

BELL SYSTEM PRACTICES
Teletypewriter Stations

SECTION P39.640
Issue 1, July, 1956
AT&T Co Standard

TELETYPESETTER PERFORATOR WITH FIXED COUNTING MECHANISM REQUIREMENTS, PROCEDURES, AND LUBRICATION

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1. GENERAL

1.01 This section contains the requirements, adjusting procedures, and lubricating procedures for the maintenance of the teletypesetter perforator (TPE 20) with a fixed counting codeblade mechanism.

1.02 The teletypesetter perforator with a fixed counting mechanism is also called the standard Teletypesetter Perforator. The word standard as applied to the perforator

does not mean standardization by the Bell System but refers to a feature of the linecasting machine with which the perforator is associated. Also, the word standard is applied to a perforator (TPE 20) with the fixed counting mechanism to distinguish it from a perforator (TPE 21) with a removable counting code-blade mechanism.

2. REQUIREMENTS AND PROCEDURES

Note: The adjustments of 2.01 and 2.02 are made at the factory when the perforator is assembled, and should require readjustment only when the shim pile-ups have been disturbed or when a new counting selector-bar assembly or a new perforating selector-bar assembly is to be installed in the perforator. In any of these events, it will be necessary to check all the associated adjustments.

2.01 Counting Selector-Bar Assembly Height

Note: When checking this adjustment, tilt the perforator to an angle of about 45° by lifting the base at the front with the rear (bottom edge) on the bench.

- (a) The height of the counting selector-bar assembly should be such that the following requirements are met:
 - (1) With the front counting selector-bar link held to the right, there should be Min .015", Max .030" clearance between the front counting selector-bar and the lugs on the counting-code keylevers when the counting selector-bar is in a position to make this clearance a maximum.
 - (2) With the perforating selector-bar assembly removed and any character keylever held depressed, so that the front counting selector-bar link is locked, the rest of the selector-bar links should be locked, or may have a lateral play of not more than .020".
- (b) To adjust, by means of shims and half shims, raise, lower or tilt the counting selector-bar assembly to meet the foregoing requirements. When shims or half shims are added or removed, care should be taken that the addition or removal of such shims will not cause the assembly to twist or interfere with the normal movement of associated parts when it is subsequently remounted.
- (c) Replace the perforating selector-bar assembly, being careful not to damage the tripoff plunger. **Fig. 7**

2.02 Perforating Selector-Bar Assembly Height (see the Note preceding Paragraph 2.01)

- (a) The height of the perforating selector-bar assembly should be such that the following requirements are met.

(1) With the front perforating selector-bar link locked by the depression of the middle keylever in the bottom row, the other perforating selector-bar links should be locked or have a lateral play of not more than .020".

(2) The counting selector-bar links should at the same time be just locked or have a lateral play of not more than .030".

Note: Recheck the foregoing requirements, using the end keylevers in the third row from the top, and with the front perforating selector-bar-link or the one next to it locked.

(b) To adjust, raise, lower, or tilt the height of the perforating selector-bar assembly by means of shims and half shims between the assembly and the casting. When shims or half shims are added or removed, care should be taken that the addition or removal of such shims will not cause the assembly to twist or interfere with the normal movement of associated parts when it is subsequently remounted.

2.03 Counting Selector-Bar-Link Detents

(a) Each counting selector-bar-link detent roller should ride an equal distance into the right and left notches in the counting selector-bar links. The detent rollers should ride fully on their links.

(1) To adjust, position the detent springs by means of their elongated mounting holes.

(b) With the detent roller first in one and then in the other notch in the counting selector-bar links, hook a scale over the detent spring just to the right of the roller and pull at right angles to the spring. It should require Min 1 oz, Max 1-1/2 oz to start the detent spring moving.

(1) To adjust, bend the detent springs.

2.04 Shift Bail

(a) With the forward end of the extreme left counting-code keylever held against its corresponding character-code keylever, there should be a clearance of Min .010", Max .040", as indicated in Fig. 1A, between the counting-code keylever and the character-code keylever at the point in the bend of the counting-code keylever. In a similar manner, and for the same clearance, check the extreme right counting-code keylever, and character-code keylever. Also, the shift bail should have some endplay, not more than .006".

Fig. 1A

(1) To adjust, loosen the shift and unshift brackets on the shift bail and adjust the position of the shift bail by means of its pivot screws. Readjust the shift and unshift brackets in accordance with Paragraph 2.07.

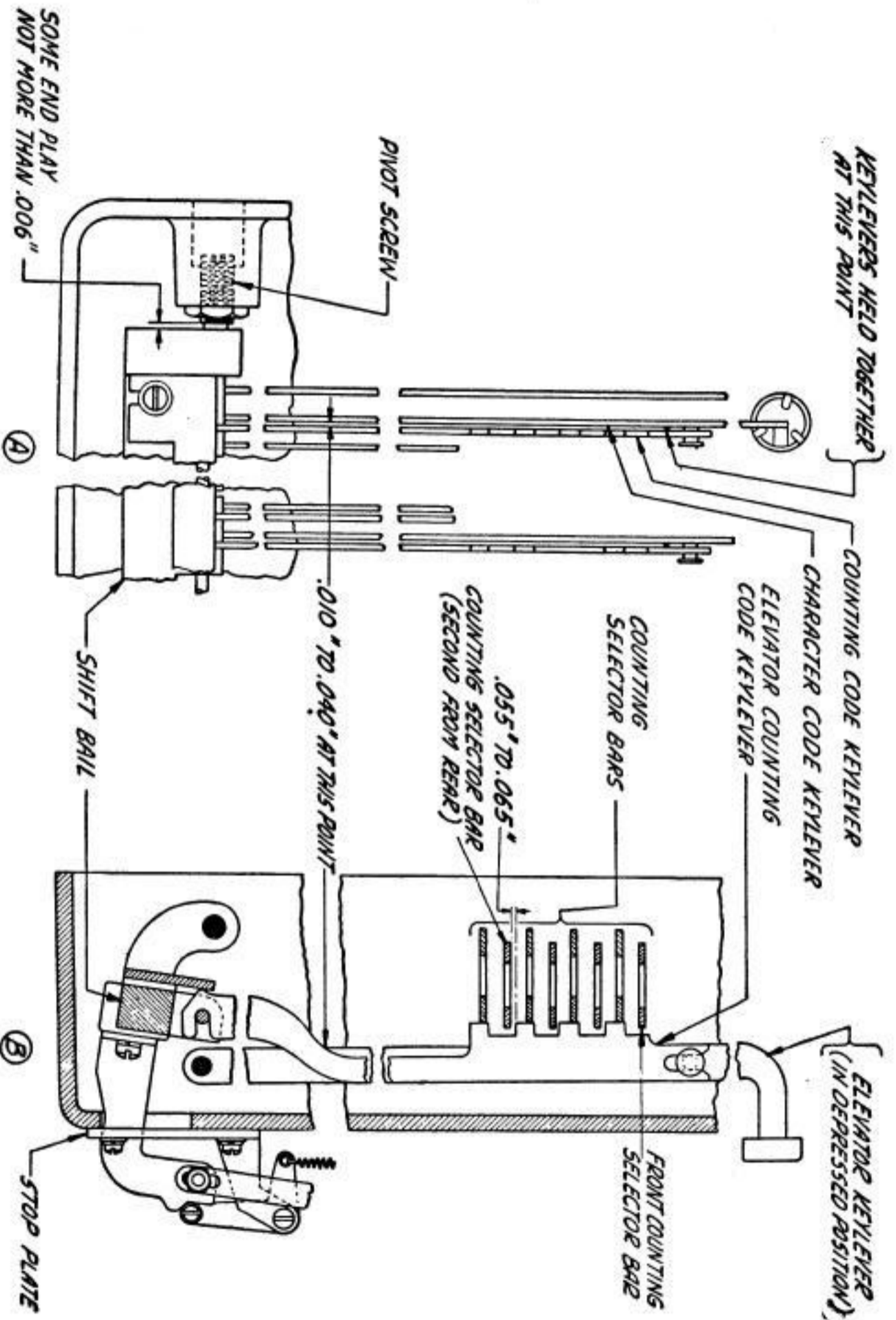


Fig. 1

- (1) To adjust, position the shift-bail stop plate by means of its elongated mounting holes. **Fig. 1B**

2.06 **Shift-Lever Bearing Bracket and Unshift-Lever Bearing Bracket**

- (a) There should be some clearance, not more than .020" as indicated in Fig. 2, between the unshift-lever bearing bracket and the UNSHIFT keylever. There should also be some clearance, not more than .020", between the shift-lever bearing bracket and the SHIFT keylever.

- (1) To adjust, position the bearing brackets by means of their elongated mounting holes. **Fig. 2**

2.07 **Shift Bracket and Unshift Bracket**

- (a) When the SHIFT keylever is held firmly depressed (using Min 16 oz, Max 32 oz key pressure) and the shift bail held lightly in a direction to make the clearance a maximum, there should be some clearance not more than .040" as indicated in Fig. 3, between the rear edge of the shift-bail extension and the shift-bail stop plate. A similar clearance should exist between the front edge of the shift-bail extension and the shift-bail stop plate when the UNSHIFT keylever is held depressed in the same manner.

- (1) To adjust, add shims between the shift bail and the shift or unshift brackets to decrease the clearance. To increase the clearance, remove shims. **Fig. 3**

- (b) The shift and unshift levers should engage the SHIFT and UNSHIFT keylevers properly, as indicated in Fig. 2 and the shift and unshift levers and connecting links should have some sideplay at their pivot points.

- (1) To adjust, position the shift and unshift brackets by means of their elongated mounting holes.

2.08 **Shift-Bail Balancing Spring**

- (a) Unhook the forward end of the shift-bail balancing spring. With the shift bail in the shift (rear) position, hook a scale in the spring eye and pull the spring to its position length hooked. It should require Min 9 oz, Max 11 oz to stretch the spring to this length.

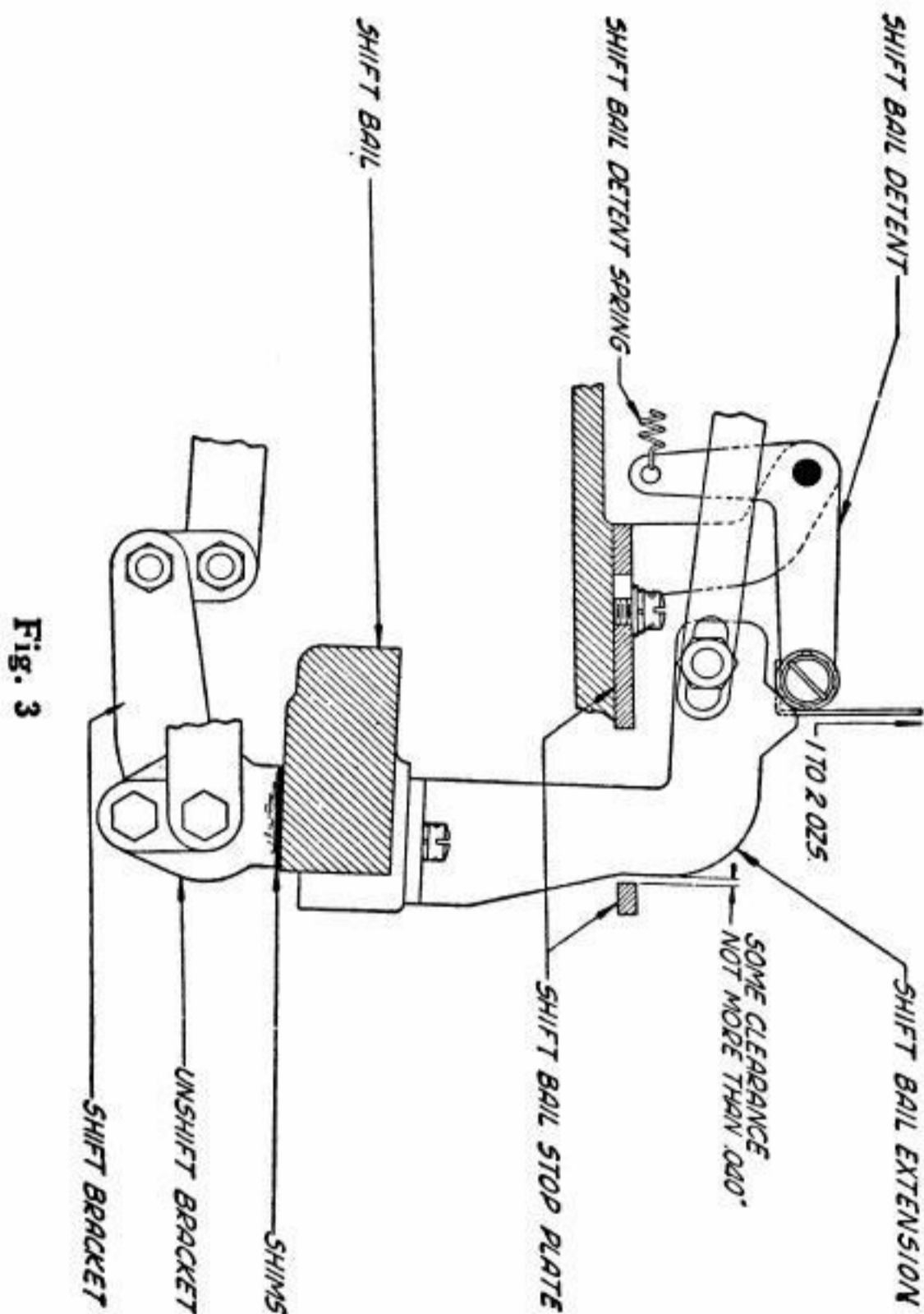


Fig. 3

2.09 **Shift-Bail Detent Spring:** Hook a scale under the detent-roller mounting-screw nut and pull upward. It should require Min 1 oz, Max 2 oz, as indicated in Fig. 3, to start the detent moving.

Fig. 3

2.10 Keylever Spring

(a) The openings between the ends of all keylever springs except the SPACE keylever spring should be $1\frac{9}{16}$ " , as indicated in Fig. 4. The opening between the ends of the space keylever should be $1\frac{15}{16}$ " .

(1) To adjust, bend the springs.

Fig. 4

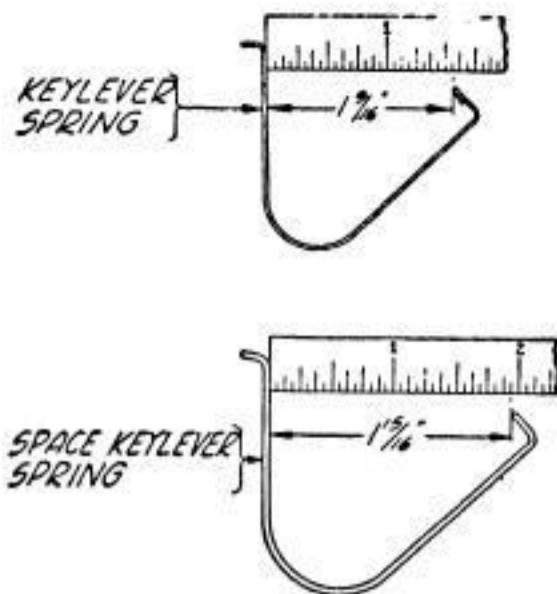


Fig. 4

2.11 Main Clutch (Operating Camsleeve Jaw Clutch)

(a) With the operating camsleeve in the stop position (the driven clutch-member fully cammed out of mesh with the driving clutch-member), the clearance between the points of the opposite rows of clutch teeth should be Min .006", Max .010", as indicated in Fig. 5.

- (1) To adjust, loosen the four screws which hold the main-shaft bearing caps and move the main shaft to the front or rear.

Fig. 5

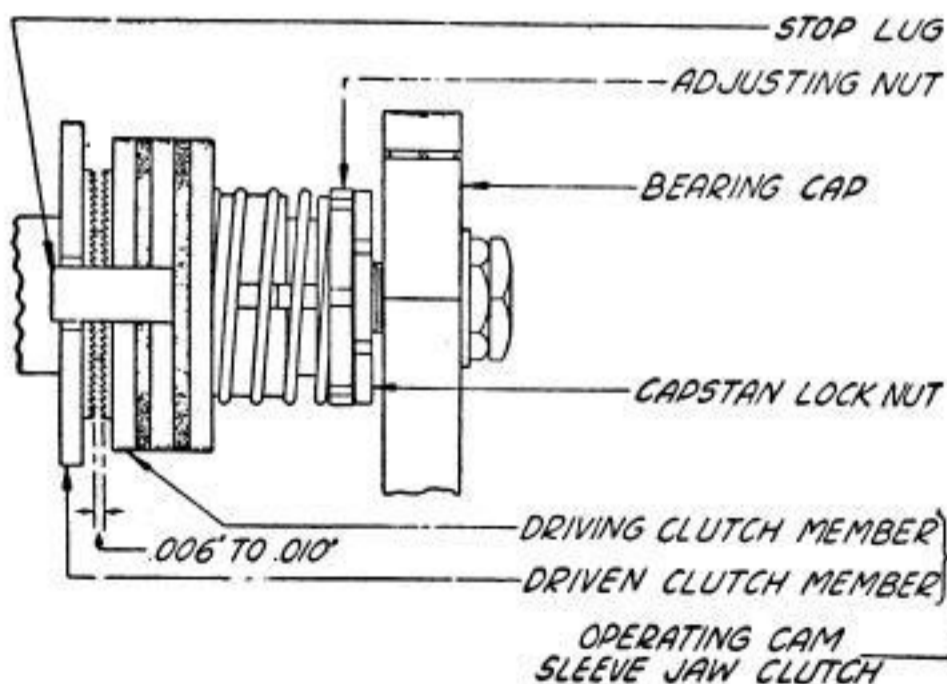


Fig. 5

2.12 Return-Clutch-Lever Unit Bracket

(a) The return-bail roll should ride fully on its cam.

(1) To adjust, position the return-clutch-lever bracket by means of its mounting screws.

2.13 Motor Position

(a) There should be a minimum amount of play, without binding, between the motor pinion and the main-shaft driving gear throughout one complete revolution of the gear. The center of the motor pinion should line up with the center of the gear.

(1) To adjust, use shims between the motor feet and the base, and position the motor. **Fig. 6**

Note: If shims are added or removed, care should be taken that the addition or removal of such shims will not cause the assembly to twist or interfere with the normal movement of associated parts, when it is subsequently remounted.

2.14 **Main-Clutch Spring:** With the stop-lugs in a horizontal position and with the two members of the main clutch in mesh, apply the push end of a scale to the driven member at the clutch-throwout camming surface and push in line with the shaft. It should require Min 3 lb, Max 4 lb to just separate the clutch members. **Fig. 5**

2.15 Stoplever Camroller Eccentric Screw

(a) With a keylever held depressed and the stoplever camroller first on one of the stop-lugs which form the high part of its stoplever cam, the stoplever extension should overtravel the nonrepeat latch by Min .005", Max .020", as indicated in Fig. 6. Check for this same clearance with the camroller on the opposite stop-lug.

(1) To adjust, position the eccentric screw and locknut which mount the roller. **Fig. 6**

2.16 Universal-Bar Backstop Screw

Note: In order to check this requirement it will be necessary to remake the adjustment. If the adjustment is changed, recheck 2.17.

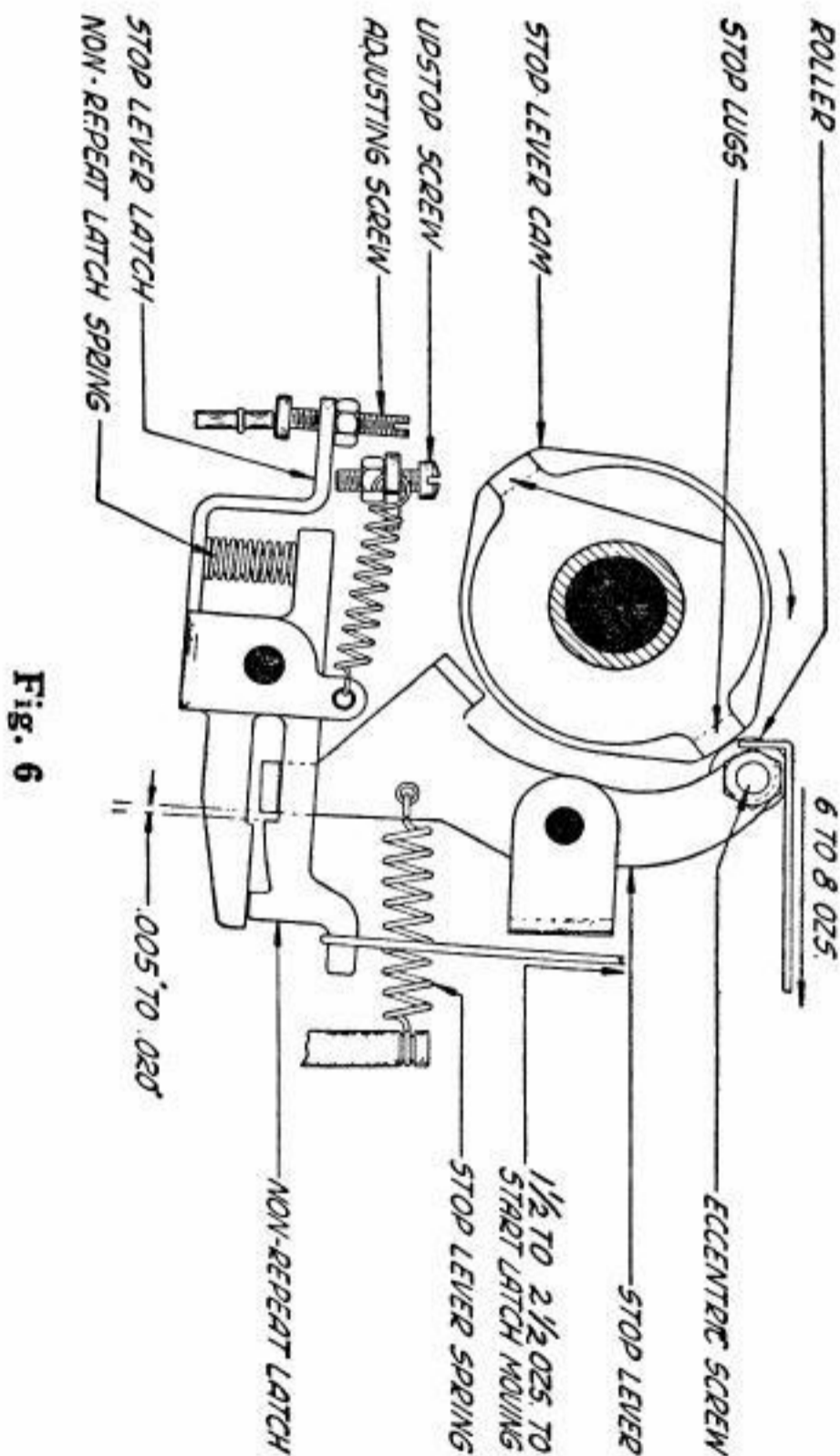
Backoff the universal-bar backstop screw. With the R, Y, and 5 keylevers held depressed at the same time, turn the universal-bar backstop screw in until it just touches the universal-bar Y lever. Then turn the screw in approximately two-thirds of a turn, and tighten the locknut. **Fig. 7**

2.17 Stop Lever-Latch Adjusting Screw

(a) With the operating camsleeve in the stop position, and all the keylevers in their unoperated positions, there should be a clearance of Min .002", Max .006" as indicated in Fig. 7, between the nonrepeat latch and the upper surface of the stoplever extension.

- (1) To adjust, position the stoplever-latch adjusting screw.

Fig. 7



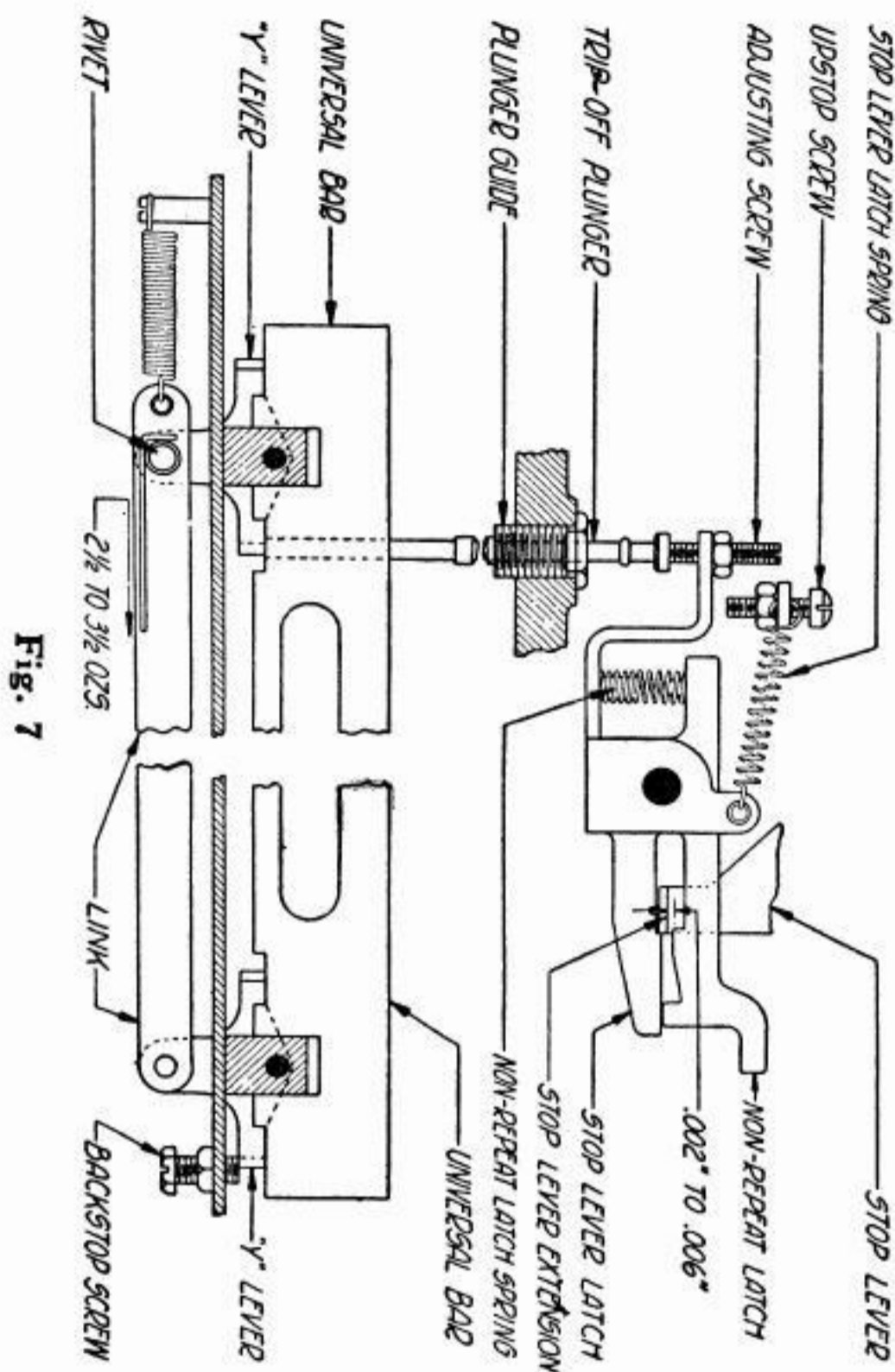


Fig. 7

2.18 Stoplever-Latch Upstop Screw

(a) With any keylever held depressed, there should be a clearance of Min .004", Max .025" as indicated in Fig. 8, between the upstop screw and the stoplever latch. Check all keylevers.

(1) To adjust, position the stoplever-latch upstop screw.

Fig. 8

2.19 **Universal-Bar Spring:** Trip the main clutch by depressing a keylever. With a scale hooked over the rivet which connects the left universal-bar Y lever with the link, pull to the right in line with the link. It should require a pull of

Min 2-1/2 oz, Max 3-1/2 oz, as indicated in Fig. 7, to just start the link moving.

Fig. 7

2.20 **Stoplever Spring:** With the stoplever camroller on a high part of its cam, hook a scale over the roller eccentric screw nut and pull horizontally. It should require a pull of Min 6 oz, Max 8 oz, as indicated in Fig. 6, to start the camroller moving away from its cam.

Fig. 6

2.21 **Stoplever-Latch Spring:** With the stoplever roller on a high part of its cam, hook a scale under the stoplever latch just to the right of the adjusting screw, and pull vertically upward. It should require Min 1/2 oz, Max 1-1/2 oz to start the stoplever latch moving.

Fig. 6

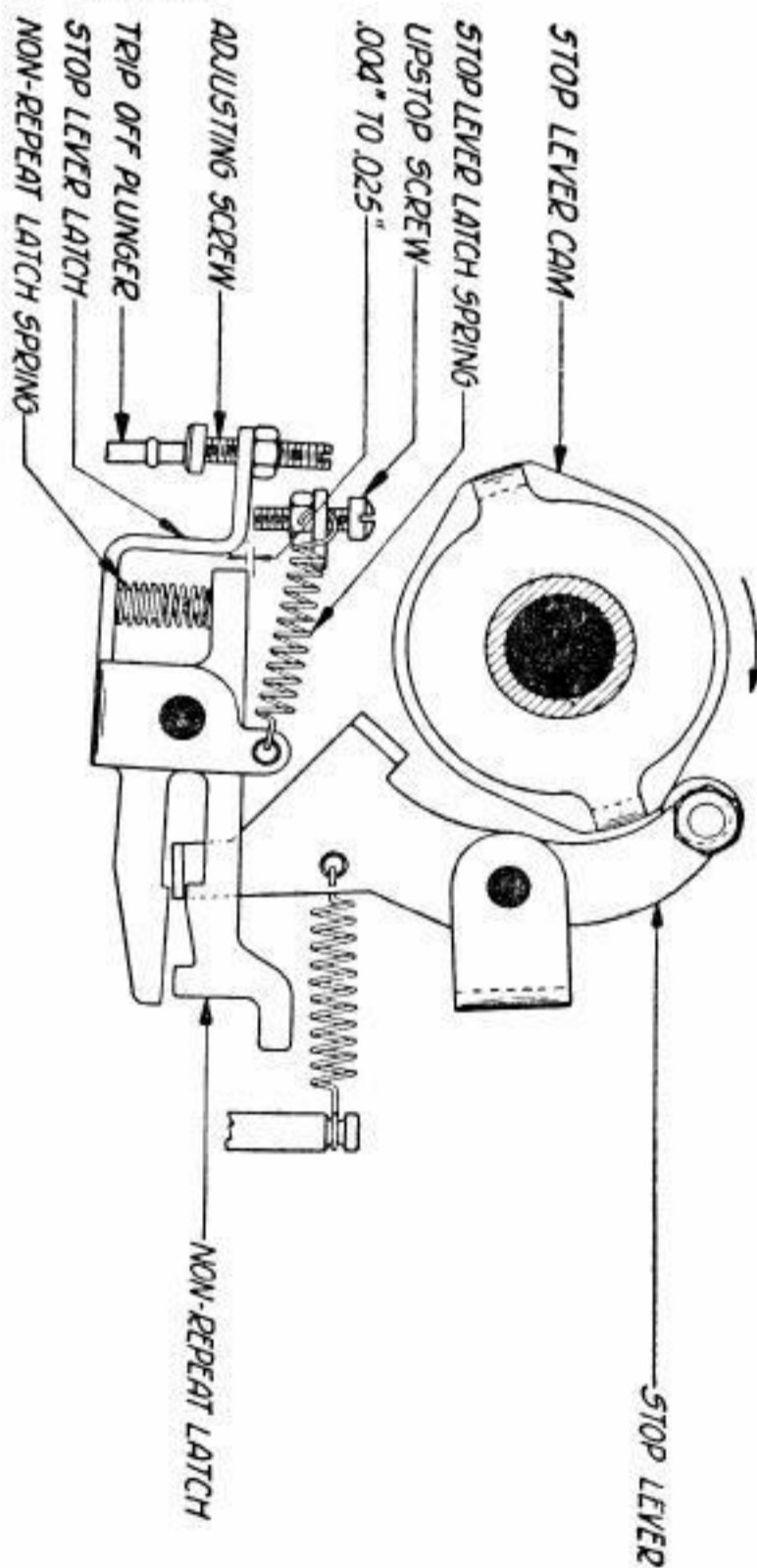


Fig. 8

2.22 Nonrepeat-Latch Spring: With the stoplever roller on a high part of its cam, hook a scale under the right end of the nonrepeat latch and pull up. It should require a pull of Min 1-1/2 oz, Max 2-1/2 oz, as indicated in Fig. 6, to start the nonrepeat latch moving. **Fig. 6**

2.23 Transfer Levers

(a) The T transfer levers should line-up with the counting selector-levers.

(1) To adjust, position the guide plate and transfer-bail bracket by means of their elongated mounting holes. The guide plate will maintain the front to rear position of the transfer bail, while the left to right position is being adjusted according to Paragraph 2.23(c). **Fig. 9A**

(b) The counting code-discs should also line-up with the T transfer levers.

(1) To adjust, position the stop-unit bracket by means of its elongated mounting holes. Before tightening the mounting screws, hold the stop-unit bracket down against the horizontal locating surface on the clutch-shaft casting. **Fig. 9A**

(c) With the first and third from the rear counting selector-levers to the left, and the second and fourth to the right, move the left end of the transfer bail down until the T transfer levers position the counting code-discs against their stops. Under this condition, at least one of the code discs should be moved clockwise against its stop, and at least one which is moved counterclockwise should also be against its stop.

(1) To gauge, hold a small screwdriver firmly in a counting code-disc notch and try to move the code disc to the left and right. If the code disc is against its stop there will be no perceptible side play.

(2) To adjust, position the transfer-bail bracket to the left or right by means of its elongated mounting holes. Be sure that the transfer-bail bracket is against the side plate before tightening the mounting screws. **Fig. 9B**

(d) With the front counting selector-lever to the right and the transfer-bail roller on a high part of its cam there should be a clearance of Min .060", Max .070", as indicated in Fig. 9C, between the left end of the front T transfer lever and its corresponding counting selector-lever.

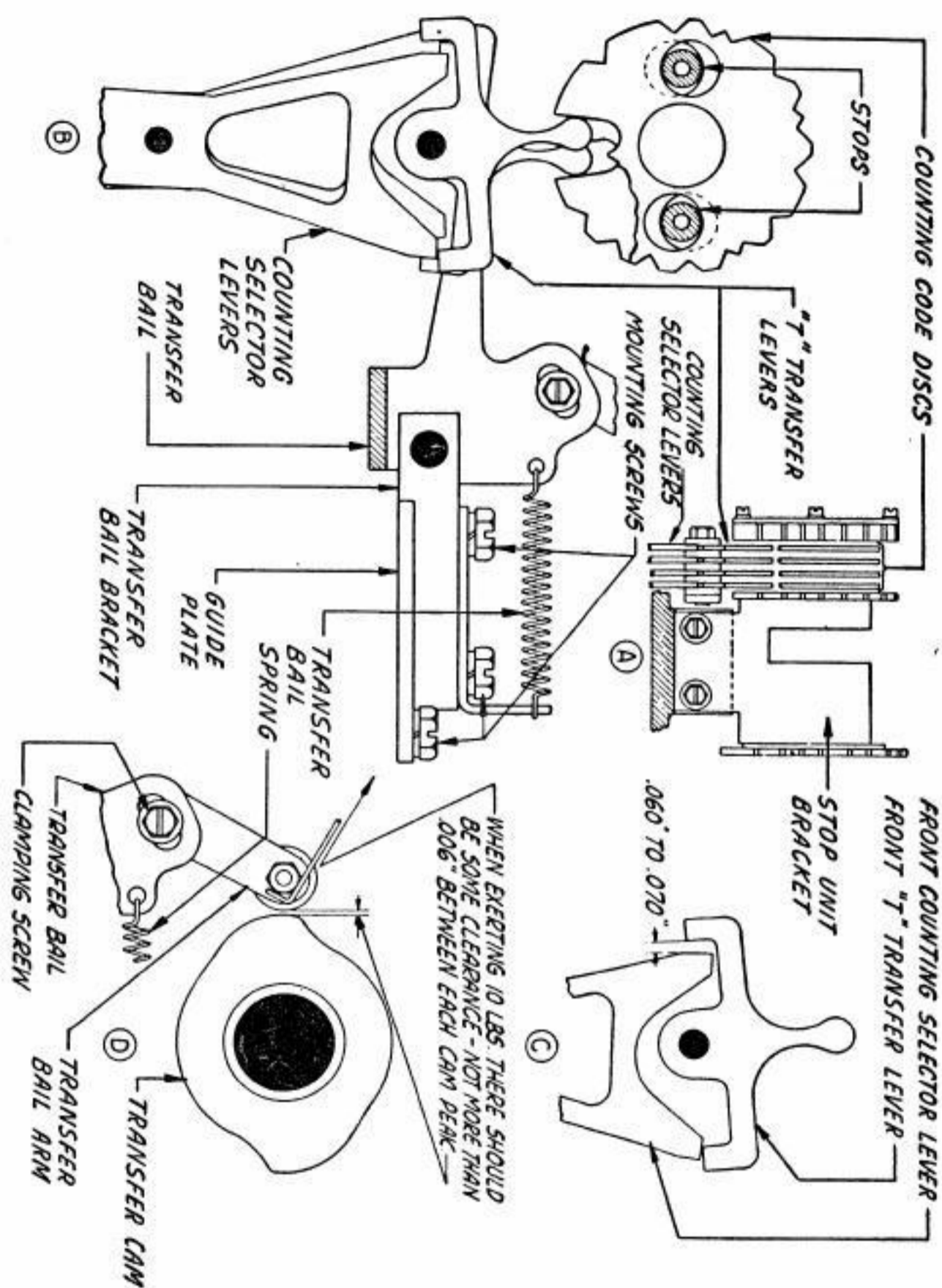


Fig. 9

- (1) To adjust, position the counting selector-bar assembly by means of its elongated mounting holes. Then position the stop screw on the counting selector-bar detent bracket so that it touches the base casting, and tighten the stop screw locknut. With the stop screw adjusted according to the foregoing, the assembly may be removed and replaced without further adjustment,

provided the stop screw is positioned against the casting when remounting the assembly. **Fig. 9C**

(e) With the first and third from the rear counting selector-levers to the left, and the second and fourth to the right, trip the main clutch and rotate the motor handwheel until the transfer-bail roller rides on a high part of the transfer cam. Then hook a scale over the transfer-bail-arm roller shoulder-screw locknut and pull at right angles to the transfer-bail arm with a force of approximately 10 lb. Under this condition, there should be some clearance, not more than .006", as indicated in Fig. 9D, between both cam peaks and the roller.

(1) To adjust, position the transfer-bail arm by means of its elongated mounting holes. **Fig. 9D**

2.24 Transfer-Bail Spring: With the operating camsleeve in the stop position, hook a scale over the transfer-bail-roller shoulder-screw locknut, and pull toward the left at right angles to the roller arm. It should require Min 19 oz, Max 25 oz to start the roller moving away from the cam.

2.25 Counting-Shaft Endplay

(a) The counting shaft should have no perceptible endplay.

(1) To adjust, position the rear section of the counting shaft by means of the four screws which hold the counting-shaft bearing caps. **Fig. 10**

2.26 Reset-Collar Lever

(a) With the reset-collar-lever roller first on one and then on the other peak of its cam, so that the reset collar is moved to its extreme rear position, there should be a clearance of Min .020", Max .030", as indicated in Fig. 11, between all the stopblades and the reset collar when the play in the lever and the collar is taken up in a direction to make the clearance a maximum. When the play is taken up in the opposite direction, there should be some clearance between all the stopblades and the reset collar.

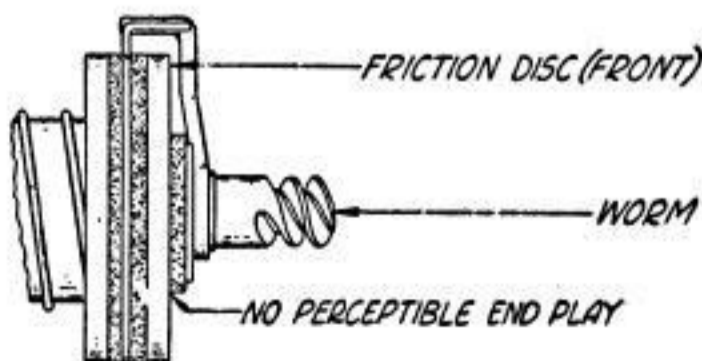


Fig. 10

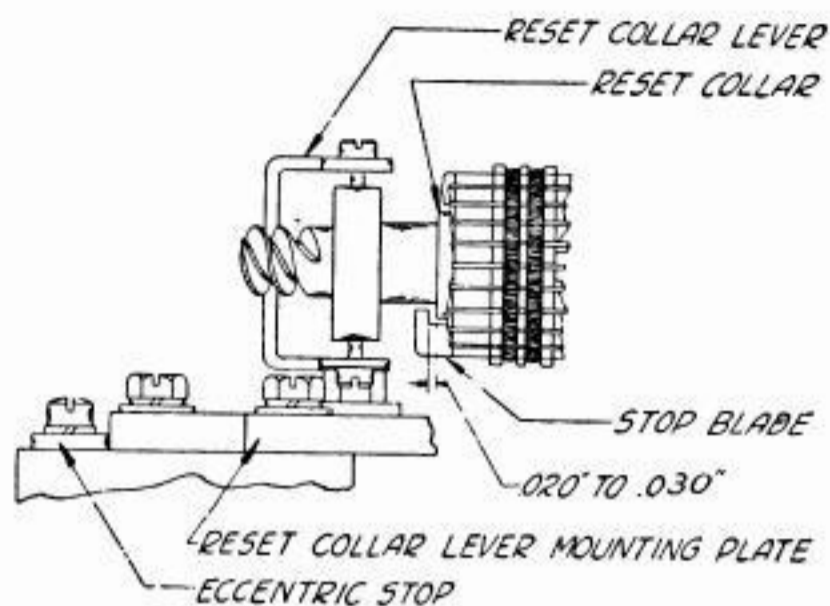


Fig. 11

(1) To adjust, back off the eccentric stop and position the reset-collar-lever mounting plate by means of its elongated mounting holes. Set the eccentric stop against the mounting plate and tighten the screws.

Fig. 11

Note: Make sure that the reset-collar lever resets each stopblade securely. If necessary, refine the adjustment.

2.27 Zero Lever

(a) With the stopblade that is in front of the zero lever in its forward detent position and the zero lever held in its forward position, there should be some clearance, not more than .010", as indicated in Fig. 12A, between the front end of the zero lever and the stopblade. Check each stopblade for this same clearance.

(1) To adjust, position the zero-lever stop screw and locknut.

Fig. 12A

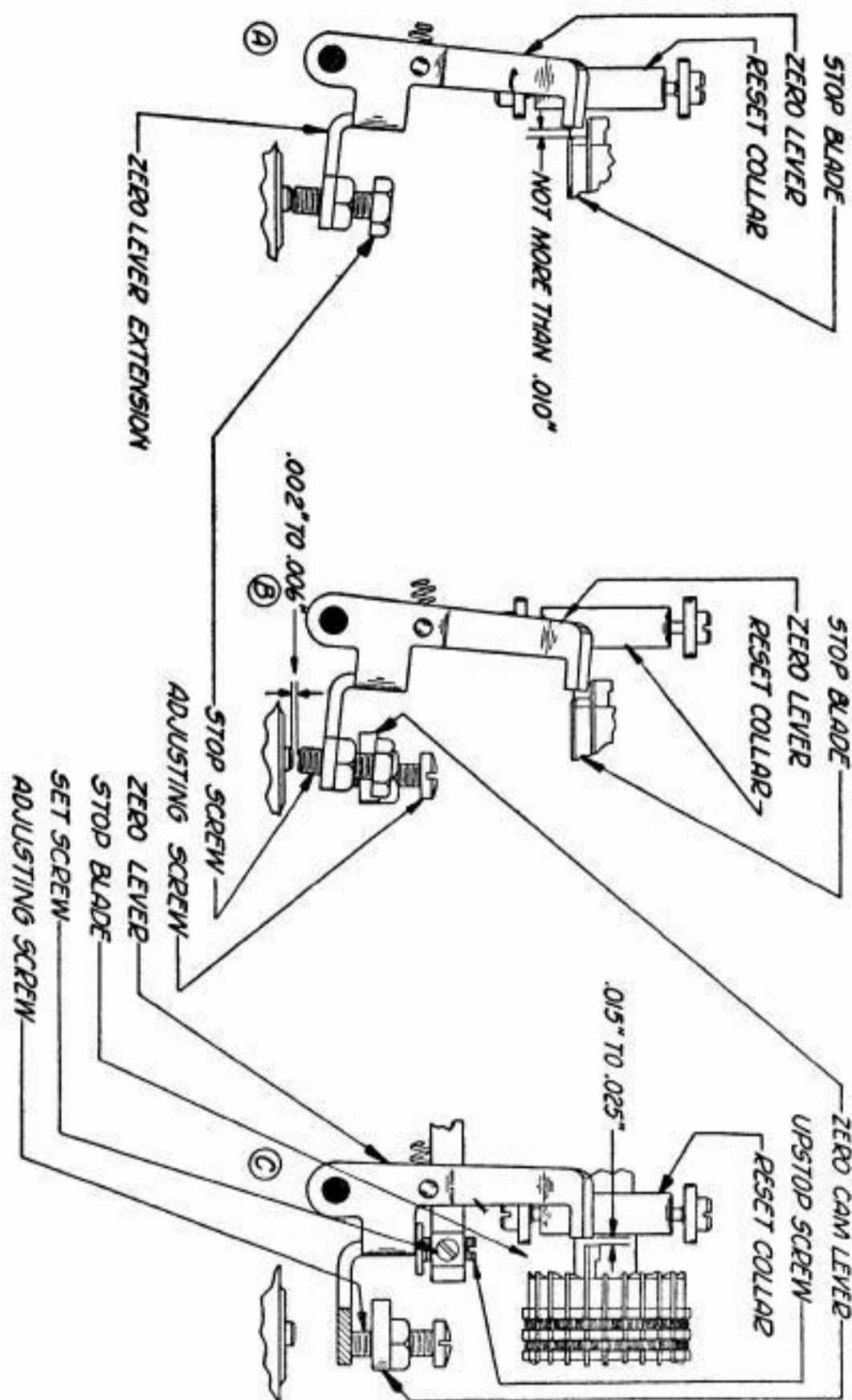


Fig. 12

(b) With the zero-cam lever on a peak of its cam, there should be some clearance of Min .002", Max .006", as indicated in Fig. 12B, between the zero-lever stop screw and its stop. Check this clearance on both peaks of the cam.

(1) To adjust, position the zero-cam lever adjusting screw.

Fig. 12B

(c) With the zero-cam lever on a low part of its cam, there should be a clearance, of Min .015", Max .025" as indicated in Fig. 12C, between the forward end of the zero

lever and any stopblade that is in the reset (rear) position. Check each stopblade for this same requirement.

- (1) To adjust, position the zero-lever upstop screw. **Fig. 12C**

2.28 Zero-Lever Spring: With the zero-cam lever on a low part of its cam, apply the push end of a scale to the top of the zero-lever stop screw. It should require Min 1-1/2 lb, Max 2-1/4 lb to start the lever moving downward.

2.29 Stop-pin Springs

To operate its selected position, hook a scale under it, in front of its stop-pin spring and pull in line with the pin slot. It should require Min 6 oz, Max 10 oz to start each stop pin moving.

2.30 Left Counting Cross-Shaft

(a) The left bearing-bracket of the left counting cross-shaft should be positioned so that the following requirements are fulfilled.

- (1) There should be a minimum amount of play (without binding) between the cross-shaft gear and the counting-shaft worm. Check through one complete revolution of the cross shaft.

- (2) The counting cross-shaft should be free in its bearings without any tendency to bind.

- (3) There should be at least .010" clearance between the rear of the cross-shaft gear and the counting-shaft friction-clutch arm.

- (4) The front of the cross-shaft gear should clear the reset-collar lever by at least .010" when the reset collar is in its extreme rear position.

- (5) To adjust, position the left bearing-bracket of the left counting cross-shaft by means of its elongated mounting holes.

(b) The left counting cross-shaft should have same endplay, not more than .004".

- (1) To adjust, position the collar on the left end of the cross-shaft by means of its setscrew.

2.31 Return-Clutch Throwout Lever

(a) This part of the adjustment is for perforators equipped with clutch-throwout-lever mounting brackets doweled to the casting.

- (1) With the return clutch in its stop position, and the shoulder on the driven member held against the end of the return-clutch throwout lever, there should

be a clearance of Min .015", Max .020" between the points of the opposite rows of teeth on the clutch driving-member and the clutch driven-member.

(2) To adjust, add or remove shims on the throwout-lever stud to obtain this clearance. **Fig. 14**

(b) This part of the adjustment is for perforators equipped with slotted-clutch throwout-lever mounting brackets.

(1) With the return clutch in its stop position, and the shoulder on the driven member held against the end of the return-clutch throwout lever, there should be a clearance of Min .015", Max .020" between the points of the opposite rows of teeth on the clutch driving-member and the clutch driven-member.

(2) To adjust, position the return-clutch throwout-lever bracket by means of its mounting slots. **Fig. 15**

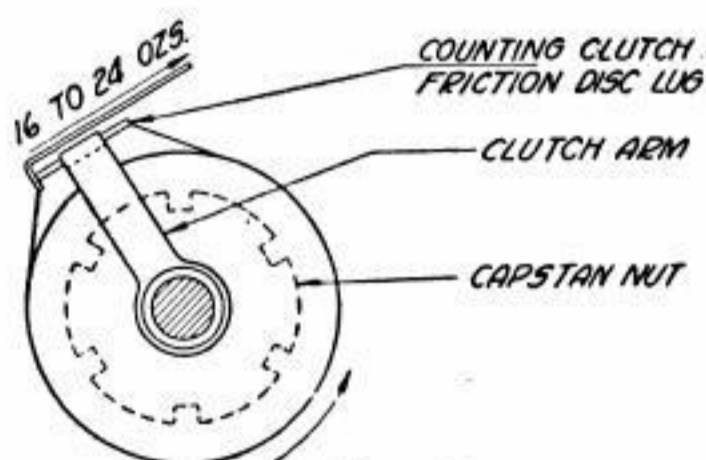


Fig. 13

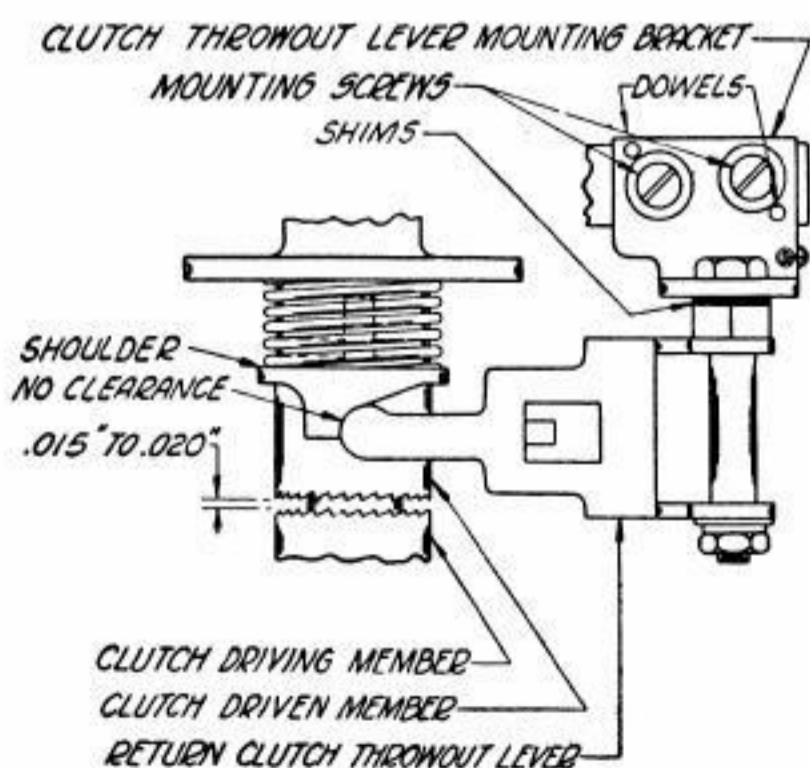


Fig. 14

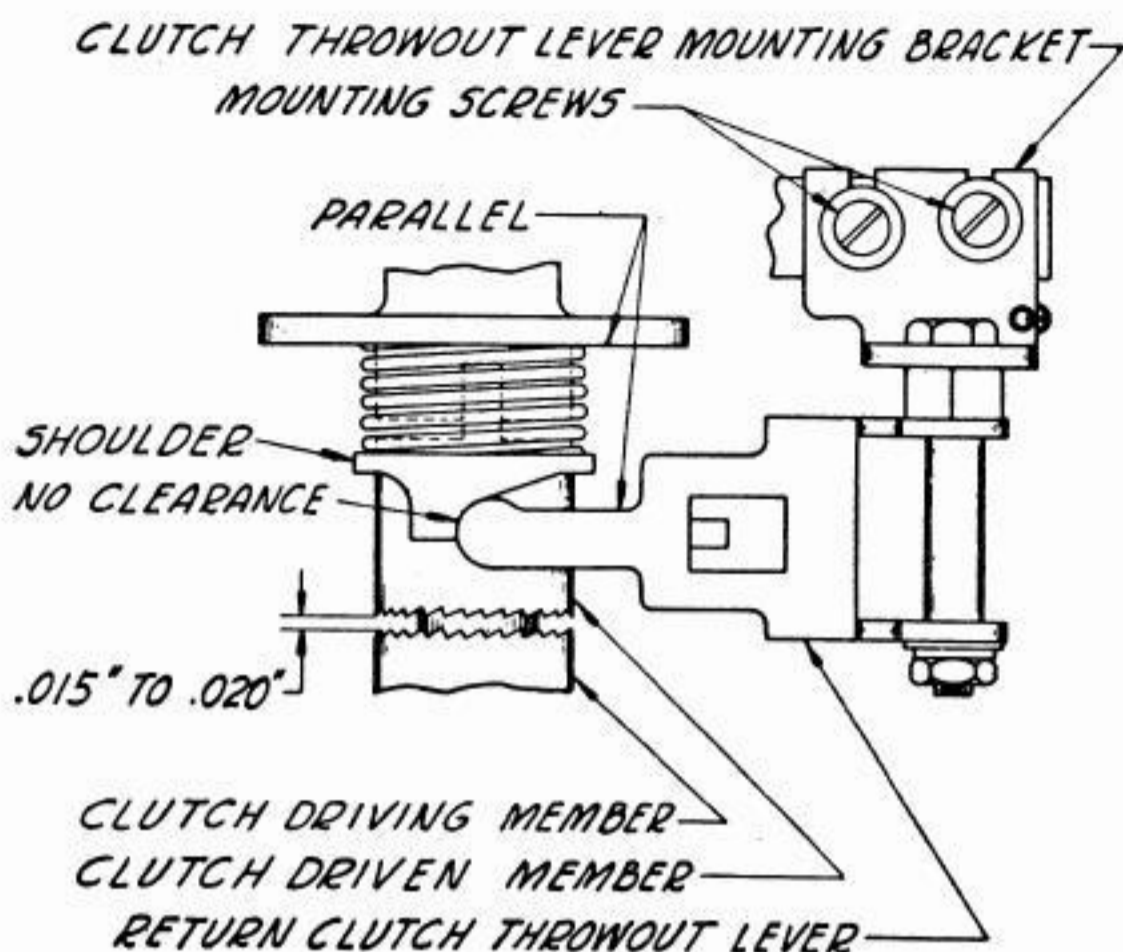


Fig. 15

2.32 Counting-Shaft Friction Clutch

(a) Hook a scale on the counting-clutch friction-disc lug and pull at right angles to the lug. It should require a pull of Min 16 oz, Max 24 oz as indicated in Fig. 13, to just start the friction disc moving in a direction opposite to that in which the motor drives it.

(1) To adjust, vary the tension by means of the clutch-spring capstan nut and capstan locknut. **Fig. 13**

2.33 Return-Actuating Lever

(a) With the motor running, depress the RET keylever very slowly. The return clutch should engage at the same time, or slightly before the main clutch engages.

(b) To adjust:

(1) For perforators equipped with the newstyle return-actuating levers with eccentrics, adjust the operating position of the tripoff pawl to obtain this timing by loosening the clamping screw and positioning the return-actuating lever by means of the eccentric.

(2) For perforators equipped with the old-style return-actuating lever without eccentrics, this adjustment is made by loosening the shoulder screw that engages

the elongated hole in the return keylever extension and positioning the return actuating-lever. **Figs. 16, 17**

2.34 Return-Clutch Throwout-Lever Spring: With the return clutch engaged and the throwout cam clear of the throwout lever, hold the tripoff pawl away from the return-clutch throwout lever, and hook a scale beneath the clutch throwout lever just below the spring mounting hole, and pull vertically upward. It should require Min 3 oz, Max 5 oz to start the clutch throwout lever moving.

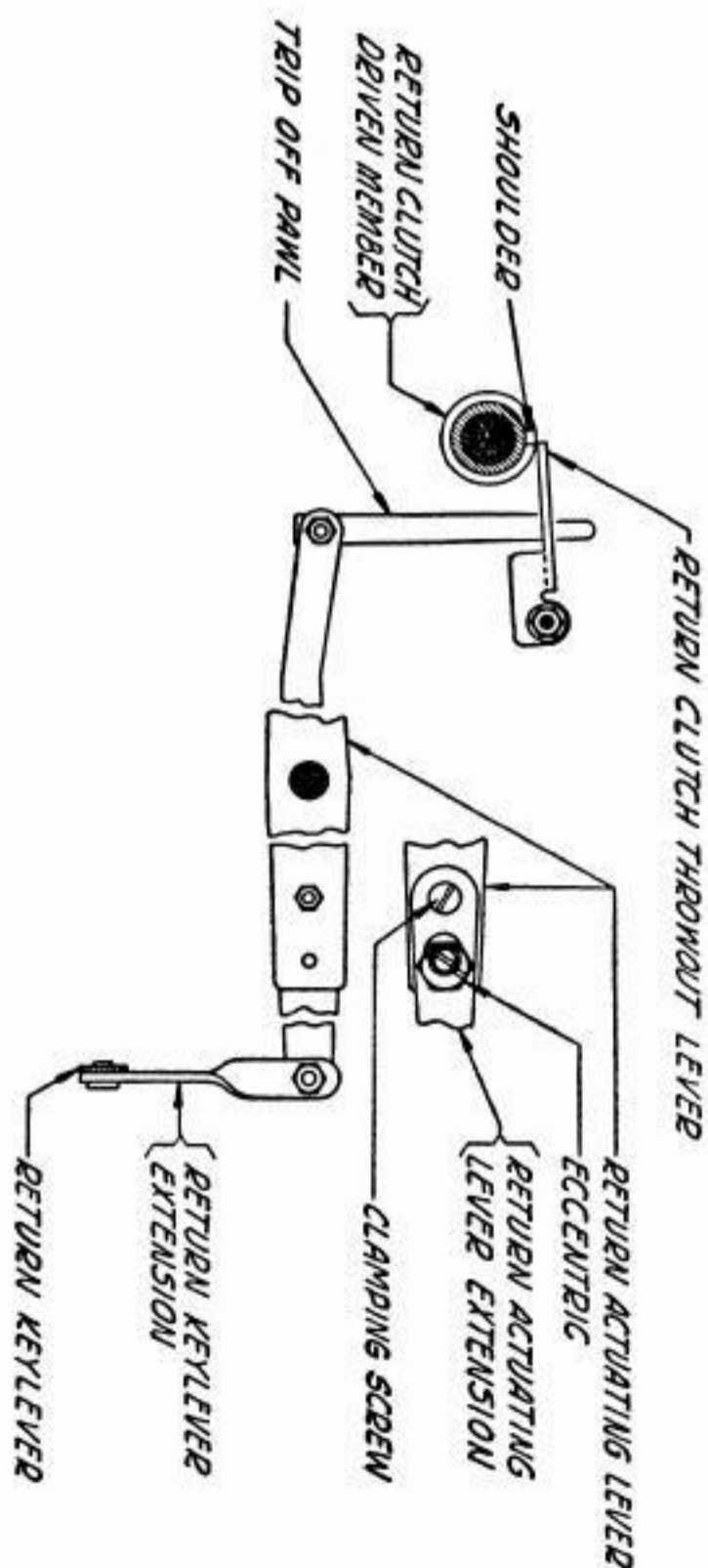


Fig. 16

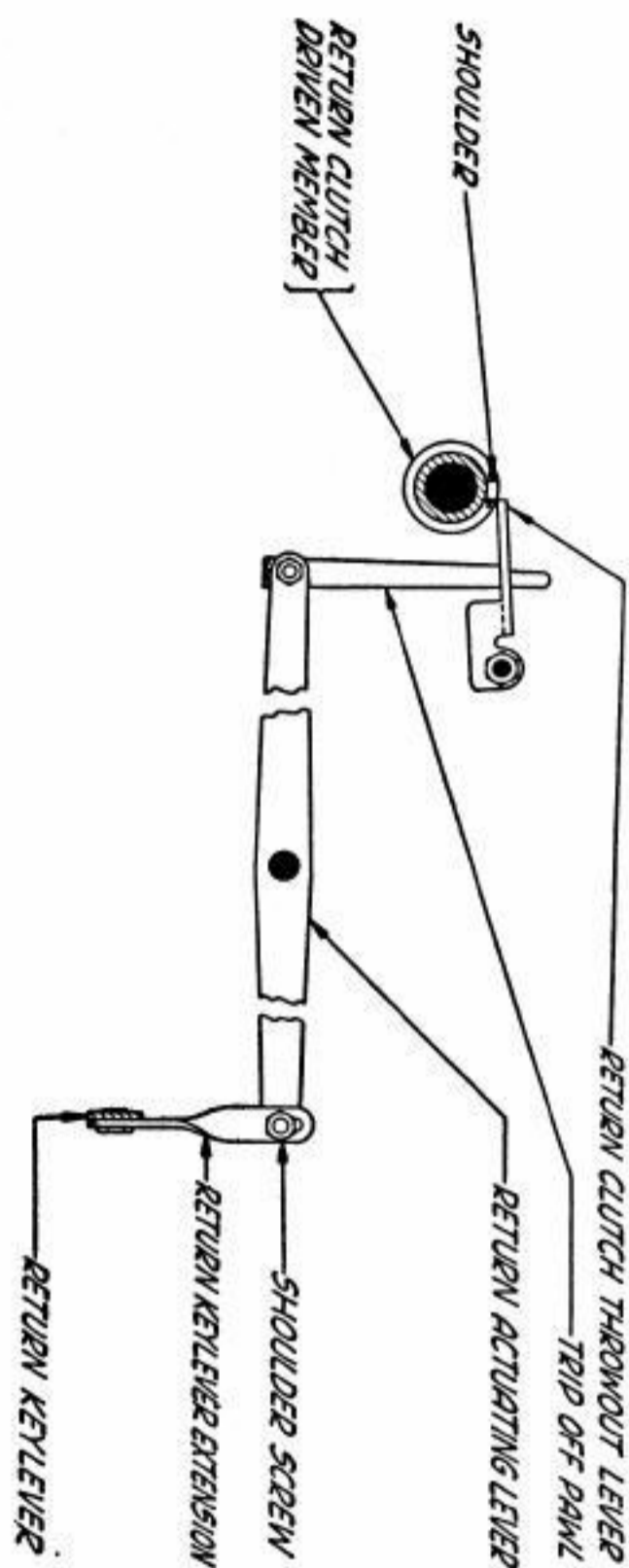


Fig. 17

2.35 Return-Clutch Throwout-Lever Tripoff-Pawl Spring:

With the return clutch in its stop position, hook a scale under the spring at a point where it rests against the actuating lever, and pull vertically upward. It should require Min 1 oz, Max 3-1/2 oz to move the spring away from the actuating lever.

2.36 Return-Clutch Spring: With the return-clutch teeth engaged and the return-clutch throwout lever held away from the clutch, a pull of Min 9 oz, Max 12 oz should be required to separate the clutch teeth when pushing with a scale in line with the shaft against the shoulder of the return-clutch driven member.

2.37 Right Counting Cross-Shaft

- (a) There should be a minimum play (without binding) between the shaft worm and the counting-pointer gear.
 - (1) Gauge through one complete revolution of the gear.
 - (2) To adjust, position the height of the right-end bearing bracket by means of its elongated mounting holes.
- (b) The right counting cross-shaft should have some end-play, not more than .004", and the right cross-shaft gear should line up with the left cross-shaft gear.
 - (1) To adjust, position the collars (located on either side of the left bearing) by means of their setscrews.

2.38 Retaining-Pawl Release Lever

- (a) With the return-bail camroller on the high part of its cam, the retaining pawl should clear the teeth on the spacing rack by Min .030", Max .045", as indicated in Fig. 18.
 - (1) To adjust, position the retaining-pawl release-lever link by means of the shoulder screw which engages the elongated hole in the link and connects the link to the retaining-pawl release lever. Tighten the shoulder screw locknut.

Fig. 18

2.39 **Return-Bail Spring:** With the return-bail camroller on the low part of its cam and the retaining-pawl release-lever link held away from the return bail, hook a scale to the shoulder screw at the right end of the return bail and pull vertically upward. It should require a pull of Min 12 oz, Max 20 oz, as indicated in Fig. 18, to just start the bail moving.

Fig. 18

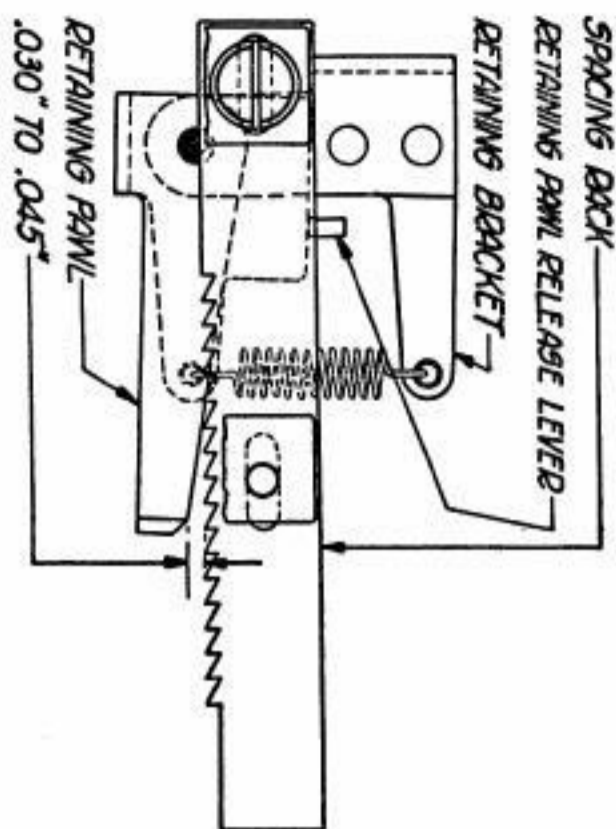
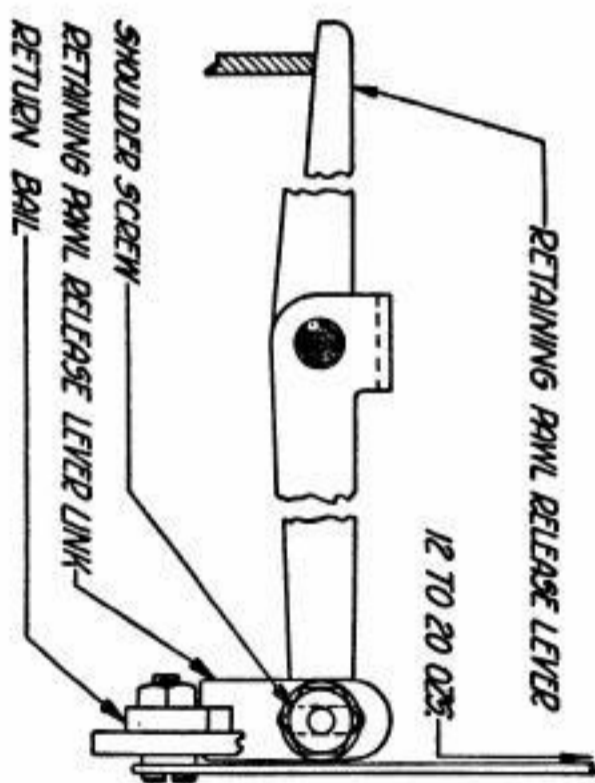


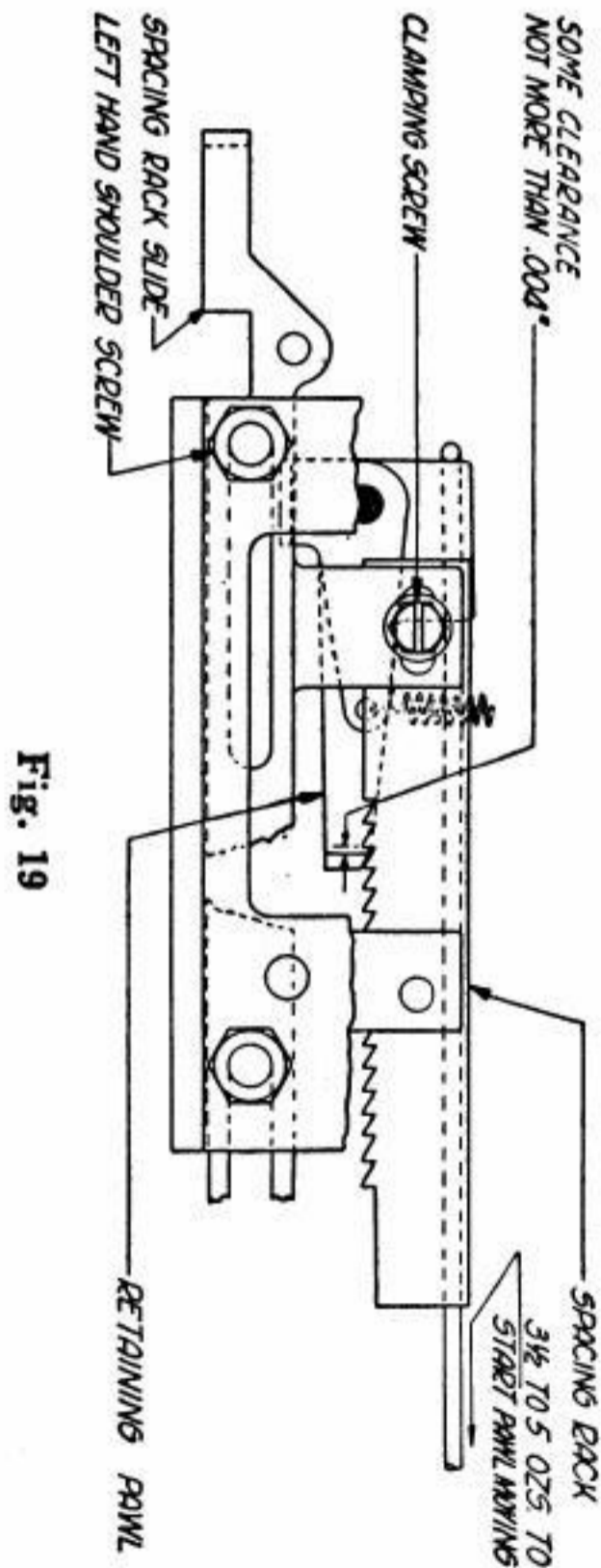
Fig. 18



2.40 Justification-Pointers Return Position

(a) With the operating camsleeve in its stop position and the spacing-rack slide moved to the right until it rests against the left-hand shoulder screw (return position), there should be some clearance, not more than .004", as indicated in Fig. 19, between the retaining pawl and the second tooth from the left end of the spacing rack.

- (1) To adjust, position the spacing rack by means of its clamping screw. **Fig. 19**
- (b) There should be some clearance, not more than .010", between the ends of the justification pointers when they are in their returned position.
- (1) To adjust, position the left-hand pointer by means of the clamping screw which fastens the left pointer to its gear segment. **Fig. 26**



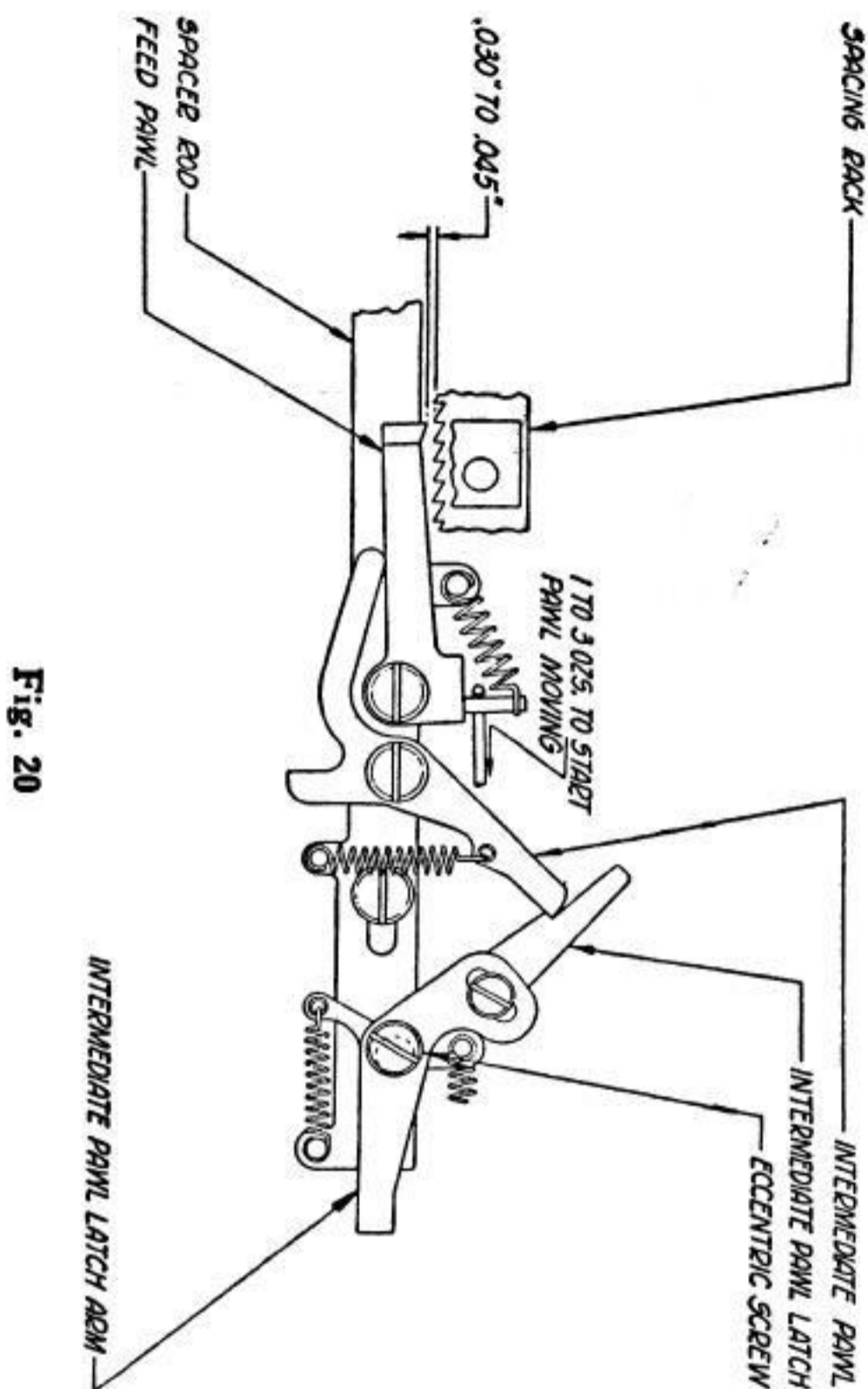


Fig. 20

2.41 **Retaining-Pawl Spring:** With the spacing-rack slide in the returned position, hook a scale over the upper end of the retaining pawl and pull horizontally to the right. It should require a pull of Min 3-1/2 oz, Max 5 oz as indicated in Fig. 19, to start the pawl moving. **Fig. 19**

2.42 **Intermediate-Pawl-Latch Eccentric Screw**

Note: Omit this adjustment when the perforator is provided with the improved spacer-rod mechanism.

- (a) With the operating camsleeve in its stop position and the intermediate pawl in its latched position, there should be a clearance of Min .030", Max .045", as indicated in Fig. 20, between the feed pawl and the spacing-rack teeth.

- (1) To adjust, position the intermediate-pawl-latch eccentric screw.

Fig. 20

2.43 Spacer Rod

- (a) With the justification pointers in their returned position, depress the spacebar and rotate the motor by hand. When the feed pawl engages the fourth tooth from the retaining pawl, the third tooth from the left end of the spacing rack should overtravel the retaining pawl by Min .004", Max .012", as indicated in Fig. 21, when the spacer-bail camroller rides on the high part of its cam. Check this overtravel on both high parts of the cam.

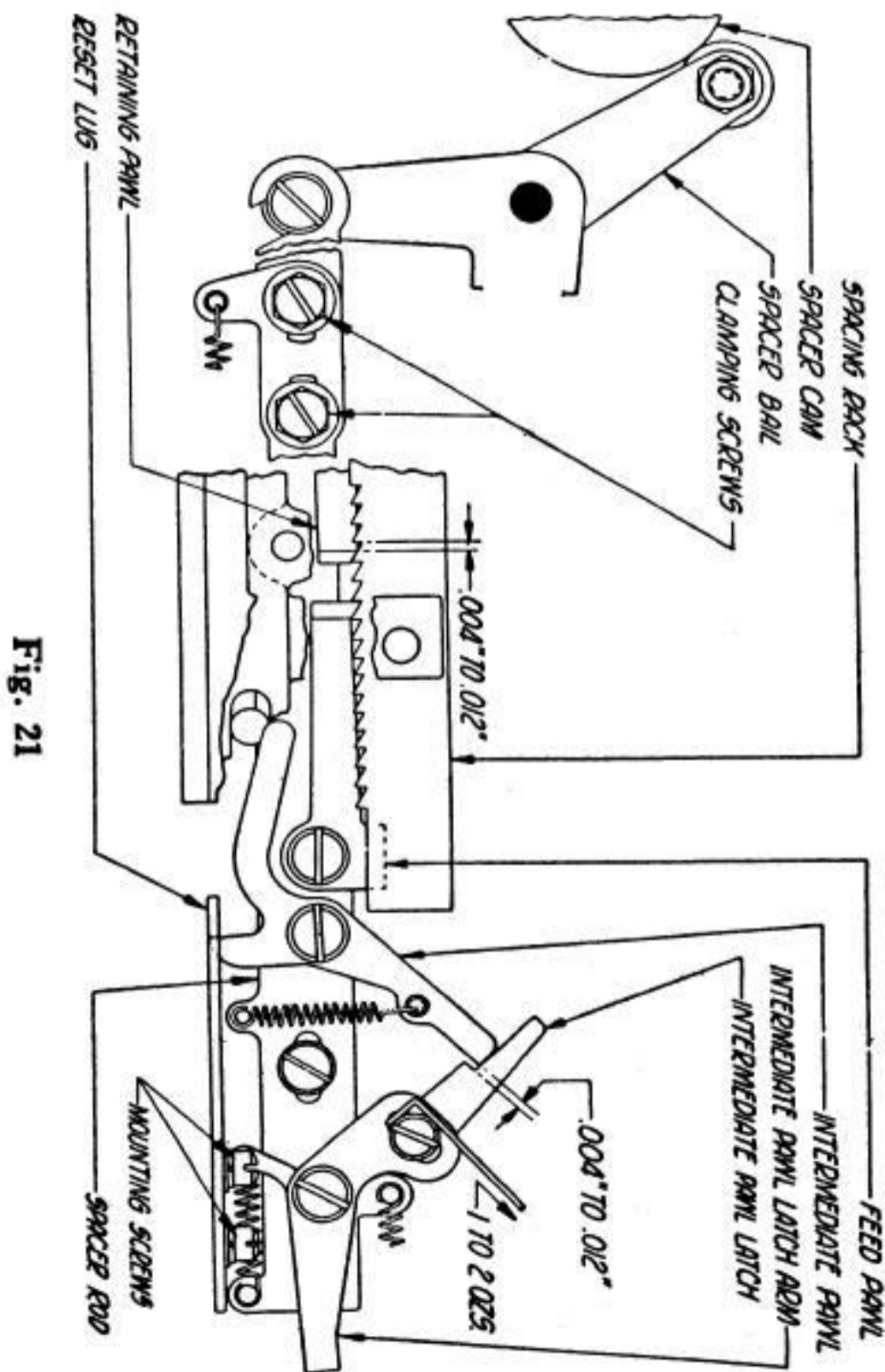


Fig. 21

- (1) To adjust, vary the length of the spacer rod by means of its two clamping screws to meet this requirement.

Fig. 21

2.44 **Reset Lug**

- (a) The intermediate pawl should overtravel the latching surface of its latch, by Min .004", Max .012" when the spacer-bail camroller is on a high part of its cam. Check for this clearance on the other high part of the cam. When the perforator has the improved spacer-rod mechanism, the overtravel should be Min .004", Max .020".

- (1) To adjust, position the reset lug by means of its elongated mounting holes to obtain this requirement.

Fig. 21

2.45 **Eccentric Screw:** (Applies only when the perforator has the improved spacer-rod mechanism.)

- (a) There should be a clearance of Min .020", Max .050" between the feed pawl and the spacing rack and a clearance of Min .020", Max .060" between the feed pawl and the intermediate pawl.

- (1) To adjust, position the eccentric screw.

2.46 **Spacebar Stop**

- (a) For perforators equipped with the spacebar having square-bar stiffeners (new style), there should be Min .015", Max .025" clearance between the spacebar and the stop screws when the spacebar is held down by depressing the SPACE keylever near the keylever guide.

- (1) To adjust, position the spacebar stop screws.

- (b) For perforators equipped with spacebar loops having flat-wire stiffeners (old style), the main clutch should trip when a .035" gauge is held between the left stop-screw and the spacebar when the pressure to operate the spacebar is applied directly above the left stop-screw. The main clutch should fail to trip when a .045" gauge is used. Check the right end of the spacebar for the same requirement with pressure applied above the right stop-screw.

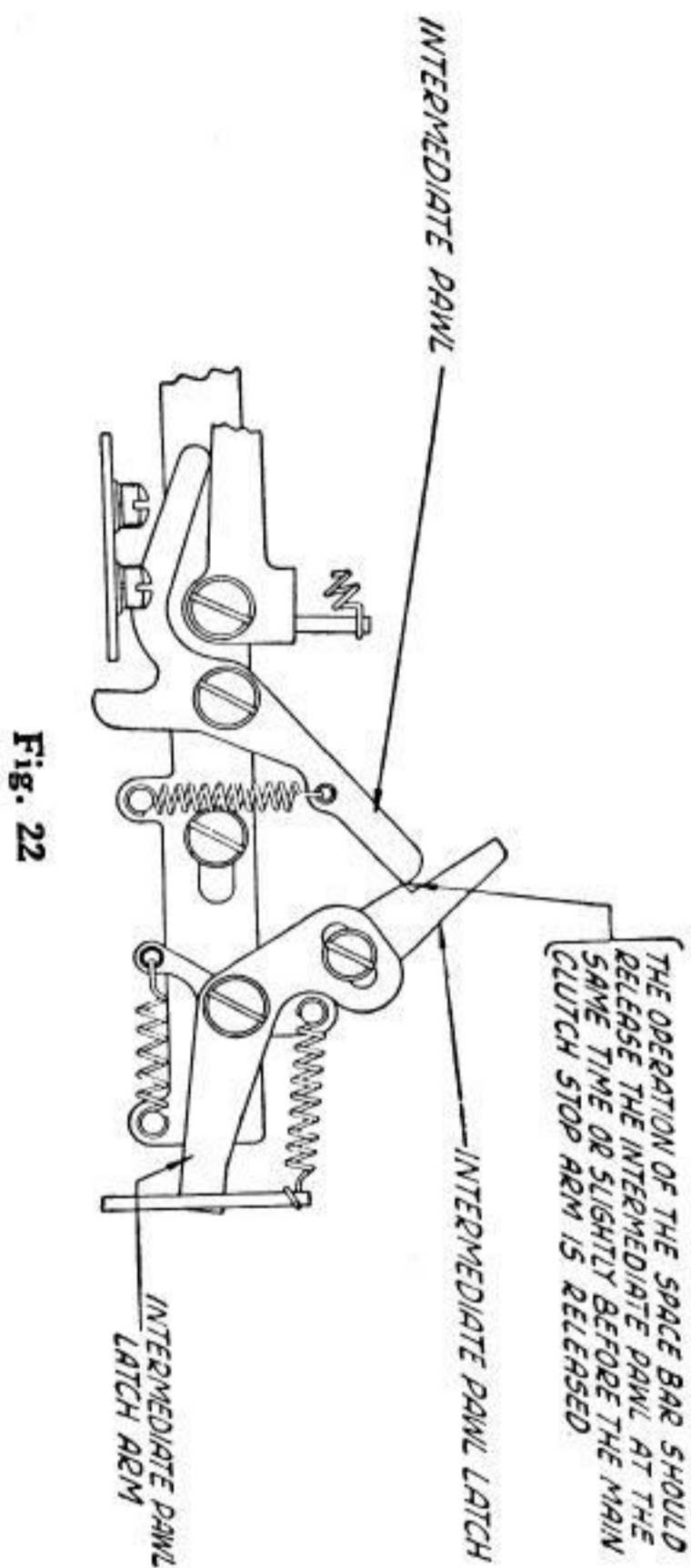


Fig. 22

- (1) To adjust, position the stop screws to meet these requirements and tighten the locknuts.

2.47 Intermediate-Pawl Latch

- (a) With the operating camsleeve in its stop position, depress the spacebar slowly. The intermediate pawl should release at the same time or slightly before the main-clutch stop-lever is released.

- (1) To adjust, position the intermediate-pawl-latch arm by means of its elongated mounting hole. **Fig. 22**

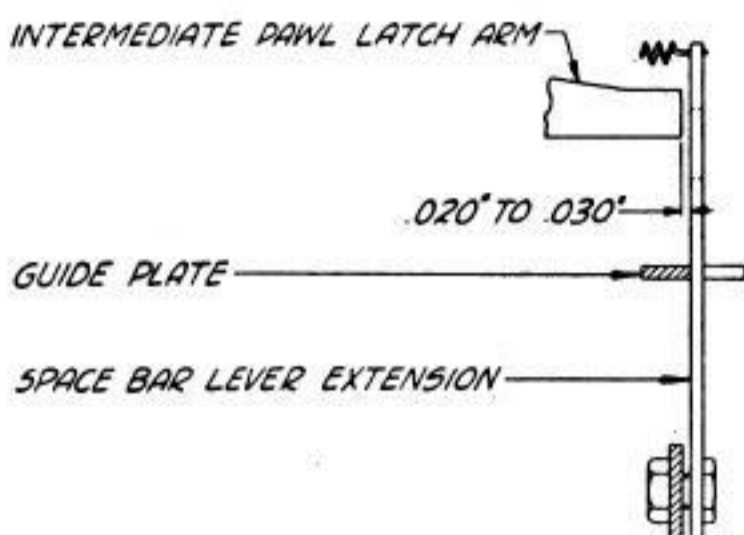


Fig. 23

2.48 Spacebar-Lever Extension Guide-Plate: There should be a clearance of Min .020", Max .030", as indicated in Fig. 23, between the end of the intermediate-pawl-latch arm and the spacebar-lever extension when the spacebar is held depressed to its stops and the motor handwheel rotated until the spacer-bail roller rides on a high part of its cam. Check the other high part of the cam for the same clearance.

- (1) To adjust, position the guide plate by means of its elongated mounting holes. Recheck Paragraph 2.47.

Fig. 23

2.49 Spacebar-Lever Extension Spring: With the operating camsleeve in its stop position, hook a scale over the upper end of the spacebar-lever extension at the point where the spring is hooked, and pull in line with the spring. It should require Min 1/2 oz, Max 1-1/2 oz to start the extension moving.

2.50 Intermediate-Pawl-Latch Spring: With the intermediate pawl out of engagement with the notch in the intermediate-pawl latch, hook a scale over the head of the intermediate-pawl-latch clamping screw, and pull at right angles to the pawl latch. A pull of Min 1 oz, Max 2 oz, as indicated in Fig. 21 should be required to start the latch moving. When the perforator has the improved spacer rod mechanism, the required pull should be Min 3 oz, Max 5 oz.

Fig. 21

2.51 Intermediate-Pawl Spring: With the spacer-bail cam-roller on the high part of its cam and with the feed pawl and intermediate-pawl latch held away from the intermediate pawl, hook a scale over the latching end of the interme-

mediate pawl, and pull at right angles to the pawl. A pull of Min 1-1/2 oz, Max 2-1/2 oz, as indicated in Fig. 24, should be required to start the pawl moving. When the perforator has the improved spacer-rod mechanism the pull should be Min 3 oz, Max 5 oz.

Fig. 24

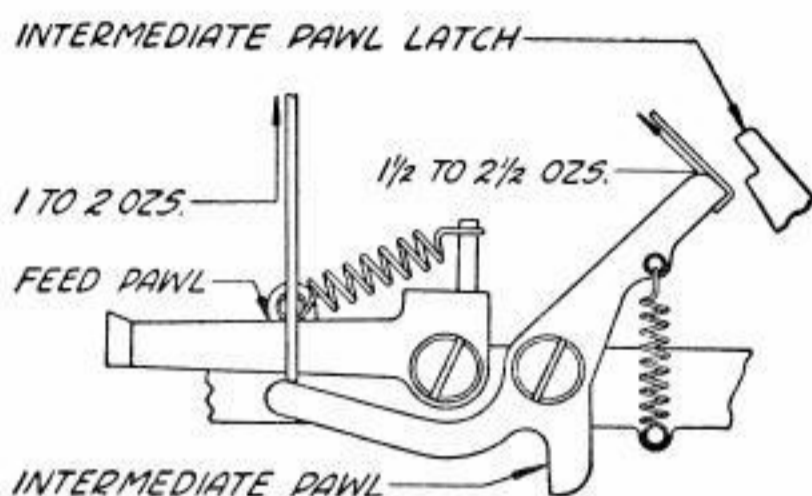


Fig. 24

2.52 Justification-Pointers Feed-Pawl Spring: With the operating camsleeve in its stop position and the intermediate pawl in its latched position, hook a scale in the feed-pawl spring hole, just below the spring, and pull horizontally toward the right. It should require Min 1 oz, Max 3 oz, as indicated in Fig. 20, to start the feed pawl moving. **Fig. 20**

2.53 Spacer-Rod Spring: With the operating camsleeve in its stop position, hook a scale over the spacer-bail cam-roller mounting-screw nut, and pull at right angles to the bail. It should require Min 12 oz, Max 20 oz to start the roller moving away from the cam.

2.54 Counting-Pointer Clutch Spring:

(a) Remove the motor handwheel, if necessary, and move the counting pointer to the right end of the scale. With the push end of a scale applied to the rear of the counting-clutch release lever, just above the adjusting screw locknut, a push of Min 6 lb, Max 8 lb, as indicated in Fig. 25, should be required to release the pointer.

(1) To adjust, hold the rear collar with a wrench and loosen the locknut on the pointer release-plunger. Then apply a wrench to the flats at the rear of the plunger. To increase the tension, rotate the plunger clockwise; to decrease the tension, rotate the plunger counterclockwise (as viewed from the front of the perforator). Tighten the locknut.

Fig. 25

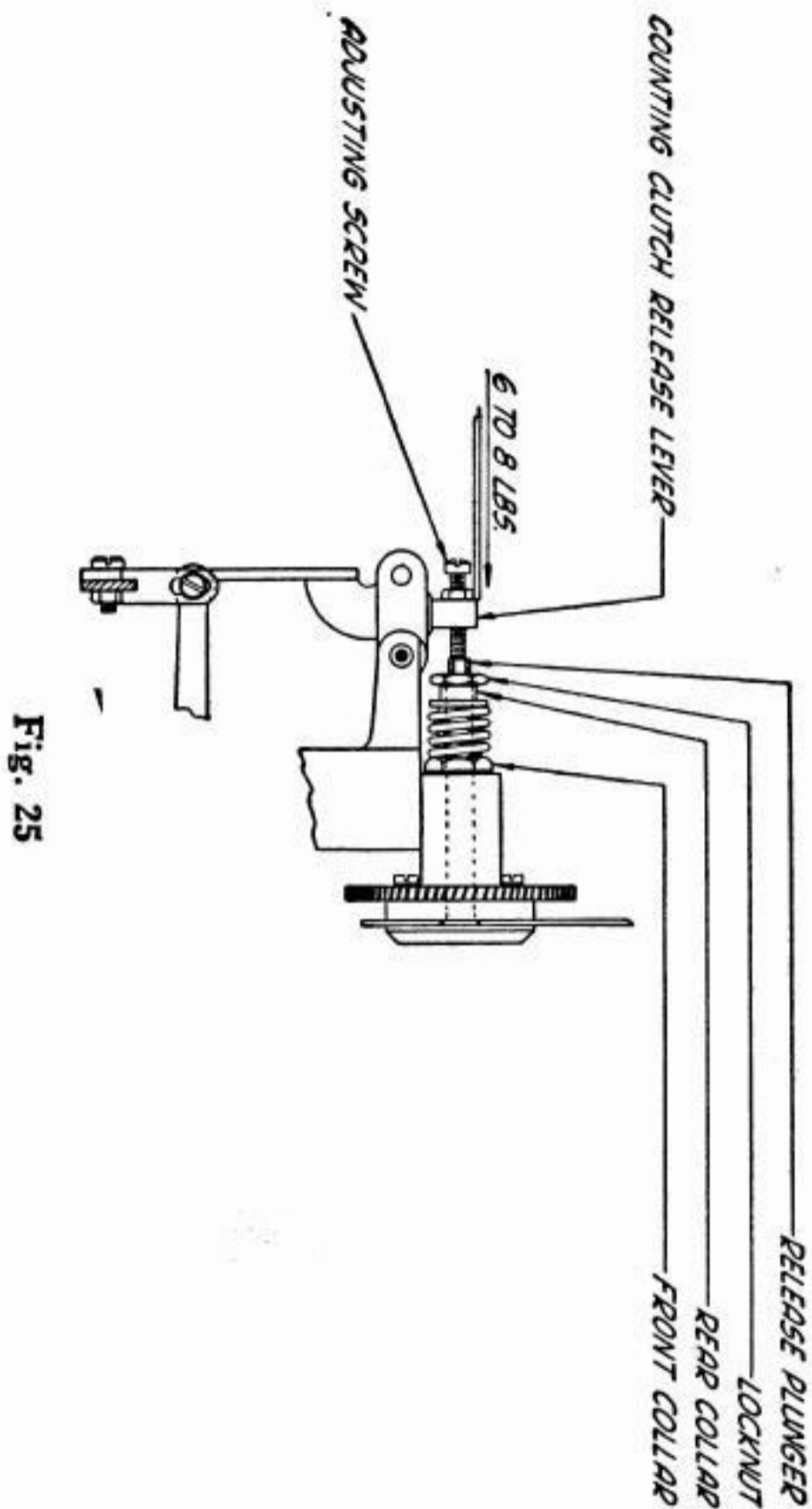


Fig. 25

2.55 Counting-Pointer-Clutch Release: With the counting-clutch release-lever adjusting screw backed off and the return-bail roller on the high part of its cam, move the counting pointer to its extreme right position, and turn in the adjusting screw until the pointer is released, allowing it to return to its starting position. Advance the screw one-quarter of a turn, and tighten the locknut.

Fig. 25

2.56 **Counting-Pointer Return-Spring-Arm Position:** With the counting pointer against its right-hand stop, the length of the counting-pointer return cord should be such that the spring arm is Min $1/16''$, Max $3/16''$ from the spring post.

2.57 **Counting-Pointer Return Spring:** With the counting pointer approximately in the center of the scale, apply the push end of a scale at right angles to the upper end of the counting-pointer spring arm. It should require Min 3 oz, Max 5 oz to start the arm moving.

2.58 **Justification-Pointers Return Spring:** With the justification pointers in their stop positions, unhook the upper ends of the justification-pointers return springs. Hook a scale in each spring eye. It should require Min $2-1/2$ oz, Max $4-1/2$ oz to pull each spring to position length (the point opposite where the springs were hooked).

2.59 **Signal-Lamp Contacts**

CAUTION: Disconnect the perforator power plug before making these adjustments.

(a) The line on the left-hand justification-pointer cam should be in the center of its roller.

(1) To adjust, position the cam by means of its clamping screw.

(b) With the push end of a scale applied to the lower-contact spring, near the contact point, it should require a push of Min 3 oz, Max 4 oz, as indicated in Fig. 26, to start the spring moving away from its stiffener.

(1) To adjust, remove the spring from the contact assembly, and bend. **Fig. 26**

(c) There should be a clearance of Min $.015''$, Max $.025''$, as indicated in Fig. 26 between the contact points of the upper and lower contact springs when the contacts-operating lever clears the bakelite tip on the upper contact spring.

(1) To adjust, bend the upper contact spring. **Fig. 26**

(d) With the left and right pivot-adjusting blocks approximately in the centers of their adjustments, and the justification pointers advanced five spaces, position the contacts bracket so that when the counting pointer is moved from the left to the right, the lamp will light when the counting pointer is approximately four scale divisions to the left of the justification pointer. **Connect the perforator power plug.** **Fig. 26**

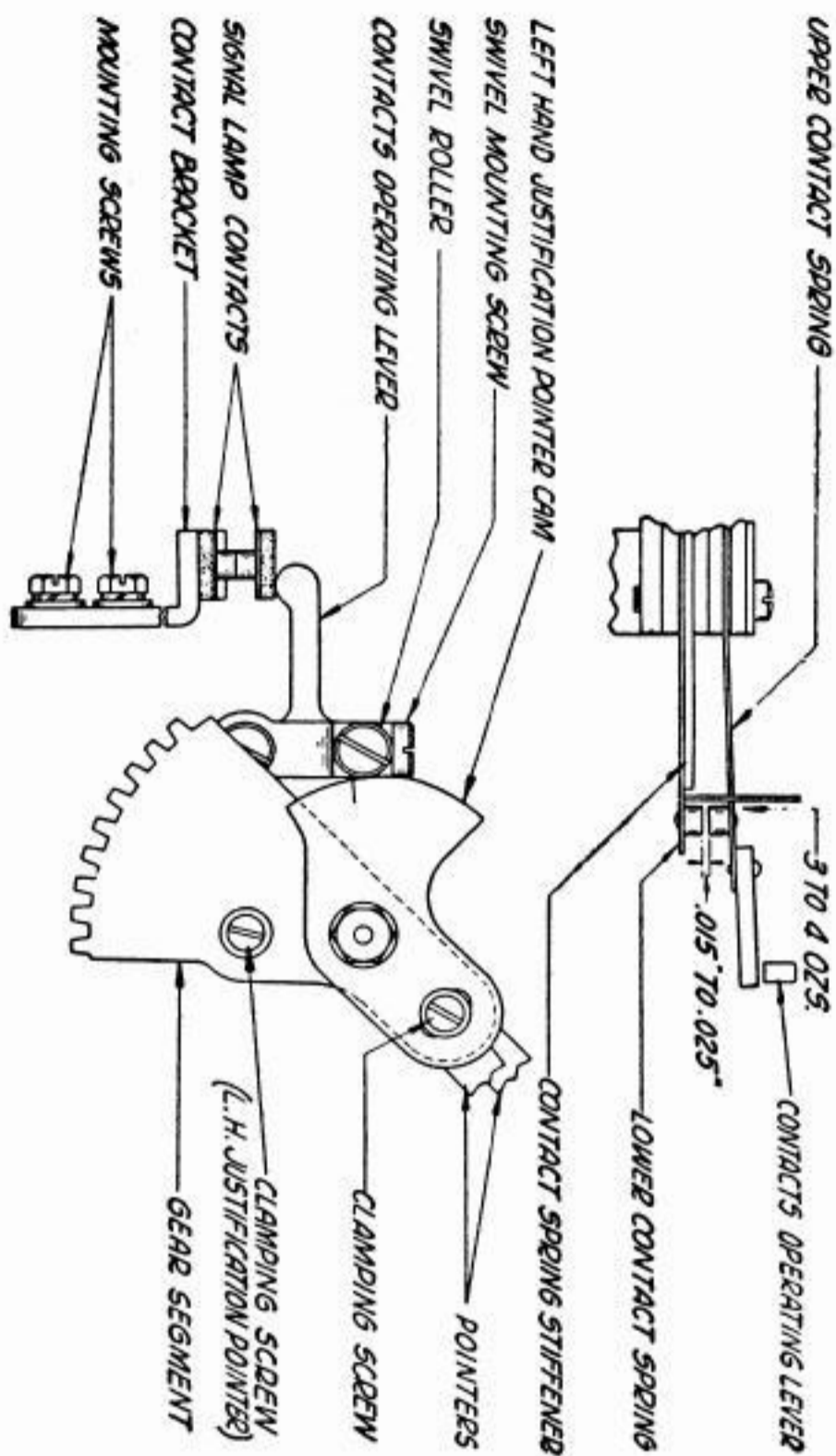


Fig. 26

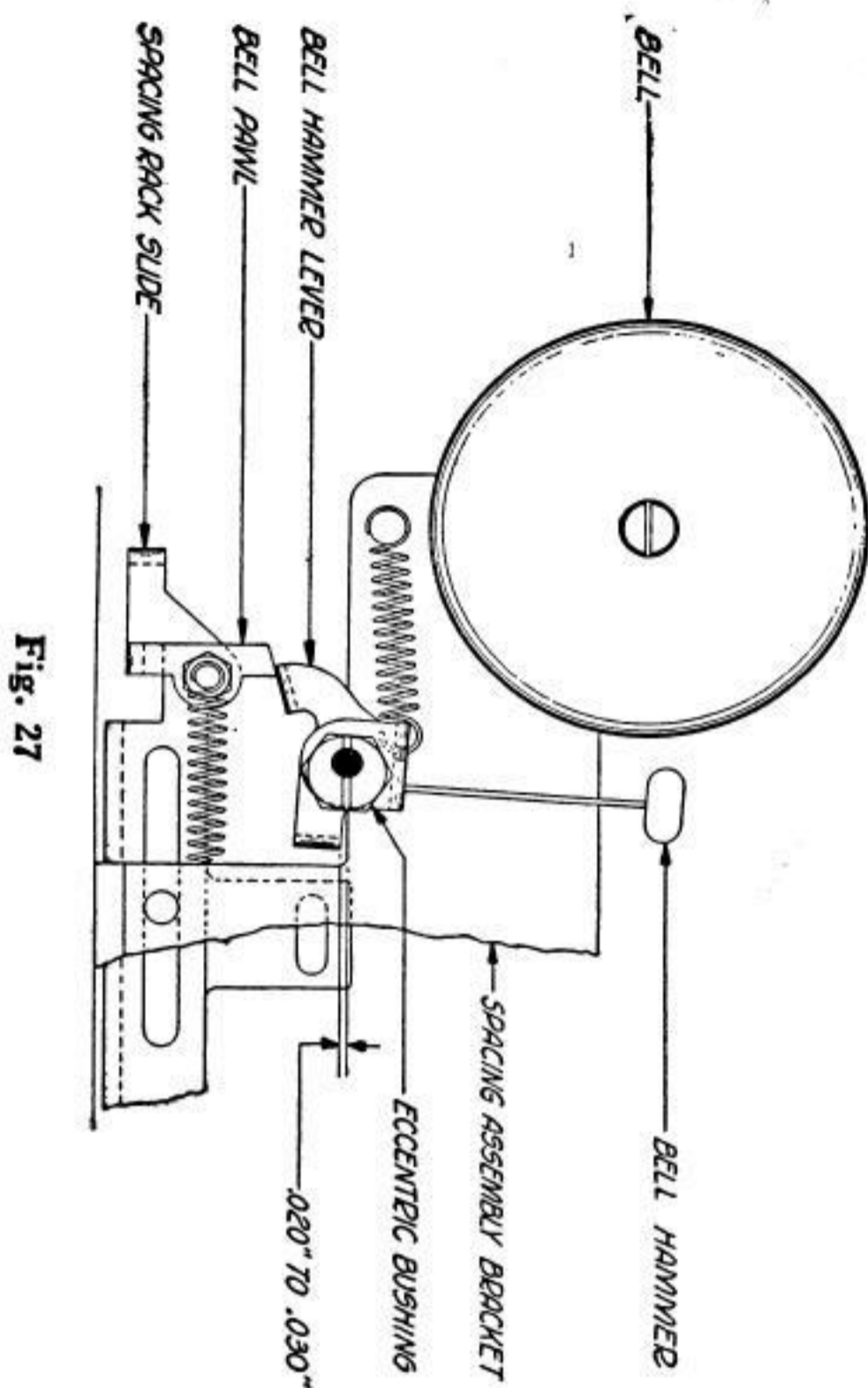


Fig. 27

2.60 **Signal-Lamp Contact-Lever Spring:** Set the justification pointers in their returned positions and the counting pointer opposite scale division 30. With a scale hooked in the signal-lamp contact-lever spring hole, pull vertically upward. It should require a pull of Min 2 oz, Max 6 oz to start the lever moving.

2.61 **Bell-Hammer-Lever Eccentric:** With the justification pointers advanced eight spaces, there should be a clearance of Min .020", Max .030", as indicated in Fig. 27, between the upper right-end of the bell-hammer lever and the lower edge of the spacing-assembly bracket.

- (1) To adjust, position the eccentric bushing by means of its mounting screw. The high part of the eccentric bushing should be towards the right.

Fig. 27

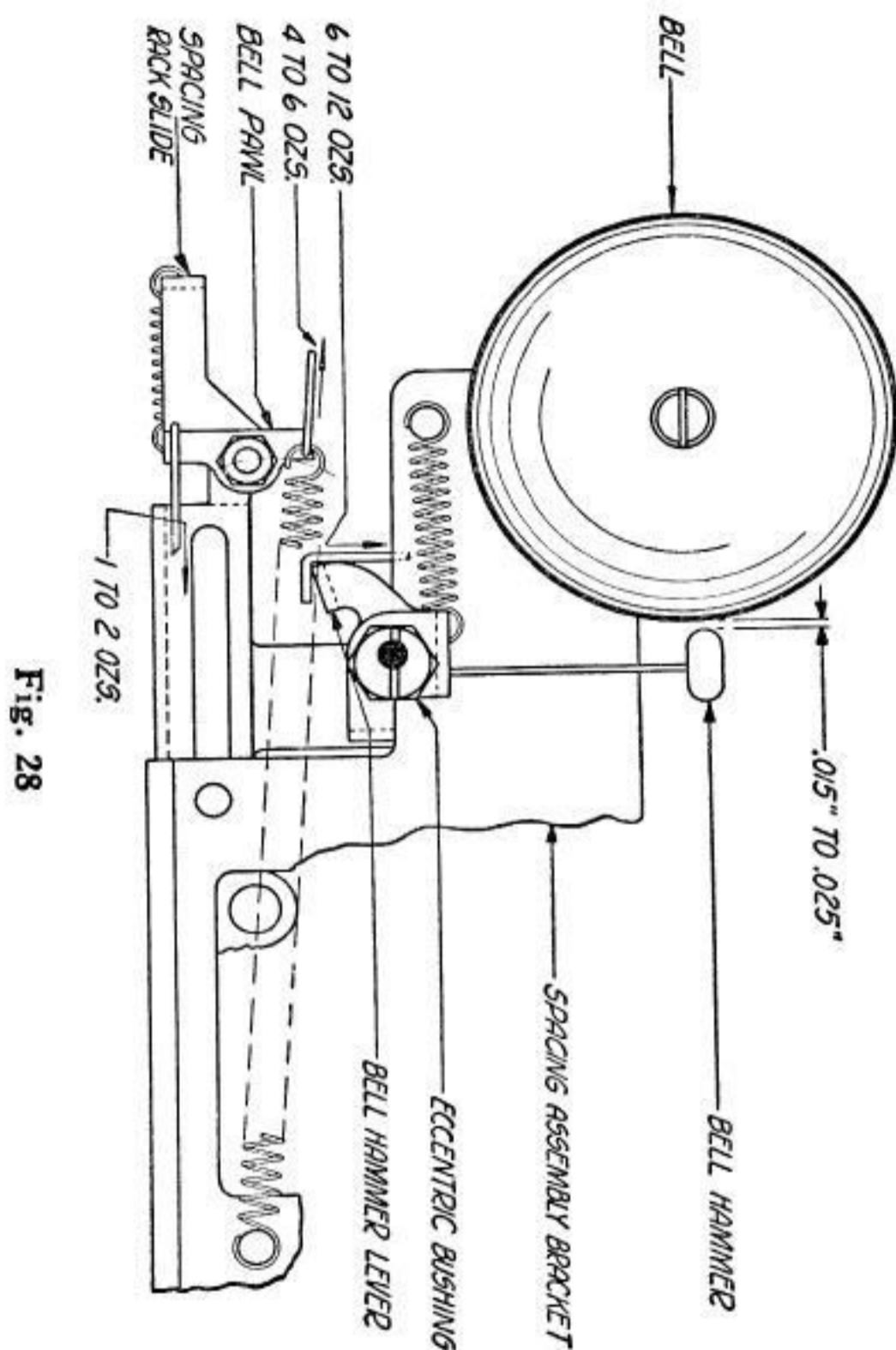


Fig. 28

2.62 Bell Hammer

- (a) With the right end of the bell-hammer lever against the lower edge of the bracket, there should be a clearance of Min .015", Max .025", as indicated in Fig. 28, between the bell and the hammer.

- (1) To adjust, bend the hammer wire.

Fig. 28

2.63 **Bell-Hammer-Lever Spring:** With the right end of the bell-hammer lever against the lower edge of the bracket, hook a scale under the left end of the lever and pull up vertically. It should require a pull of Min 6 oz, Max 12 oz, as indicated in Fig. 28, to start the lever moving. **Fig. 28**

2.64 **Spacing-Rack-Slide Return Spring:** With the spacing-rack slide in its stop position, unhook the return spring and hook a scale in the spring eye. It should require a pull, as indicated in Fig. 28, to pull the spring to position length. Replace the spring. **Fig. 28**

2.65 **Bell-Pawl Spring:** Hook a scale over the lower end of the bell pawl and pull horizontally to the right. It should require a pull, as indicated in Fig. 28, to start the pawl moving. **Fig. 28**

2.66 **Pivot-Adjusting-Block Screws Friction**

(a) With the pivot-adjusting blocks near the centers of their screws, hook a scale over the hexagonal nut setscrew and pull at right angles to the setscrew. It should require a pull of Min 20 oz, Max 30 oz, as indicated in Fig. 29, to start the adjusting screw turning.

(1) To adjust the friction of each pivot-adjusting-block screw, loosen the hexagonal nut setscrew and position the nut. Tighten the setscrew. **Fig. 29**

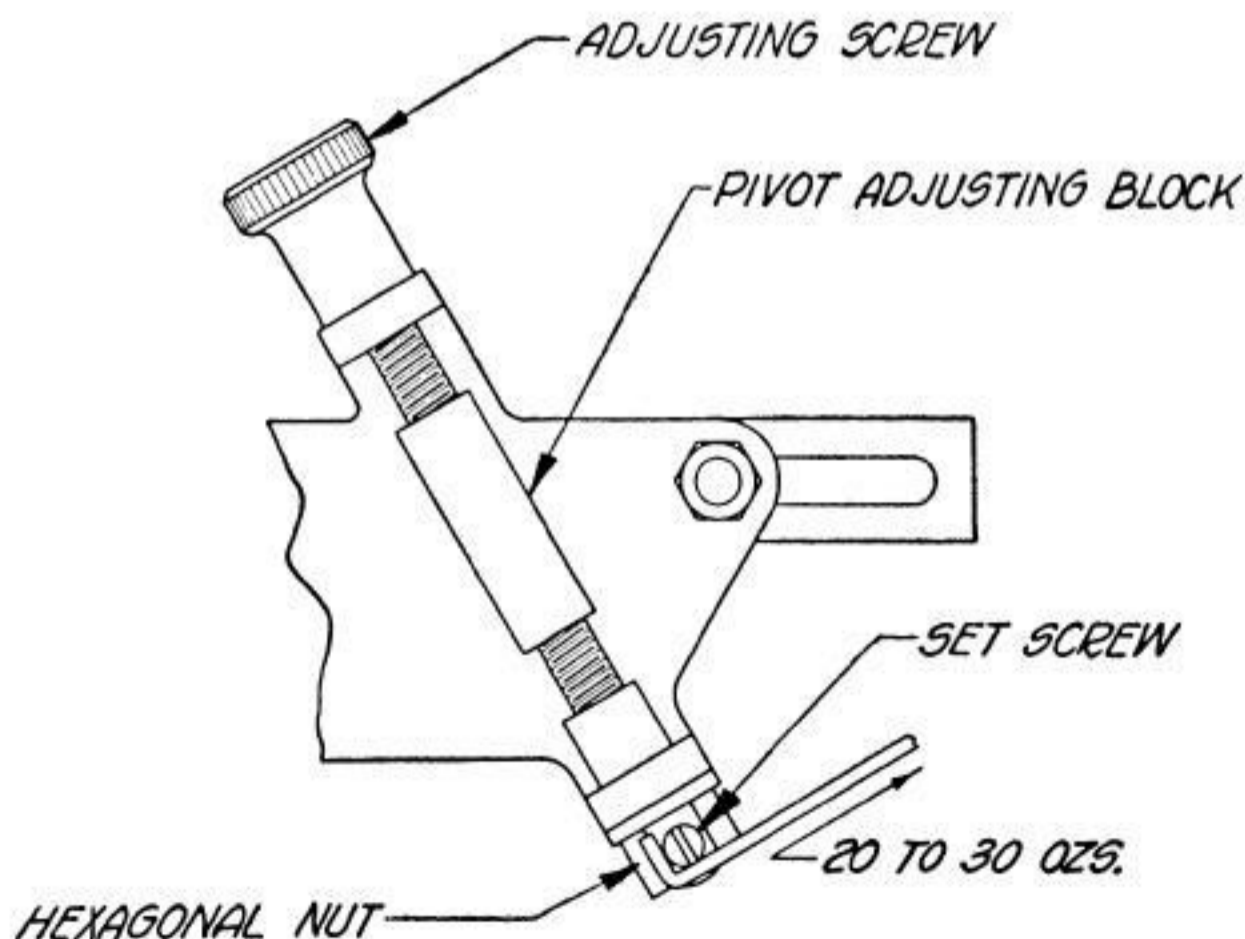
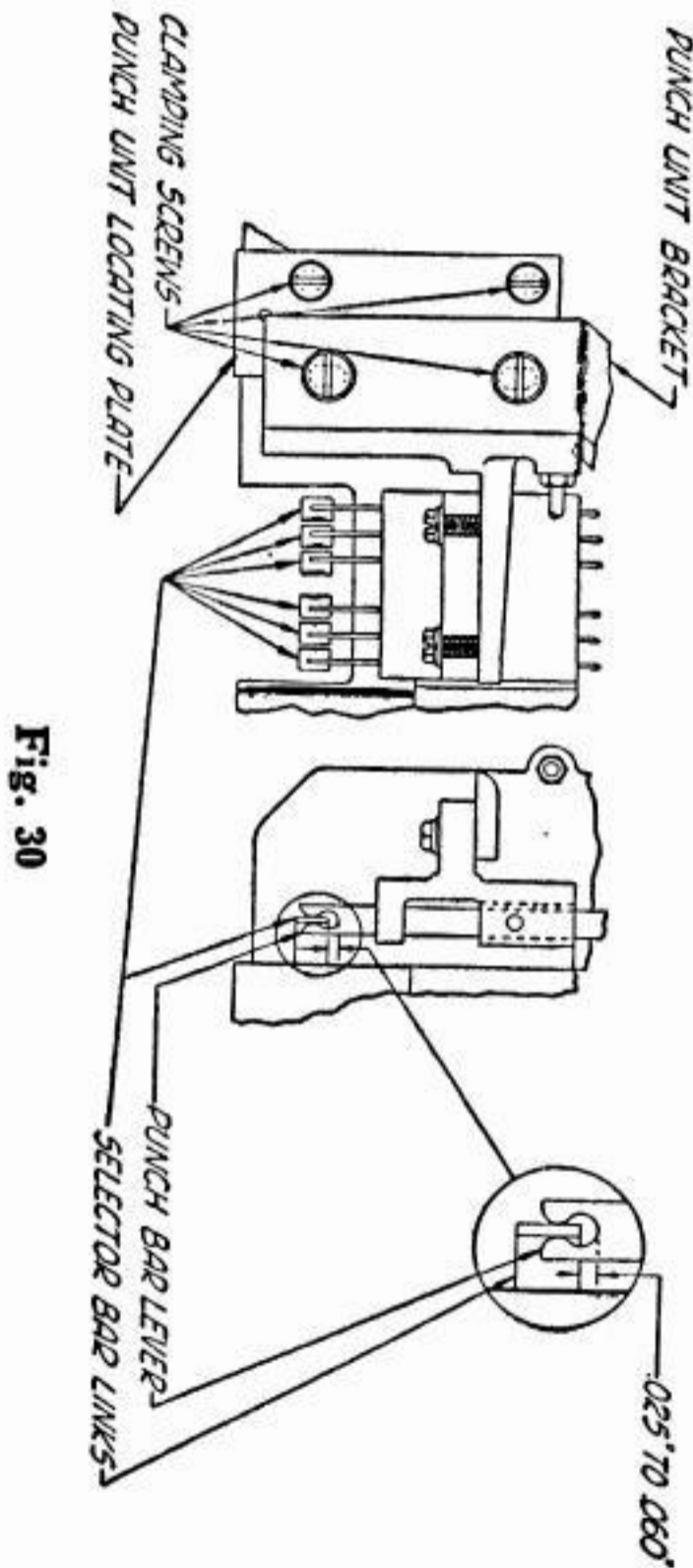


Fig. 29

2.67 Shift-Indicating Semaphore

(a) The semaphore should show all red when the shift bail is in the shifted position, and all white when in the unshifted position.

(1) To adjust, position the semaphore connecting-link by means of its elongated mounting hole to obtain this requirement.



2.68 Punch Unit

(a) There should be a clearance of Min .025", Max .060", as indicated in Fig. 30, between the upper edges of the front and rear selector links and the tops of the slots in their respective punchbar levers; also the punch-hammer operating-lever roller should ride fully on its cam.

(1) To adjust, loosen the locating plate mounting screws and position the punch-unit bracket by means of its elongated mounting holes. Then position the punch-unit locating plate securely against the punch-unit bracket and tighten the clamping screws. **Fig. 30**

Note: When mounting the punch-unit, see that the clearance between the front selector-link and the punchbar lever is approximately equal (within 1/64") to the clearance between the rear selector-link and its punchbar lever.

2.69 Punchbar-Levers Bearing Bracket

(a) With the motor running and tape in the perforator, hold the R, Y, and 5 keylevers depressed (with three fingers of the right hand) in such a manner that the three keylevers lock each other (this may be checked by observing that the right or left edges of the six punchbar levers are aligned). Then, trip the main clutch by manually lifting the left end of the stoplever latch. At least one and not more than two code perforations should be punched in the tape on each side of the feed hole.

(1) To adjust, position the punchbar-levers bearing bracket by means of its slotted mounting holes.

Fig. 31

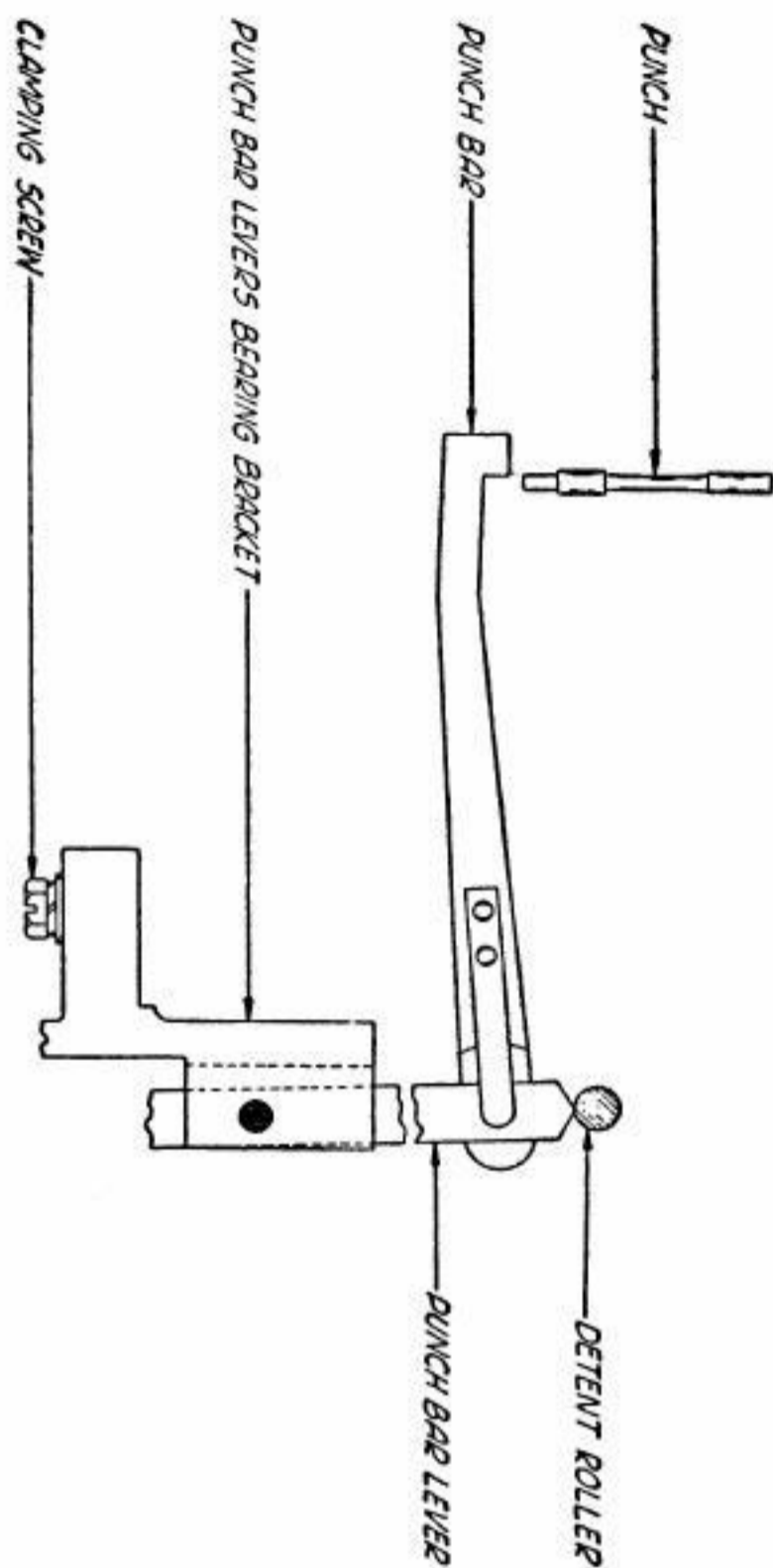


Fig. 31

2.70 Punch-Hammer Pivot Screws

(a) With the punch hammer in its lower (unoperated) position, the punchbars should line up under their respective punches when viewed from the left end of the perforator. The punch hammer should also have some endplay, not more than .004".

- (1) To adjust, position the punch hammer by means of its pivot screws.

2.71 Punch-Hammer Operating Lever

(a) With the perforator connected to the proper power supply and with the punch-control lever in the ON position (to the left), the punch-hammer operating-lever adjustable plunger should be adjusted so that all the punches are driven through the tape with the proper operating margin.

(1) To adjust, with the punch-hammer stop screw backed off, place a piece of tape in the die. Operate the Rubout keylever (with the motor running) and then back off the punch-hammer operating-lever adjustable plunger until there is a failure of perforations in the tape. Continue to operate the Rubout keylever and adjust the operating-lever plunger until all the holes are just punched clean in the tape; then advance the plunger an additional one-quarter turn and tighten the locknut. Adjust the punch-hammer stop screw as per Paragraph 2.72.

2.72 Punch-Hammer Stop Screw

(a) With the operating camsleeve in the stop position and the punch-control lever in the ON (to the left) position there should be some clearance, not more than .006", as indicated in Fig. 34, between the punch-hammer stop screw and the punch hammer.

(1) To adjust, position the punch-hammer stop screw. In order to facilitate the tightening of the stop screw locknut, put the punch-control lever in the OFF (to the right) position and remove the punch-hammer operating-lever adjustable plunger. **Fig. 36**

2.73 Punchbar-Lever Detent

(a) The front edge of the punchbar-lever detent bracket should be Min 3/16", Max 1/4" from the front edge of the first punchbar lever, and the detent bracket should have some endplay, not more than .020".

(1) To adjust, position the bracket by means of the punchbar-lever detent-bracket pivot screws.

2.74 Punchbar-Lever Detent Spring: Hold the RUBOUT key fully depressed and hook a scale under the center of the detent roller and pull vertically upward. It should require Min 3/4 oz, Max 1-3/4 oz to start the detent moving.

2.75 Punch-Control-Bail Spring: With the punch-control lever in the OFF (to the right) position, unhook the punch-control-bail spring and hook a scale in the spring eye. It should require Min 4 oz, Max 8 oz to pull the spring to position length.

2.76 Backspace-Cam Spring: With the stud on the tape-feed pawl held away from the backspace cam, hook a scale over the end of the backspace-cam arm at the spring hole, and pull toward the left in line with the spring. It should require Min 3 oz, Max 5 oz to start the cam moving.

2.77 Backspace-Pawl Spring: Hook a scale on the backspace pawl, at the spring hole, and pull upward. It should require Min 1 oz, Max 1-1/2 oz to start the pawl moving away from its stop.

2.78 Tape-Feed-Roll Bearing Plate

(a) With the feed pawl, tape-tension lever, and the feed-roll detent lever held away from the feed roll, the feed roll should rotate freely.

(1) To adjust, position the feed-roll bearing plate by means of its mounting holes.

2.79 Tape-Stripper Plate

(a) There should be some clearance, not more than .010", between the upper edge of the tape-stripper plate and the feed roll.

(1) Gauge through one complete revolution of the feed roll.

(2) To adjust, position the tape-stripper plate by means of its elongated mounting holes.

2.80 Tape-Feed-Roll Detent (Preliminary Adjustment)

(a) With the punch-hammer operating-lever roller on a high part of its cam, insert the feed-roll position gauge (TP84067) into the punch block so that the projection on the gauge stops against the punch-block feed pin.

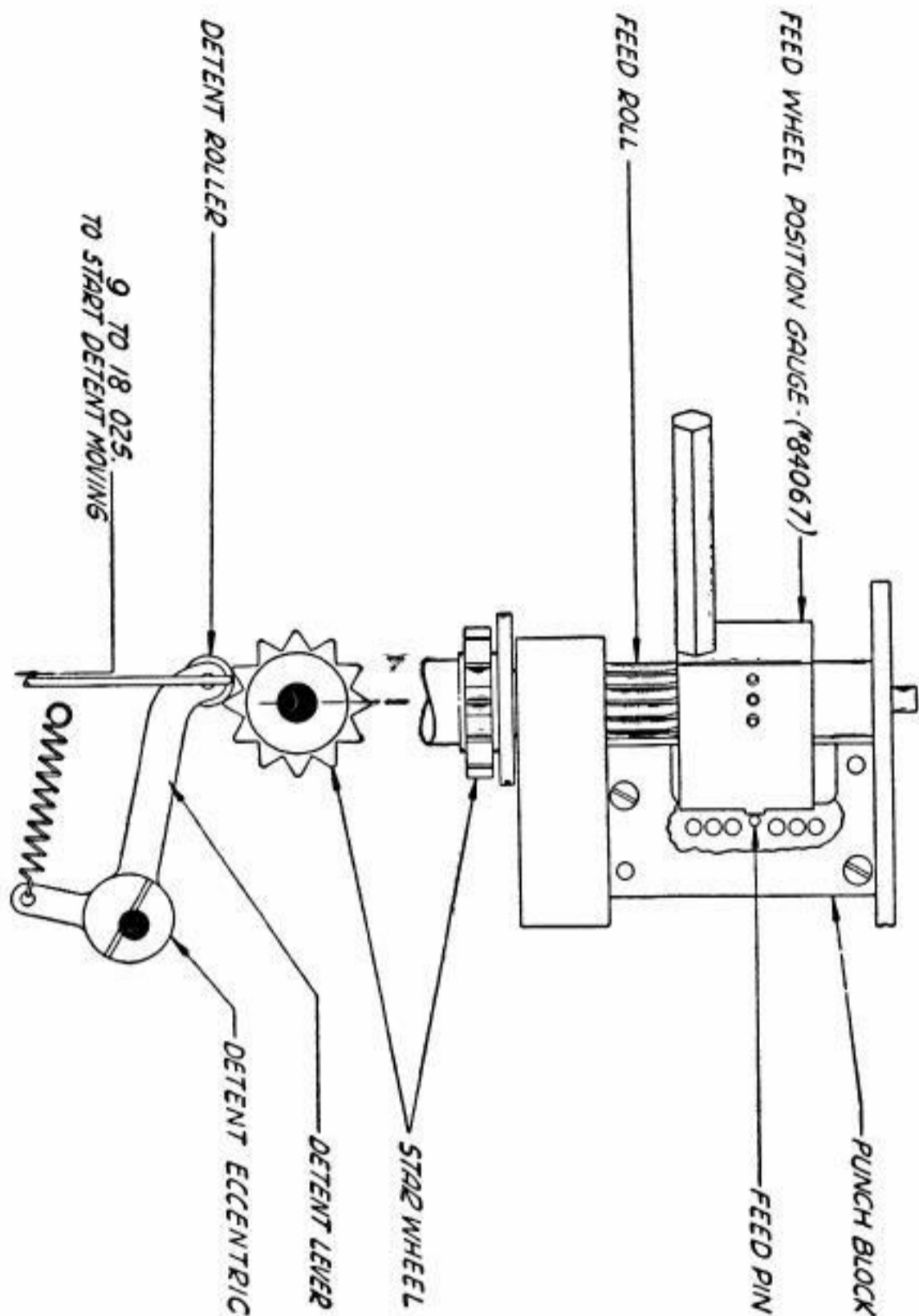


Fig. 32

(1) To adjust, position the feed roll by means of the feed-roll detent eccentric, using the lower semi-circle of its adjustment only, so that a pin of the feed roll will line up with the center hole on the gauge.

Note: The adjustment of the feed-roll detent and the feed pawl are interrelated. It is necessary that the following Tape-Feed-Pawl adjustment be made before the Tape-Feed-Roll Detent (Final Adjustment) is made.

Fig. 32

2.81 Tape-Feed Pawl

(a) The feed pawl should engage a tooth on the feed-roll ratchet without overtravel when the main shaft is rotated until the selected punchbars just touch the ends of the punches.

- (1) To adjust, position the feed-pawl eccentric by means of its mounting screw. **Fig. 35**

2.82 **Tape-Feed-Roll Detent (Final Adjustment):** If necessary refine the tape-feed-roll detent adjustment so that the perforations in the tape meet the standard spacing of ten holes to the inch. This may be checked by perforating a length of tape consisting of a series of nine BLANKS (TAPE key) followed by a RUBOUT, and checking it against the tape gauge (TP2215). **Fig. 33**

Note: If this adjustment is changed, recheck 2.81.

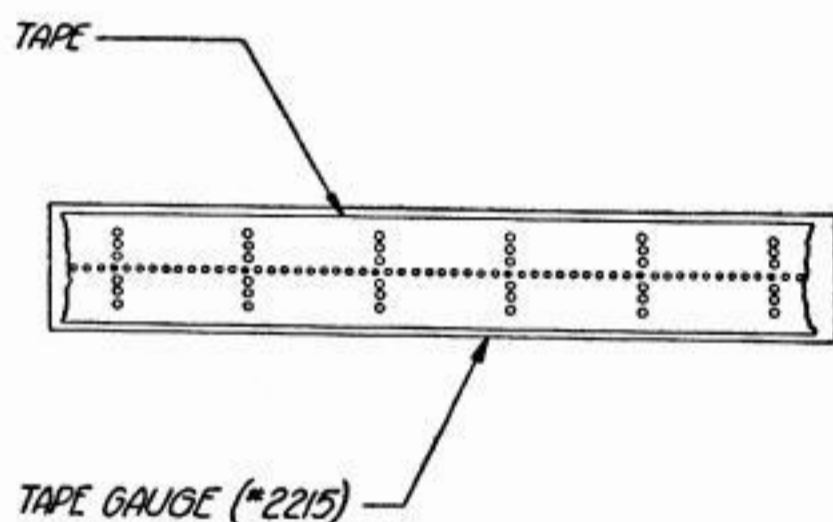


Fig. 33

2.83 Tape-Tension-Lever Spring

(a) Hook a scale over the end of the slotted extension of the tape-tension lever and pull at right angles to the lever. It should require Min 5 oz, Max 5-1/2 oz, as indicated in Fig. 36, to start the lever moving away from the tape-feed roll.

- (1) To adjust, loosen the tape-tension-lever shaft lock-nut, and turn the spring by rotating the tape-tension-lever shaft (clockwise to increase and counter-clockwise to decrease the tension). **Fig. 34**

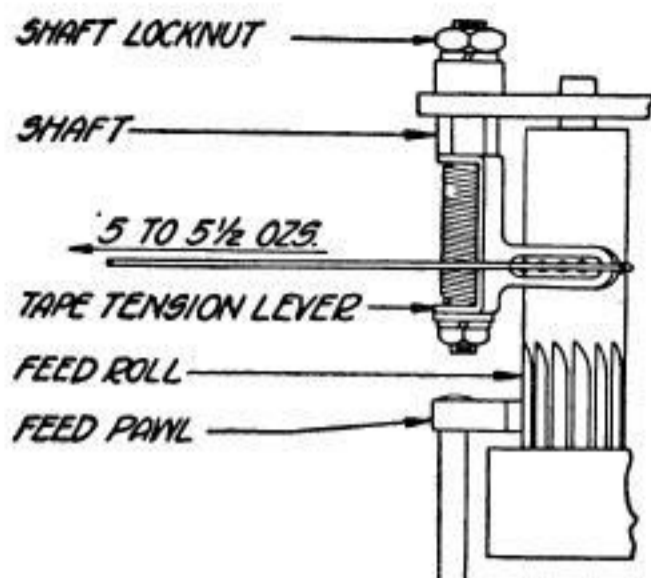


Fig. 34

2.84 **Tape-Feed-Pawl Spring:** Hook a scale over the stud on the feed pawl and pull horizontally. It should require a pull of Min 1-1/2 oz, Max 3 oz, as indicated in Fig. 35, to start the pawl moving.

Fig. 35

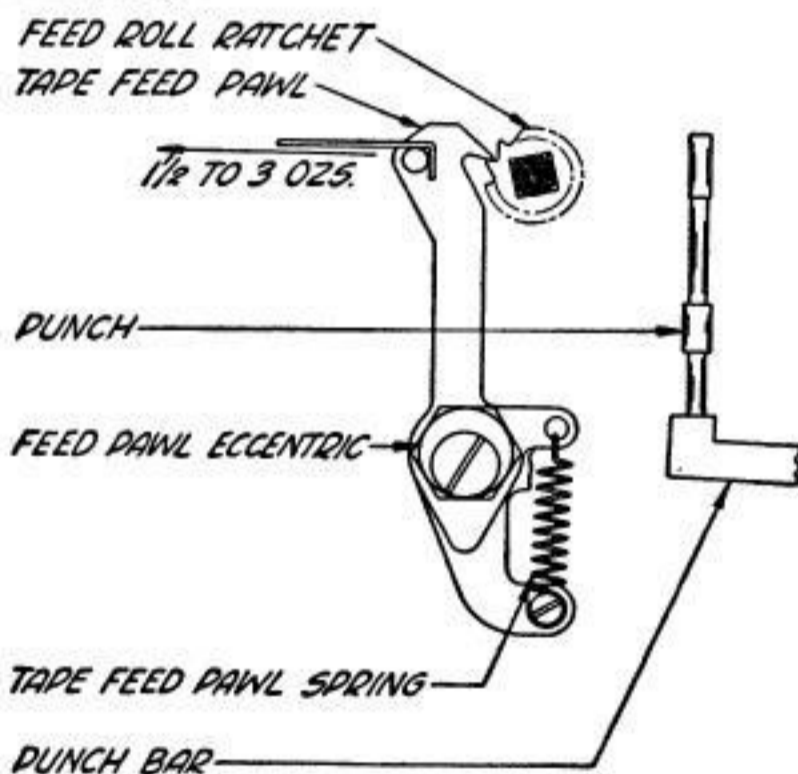


Fig. 35

2.85 **Tape-Feed-Roll Detent-Lever Spring:** Hook a scale over the detent lever at the center of the detent roller and pull vertically downward. It should require Min 9 oz, Max 18 oz, as indicated in Fig. 32, to start the roller moving away from the star wheel.

Fig. 32

2.86 **Operating Camsleeve Friction Clutch**

CAUTION: While checking this requirement, hold down the left end of the stoplever latch to prevent engaging of the clutch-jaw teeth, which might result in injury to the fingers.

(a) With the motor running and the clutch disengaged, hook a scale under the stop-lug that is engaging the stoplever. It should require Min 24 oz, Max 32 oz to just move the clutch backward from the stop position.

- (1) To adjust, position the adjusting nut and then tighten the capstan locknut. **Fig. 5**

2.87 Punch-Hammer Spring: With the operating camsleeve in the stop position, hook a scale on the stud on the feed pawl and pull upward (slightly to the left). It should require a pull of Min 4 lb, Max 7 lb, as indicated in Fig. 36, to start the punch hammer moving. **Fig. 36**

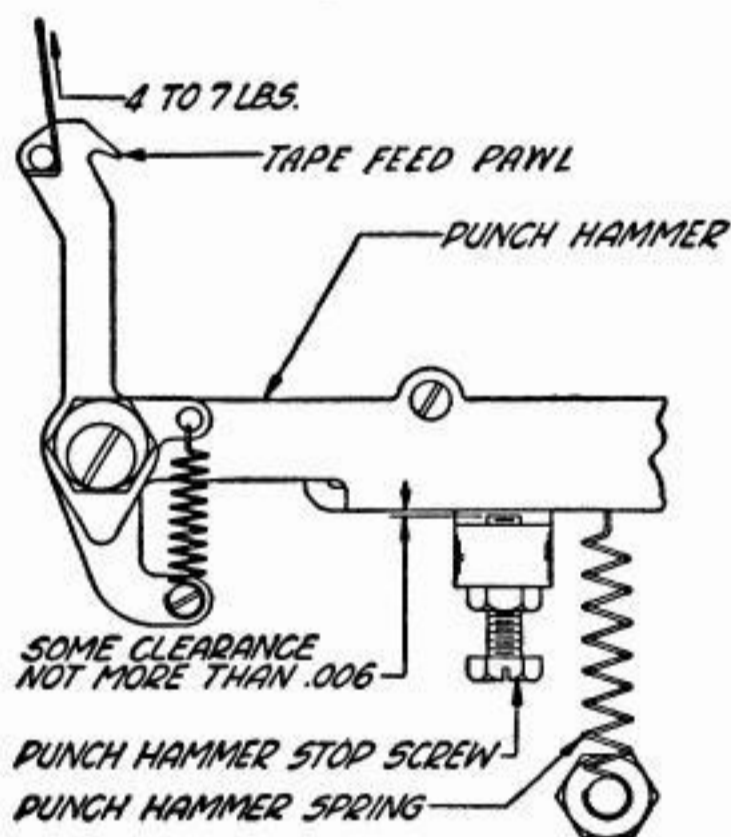


Fig. 36

2.88 Tape Guide

(a) The tape guide should be parallel to the top casting and as far to the right as possible.

- (1) To adjust, position the tape guide by means of its elongated mounting holes.

2.89 Tape-Tension Spring

(a) There should be some clearance, not more than .006", between the tape-tension spring and the plate over which the tape rides.

- (1) To adjust, position the tape-tension spring by means of its enlarged mounting hole.

Note: The vertical projection on the tape-tension spring should be at right angles to the top surface of the adjacent plate. Gauge by eye.

3. LUBRICATION

3.01 The following parts of the teletypesetter perforator should be lubricated according to the symbol indicated.

<u>Symbol</u>	<u>Meaning</u>
G	Grease
O	Oil (one or two drops)
OF	Oil Freely
SAT	Saturate
F	Fill With Oil

<u>Part</u>	<u>Lubrication</u>
(a) Punch Unit	
(1) Adjusting nut—at the punch hammer	O
(2) Backspace lever—in the guides	O
(3) Backspace pawl—at the shoulder screw	O
(4) Detent-bail bearings—two places	O
(5) Detent-bail roller	O
(6) Detent eccentric bushing	O
(7) Detent roller	O
(8) Feed-pawl eccentric bushing	O
(9) Feed-pawl release cam	O
(10) Feed-roll bearing	O
(11) Punch-block oil hole	O
(12) Punch-control bail pivots—two places	O
(13) Punch-control lever—pivots and joints	O
(14) Punch-hammer bearings—two places	O
(15) Punch-hammer lever shaft—two oil holes	O
(16) Punch joint bearings—two places	O
(17) Punch levers—all points of contact	O
(18) Tape-tension lever bearings—two places	O
(19) Vertical levers—all points of contact	O
(b) Counting Shaft Unit	
(1) Counter cross-shaft bearings—two places	O
(2) Code discs—all points of contact	O
(3) Friction-clutch washers	SAT
(4) Gear	G

<u>Part</u>	<u>Lubrication</u>
(5) Oil cup (at front of unit)	F
(6) Oil plug (at rear of shaft)	F
(7) Reset collar—all points of contact	O
(8) Reset-collar lever bearings—two places	O
(9) Shaft ball bearings—two places	O
(10) Stopblades—all points of contact	O
(11) Stop pins—all points of contact	O
(12) Stop-pin plungers	O
(13) Stop-pin rollers	O
(14) Stop-shaft worm and gear	G
(15) Transfer-bail bearings—two places	O
(16) T transfer levers—all points of contact	O
(17) Zero-cam bail bearings—two places	O
(18) Zero lever bearings—two places	O

(c) Main Shaft

(1) Ball bearings—two places	O
(2) Driven-clutch cam and follower	G
(3) Gears	G
(4) Nonrepeat latch—all points of contact	O
(5) Operating-clutch friction washers	SAT
(6) Operating-clutch sliding member	OF
(7) Plug (at rear of shaft)	F
(8) Punch hammer cam and roller	G
(9) REPEAT key bearing	O
(10) Return cam and roller	G
(11) Return-clutch sliding member	OF
(12) Return-clutch throwout-lever bearings—two places	O
(13) Spacer operating-cam and roller	G
(14) Stopblade reset cam and roller	G
(15) Stoplever bearings—two places	O
(16) Stoplever cam and roller	G
(17) Stoplever latch—all points of contact	O
(18) Transfer-bail cam and roller	G
(19) Tripoff plunger—at the guide	O
(20) Zero-set cam and follower	G

Part

Lubrication

(d) Adjustable Pointer Unit

(1) Adjusting collar—at prongs	O
(2) Bell-hammer eccentric bushing	O
(3) Bell pawl—at the stud	O
(4) Contact-lever bearings—two places	O
(5) Feed-pawl bearing	O
(6) Gears and worm	G
(7) Indicator scale guides	O
(8) Intermediate pawl—all points of contact	O
(9) Intermediate-pawl latch—all points of contact	O
(10) Justification pointers—all points of contact	O
(11) Left-pointer rack—all points of contact	O
(12) Pivot-adjusting blocks—at guides	O
(13) Pointer bracket—oil hole	O
(14) Release-lever bearings	O
(15) Retaining-pawl bearings	O
(16) Retaining-pawl release-lever bearings	O
(17) Return-actuating lever bearing points	O
(18) Return-bail bearings	O
(19) Right-pointer rack—all points of contact	O
(20) Semaphore bearings	O
(21) Semaphore linkage—all points of contact	O
(22) Shaft bearings—two places	O
(23) Shift-detent bearing and roller	O
(24) Spacebar-lever extension—at the guide	O
(25) Space-rack slide—all points of contact	O
(26) Spacer-bail bearings	O
(27) Spacer rod—all points of contact	O
(28) Spacing rack—all points of contact	O
(29) Spring-arm bearings	O
(30) Swivel and rollers—bearing points	O
(31) Vertical-link bearings	O

(e) Keyboard

(1) Counting selector-bars—in the slots	O
(2) Counting selector-levers—all points of contact	O

<u>Part</u>	<u>Lubrication</u>
(3) Detent rollers	O
(4) Perforating selector-bars—in the slots	O
(5) Selector-bar links—all points of contact	O
(6) Shift-bail bearings—two places	O
(7) Shift linkages—all points of contact	O
(8) Spacebar-loop bearings	O
(9) Universal bar—in the slots	O
(10) Unshift linkages—all points of contact	O
(11) Y levers—all points of contact	O
(f) Miscellaneous	
(1) Message line guide—at the rod	O
(2) Motor—two oilers	O
(3) Motor pinion	G
(4) Tape-reel bearing	O

4. COMMON MAINTENANCE TROUBLE

4.01 A commonly encountered complaint is that of heavy keyboard touch. This may sometimes be caused by the operator partially depressing "locating keys" (those keys under the little finger of each hand). Such a depression will cause the other keys to work heavy. However, if a malfunctioning of the perforator is suspected, the following procedures may serve to eliminate the complaint.

- 1) Make sure that the steel washer is between the stop-lever and the brass casting.
- 2) Remove the perforating selector-bar assembly and the counting selector-bar assembly.
- 3) Disassemble each of the selector-bar assemblies and clean them thoroughly.
- 4) Check that all selector bars are free of bows.
- 5) Check that all selector-bar Y levers are free of binds and that the selector-bar links ride freely in their guides.
- 6) Check that the tripoff plunger and the punchbar levers operate freely in their respective guides.
- 7) Check that all rollers are free of binds.

8) Recheck the following adjustments:

<u>Adjustment</u>	<u>Paragraph</u>
Keylever Spring	2.10
Main Clutch	2.11
Stoplever Camroller Eccentric Screw	2.15
Universal-Bar Spring	2.19
Universal-Bar Back Stop Screw	2.16
Stoplever-Latch Adjusting Screw	2.17
Counting-Shaft Endplay	2.25
Counting-Shaft Friction Clutch	2.32
Operating-Camsleeve Friction Clutch	2.86
Stoplever Spring	2.20
Nonrepeat-Latch Spring	2.22
Stoplever-Latch Spring	2.21
Counting Selector-Bar-Link Detents	2.03

5. REFERENCE TO BELL SYSTEM PRACTICES

5.01 The following lists Bell System Practices applicable to the teletypesetter perforator.

<u>BSP</u>	<u>Section</u>
Requirements and Procedures— General	P30.012
Index of Installation and Maintenance Information— 20 Teletypewriter Apparatus	P39.101