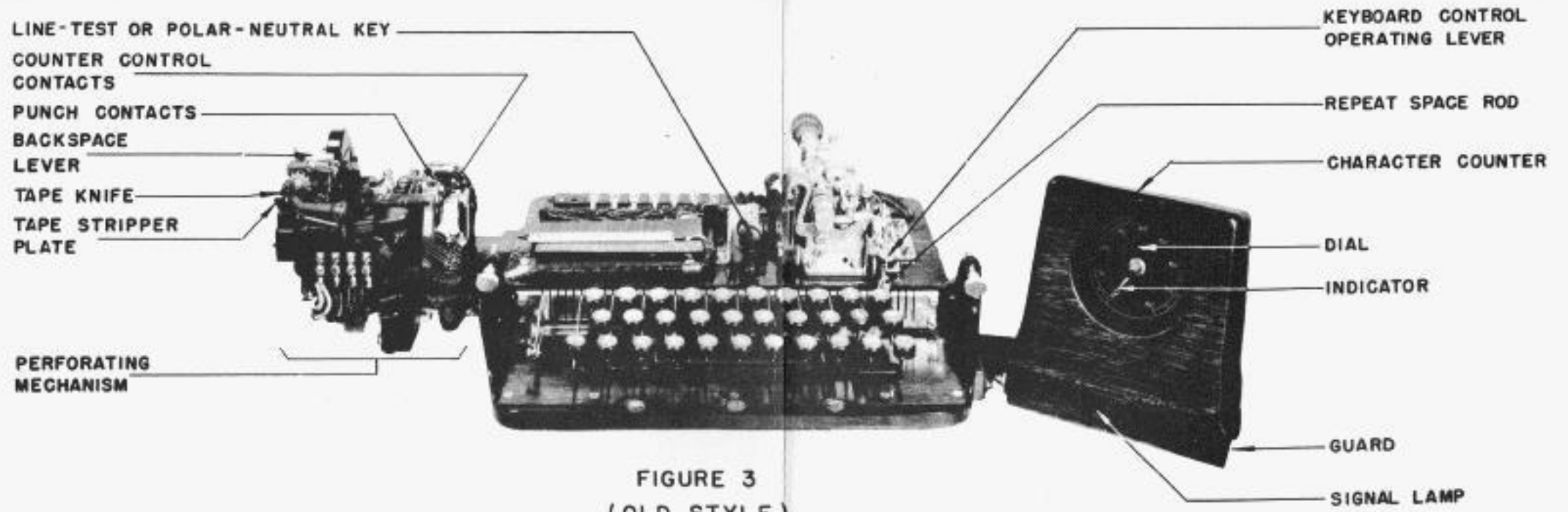


FIGURE 3  
(OLD STYLE)

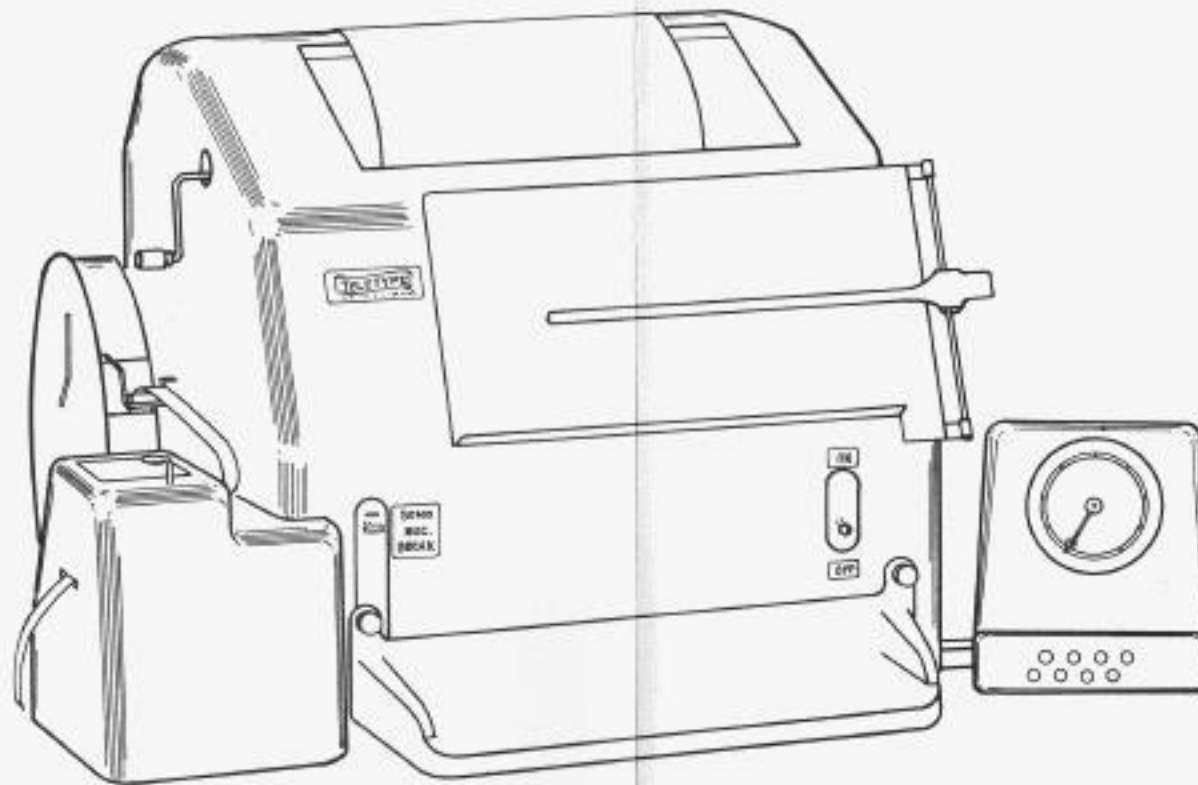


FIGURE 4  
(OLD STYLE)

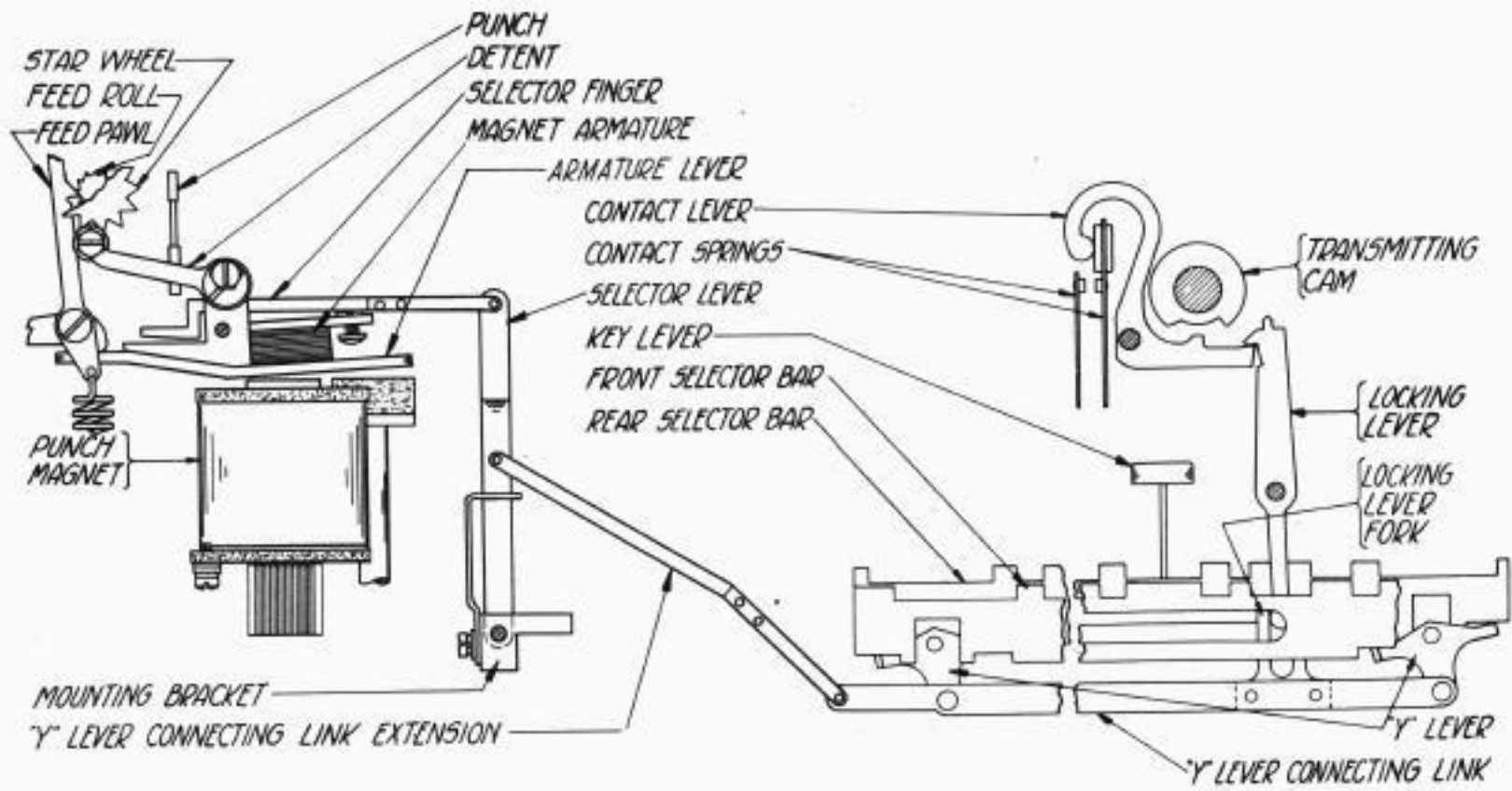


FIGURE 5

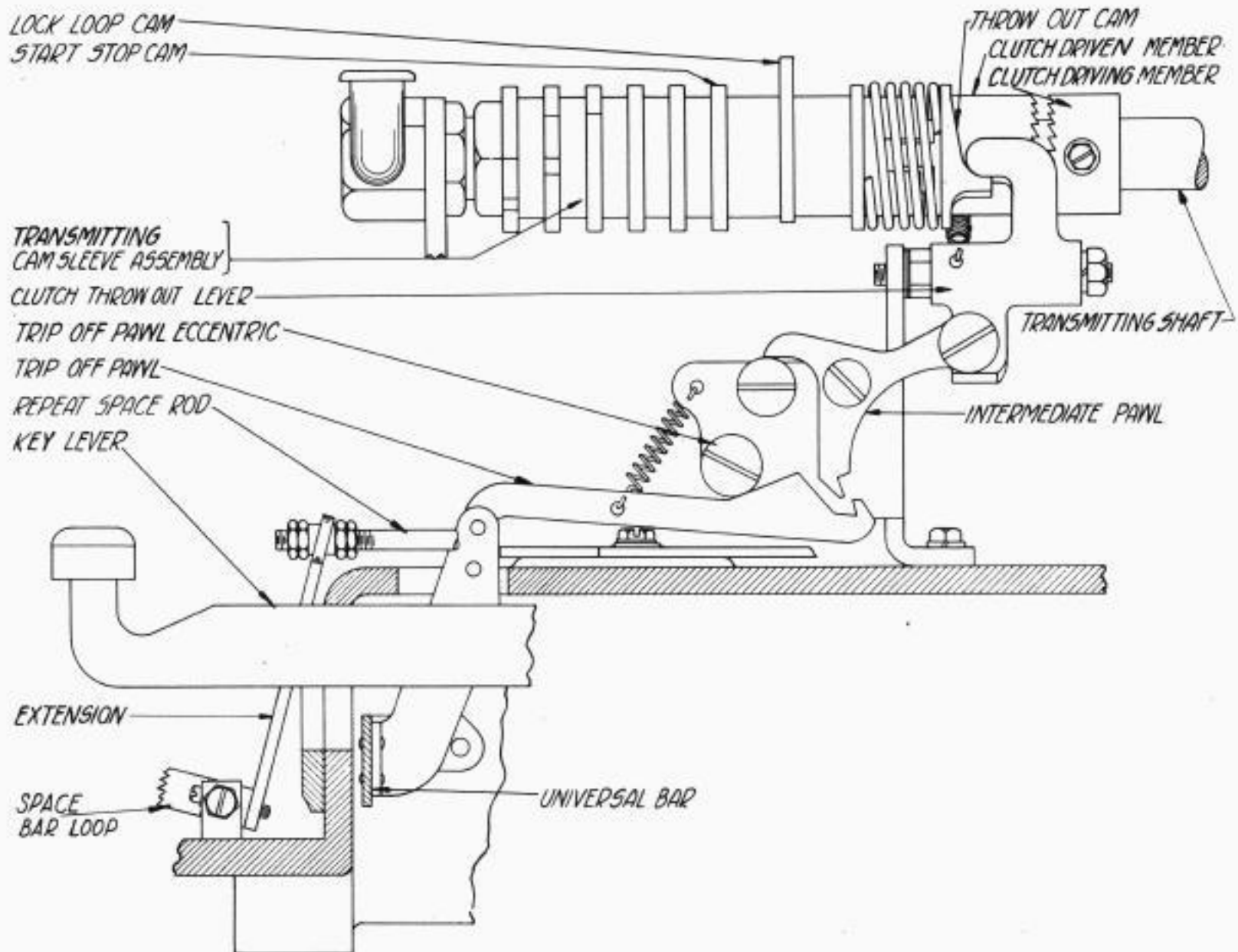


FIGURE 6

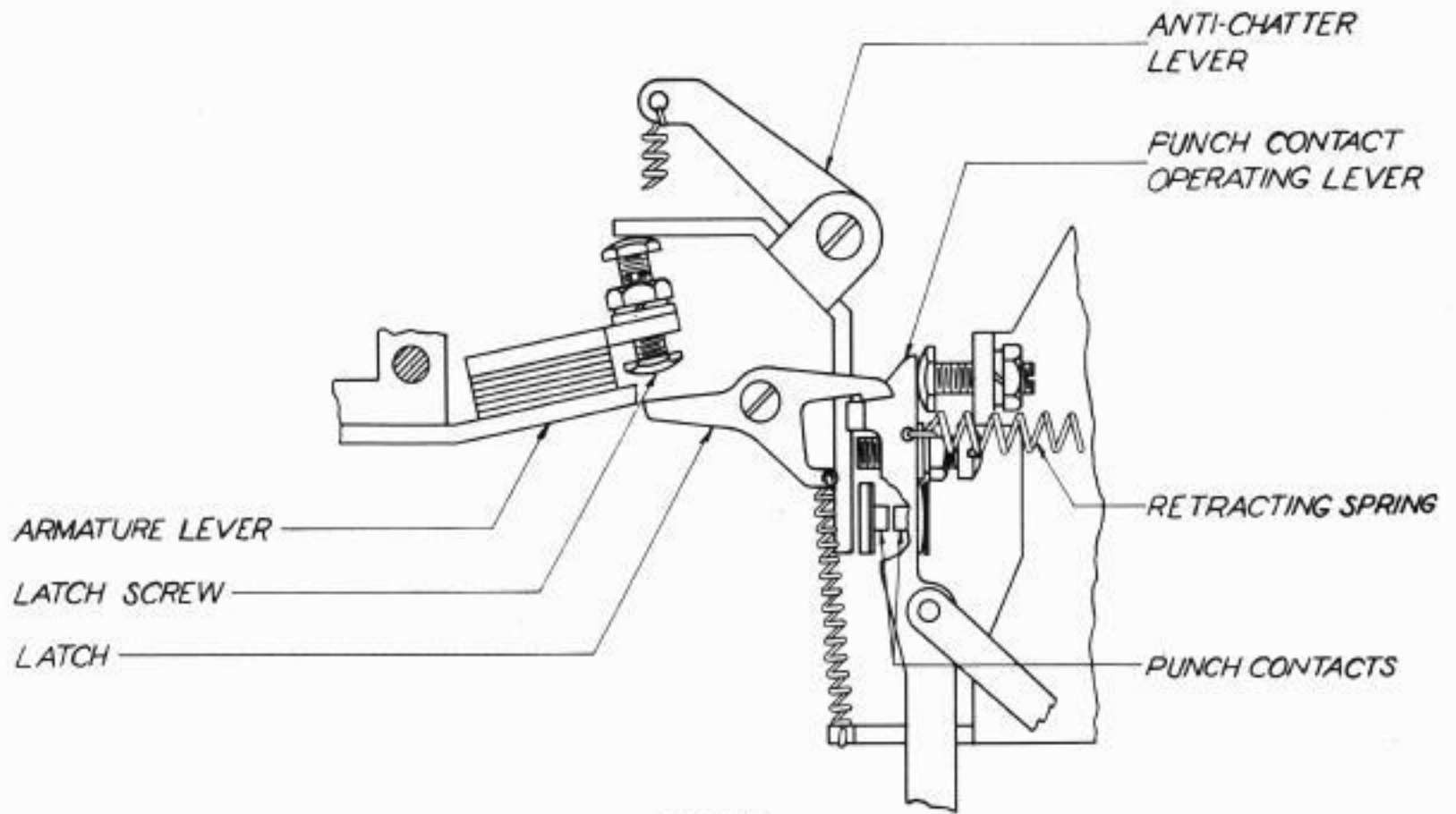


FIGURE 7

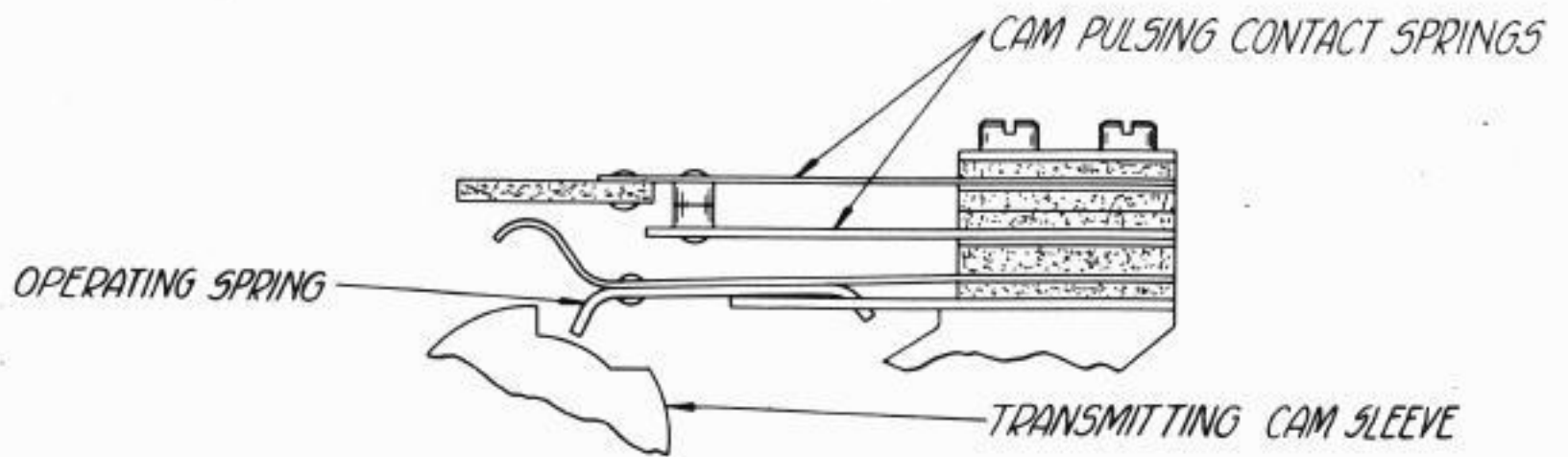


FIGURE 8

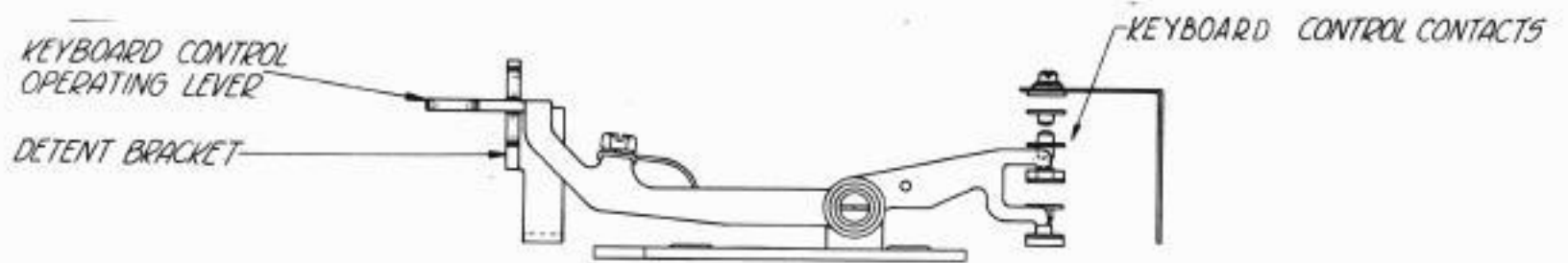


FIGURE 9

UPPER CASE	WEATHER SYMBOLS	↑	⊕	○	/	3	→	↓	8	↙	←	↘	·	9	0	1	4	BELL	5	7	⊖	2	/	6	+									
	COMMUNICATIONS	-	?	:	\$	3	!	&	£	8	'	(	)	.	9	0	1	4	BELL	5	7	:	2	/	6	"								
LOWER CASE		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	BLANK	C.R.	L.F.	SPACE	LTR. SHIFT	FIG. SHIFT	
FEED HOLES	1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	4	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

FIGURE 10



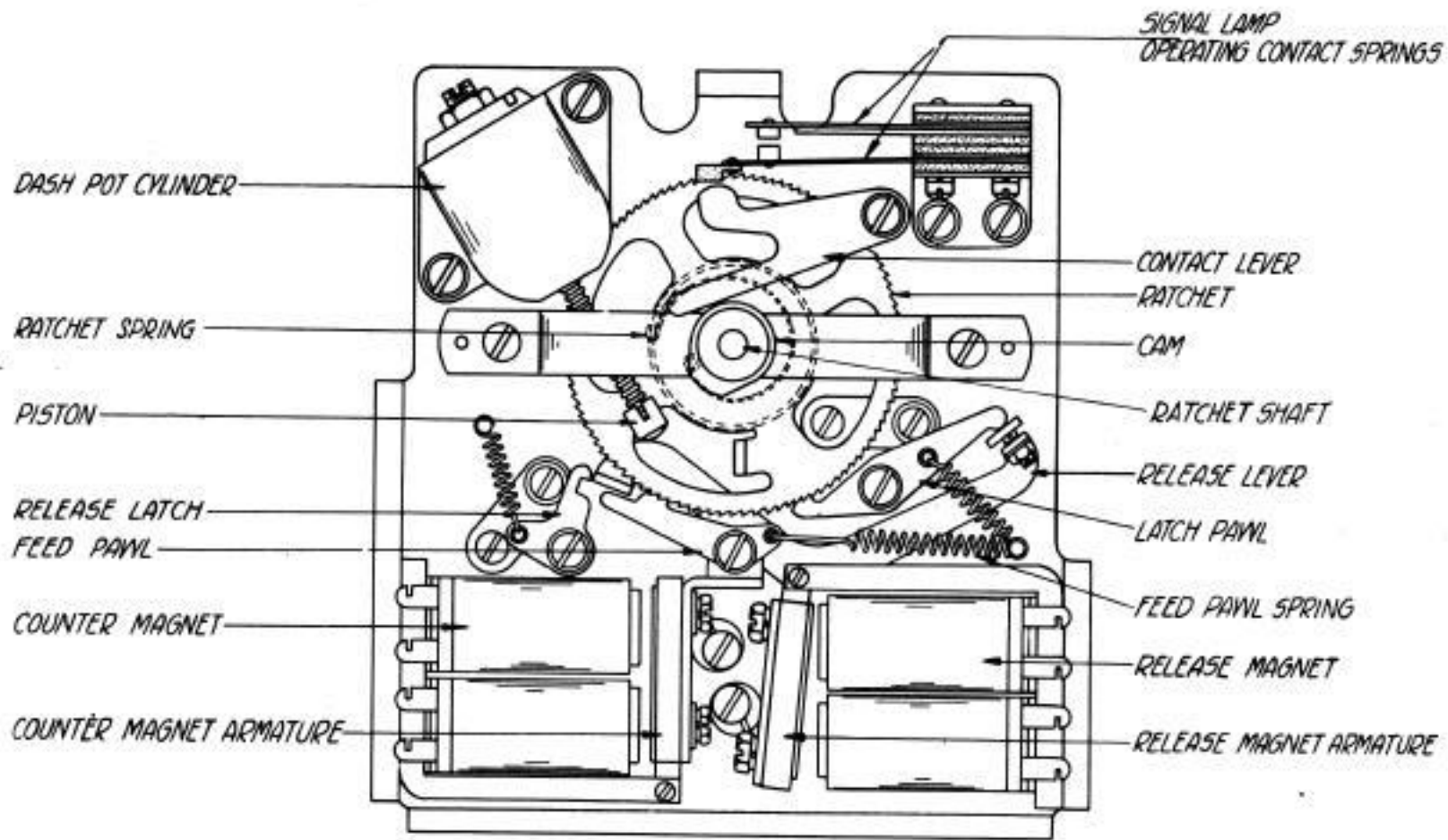


FIGURE 11

COUNTER CONTROL CONTACT  
ASSEMBLY MOUNTED ON  
PERFORATOR CASTING

COUNTER CONTROL CONTACT  
ASSEMBLY MOUNTED ON  
KEYBOARD CASTING

TO OPERATE PERFORATOR,  
APPLY 110 VOLTS D.C. TO  
THESE TERMINALS

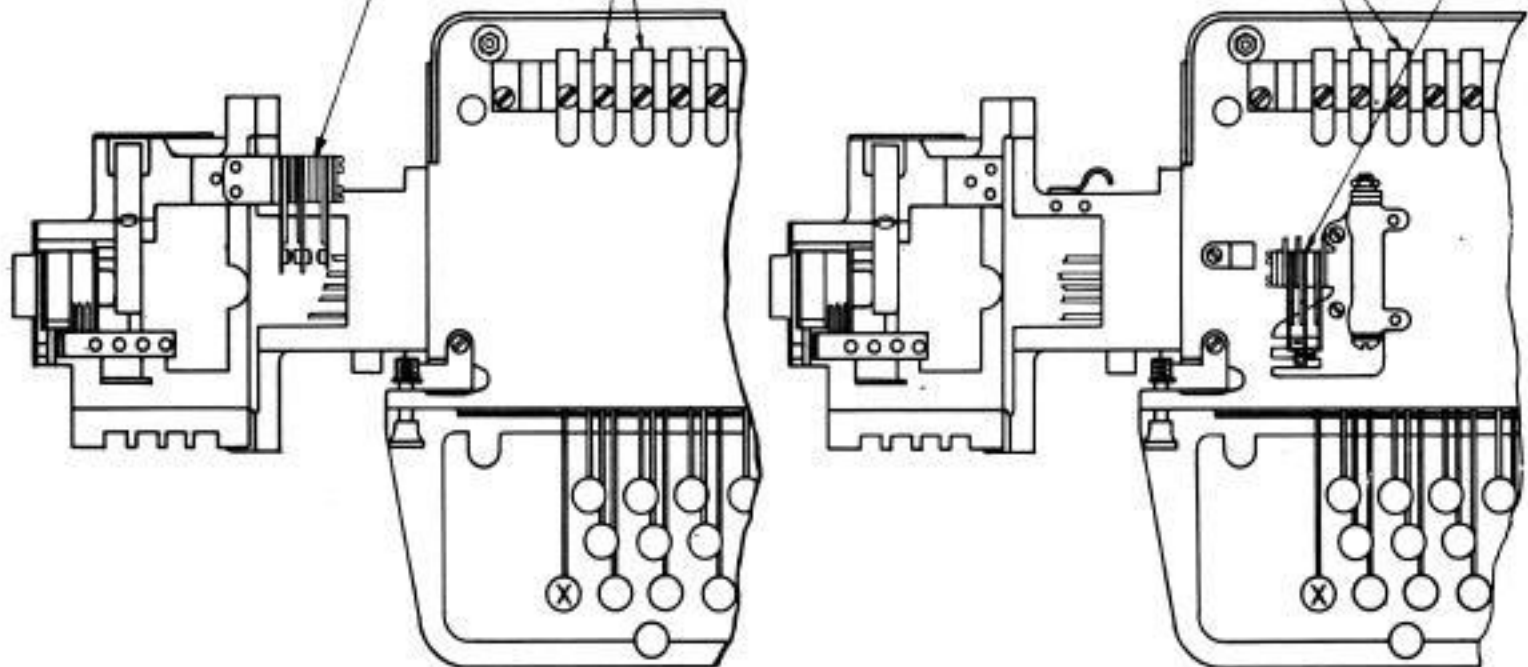


FIGURE 12

FIGURE 13

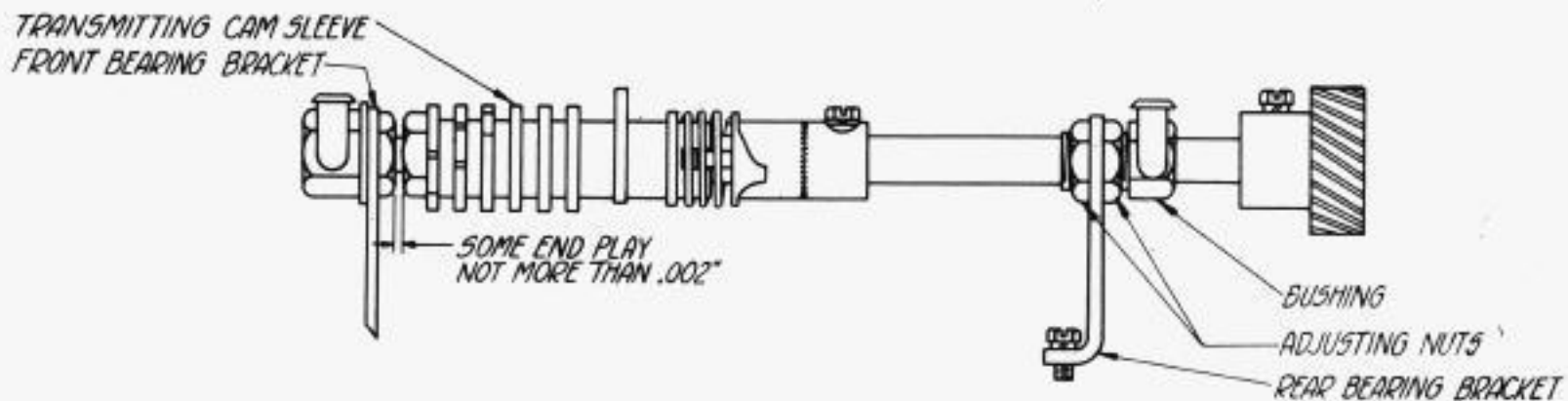
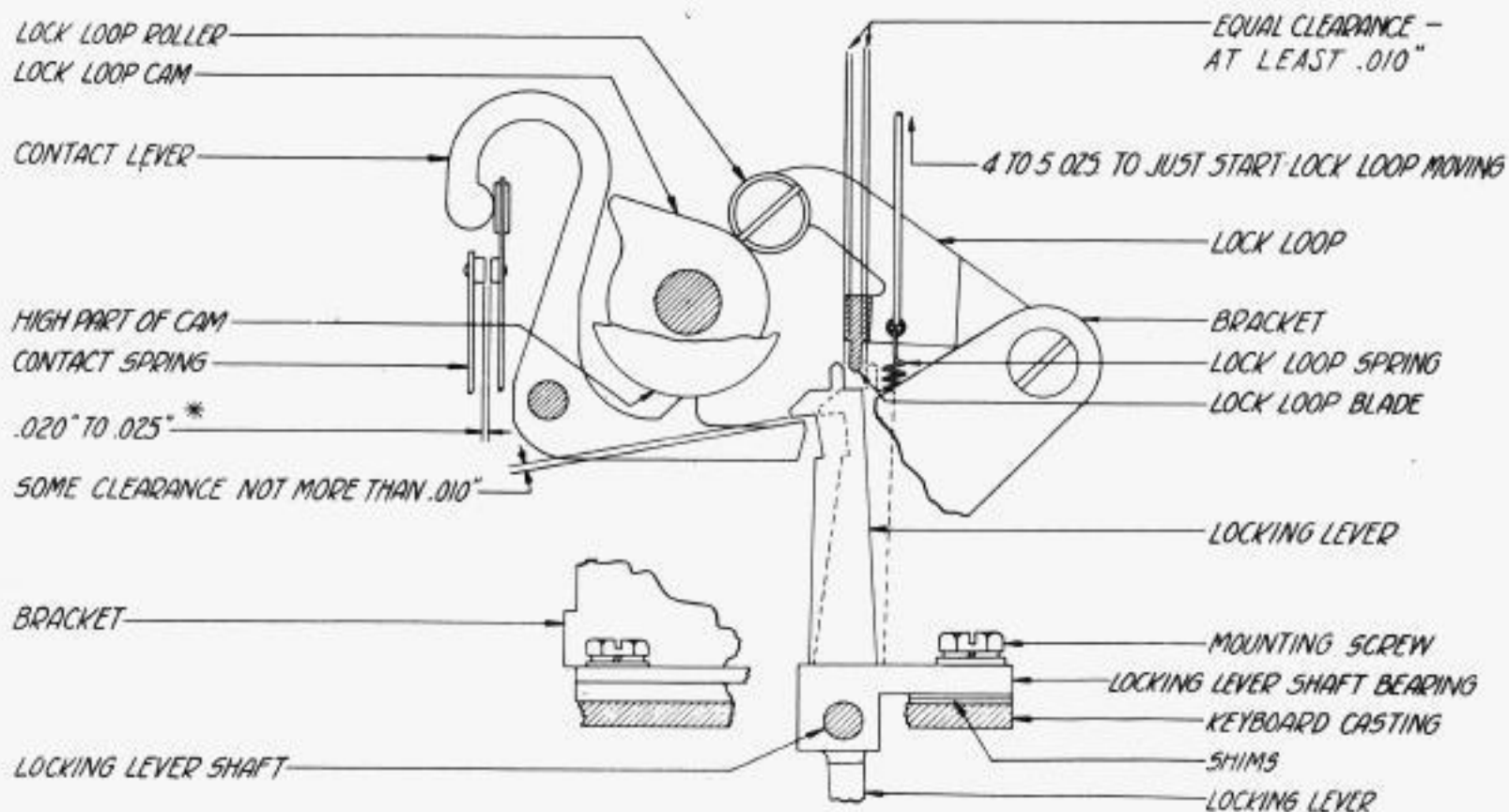


FIGURE 14



\*.015" TO .025" FOR START-STOP CONTACT ONLY

FIGURE 15

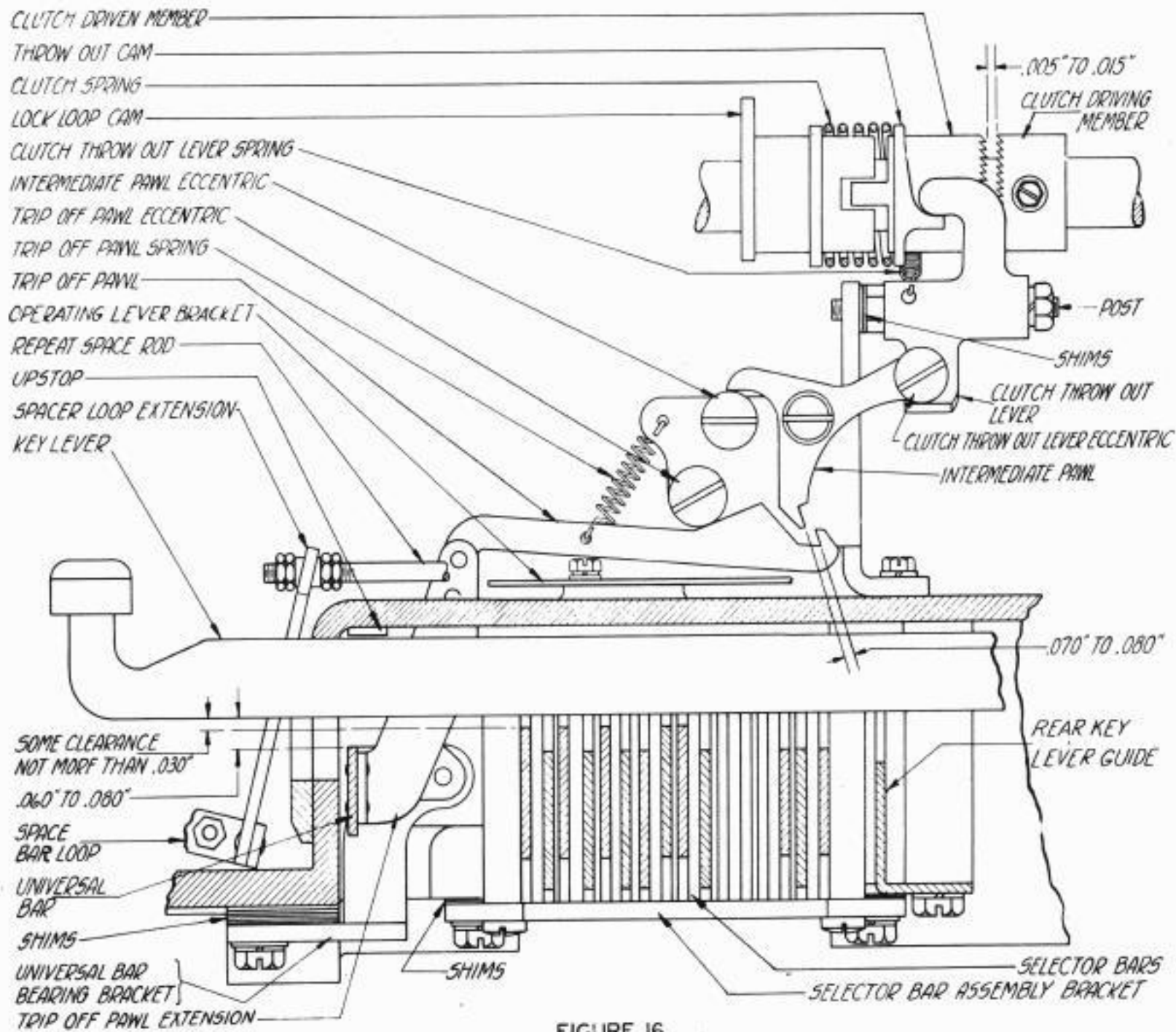


FIGURE 16

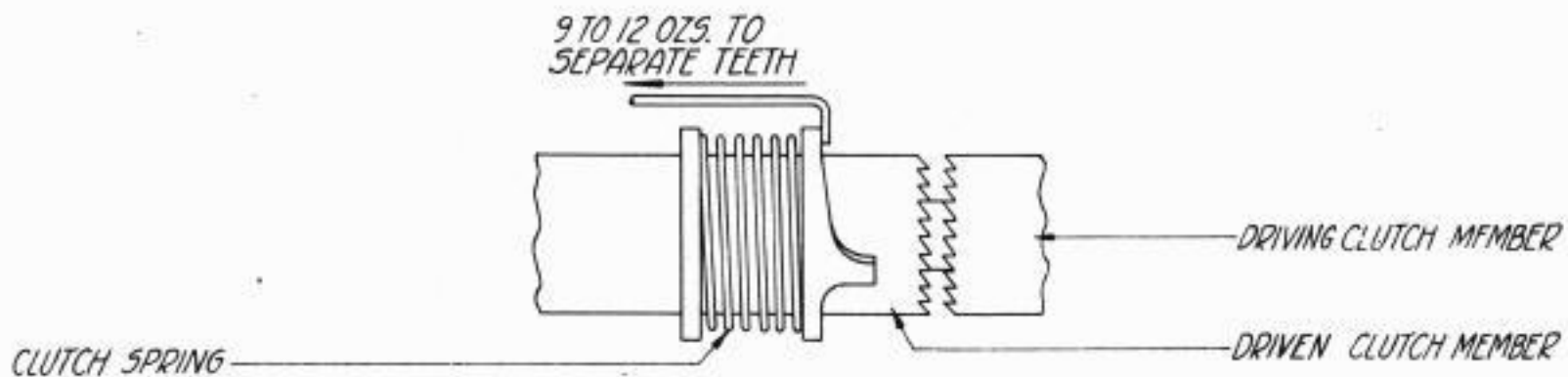


FIGURE 17

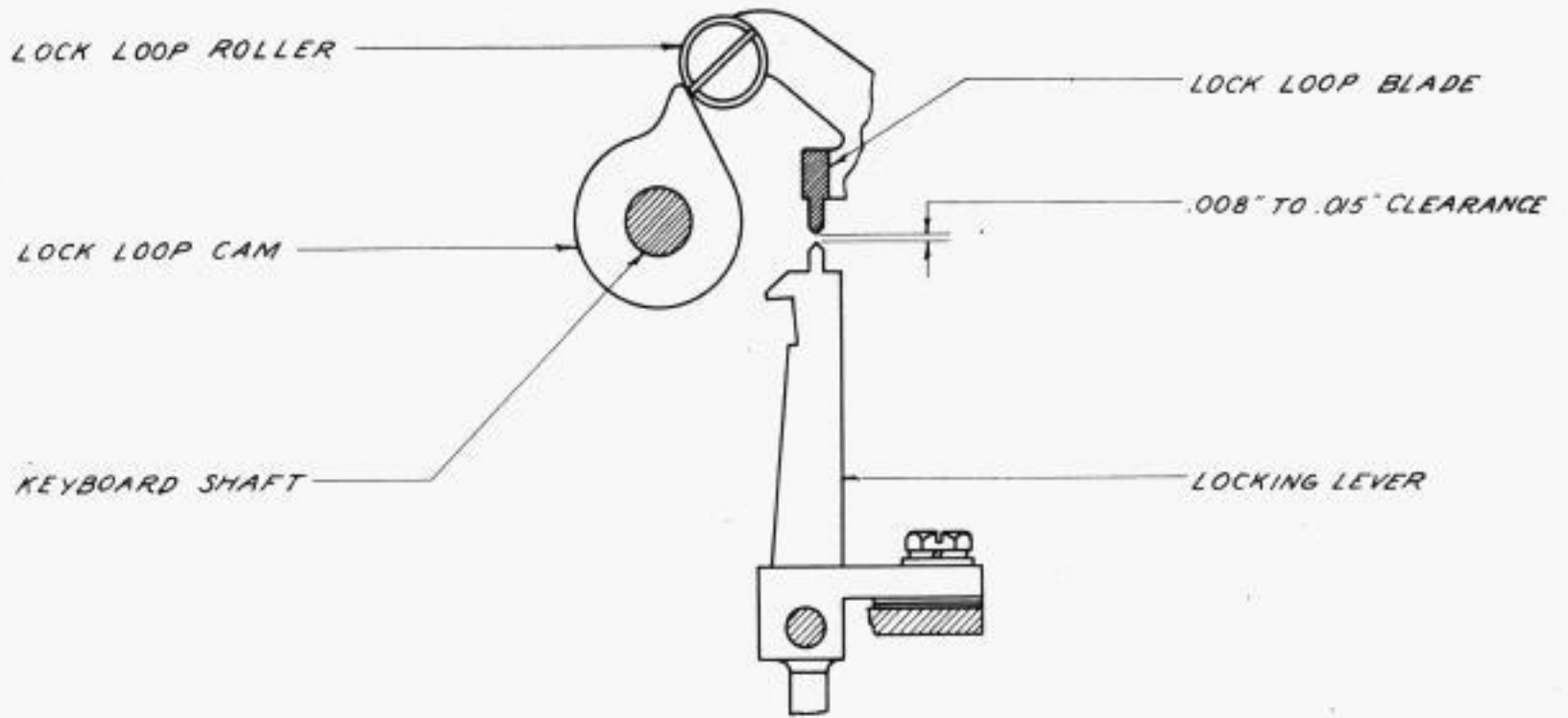


FIGURE 18

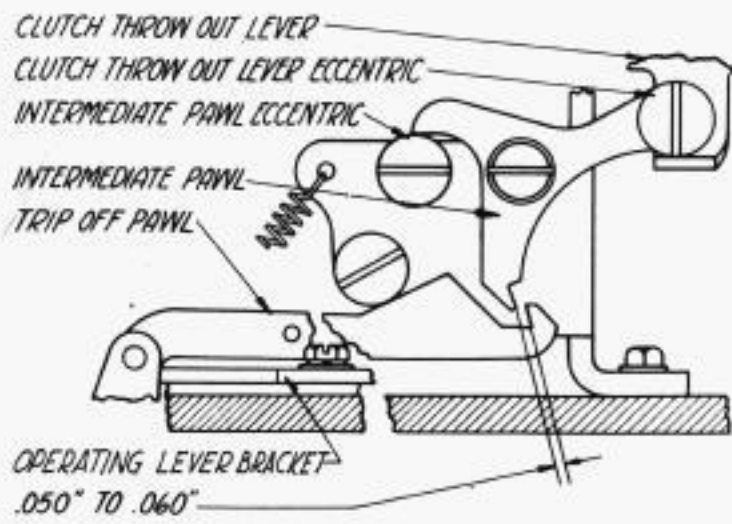


FIGURE 19

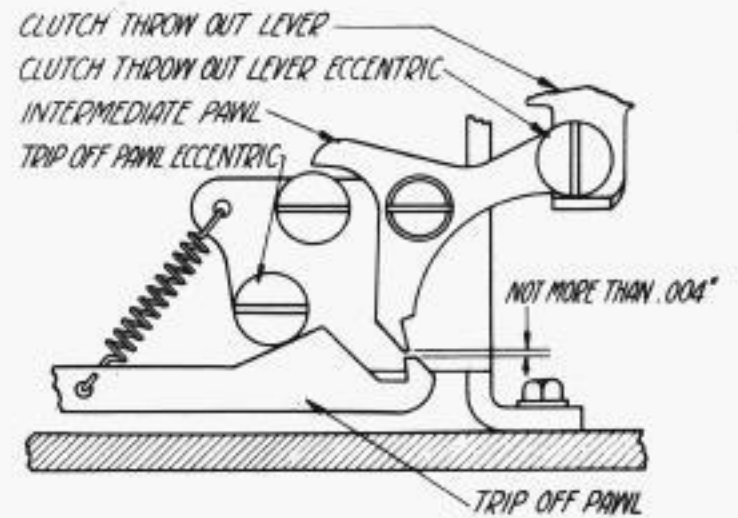


FIGURE 20

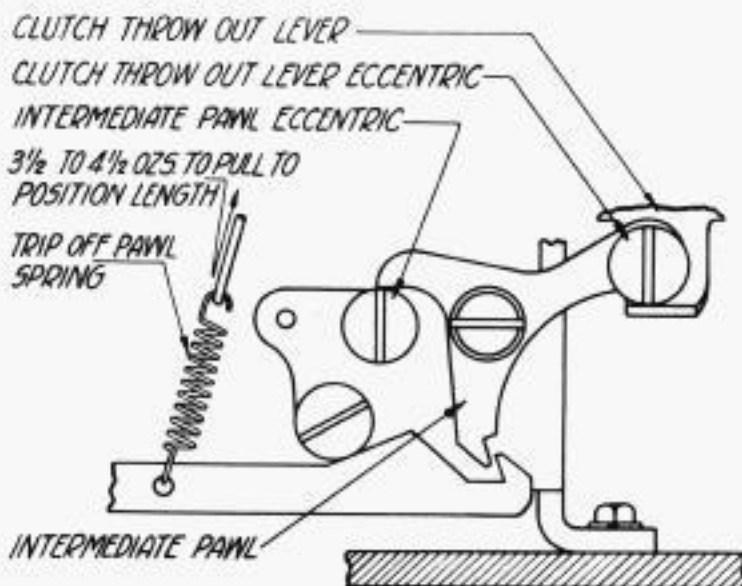


FIGURE 21

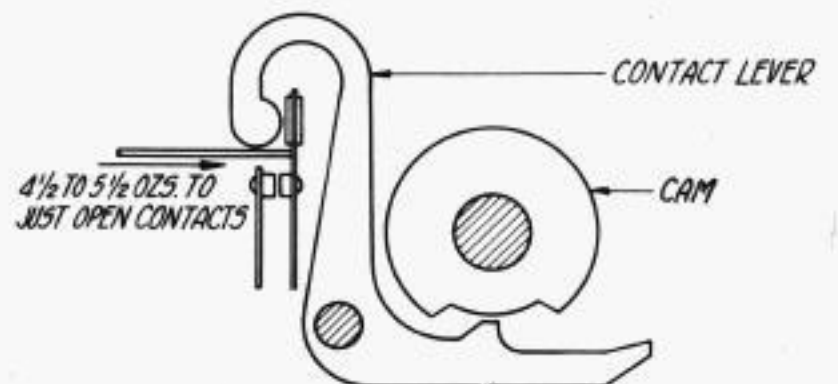
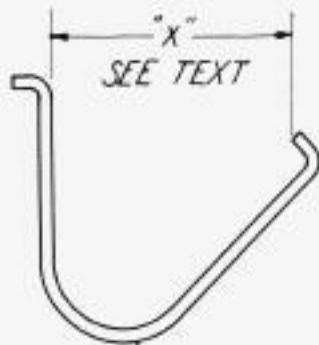


FIGURE 22

TRANSMITTER REAR BRACKET



KEYLEVER SPRING

REPEAT SPACE ROD

BACKSTOP SCREW

MOUNTING SCREW

REPEAT SPACE ROD BRACKET

FIGURE 23

SOME CLEARANCE NOT OVER .008"

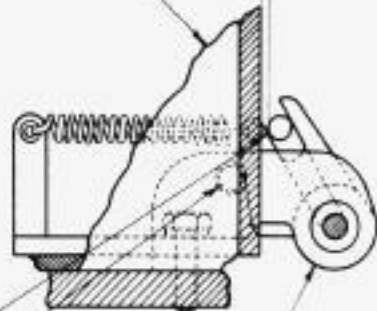


FIGURE 24

TRANSMITTER REAR BRACKET

SOME CLEARANCE NOT OVER .008"

REPEAT SPACE ROD

REPEAT SPACE ROD BRACKET

FIGURE 25

KEYBOARD CONTROL OPERATING LEVER

DETENT BRACKET

.010" TO .020"

THROW OUT CAM

CLUTCH THROW OUT LEVER

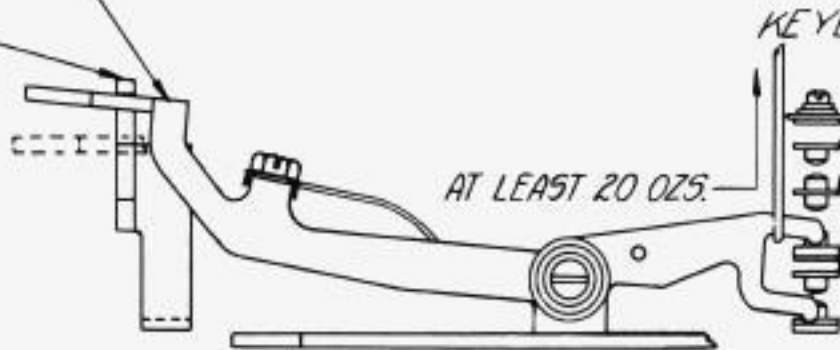


FIGURE 26

KEYBOARD CONTROL CONTACTS

AT LEAST 20 OZS.

FIGURE 27

INTERMEDIATE PAWL

AT LEAST .00"

REPEAT SPACE ROD

REPEAT SPACE ROD BRACKET

FIGURE 28

INTERMEDIATE PAWL

.010" TO .020"

REPEAT SPACE ROD

REPEAT SPACE ROD BRACKET

FIGURE 29

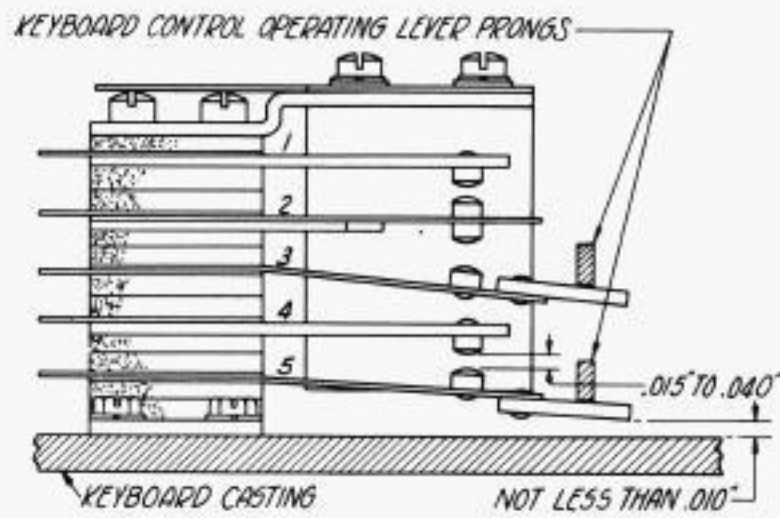


FIGURE 30

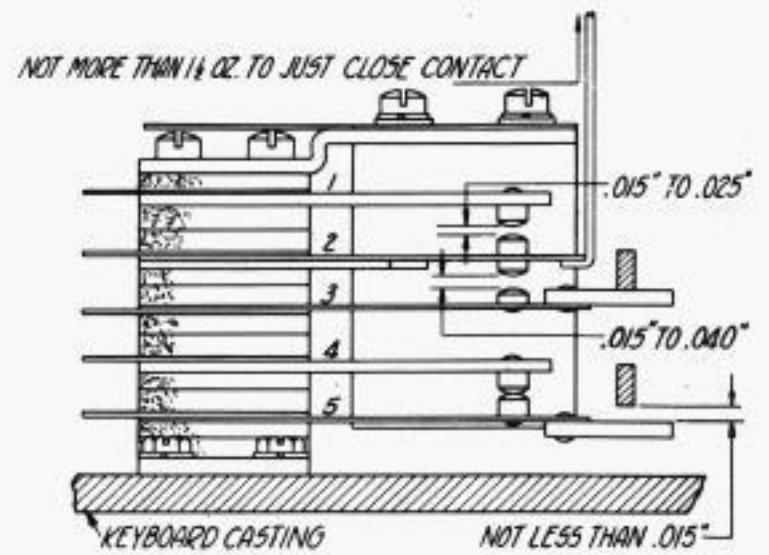


FIGURE 31

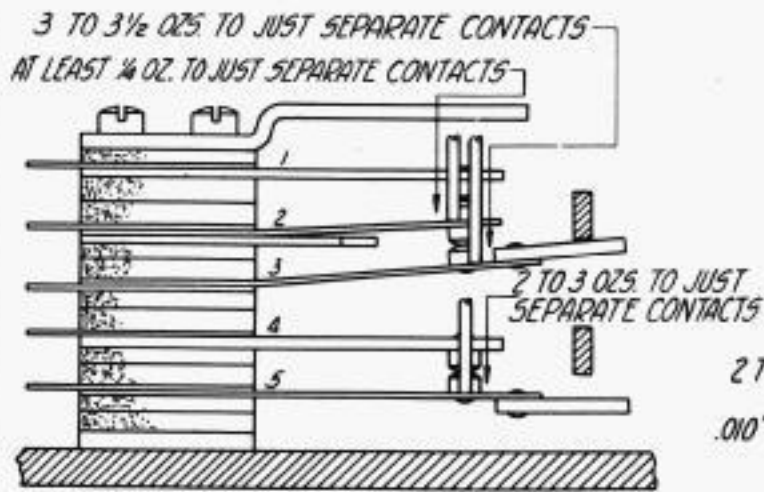


FIGURE 32

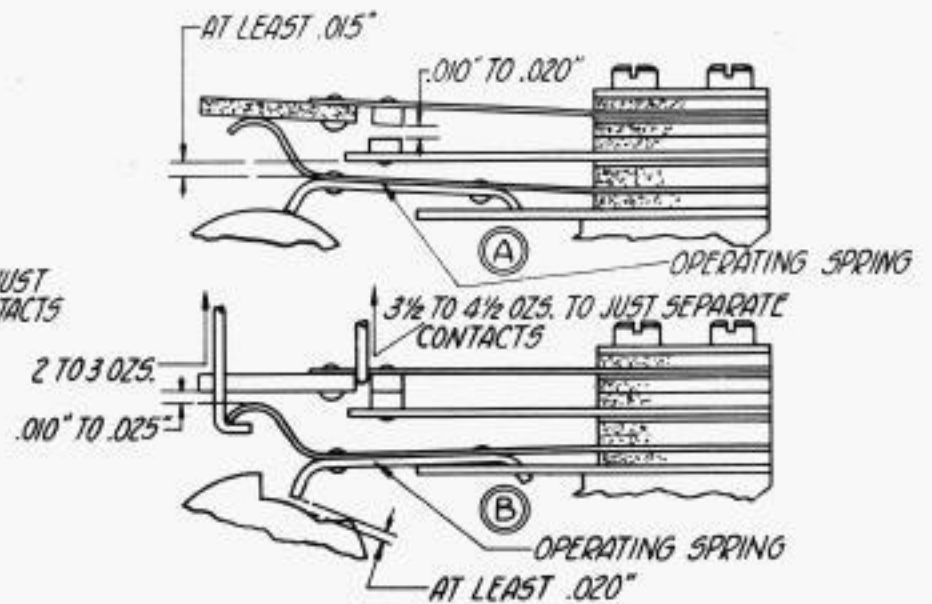


FIGURE 33

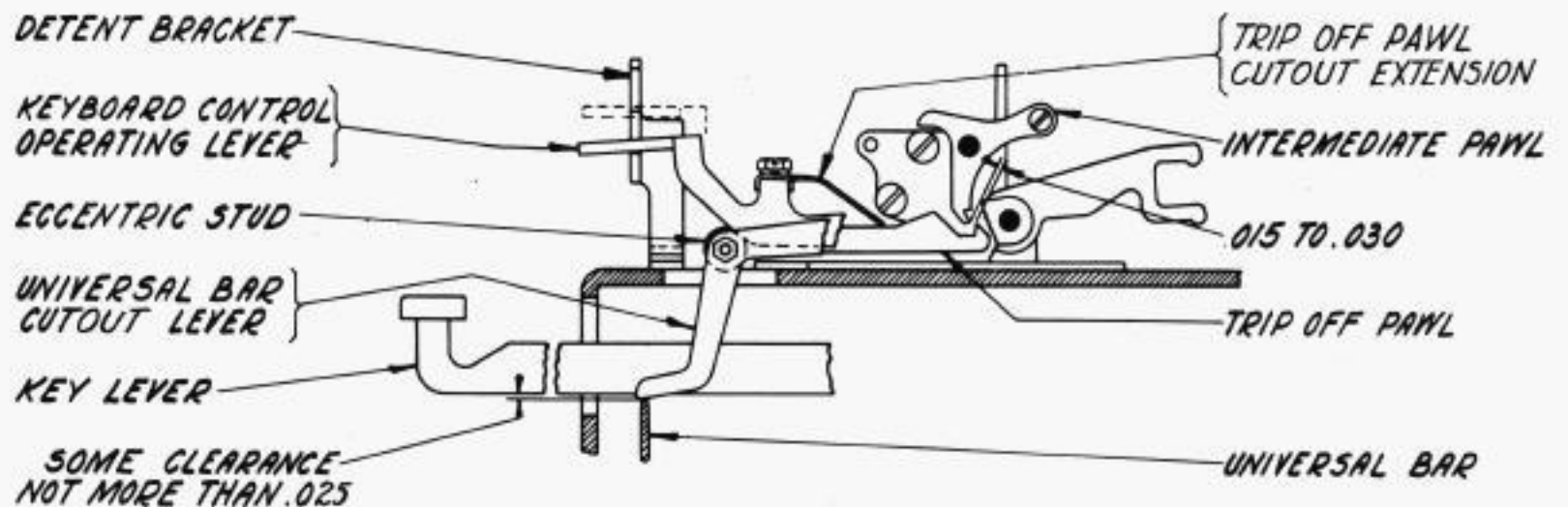


FIGURE 34

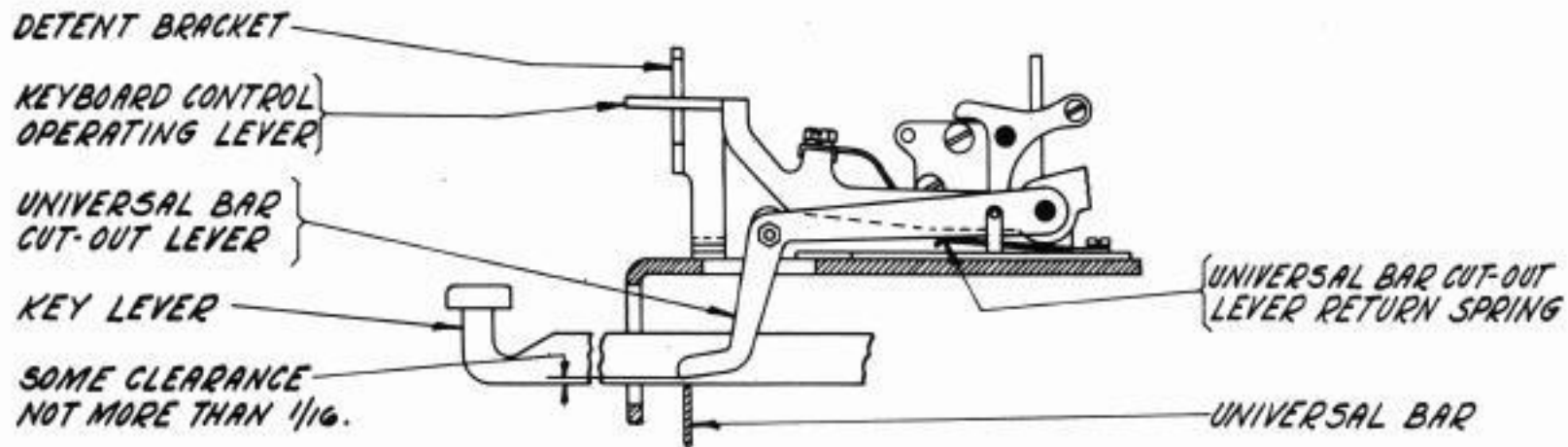


FIGURE 35

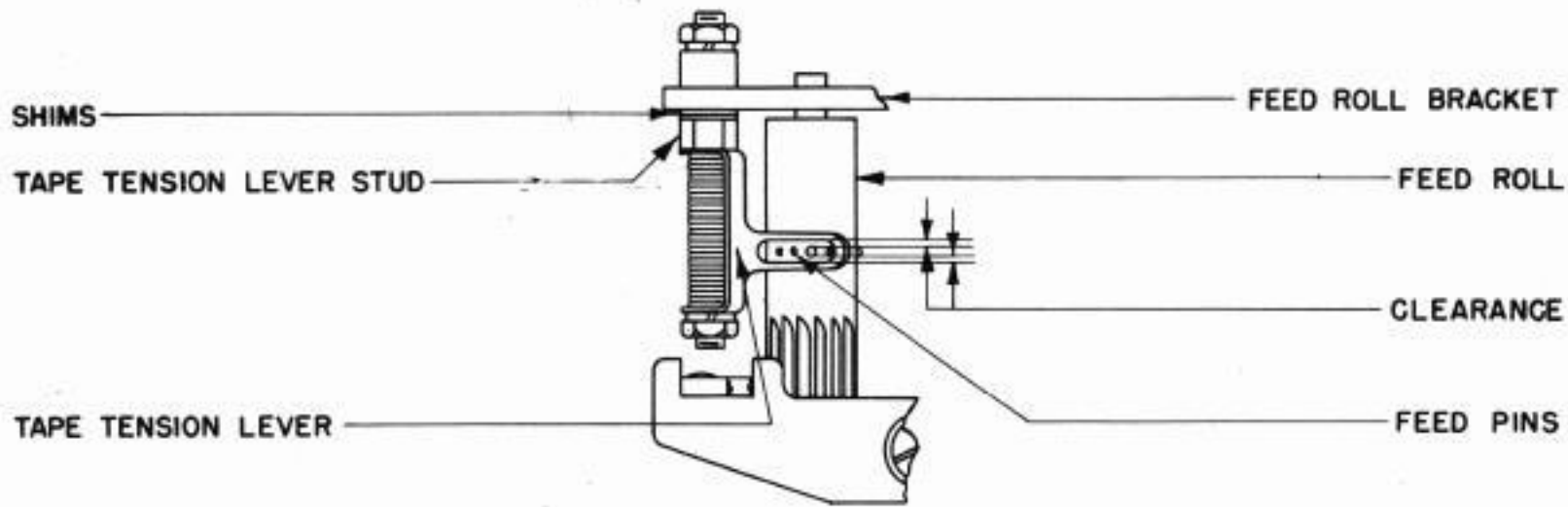


FIGURE 36

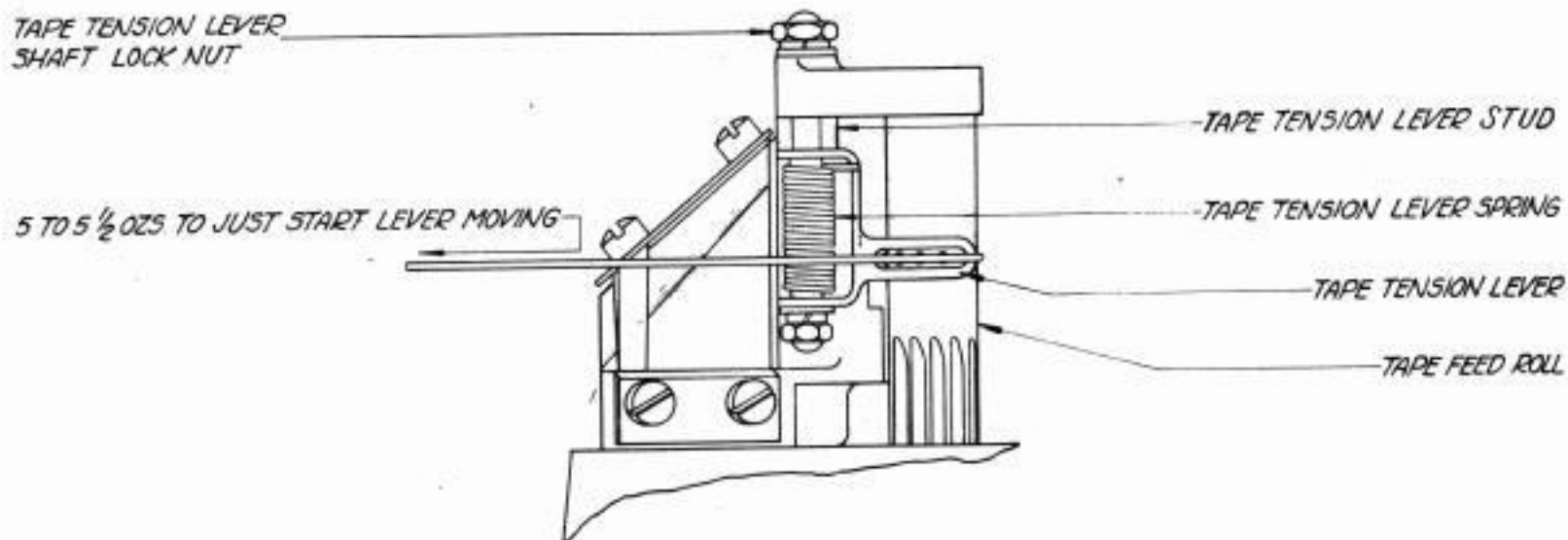


FIGURE 37

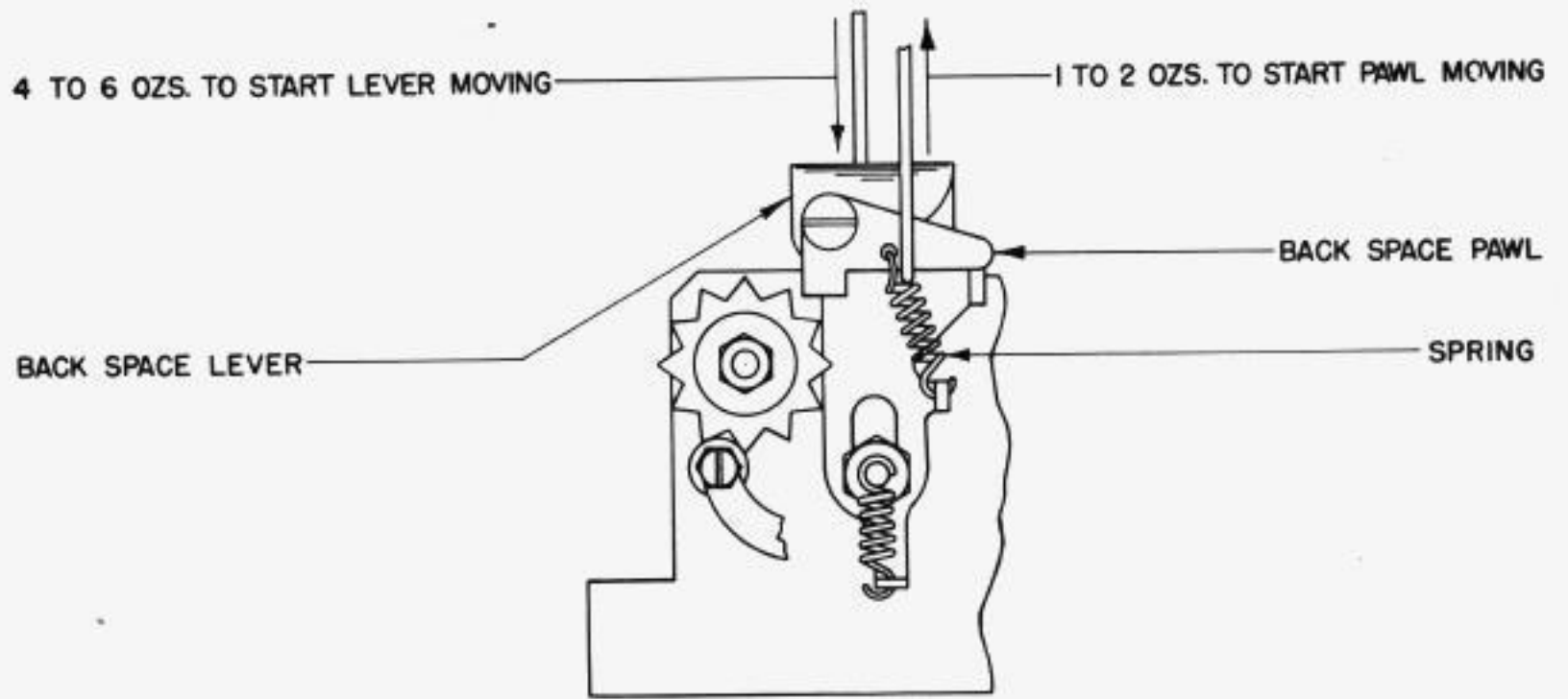


FIGURE 38

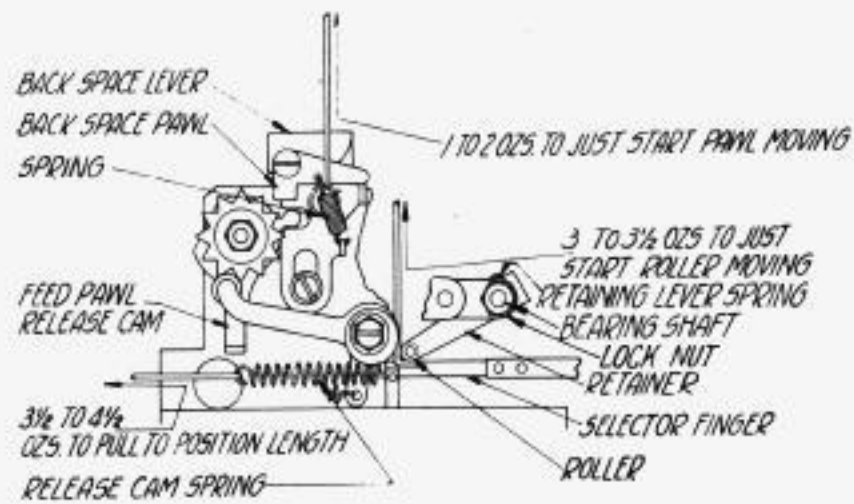


FIGURE 39

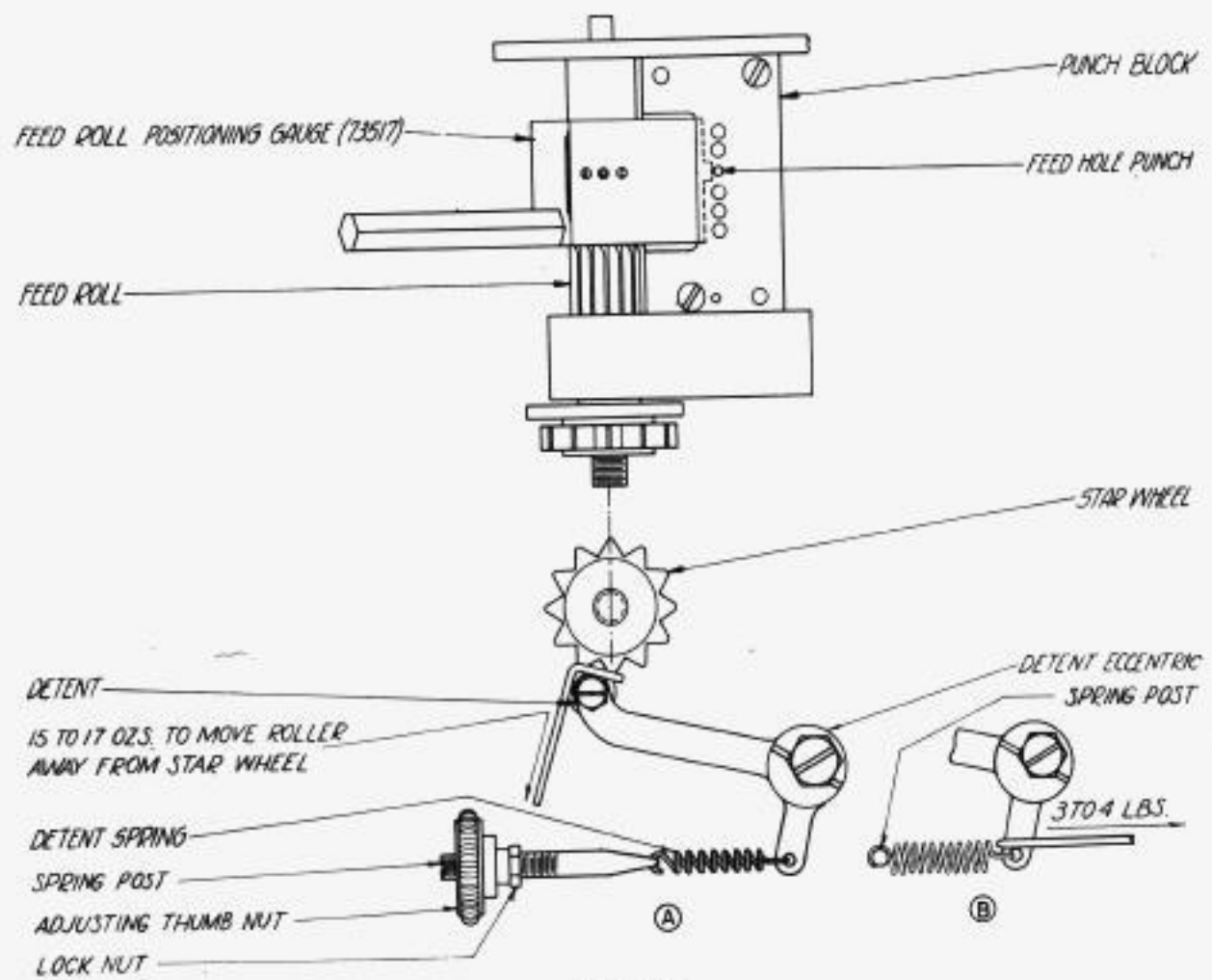


FIGURE 40



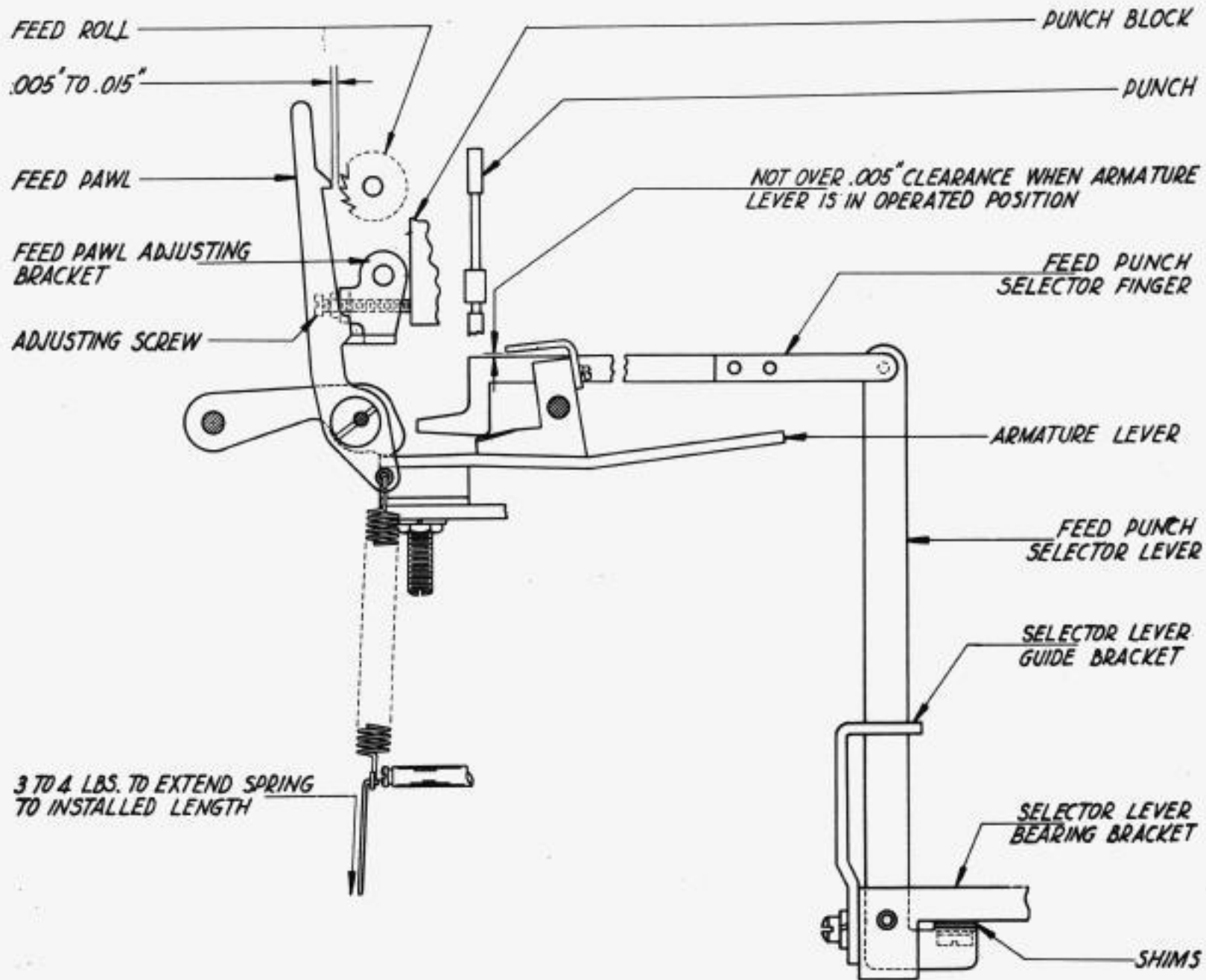


FIGURE 41

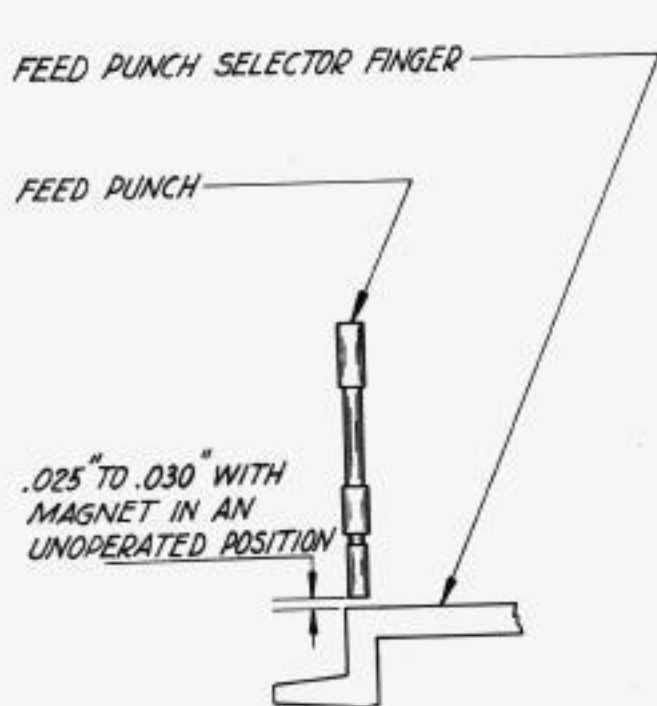


FIGURE 42

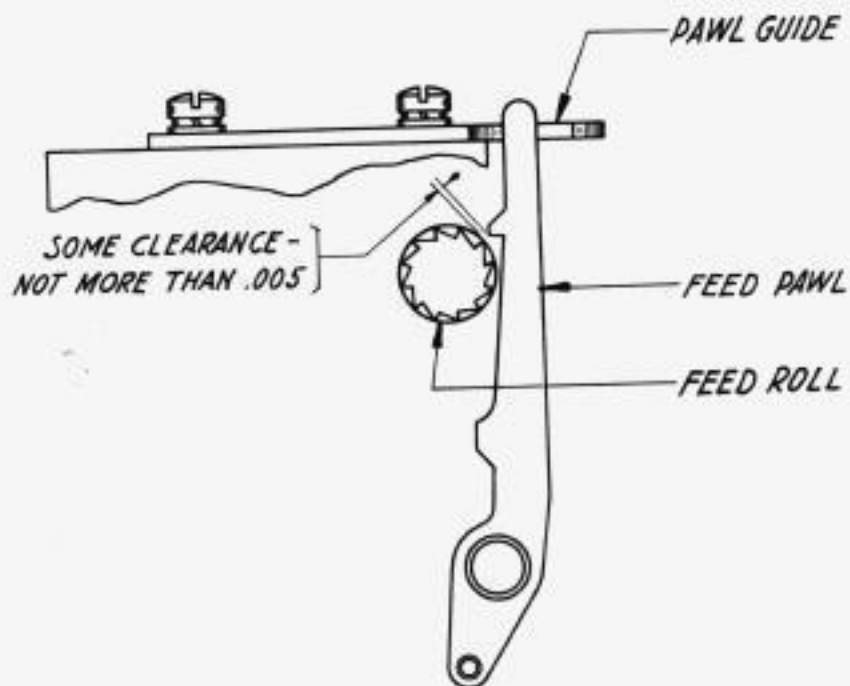


FIGURE 43

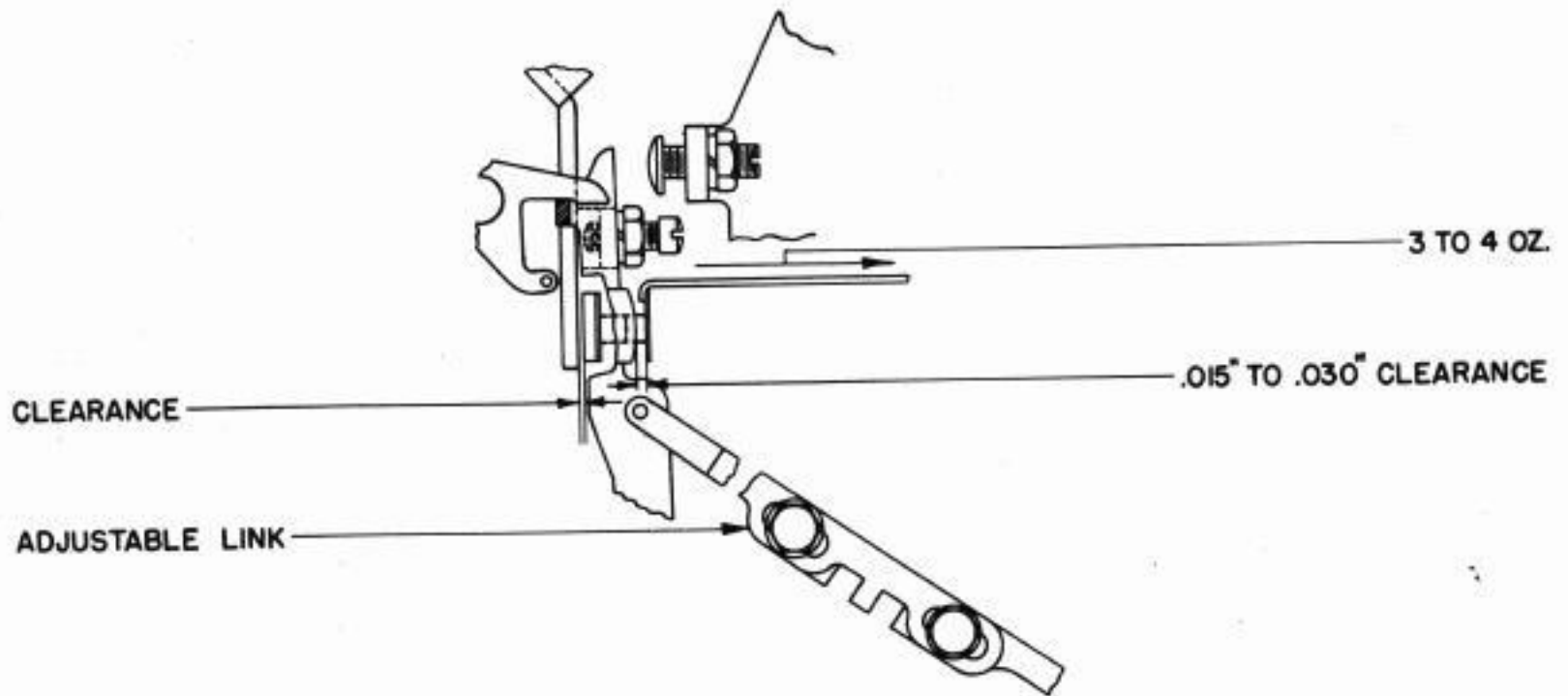


FIGURE 44

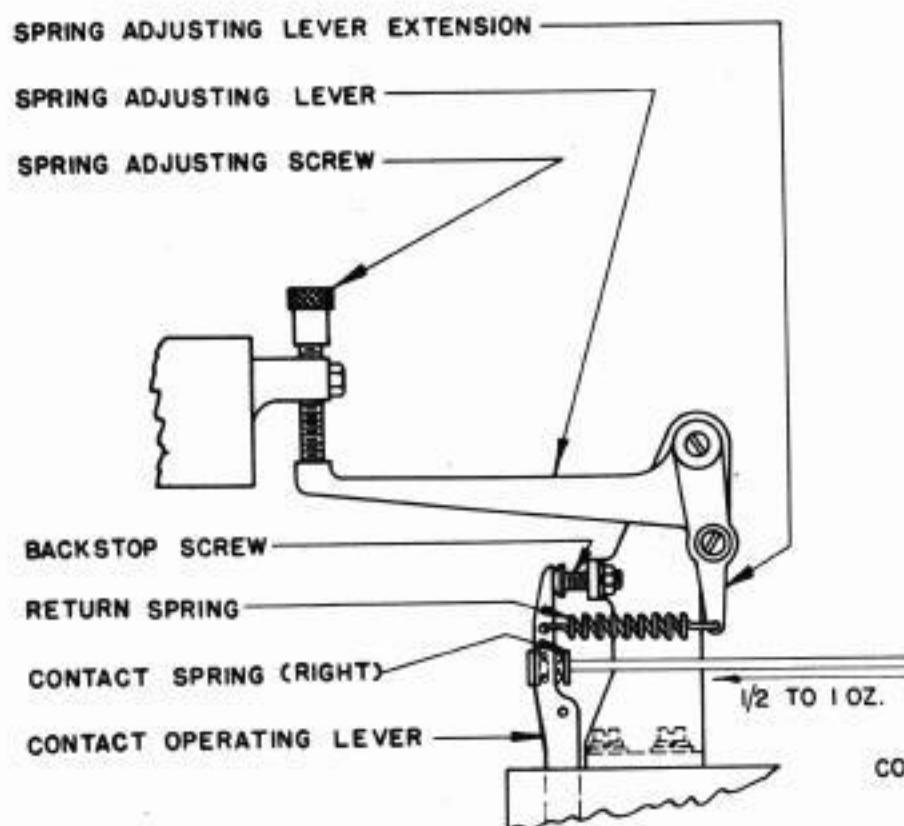


FIGURE 45

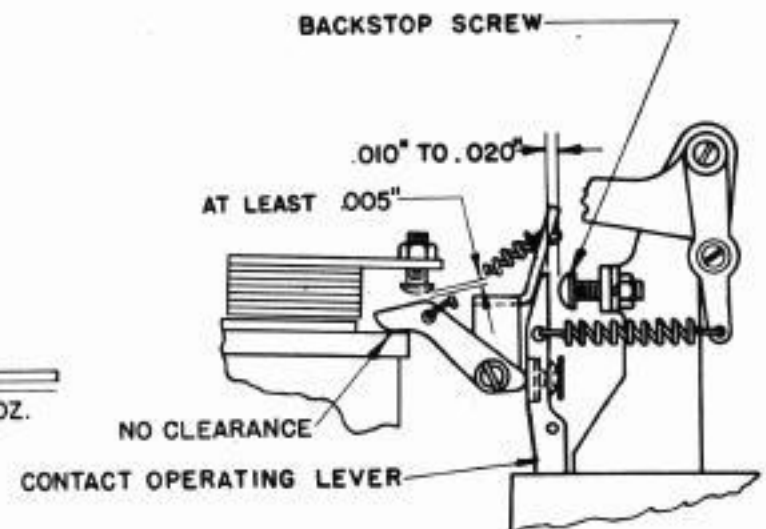


FIGURE 46

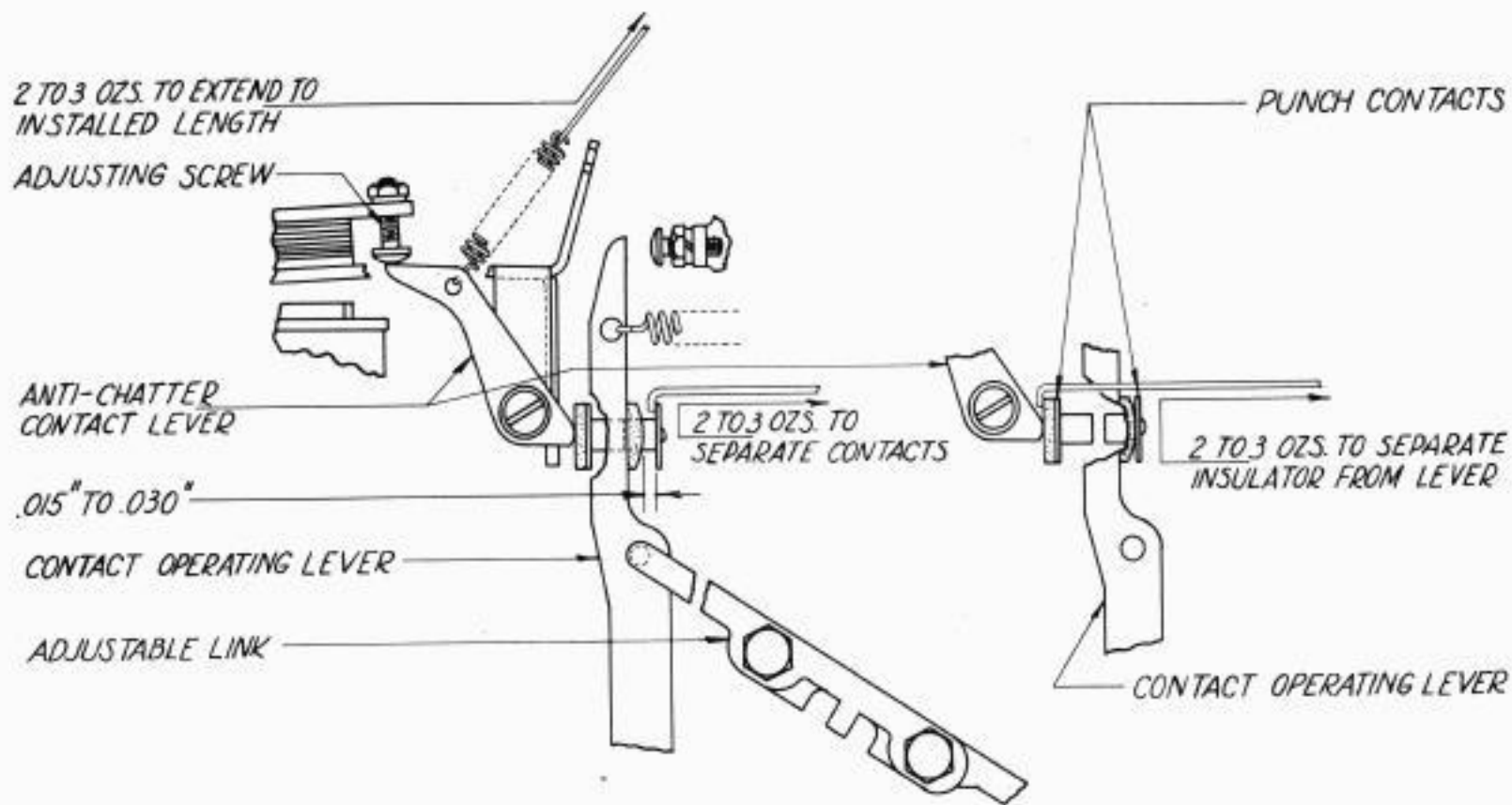


FIGURE 47

FIGURE 48

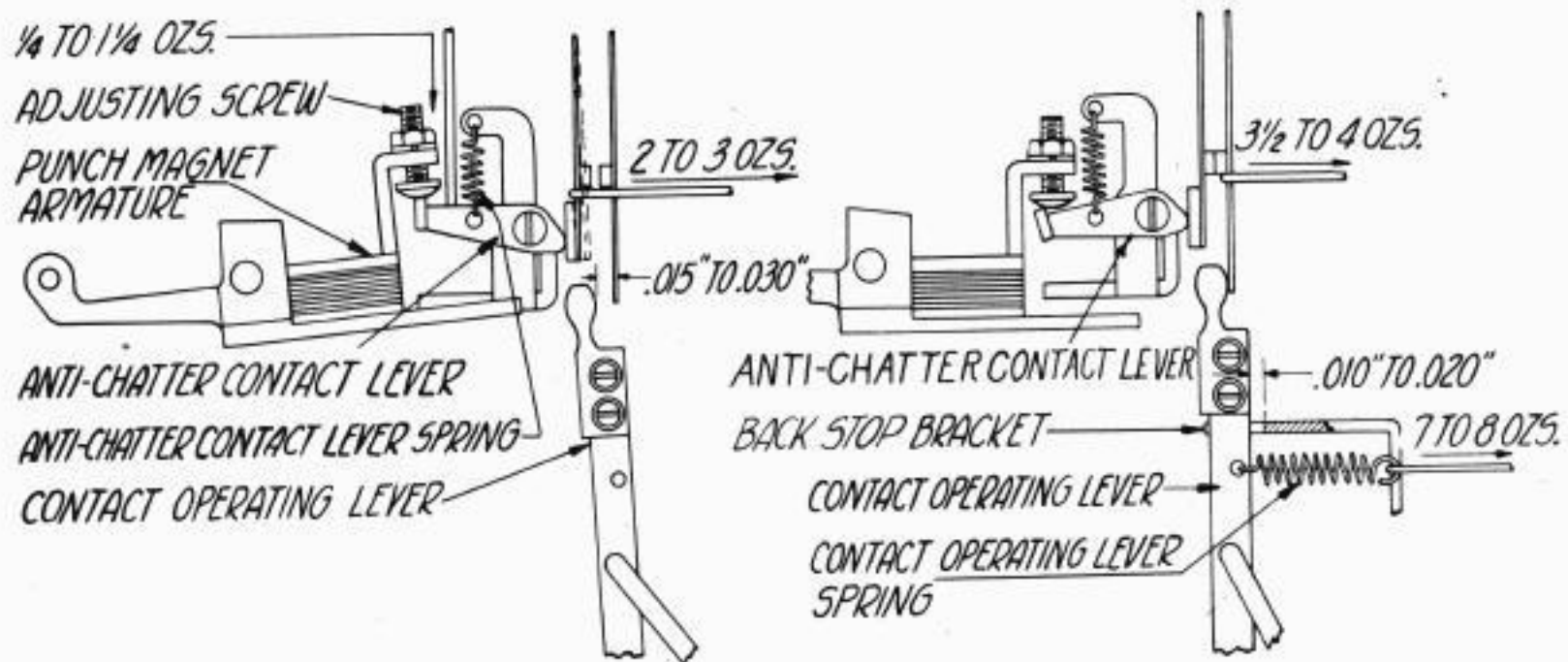


FIGURE 49

FIGURE 50

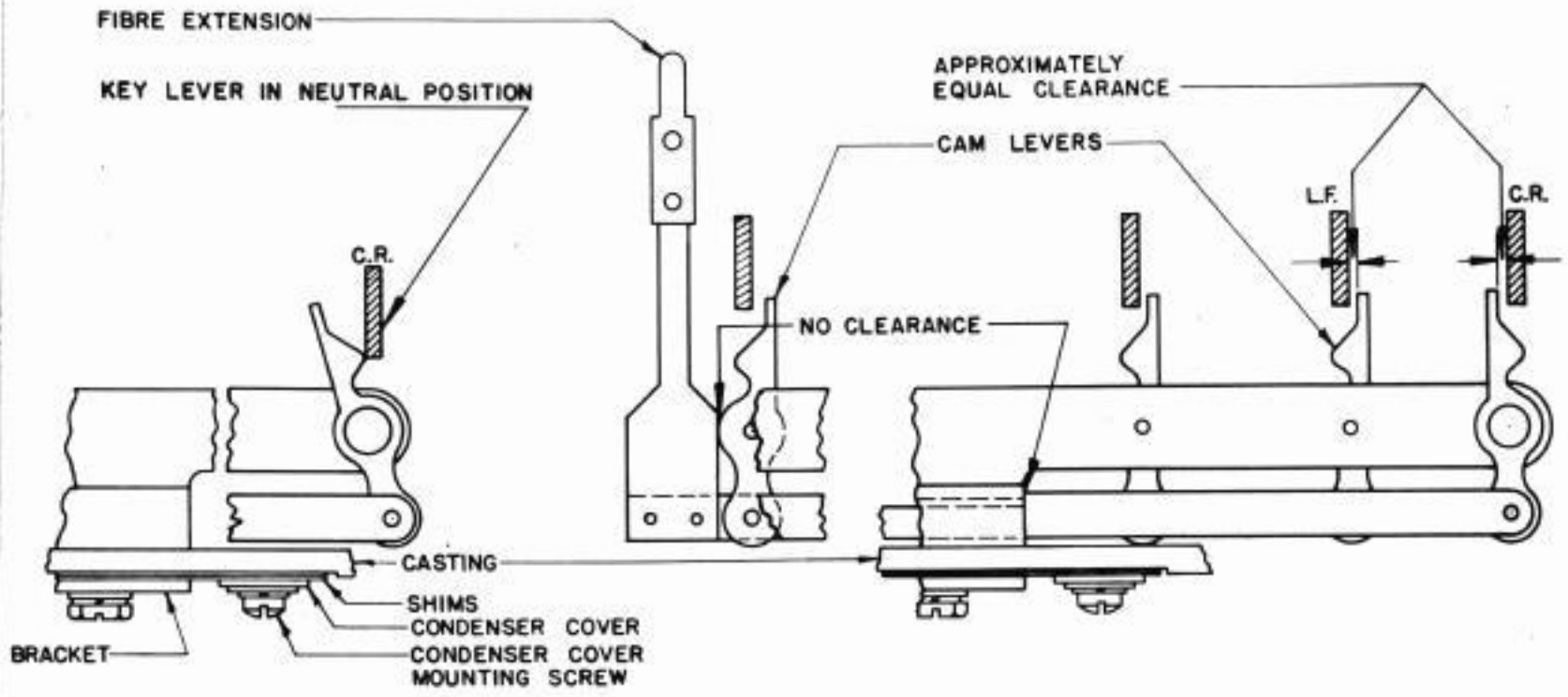


FIGURE 51

FIGURE 52

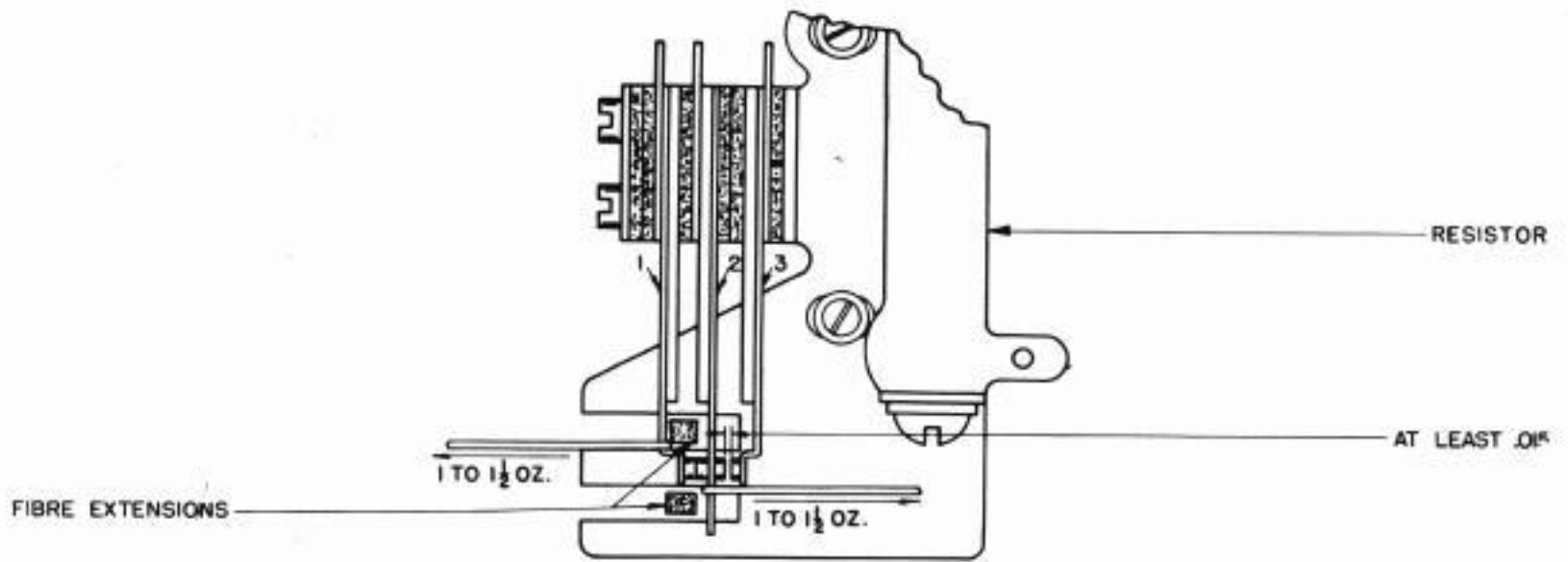


FIGURE 53

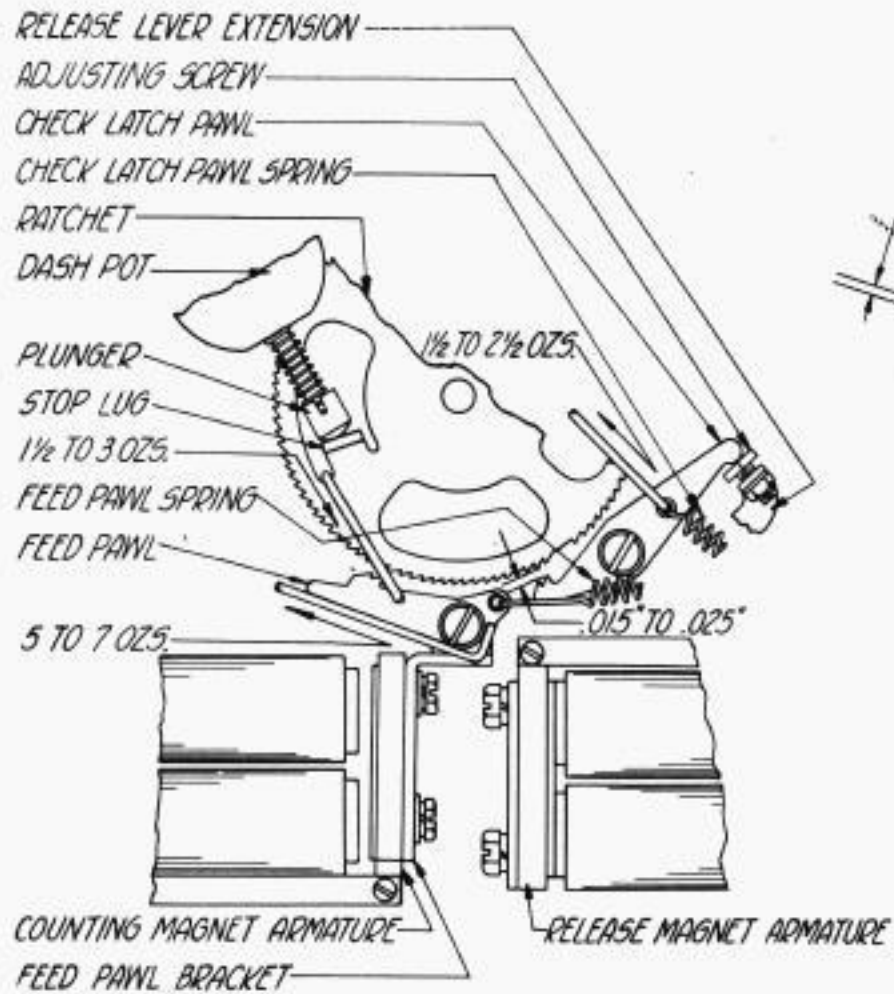


FIGURE 54

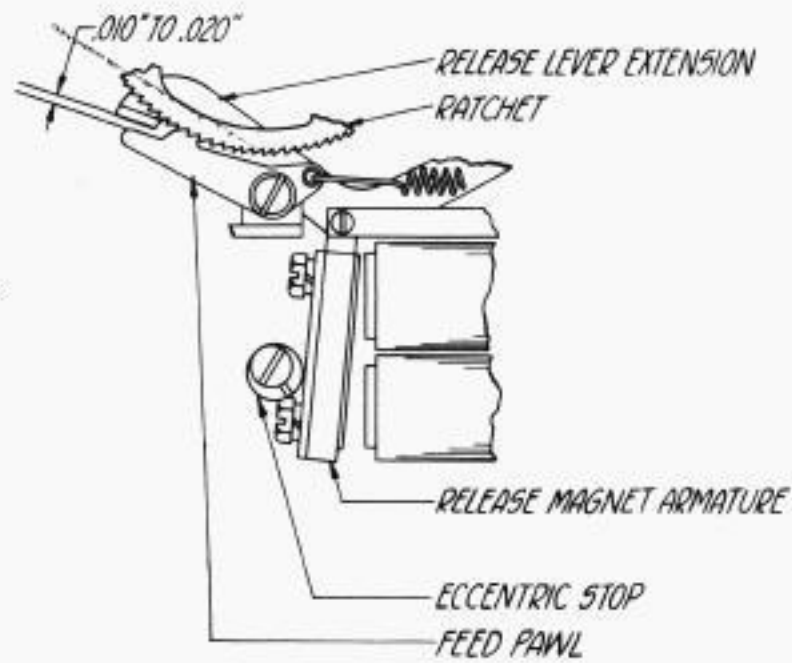


FIGURE 55

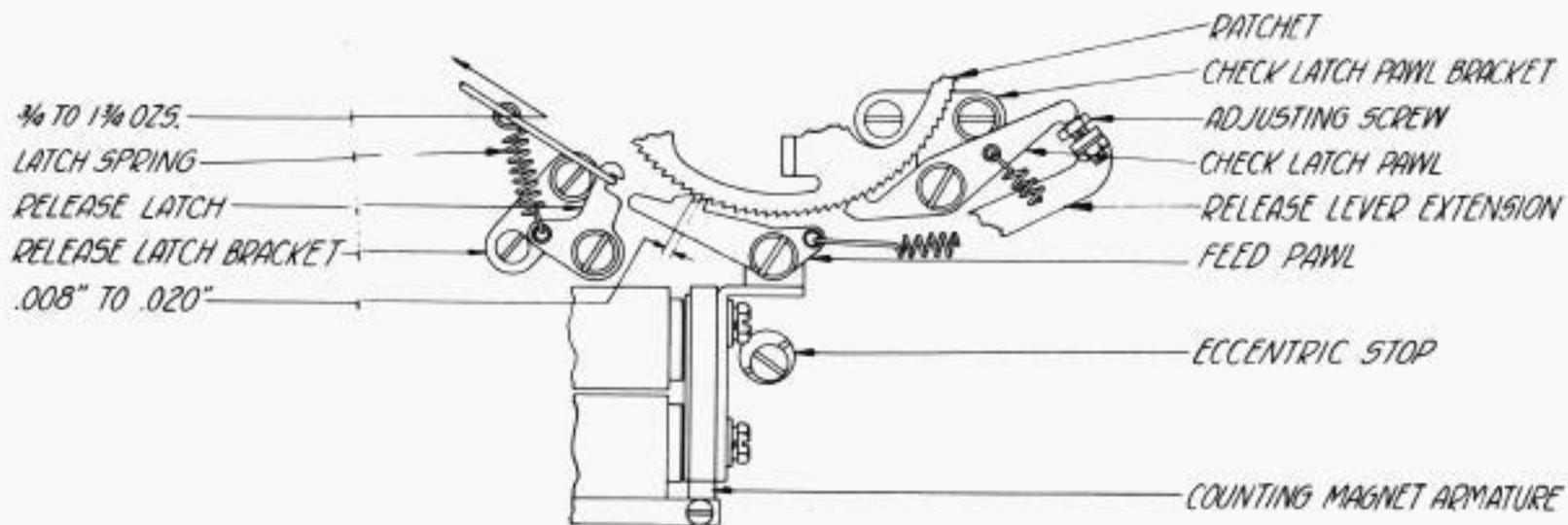


FIGURE 56

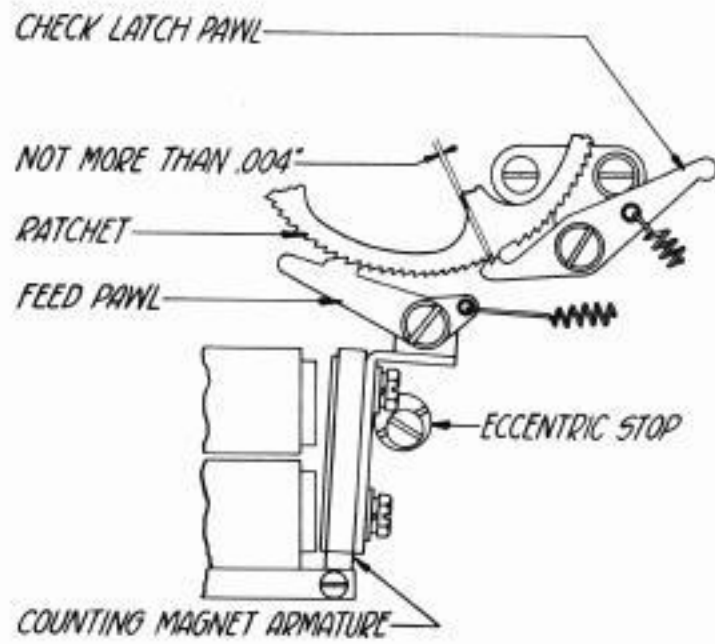


FIGURE 57

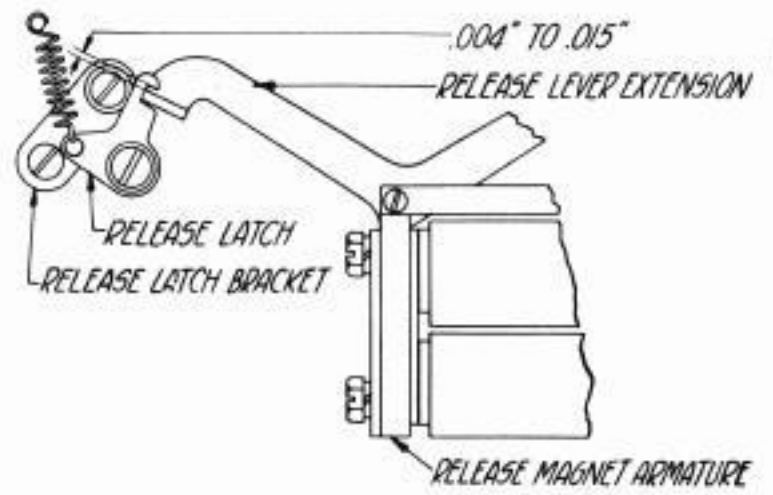


FIGURE 58

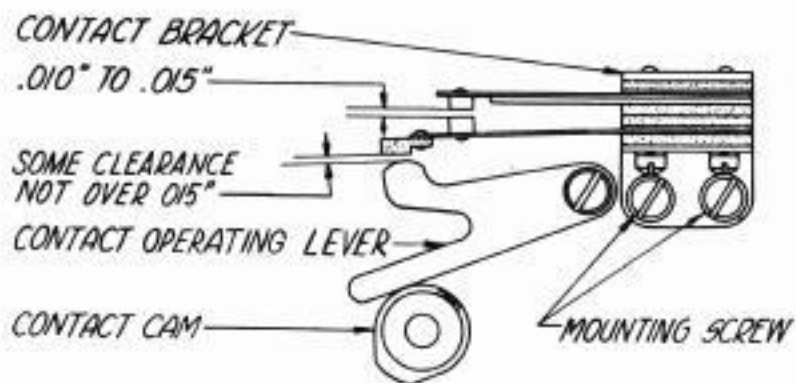


FIGURE 59

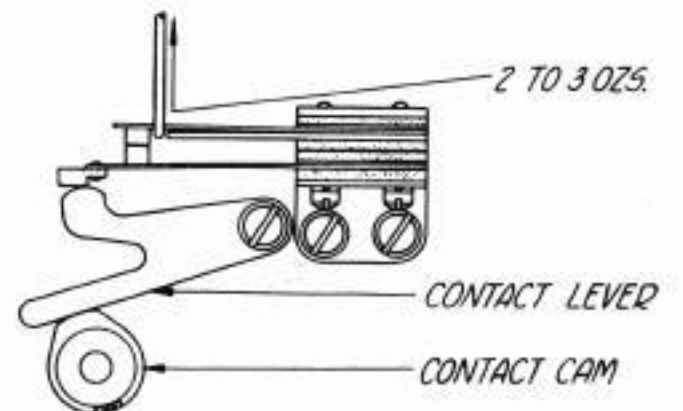


FIGURE 60