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TELETYPE

PRINTING TELEGRAPH SYSTEMS

*M23
TICKER
(CP, CB)*

DESCRIPTION AND ADJUSTMENTS
OF THE
TYPEWHEEL TAPE PRINTER (TICKER)
(FOR TICKERS BEARING SERIAL NUMBERS ABOVE 1000)



CORPORATION
SUBSIDIARY OF
Western Electric Company
CHICAGO, U.S.A.

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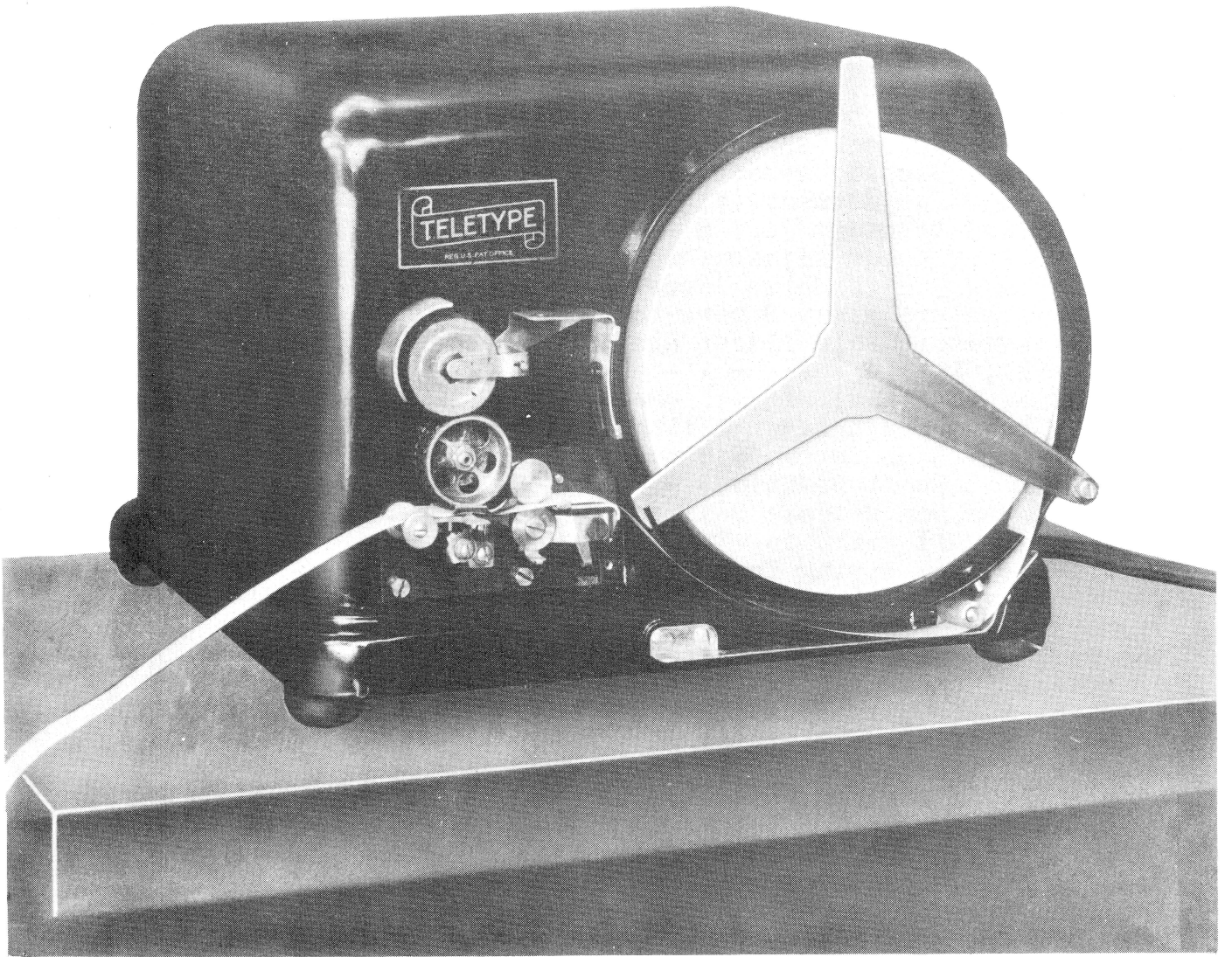
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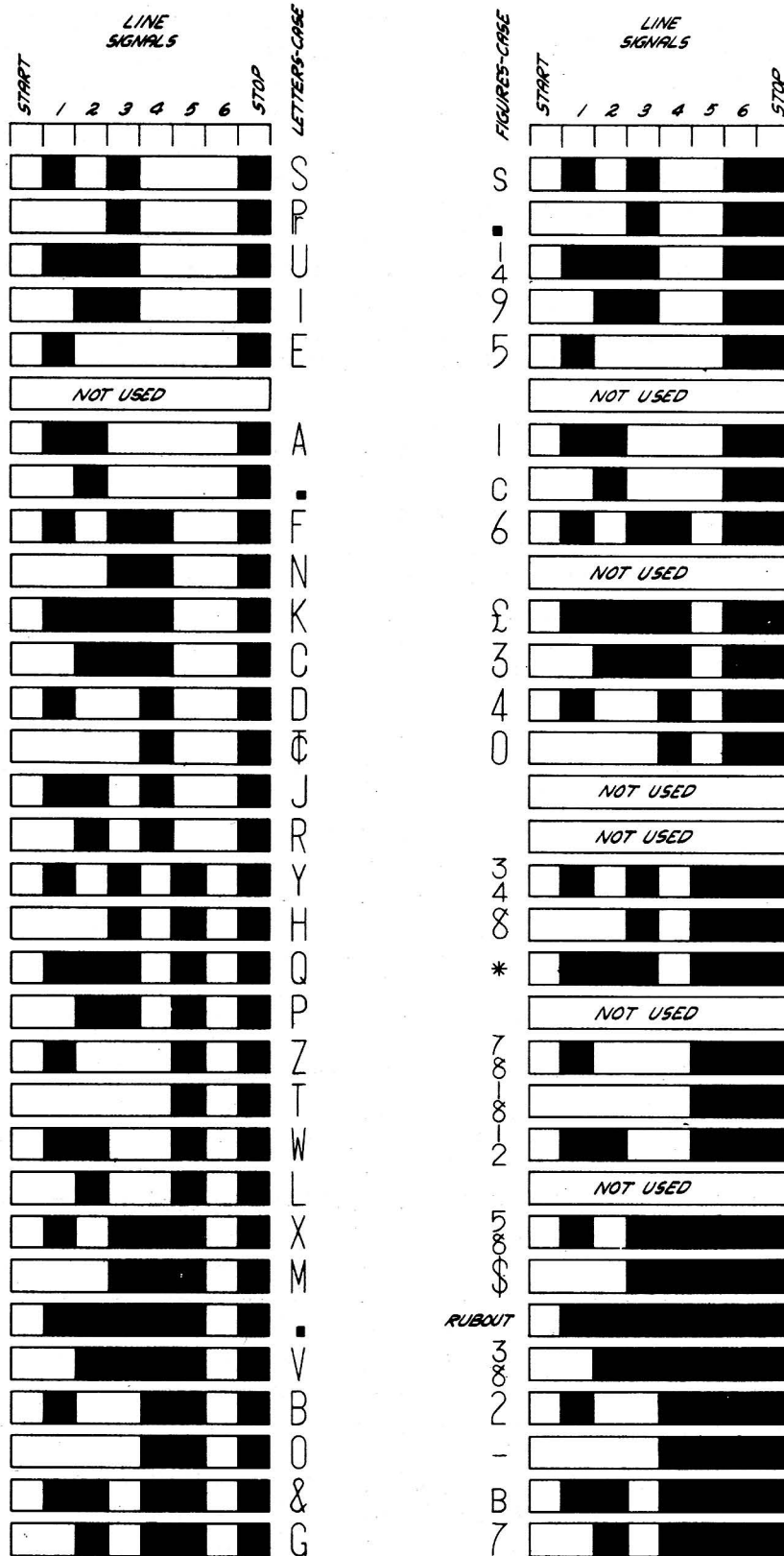
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CHARACTER SENT



NOTE:- BLACK BLOCKS INDICATE "MARKING" IMPULSES.
 WHITE BLOCKS INDICATE "SPACING" IMPULSES.

FIGURE 1.

GENERAL DESCRIPTION

The Typewheel Tape Teletype is a motor driven telegraph printer. The characters which can be printed are molded in rubber on the rim of the typewheel. The printing is done on a paper tape $\frac{3}{4}$ " wide by pressing the tape against the characters on the typewheel. Letters are printed close to the upper edge of the tape while figures are printed near the lower edge of the tape. This printer is primarily intended for receiving stock quotations.

The operation of the printer is controlled by combinations of positive and negative impulses transmitted over the line wire to which the printer is connected. All of the operations of the printer are initiated by, and the character to be printed is determined by, movement of the armature of a polarized magnet actuated by the line impulses.

CODE

The signalling code employed to transmit characters in a six unit "start-stop" code which consists of six selecting impulses used in various combinations of positive and negative intervals. Each group of six selecting impulses is preceded by a start impulse and followed by a stop impulse to maintain unison between the transmitting apparatus and the printers. Impulses which move the magnet armature toward the front of the printer are called marking impulses and those which move it in the opposite direction are spacing impulses. Figure 1 shows graphically the code used, there being sixty-four possible combinations.

OPERATION OF START-STOP SYSTEM

This printer is operated on the "start-stop" principle. The start and stop impulses cause the selector cam drum to revolve in unison with the transmitting distributor so that the character signals sent out by the transmitter may be properly received by the selecting mechanism and translated into letters and other characters.

The transmission of the start impulse, which is a spacing impulse, starts the selector cam drum revolving (Fig. 2). The speed of rotation is such that when the transmitting distributor has revolved far enough to send out the first impulse, the selector cam drum has revolved to the proper position to receive it. When the transmitter has revolved to the position to send out the second impulse, the selector cam drum also will have rotated to a similar position. At the end of the revolution, after the sixth impulse has been received, the reception of the stop pulse stops the selector cam drum.

The selector cam drum is geared to rotate one-twelfth faster than the transmitter, but it is so constructed that the distance from the position where it can receive one impulse and where it can receive the next impulse is one-twelfth greater than the distance between the position where the transmitting distributor can send out one impulse and the next one.

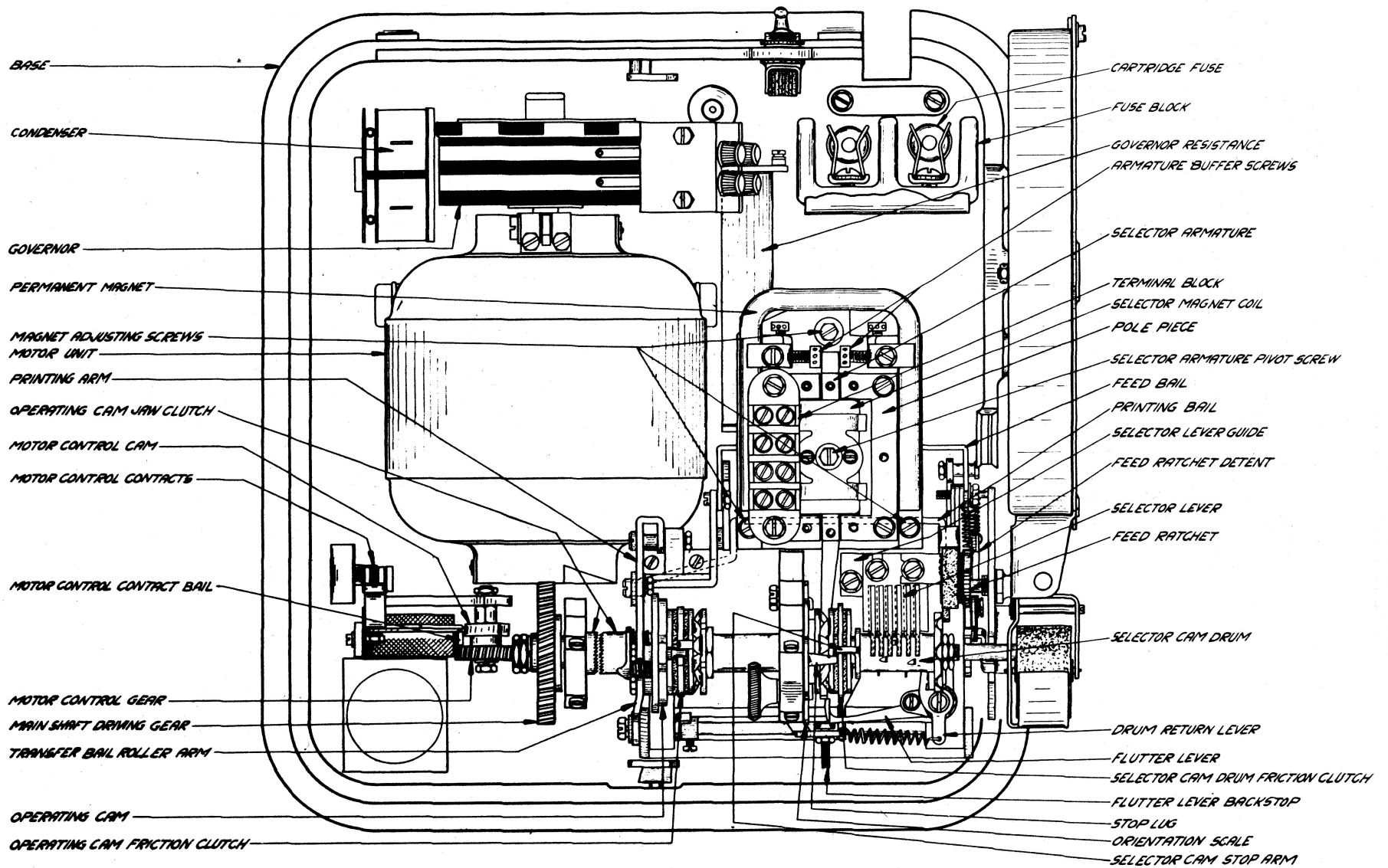


FIGURE 2.

The reason that the selector cam drum is made to rotate one-twelfth faster than the transmitting distributor is this: It is not possible to maintain several units at exactly the same speed. In a short time even a slight speed difference would cause the transmitting mechanism and receiving mechanism to get out of unison so that when the transmitting distributor was sending out the first impulse of a character signal, the selector cam drum might be in a position to receive the second. This is avoided by arranging the selector cam drum to rotate faster than the transmitting distributor which allows it to complete its revolution sooner than the transmitting distributor completes the corresponding one. In other words, if the transmitting distributor has to travel 45° to get from the position where it sends out the first impulse to the position where it sends out the second, the selector cam drum must travel 48.75° to get from the position where it can receive the first impulse to the position where it can receive the second, but as the selector cam drum travels one-twelfth faster, it will reach this second position at the same time the transmitting distributor reaches its second position.

When the selector cam drum has completed a revolution, it comes to a stop until the transmitting distributor again sends out a "start" impulse. Now, if the speed of the selector cam drum is slightly faster than its proper speed, the only effect will be that it will remain at rest slightly longer. If its speed is slightly slower than the proper speed, it will remain at rest just that much less time. Of course, there will be a slight error in the position of the selector cam drum in the various positions, but the mechanism is so constructed to provide for this, and due to the fact that the selector cam starts each revolution in unison with the transmitting distributor, this error does not become any greater.

DESCRIPTION OF PRINTER

The printer consists primarily of a motor unit, a selector magnet unit, a main shaft unit, a typewheel shaft unit, a selector lever unit, transfer mechanism, printing mechanism and tape feed mechanism.

The motor unit consists of a motor with pinion and governor, a governor resistance and a condenser for governor contact protection (Fig. 2). When an induction motor is used, the governor and contact protection are not provided.

The selector magnet unit consists of a selector armature, selector magnet coils, two pole pieces and a permanent magnet (Fig. 2). The armature is pivoted so that the line signals passing through the coils will move the bent up end of the armature toward the rear of the printer on spacing impulses and toward the front on marking impulses. The armature acting in conjunction with the flutter lever and the drum return lever determines the position of the selector cam drum.

The main shaft unit consists of a driving gear, operating cam jaw clutch, operating cam, operating cam friction clutch, selector cam drum friction clutch and selector cam drum (Fig. 2).

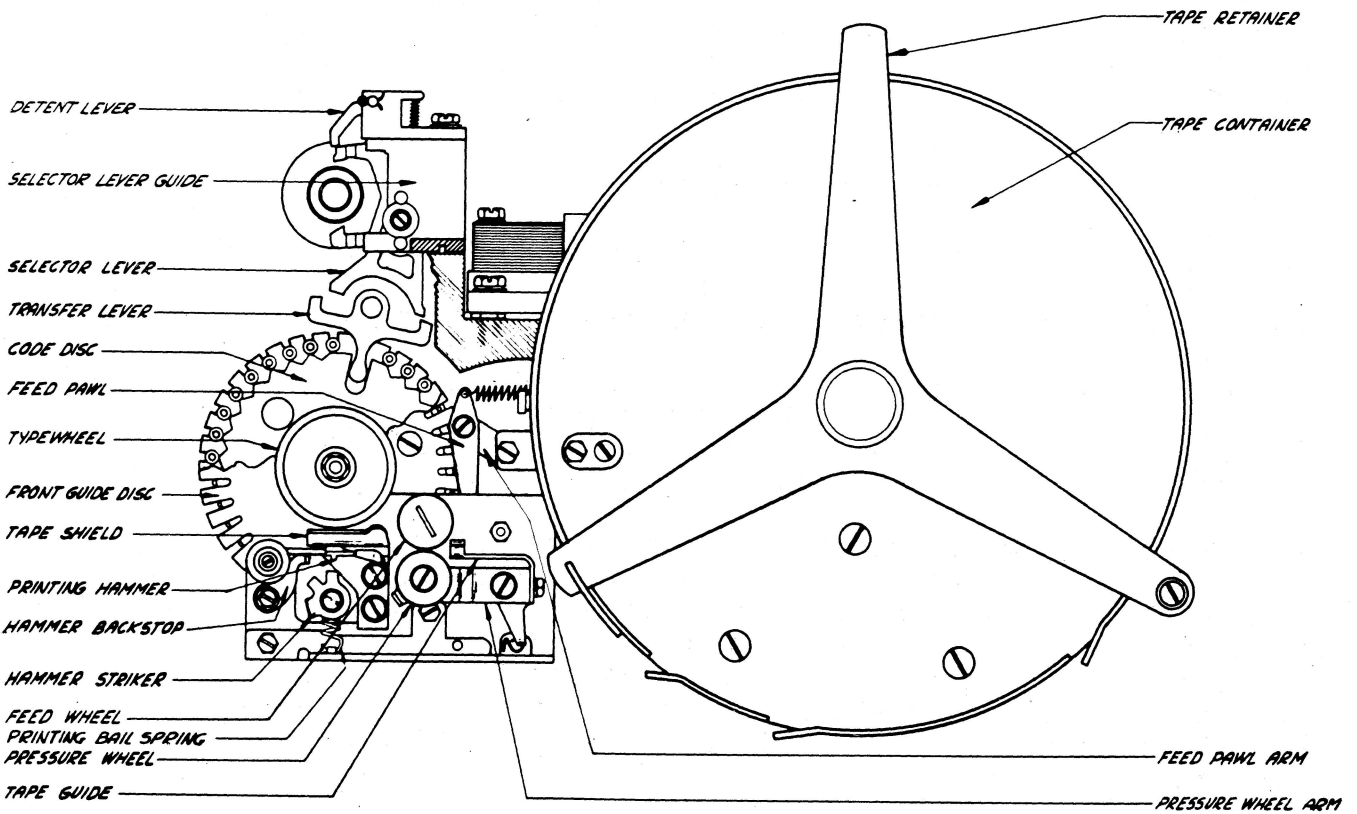
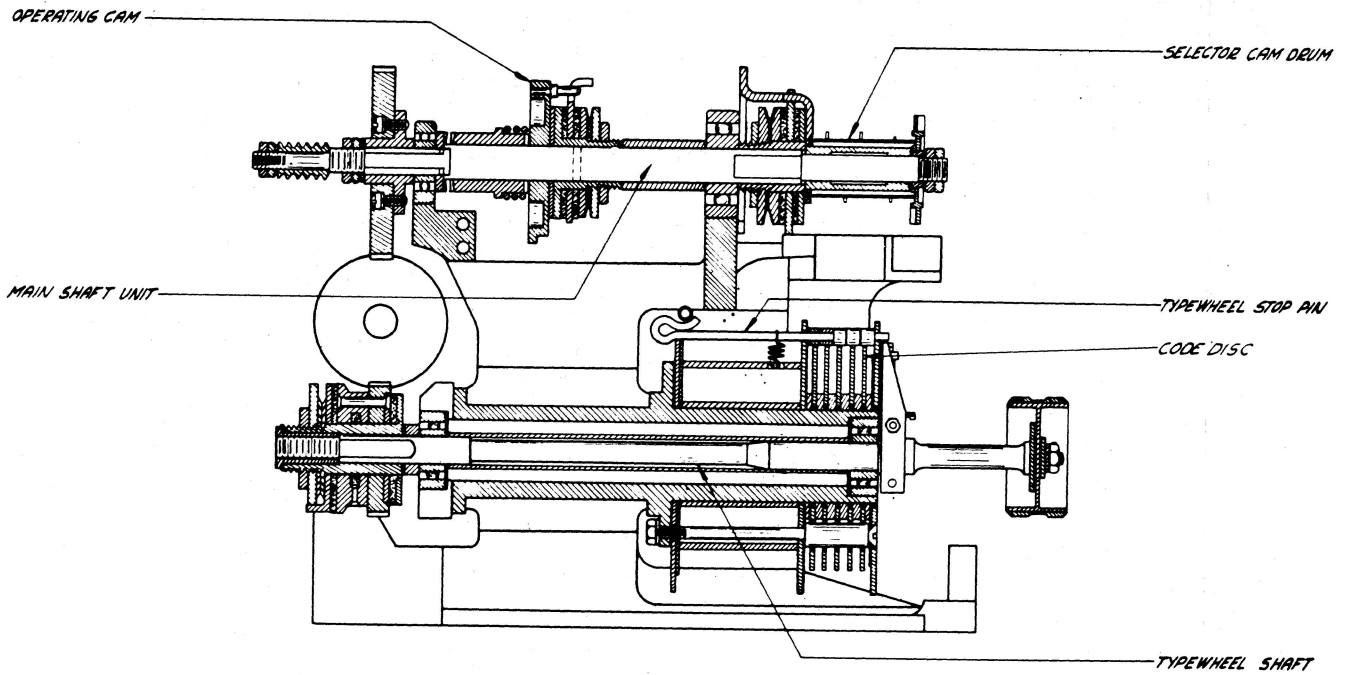


FIGURE 3.

The selector cam drum consists of a hollow cylinder with twelve cams projecting from its outer surface. Six of these cams are marking cams and six are spacing cams. Fastened to the rear end of the cylinder is an L shaped arm called the stop arm. Fastened to the front end of the cylinder is an indented disc known as the flutter cam. There are seven indents on each side of this cam. The flutter cam passes through the forked arm of an L shaped lever called the flutter lever. On the same pivot as the flutter lever is the cam drum return lever, the right end of which bears against the back of the flutter cam (Figs. 2 & 4).

The selector cam drum slides back and forth on a sleeve on the main shaft (Figs. 2 & 4). A spring attached to the cam drum return lever tends to move the cam drum against the front stop. The long arm of the flutter lever projects to the rear and can rest against the end of the selector armature when the armature is in the marking position. When the flutter lever is resting against the end of the armature and the cam drum is rotated, the drum will be moved backward and forward, by the action of the flutter cam, so that the marking cams will be in line with the marking (lower) arms of the selector levers at the instant that each cam is passing over the end of the corresponding marking arm. When the flutter lever is not against the end of the armature due to the armature being in the spacing position, the cam drum will remain against its front stop and the flutter cam will merely move the rearward projecting arm of the flutter lever in and out. When the selector cam drum is against its front stop, the spacing cams will line up with the spacing (upper) arms of the selector levers.

The stop arm attached to the rear end of the cam drum has a horizontal portion which passes through a slot in the selector friction disc; thus when this disc rotates the drum rotates with it. When the cam drum is nearing the end of its revolution and the stop signal is received, the flutter lever will be against the end of the armature and the cam drum will be moved to the rear. This will cause the arm to project far enough through the slot in the disc to be engaged by the stop lug on the orientation scale. When the start signal is received the armature will move to the spacing position, releasing the flutter lever and permitting the cam drum to move to its front stop. This will disengage the stop arm from the stop lug and the drum will revolve.

The marking cams are the series of six cams located spirally around the drum, the number one cam being the rearmost cam to the left of the stop arm looking at the front of the printer with the stop arm up. The spacing cams are the series having the number one cam placed just to the right of the stop arm.

The operating cam is located to the rear of the selector cam drum (Figs. 2 & 4). It is a combined internal and external cam, the transfer and printing bail rollers being controlled by the internal surface and the feed bail roller by the external surface. The operating cam is driven by two clutches. A friction clutch initiates the rotation and after the cam has rotated a few degrees a jaw clutch engages and carries the cam nearly to the end of the revolution where it is disengaged and the friction clutch continues to drive the cam until it is stopped by a projection on the cam striking against the cam release bail arm.

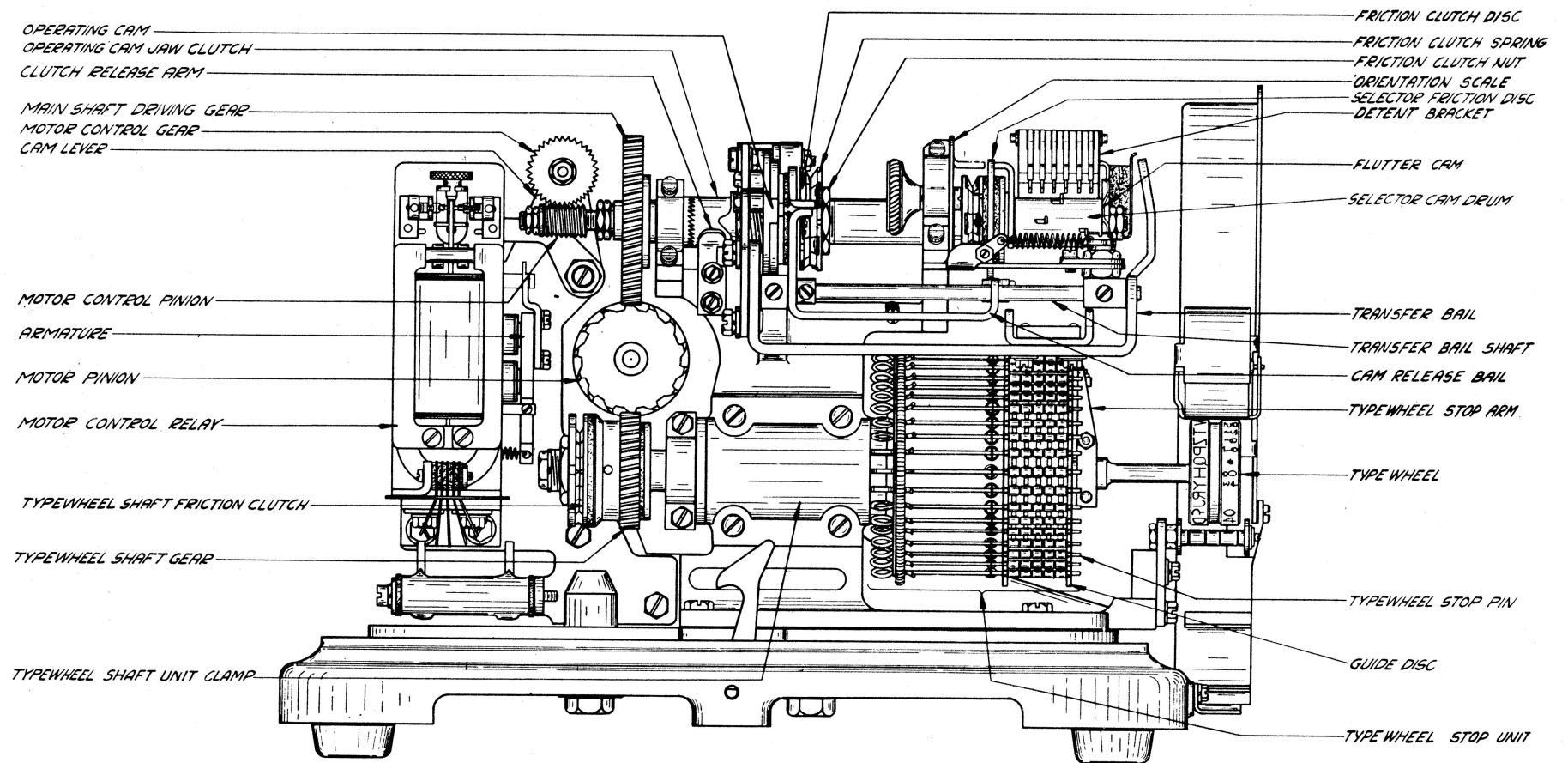


FIGURE 4. .

Shortly after the start of the rotation of the operating cam, the printing bail roller rides to the peak of the cam, thus rocking the printing bail and lifting the hammer striker against the printing hammer, which presses the tape against the typewheel, printing a character. As the printing bail roller rides down the cam, the transfer bail roller is riding up and as it reaches the peak, the transfer levers are moved against the selector levers and the selection set up in the selector levers is transferred to the code discs (Fig. 3). While the transfer bail roller is riding to the peak of the internal cam, the feed bail roller is riding up the external cam. The motion transmitted through the feed bail causes the feed pawl to move upward and engage the next tooth of the feed ratchet. Then as the roller rides down the cam, the feed bail spring moves the feed pawl downward, thus stepping the feed ratchet one tooth and through the medium of the feed wheel and pressure wheel, moving the tape forward one letter space.

The selector lever unit is located to the right of the selector cam drum and holds the selector levers in a position so that they can be moved to either the spacing (up) or marking (down) position by the selector cams. The selector levers are mounted in slots in a guide. Six detent levers are mounted one above each selector lever to insure that the levers will remain where placed by the action of the selector cams (Fig. 3).

The selector levers have four arms, the two upper arms being located one above and the other below the cam drum. The ends of these arms are offset with respect to each other, the lower or marking arm being offset toward the back and the upper or spacing arm being offset toward the front of the printer. This is done so that when the marking cams line up with the marking arms, the spacing cams will pass to the rear of the spacing arms and when the spacing cams are in line with the spacing arms, the marking cams will pass to the front of the marking arms (Figs. 3 & 4).

The two lower arms of the selector levers are located above and in line with the transfer levers so that when the transfer levers are moved upward against the selector levers, one arm of each transfer lever will strike against an arm of the corresponding selector lever, which arm depending upon whether the selector lever is in marking or spacing position. Thus the selection set up in the selector levers will be transferred to the code discs. It is to be noted that while there are six transfer levers there are only five code discs. The sixth transfer lever controls a shift mechanism which determines whether letters or figures shall be printed.

The typewheel shaft unit consists of a driving gear, typewheel shaft friction clutch, typewheel stop arm, typewheel and typewheel stop unit. The typewheel stop unit consists of code discs, typewheel stop pins and tension springs (Figs. 3 & 4).

The five code discs which are part of the typewheel stop unit have a series of notches in their outer edges. At right angles to the code discs and equally spaced around their circumference are thirty-two stop pins. These pins are held in slots in three guide discs, two to the rear and one to the front of the code discs. Tension springs

pull the pins against the edges of the discs. The friction is minimized by small rollers placed on the pins. The code discs can be rotated slightly to either of two positions. The counter-clockwise position is the marking position, while the opposite is the spacing position. With the code discs set in any particular combination, the notches will be lined up in a certain position permitting the corresponding pin to move toward the center into the path of the typewheel stop arm, thus determining the letter to be printed. With the five discs there are thirty-two possible combinations, thus any one of the thirty-two stop pins can be selected and the typewheel stopped in any one of the thirty-two positions. Only thirty-one of these positions are utilized for characters, the thirty-second position, which corresponds to the all marking combination, having no character. The stop pin for this position is different from the others, and not only stops the typewheel but prevents the tape from feeding. The typewheel is blank in this position. By the use of the shift mechanism it is thus seen that it is possible to print 62 characters. In this printer, however, some of the positions are not utilized.

The typewheel shaft is driven through the medium of a friction clutch. The typewheel and typewheel stop arm are fastened on this shaft so that when the typewheel is stopped to print a character, the friction clutch slips. The typewheel stop arm is equipped with a latch which passes over the end of the pin which is stopping the arm and engages with the opposite side of it, preventing rebound.

Having described the functions of the various units and mechanisms of the printer, it would now be well to follow through the complete operation of the printer in selecting and printing a character. Let us suppose that the letter "Y" is being transmitted. The transmitting distributor first sends out a start impulse which is always spacing. This impulse moves the selector armature to the spacing side and away from the flutter lever. This permits the cam drum return lever, by the action of its spring, to move the selector cam drum toward its front stop, disengaging the stop arm on the selector cam drum from the stop lug and initiating the rotation of the selector cam drum.

The next impulse is marking, which moves the selector armature to the marking side. As the cam drum rotates, the flutter lever will be moved outward permitting the selector armature to move into the path of the lever and block it. When the flutter lever is blocked by the selector armature, the flutter lever fork guides the flutter cam as it rotates so that the #1 marking cam on the drum will be moved into line with the marking arm of the #1 selector lever, and the cam will move the lever down to the marking position.

The next impulse is spacing. Therefore, the selector armature is moved to the spacing side, the flutter lever released and the cam drum permitted to move to its front stop. Thus, #2 spacing cam will be in line with #2 selector lever and as the drum revolves the #2 selector lever will be moved upward to the spacing position.

The third impulse being marking, the selector armature is again moved to the marking side and as the third marking cam approaches the marking arm of the third selector lever, the flutter cam will move the flutter lever outward, permitting the armature to slip into

its path and hold it. As the drum rotates further, the flutter lever being blocked, the flutter cam will cause the cam drum to be moved rearward and the third marking cam to come in line with the marking arm of the third selector lever and move it downward to the marking position.

The fourth impulse being spacing, the selector armature will be moved to the spacing side, releasing the flutter lever, permitting the #4 spacing cam to move the spacing arm on the #4 selector lever upward.

The fifth impulse being marking, the selector armature will move to the marking side and in due course will block the flutter lever causing the fifth marking cam to move the fifth selector lever down.

The sixth impulse being spacing, the sixth selector lever will be moved to the spacing position.

After the reception of the sixth selecting impulse, the stop impulse is received. As this impulse is always marking, the selector armature blocks the flutter lever and the cam drum will be moved to its rearward position and just as the rotation is completed, the stop arm strikes against the stop lug and the cam drum is held at rest until the reception of the next start impulse.

During the rotation of the selector cam drum and after the reception of the fourth impulse, a depression in the edge of the selector friction disc comes opposite the roller of the cam release bail. Through the action of the spring, this roller is pulled into the depression, the bail is rocked and the operating cam is released. The operating cam then starts to revolve. Shortly after the reception of the fifth pulse, the operating cam has revolved far enough to operate the printing mechanism. However, the letter printed will not be the one just selected, but a letter selected by the previous rotation of the cam drum. Following the sixth pulse, the operating cam has reached the position where it causes the operation of the transfer bail and thus the combination which has just been set up in the selector levers will be transferred to the code discs. The selector cam drum, of course, has now come to rest, but the operating cam continues to revolve, causing the spacing of the tape for the previous letter before it completes its rotation and comes to rest against the cam release bail arm. The printing of the letter "Y", the selection of which has just been described, does not take place until the next selection is received and the selector friction disc revolves far enough to release the operating cam.

When the selection is transferred to the code discs, these code discs in assuming their new positions move the previously selected pin out of engagement with the typewheel stop arm and permit the stop arm to revolve until it strikes against the "Y" pin which has been permitted to move inward due to the rearrangement of the notches in the code discs.

It will be seen from the above description that a letter which is selected during one revolution of the cam drum is not printed until the next revolution of the cam drum. In other words, while one character is being selected, the preceding character is being printed.

The typewheel shaft is geared to run 50% faster than the main shaft in order to allow plenty of time for it to rotate from one stop position to any other.

MOTOR CONTROL UNIT

The purpose of the motor control unit is to start and stop the printer motor by means of the signal line. Its operation is as follows: The power supply is connected to the motor through the motor control contacts (Fig. 2). These contacts are opened or closed by the motor control contact bail which is pivoted to the motor control cam lever. The motor control cam lever is moved slowly up and down by the motor control cam. This cam is rotated by the motor control gear and pinion, the pinion being fastened to the rear end of the main shaft.

If the contact bail is blocked by the motor control magnet armature, the forked end of the bail which engages the motor control contact spring will be moved toward the front of the printer by the downward movement of the cam lever, thus opening the contacts and stopping the motor.

The movement of the motor control magnet armature is determined by the motor control relay. This relay is in series with the line and the tongue of the relay is actuated by the line signals in the same manner as the selector armature. When the tongue of the relay is on the marking side, current flows through the magnet coils from the local power supply and the motor control armature is moved out of the path of the motor control contact bail. When the tongue of the relay is on the spacing side, the magnet coils are shunted and the armature is moved into the path of the motor control contact bail by its spring.

Thus, when signals are constantly actuating the motor control relay tongue, the magnet armature is being actuated in much the same manner by local current and consequently it cannot block the motor control contact bail.

If the motor has been stopped by opening the line (or applying spacing battery continuously) it will be started again by the first marking signal sent over the line. This marking signal will move the tongue of the relay to the marking side and allow current to flow through the magnet coils. The armature will be pulled up allowing the contact bail to move toward the rear of the printer and close the motor control contacts.

PRINTER ADJUSTMENTS

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

The spring tension values given in this bulletin were derived from measurements made with Teletype spring balance (Catalog Nos. 138-55

and 138-58). These spring balances are calibrated for use in a vertical "pull" position. When used in any other position, the reading is an indicated value.

Orientation Scale Guide Adjustment, Fig. 5

Loosen the guide mounting screws and the orientation scale thumb nut. Set the scale at 60 and turn the thumb nut in until the scale is friction tight. Rotate the selector cam drum until the stop arm is opposite the stop lug on the scale. With the scale still set at 60, pivot the scale on the scale stud so that the top surface of the stop lug is in line with the top surface of the stop arm. Tighten thumb nut. Adjust the position of the guide by means of its mounting screws so that the front and rear of the guide touches or is within .010" of the orientation scale.

Main Shaft Position, Fig. 5

With the selector armature to the spacing side, rotate the main shaft until the selector cam drum stop arm is in front of the stop lug. Loosen the four main shaft bearing bracket screws and adjust the position of the main shaft so that there is .004" clearance between the selector cam drum stop arm and the stop lug, after the right hand bearing bracket screws have been tightened.

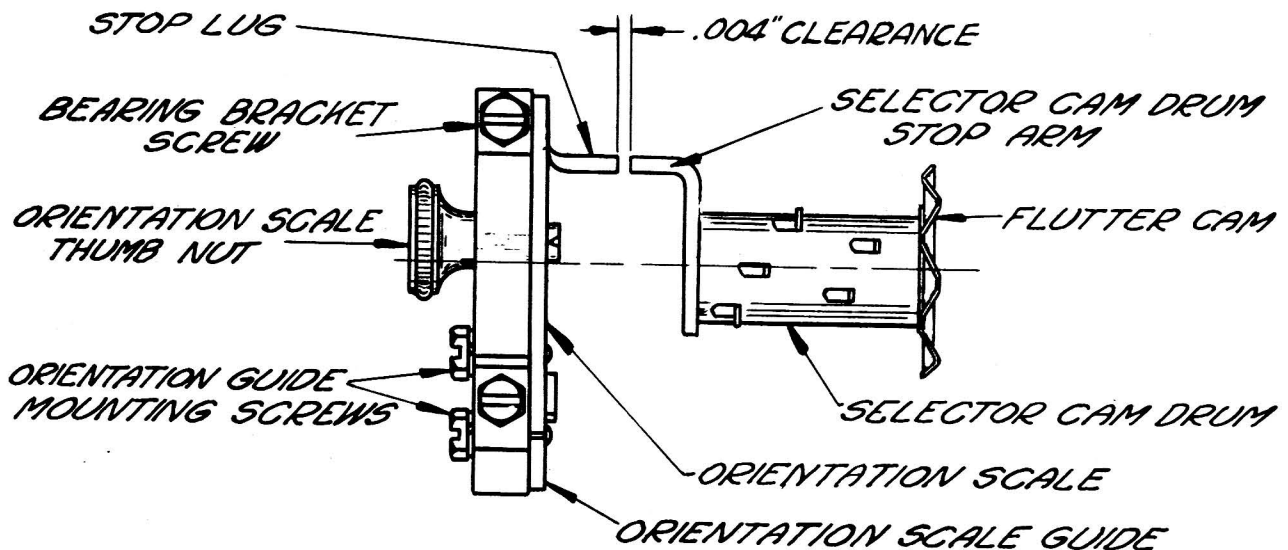


FIGURE 5.

Operating Cam Clutch Release Arm Position, Fig. 6

Rotate the main shaft until the operating cam is stopped by the cam release bail arm. Adjust the position of the clutch release arm by means of its clamping screws so that the clutch teeth are separated by from .012" to .015", and so that there is at least .002" between the rear of the clutch release arm and the clutch driven member. In this position the engaging edge of the clutch release arm and the high part of the driven member cam should engage 1/32" and to the full depth of the clutch release arm. If the release arm is not safely on the high part of the driven member cam, when the operating cam is

stopped by the cam release bail arm, the clutch teeth may become engaged at this time, causing damage to the printer.

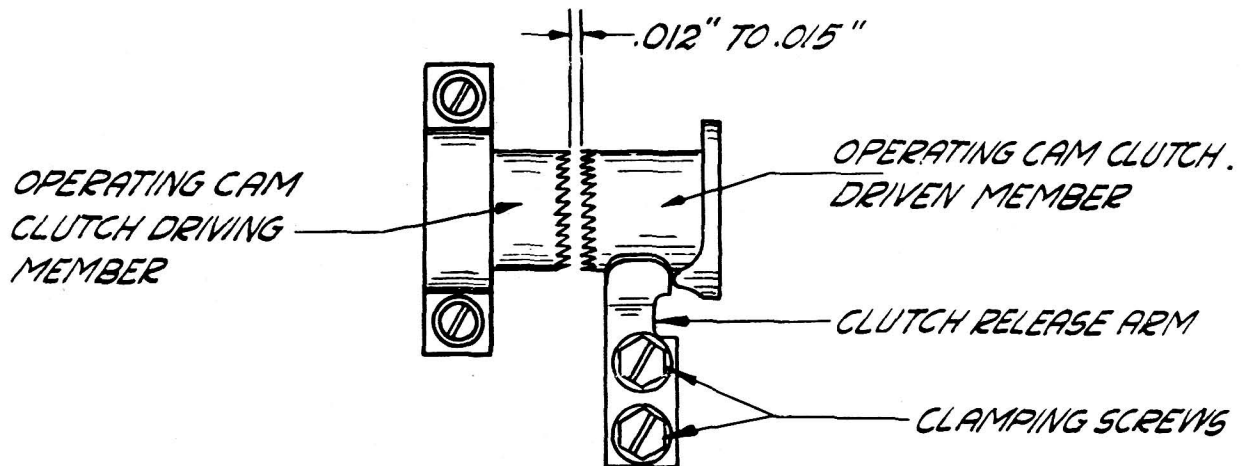


FIGURE 6.

Main Shaft Jaw Clutch Spring Tension

With the selector armature on the spacing side, rotate the main shaft until the transfer bail roller is at the place where it just starts to ride up the cam. Hold the main operating cam and turn the main shaft back a slight amount to free the clutch teeth. Hold a small screwdriver vertically so that the tip of the screwdriver is resting on the top of the clutch driven member and so that the narrow side and not the flat side of the screwdriver is against the shoulder. The screwdriver should be held lightly at the upper end of the handle. Hook a 32 oz. scale on the screwdriver so that the scale wire is resting on the operating cam and the orientation scale and pull towards the front of the printer. It should require from 12 to 18 ozs. to separate the clutch teeth.

Flutter Lever Gap Adjustment, Fig. 7

Remove flutter lever and spring. Loosen flutter lever clamping nut and set screw. Replace flutter lever and adjust the flutter lever gap so that the flutter cam will turn freely in the gap and so that the minimum play of the flutter lever on the cam, checked for one complete revolution, is less than .002". Tighten set screw. Remove flutter lever, tighten clamping nut and replace the flutter lever and spring.

Detent Bracket Adjustment, Fig. 8

Adjust the position of the detent bracket so that the travel of the detent is equi-distant from the point on the selector lever when the selector lever is moved to either marking or spacing positions. Check #1 and #6 detents. When making this adjustment, make certain that the centers of the detents and the centers of the selector levers are in line.

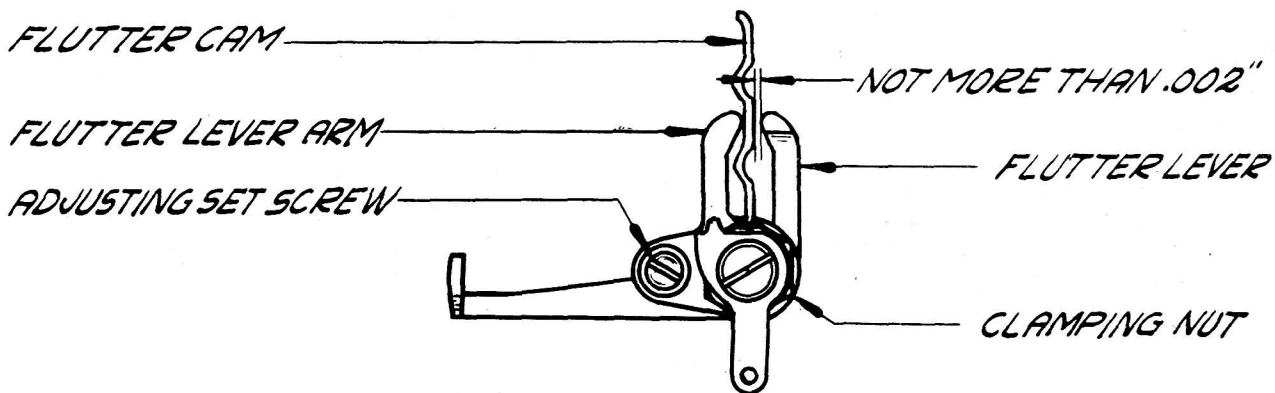


FIGURE 7.

Detent Spring Tension, Fig. 8

With the selector levers in the spacing position, hook an 8 oz. scale under the front end of the detent and pull vertically. It should require from 3 to 4 ozs. to start each detent moving.

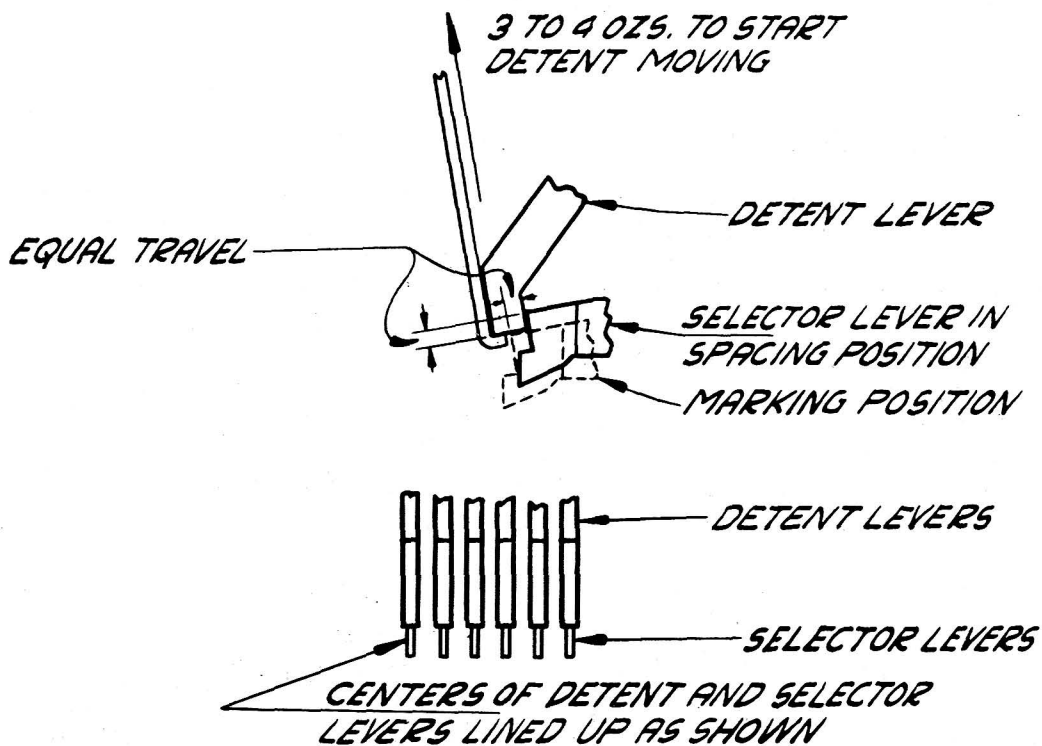


FIGURE 8.

Selector Lever Guide Adjustment, Fig. 9

Loosen the selector lever guide mounting screws and adjust the position of the selector lever guide so that when the selector armature is held to the spacing side and the main shaft rotated, the left side

of the spacing cams on the selector cam drum will line up with the left side of the spacing arms of the selector levers. When making this adjustment, the spacing arms should be moved toward the front of the printer so as to take up all play of the lever in the guide.

Note: Due to variations, all the selector lever arms may not line up with the left side of the cams. It is, therefore, satisfactory if one or more arms line up with the left side of the cams, provided the other cams are fully on.

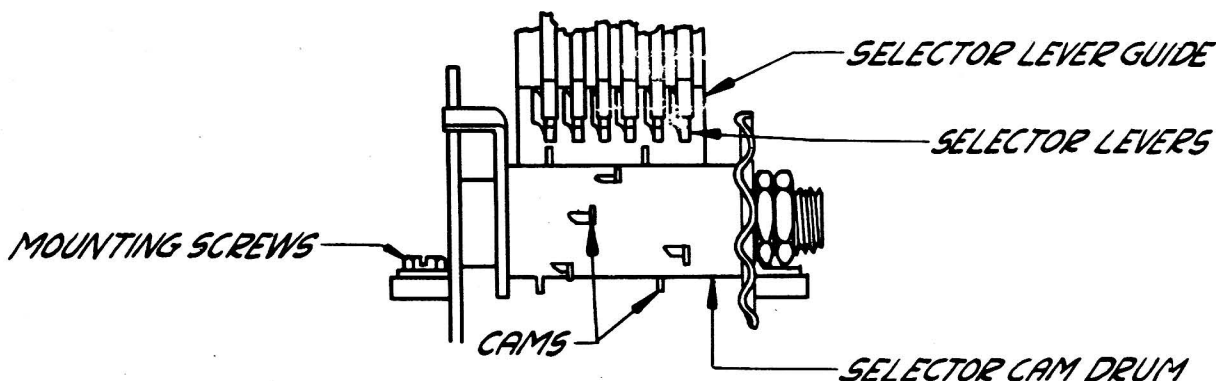


FIGURE 9.

Selector Lever Guide Shims Adjustment, Fig. 10

With the selector levers in the spacing position (up) and the selector armature to the spacing side, turn the main shaft and check to see that the spacing cams on the selector cam drum clear the spacing arms of the selector levers by at least .002". (See "A" Fig. 10.) Place the selector levers in the marking position (down). Turn the main shaft and at the same time move the selector cam drum by hand so that the marking cams on the drum will be in line with the marking arms of the selector levers. The marking cams should clear the marking arms by at least .002". (See "B" Fig. 10.) Add or remove shims located under the selector lever guide to divide the clearance equally between the spacing and marking cams and arms.

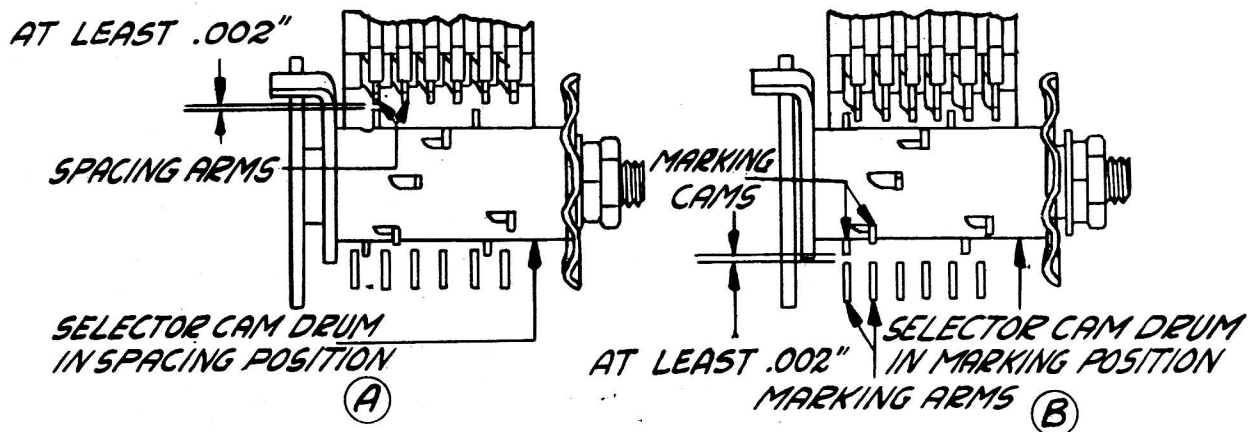


FIGURE 10.

Selector Armature Pivot Screws Adjustment

Remove the permanent magnet and back off the armature buffer screws. Then adjust the up and down position of the selector armature, by means of its pivot screws, so that the top surface of the armature is flush with the top surface of the left end of the pole pieces, and also so that the selector armature is free and without play.

Selector Armature Pole Pieces and Buffer Screws Adjustment, Fig. 11

Back off the armature buffer screws and loosen the armature pole piece mounting screws and posts. Place a .020" gauge on each side of the selector armature between the armature and each end of the front and rear pole pieces. Clamp the pole pieces together by hand and tighten the pole piece mounting screws and posts. Before removing the gauges, adjust the buffer screws so that there is .003" clearance between each buffer screw and the side of the armature.

Remove gauges and replace the permanent magnet so that the ends of the magnet are approximately $3/4$ " from the left hand end of the laminated pole pieces.

After tightening the permanent magnet clamping screws, recheck the armature buffer screws adjustment as follows: Place the selector armature on the spacing side. Hook an 8 oz. scale over the armature pin and pull at right angles to the armature towards the front of the printer. Observe the tension required to pull the armature to the marking side. Now hook the scale over the pin and pull at right angles to the armature towards the rear of the printer. Observe the tension required to pull the armature to the spacing side. The two tensions should be within one ounce of being equal. Adjust the position of the buffer screws to obtain this result. Each tension should be at least 4 ozs. After this adjustment, the armature should still have .006" travel. Note: In cases where at least 4 oz. tensions cannot be obtained, it may be necessary to replace the permanent magnet with a stronger one. (This tension does not apply in cases where non-magnetic buffer screws are used.)

Magnet Base Position, Fig. 12

Loosen base mounting screws. With the selector armature to the spacing side, rotate the main shaft until the selector cam stop arm has just passed the stop lug. Place the selector armature on the "marking side" and the flutter lever against the end of the armature. Then adjust the position of the magnet base so that when the main shaft is turned, the right side of the marking cams on the selector cam drum line up with the right side of the marking arms of the selector lever. (See "A", Fig. 12.) When making this adjustment, the marking arms should be moved toward the rear of the printer so as to take up all the play of the lever in the guide.

Note: Due to the variations, all the selector lever arms may not line up with the right side of the cams. It is, therefore, satisfactory if one or more arms line up with the right side of the cams, provided the other cams are fully on. Now pivot the magnet base on the front mounting screw so that there is .002" clearance between the side of

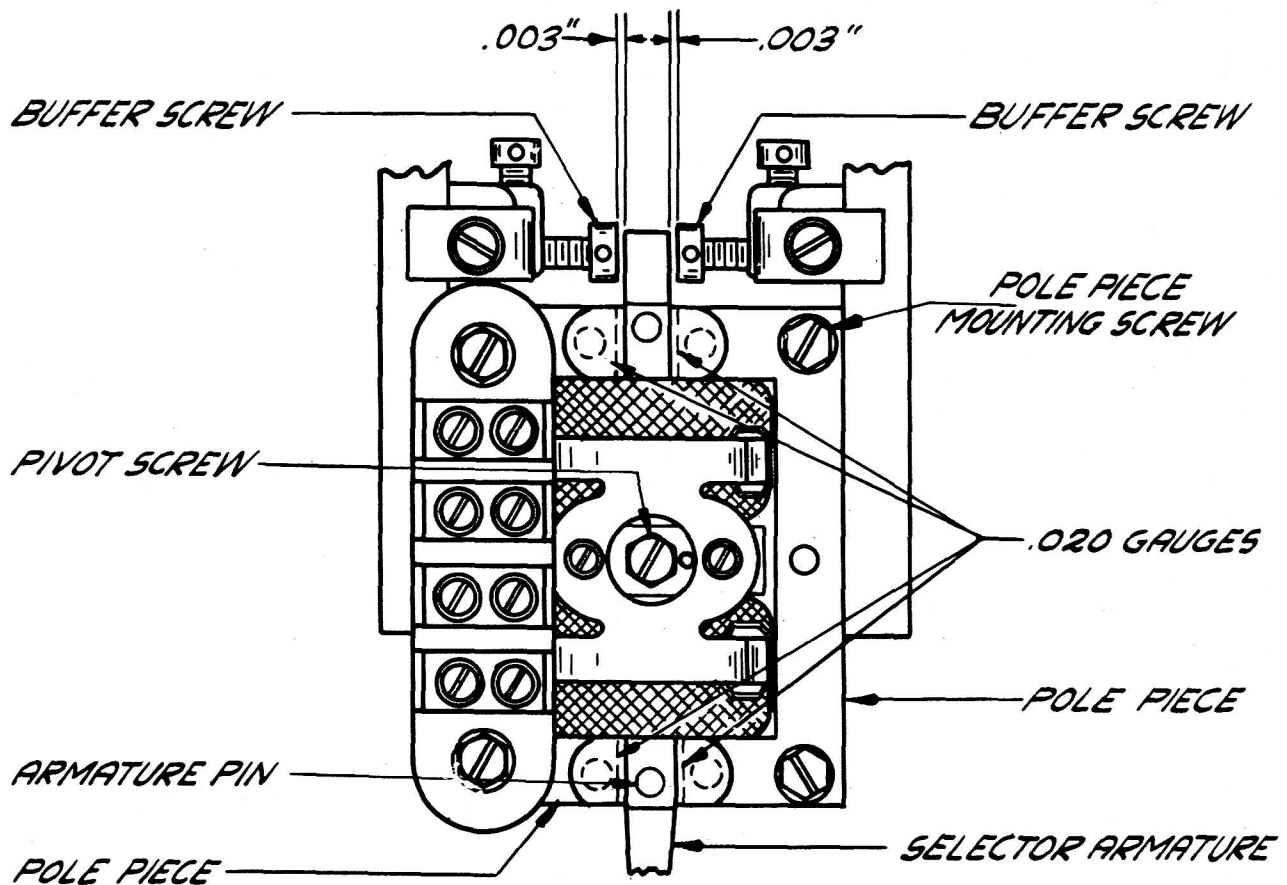


FIGURE 11.

the selector armature and the end of the flutter lever throughout its entire travel when the selector armature is in the spacing position. (See "B", Fig. 12.) Recheck the alignment of the marking cams and marking arms. Tighten the mounting screws.

With the selector armature held to the spacing side, rotate the main shaft until the selector cam stop has just passed the stop lug. Hold the selector armature to the marking side and rotate the main shaft. There should be at least .006" clearance between the end of the selector armature and the side of the flutter lever when the flutter lever is on each high part of the flutter cam and the selector cam drum is on the spacing side. (See "C", Fig. 12.)

This clearance must be sufficient to prevent any bind between the selector cam and its limiting sleeve and washer (on the main shaft) for a complete revolution of the main shaft. With the selector armature in the marking position, re-check the engagement of the marking cams and arms and the clearance of the spacing cams and arms. With the selector armature in the spacing position, check the reverse engagements and clearances.

Selector Drum Return Lever Spring Tension, Fig. 13

Adjust the flutter lever backstop by means of its mounting screws so that the return lever spring tension is from 10 to 11 ozs., and so

that the overall length of the spring is about 1-3/8". To measure this tension, place the selector cam drum against the spacing side. Hook a 32 oz. scale over lever in back of spring hole and pull in line with spring.

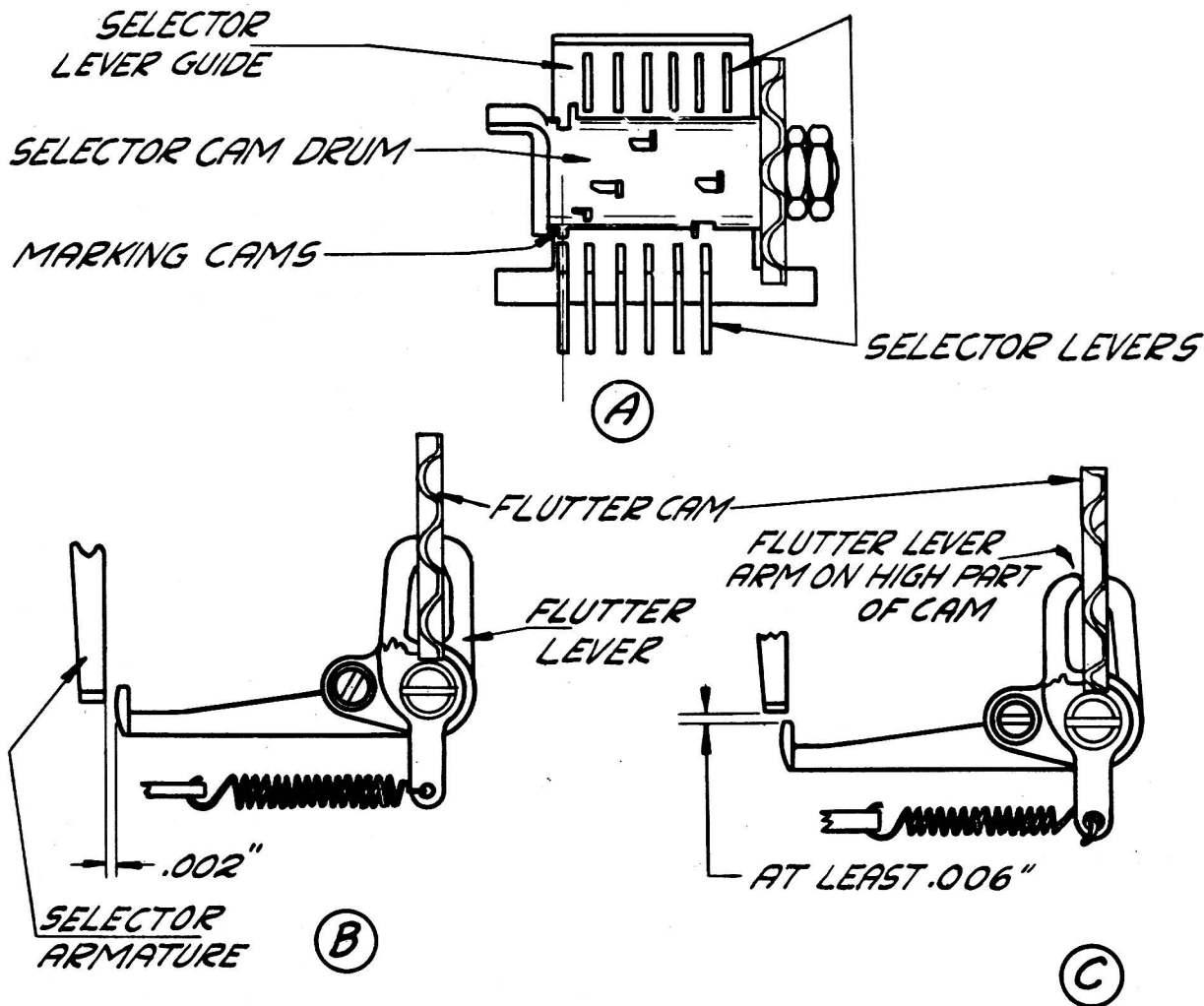


FIGURE 12.

Flutter Lever Stop Screw Adjustment, Fig. 13

Place the armature on the spacing side. Rotate the main shaft and determine which point on the flutter cam causes the flutter lever to travel "out" the farthest. Then, with the flutter lever resting on this highest point, adjust the stop screw so that there is .004" clearance between the screw and flutter lever.

Transfer Bail Shaft Position

Loosen the transfer bail shaft set screw and set the shaft so that the right end of the shaft projects beyond the side of the transfer bail approximately 1/32".

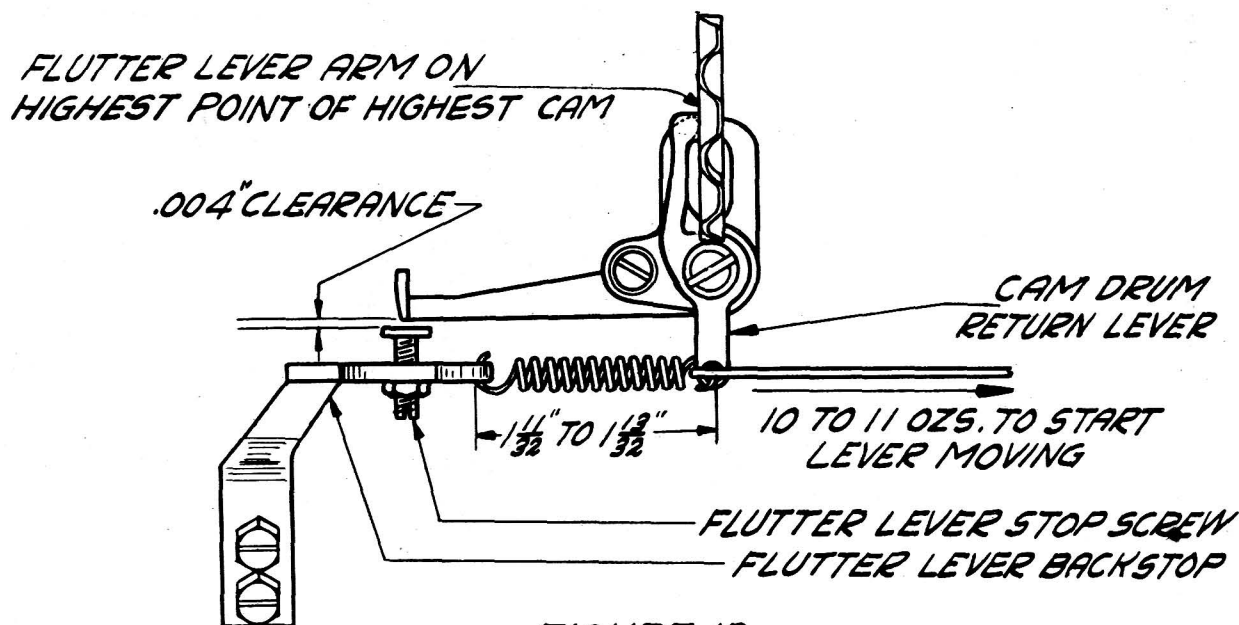


FIGURE 13

Operating Cam and Release Bail Rollers Adjustment

Adjust the feed bail, printing bail, transfer bail and cam release bail rollers by means of their bearing screws and nuts so that the rollers turn freely and have no play. Care should be used when adjusting printers having new style studs and rollers to see that the screw slot in the stud is not burred, as this will cause the roller to bind and wear excessively. The rollers must turn freely on the studs.

Cam Release Bail Position, Fig. 14

Remove the cam release bail spring and loosen the bail collar screw. Set the collar so that the bail has from .002" to .004" play between the collar and casting. Replace the spring. With the selector armature on the marking side, rotate the main shaft until the operating cam stop lug is stopped by the cam release bail. In this position, the overlap of the stop lug on the bail arm should be 1/16".

Cam Release Bail Spring Tension, Fig. 14

With the cam release bail roller resting on the low part of the cam, hook a 32 ounce scale in the spring hole and pull in line with the spring. It should require from 16 to 20 ounces to just start the bail moving.

Transfer Lever Bearing-Bracket Position, Fig. 15

Remove the four screws and clamp holding the typewheel shaft unit to the main casting and remove the unit from the printer. Loosen the transfer bail roller arm clamping screws.

Loosen the transfer lever bearing bracket clamping screws. The bracket may now be moved in all directions. First set the lateral position of the bracket, as described under "A".

- A. With the transfer bail held in the "upward" position, set the transfer bracket so that both arms of the transfer levers line up with the selector levers (Fig. 15-A).
- B. With the selector armature on the marking side and the flutter lever against the end of the selector armature, rotate the main shaft until the selector cam stop arm is resting against the stop lug. Place all selector levers in the marking position (down). Raise the transfer bracket and check the bite that the transfer levers have on the selector levers. Then set the selector levers in the spacing position (up). Raise the transfer bracket and check the bite on the spacing side. Now shift the bracket forward or backward so that the bite on the spacing side is equal to the bite on the marking side (Fig. 15-B). Tighten bracket clamping screws. Recheck adjustment "A".

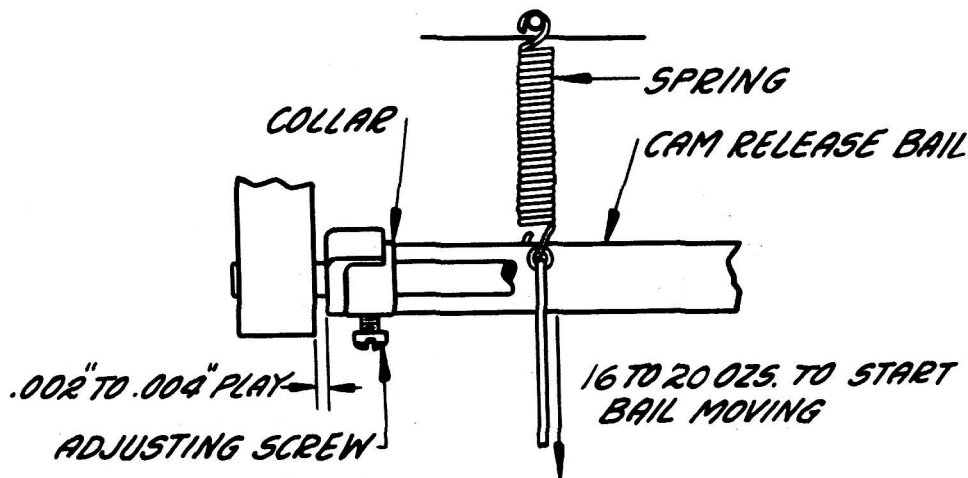


FIGURE 14.

Typewheel Stop Pin Spring Tension

Hold the typewheel stop unit in a horizontal position. Hook an 8 oz. scale over the front of the unselected stop pin and pull vertically in line with the pin slot. It should require not more than 6 ozs. to start the stop pin moving.

Owing to the wider space between the "S" and "G" pins, the tensions of these pins, on printers not equipped with individual springs, will be slightly higher. Allow a maximum of 7 ozs. The tension of selected pins should not be less than 2 ozs.

On machines equipped with a rubout bar, check the tension of the rubout bar in the unselected position. It should require from 5 to 7 ozs. to start the bar moving.

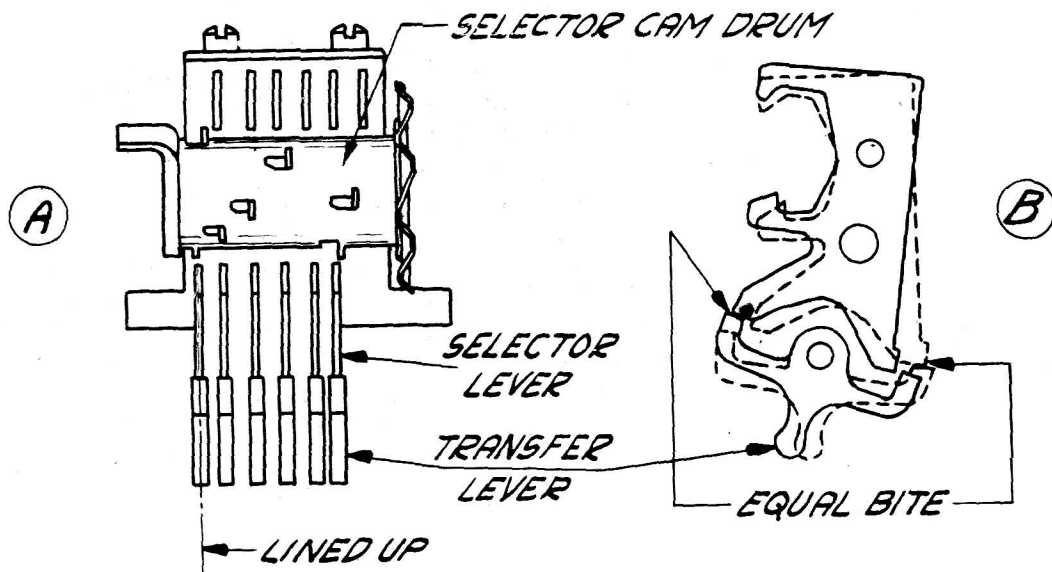


FIGURE 15.

Typewheel Stop Arm Latch Spring Tension

With the typewheel stop unit in a vertical position, hook an 8 oz. scale over the end of the stop arm latch and pull at a right angle to the latch. It should require 3 ozs. to just start the latch moving.

To Replace Typewheel Shaft Unit

With the selector armature on the spacing side, rotate the main shaft until the selector cam drum stop arm has just passed the stop lug. Place the selector armature on the marking side and the flutter lever against the end of the armature. Rotate the main shaft until the transfer arm roller is on the high part of the operating cam. Set the position of the transfer lever slots in the code discs so that they are in line. Replace the typewheel shaft unit so that the transfer levers are in their respective code disc slots. Replace the unit clamp and tighten screws.

Typewheel Shaft Unit Position

- A. With the selector armature on the spacing side, rotate the main shaft until the transfer bail roller is at the place where it just starts to ride up the cam.
- B. Loosen the typewheel shaft unit clamping screws sufficiently to permit the unit to be shifted horizontally.
- C. Adjust the horizontal position of the unit so that the transfer levers line up with their respective code discs.
- D. Loosen the shift lever set screws.
- E. Assure that the transfer bail roller arm clamping screws are loose.

- F. Move #1, #3 and #5 selector levers to the spacing position (up) and #2, #4 and #6 selector levers to the marking position (down). Move the #1, #3 and #5 code discs to the spacing position (clockwise) and #2 and #4 code discs to the marking position (counter-clockwise). Now continue rotating the main shaft until the transfer bail arm roller is on the high part of the operating cam. Hold the transfer bail up by hand and at the same time rotate the typewheel shaft unit in a clockwise and counter-clockwise direction until the arm on each transfer lever is against the arm of its respective selector lever. While holding the transfer bail up, tighten the shaft unit clamping screws.
- G. Recheck the horizontal position of the unit.

Typewheel Shaft Gear Position Adjustment

Shims may be used to align the centers of the typewheel shaft gear and motor pinion. The shims should be placed on the typewheel shaft between the friction clutch assembly and the bearing.

Transfer Bail Adjustment

With the selector cam stop arm against the stop lug and the operating cam stop lug against the cam release bail arm, move the selector armature to the spacing side and turn the main shaft until the transfer bail arm roller is on the high part of the operating cam. Place #1, #3 and #5 selector levers in the spacing position (up) and #2, #4 and #6 selector levers in the marking position (down). Place #1, #3 and #5 code discs in the spacing position (clockwise) and #2 and #4 code discs in the marking position (counter-clockwise). Now hold the transfer bail roller arm so that the roller is against the cam and at the same time, hold the transfer bail operated so that the transfer levers are up securely against their respective selector levers. Tighten transfer bail roller arm clamping screws.

Motor Position Adjustment, Fig. 16

By means of the motor adjusting nuts and motor mounting nut, move one end of the motor up or down so that the minimum play between the motor pinion and the main shaft gear, checked for one complete revolution of the main shaft, is .002". Recheck this play after the motor mounting screws and nuts have been tightened.

Feed Bail Spring Tension, Fig. 17

Remove the feed pawl spring. With the feed bail roller on the low part of the cam, hook a 32 oz. scale over the feed pawl bearing screw and pull vertically. It should require from 18 to 24 ozs. to support the feed bail. Replace the feed pawl spring.

Pressure Wheel Lever Spring Tension, Fig. 18

Hook a 32 oz. scale over the spring arm of the pressure wheel lever and pull in line with the spring. It should require from 14 to 18 ozs. to just start the lever moving. The pressure wheel should line up with and roll evenly on the feed wheel. Check this by observing that the tape passes from the printer with equal clearance between the tape guide flanges.

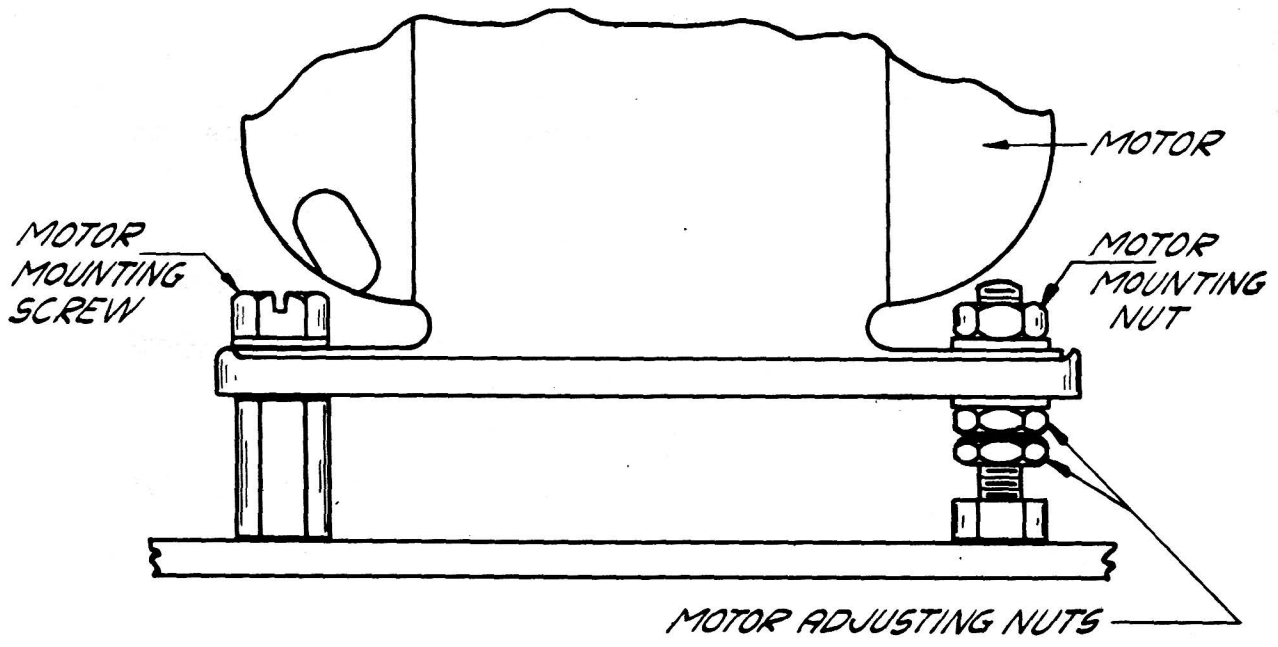


FIGURE 16.

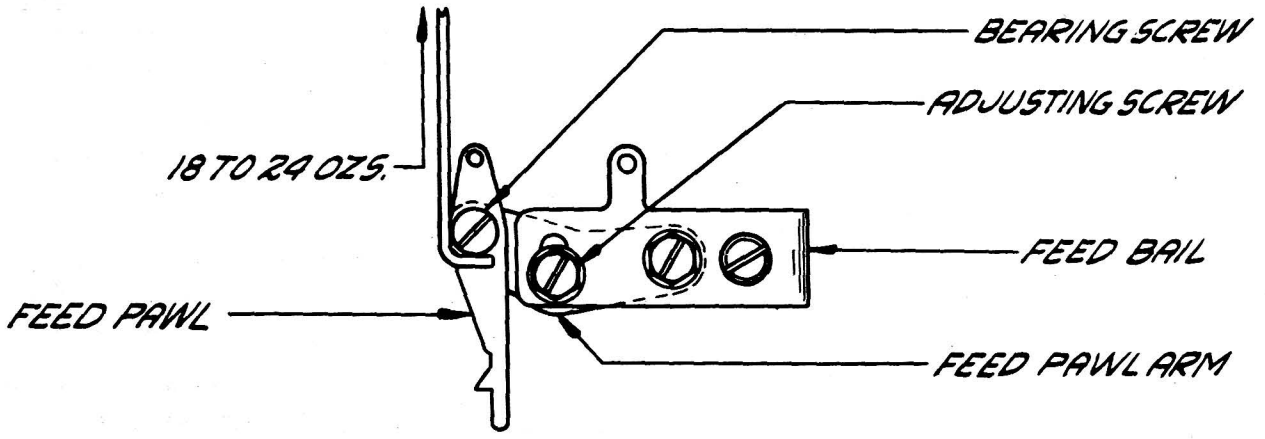


FIGURE 17.

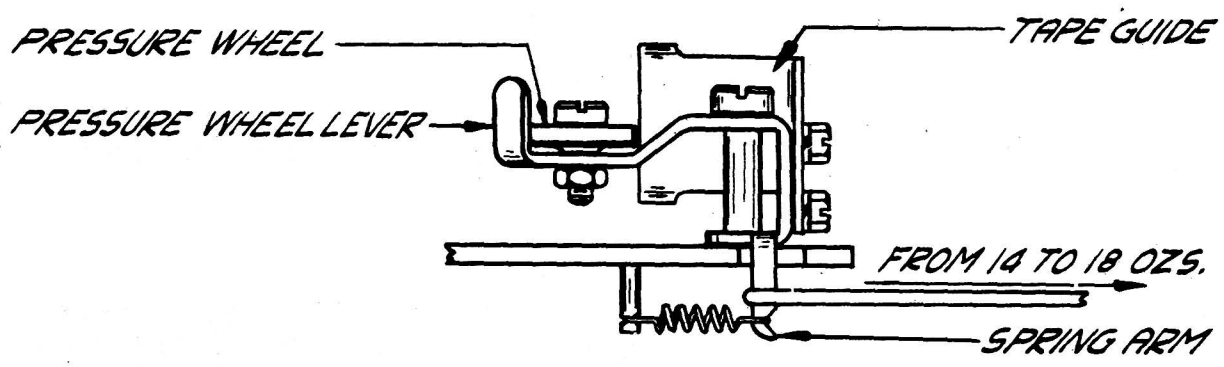


FIGURE 18.

Feed Ratchet Detent Lever Spring Tension, Fig. 19

Hook a 32 oz. scale in the spring hole of the detent lever and pull in line with the spring. It should require from 8 to 10 ozs. to just start the lever moving.

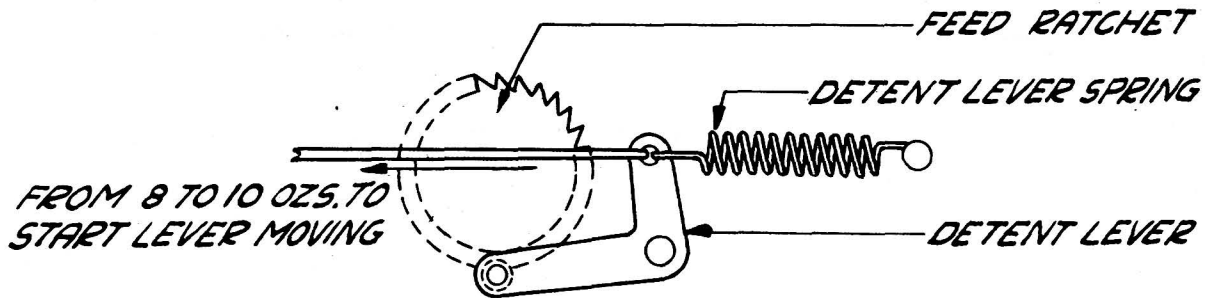


FIGURE 19.

Feed Pawl Arm and Space Blocking Arm Adjustment, Fig. 20

With the selector armature on the spacing side, rotate the main shaft until the transfer bail roller is at the place where it just starts to ride up the cam. Move all selector levers to the marking position (down) and rotate all the code discs to the marking position (counter-clockwise) so that the rub-out bar is selected. Now continue rotating the main shaft (about one-half revolution) until the feed bail roller is on the high part of its cam.

Loosen the two screws holding the feed pawl arm and the space blocking arm. Set the position of the space blocking arm so that the arm overlaps the selected rub-out bar by .030" and also so that there is a clearance of .030" between the blocking arm and the rub-out bar. Then, before tightening the screws and without disturbing the position of the blocking arm, set the position of the feed pawl arm so that the end of the pawl overtravels the tooth that is in the horizontal center of the feed ratchet wheel by approximately 1/2 tooth, or sufficient to prevent any movement of the feed ratchet when the feed bail roller passes over the low point of the operating cam. Tighten the screws.

Feed Pawl Spring Tension, Fig. 20

Hook an 8 oz. scale in the spring hole of the feed pawl and pull in line with the spring. It should require from 2 to 4 ozs. to just start the pawl moving.

Printing Hammers Adjustment

Remove the typewheel. Adjust the position of the printing hammers by means of shims between the printing hammer stud nut and the rear tape guide flange so that the sides of the strip between the two openings in the tape shield are equally distant from the sides of the letters and figures printing hammers when the printing hammers are flush against the hammer spacer. Replace the typewheel.

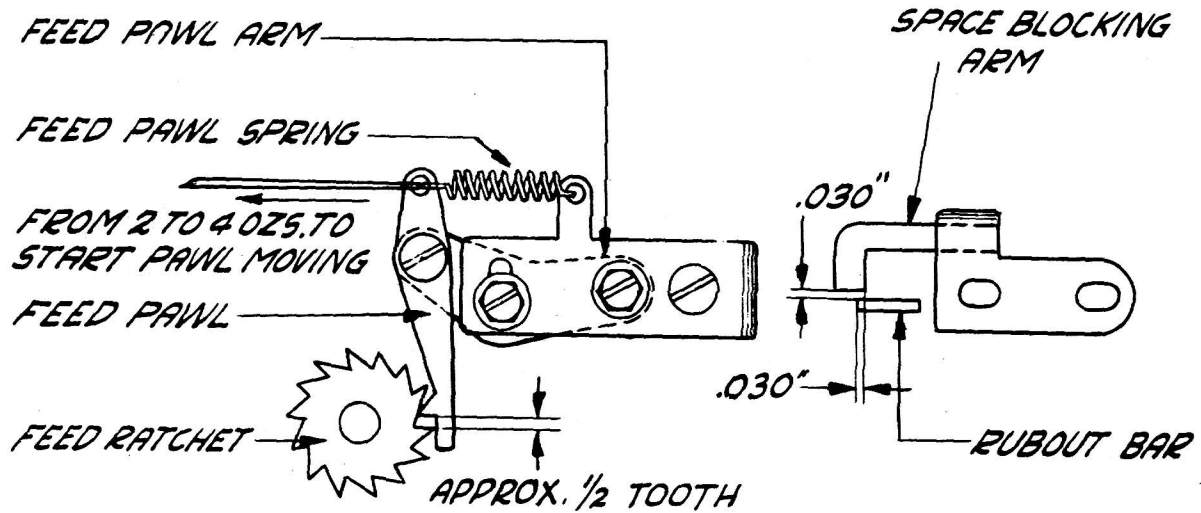


FIGURE 20.

Typewheel Shaft Adjustment, Fig. 21

Adjust the position of the typewheel shaft by means of its bearing bracket so that the space between the letter and figure characters on the typewheel lines up with the strip between the two openings in the tape shield. Re-check typewheel shaft gear adjustment.

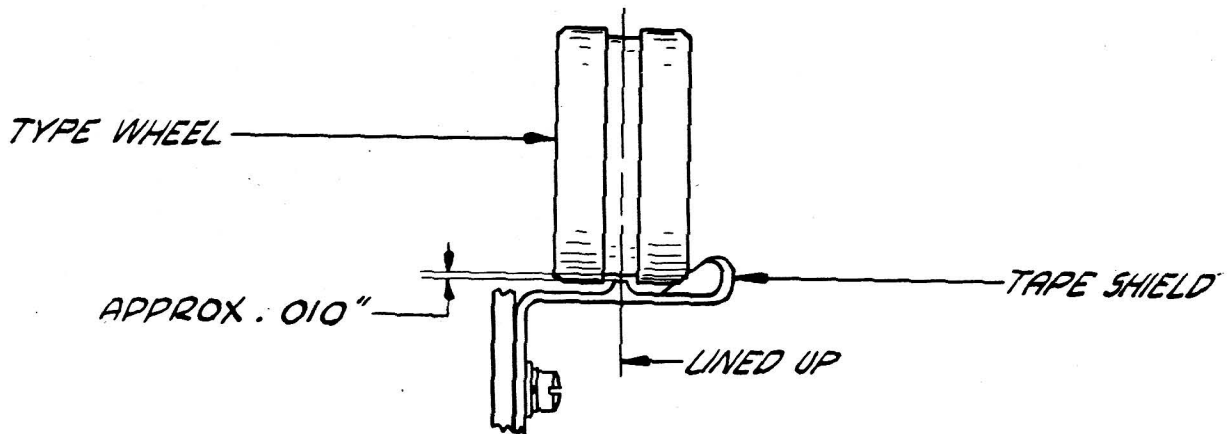


FIGURE 21.

Printing Bail Adjustment

Loosen printing link eccentric screw nut and turn eccentric screw so that the printing link is midway between its upper and lower adjusting limits. Tighten eccentric screw nut. With the selector armature on the spacing side, turn the main shaft until the printing arm roller is on the high part of the operating cam. Loosen the printing link clamping screws and set the position of the printing bail so that

when the printing hammer striker is in the "figures" position, the "figures" printing hammer is lightly touching a "figures" character on the typewheel.

Hammer Backstop Adjustment, Fig. 22

Loosen the hammer backstop mounting screw and adjust the hammer backstop so that when the hammers are held lightly against a character on the typewheel there is from .020" to .030" between the hammers and the hammer backstop. Tighten the screw. The backstop in this position should now hold the hammers in a very nearly horizontal position and allow the tape to pass through the feed unit in a straight line.

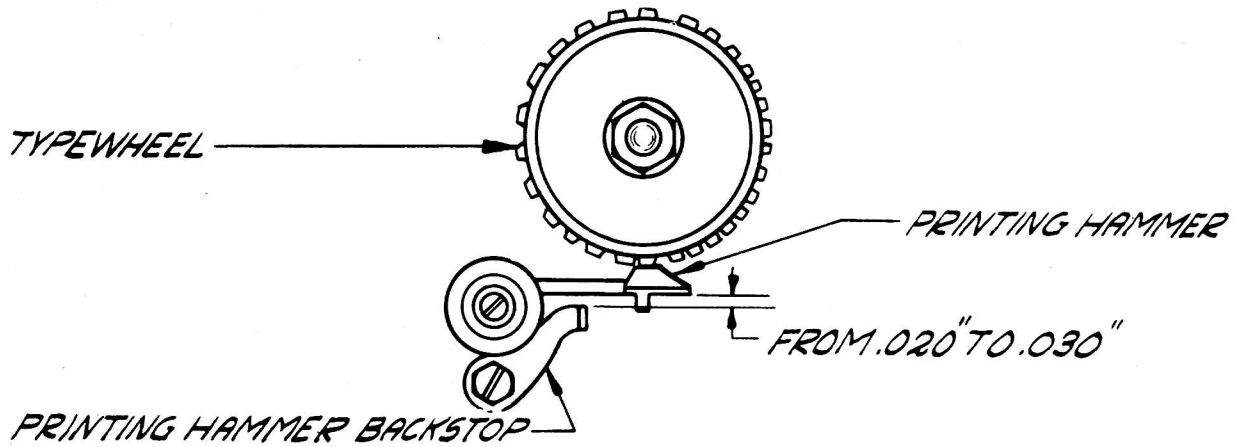


FIGURE 22

Hammer Striker Spring Tension, Fig. 23

With the hammer striker in the "figures" position, hook an 8 oz. scale over the "figures" arm of the hammer striker and pull horizontally. It should require from 4 to 6 ozs. to pull the striker from "figures" to "letters" position.

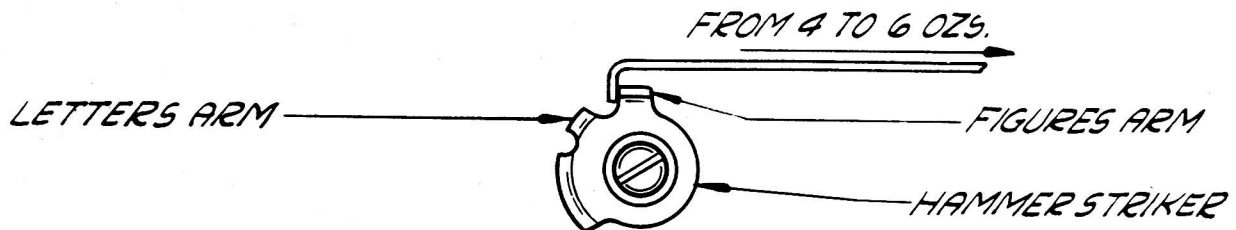


FIGURE 23.

Tape Shield Adjustment, Fig. 21

Set the position of the tape shield by means of its clamping screws so that the strip between the two openings in the tape shield is approximately .010" away from the section of the typewheel between the letter and figure characters. This adjustment should be such as to

give clear printing with a minimum crimping of the tape.

Care should be taken when making this adjustment that the shield is in a horizontal plane and that the printing surfaces of the printing hammers pass through the middle of the openings in the tape shield.

Shift Lever Adjustment

(For Printers equipped with printing bails of 45° angle between the hammer striker stops.)

With the transfer bail roller on the low part of the operating cam, shift the code discs so that they are in the spacing position (clockwise). Adjust the shift lever so that when the print hammer striker arm is against the "letters" stop, the bottom of the shift transfer lever is in line with the bottom of the other transfer levers. Tighten the screws.

Shift Lever Adjustment

(For printers equipped with printing bails of 54° angle between the hammer striker stops.)

- A. With the selector armature to the spacing side, rotate the main shaft until the printing bail roller has just passed the peak of the cam. Move the #6 selector lever to the marking position (down). Now continue rotating the main shaft until the transfer bail roller is on the peak of the cam. Adjust the vertical position of the shift lever so that the end of the left tine of the fork of the lever is 1/16" below the lower edge of the hammer striker arm. Also adjust the horizontal position of the shift lever so that there is at least .005" clearance between the shift transfer lever and the right arm of the selector lever when the print hammer striker arm is against the figures stop. Tighten clamping screws.
- B. Back the transfer bail roller off the peak of the cam and place the #6 selector lever in the spacing position (up). Turn the main shaft until the transfer bail roller is again on the peak of the cam. Then check the clearance between the shift transfer lever and the left arm of the selector lever. If necessary, adjust the shift lever so that this clearance is also at least .005". If it is necessary to readjust the shift lever, recheck adjustment "A".

When the shift lever has been properly adjusted, there will be at least .005" clearance between the shift transfer lever and the selector lever when in either the "letters" or "figures" position.

Typewheel Stop Arm Adjustment

Set up the "A" combination and select the "A" stop pin. Loosen the typewheel stop arm clamping screw and set the position of the arm on the shaft so that the arm lock latch bites fully on the selected stop pin and so that the stop arm clears the front guide disc by .004". Rotate the typewheel shaft until the "H" character on the typewheel is approximately opposite the stop arm. Press the "letters" printing

against the orientation stop lug by holding the flutter lever against its backstop (to the left). If the operating cam stop lug is permitted to pass the cam release arm, the cam-driven clutch will engage with the drive clutch, causing the hand to be pulled to the printer, and injury may result.

Selector Cam Friction Clutch Tension

Take the clutch tension with the motor running and the selector cam stop arm against the stop lug. Hook a 32 oz. scale over the selector cam stop arm and pull horizontally. It should require from 18 to 22 ozs. to just start the stop arm moving away from the stop lug.

Operating Cam Friction Clutch Tension

Take this tension with the motor running and the operating cam stop lug against the cam release arm. Hook a 32 oz. scale over the operating cam friction clutch drive pin, and pull up vertically. It should require from 20 to 24 ozs. to just start the operating cam stop lug moving away from the cam release arm.

Typewheel Shaft Friction Clutch Tension

Take this tension with the motor running. Stop the typeshaft by holding the selector armature to spacing and grasp the stop arm. Lift the spacing stop pin and hook a 32 oz. scale over the end of the stop arm. The pull at right angles to the stop arm should require from 12 to 16 ozs. to hold the stop arm against the clutch friction.

Printing Link Eccentric Screw Adjustment

Loosen the eccentric screw nut just enough to allow the eccentric screw to be turned. Turn the screw until the printing just fails. Then turn the screw in slowly until the printing is legible and tighten the nut.

Before making this adjustment, care should be taken that the inker roller rides evenly over both letters and figures on the typewheel.

MOTOR CONTROL UNIT ADJUSTMENTS

Motor Control Unit Bracket Adjustment

Adjust the motor control unit bracket, by means of its mounting screws, so that there is a slight amount of play between the motor control gear and worm (not more than .004"). Note: The centers of the two gears should be in line vertically.

Remove motor control relay.

Motor Control Cam Lever Spring Tension, Fig. 25 •

With the cam lever on the low part of the motor control cam, apply an 8 oz. push scale to the top of the motor control lever (directly above the bearing screw) and push downward. It should require 2 ozs. to just start the lever moving. Note: Hold the motor control magnet armature against the magnet cores so that it does not interfere with taking tension

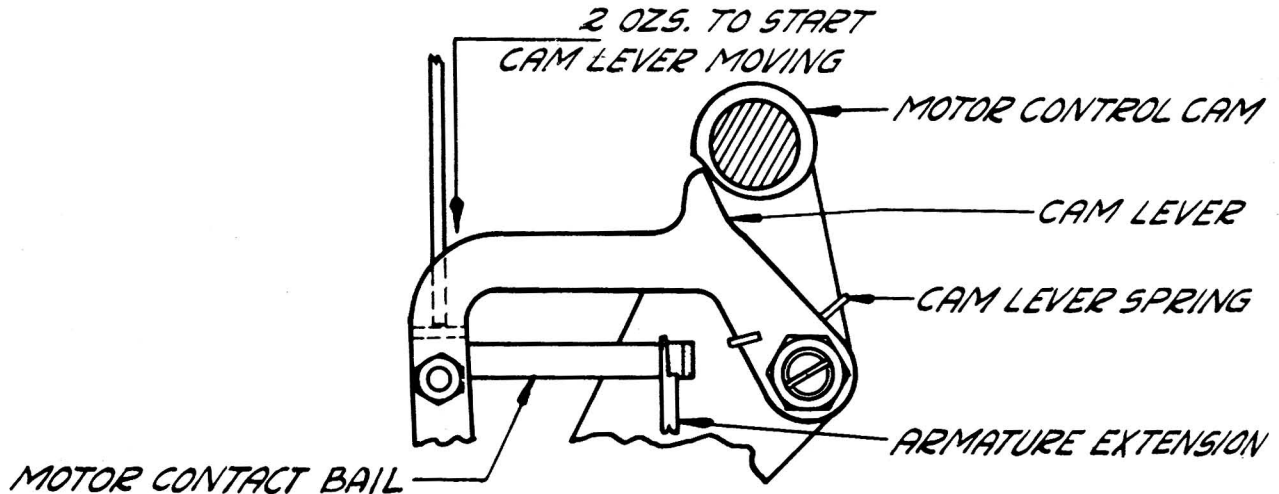


FIGURE 25.

Motor Control Magnet Bracket Adjustment, Fig. 26

Rotate the main shaft until the cam lever is resting on the high part of the cam. Hold the magnet armature against the magnet cores and adjust the magnet bracket by means of its mounting screws so that when the contact bail is moved just below the notch of the armature extension, there will be a clearance of from .006" to .010" between the outer side of the armature extension and the inner side of the bail. Check to see that the magnet core faces are clean.

Motor Control Magnet Armature Spring Tension, Fig. 26

Unhook the armature spring from the spring post. When the armature is held against the magnet cores, it should require from 4 to 5 ozs. on D.C. motor printers and from 3 to 4 ozs. on A.C. motor printers to pull the spring to its position length.

Motor Control Contact Adjustment

Remove the motor control contact guard. Make sure that the contact springs are straight and vertical and that the contact faces are parallel and in line. Also make sure that the spring stiffener is straight and that the spring lies snugly against it along its entire length. With the motor control cam lever against the highest part of the cam and the contact bail resting in the magnet armature extension notch, there should be from .015" to .030" space between the motor control contacts. To check the proper adjustment of the motor control contacts, run the motor under the full friction of all clutches (selector armature in marking position) and open the line circuit. When the motor comes to rest, the contact bail should have opened the motor control contacts enough so that jarring of the motor by striking with the hand will not cause the contacts to spark. If necessary, bend the motor control contact springs to obtain this adjustment.

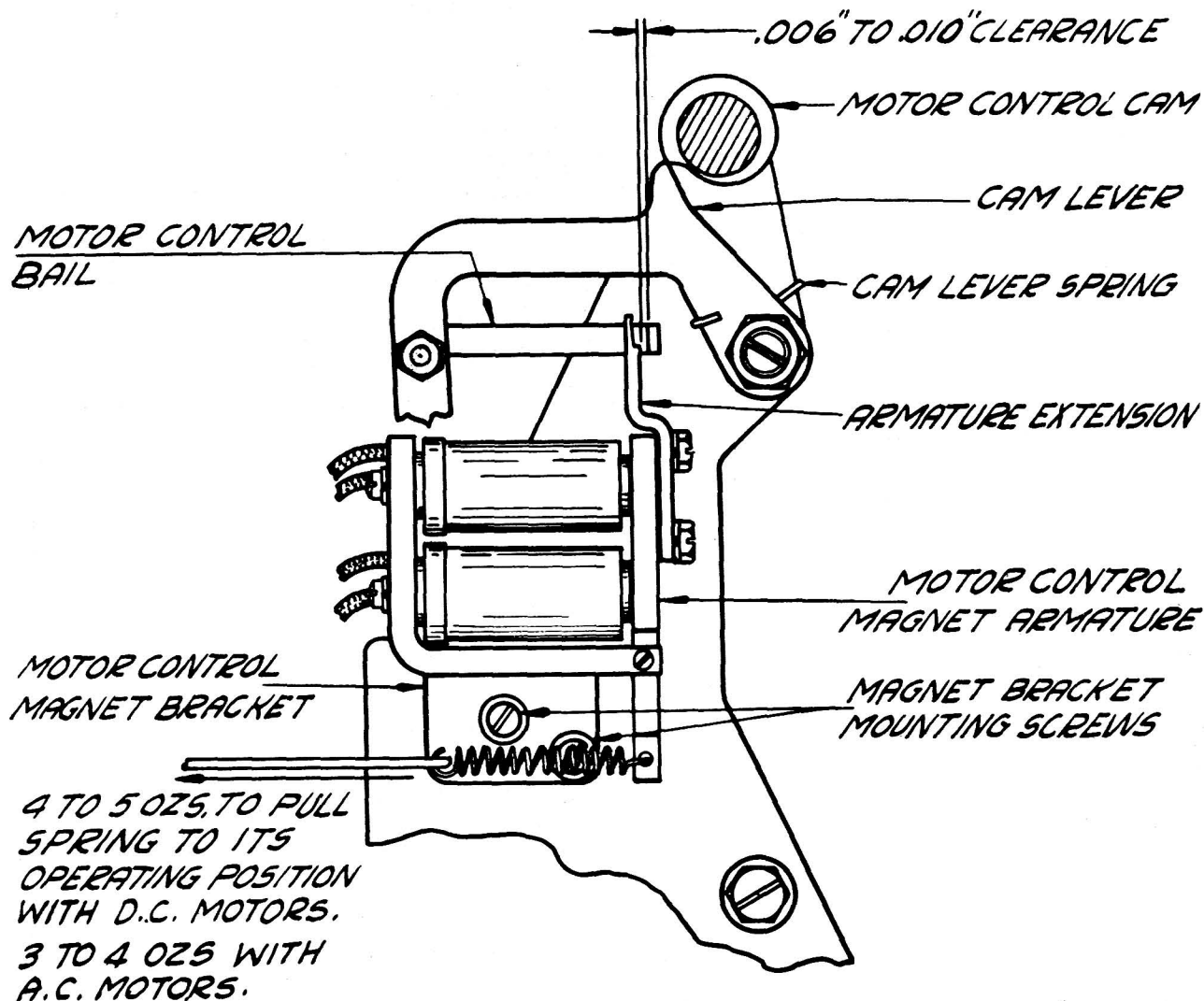


FIGURE 26.

Motor Contact Spring Tension

Apply an 8 oz. push scale directly above the rear contact spring and against the front contact spring fibre. It should require from 3 to 4 ozs. on D.C. or A.C. series motor printers and 4 to 5 ozs. on induction motor printers to cause the front spring to just break contact with the rear spring. Recheck the motor control contact adjustment, see that contacts are in line and meet squarely. Replace contact guard.

Replace motor control relay.

Relay Adjustments, Fig. 27

Back off the left and right hand contact screws and pole piece screws and turn the bias spring screw so that the spring does not touch the armature.

The relay armature should be centered in the relay coil opening.

Turn the right hand contact screw in until it just touches the armature. The contacts should be in line and meet squarely. Note: Right and left hand contact screws should be clamped securely after each adjustment.

Turn the left hand contact screw in so that when the armature is resting against the right hand contact screw there is .002" space between the armature and the left hand contact screw.

Turn the right hand contact screw out so that when the armature is resting against the left hand contact screw there is .004" space between the armature and the right hand contact screw

With the armature against the right hand contact screw, turn the right hand pole piece screw in until there is .004" space between the pole piece and the armature.

With the armature against the left hand contact screw, turn the left hand pole piece screw in until there is .004" space between the pole piece and the armature.

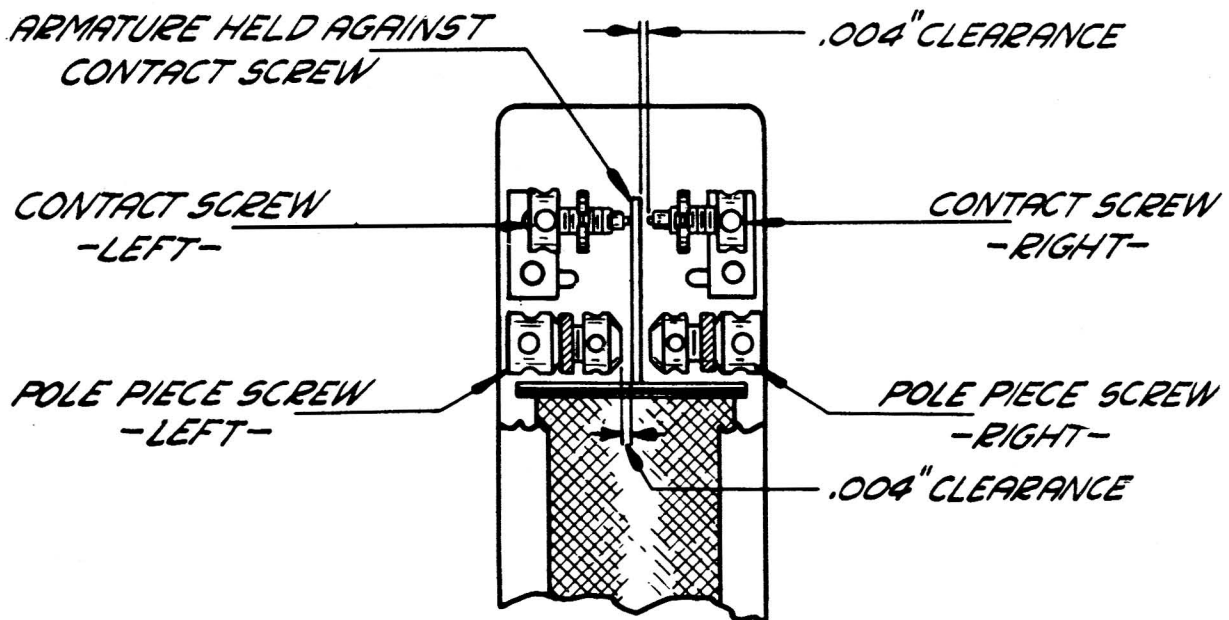


FIGURE 27

Bias Spring Screw Adjustment

Before adjusting the bias spring, normal operating current should be passed through the relay in a direction to give the tongue a marking bias. This current should be permitted to pass through the coils of the relay for approximately 5 seconds. The tongue of the relay will then rest against the contact toward the front of the printer. Turn the bias spring screw to the left until the spring has just sufficient tension to move the armature to the spacing contact plus an additional 1/8 turn.

GOVERNOR ADJUSTMENTS

Speed Adjusting Wheel Friction Washer Spring Tension, Fig.28-A

Remove the governor cover. Turn the adjusting wheel so that the tension on the governor contacts is from 13 to 14 ozs. Measure this tension by hooking a 32 oz. scale over the contact spring arm next to the contact and pulling parallel to the speed adjusting spring.

To measure the tension of the speed adjusting wheel friction washer, insert a bank pin in the leather rim (radially) and hook a 32 oz. scale to the pin, making sure that the hook is against the leather rim. Pulling at right angles to the pin and in the plane of the wheel, it should require from 8 to 12 ozs. to just start moving the wheel.

To adjust the tension remove the friction washer and bend the large projections.

Adjusting Screw Guide Pin

The adjusting screw guide pin should be in a position so that the flattened end of the pin is held securely in the guide groove at each limit of adjustment of the speed-adjusting wheel.

Governor Brush Springs, Fig. 28-B

The required tension to depress the brush spring to approximately its operating length, that is, to within $1/32$ " of the brush holder, shall not be more than 4 ozs. and not less than 3 ozs.

The pigtails should be soldered to both the carbon brush and the brass insert of the brush screws.

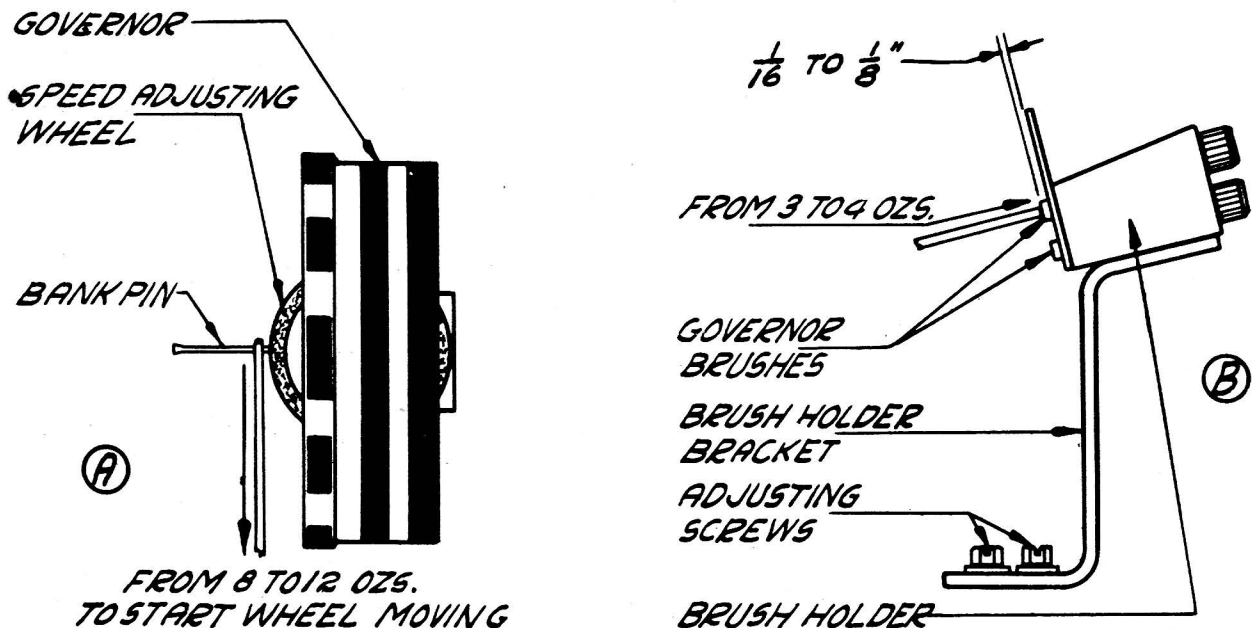


FIGURE 28.

Governor Brushes Position

Adjust the position of the brush holder bracket so that the brushes project from 1/16" to 1/8" beyond the holder. Be sure that the brushes ride on the center of the collector rings. Elongated mounting holes are provided in the bracket to make it adjustable.

Speed Setting

The tuning fork supplied is used for the purpose of regulating the printer motor speed. The fork is equipped with shutters attached to the ends of the tines. The printer is provided with a speed target of alternate black and white spots.

Tap the fork lightly, just enough to start it vibrating; a sharp blow may cause the shutters to buckle. Hold the fork close to the eye and view the moving spots on the target through the fork shutters. If the spots appear to be moving in the direction of rotation, the motor speed is too high. The speed is too low if the spots appear to move in a direction opposite to that of rotation. The speed is correct when the spots seem to be stationary.

The motor speed may be increased by pushing against the speed adjusting lever which is mounted on the top of the motor next to the governor. This turns the speed adjusting wheel in such a direction as to increase the tension of the governor armature spring, thereby speeding up the motor.

The speed is decreased by pressing the speed adjusting wheel guard towards the outside surface of the revolving governor. The engagement of the guard with the speed adjusting wheel will cause the wheel to be moved in such a way as to decrease the tension of the governor armature spring.

Orientation

The orientation scale, mounted directly behind the selector cam friction clutch, is used for the purpose of orientating the printer to the incoming signals.

The prescribed routine test should be transmitted to the printer continually while the range is being taken. In determining range, the high reading is the highest point on the graduated scale at which the printer will print correctly. The low reading is the lowest point on this scale at which the printer will print correctly providing the stop arm engages the stop lug at least one sixty-fourth of an inch. For true range readings, the printer must operate perfectly at both ends of the range while at least twelve feet of the prescribed routine test is being printed.

Loosen the thumb nut and shift the orientation scale reading toward zero until errors begin to appear in the test, or until the prescribed minimum engagement of the stop arm and stop lug is reached. Then move the scale back slowly until these errors disappear and at least 12 feet of test is received correctly. This position indicates one limit of the orientation range. Now move the orientation scale toward the high reading of the scale until the errors begin to appear in the test.

Then move it back slowly until the errors disappear and again note the position on the scale. This indicates the other limit of the range.

The two limits of the range having been found, the orientation scale should be set midway between these two points.

Coil Resistance and Operating Currents

The resistance of the selector magnet coils (which may be identified by the color of their leads) is as follows:

<u>Color of Leads</u>	<u>Use</u>	<u>Operating Current</u>		<u>Resistance (Per Coil)</u>
		<u>Coils in Series</u>	<u>Parallel</u>	
Green & White	W.U.	50 m/a	100 m/a	39 ohms
Blue & Yellow	-	-	-	15 ohms
Red & Yellow	N.Y.Q.	100 m/a	200 m/a	8 ohms

The motor control relay coil measures five ohms. The motor control magnet coils measure 800 ohms each.

LUBRICATION OF TYPEWHEEL TAPE PRINTER

Proper attention to lubrication is of the utmost importance. If the moving parts of the printer are properly lubricated, wear will be minimized and it will operate for long periods without readjustment. How often the printer should be oiled depends on the class of service in which it is used and the speed at which it operates.

For oiling, do not use very light oils such as typewriter oils. These oils have not sufficient body. Gargoyle "DTE" heavy medium is especially recommended, but any good light automobile motor oil such as "Mobile Arctic Light" may be used.

Apply oil to the following parts:

- Each code disc
- Selector detent bearings
- Selector lever guide
- Selector cam drum bushing
- Flutter lever bearing screw
- Cam release bail bearings
- Transfer bail bearings
- Transfer bail roller
- Cam release bail roller
- Feed bail roller
- Transfer lever bearings
- Shift transfer lever bearings
- Typewheel stop pin rollers
- Five bearing points of feed bail
- Feed pawl bearing screw
- Feed ratchet
- Detent lever bearing screw

Printing arm roller
Six bearing points of printing bail
Two hammer striker bearings
Printing hammer bearings
Feed wheel and pressure wheel bearings
Pressure wheel lever bearings
Operating cam clutch and spring
Stop pin guides (Three)
Motor armature bearings (Two)

Saturate the three friction clutches and flutter cam oiler with oil.

Apply a drop of oil in each oil hole for upper and lower selector armature bearings, motor control cam and gear bearing and operating cam bearing. Oil all ball bearings.

Apply a thin film of medium cup grease to all gears and to the notch in the spring hook on the feed bail.

Apply a thin film of medium cup grease, after oiling the following parts:

On function bracket around head of printing bail shoulder screw #33-41

On printing bail connecting link extension around head of shoulder screw #6800

On printing arm around head of shoulder screw #6799

On feed bail around head of shoulder screw #1196

On feed bail stud #76178 at point of contact with feed roller bail

INDUCTION MOTOR - MAINTENANCE, ADJUSTMENTS AND LUBRICATION (FIG. 29)

Description

The induction motors can be identified by the fact that no commutator or governor is used on these motors. This type of motor is known as the wound stator split phase induction motor with squirrel cage rotor.

The motor has two quadrature windings, known as the main and starting windings. The main winding is wound with heavy wire and is located in the bottom of the stator slots. The starting winding consists of a relatively few turns of considerably smaller wire located in the top of the stator slots and displaced ninety electrical degrees from the main winding. In series with the starting winding is a starting switch, which is closed during the starting period and open during running conditions.

The starting switch is operated by a centrifugal mechanism which opens the switch when approximately 75% synchronous speed is attained. When starting, the motor simulates a two-phase motor. The efficiency, however, under these conditions is poor and the function of the centrifugal mechanism is to cut out the starting winding when the rotor has attained sufficient speed to set up a field of its own, which, acting with the stator field, produces the necessary torque to operate as a single phase induction motor.

The induction motor thus started operating as a single phase motor tends to turn its rotor in synchronism with the frequency of the alternating current field driving it. For this reason the speed of the induction motor remains practically constant regardless of changes in the voltage of the power supply and requires no governor mechanism. The speed of the induction motor, therefore, cannot be varied and the proper operating speeds of ticker mechanisms are attained by the use of various sets of gears and pinions.

These motors will not stand a continuous stalled condition and will burn out in such a case.

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

In considering the assembly of the motor, the switch end of the rotor is considered that end on which is mounted the centrifugal mechanism. The other end of the rotor will be designated as the pinion end. Correspondingly, the end shields will be designated as the switch end shield and the pinion end shield, respectively.

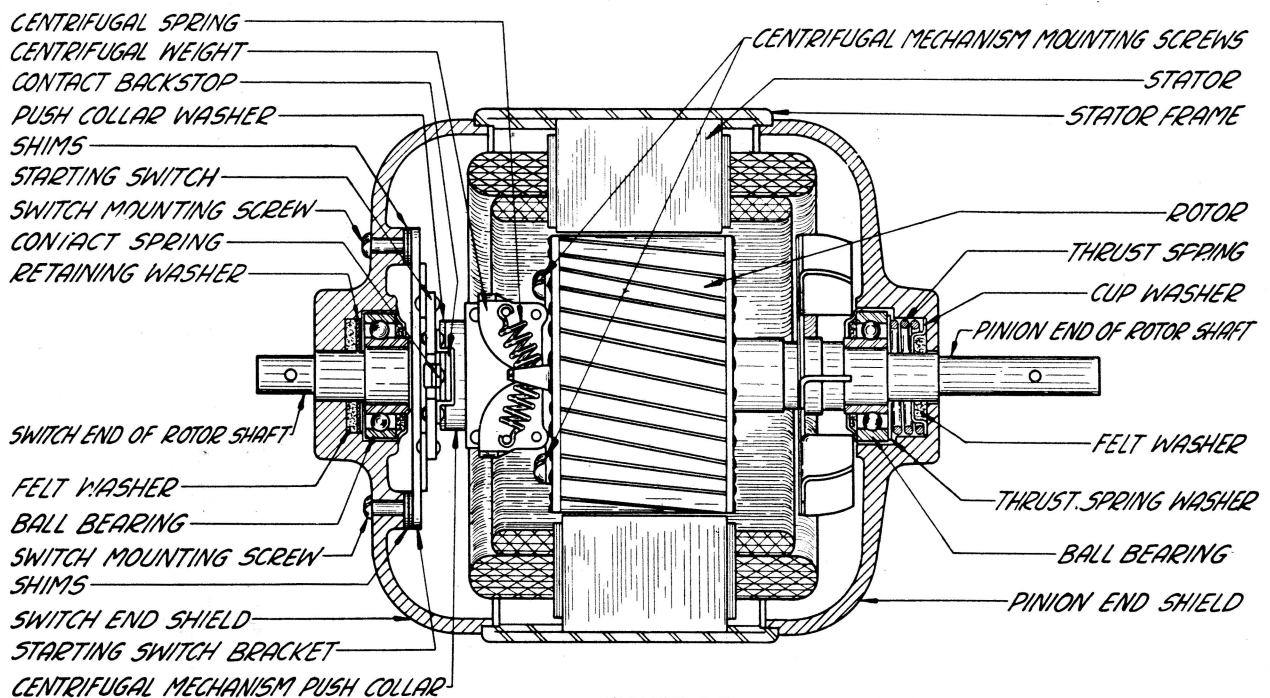


FIGURE 29

Motor Take-Down

If it becomes necessary to take the motor apart, the following procedure should be observed:

1. Remove the four screws which are used to hold each end shield in place. If the end shields stick, apply a screwdriver or similar tool to the slot on the under side of the casting and pry them loose. Remove the pinion end shield.
2. Remove the two screws holding the starting switch in place, being careful not to lose the spacing washers that may be present for locating the switch mechanism properly. The switch end shield may now be removed.
3. Disconnect the two wires to the starting switch which will enable the rotor being removed completely.

Removal of Bearings

If properly lubricated, it should never be necessary to remove the ball bearings from the rotor shaft for the purpose of replacing the bearings. It will be necessary, however, to remove the ball bearing on the switch end of the rotor shaft in case the starting switch or the centrifugal mechanism have to be replaced.

A bearing puller should be used when removing a ball bearing and care should be used so as not to dent the brass covering that encloses one face of the bearing or burr the shaft. Never use a hammer, chisel or any tool of this nature directly against the face of the inner or outer ring.

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

For instructions on how to mount the bearings, see "Assembly and Adjustment".

Maintenance Routine

If the motor has been in service for some time, the following items should be observed:

1. See that the starting contacts are in good condition and close evenly.
2. Make sure that the push collar of the centrifugal mechanism of the starting switch is in good condition.

3. If the ball bearings are in good condition, that is, if they run smoothly and are free from noise, no other attention will be necessary than to thoroughly clean them in a carbon tetrachloride cleaning solution or other non-corrosive solvent and apply a little grease.
4. The inside of the motor frame should be cleaned so that good ventilation will be assured and all oil should be wiped from the coils, as it has an injurious effect on the insulation.

Assembly and Adjustment

The following instructions cover the assembly and adjustment of ticker induction motors with the thrust spring assembled in the pinion end shield:

1. Assemble one ball bearing on the pinion end of the rotor shaft, with the enclosed face of the bearing facing towards the rotor. Before putting on the bearing, wipe the shaft clean and examine for burrs or corrosion. If necessary, dress down the shaft just enough to remove the inequalities of the surface and any burrs on the shaft shoulder, to insure proper seating of the bearing. Now wipe the shaft clean and apply a little oil to the part of the shaft that seats the bearing.
2. The bearing has what is known as a "light tap" fit. That is, the bearing fits on the shaft so that a series of light taps will drive it in place. The best tool is a bearing pusher or a piece of pipe or tubing, preferably of brass, which is just large enough to slip over the shaft and will bear on the inner ring. Never apply pressure of any kind to the outer ring, the balls or the retainer, as this is likely to injure the bearing. It is absolutely essential that the bearing be started straight and the blows be light. See that the bearing is solidly up against the shaft shoulder.

Assemble the centrifugal mechanism to the shaft, mounting it on a rotor by means of the two centrifugal mechanism mounting screws.

3. Place the push collar washer on the switch end of the rotor shaft in front of the push collar of the centrifugal mechanism.
4. Insert the rotor partly in the stator frame with the switch end partly out of the frame.
5. Place the starting switch on the shaft next to the push collar washer with the contact spring towards the rotor. If the starting switch has been disconnected from the stator leads, it should now be soldered. In soldering, the lead is threaded through the starting switch from the outside face and soldered on the opposite side, which will be the inner side facing the rotor.
6. Press one ball bearing in place on the switch end of the rotor shaft with the enclosed end of the bearing facing the rotor. (Follow instructions under "I".)

7. Assemble in the pinion end shield the following, in the order given: felt washer, cup washer, thrust spring, thrust spring washer.
8. Place a felt washer and the retainer washer in that order in the switch end shield.
9. Slide the switch end shield over the rotor shaft, inserting the ball bearing in the machined recess of the switch end shield, making sure bearing is fully seated.
10. Mount the starting switch, by means of the two switch mounting screws, in the switch end with the contact points on top. The switch end shield has two machined lugs on the inner side for mounting the starting switch.

The shield should have $1/16$ " travel on the rotor shaft when the starting switch is in place. To obtain the proper travel, it may be necessary to place spacing washers between the starting switch and the switch end shield. The washers are furnished in $1/64$ ", $1/32$ " and $3/64$ " thicknesses. The starting switch must be kept in perfect alignment and not tilted, that is, each side must have the same thickness of spacing washer.

11. Adjust the starting switch as follows: Hold the rotor to prevent it from moving and press the switch end shield away from the rotor and note that the contact points still close firmly. Hold the rotor as above and with the switch end shield pressed toward the rotor, the contacts should open after the weights of the centrifugal mechanism have moved equally, approximately $1/3$ of their travel outward. This contact adjustment should be checked and corrected by bending the contact spring just below the limiting strap when necessary. Care must be exercised in this adjustment in order to prevent sparking of the contacts.

The tension of the springs holding the weights should be 10 to 12 ounces. Remove one end of the spring from the post and hook a 32 ounce scale in the spring loop and pull the spring until the loop is opposite its post for this measurement.

12. Push the switch end shield in place up against the stator frame, taking care that the leads soldered to the starting switch are well back out of the way of revolving parts. Care should be used to see that the motor leads are not caught and pinched between the housing and end shield.
13. Slide the pinion end shield over the motor shaft and up against the stator frame.
14. Insert and tighten up the end shield clamp screws. Tighten the screws up evenly. Use the shorter screw in the pinion end shield.
15. Rotate the rotor shaft by hand to see that it turns freely.

16. Check the tension of the thrust spring by applying pressure parallel with the shaft, to the switch end of the rotor shaft. It should require at least 7 pounds pressure to just start the rotor moving.
17. Replace the motor pinion and fan or handwheel.

Lubrication: As new ball bearings and bearings to be reassembled on rotor shafts will have little or no grease on them, it is essential that a quantity of an approved grease be applied before placing the rotor with bearings into the motor frame. Apply a small amount of the grease supplied for use in motor bearings on the balls and races of each ball bearing.

In service these bearings should be oiled with heavy medium "DTE" oil, at intervals of twice a month.

A.C. SERIES MOTOR AND D.C. SHUNT MOTOR MAINTENANCE, ADJUSTMENTS & LUBRICATION (FIG. 30)

Description

The A.C. series and D.C. shunt motors may be recognized from the fact that they have brushes and commutators and are always used with governors. As these two types of motors are made in the same frame and are essentially the same mechanically, the maintenance requirements are identical.

The internal construction and assembly of these motors is shown in Figure 30.

Motor Take-Down

If it becomes necessary to take the motor apart, the following procedure should be observed:

1. Remove brushes.
2. Remove the four screws in each end shield which are used to hold the ball bearing retainers.
3. Remove the two clamping rod nuts on the end shield opposite the commutator and take off the end shield. If the end shield sticks, apply a screwdriver or similar tool to the slots on each side of the casting and pry it loose.
4. Pull out the armature, taking care not to mix the parts from each of the ball bearings.

Maintenance Routine

If the motor has been in service for some time, the following procedure should be followed:

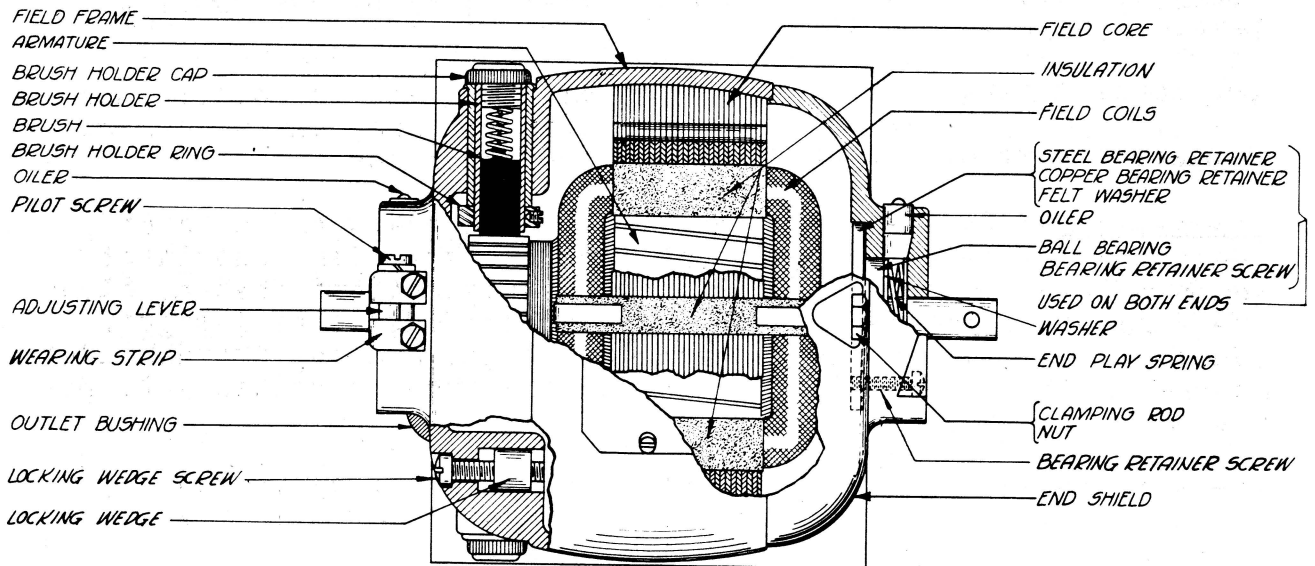


FIGURE 30

1. Examine Commutator:

If the commutator is pitted from sparking, smooth it up with a fine grade of sandpaper. (Do not use emery cloth.) Should the marks be too deep to be removed by this process, the armature should be sent to a shop where the commutator can be turned down on a lathe.

Note: If the commutator is smooth and reddish brown in color, no attention is necessary, as this is the correct appearance for good operation.

2. Brush Holders:

The brush holders should be cleaned so that the brushes may readily slip in and out.

3. Brushes:

The brushes should be examined for excessive wear, cracks and chipped-off portions. The brush should be so formed as to make contact with the commutator by at least half of its cross-sectional area. It should be noted that if the brushes are excessively worn, they may be more likely to spark, as the spring tension holding the brush is considerably reduced. In this case, they should be replaced. Before replacing the brushes, they should be wiped clean of any metallic dust or lubricant and checked for freeness in the brush holders.

4. Ball Bearings:

If the ball bearings are in good condition, that is, if they run smoothly and are free from noise, no other attention will be necessary than to thoroughly clean them in a carbon tetrachloride

cleaning solution or other non-corrosive solvent and apply a little grease.

When it is necessary to replace a ball bearing, the outer race and ball retainer may be easily removed by hand, but a bearing remover should be used to pull off the inner race.

The new inner race should be forced on the shaft by means of a bearing pusher or by a series of light blows. Care should be taken to see that the race is started straight and that no blows are struck directly on the race, as it may easily be damaged. Check to see that the bearing race is tight against the shoulder on the shaft. The new ball retainer can then be pushed into position on the bearing race.

The machined sections of the end shields should be thoroughly cleaned so that the outer ball bearing races may slip freely back and forth and thus align themselves.

5. Ball Bearing Retainers:

If the ball bearing retainers let the lubricant leak out, or are damaged so that dirt may get into the bearings, they should be replaced. It is necessary to remove the inner bearing races as described before in order to remove the bearing retainers.

6. Motor Frame:

The inside of the motor frame should be cleaned so that good ventilation will be assured and all oil should be wiped from the coils, as it has an injurious effect on the insulation.

Assembly

The motor may be re-assembled as follows:

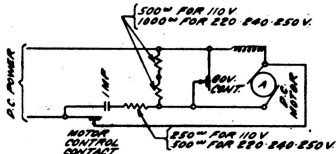
1. Check to see that felt and steel retainers and washers are in the proper places and in good condition.
2. Replace armature in frame, commutator end first, after arranging the steel and copper retainers so that the cut-away sections will come at the brush holders and thus give clearance at these points.
3. Replace the four screws that hold the bearing retainers to this end shield.
4. Replace the other end shield and tighten the two nuts, after checking to see that the end play spring and washer are in place and the end shield is on straight.
5. Replace the four screws which hold the retainers.
6. Check the armature for freeness and see that all end play is removed by the action of the thrust spring.

7. Replace brushes and see that they are properly seated on commutator.

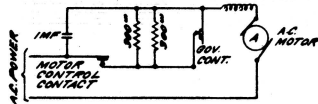
Lubrication

As the new ball bearings to be assembled on the armature shafts will have little or no grease on them, it is essential that a quantity of an approved grease be applied before replacing the armature in the motor frame. Apply a small amount of the grease supplied for use in motor bearings on the balls and ball races of each ball bearing.

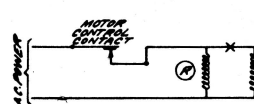
In service, these bearings should be oiled with heavy medium "DTE" oil at intervals of twice a month.



SCHEMATIC DIAGRAM OF D.C. MOTOR CIRCUIT.



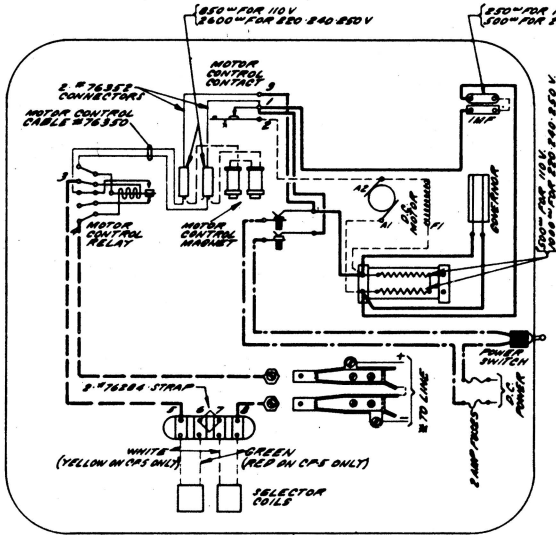
SCHEMATIC DIAGRAM OF A.C. SERIES MOTOR CIRCUIT



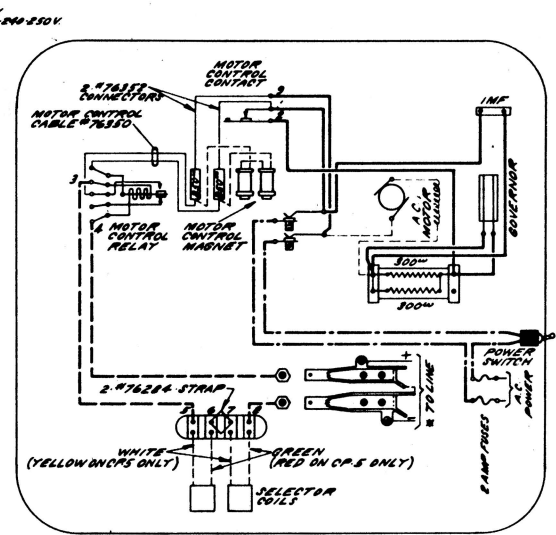
SCHEMATIC DIAGRAM OF INDUCTION MOTOR CIRCUIT.

ASSOCIATED CABLES	
#76386	D.C. MOTOR UNIT
#76266	A.C. SERIES MOTOR UNIT
#76265	SELECTOR UNIT
#76267	BASE
#76352	CONNECTOR
#76350	MOTOR CONTROL
#76284	STRAP

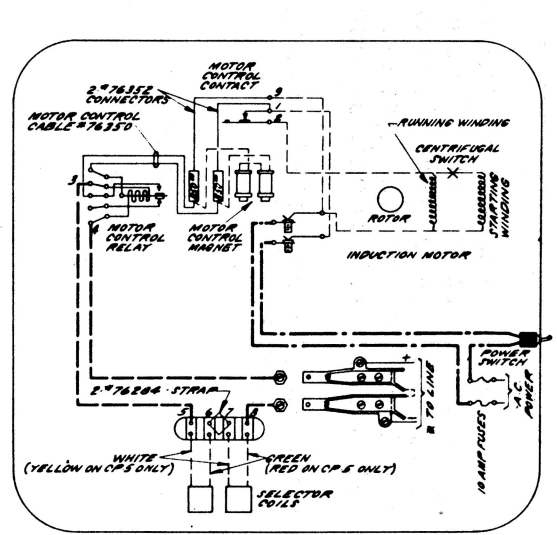
- REVISIONS**
- TWO WIRES FROM #767 INSTEAD OF ONE. A.E.
 - CHANGE LINE JACK. A.E.
 - ADDED MOTOR CONTROL MAGNETS. A.E.
 - MOTOR CONTROL CIRCUIT CHANGED. A.E.
 - D.C. MOTOR CIRCUIT CHANGED. A.E.
 - MOTOR CONTROL CIRCUIT CHANGED. A.E.
 - A.C. MOTOR CIRCUIT CHANGED. A.E.
 - D.C. MOTOR CIRCUIT CHANGED. A.E.
 - RETRACED #767. A.E.
 - 220 240 250 V. OPERATION ADDED. A.E.
 - ADDED #767. A.E.
 - REDRAWING & CABLE INFORMATION ADDED. A.E.
 - 12-131. A.L.P. & S.N.
 - REMOVED UNWOUND MOTOR CABLES. A.L.P. & V.R.N.



TICKER TELETYPE WITH D.C. MOTOR (TOP VIEW) FIG. 1.



TICKER TELETYPE WITH A.C. SERIES MOTOR (TOP VIEW) FIG. 2.



TICKER TELETYPE WITH INDUCTION MOTOR (TOP VIEW) FIG. 3.

NOTES:
 ALL WIRES TO BE BLACK DELTASTEON #18 ART JUNK COVERED FIXTURE, EXCEPT MOTOR LEADS.
 THIN LINES INDICATE WIRES NOT IN CABLE.
 WHEN CONTROL RELAY IS OMITTED SPICE AND TAPE WIRES #1 TO WIRE #2 AND WIRE #3 TO #4, ALSO TAPE END OF WIRE #3.
 TO CONNECT SELECTOR MAGNETS IN MULTIPLE: STRAP #5 TO #7 AND #6 TO #8.

NOTES CONT'D
 TO CONNECT SELECTOR MAGNETS IN SERIES: STRAP #8 TO #7.
 #8 BASES EQUIPPED WITH LINE CORDS & PLUGS MUST BE CONNECTED WITH TIP TO TERMINAL MARKED "-" AND SLEEVE TO TERMINAL MARKED "+".

TELETYPE CORPORATION
 967-M
 OCT 19 1954
 967-N

WIRING DIAGRAM
 CP-12,3,4,5,7,11,14
 CB-12,7

TICKER TELETYPE
 DR. A.L.P.
 TR. A.L.P.
 CHKD. A.E.
 ENGR'D. H.L.B., E.S.
 APPROVED: [Signature]

ADDITION TO BULLETINS

Bulletin 127, Issue 3, Type Bar Tape Printer (Model 14) , Page 36
Bulletin 137, Issue 2, Typewheel Tape Printer (Ticker), Page 29
Bulletin 138, Issue 5, Type Bar Page Printer (Model 15), Page 50
Bulletin 141, Issue 3, Transmitter, Page 18
Bulletin 147, Issue 2, Single Magnet Reperforator, Page 14
Bulletin 159, Issue 2, Typewheel Page Printer (Model 26), Page 36
Bulletin 160, Issue 1, Type Bar Printer (Model 20), Page 38
Bulletin 170, Issue 1, Multiple Transmitter Distributor and Base, Page 9
Bulletin 171, Issue 2, Typing Reperforator, Page 22
Bulletin 175, Issue 1, Single Unit Transmitter and Base, Page 8
Bulletin 176, Issue 1, Translator Unit, Receiving Distributor and Pane, Page 8
Bulletin 178, Issue 1, Reperforator Transmitter Distributor, Page 36
Bulletin 182, Issue 1, Multiplex, Start-Stop Extensor Set, Page 22
Bulletin 183, Issue 1, Portable Signal Distortion Test Set, Page 5
Bulletin 185, Issue 1, Multiple Transmitter Distributors and Base, Page 12
Bulletin 186, Issue 1, Two Channel Start-Stop Transmitter Distributor, Page 20
Bulletin 189, Issue 1 XD79 and XD95 Distributors, Page 15
Bulletin 192, Issue 1, Teletype Automatic Wheatstone Perforator Set, Page 19
Bulletin 193, Issue 1, Reperforator Transmitter Distributor (Model 14), Page 9
Bulletin 197, Issue 1, Multiple Reperforator Set, Page 25

Add the following adjustment immediately preceding the "SPEED
ADJUSTING WHEEL FRICTION WASHER SPRING TENSION ADJUSTMENT":

ADJUSTMENTS FOR ALIGNMENT AND SQUARENESS OF GOVERNOR CONTACTS

All governor contacts can be adjusted for alignment of edges; only those governor shells which provide elongated mounting holes for the fixed contact bracket permit adjustment of the contact for height by positioning the contact bracket.

The governor contacts should be in line and meet squarely so that maximum contact surface is provided. (Check with the retractile spring tension Adjusted so that the contacts just make, or the the limit of the adjusting screw).

- (a) Line up edges of contacts by means of the floating contact hinge mounting screw.
- (b) Adjust contacts for squareness from right to left by positioning the height of the fixed contact bracket using the elongated mounting holes in the governor shell.
- (c) To adjust from front to back, twist the floating contact hinge, applying pressure to the arm near the contact.

NOTE: Check by use of a .002" gauge (smaller if available). Check with gauge between edges of contacts to see that the gauge enters (or does not enter equally on all sides.

* * *

CHANGES IN BULLETINS

- 137, Issue 2, Type Wheel Tape Printer (Ticker), Page 29
- 147, Issue 2, Model 14 and 20 Nontyping Reperforator, Page 14
- 159, Issue 2, Model 26 Type Wheel Page Printer, Page 36
- 170, Issue 1, Single and Multiple Transmitter Distributor and Base, Page 9
- 175, Issue 1, Single Unit Transmitter and Base, Page 8
- 176, Issue 1, Translator Unit, Receiving Distributor and Panel, Page 8
- 183, Issue 1, Portable Signal Distortion Test Set (Code Disc Operated), Page 5

SPEED ADJUSTING WHEEL FRICTION WASHER SPRING TENSION ADJUSTMENT

Change the tension requirement for starting the adjusting wheel moving to read "16 to 24 ozs." instead of "16 to 20 ozs."

Bulletin 137 - Change the requirement to read "16 to 24 ozs." instead of "8 to 12 ozs."

Bulletin 147 - Change the requirement to read "16 to 24 ozs." instead of "8 to 16 ozs."

* * *

CHANGES IN LUBRICATION SPECIFICATIONS
WHICH APPLY TO ALL TELETYPE APPARATUS

The following lubricants have been standardized for use on all types of Teletype apparatus. These lubricants supersede those referred to in preceding Teletype specifications. The lubricants can be ordered from Teletype as follows:

88970	1 Qt. of KS-7470 Oil
88971	1 Gal. of KS-7470 Oil
88973	1 Lb. of KS-7471 Grease
*88975	KS-8319 Grease Gun
97116	4-oz. Tube of KS-7471 Grease

The above grease is recommended instead of oil for lubricating motors equipped with ball bearings. The 88975 grease gun should be used for injecting grease into the bearings of Teletype ball bearing motors. The gun may be used also for applying grease to other parts of the apparatus and no other grease container need be carried. If this grease gun is not available, the oil listed in the foregoing should be substituted for lubricating ball bearing motors.

* Instructions for Filling the Grease Gun

1. Unscrew the lubricant tube from the cap casting of the grease gun.
2. Insert fresh lubricant through the open end of the tube with the fingers. Apply gradually to eliminate air pockets.
3. Tamp the lubricant down solidly in the tube by pounding the closed end solidly against the palm of the hand. Continue to add lubricant until the tube is completely filled and the metal follower rests against the perforated tube cover.
4. Fill the cap casting with lubricant flush to the bottom side of the tube threads.
5. Screw the lubricant tube into the cap casting part way only. Then insert a pencil or rod through the perforated tube cover and exert pressure against the metal follower so as to expel any entrapped air past the tube threads. When lubricant begins to ooze through the threads, tighten the lubricant tube securely in the cap casting.
6. Operate the handle back and forth for several strokes or until lubricant is pumped from the nozzle. The gun is then ready for use. If the lubricant does not flow from the nozzle in a solid stream, it is an indication that all air has not been expelled from the lubricant tube. Invert the gun and pound the cap casting end against the palm of the hand to jar the lubricant into the pump cylinder.

*Instructions for Lubricating Motor Ball Bearings

The motor bearings are packed with grease before the motor leaves the factory and under ordinary operating conditions need no additional lubrication for

approximately two months. At the regular lubricating intervals one or two strokes of the plunger of the gun should apply sufficient grease to each bearing. To lubricate, press the nozzle of the gun against the ball oiler and force the grease into the hole by pushing on the plunger of the gun. Care should be taken that the bearings are not overloaded. Overloading will result in the grease oozing out of the end castings and being forced into the motor or being thrown on other parts of the mechanism. After lubricating, the motor should be run for a few minutes and then any excess grease that has been forced out of the ends of the castings should be wiped off. Each time that the gun is used for lubricating a motor bearing, the plunger should first be depressed slightly to make sure that grease will be delivered.

ADJUSTMENTS OF TICKER SELECTOR MAGNET UNIT
WITH "T" SHAPED ARMATURE

To be used in conjunction with Bulletin 137 -
Description and Adjustments of the
Typewheel Tape Printer (Ticker).

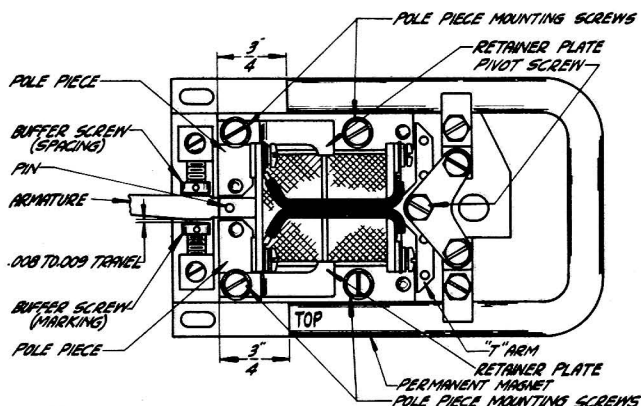
Page 12.

Cancel: SELECTOR ARMATURE PIVOT SCREWS ADJUSTMENT.
SELECTOR ARMATURE POLE PIECES AND BUFFER SCREWS ADJUSTMENT, FIG. 7.

and substitute the following:

SELECTOR ARMATURE PIVOT SCREWS ADJUSTMENT:-Remove permanent magnet and back off armature buffer screws. Adjust the "up" and "down" position of the armature, by means of its pivot screws, so that the top surface of the armature is flush with the top surfaces of the right ends of the pole pieces, and so that the armature is free, without end play. Replace permanent magnet so that the mark "TOP" is uppermost.

PERMANENT MAGNET ADJUSTMENT:-Adjust the position of the permanent magnet so that the ends of the magnet are approximately $\frac{3}{4}$ " from the left ends of the pole pieces (See figure).



POLE PIECES ADJUSTMENT:-Loosen pole piece mounting screws. Move one pole piece as far toward the buffer screws as possible, holding it against the permanent magnet, and tighten the mounting screws just enough to hold the pole piece in this position. Hold the armature against this pole piece at the left end and adjust the other pole piece so that it just touches the "T" arm of the armature. Make sure that this pole piece is against the permanent magnet and tighten the mounting screws. Now hold the left end of the armature against this pole piece and adjust the other pole piece so that it just touches the "T" arm of the armature. Make sure that this pole piece is against the permanent magnet and tighten the mounting screws.

Note:-When tightening the left hand pole piece mounting screws hold the selector coil retainer plates so that the selector coils are held securely between the retainers.

BUFFER SCREWS ADJUSTMENT:- (A) Insert a .020" gauge between the left end of one pole piece and the armature. Hold the armature against the gauge and adjust the buffer screws so that there is from .004" to .005" space between each buffer screw and the side of the armature. Remove the .020" gauge. (B) Place the selector armature on the spacing side, hook an 8 oz. scale over the pin on the armature and pull at right angles toward the front of the printer. Observe the tension required to pull the armature to the marking side. Now hook the scale over the pin and pull at right angles toward the rear of the printer. Observe the tension required to pull the armature to the spacing side. If the two tensions are not within one ounce of being equal, refine the buffer screws adjustment. This adjustment should be made so that the armature will have from .008" to .009" travel between the buffer

(over)

screws (See figure).

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MAGNET BASE POSITION, FIG. 8 - change to read: "from .003" to .005" instead of "from .002" to .004".

Insert after MAGNET BASE POSITION, FIG. 8.

After tightening base mounting screws recheck BUFFER SCREWS ADJUSTMENT, item (B). If it is necessary to change the adjustment of the buffer screws recheck MAGNET BASE POSITION.

ADJUSTMENTS OF FIVE UNIT TICKER SHIFT MECHANISM

To be used in Conjunction with Bulletin #137 -
Description & Adjustments of Typewheel Tape Ptr. (Ticker)

For tickers equipped with the five unit shift mechanism add the following adjustments after flutter cam oiler adjustment on page 23, Bulletin 137.

1-Remove cover guide. Place the code discs in the spacing position. Loosen the shift pawl lever arm mounting screws and the shift bracket mounting stud and screw. Adjust the shift bracket so that there is from .070" to .080" space between the shift pawl lever roller and the lower shift pawl when the roller is against the upper shift pawl (near the upper end). Tighten the shift bracket mounting stud and screw and recheck the above adjustment.

2-Remove both shift pawl springs and check pawls for freeness. Replace springs.

3-Check to see that the shift pawl lever roller turns freely and that the pin is bent so as to be safe from falling out.

4-Check to see that the shift pawl lever is free and has not more than .006" end play.

5-Adjust the shift pawl lever arm so that the pin on the shift pawl lever does not bind in the selector lever when in either the marking or the spacing position and so that the travel of the shift pawl lever roller is centered between the upper and lower shift pawls. Tighten the shift pawl lever arm mounting screws and recheck the above adjustment.

6-Check to see that when the #6 selector lever is in the marking position there is a clearance of from .002" to .006" between the shift pawl lever roller and the lower shift pawl when the play of the shift pawl lever and roller is taken up in a direction to make this clearance a maximum. Make the same check between the shift pawl lever roller and the upper shift pawl with the #6 selector lever in the spacing position. If necessary readjust the shift pawl lever arm or the shift bracket to obtain the above clearances. If it is necessary to readjust either arm or bracket recheck adjustment #5.

7-Check to see that both upper and lower shift pawls are safely on their stop pin rollers and that they clear the front guide disc.

8-Place the code discs in the marking position and #6 selector lever in the spacing position and check to see that there is not more than .015" clearance between the shift pawl lever roller and the lower shift pawl when all the play of the shift pawl lever and roller is taken up in a direction to make this clearance a maximum.

Make the same check between the shift pawl lever roller and the upper shift pawl when #1, #2, #4 and #5 code discs and #6 selector lever are in the marking position and #3 code disc is in the spacing position.

9-Place the code discs in the spacing position and check to see that the center of the shift pawl lever roller is at least .010" below a line connecting the upper ends of the shift pawls.

10-UPPER AND LOWER SHIFT PAWL SPRING TENSION:- With the code discs in the spacing position hook a 32 oz. scale over each pawl at the end of the pawl and pull at right angles to the pawl. It should require from 10 1/2 to 14 ozs. to just start each pawl moving.

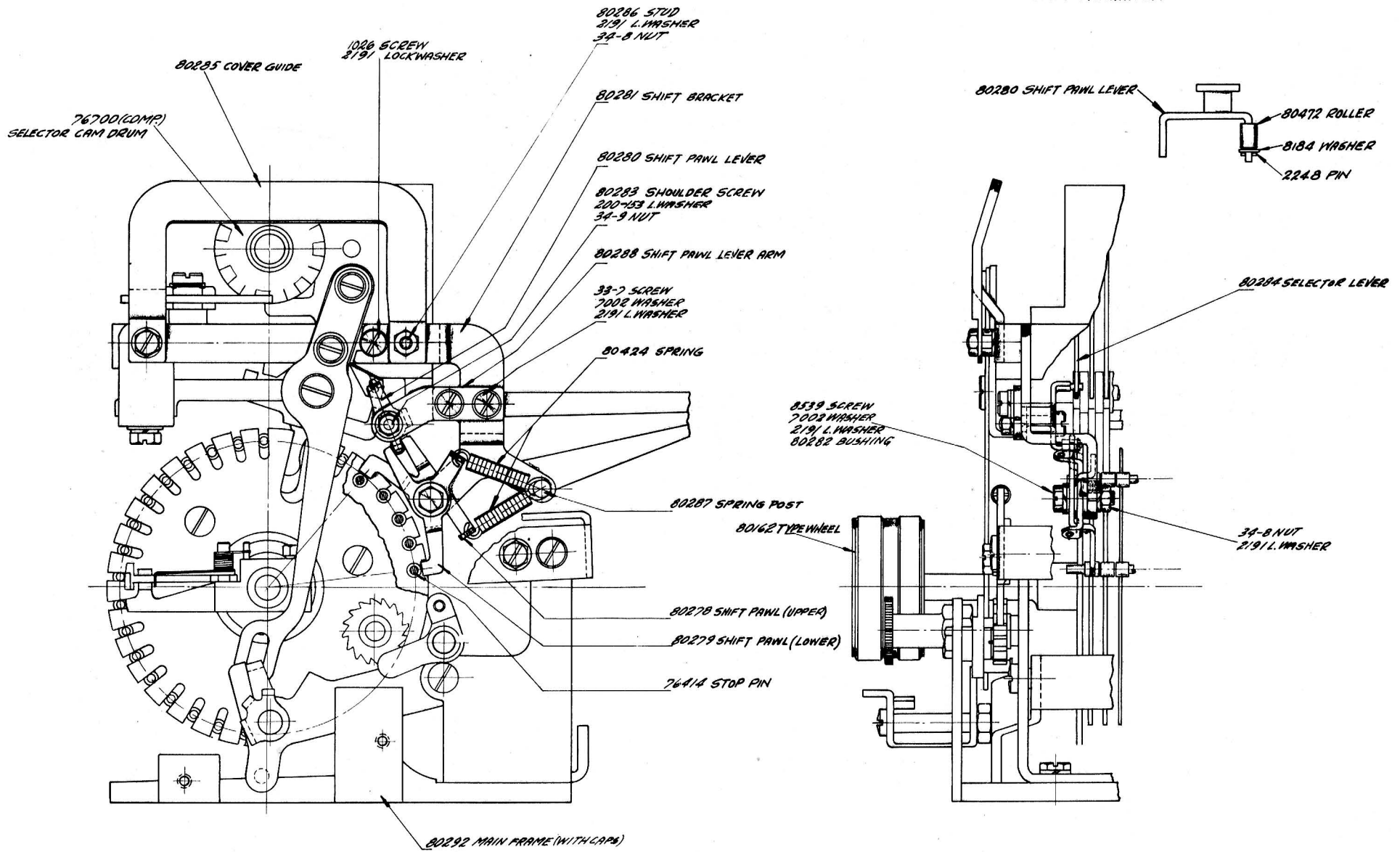
11-Replace cover guide.

LUBRICATION:

In addition to the parts listed on page 8, Bulletin 137, the following parts of the new shift mechanism should be lubricated in the same manner:

- | | | | |
|-----|--------------------------|-----|----------------------|
| (1) | Shift pawl lever roller | (3) | Shift pawl lever pin |
| (2) | Shift pawl lever bearing | (4) | Shift pawl bearing |

(over)



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PARTS NOT LISTED HERE ARE THE SAME AS SHOWN ON PAGE #1 & 2 BULLETIN 1036

