

**BELL SYSTEM PRACTICES**  
**Teletypewriter and Data Stations**

**SECTION P35.651**  
**Issue 7, April, 1959**  
**AT&TCo Standard**

## **14 TYPING REPERFORATOR**

### **REQUIREMENTS AND PROCEDURES**

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## **1. GENERAL**

1.01 This section contains the apparatus requirements and adjusting procedures for the maintenance of 14-type typing reperforators.

1.02 This section is reissued to:

- (a) Revise adjustments for clutch spring, punch bail, feed pawl eccentric, tape-tension-lever spring, and mainbail cam friction-clutch torque.
  - (b) Add a reference to the use of the punch-block cleaning tool.
  - (c) Revise the instructions for removing the type basket
- Changes are indicated by marginal arrows.

1.03 **To remove cover**, raise lid, shift platen to rear (LTRS) position and grasp lid at each side close to hinge using both hands. Lift vertically upward taking care to avoid snagging the platen push rod. In replacing cover, make sure that the platen is in the LTRS position and then lower the cover vertically and carefully into place grasping it as aforementioned.

1.04 **To remove reperforator unit**, remove the two thumb-screws, grasp the rear motor-gear-guard handle and the left-side handle, lift rear of base plate to clear left-rear positioning stud, and rotate the unit counterclockwise about its right-front stud until the handle on the right side becomes accessible. Then move the right hand to this handle and raise the unit straight upward. To replace the unit reverse this procedure.

## 2. CLEANING

2.01 Typing reperforators should be cleaned in accordance with Section P30.010, covering cleaning teletypewriter apparatus.

## 3. LUBRICATION

3.01 Typing reperforators should be lubricated in accordance with Section P35.604.

## 4. REQUIREMENTS AND PROCEDURES

4.01 **Selector cams** should line up with their respective selector levers. Gauge by eye while selector cam sleeve is rotated through at least one complete revolution.

- (a) To adjust, loosen the upper and lower main-shaft bearing-cap mounting screws and raise or lower the shaft. Tighten the upper-bearing-cap mounting screws and position the bearing retainer on the lower bearing cap so that the bridge of the retainer rests against the upper face of the ball bearing, and clears the lower bearing cap. Tighten the lower-bearing-cap mounting screws.

#### 4.02 Clutch-throwout Lever:

- (a) Main-shaft clutch teeth should clear each other by Min .010", Max .020" as in Fig. 1, when clutch is fully cammed out of engagement.
- (b) Clutch-throwout lever should be free in its bearings with some endplay, not more than 0.002".
  - (1) To adjust, position clutch-throwout-lever pivot screws.

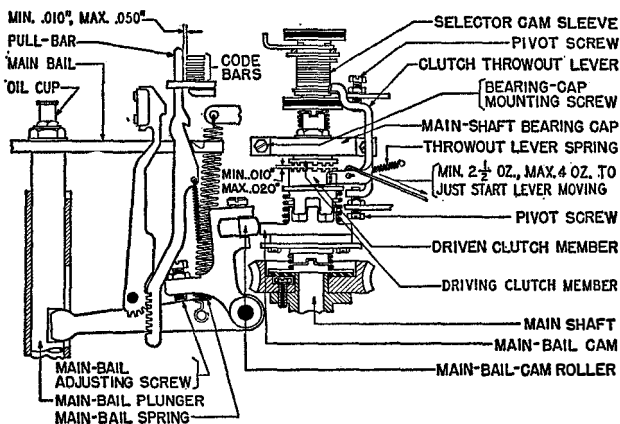


Fig. 1

#### 4.03 Clutch-throwout-lever spring should have a tension of

Min 2-1/2 oz, Max 4 oz, measured at right angles to the throwout lever as in Fig. 1 but, unlike Fig. 1, with the clutch teeth fully engaged and the clutch-throwout lever resting against the low part of the driven-clutch member. **Fig. 1**

**4.04 Clutch Spring:** It should require the pull shown to just separate the clutch teeth when tips of teeth are resting against each other as in Fig. 2. **Fig. 2**

Note: The 75-wpm spring, which has the higher spring compression, can be identified by an end turn that is painted yellow.

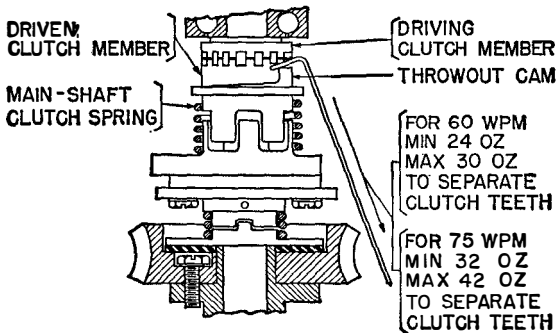


Fig. 2

4.05 **Clutch driven member**, after being pulled manually to position of extreme disengagement, should start and slide until it engages with or touches the driving member teeth when the clutch spring is opposed by a force of not less than 10 ounces.

- (a) To gauge, pull driven member to fully-disengaged position with 30-ounce tension, gradually reduce tension and permit driven member to slide until it touches driving member. The gauge reading should not go below 10 ounces.
- (b) To adjust, clean and lubricate clutch. If sliding surfaces of driven member and bushing on which it slides are not smooth and polished, replace these parts or return unit to shop for replacement.

Note: Failure to receive first character after a period of idleness may be caused by sticking of main-shaft clutch parts. If trouble of this nature is reported it may be checked by observing typing of first character received after main shaft has been at rest for at least 10 minutes, power disconnected.

4.06 **Motor Position and Gear Mesh:** Motors and governors should meet the requirements of Section P32.004 covering teletypewriter motor units and the adjustment of governor contacts. With regard to the position of the motor the requirements are as follows:

- (a) With the motor-base-plate eccentric stop approximately in the center of its adjustment and the base plate resting against the stop, a horizontal center line through the

main-shaft gear should coincide approximately with a horizontal line through the center of the pinion.

(1) To adjust, add or remove shims between the motor feet and the base plate using the same number of shims under each motor foot. Shims not used should be retained beneath their respective mounting-screw lockwashers to prevent the screws from protruding beneath the base plate.

(b) Motor pinion and main-shaft gear should engage with minimum backlash and without bind throughout a complete revolution of the main shaft. Gauge by eye and feel.

(1) To adjust, position motor on mounting plate, obtaining location for minimum gear noise.

(c) **Ribbon-feed lever** should clear the motor when the mainbail is in its uppermost position and motor and motor plate are in their normal operating position. Gauge by eye.

#### 4.07 Motor Speed:

<u>Operations per Minute</u>	<u>Words per Minute</u>	<u>Code No. of Target</u>	<u>Black Spots on Target</u>	<u>Free Speed of Receiving Shaft in RPM</u>
AC or DC Governed Motors				
368.0	61.3	1G	10	420.6
460.0	76.7	1G	10	525.7
60 Cycle AC Synchronous Motors				
367.5	61.2	—	—	420.0
459.4	76.6	—	—	525.0

Note: Word speed is based on six operations (five characters and one space) per word. Nominal speeds of 368 and 460 operations per minute are commonly known as 60 and 75 speed, respectively.

(1) Check and adjust speed of governed motors as outlined in Section P30.020 covering speed regulation of teletypewriter apparatus.

Note: If speed is variable, refer to Section P32.004 covering adjustment of governor contacts.

4.08 **Tape-feedout lever** (on the range finder) should be free to pivot with a minimum amount of endplay.

- (a) To adjust, position the tape-feedout-lever adjusting collar.

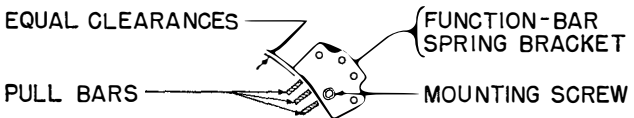
**Note:** For adjustments 4.09 and 4.10 the type basket should be removed to make the parts accessible. To do this proceed as follows: Unhook springs associated with codebar locking lever, LTRS pullbar, space pullbar, punch-bail rocker arm, and bell hammer. Remove the three type-basket-assembly mounting screws. Remove the front mounting screw of the right ribbon-spool bracket, loosen rear mounting screw, and swing the bracket so that ribbon-spool cup will not interfere with the type-basket assembly. Remove the vertical-lever-bracket mounting screws and remove the vertical-lever assembly. Then, using a piece of string or wire, tie the pullbars out of engagement with their guide and slide the type-basket assembly upward and out of the unit.

4.09 **Function-bar Spring Brackets:** Pullbars supported by function-bar spring brackets should be free, without bind, and should have approximately equal clearance between the corresponding edges of the function-bar spring brackets.

**Fig. 3**

**Note:** This need be checked only when spring brackets are moved.

- (a) To adjust, position function-bar spring brackets.



**Fig. 3**



4.10 **Character-pullbar spring** tension should be Min 3 oz, Max 4 oz, and **FIGS-pullbar spring** tension should be Min 5-1/2 oz, Max 6-3/4 oz. See Fig. 4.

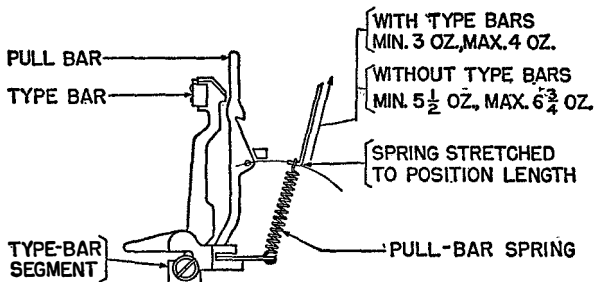


Fig. 4

Note 1: See 4.31 and 4.32 for function-pullbar operating requirements.

**Note 2: Replace type basket, reversing procedure described for its removal.**

4.11 **Mainbail** of units equipped with roller guides should not bind at any point throughout its travel.

(a) To check, rotate main shaft until the mainbail is in its highest position. Swing motor out of the way and remove ribbon-feed-lever spring and mainbail spring allowing bail to drop. Block all pullbars out of the path of the mainbail. (A convenient way to do this is to place a length of rosin-core wire solder between the pullbars and codebars.) Then with a finger under the mainbail lever raise the mainbail slowly to its highest position and release. There should be no evidence of bind on the upward travel and the bail should fall freely of its own weight to its lowest position when released.

(b) To adjust, restore spring and so position the pullbar guide that its mounting screws are in the middle of the elongated slots, then loosen the mounting screw of both mainbail-roller guides.

(1) With the blank combination set up and the mainbail opposite the unselected pullbar humps as in Fig. 5, shift the right roller guide to obtain the same clearance between the mainbail and the LTRS and FIGS pullbar humps. Tighten the right-roller-guide top mounting screw friction-tight.

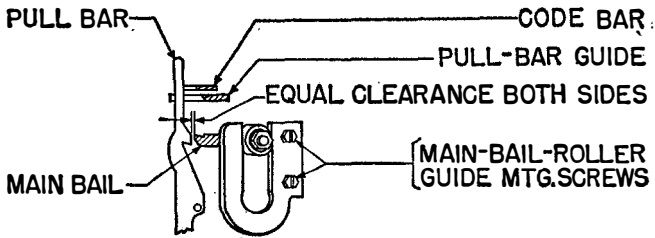


Fig. 5

(2) With the mainbail in its lowest position as in Fig. 6, adjust the mainbail adjusting screw to give some clearance between pullbars and codebars. Shift the right roller guide around its friction-tight top mounting screw to obtain approximately the same clearance between the codebars and LTRS and FIGS pullbars. Tighten the right-roller-guide bottom mounting screw friction-tight and recheck (1). Then fully tighten both right-roller-guide mounting screws after making any necessary readjustments. Position left roller guide so that check conditions outlined in (a) are met and then tighten both of its mounting screws.

Fig. 5

Note: When this adjustment is made check 4.12, 4.13, and 4.40.

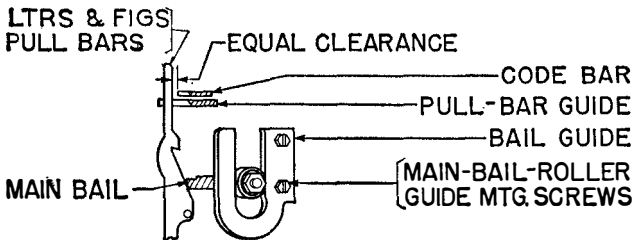


Fig. 6

#### 4.12 Pullbar Guide:

- (a) Oil cup on the top of the mainbail plunger should clear the pullbar guide.
- (b) Mainbail should clear the projections on unselected **pullbars** by Min 0.008", Max 0.020" when "Blank" and LTRS combinations are set up in turn and mainbail play is taken up to make this clearance a minimum.

(c) No. 1 (top) "T" lever should clear the bottom of the notch in the No. 1 codebar by Min 0.004", Max 0.080" at the point of minimum clearance. All other "T" levers should have some clearance at the bottom of the notches in their associated codebars at the point of minimum clearance.

Fig. 7

(1) To adjust, position pullbar guide.

Note 1: If requirements cannot be met it may be necessary to readjust mainbail-roller guides per 4.11 (b).

Note 2: If adjustment is made check 4.13, 4.39, and 4.40.

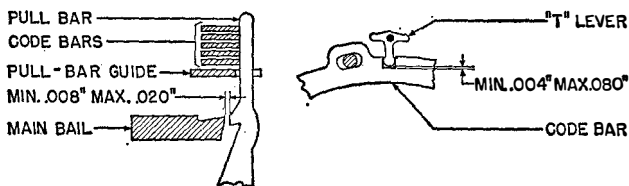


Fig. 7

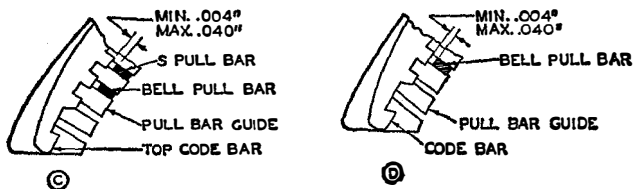
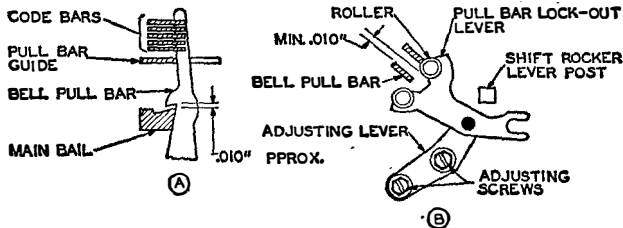


Fig. 8

4.13 Pullbar-lockout lever should meet the following requirements.

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- (a) With the platen in the FIGS position, select the Blank combination and rotate the main shaft until the main-bail is in its uppermost position. Adjust the pullbar lock-out lever so that the S pullbar clears the codebars by Min 0.004", Max 0.040". With the platen in the LTRS position there should be Min 0.004", Max 0.040" between the **Bell** pullbar and the codebars. Reposition the pullbar-lockout lever if necessary. **Fig. 8(C) and 8(D)**

Note: Substitute **J** for **S** on units arranged to ring the bell on upper-case **J** instead of **S**.

- (b) With the platen in the FIGS position select the **Bell** combination and rotate the main shaft until the main-bail is moved to within approximately 0.010" from the **Bell** pullbar notch. There should be at least 0.010" clearance between the **Bell** pullbar and the lockout-lever roller with the play of the platen shaft, shift rocker, and lockout lever taken up in a direction to make this clearance a minimum. **Fig. 8(A) and 8(B)**

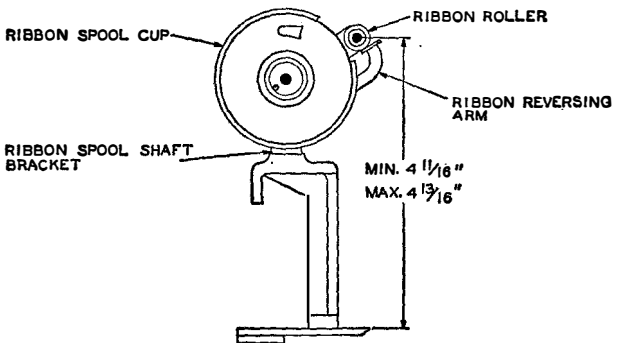
Gauge by eye.

Note: As an increase in pullbar clearance also increases the load on the platen-shift spring, the platen-shift mechanism should be checked (manually) for correct operation.

#### 4.14 Ribbon-spool Cups:

- (a) Center of left ribbon-spool-cup roller should be Min 4-11/16", Max 4-13/16", from the base plate.
- (b) Center of right ribbon-spool-cup roller should be Min 2-3/16", Max 2-5/16" from the top surface of the tape guide. **Fig. 9**

(1) To adjust, position ribbon-spool cups.

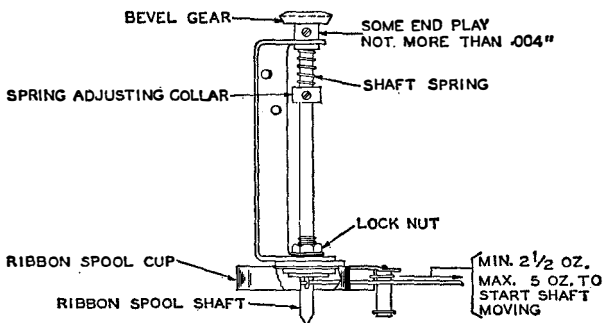


**Fig. 9**

4.15 **Ribbon-spool shafts** should have perceptible endplay, but not more than 0.004". **Fig. 10**

(a) To adjust, position ribbon-spool-shaft gears.

Note: If the unit is equipped with an end-of-line indicator mechanism the required endplay in the right-hand ribbon-spool shaft should be obtained by positioning the rear collar on the right-hand ribbon-spool shaft.



**Fig. 10**

4.16 **Ribbon-spool brackets** should be parallel with the edges of the base plate and there should be a minimum amount of backlash between the bevel gears on the ribbon-feed shaft throughout a complete revolution of the ribbon-spool shafts when the ribbon-feed shaft is in its extreme left and right positions, respectively.

(a) To adjust, position the ribbon-spool brackets.

Note: If unit is equipped with an end-of-line indicator mechanism the right brackets should be so positioned that the front edge of its ribbon-spool cup is approximately in line with the front edge of the left ribbon-spool cup and the gear backlash obtained by positioning the gear on right ribbon-spool shaft.

4.17 **Ribbon-spool-shaft Springs:** The resistance to turning caused by the ribbon-spool-shaft springs should be Min 2-1/2 oz, Max 5 oz, measured as in Fig. 10 by pulling on the pin with ribbon-feed shaft disengaged from ribbon-spool shaft.

**Fig. 10**

(a) To adjust, move spring collar longitudinally on shaft.

**4.18 Ribbon-reverse Arm:**

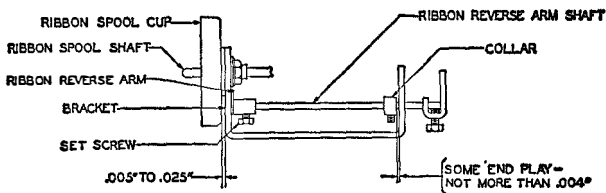
(a) Left ribbon-reverse-arm shaft should clear the ribbon-spool cup by Min 0.005", Max 0.025" when the reverse arm is held against the ribbon-spool bracket to make this clearance a minimum. **Fig. 11**

(b) The rear of the right ribbon-reverse-arm ribbon slot should be in line with or slightly behind the rear flange of the roller on the spool cup.

(1) To adjust, position reverse arm.

**4.19 Left ribbon-reverse-arm shaft** should have some end-play, not to exceed 0.004". **Fig. 11**

(a) To adjust, position shaft collar.



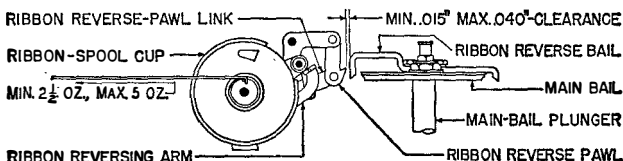
**Fig. 11**

**4.20 Right ribbon-reverse-arm shaft** should clear the ribbon-spool cup by not more than 0.004" when its collar is held against the ribbon-spool bracket to make the clearance a maximum.

(a) To adjust, position shaft collar.

**4.21 Ribbon-reverse pawls** should clear the ribbon-reverse bail by Min 0.015", Max 0.040" when the reverse arm is against the spool cup and the bail is opposite the pawl. **Fig. 12**

(1) To adjust, position reverse arm.



**Fig. 12**

4.22 **Ribbon-reverse-pawl links** should not bind on their shoulder screws.

(a) To adjust, reposition levers on rear ends of shafts and recheck 4.18 and 4.21.

4.23 **Ribbon spools** should be sufficiently tight on their shafts so that they will not slide off in service.

(a) To adjust, spread slot in end of shaft.

4.24 **Ribbon-feed-shaft tension springs** should exert a pressure of Min 3 lb, Max 5 lb, measured on the ribbon-reverse pawls as in Fig. 13 when the feed shaft is held in engagement with the opposite spool-shaft gear and the main-bail is in its uppermost position.

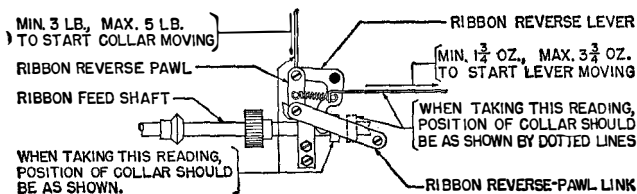


Fig. 13

4.25 **Ribbon-feed-shaft detent-plunger spring** should so press the plunger against the detent that it requires a force of Min 1-1/2 lb, Max 3-1/2 lb to push the detent over the plunger as in Fig. 14 when the ribbon-feed and check pawls are held clear of the bracket.

Fig. 14

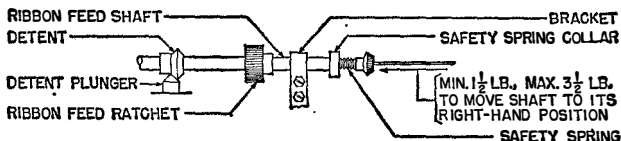
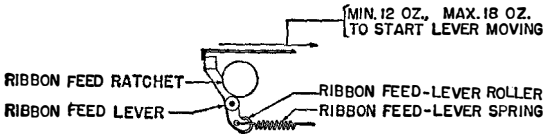


Fig. 14

4.26 **Ribbon-feed-lever spring tension** should be Min 12 oz, Max 18 oz measured as in Fig. 15 after removing ribbon-feed-pawl spring and placing feed-lever roller in plunger indent. **Fig. 15**



**Fig. 15**

4.27 **Ribbon-check pawl (top end)** should clear the pullbar guide by Min  $3/64$ ", Max  $5/64$ ", gauged by eye.

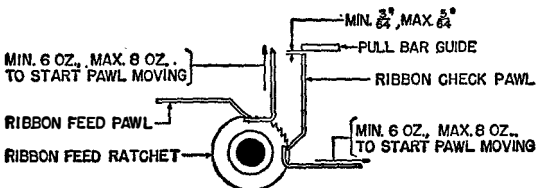
(a) To adjust, position check pawl. **Fig. 16**

4.28 **Ribbon-feed-pawl and ribbon-check-pawl spring tension** should be Min 6 oz, Max 8 oz.

(a) To gauge, with the ribbon-feed shaft pushed to the right, and the main shaft in its stop position, hook the scale over the extreme lower end of the pawl and pull at right angles to the pawl, as in Fig. 16. A pull of 6 to 8 oz should just start the pawl moving away from the ratchet. Make sure that the pawl does not bind against a tooth on the ratchet when tension is being measured. **Fig. 16**

(b) To adjust, bend the pawl.

Note: Pull R typebar down to platen in gaining access to check pawl.



**Fig. 16**



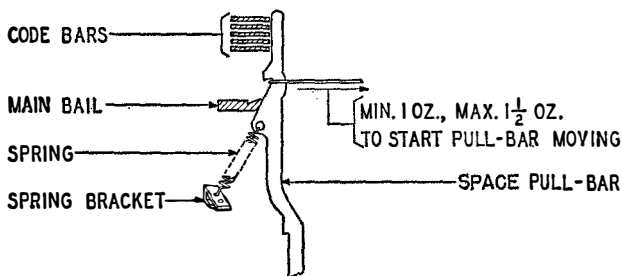
4.29 **Ribbon-feed pawl** should move its ratchet one or two teeth at a time.

(a) To adjust, position feed pawl.

4.30 **Ribbon-reverse-pawl spring** tension should be Min 1-3/4 oz, Max 3-3/4 oz measured as in Fig. 13 with ribbon-feed-shaft collar moved away from ribbon-reverse lever as shown dotted. **Fig. 13**

4.31 **LTRS- and space-pullbar spring** tension should be Min 1 oz, Max 1-1/2 oz, when measured as in Fig. 17 with the mainbail in its lowest position. **Fig. 17**

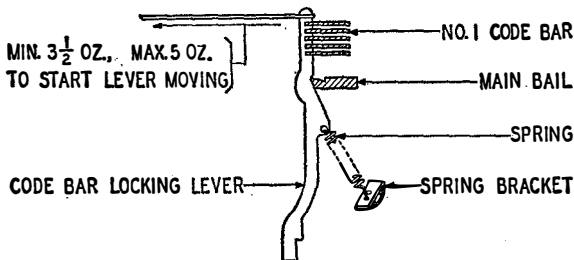
(a) To adjust, position left function-pullbar spring bracket.



**Fig. 17**

4.32 **Codebar-locklever spring** tension should be Min 3-1/2 oz, Max 5 oz, when measured as in Fig. 18 with the mainbail in its highest position and the codebar bellcranks held away from the codebar-locking lever. **Fig. 18**

(a) To adjust, position right function-pullbar spring bracket.



**Fig. 18**

4.33 **Punch arm** should be centrally located in its bracket and have endplay, not to exceed 0.005". **Fig. 19**

- (a) To adjust endplay, position front pilot screw; to adjust location, position both pilot screws.

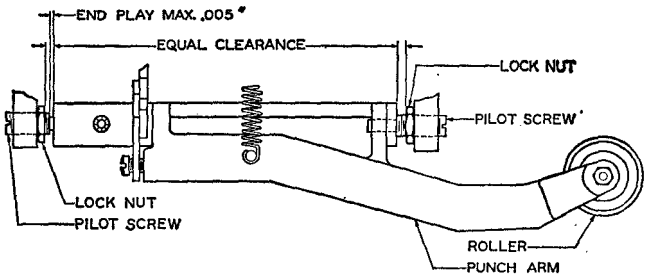


Fig. 19

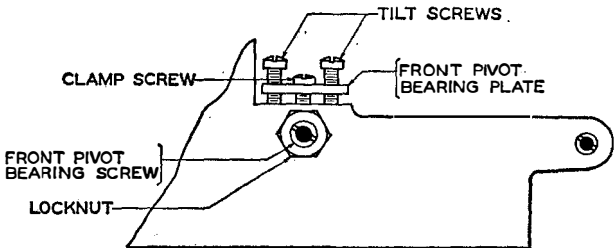


Fig. 20

Note 1: Punch arm is located when assembled and it is seldom necessary to relocate it.

Note 2: New units have a hole in the main-shaft bracket for access to the rear pivot screw; however, older units may not have this hole and in these cases it will be necessary to remove the main bracket from the base plate to adjust rear pivot screw.

#### 4.34 Punch Bail:

- (a) The rear edge of the No. 1 (rear) **selector finger** and the front edge of the No. 5 (front) selector finger should be within the outer edges of their respective **punch pins** when LTRS combination is set up and the main shaft is rotated until the selector fingers just touch the pins. **Fig. 21**
- (b) There should be some clearance, not more than 0.003",<sup>↑</sup> between the No. 1 (rear) selector finger and its punch when the No. 5 (front) selector finger just touches its associated punch. **Fig. 21,**<sup>↓</sup>
- (c) Punch bail should have some endplay, not to exceed 0.005" as gauged by eye.
  - (1) To adjust, loosen front-pivot bearing-screw locknut. Then, to meet requirement:
    - (a) Keep clamp screw fixed and rotate front-pivot bearing plate by means of the tilt screws.
    - (b) Loosen clamp screw and raise or lower front bearing plate as required by turning each tilt screw an equal amount in the direction required.
    - (c) Position front-pivot bearing screw. **Fig. 20**

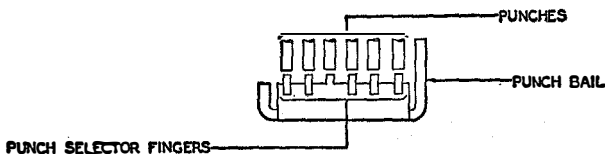


Fig. 21

4.35 **Feed roll** should rotate freely and have endplay not to exceed 0.004", when its detent, feed pawl, and tape-tension lever are held clear of the roll. **Fig. 22**

- (a) To eliminate bind, position rear bearing bracket; to adjust endplay, position bearing bushing.

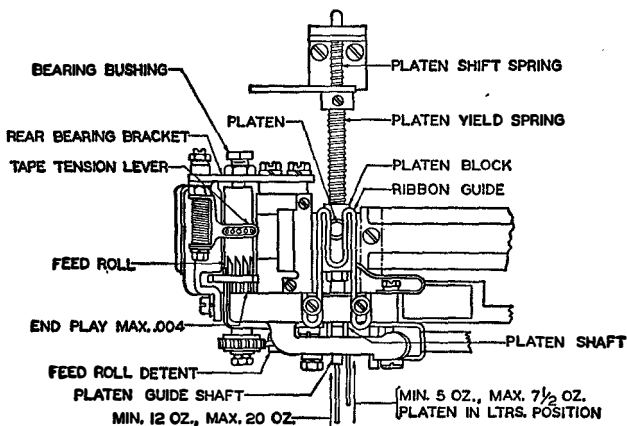


Fig. 22

4.36 **Tape-tension lever** should be centrally located with respect to the feed-roll pins. This requirement should be measured as follows:

(a) Take up the feed-roll endplay towards the star wheel, and the tension-lever endplay towards its adjusting nut. The edge of the lever slot may touch the feed-roll pins on the side of the pins nearest the ratchet but there must be clearance on the opposite side.

(b) Take up the feed-roll endplay away from the star wheel, and the tension-lever endplay away from the lever-adjusting nut. The edge of the lever slot may touch the feed-roll pins on the side of the pins farthest away from the ratchet but there must be clearance on the opposite side.

Fig. 23

(1) To adjust, add or remove shims between the shoulder on the tape-tension-lever stud and its mounting bracket.

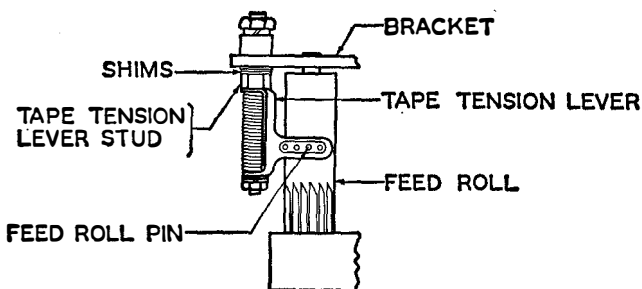


Fig. 23

4.37 **Feed-roll Detent:** (Preliminary Adjustment) (Final 4.46) Centers of feed punch and feed-roll pin should be approximately 0.6" apart when the punch bail is in its operated position. **Fig. 24, 28**

(a) To adjust, position feed roll by means of its detent eccentric so that the feed pin centers in the middle hole of the TP73517 feed-wheel-position gauge when the latter is inserted in the punch block with its projection against the feed punch.

Note: Center of eccentric head should be to the left of the screw body.

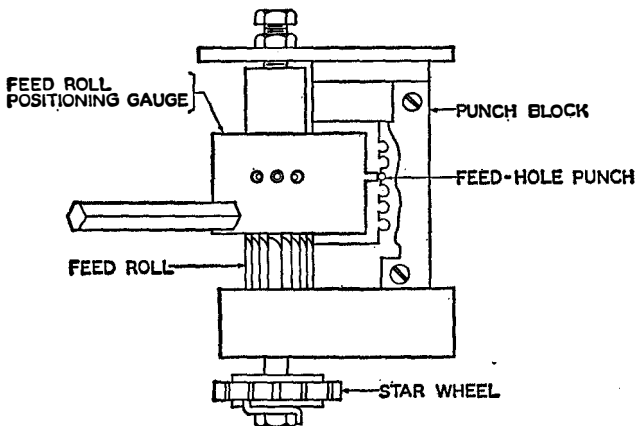


Fig. 24

**4.38 Feed-pawl Eccentric:** (Preliminary Adjustment) (Final 4.48) Feed pawl should bottom in the feed-roll tooth which is just below the horizontal center line of the roll when the punch-rocker-arm roller is on the low part of its cam. **Fig. 29**

- (a) To adjust, position feed-pawl eccentric, keeping center of eccentric head to left of screw body.

**4.39 Codebar Bellcranks:**

- (a) Bellcranks and their separator plates should be in horizontal planes.
- (b) Bellcranks and associated codebars should line up and move freely between separator plates.
- (c) Bellcranks should engage the top ends of their vertical levers fully and not interfere with the vertical levers associated with bellcranks above and below.
- (d) Bellcranks should clear the adjacent right ends of associated codebars by Min 0.010", Max 0.050", when Blank combination is set up and main shaft is rotated until **new-style two-step bellcranks** are positioned as in Fig. 25(C). In the case of the older **one-step bellcranks**, this requirement should be met when main shaft is rotated until the locking lever rests on the codebars as in Fig. 25(A).

**Fig. 25**

- (1) To adjust, position vertical-lever bracket to obtain horizontal plane for bellcrank movement, add or remove shims on bellcrank pivot beneath bottom separator plate to raise or lower bellcranks, and position bellcrank pivot post in its slot to position bellcranks horizontally. Before making these adjustments check 4.12 and **if any of these adjustments are made check 4.41 and 4.42.**

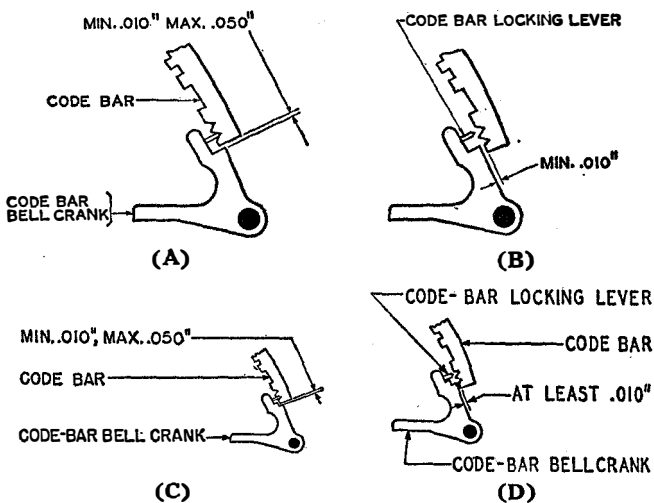


Fig. 25

#### 4.40 Mainbail Adjusting Screw:

(a) Unselected pullbars should clear inner edges of codebars by Min 0.010", Max 0.050", as in Fig. 1, when Blank and LTRS combinations are set up in turn, mainbail roller is on the high part of its cam, and play in mainbail and pullbars is taken up to make this clearance a minimum.

Fig. 1

(b) Front edges of codebars should clear the adjacent edges of associated codebar bellcranks by at least 0.010" as in Fig. 25(B) and 25(D) when LTRS combination is set up and mainbail roller is on the high part of its cam.

Fig. 25

Note: Before making any adjustment to meet these requirements check 4.12 and 4.39.

(1) To adjust, position mainbail adjusting screw.

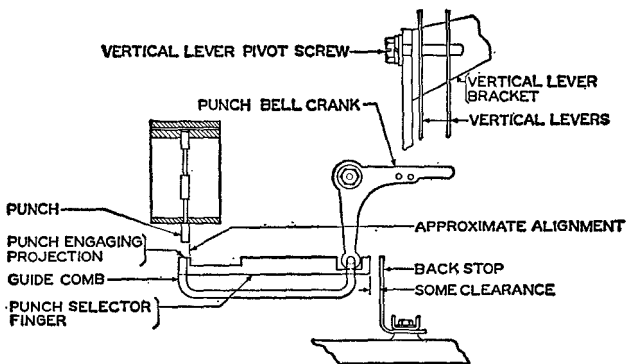
Note: If requirements cannot be met it may be necessary to readjust mainbail-roller guides per 4.11(b).

4.41 Right edges of the punch-engaging projections on the punch-selector fingers should be in approximate alignment with the right edges of the punch pins when LTRS combination is set up, main shaft is rotated until the codebar

bellcranks are resting on the codebars, and all play in associated parts is taken up by pressing lightly toward the left on the right ends of the selector fingers.

**Fig. 26**

- (a) To adjust, position **vertical-lever pivot screw** in its slot in the vertical-lever bracket. If this adjustment is made check 4.42.



**Fig. 26**

**4.42 Punch-selector-finger Backstop:**

- (a) Left ends of punch-selector fingers should engage their guide comb at the left end of the punch bail by not less than one-half the thickness of the comb when held to the right against the backstop.
- (b) Right ends of punch-selector fingers should clear the backstop when mainbail is in its lowest position.

**Fig. 26**

- (1) To adjust, position backstop.

**4.43 Punch-bellcrank springs** should have a tension of Min 2 oz, Max 3 oz, measured when the unit is in the stop position by pulling vertically upward on the bellcrank at the spring and noting when the bellcrank starts to move.

**Fig. 27**



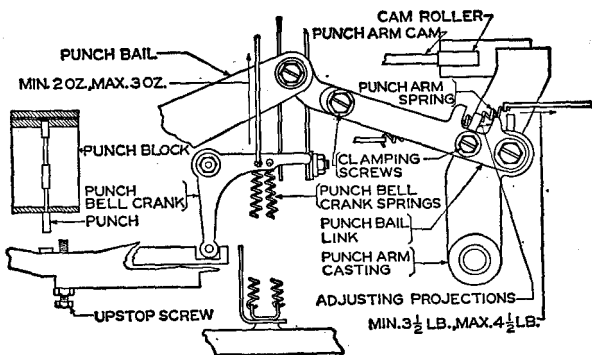


Fig. 27

4.44 **Punch-arm spring** should have a tension of Min 3-1/2 lb, Max 4-1/2 lb, measured at the spring post in line with the spring as the roller starts moving away from the low part of its cam. **Fig. 27**

4.45 **Punch Travel:** Punches should punch holes in tape cleanly when LTRS combination is set up and the typing reperforator is operated under power.

Note: By cleanly is meant a well-defined hinged lid, with no fibrous edges, and no appreciable tear at the hinged portion of the feed hole. A slight tear at the hinged portion of the code perforations is permissible.

(a) To adjust: Remove tape from under tension lever and carry it over the top of the lever so it can be fed by hand, back off mainbail-spring-adjusting screw until the spring lever touches the casting, back off punch-bail upstop screw, adjust punch-bail link (see Fig. 27) by means of its projections so the feed hole is just punched through the tape cleanly when LTRS selection is set up and the unit is operated under power. **Fig. 27**

Note 1: Feed-punch pin is approximately 0.010" shorter than code-punch pins.

**Caution: Avoid excessive punch-pin travel, otherwise the operating bail might jam when the upstop screw is adjusted.**

Note 2: If the tape does not move freely, the punch-block cleaning tool should be inserted between the guide plate and the die plate of the punch block and moved forward and backward a few times to remove lint and paper scraps.

Restore mainbail-spring-adjusting screw to its former setting and advance punch-bail upstop screw (see Fig. 27) in small steps (tighten locknut each time) until feed punch fails to perforate tape when operated under power. Turn back upstop screw in 1/12 turn steps (tighten locknut each time) until feed punch clearly embosses but does not fully punch the tape, then back off upstop screw an additional 1/6 turn and lock it in this position. Check that feed holes are punched cleanly.

**Fig. 27**

**Caution: Do not take defective punch blocks apart. If satisfactory punching cannot be obtained replace block assembly.**

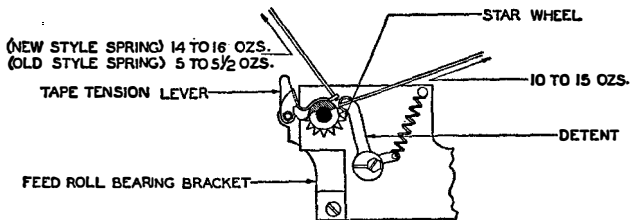
**4.46 Feed-roll Detent: (Final Adjustment) (Preliminary 4.37)** Perforations in tape should be evenly spaced, 10 to the inch, with an allowable variation of  $\pm 0.007''$  in a 4" length.

(a) To check, perforate a series of nine Blanks and one LTRS combination seven or eight times, bend back the lids of all No. 3 code holes, place the tape on top of a TP95960 gauge, then hold tape and gauge up to a light background and align a No. 3 code hole in the tape with the hole 1-1/2 inches from the left end of the gauge. Gauge holes shall be visible through all No. 3 code holes to the right of the point of alignment and the code hole above the large hole at the right end of the gauge shall fall entirely within the circumference of the gauge hole.

(b) To adjust, reposition feed-roll-detent eccentric and check 4.48.

**4.47 Feed-roll-detent spring** should have a tension of Min 10 oz, Max 15 oz, measured at right angles to the detent lever at the roller as the roller starts moving from the star wheel.

**Fig. 28**



**Fig. 28**

**4.48 Feed-pawl Eccentric: (Final Adjustment) (Preliminary 4.38)**

(a) With the high part of the feed-pawl-eccentric bushing toward the left and the tape-tension lever resting against the feed roll, the feed pawl should rotate the feed roll one full step during the downward travel of the feed pawl. To check, proceed as specified in following Paragraphs b, c, d, and e. The "checks" must be met on all the ratchet teeth.

(b) Manually rotate the main shaft, until the feed pawl is in its uppermost position. Hold the detent roller away from the star wheel. Rotate the main shaft slowly until the feed pawl is in its lowermost position. Allow the detent roller just to come in contact with the feed-roll star wheel. The tip of the tooth on the star wheel, which will be first contacted by the detent roller, must be above a line drawn through the center of the star wheel and the center of the detent roller.

(c) The detent roller should not tend to move the star wheel in a clockwise direction.

(d) The feed pawl should rotate the feed roll one step only.

(e) When the feed pawl (on its downward stroke) just engages a feed-roll tooth, there should be some clearance between all punch pins and the associated engaging surfaces of the punch-bail assembly.

(f) To adjust, position the feed-pawl-eccentric bushing with its locking screw loosened. Tighten the locking screw.

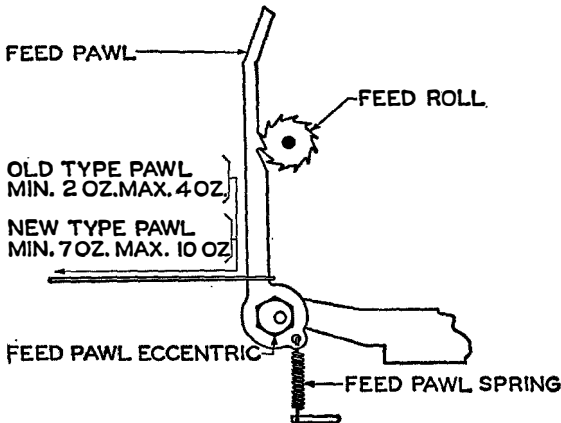


Fig. 29

4.49 **Feed-pawl spring** tension, measured as the pawl starts to move when pulling horizontally to the left at a point just above the pawl hub, should be:

**Fig. 29**

<u>Type of feed pawl</u>	<u>Tension</u>
Old type	Min 2 oz, Max 4 oz
New type (with spring hole 0.500" to the right of bearing hole)	Min 7 oz, Max 10 oz

4.50 **Tape-stripper-plate** upper edge should clear the feed roll by not more than 0.010" throughout one complete revolution of the feed roll.

(a) To adjust, position stripper plate.

4.51 **Tape-tension-lever spring** should hold the lever against the feed roll with a pressure of Min 14 oz, Max 16 oz when the new-style 15-turn TP110974 spring is used (or Min 5 oz, Max 5-1/2 oz, when the old-style 18-turn TP84023 spring is used) measured at the end of the lever, perpendicular to a plane passing through the center of the tension-lever stud and end of the lever.

**Fig. 28**

(a) To adjust, loosen locknut on rear end of stud and position stud clockwise to increase, or counterclockwise to decrease, the tension.

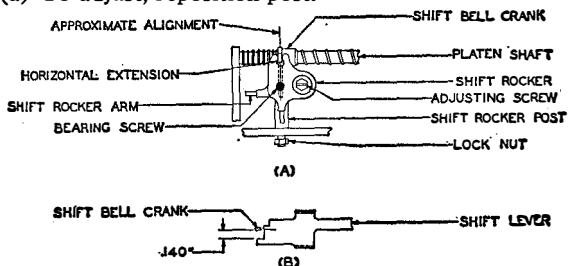
4.52 **Shift-rocker-post** sides should be parallel to the platen shaft as gauged by eye.

**Fig. 30**

(a) To adjust, position post.

4.53 **Shift-rocker-lever-post** front surface should be approximately parallel to the front edge of the base plate.

(a) To adjust, reposition post.



**Fig. 30**

4.54 **Shift-bellcrank** horizontal extension should be in approximate alignment with vertical center line through the shift-rocker bearing screw as in Fig. 30(A) when the platen shaft is so held that the front face of the downward extension of the shift bellcrank is opposite the mark on the top surface of the shift lever as in Fig. 30(B). **Fig. 30(A) and 30(B)**

Note: Older shift levers that are not marked can be marked by scribing a 0.140" line to the rear of the forward shoulder as indicated in Fig. 30(B).

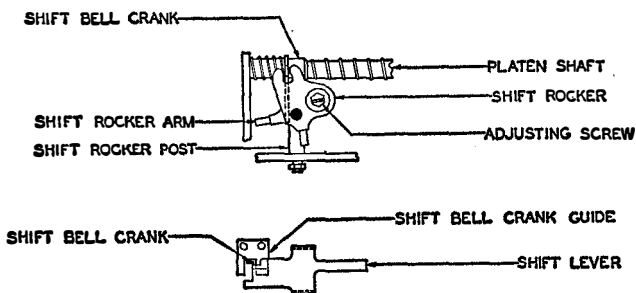
(a) To adjust, bend horizontal extension of shift bellcrank.

4.55 **Shift-bellcrank Guide:**

(a) Platen assembly should shift freely.

(b) Printing face of the platen should be approximately horizontal.

(1) To adjust, position shift-bellcrank guide. **Fig. 31**



**Fig. 31**

4.56 **Platen Travel and Latching:** The vertical extension of the shift bellcrank should overtravel the rear shoulder of the shift lever by not more than 0.015", when the play in the shift lever is taken up, at its left-hand end, toward the rear of the unit. See Fig 31 for identification of parts. **Fig. 31**

(a) To gauge, first check that the mainbail spring is properly set to meet the normal operating-tension requirement. Then temporarily increase its tension by placing a wedge between the mainbail-spring-adjusting lever and the spring-adjusting screw to force the other end of

the lever just up to the selector plate. (One jaw of a pair of long-nose pliers has been found to be a suitable wedge.) Move the platen assembly to its forward (FIGS) position and select the LTRS pullbar. Rotate the main shaft until the mainbail roller is on the low part of its cam. This point is determined by rocking the motor shaft back and forth and observing when the shift bellcrank is in its rear-most position. (At the same time the mainbail is in its extreme upward position.)

Note: On units equipped with "unshift on space" pullbars, select both the LTRS and Space combinations in succession and observe which gives the least platen travel; use this combination to make the shift-rocker adjustment.

(b) To adjust: Loosen the shift-rocker adjusting screw and reposition the shift rocker with respect to the shift-rocker arm.

(c) Remove the temporary wedge.

**4.57 Platen and Type-pallet Alignment:** In both FIGS and LTRS positions the platen should be approximately centrally located with respect to the type-pallet characters.

(a) To adjust, add or remove shims on platen shaft between the front collar and the platen block.

**4.58 Platen-shift spring** should exert a pressure of Min 5 oz, Max 7-1/2 oz, measured with the platen in the LTRS position by pressing toward the rear on the front end of the platen shaft until the platen-assembly extension starts to move away from the rear shoulder of the shift latch. **Fig. 22**

**4.59 Platen-yeild spring** should exert a pressure of Min 12 oz, Max 20 oz, measured on the front end of the platen-guide shaft by pressing toward the rear until the platen block starts to move on the platen shaft when the platen shaft is held in the extreme rear position. **Fig. 22**

**4.60 Shift-lever spring** should have a tension of Min 1/2 oz, Max 1-1/2 oz, measured as the shift lever starts to move when a downward pressure is applied on the lever in line with the right edge of the platen shaft, and the shift-bellcrank extension is held clear of the shift-lever shoulder (to the rear).

**4.61 Tape guide** should be so positioned that tape may be readily inserted into punch block.

4.62 **Tape-guide spring** edge should be parallel to the upper edge of the punch-unit casting and its curved pressure tip should engage the tape opposite the guide cutout. The spring should press the tape firmly against the rear side of the guide without buckling the tape.

(a) To adjust, position and bend spring.

4.63 **Ribbon Guide:** Ribbon should (a) be centrally located with respect to all type pallets, (b) be held approximately  $1/32''$  above the tape, and (c) show no tendency to curl at its rear edge. **Fig. 22**

(1) To adjust, position ribbon guide from front to rear to obtain (a), bend guide adjacent to casting to obtain (b), and bend forward end of lower part of guide to obtain (c).

4.64 **Mainbail Spring Tension:**

(a) Platen should move from FIGS position to LTRS position without failure.

(b) Characters and punctuation marks should be typed clearly without embossing tape.

(c) Mainbail spring tension should not exceed 15-1/2 lb, measured as spring-adjusting lever starts to move away from its adjusting screw when pulling upwards on the spring-adjusting lever from a point directly below the spring with the mainbail in its lowest or stop position.

(1) To adjust, with motor running send alternate LTRS and FIGS, slowly back off the mainbail spring-adjusting screw until platen just fails to return to LTRS position, tighten adjusting screw until platen moves to LTRS and FIGS position without failure, then tighten adjusting screw an additional 1-1/2 turns and tighten its locknut, check typing requirement and increase spring tension if necessary but not above specified maximum.

4.65 **Bell-hammer Post:**

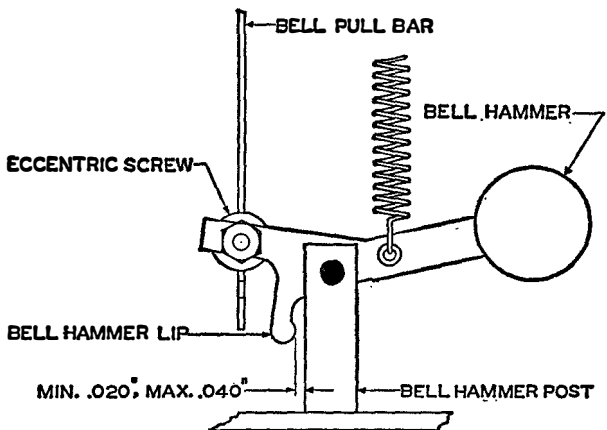
(a) Left edge of "bell" pullbar should clear the bell-hammer-eccentric screw by approximately  $1/8''$  when the mainbail is in its lowest position. **Fig. 32**

(b) With bell pullbar selected and mainbail at its highest position, tip of bell-pullbar toe should be in line with outside surface of bell hammer. To check hold bell-hammer spring away and sight along side of the bell hammer.

(1) To adjust, position bell-hammer post on base plate.

4.66 Bell-hammer lip should clear the bell-hammer post by Min 0.020", Max 0.040" when the "bell" pullbar is selected, the mainbail is in its highest position, and the "bell" typebar is held with its type pallet against the platen. **Fig. 32**

- (a) To adjust, position **bell-hammer-eccentric screw**, keeping high part of eccentric to the rear.



**Fig. 32**

4.67 **Bell** should be so positioned to obtain most satisfactory tone and should clear the left ribbon-spool bracket, the carrying handle on the left side of the unit, and the bell-bracket mounting screws, by Min 0.010". Also see 4.68.

- (a) To adjust, position bell on its mounting bracket.

4.68 **Tape platform** should clear bell by Min 0.004" and the front side of its rear vertical lip should clear and be approximately parallel to the rear edge of the tape.

- (a) To adjust, position platform.

4.69 **Mainbail-cam Friction-clutch Torque:** After motor has been run for at least 10 minutes a pull of Min 10 oz, Max 24 oz applied to mainbail cam, perpendicular to radius,



should move cam in a direction opposite normal rotation when motor is running, selector magnet is operated, and mainbail roller is held away from its cam. **Fig. 33**

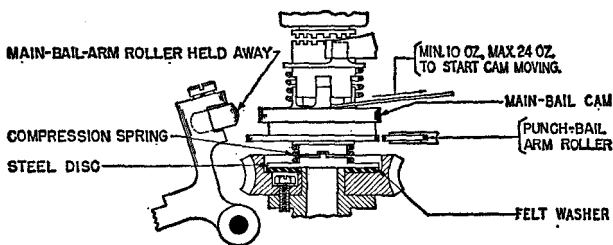
Note: This measurement requires considerable care, and need be checked only when it is thought that cam is not being brought up to speed as the clutch engages.

- (a) To check, remove tape reel and gear guard, hold mainbail roller away from cam by pressing upon lid of oil cup at top of the mainbail plunger, block magnet armature in operated position so that main clutch will not engage, hook scale into screw hole, and pull in direction reverse to normal rotation until cam just starts to move. **Fig. 33**

Note: Pulling too far will tend to make main clutch engage and give a greater reading, therefore only a slight backward motion of cam should be given.

**Caution: It is important to keep clutch stoparm against driven jaw to prevent main clutch engaging and winding scale around main shaft, so either keep armature operated to avoid tripping clutch stoparm, or block or clamp clutch stoparm so that main clutch cannot engage.**

- (b) To adjust, replace compression spring, steel disc, and felt washer of clutch. If torque is too high, lubricate clutch and recheck before replacing parts.



**Fig. 33**

**4.70 Typebars and pullbars** should be free of bind.

(a) To adjust, so bend typebars individually that they do not exert appreciable pressure on sides of slots. Check to see that foreign material is not impeding movement and if bind cannot be relieved in this manner, replace typebar as follows: Remove ribbon and ribbon guide; remove the platen-guide shaft from platen block; push the platen block to the rear and rotate it clockwise out of path of typebars; move typebar forward and downward as far as it will go and lift its pivoted end from typebar segment; in case it cannot be readily disengaged or if it is located at extreme left-hand end, back off left typebar bearing-rod retaining screw, not to exceed one full turn, to facilitate disengagement; hook replacement bar over bearing rod, lapping it with TP87698 carborundum stone if necessary to relieve bind in segment slots; mesh typebar and pullbar teeth so that typebar rests against its backstop and top of pullbar is in line with tops of other pullbars; and reassemble.

**4.71 Alignment of Type:** Characters should be inked evenly and not be noticeably out of line or misspaced with respect to the character **N**. Typebars shall lie evenly spaced against the backstop when unit is not printing.

(a) To check, type a series of characters between the letter **N** as **NANBNCN**, etc. In case of doubt about any character, type character at least six times between two letters **N**.

Note: On some early units it may be found that characters do not space reliably on a repeated test. This condition can be corrected completely only by extensive modifications to provide the following features which are standard on later units.

- (1) Mainbail-roller guides.
- (2) Latest mainbail and punch cams, TP101436 and TP95460 respectively.
- (3) Resilient backstop brackets, TP103341.

(b) To adjust, proceed as described in the following in cases where only a few type require adjustment. However, if many type appear to require adjustment it is well to first check the possibility of readjusting **N** to minimize the readjustment effort on other type.

- (1) To correct spacing, bend typebar in its straight shank in the direction required and then straighten character as described in (2). The typebar may be bent using two pliers, one to hold typebar near the

typebar segment and the other to apply the bending force; or by using the TP78589 three-prong pliers with the single prong on the side toward which the bend is to be made.

(2) To straighten type so that sides of character will be vertical and upper-case character will be spaced the same as the lower-case character bend top of typebar at its junction with the straight shank. This can be done by holding typebar shank at point of bend with one pliers while applying bending force on top of typebar with another pliers. TP78590 parallel pliers are recommended for holding shank and short-nose pliers for applying bending force.

(3) To bring type into horizontal alignment shift type pallet. To do this pull typebar forward and place a block behind it to hold it forward from other typebars. Heat type pallet with an electric soldering copper until solder is melted and then reposition pallet as required. After solder is thoroughly reset remove block and recheck alignment.

(4) To correct uneven inking of characters twist typebar, peen type pallet, or unsolder and tip pallet as required. If one side of type prints light or fails to print, twist typebar, proceeding as described in (2) except applying a twisting force instead of bending force. Special pliers may be used to cut or peen type just back of face position that is printing light; these are the TP78587 two-side cutting pliers and TP78588 one-side cutting pliers. If inking discrepancy is at top or bottom of character, pallet may be unsoldered as described in (3) and tipped into required position.

Note: If type pallets have been unsoldered in the alignment procedure they should be held down on top of a piece of cardboard placed over the ribbon guide and their slots refilled with solder. Brush off any excess solder.

4.72 **Platens** which are worn should be replaced. In the case of the two-piece platen assembly it is probable that only the plastic insert will need replacement and in some cases the insert may be turned over to obtain additional life.

4.73 **Ribbons** which are worn or defective should be replaced with new ribbons. Bell System 6141 ribbon, Black Record, heavy-inked, marked "Heavy" or "Special", is recommended.

## 5. REFERENCE TO BELL SYSTEM PRACTICES

5.01 The following Bell System Practices provide additional information that may be required in connection with this section.

<u>Subject</u>	<u>Section</u>
Teletypewriter Apparatus—General Requirements and Procedures	P30.012
Teletypewriter Apparatus—Cleaning—General Requirements	P30.010
Teletypewriter Apparatus—Preparation of Apparatus for Installation	P33.014
14 Typing Reperforator, Auxiliary Features—Requirements and Procedures	P35.653
Bases for 14 Teletypewriter and Typing Reperforator	P35.620
14 Typing Reperforator—Lubrication	P35.604
Teletypewriter Motor Units and Governors (Other than 28)—Requirements and Procedures	P32.004
Teletypewriter Selector Mechanisms—Requirements and Procedures	P32.001
Teletypewriter Stations—Orientation and Distortion Tests	P30.002
Teletypewriter Apparatus—Speed Regulation	P30.020