

BELL SYSTEM PRACTICES
Teletypewriter and Manual
Telegraph Station and P.B.X.
Installation and Maintenance

SECTION P35.610
Issue 3, October, 1940
AT&T Co Standard

TELETYPEWRITER—TYPING UNIT

14 TYPE

REQUIREMENTS AND PROCEDURES

1. GENERAL

1.01 This section contains the apparatus requirements and adjusting procedures for the maintenance of teletypewriter typing units of the 14 type. It is reissued to add or revise the requirements and procedures marked with an asterisk (*) in the Table of Contents, 1.03.

1.02 The following shall be observed in applying requirements and procedures.

(a) Use appropriate gauges and Teletype scales, unless otherwise specified, as spring tensions (including gram equivalents) are values indicated by these scales when used as shown:

Use Teletype Scale	When Max. Tension Shown Is
138-55M	Up to 8 ozs.
138-58M	Above 8 ozs. up to 32 ozs.
82711M	Above 32 ozs. up to 64 ozs.
4841M	Above 64 ozs. up to 12 lbs.
2727M	Above 12 lbs. up to 25 lbs.

(b) Before readjusting a part, loosen locking device (clamping screw, lock nut, etc.). Reset locking device after adjustment is completed.

(c) After readjusting a part, check adjustment of related parts which may have been disturbed.

(d) Parts dismantled to facilitate checking or readjustment shall be reassembled after operation is completed, reassembling any dismantled shims in original position.

(e) Springs which are outside tension limits shown and for which no adjustment is provided shall be replaced.

(f) Refer to Ordering Information for part names and numbers as designations used are in some cases abbreviated to save space.

(g) Contact points shall fall wholly within the circumference of the opposing contact except contacts having same diameter whose centers shall not be out of alignment more than 25% of their diameter.

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2. CLEANING

2.01 If necessary, typing units shall be cleaned in accordance with general Section, P30.010, covering Cleaning Teletypewriter Apparatus.

3. LUBRICATION

3.01 Typing units shall be lubricated in accordance with Section P35.601 covering Lubrication of 14 Type Teletypewriters.

4. REQUIREMENTS AND PROCEDURES

4.01 **Selector cams** shall line up with their respective selector levers. Gauge by eye.

(a) To adjust, loosen main shaft bearings and raise or lower main shaft.

4.02 **Main shaft clutch teeth** shall clear each other by Min. .010", Max. .020" as in Fig. 1 when clutch is fully cammed out of engagement.

(a) To adjust, reposition clutch throw-out lever pivot screws making sure that the throw-out lever is free in its bearing, without perceptible end play when pivot screw lock nuts are tightened.

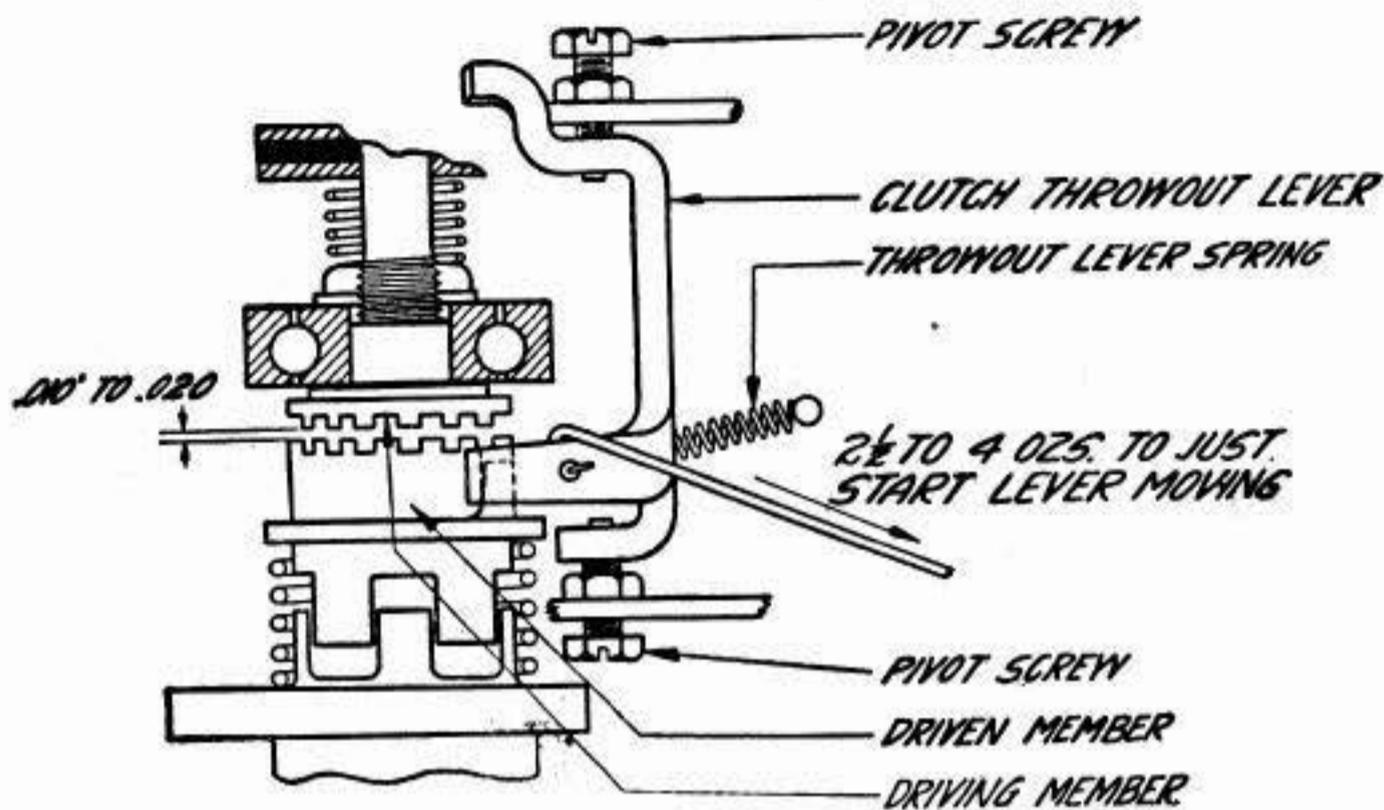


Fig. 1

4.03 **Clutch throw-out lever spring** shall have a tension of Min. 2-1/2 ozs. (70 gms.), Max. 4 ozs. (115 gms.) measured at right angles to the throw-out lever as in Fig. 1 when clutch teeth are fully disengaged.

4.04 **Main Shaft Clutch Spring:** A pull of 30 ozs. (850 gms.) applied to driven jaw of clutch as in Fig. 2 shall separate clutch teeth when tips of teeth are resting against each other. A pull of 24 ozs. (680 gms.) similarly applied shall not separate clutch teeth.

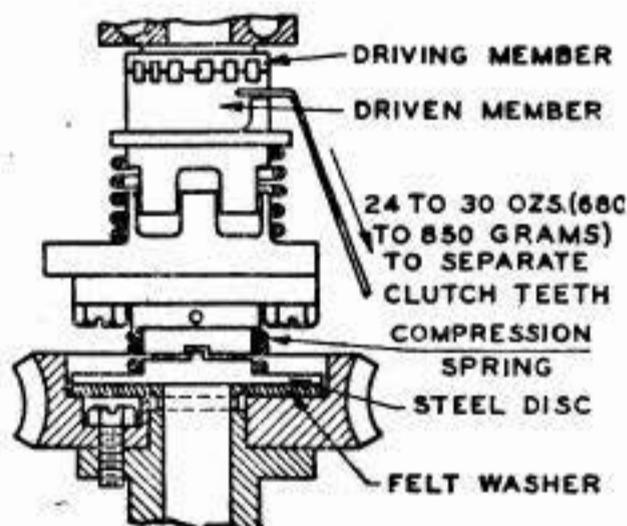


Fig. 2

4.05 **Clutch driven member**, after being pulled manually to position of extreme disengagement, shall 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 ozs. (285 gms.).

(a) To gauge, pull driven member to operated position with 30 oz. tension as in 4.04, gradually reduce tension and permit driven member to slide until it touches driving member. The gauge reading should not go below 10 ozs.

(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 typing 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 for by observing typing of first character received directly from associated keyboard after main shaft of typing unit has been at rest for at least 10 minutes, power disconnected.

4.06 **Motors and governors** shall meet the requirements of Section P36.640 covering 15 Type Teletypewriter Motor Units except those with regard to the speed and position of the motor which shall be as specified below.

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

(1) To adjust, reposition motor on mounting plate.

(b) There should be clearance between motor and ribbon feed lever when main bail is up and motor and motor plate are moved forward to their normal operating position. Gauge by eye.

(c) **Motor Speed:** The free speed of receiving shaft in revolutions per minute, corresponding to operations per minute with the shaft running free is:

Operations Per Minute	Words Per Minute	Code No. of Target	Black Spots on Target	Free Speed of Receiving Shaft in R.P.M.
240.0	40.0	1J	23	274.3
368.0	61.3	1G	10	420.6
460.0	76.6	1G	10	524.7

Note: Word speed is based on 6 operations (five characters and one space) per word. Speeds of 240, 368 and 460 operations per minute are commonly known as 40, 60 and 75 speed respectively.

(1) Check and adjust speed as outlined in Section P30.020 covering Speed Regulation of Teletypewriter Apparatus.

Note: If speed is variable, replace governor contacts and clean governor brushes, collector rings, motor brushes and commutator with a cloth moistened with CP carbon tetrachloride per KS-6815.

4.07 **Selector lever springs** shall have a tension of Min. 20 ozs. (565 gms.), Max. 24 ozs. (680 gms.) when selector levers are in unoperated position and springs are unhooked from their mounting posts and stretched to position length. Code bars, "T" levers, selector sword and lever bearings shall be free of bind and code bars shall move to extreme right when a force of Min. 5 ozs. (145 gms.), Max. 7 ozs. (200 gms.) is applied as in Fig. 3 when the main bail is positioned so as to hold the pull bars away from the code bars. The code bars shall start from the extreme right when the above force is reduced to 1-1/2 ozs. (40 gms.).

(a) To adjust, clean and lubricate code bars, "T" levers and selector sword and lever bearings to eliminate any bind and see caution above 4.42; replace springs which do not meet tension requirement.

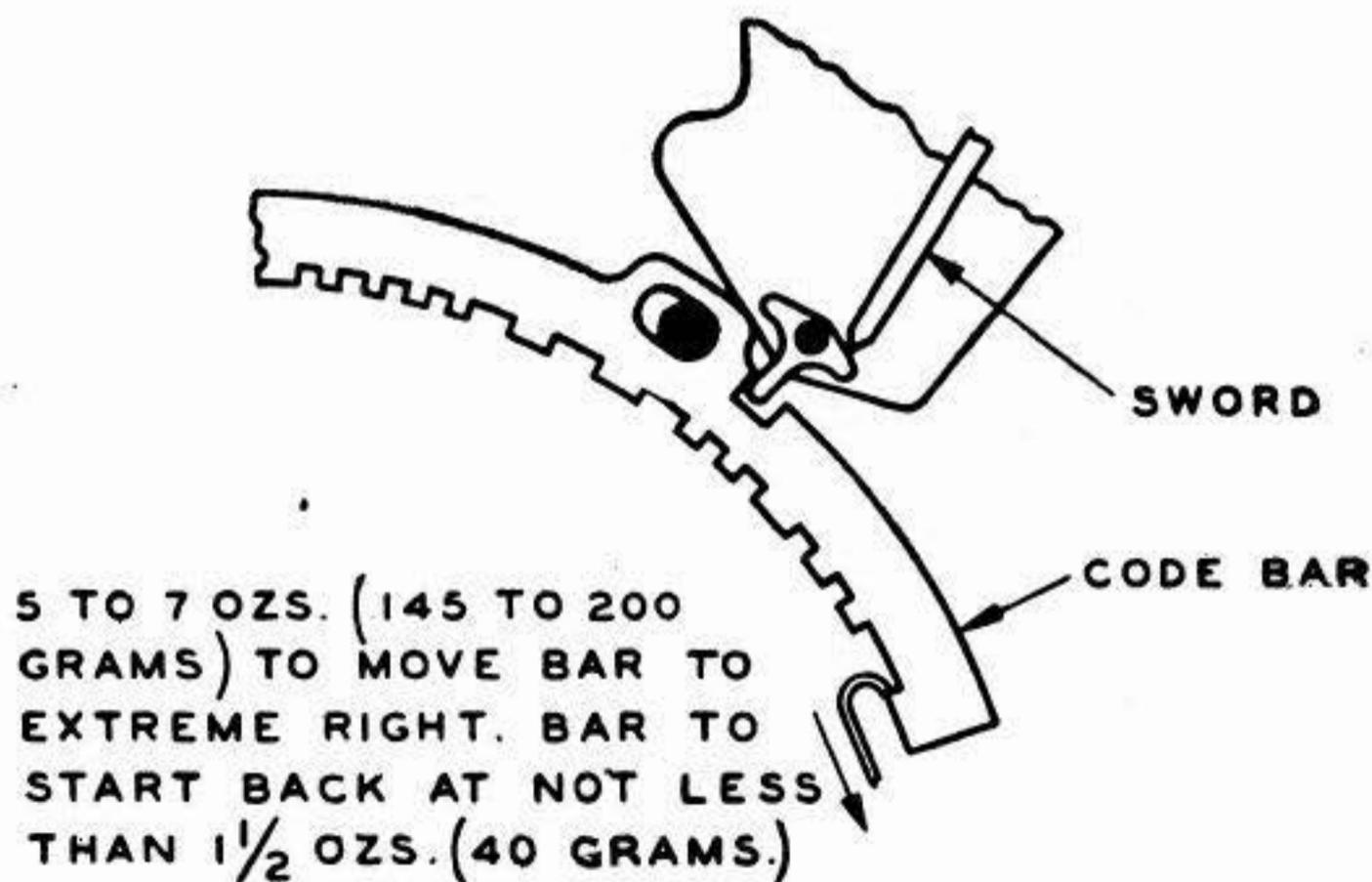


Fig. 3

Note: Remove range finder assembly for adjustments 4.08 to 4.31 inclusive.

4.08 **Sword separator plate leaf springs**, except those of top and bottom plates, shall press lightly against their respective swords.

Note: If necessary to check, remove separator plates and check to see that leaf spring end is Min. .045", Max. .055" away from plane of plate as gauged by eye.

(a) To adjust, bend leaf spring at narrow portion.

Note: Requirements 4.09 to 4.21 inclusive apply only to typing units equipped with holding type selector magnets.

4.09 **Armature lever** shall have a minimum amount of end play without bind as gauged by eye and feel when armature lever and selector arm springs are unhooked. See Fig. 4.

(a) To adjust, reposition top armature lever pivot screw.

4.10 **Selector armature** when in its operated position shall touch both magnet cores at approximately the centers of their pole-faces; and the cores shall be centrally located with respect to the armature as gauged by eye when holding a light background behind magnet and armature assembly.

Caution: Make sure armature and pole-faces are free of oil and dirt.

(a) To adjust, remove selector magnet bracket from typing unit and reposition magnet core assembly while holding assembly so cores are vertical and armature rests against pole-faces by its own weight.

Note: With proper adjustment, at least 3-1/2 lbs., applied at right angles to armature edge midway between cores, should be required to pull armature away from cores when .020 ampere is flowing to the magnet coils. (Coils in series shunted by 5000 ohm resistance.) This electrical check need not be made for .060 ampere operation (coils in parallel).

4.11 **Selector arm** shall have a minimum end play without bind as gauged by eye and feel and its top surface shall clear armature lever by Min. .008", Max. .016" when armature lever, selector arm and selector arm stop detent springs are unhooked. See Fig. 4.

(a) To adjust, reposition bottom selector arm pivot screw for clearance, then top screw for end play.

Note: It may be necessary to remove the selector arm and magnet brackets to readjust the bottom pivot screw.

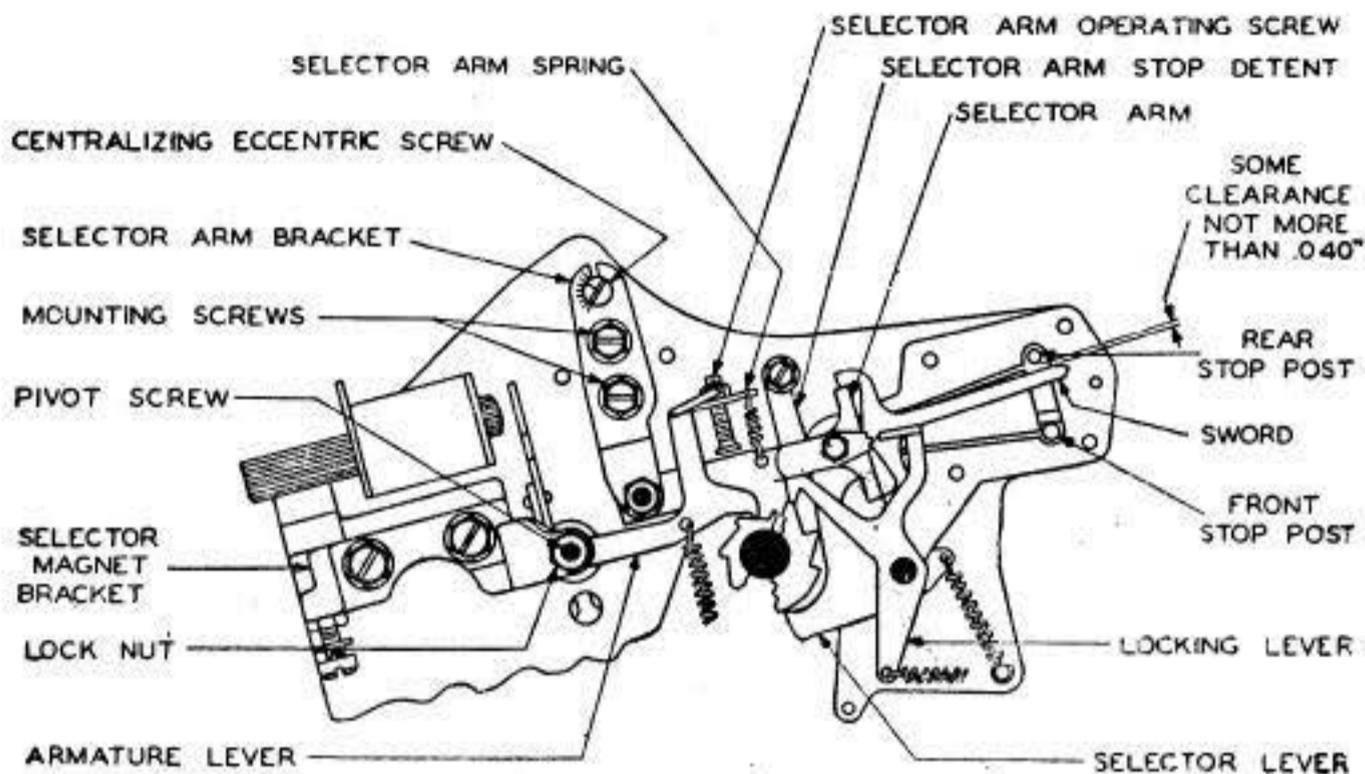


Fig. 4

4.12 **Selector swords** shall clear both stop posts by approximately equal amounts, not more than $.040''$, measured as in Fig. 4 after (1) removing locking lever and selector arm springs, (2) placing associated selector lever on peak of its cam, (3) placing the sword arm against the armature extension end and (4) moving the armature slowly from its unoperated or operated position to a point where the extension arm just clears the sword arm. When checking clearance to front stop post unhook armature lever spring from spring arm.

Note: Use No. 1 sword in gauging and adjusting, then check remaining swords.

(a) To adjust, loosen selector arm bracket until held friction tight; equalize clearance between swords and stop posts by turning centralizing eccentric, making sure that the selector arm stop detent does not interfere and that the eccentric indicating line is adjacent to scale on bracket; and then move bracket closer or further away from swords by inserting the 90783M wrench in one of the two holes provided and turning wrench.

4.13 **Locking wedge** shall clear locking lever by Min. $.006''$ Max. $.010''$ as in Fig. 5 when lever is resting on the long high part of its cam and end of wedge is held in line with lever.

(a) To adjust, reposition locking wedge.

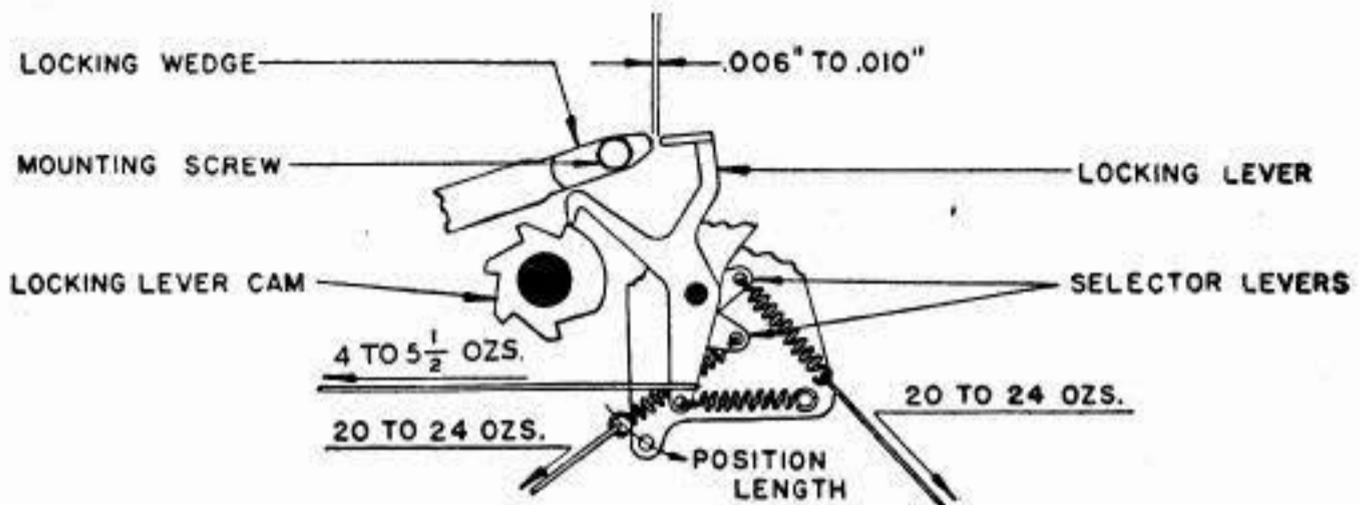


Fig. 5

4.14 **Locking lever spring** shall have a tension of Min. 4 ozs. (115 gms.), Max. 5-1/2 ozs. (155 gms.) measured as in Fig. 5 when lever starts to move from high part of its cam.

4.15 **Locking lever** shall clear sides of locking wedge by equal amounts within .003" as gauged by eye when armature lever is in its operated (rear) and unoperated positions. See Fig. 6.

Note: Make sure that selector arm operating screw does not interfere with selector arm.

(a) To adjust, reposition selector arm stop detent eccentric post.

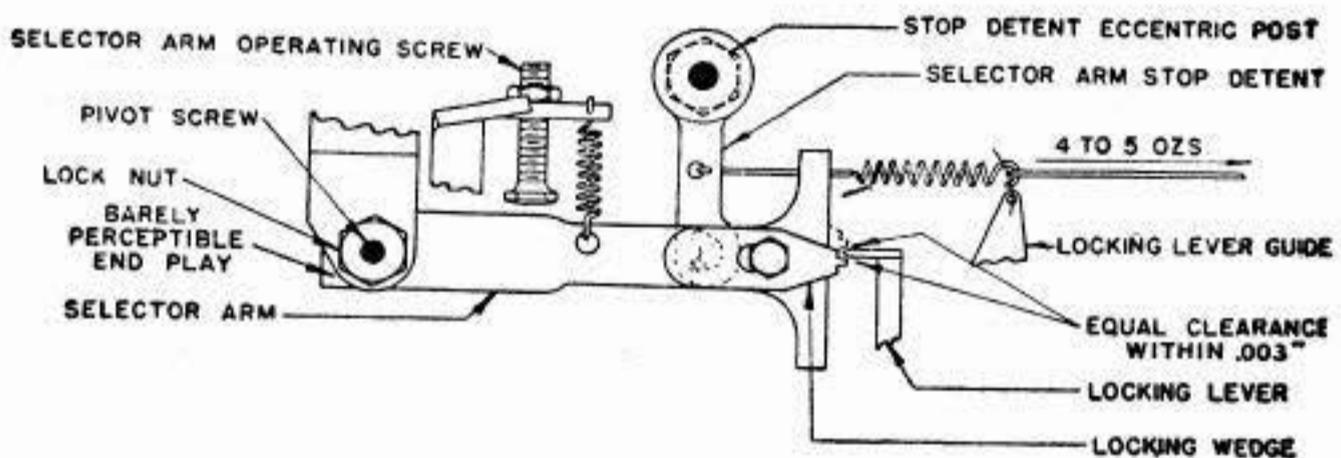


Fig. 6

4.16 **Selector arm stop detent spring** shall have a tension of Min. 4 ozs. (115 gms.), Max. 5 ozs. (140 gms.) measured as in Fig. 6 when stretched to position length.

4.17 **Armature lever** shall clear its cam by Min. .060", Max. .065" as in Fig. 7 when locking lever has just dropped off high part of cam, the cam is held back against the locking lever and the selector arm is held in its operated (rear) position by the locking lever.

Note: On units operated at 75 speed this clearance shall be Min. .058", Max. .062".

- (a) To adjust, loosen selector magnet bracket and selector magnet bracket adjusting arm until held friction tight, then reposition selector magnet bracket by inserting and turning 90783M wrench in hole above adjusting arm end.

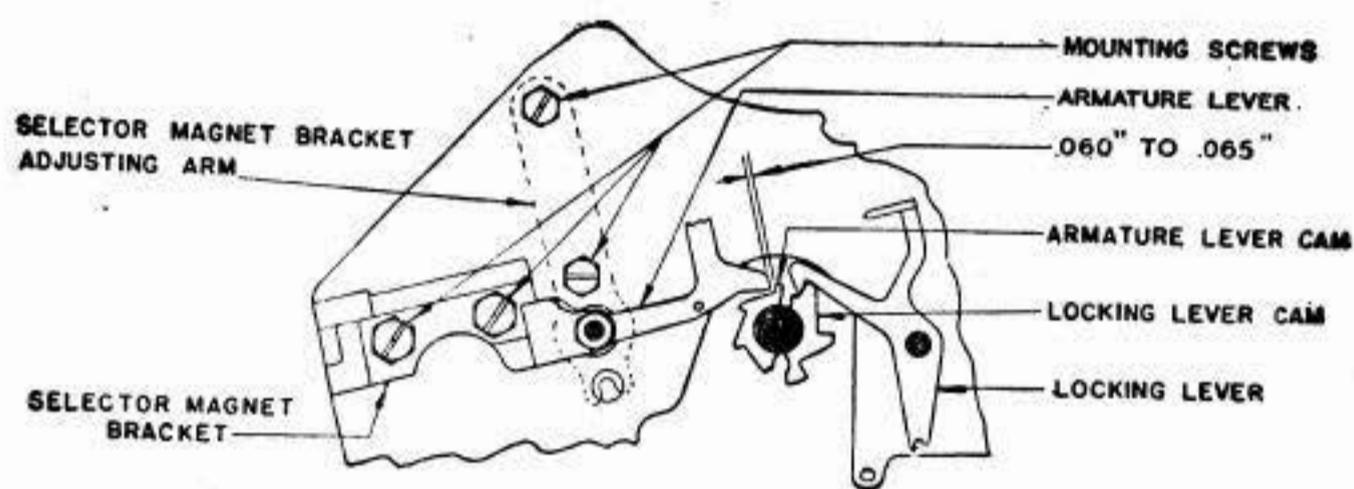


Fig. 7

4.18 **Selector Magnet Bracket:** With the selector magnet energized, the clearance between selector arm and its operating screw shall be .004" to .006" greater when armature lever is on the peak of its cam which gives the greatest throw to the armature lever as in Fig. 8A than when opposite an indent as in Fig. 8B.

- (a) To adjust, energize the magnets, hold cam sleeve so the armature lever is opposite a peak of its cam, turn main shaft to the position where it gives the greatest throw to the armature lever, loosen selector magnet bracket and reposition latter by means of its adjusting screw until the armature lever just touches the peak of the cam, then give the screw an additional 1/10 turn counter-clockwise; if the selector arm does not clear its operating screw, back off the operating screw to provide at least .006" clearance and recheck requirement: if difference in clearances exceeds .006" turn magnet bracket adjusting screw clockwise, if less than .004" turn screw counter-clockwise.

Note: Avoid lost motion due to loose fitting screw threads.

4.19 **Armature lever spring** shall have a tension of Min. 13 ozs. (370 gms.), Max. 15 ozs. (425 gms.) measured as in Fig. 8A when the armature lever is on a high part of cam.

Note: On units operated at 75 speed this tension shall be 16 ozs. unless biased test signals are available, in which case the armature lever spring shall be adjusted to meet the bias tolerance requirements given in other practices.

(a) To adjust, reposition spring arm.

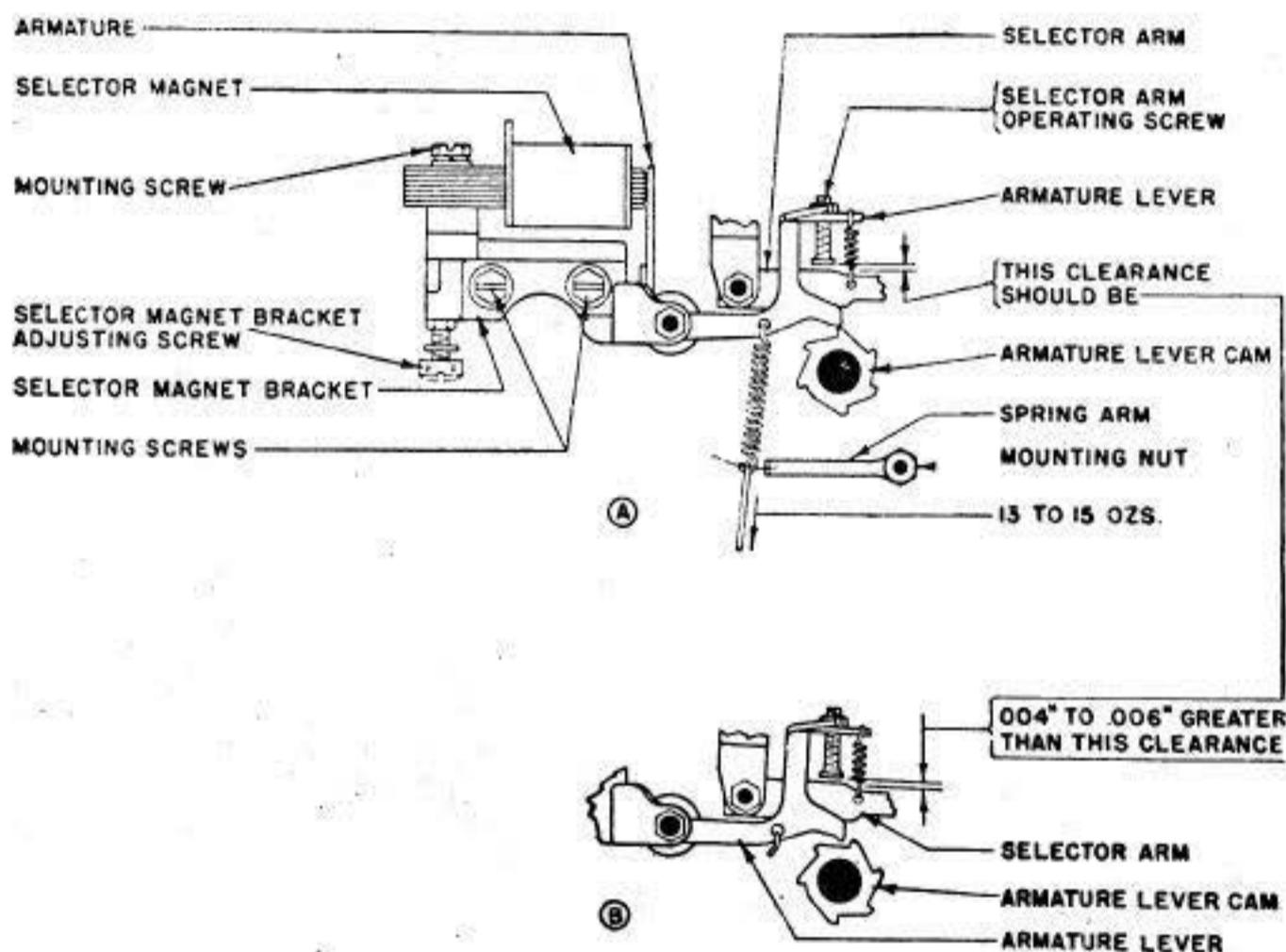


Fig. 8

4.20 **Selector arm** shall clear its operating screw by Min. .003", Max. .006" as in Fig. 9 when magnet is energized, selector arm is in its operated (marking) position and armature lever is between peaks of its cam.

(a) To adjust, reposition selector arm operating screw.

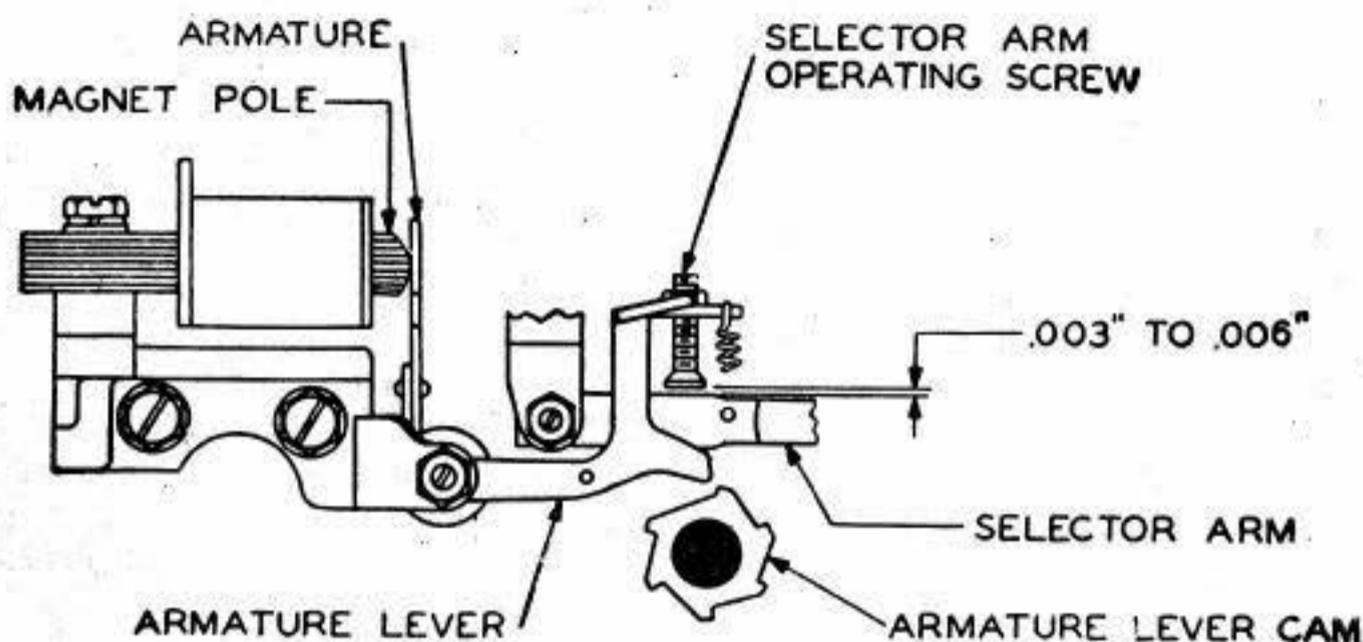


Fig. 9

4.21 **Selector arm spring** shall have a tension of Min. 1-1/4 ozs. (35 gms.), Max. 1-3/4 ozs. (50 gms.) measured as in Fig. 10 when armature lever is on a high part of its cam and selector arm stop detent spring is unhooked.

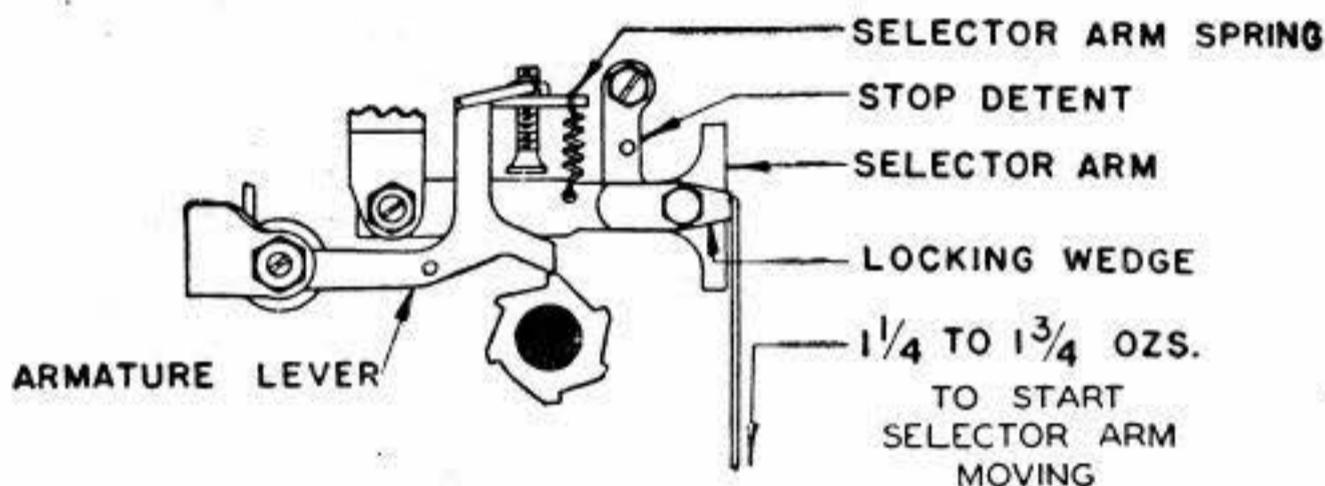


Fig. 10

Note: Requirements 4.22 to 4.28 inclusive apply only to typing units equipped with pull type selector magnets.

4.22 **Selector armature** shall have minimum end play without bind in its bearings, gauged by eye and feel, and its locking wedge shall clear No. 1 sword by not more than .008" as in Fig. 11 when the No. 1 selector lever rests on peak of its cam, the No. 1 sword front arm is held against outer separator plate without bending latter and the armature end play taken up so as to reduce clearance to minimum.

(a) To adjust, reposition armature bearing pivot screws, outer screw for clearance, inner screw for end play noting that 1/4 turn of screw is equivalent to approximately .006" adjustment.

Note: In replacing armature bracket make sure armature spring clears bracket and its mounting screw.

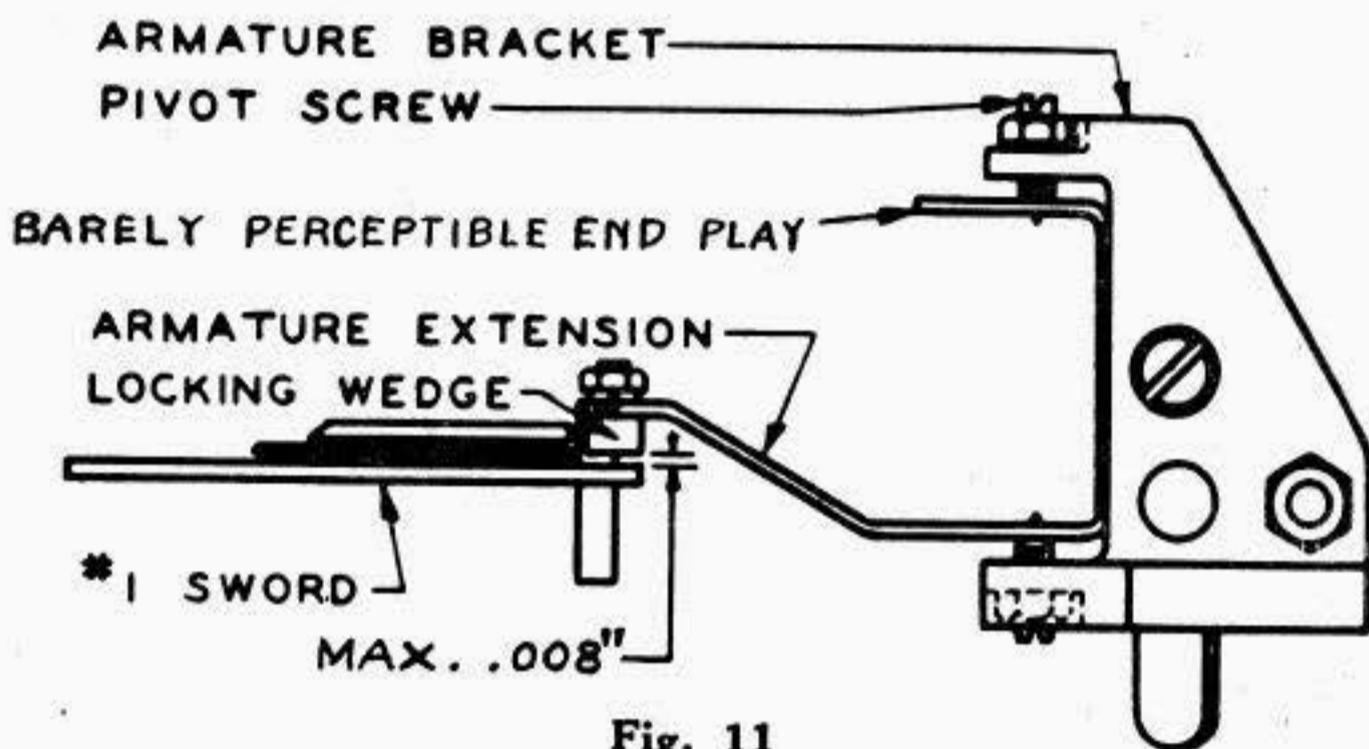


Fig. 11

4.23 Selector Swords: No. 1 sword's centerline shall intersect the armature pivot screw centerline, gauged by eye, when the swords are held centrally located between the stop posts with 72581M gauge pins as in Fig. 12.

(a) To adjust, unhook lock lever spring; loosen magnet and armature bracket mounting screws and bracket link screw (see Fig. 37); back off armature stop screw and nut; move armature bracket eccentric out of way; rotate cam sleeve until No. 1 selector lever rests on peak of its cam; place armature so its extensions are between sword arms and insert 72581M gauge pins between posts and swords as in Fig. 12; place 73370M locating gauge over end of No. 1 sword so legs of gauge are against ends of sword arms; move armature bracket to position which will bring end of armature extension flush against flat surface between legs of gauge; then holding bracket in this position tighten link screw and armature bracket mounting screws.

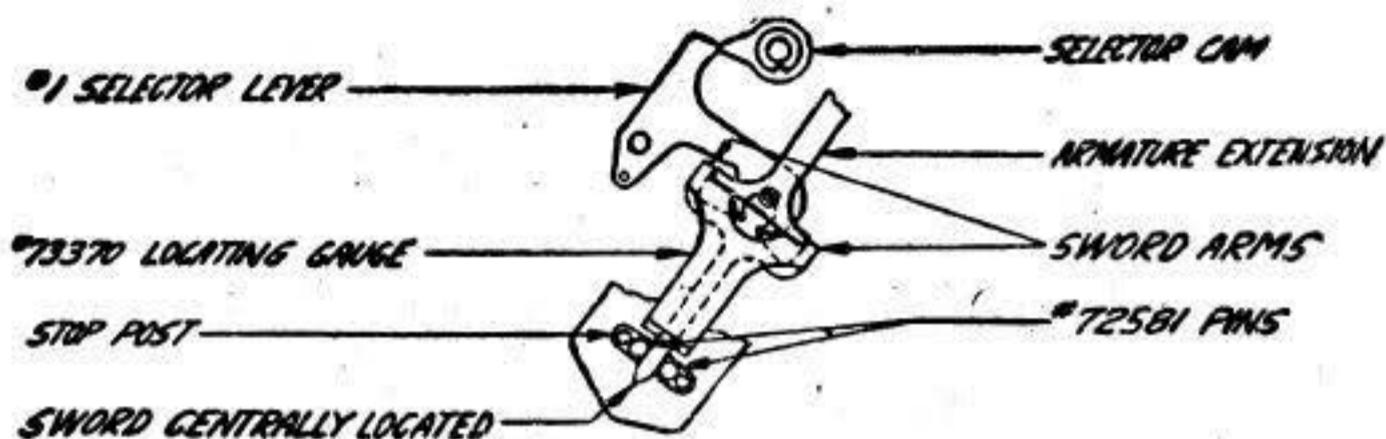


Fig. 12

4.24 Selector swords shall clear both the right and left stop posts by not more than .040" as in Fig. 13 after (1) placing the associated selector lever on peak of its cam, (2) placing the sword arm against the armature extension end and (3) moving the armature slowly from its unoperated or operated position to a point where its extension arm just clears the sword arm. When checking clearance to right stop post, unhook armature spring from its adjusting screw.

Note: Use No. 1 sword as a guide in gauging and adjusting, then check remaining swords.

Note: On units operated at 75 speed, these clearances shall not exceed .020" and shall be equal within .005". It may be necessary to replace worn swords or armatures to meet this requirement.

(a) To adjust, reposition armature bracket, backward to increase clearance and forward to decrease clearance, tighten mounting screws and then move eccentric stop against bracket and tighten its screw.

Note: Eccentric stop is provided so that armature bracket can be removed and reassembled without changing its adjustment, provided it is held against the stop while clamping screws are tightened and provided link screw is not loosened.

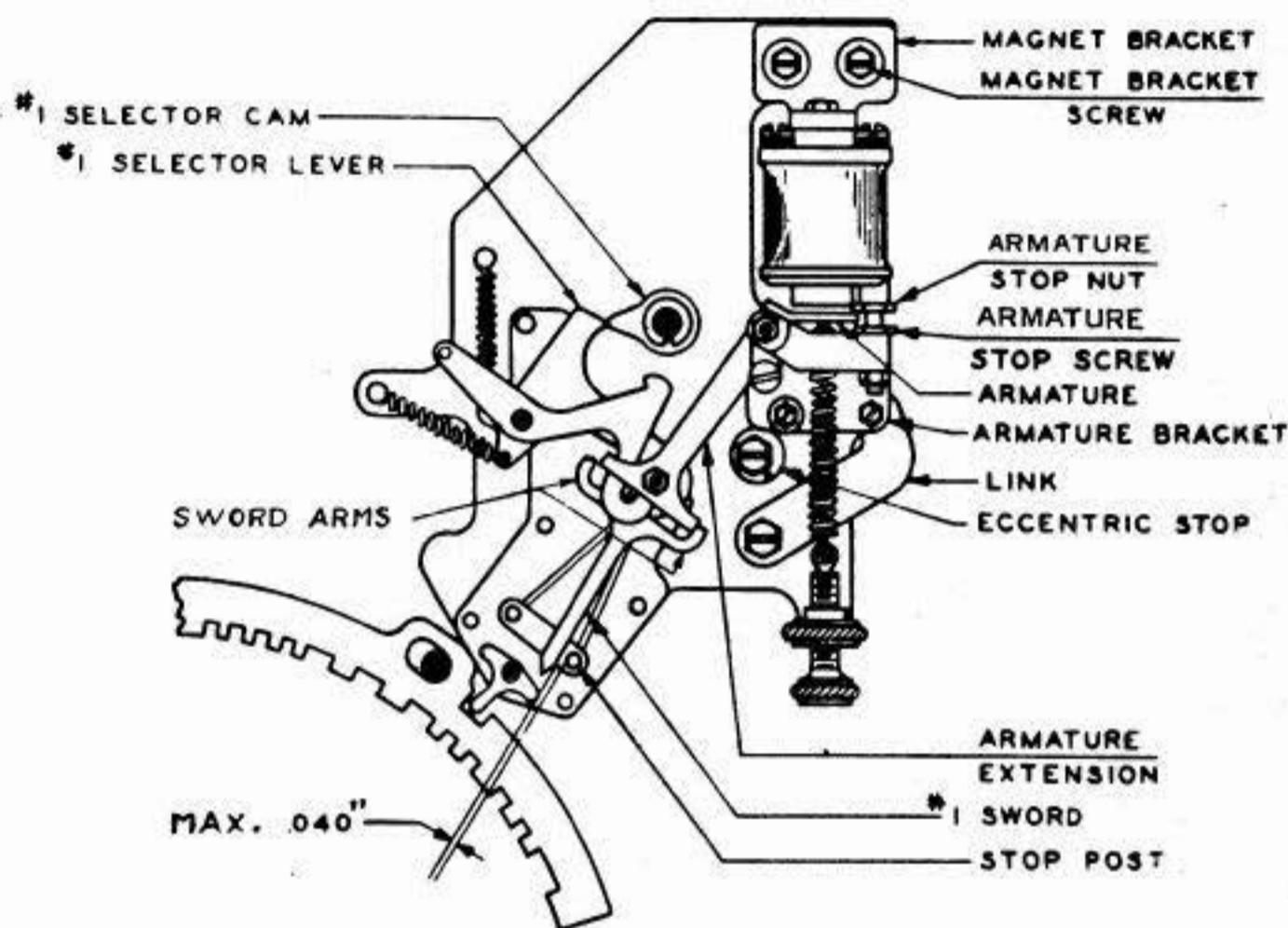


Fig. 13

4.25 **No. 1 sword arms** (right and left) shall clear the associated armature extension lug by Min. .035", Max. .037" when the end of the opposite arm is against its armature extension lug and the No. 1 selector lever is on the high part of its cam.

(a) To adjust right arm clearance, reposition armature stop screw with armature released; to adjust left arm clearance, reposition armature stop nut with the armature operated. If either clearance is changed recheck clearance of other arm.

Caution: Be sure stop nut is tight on its screw; pinch split hub if nut is loose.

4.26 **Selector armature spring** shall have a tension of Min. 6 ozs. (170 gms.), Max. 6-3/8 ozs. (180 gms.) with armature released when spring is stretched to position length.

Note: On units operated at 75 speed, this tension shall be 7 ozs. unless biased test signals are available, in which case the armature spring shall be adjusted to meet the bias tolerance requirements given in other practices.

- (a) To adjust, reposition selector armature spring adjusting screw.
- 4.27 **Armature locking wedge** shall clear the locking lever by Min. .008", Max. .012" as in Fig. 14 when locking lever is resting on long high part of cam.
- (a) To adjust, reposition locking wedge in its slot in the armature extension.

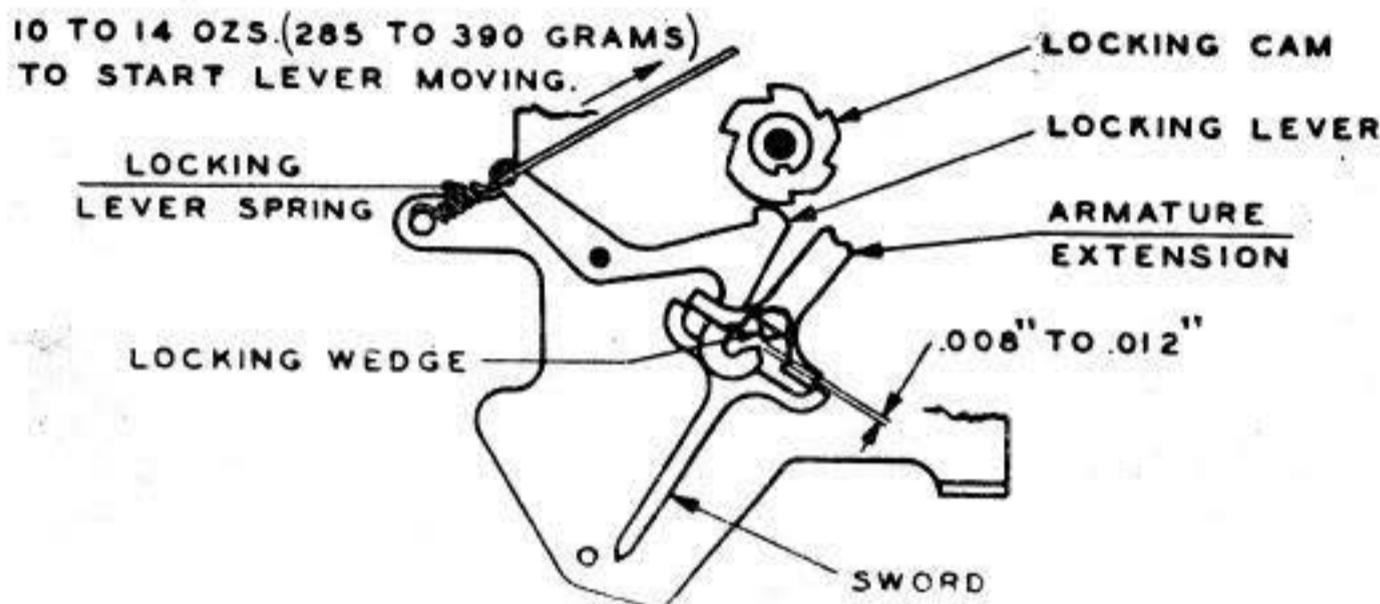


Fig. 14

- 4.28 **Armature locking lever spring** shall have a tension of Min. 10 ozs. (285 gms.), Max. 14 ozs. (395 gms.) measured as in Fig. 14 when locking lever is on long high part of cam.
- 4.29 **Stop lever** shall overtravel trip latch Min. .004", Max. .006" as in Fig. 15.
- (a) To adjust, reposition stop lever eccentric screw.

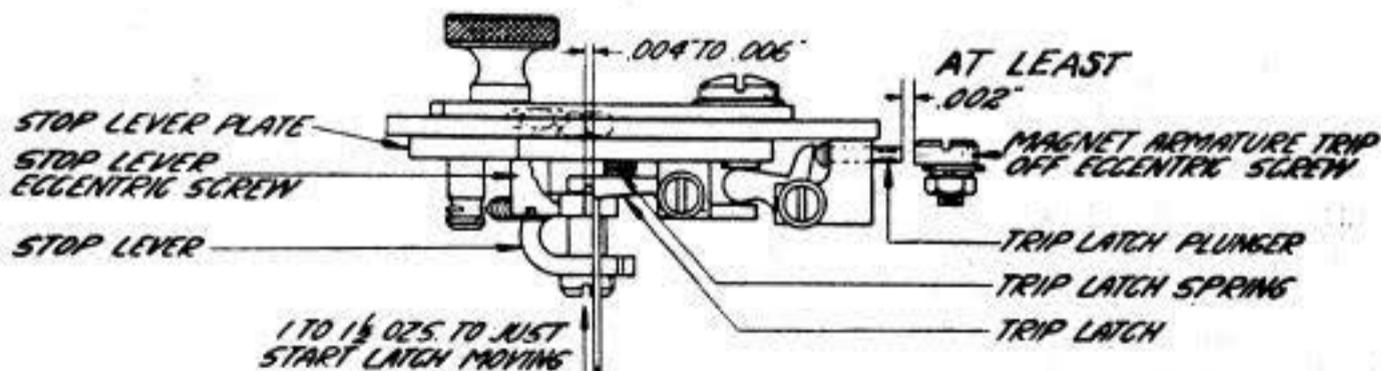


Fig. 15

4.30 **Trip latch spring** pressure shall be Min. 1 oz. (28 gms.), Max. 1-1/2 ozs. (40 gms.) measured as in Fig. 15 when range finder assembly is held horizontal.

4.31 **Stop lever spring** shall have a tension of Min. 3/4 oz. (21 gms.), Max. 1-1/4 ozs. (35 gms.) measured as in Fig. 16.

Note: Check 4.29 before measuring this tension.

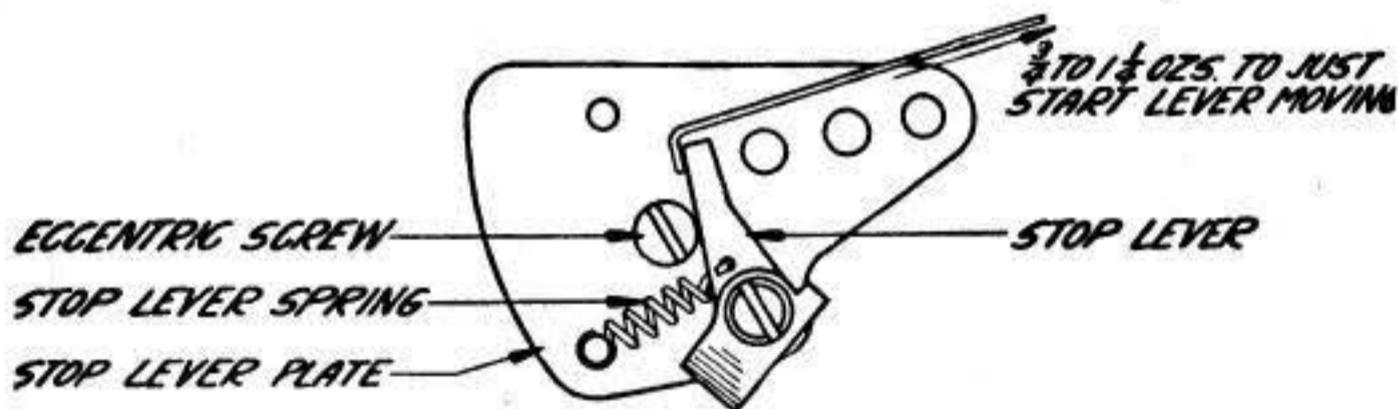


Fig. 16

Note: Reassemble range finder assembly on typing unit taking care not to jam trip latch plunger trip-off screw (eccentric screw on units having pull type magnets).

4.32 **Armature Trip-off Screw:** Stop lever shall clear its trip latch by not more than .002" when armature is unoperated and stopping edge of the lever is directly opposite the trip latch latching surface (Fig. 17); and the trip latch plunger shall have at least .002" end play as in Fig. 15 when the armature is operated and the stop lever is clear of the trip latch latching surface.

(a) To adjust, reposition armature trip off screw (eccentric screw on units having pull type magnets).

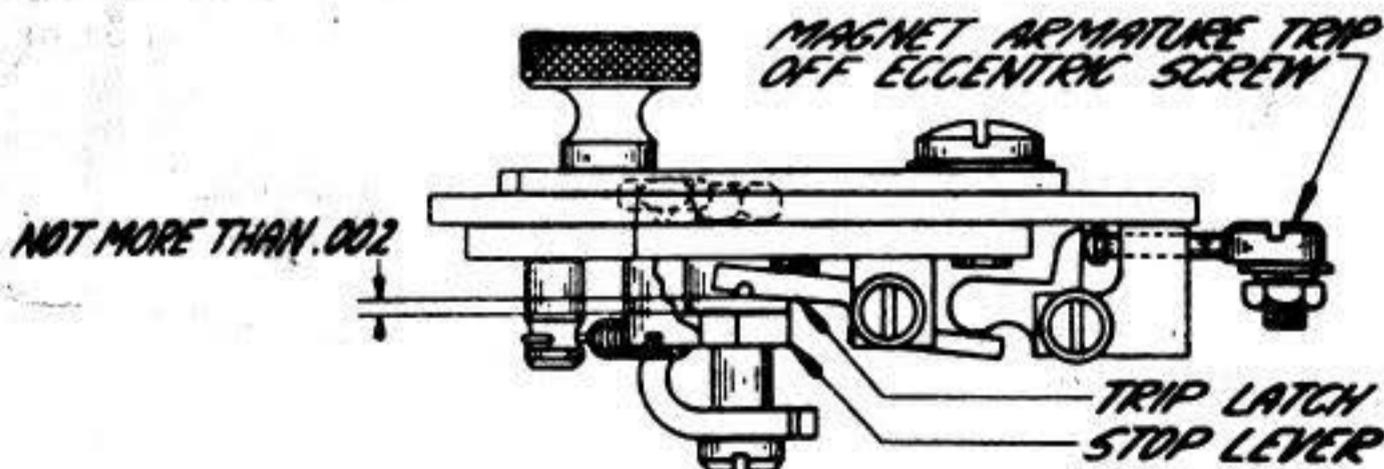


Fig. 17

4.33 **Pull Type Magnet Bracket:** Magnet core ends, on units equipped with pull type selector magnets, shall be approximately parallel to armature and shall clear armature non-magnetic (anti-freeze) strip by Min. .002", Max. .007" when the armature is held in the operated position by hand.

Note: On units operated at 75 speed, the maximum clearance shall be limited to .004". It may be necessary to bend or replace the magnet bracket in order to meet this requirement on the two core faces.

(a) To adjust, reposition magnet bracket.

Note: For adjustments 4.34 to 4.41 inclusive, bell break signal mechanism, code bar assembly and type basket should be removed to make the parts accessible. Code bar assembly is removed by unscrewing the two screws at rear of pull bar guide and moving "T" levers to the right by pushing ends of sword levers to the left. The screws should be replaced so as not to lose any shims which may be under mounting plate. Type basket is removed by removing locking pull bar, bell bracket and bell, bell clapper spring, code bar lock lever spring, letters pull bar spring and unshift-on-space pull bar spring. Tie tops of remaining pull bars lightly together with a rubber band or string. Loosen bell hammer post nut underneath base and move bell hammer out of way of bell pull bar. Remove the three mounting screws through base and which are in the legs which support type basket. Turn motor by hand until the main bail is up under pull bar projections. Then by pressing pull bars against the type bar back stop and lifting upward, basket should be free. Left ribbon spool holder and reverse lever may be removed to give more space if desired. Basket should be moved carefully from side to side in order to disengage lower ends of function pull bars from mechanisms on base.

4.34 **Spacer feed pawl** shall clear face of all teeth in ratchet by not more than .012" as in Fig. 18, when roller of spacer operating lever is in bottom of indent of main bail plunger as in Fig. 18 and when detent roller is snugly bottoming between two teeth of ratchet. Gauge by eye.

(a) To adjust, reposition detent lever plate on main casting.

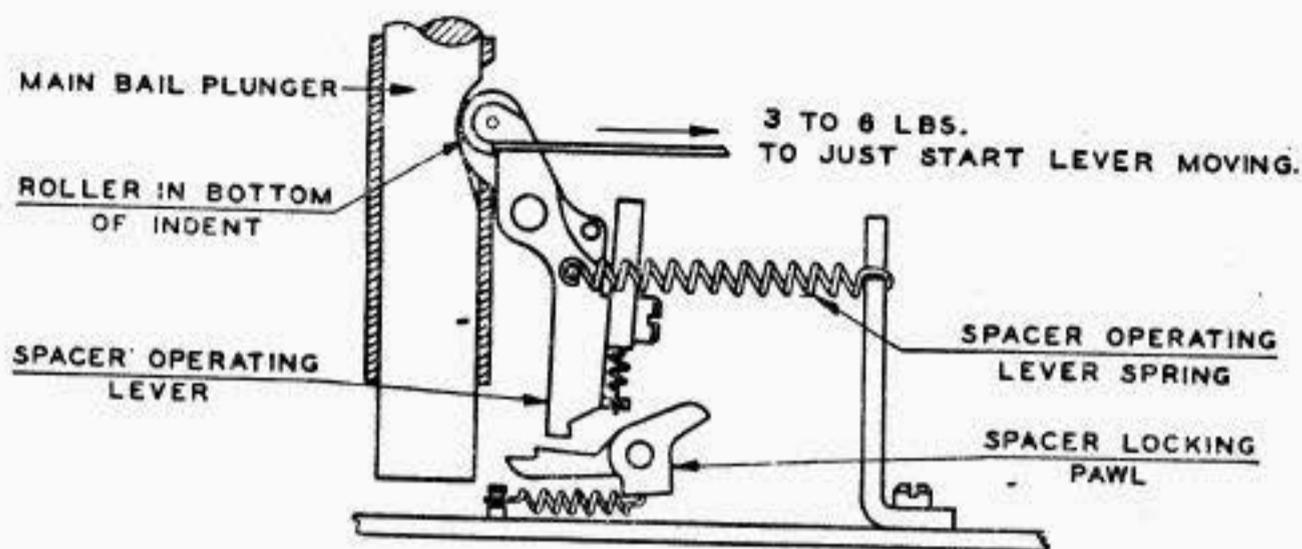


Fig. 18

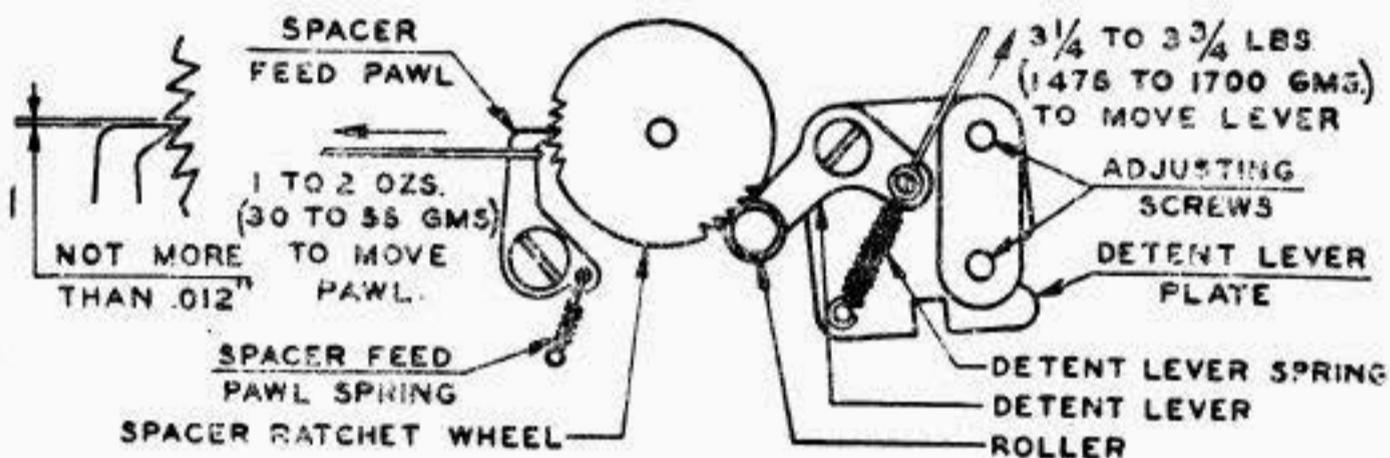


Fig. 19

4.35 **Spacer detent lever spring tension** shall be Min. 3-1/4 lbs. (1475 gms.), Max. 3-3/4 lbs. (1700 gms.), measured as in Fig. 19.

4.36 **Spacer feed pawl spring tension** shall be Min. 1 oz. (30 gms.), Max. 2 ozs. (55 gms.) measured as in Fig. 19.

4.37 **Spacer operating lever spring tension** shall be Min. 5 lbs., Max. 6 lbs. for units equipped with a horizontal spring, or Min. 3 lbs., Max. 6 lbs. for units equipped with a vertical spring, measured as in Fig. 18, when the spacer operating lever roller is in the bottom of the indent of the main bail and the spacer locking pawl is not engaged with the spacer operating lever.

4.38 **Ribbon feed lever spring tension** shall be Min. 12 ozs. (340 gms.), Max. 18 ozs. (510 gms.) measured as in Fig. 20, after removing feed pawl spring and placing feed lever roller in plunger indent.

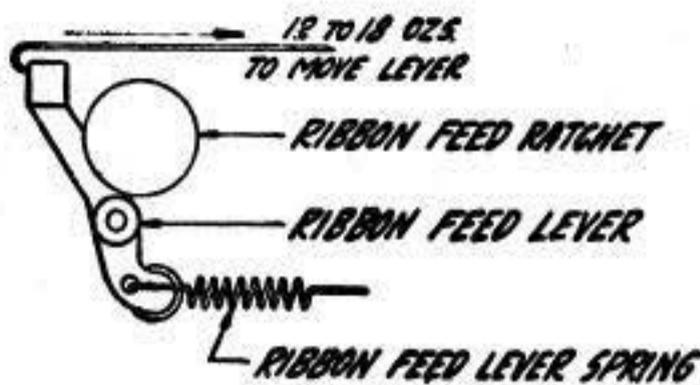


Fig. 20

4.39 **Spacer locking bail spring tension** shall be Min. 1-1/2 ozs. (45 gms.), Max. 2 ozs. (55 gms.), measured as in Fig. 21, when spacer locking pawl is held away from locking bail.

Note: The spacer locking bail spring tension on typing units equipped with an 84641M mechanism which provides for printing and spacing on upper case blank and prevent printing and spacing on lower case blank shall be Min. 7-1/2 ozs. (210 gms.), Max. 8-1/2 ozs. (240 gms.), measured in the upper loop of the spring by pulling vertically upward to position length (see Section P35.612).

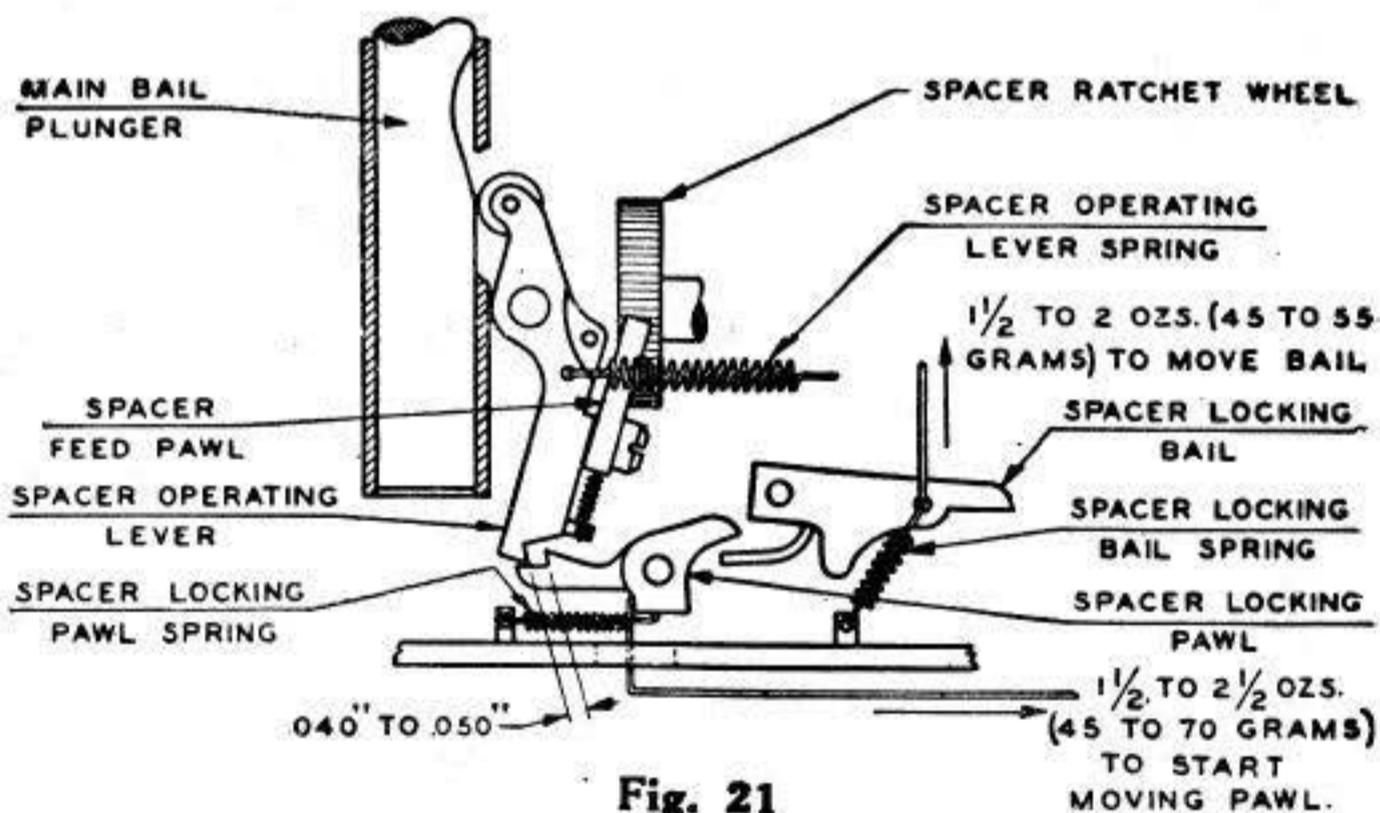


Fig. 21

4.40 **Function Bar Bracket Plates:** Two end pull bars supported by function bar bracket plates shall clear the plates as in Fig. 22. Gauge by eye.

Note: This need be checked only when plates are moved.

(a) To adjust, reposition function bar bracket plates.

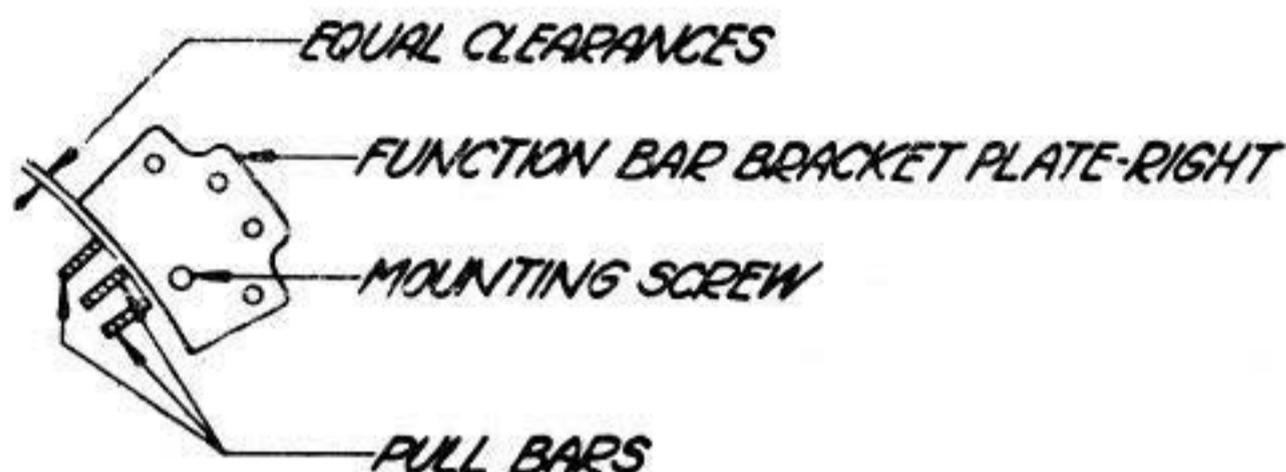


Fig. 22

4.41 **Pull Bar Springs:** Tension of character pull bar springs shall be Min. 3 ozs. (85 gms.), Max. 4 ozs. (110 gms.) and tension of function pull bar springs, which are attached to their spring brackets at this time, shall be Min. 5-1/2 ozs. (165 gms.), Max. 6-3/4 ozs. (190 gms.) or 155 to 190 grams, when detached and measured as in Fig. 23.

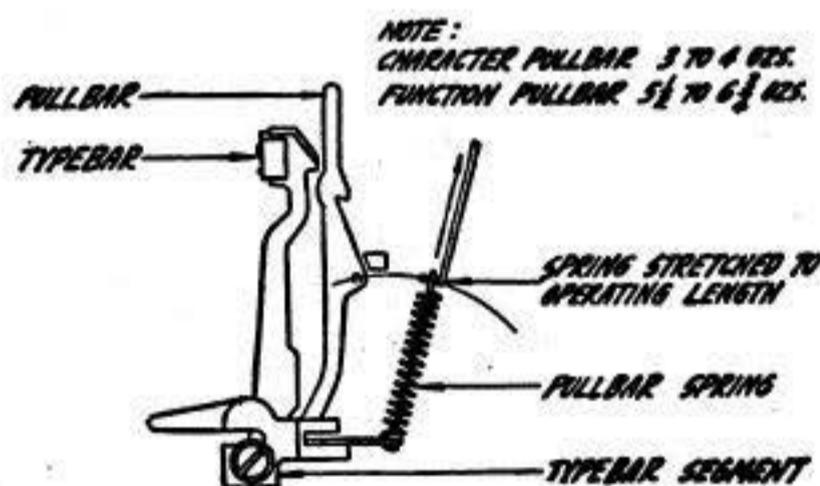


Fig. 23

Note: Place main bail in its highest position and re-mount type basket with three screws through base, making sure that all pull bar springs are in place. Reassemble springs which were removed for removal of type basket. Reassemble bell and bell hammer post

and remove tie from tops of pull bars. Place main bail in its lowest position, slip slots in pull bar guide over proper pull bars and when the assembly is almost in place engage "T" levers in notches of code bars. Reassemble any shims which may have been removed from between pull bar guide and frame casting. Remount bell break signal mechanism.

Caution: If code bars are removed from code bar assembly, care must be used in replacing, as excessive tightening of code bar post nuts may cause code bar separator collar to become imbedded in nickel silver separator washers. To prevent this condition, back off nuts and turn lower nut with fingers until lock washer is pressed flat. Then with a wrench hold lower nut in this position and tighten lock nut.

4.42 **Pull bar guide** shall be located so that (1) it clears the oil cup on top the main bail plunger; (2) the main bail clears the pull bar projections on unselected pull bars, by Min. .008", Max. .020" when "blank" and "letters" combinations are set up in turn and main bail play is taken up so as to make the clearance a minimum; (3) the No. 1 (top) "T" lever clears the bottom of the notch in the No. 1 (top) code bar by Min. .004", Max. .080". See Fig. 24. Gauge by eye.

(a) To adjust, reposition pull bar guide. If necessary to adjust check 4.43.

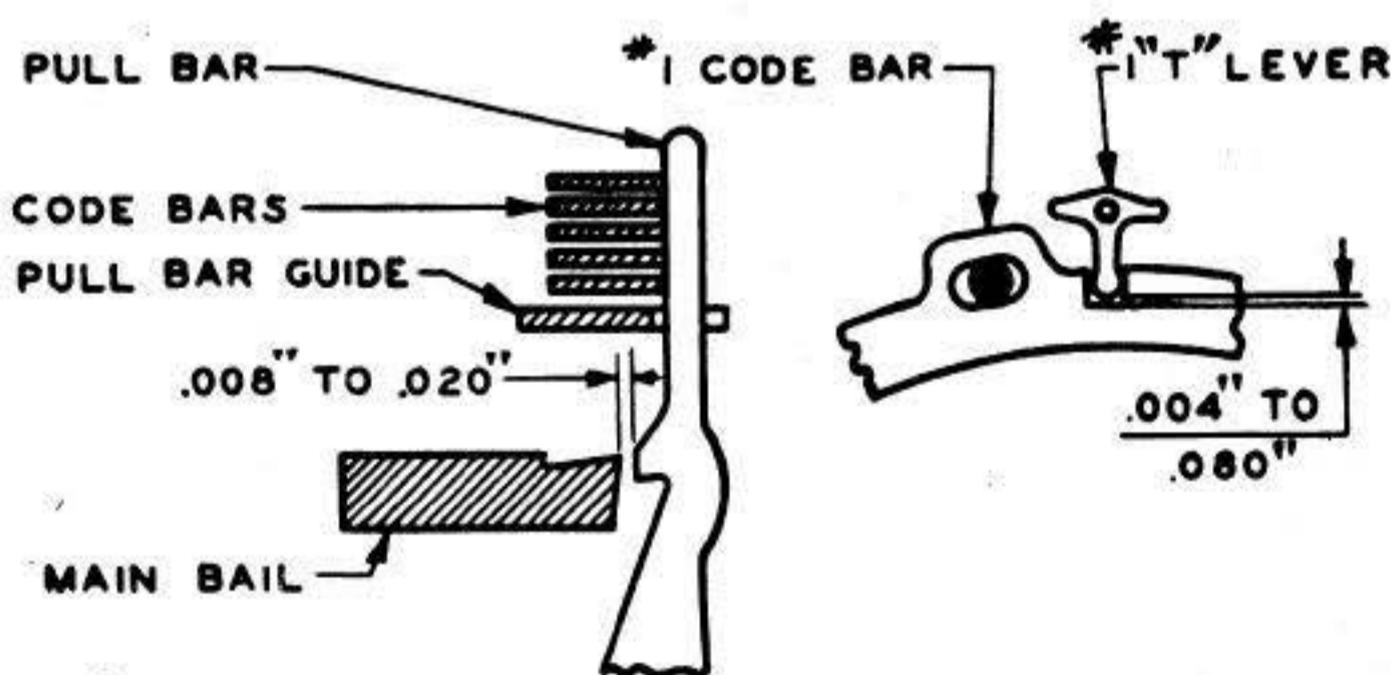


Fig. 24

4.43 **Pull bars**, except the selected one, shall clear inner edge of code bars by Min. .010", Max. .050" as in Fig. 25 when "blank" and "letters" combinations are set up in turn, main bail roller is on high part of main bail cam and play in the main bail and the pull bars is taken up to make clearance minimum.

Note: Before making any readjustment to meet this requirement check 4.42.

(a) To adjust, reposition main bail adjusting screw.

Note: If code bars and pull bar are not concentric it may be necessary to shift the type bar segment and main bracket on the base plate.

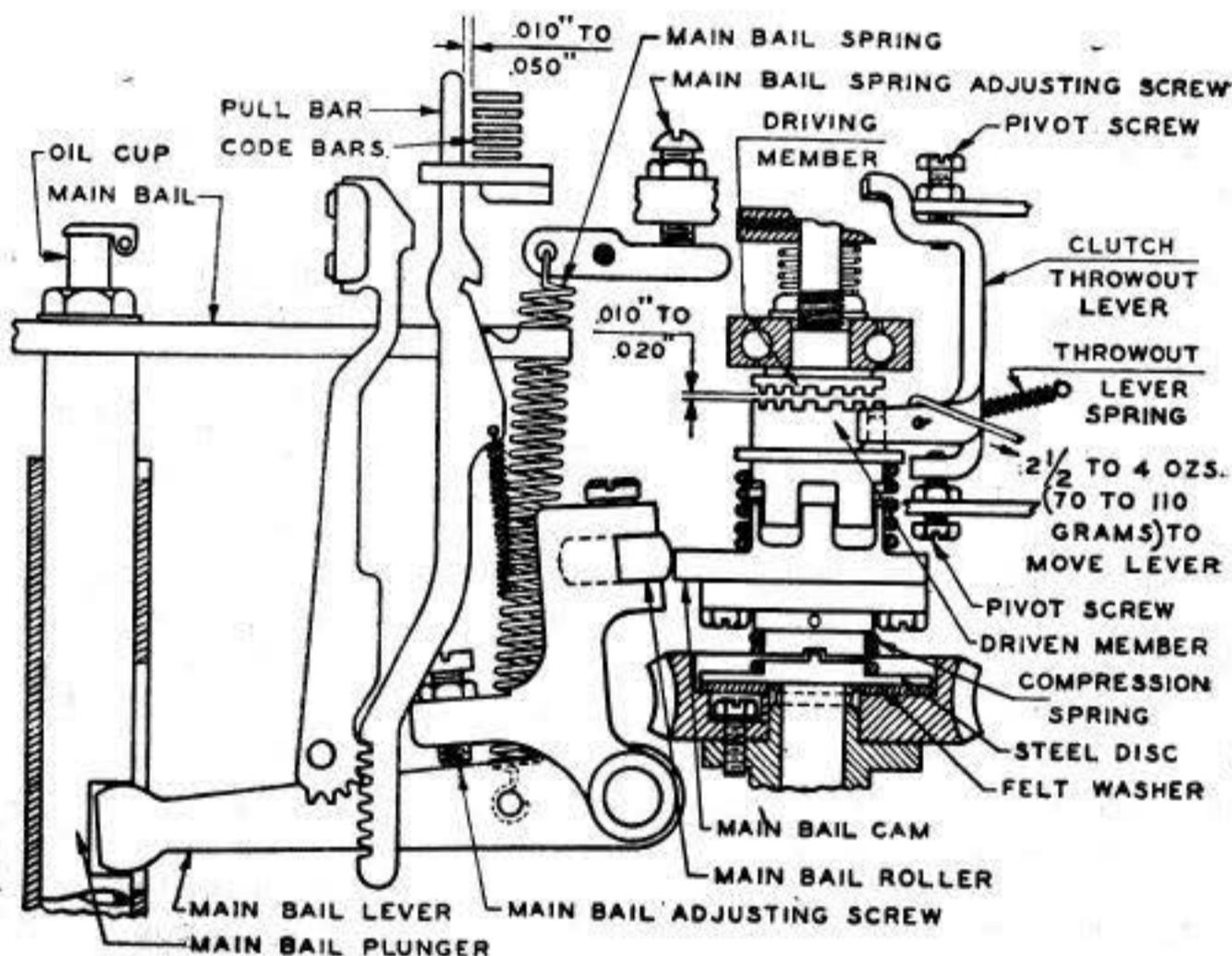


Fig. 25

4.44 **Spacer locking pawl** shall clear the operating lever by Min. .040", Max. .050" as in Fig. 21 when the main bail is in highest position and spacer locking bail is held away from locking pawl.

(a) To adjust, reposition locking pawl block on base.

4.45 **Spacer locking pawl** shall clear spacer operating lever by Min. .015", Max. .025" as in Fig. 26 when the locking pawl is in its unoperated position (so as not to prevent spacing).

(a) To adjust, bend finger on spacer locking bail, using locking bail finger holding and bending tools, 72574M and 72575M.

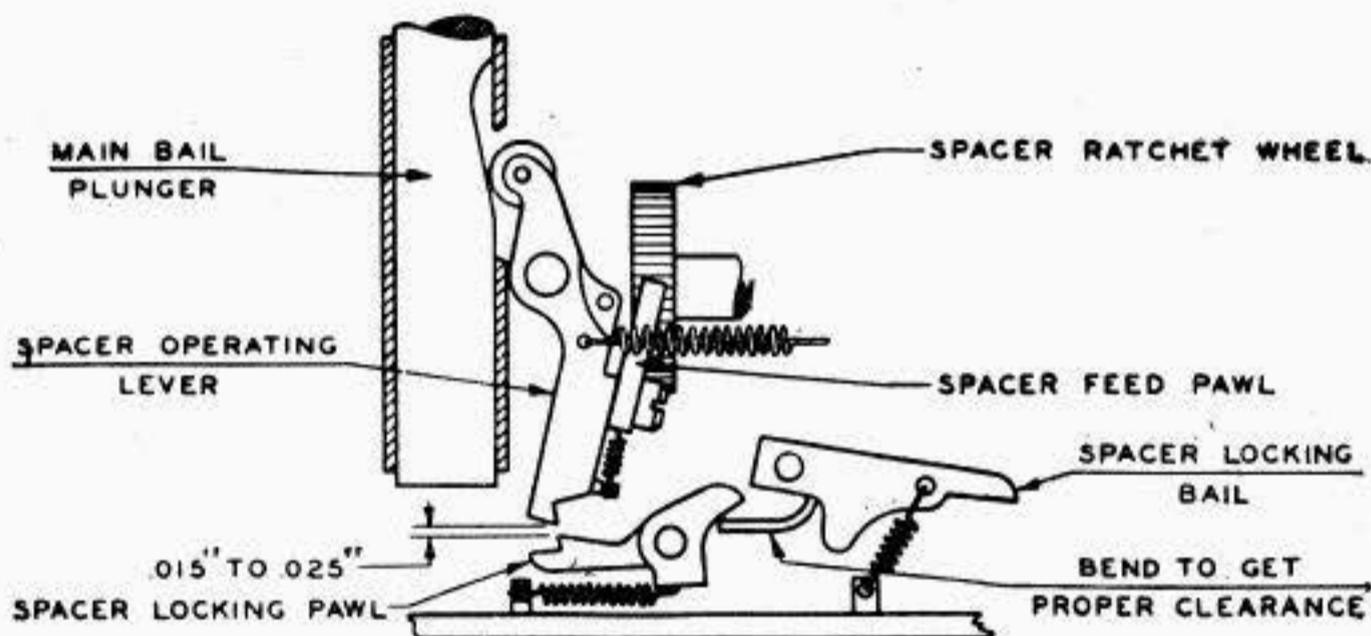


Fig. 26

4.46 **Spacer locking pawl spring** tension shall be Min. 1-1/2 ozs. (45 gms.), Max. 2-1/2 ozs. (70 gms.) as in Fig. 21 when the spacer locking bail is held out of engagement with spacer locking pawl after latter has been located in accordance with 4.44.

Note. Place typing unit so it rests on motor when checking this adjustment.

4.47 **Carriage** shall shift freely without bind from the "letters" to the "figures" position for any position of the spacing gear when the carriage locking pawl is operated by hand. Gauge by feel.

(a) To adjust, reposition platen shaft bearing and if necessary free or replace shift rocker, shift rocker lever and lockout bearings.

Note: Carriage bracket can be removed and reassembled without further adjustment provided the bracket makes contact with the three projections of the locating plate.

- 4.48 **The Numeral "5"** shall strike approximately centrally in the width of the platen. Gauge by eye.
- (a) To adjust, reposition figures position stop screw. See Fig. 27.

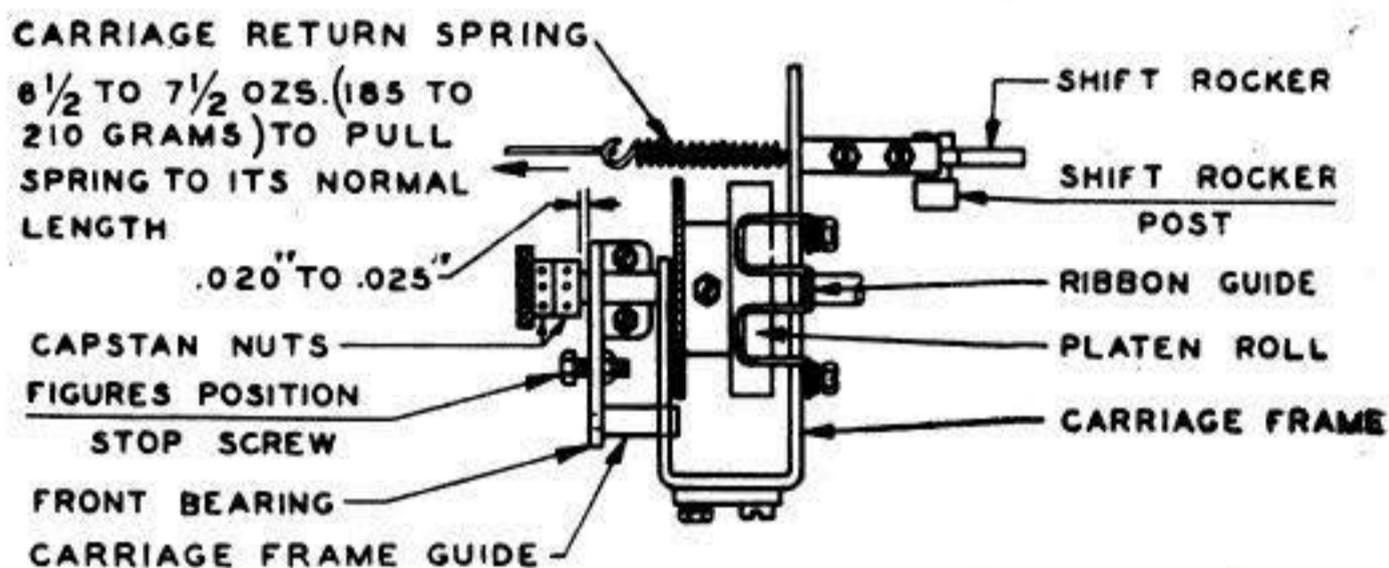


Fig. 27

- 4.49 **Top of letter "T"** shall line up with top of numeral "5" when printed on tape. Gauge by eye.
- (a) To adjust, reposition carriage locking toe on carriage frame after checking to see that carriage locking pawl is in line with locking toe.
- Note: On typing units equipped with positive shift mechanism 83969M, this adjustment should be rechecked after making adjustment 4.50 (b).
- 4.50 **Positive carriage shift mechanism** on typing units so equipped shall meet the following requirements:
- (a) Figures locking pawl shall be parallel to side of carriage shift plate. Gauge by eye. See Fig. 28.
- (1) To adjust, reposition shift bail post checking to see that carriage locking pawl of shift lock lever is in line with carriage locking toe.

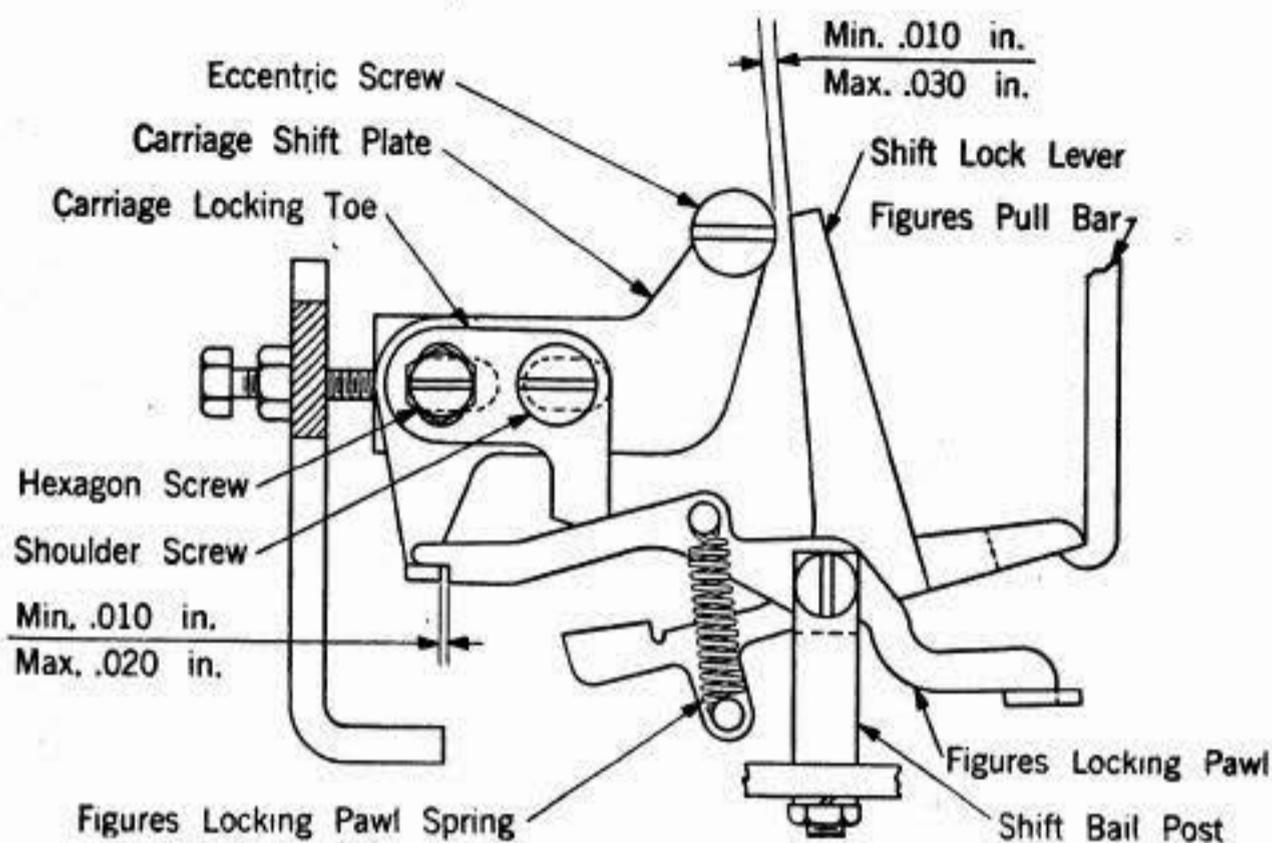


Fig. 28

(b) Carriage shift plate projection shall clear (1) shoulder of the figures locking pawl by Min. .010", Max. .020" as in Fig. 28 when the carriage is in the "figures" position and the locking pawl is held down against the shift plate projection; (2) lower edge of the figures locking pawl by Min. .010", Max. .020" as in Fig. 29 when the carriage is moved from "figures" to "letters" position.

(1) To adjust, loosen (slightly) hexagon and shoulder screws which clamp carriage shift plate and locking toe, reposition shift plate first horizontally and then vertically, tighten shoulder screw and recheck horizontal adjustment. Check carriage locking toe position 4.49 and tighten hexagon screw.

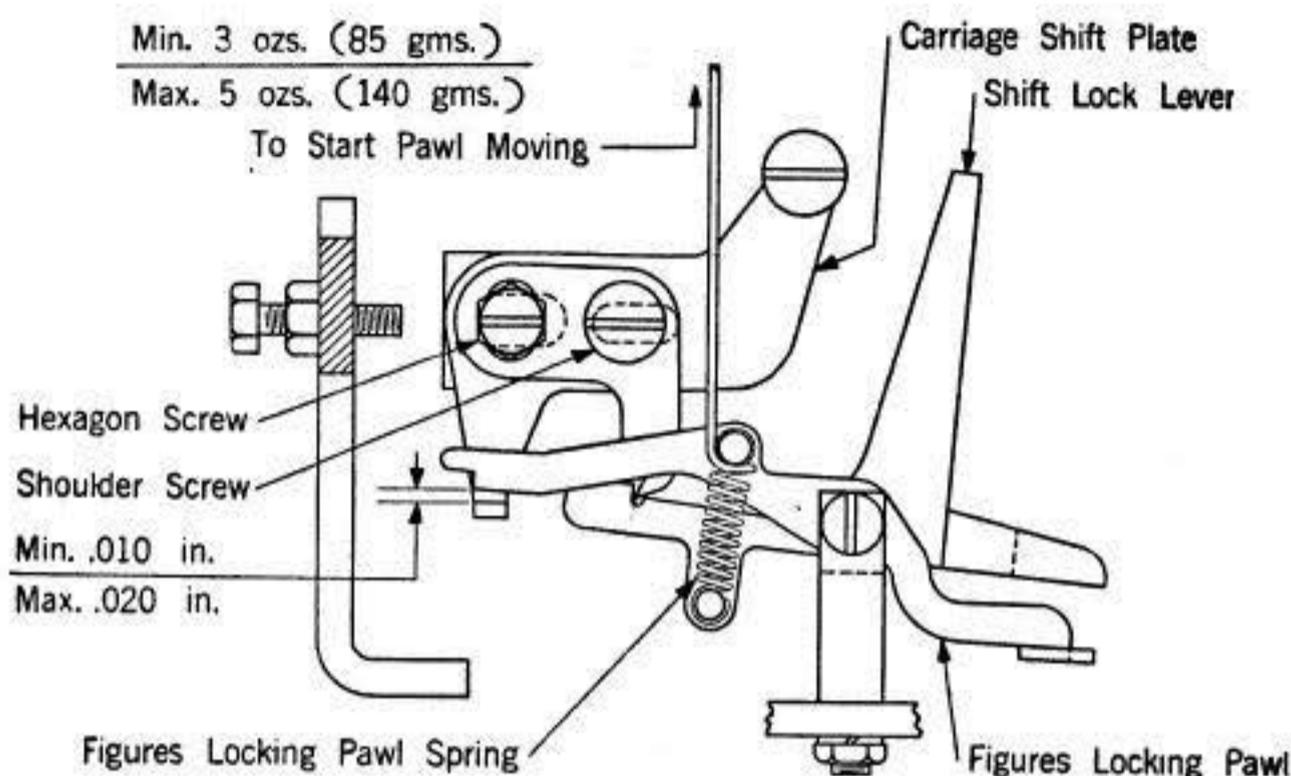


Fig. 29

(c) Carriage shift plate eccentric screw shall clear the shift lock lever by Min. .010", Max. .030" as in Fig. 28 when the carriage is in the "figures" position, "figures" combination set up and the main shaft rotated until main bail is in its highest position (pull upward on bail to insure it has reached highest position).

(1) To adjust, reposition eccentric screw.

(d) Figures locking pawl spring tension shall be Min. 3 ozs. (85 gms.), Max. 5 ozs. (140 gms.) measured as in Fig. 29 when the carriage is in the letters position and the figures pull bar is in its operated position.

4.51 **Tape guides** shall be in line with each other and be so located that printing is in middle of tape, the tape guide on feed roll side of platen clears platen by Min. .004", Max. .010" except as noted in 4.52, and the tape guide on opposite side of platen clears the platen by Min. .010", Max. .020". Gauge by eye. See Fig. 30 for pull tape feed typing units.

Note: On push tape feed typing units, feed roll is on right side of platen.

(a) To adjust, shift or bend guides.

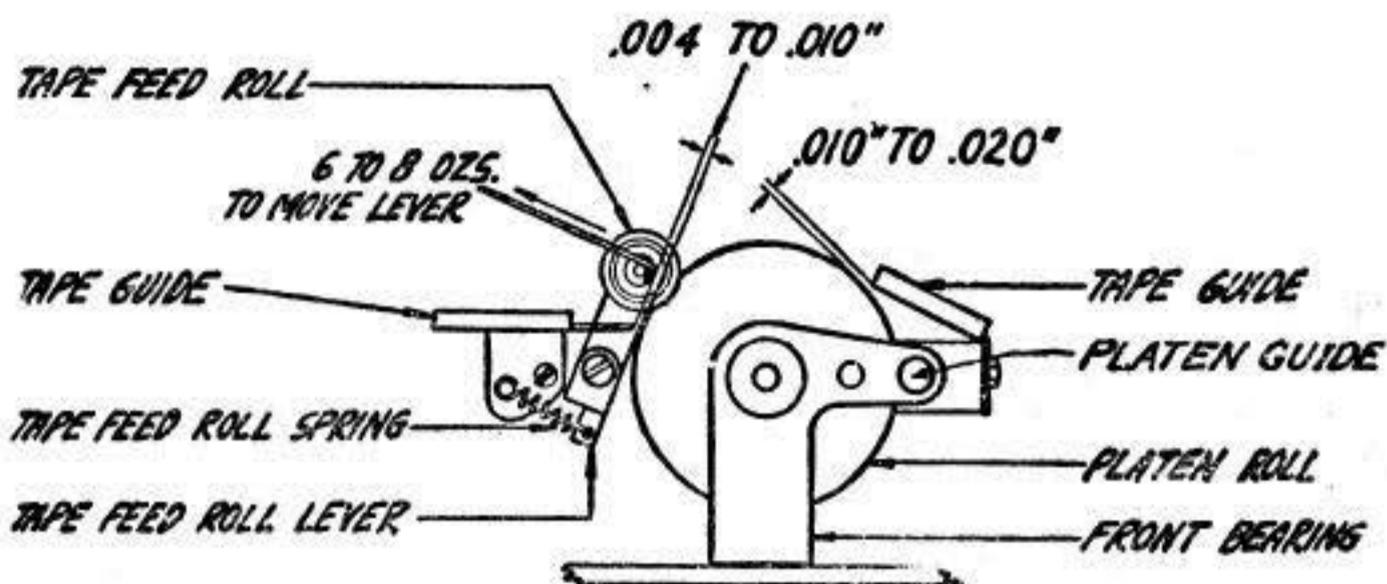


Fig. 30

4.52 Tape guide, 94634M, on push tape feed units so equipped, shall clear the platen by Min. .006", Max. .012" when the pressure roller is resting on the platen.

(a) To adjust, reposition guide on pressure roller stud.

4.53 **Exit tape chute**, except swivel tape chutes, shall clear left tape guide by not less than .015" and be so aligned with the guide that the tape will enter easily without catching. Gauge by eye.

(a) To adjust, bend chute mounting bracket.

4.54 **Swivel tape chute**, on units so equipped, shall clear the platen by Min. .010", Max. .020" and the chute centerline shall coincide with that of the platen surface when the platen is held at the mid-point of its travel. Gauge by eye.

(a) To adjust clearance, reposition right chute bracket; to adjust alignment reposition left chute bracket.

4.55 **Tape feed roll** shall be located so that both knurls rest against platen and the roller gear engages the carriage gear so as to drive reliably with minimum back-lash. Gauge by eye.

4.56 **Tape feed roll spring** tension shall be Min. 6 ozs. (170 gms.), Max. 8 ozs. (225 gms.) on pull tape feed typing units, and Min. 10 ozs. (285 gms.), Max. 14 ozs. (395 gms.) on push tape feed typing units, measured at the feed roll shaft as the feed roll leaves the platen. See Fig. 30 for pull tape feed typing unit.

4.57 **Tape release lever**, on typing units so equipped, shall hold the tape feed roll away from the platen when the lever is in its operated (depressed) position.

4.58 **Shift rocker** shall be parallel to platen shaft. Gauge by eye. See Fig. 27.

(a) To adjust, reposition shift rocker post.

4.59 **Carriage shift spring** tension shall be Min. 6-1/2 ozs. (185 gms.), Max. 7-1/2 ozs. (210 gms.) measured as in Fig. 27 when the carriage is in "letters" position.

4.60 **Carriage locking pawl spring** tension shall be Min. 1-1/2 ozs. (45 gms.), Max. 2-1/2 ozs. (70 gms.) measured as in Fig. 31 when the carriage is held in "letters" position so as to take up clearance between capstan nut and front bearing bracket.

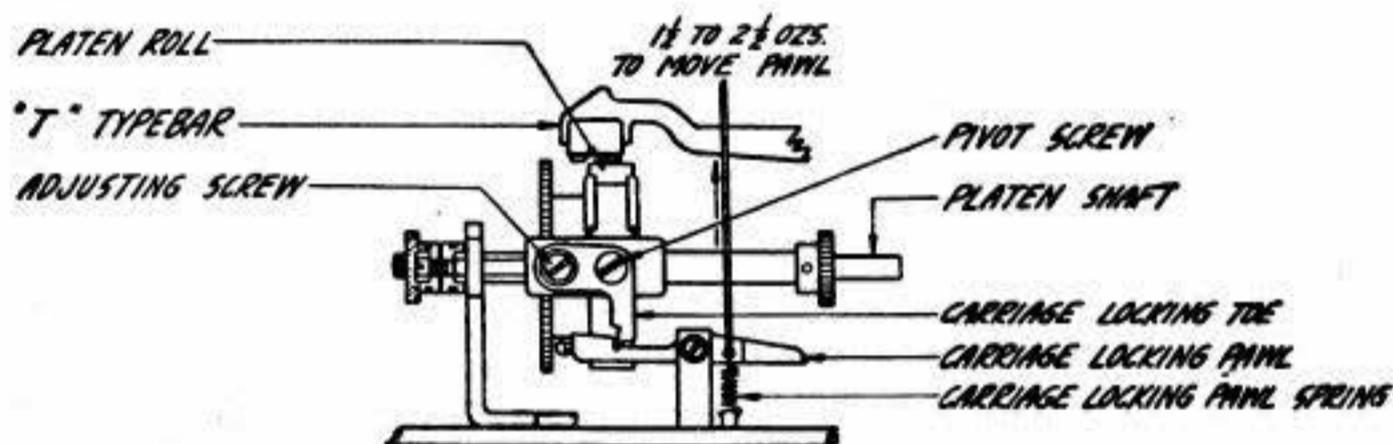


Fig. 31

4.61 **Shift rocker lever post** shall be located so its front surface is approximately parallel to the front edge of the base plate, and on typing units equipped with a non-adjustable shift rocker, so that the shift rocker lever clears "letters" pull bar toe by Min. .002", Max. .006" as in Fig. 32 when the carriage is in the "Figures" position and the "Letters" pull bar is just selected and about to move upward.

(a) To adjust, raise or lower shift rocker lever post by means of shims under post.

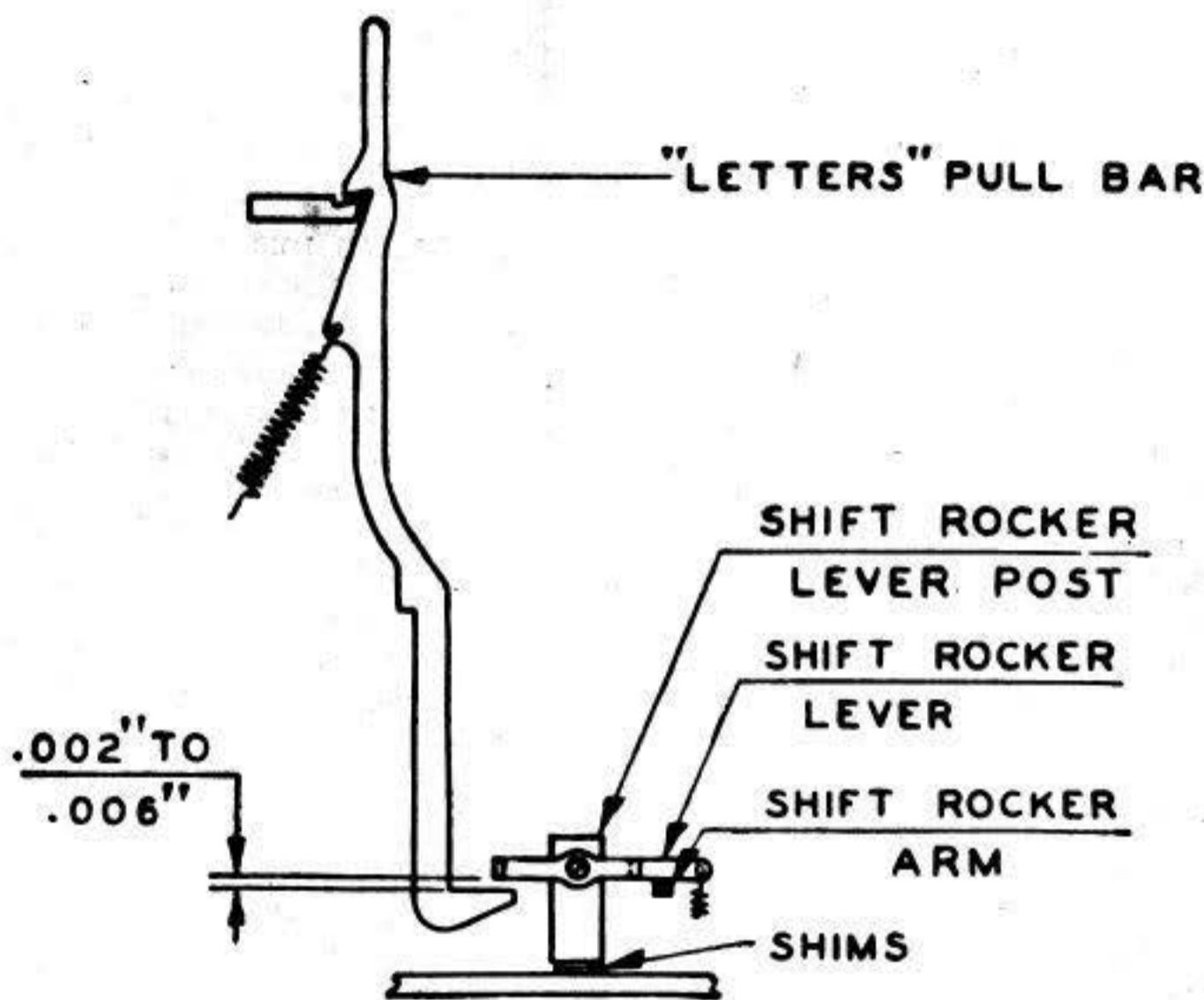


Fig. 32

4.62 Carriage spring bracket toe shall travel an equal distance on either side of a vertical line passing through the shift rocker bearing screw as in Fig. 33 when the carriage is moved from "letters" to "figures" position. Gauge by eye.

(a) To adjust, reposition carriage spring bracket toe.

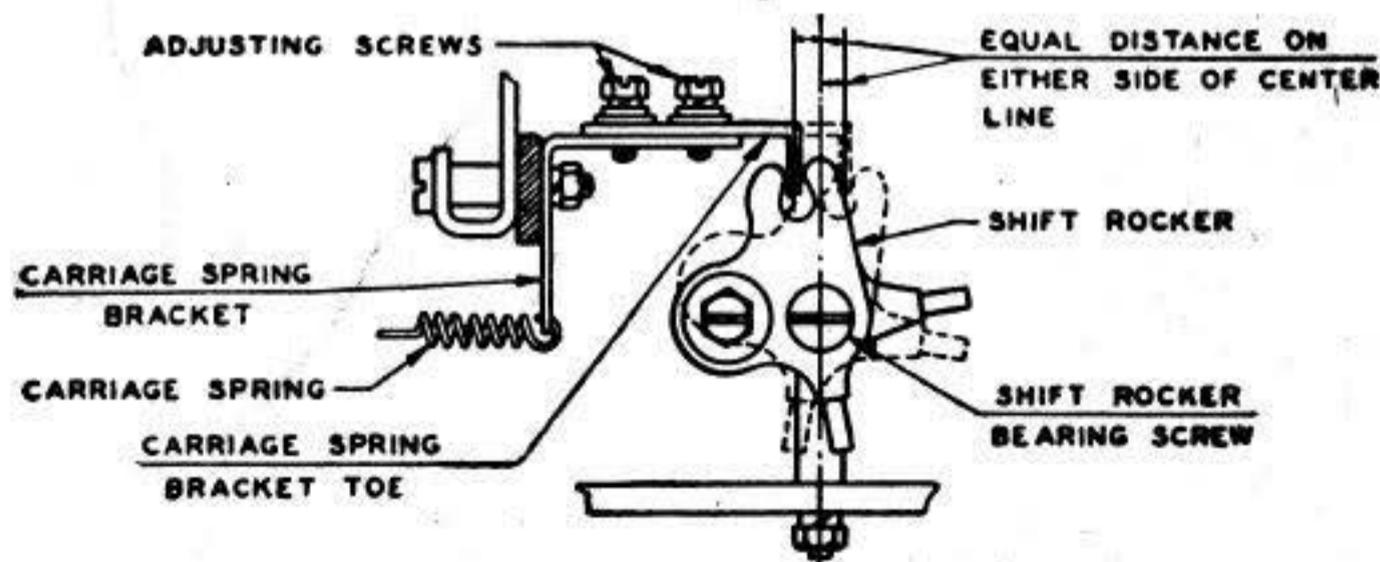


Fig. 33

4.63 **Carriage locking toe**, on units equipped with an adjustable shift rocker (see Fig. 33), shall overtravel the locking pawl notch by not more than .020" when "Letters" combination is set up and the main bail is in its highest position (pull upward on bail to insure this).

Note: If unit is to unshift on "Space," it shall meet the same requirement when "Space" combination is set up.

(a) To adjust, loosen shift rocker hexagon screw and readjust shift rocker.

4.64 **Type bars and pull bars** shall be free of bind and move freely.

(a) To adjust, bend individually so that they do not exert appreciable pressure on sides of slots. If bind cannot be relieved in this manner, replace bar as follows: Remove carriage spring, ribbon and carriage assembly; move type bar forward and downward until teeth disengage those of pull bar; unhook type bar from fulcrum and remove defective bar; hook replacement bar over fulcrum, lapping it with 87698M or 138-139M carborundum stones if necessary to relieve bind in segment slots; mesh type and pull bar teeth so that type bar rests against its back stop when top of pull bar is in line with other pull bars and reassemble carriage, ribbon, and carriage spring.

4.65 **Rear capstan nut** shall clear the carriage front bearing bracket by Min. .020", Max. .025" as in Fig. 27 when the carriage is latched in "letters" position.

(a) To adjust, reposition capstan nuts using the 6617M tommy.

4.66 **Pull Bar Lockout Lever:** "Bell" pull bar shall clear the lockout lever roller of the "S" pull bar by Min. .010", Max. .040" as in Fig. 34 and the "S" pull bar shall clear the code bars by Min. .004", Max. .020" when the platen is in the "Figures" position, "S" combination is set up and motor is rotated by hand until the main bail is approximately .010" below its notch in the "Bell" pull bar.

(a) To adjust, reposition pull bar lockout lever adjusting lever after checking 4.67.

Note: Substitute "J" for "S" in 4.66 and 4.67 on units arranged to ring the bell on upper case "J" instead of "S."

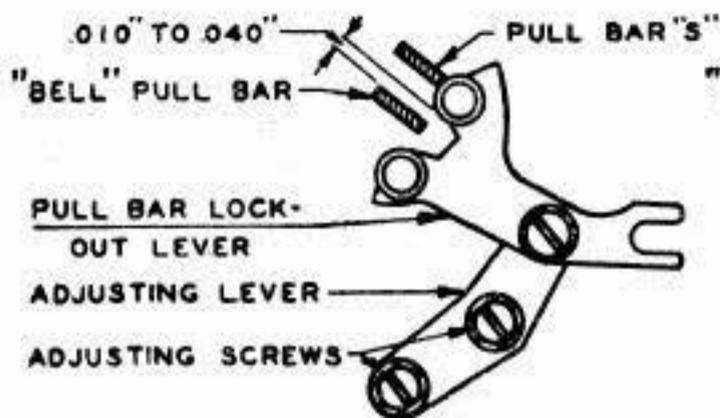


Fig. 34

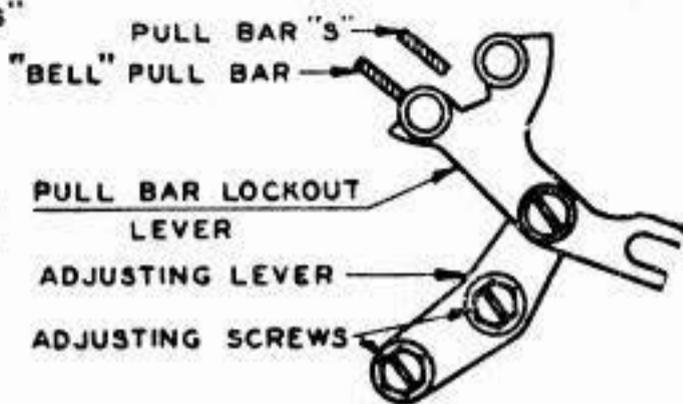


Fig. 35

4.67 **"Bell" pull bar** shall clear the code bars by Min. .004", Max. .020" when the platen is in the "letters" position, "Bell" combination is set up and motor is rotated by hand until the main bail is approximately .010" below its notch in the "S" pull bar. See Fig. 35.

(a) To adjust, reposition pull bar lockout lever adjusting lever after checking 4.66.

4.68 **Ribbon guide** shall clear top of platen by Min. .040", Max. .050". Tongue of guide shall clear the side of platen by Min. 3/16", Max. 7/32". Gauge by eye.

4.69 **Ribbon spool guard** for left spool shall be located so that upper right corner of guard slot is within 1/32" of alignment with right side of ribbon spool shaft bracket. See dotted line in Fig. 36. Similarly, upper left corner of slot in right ribbon spool guard should be within 1/32" of alignment with left side of ribbon spool shaft bracket. Gauge by eye.

(a) To adjust, reposition spool cups.

Note: On typing units equipped with 82990M motor control on upper case "H," the left ribbon spool guard shall be adjusted so that the upper edge of the guard rim cut-away is in line with the right side of the ribbon spool shaft bracket (see Section P35.611).

4.70 **Ribbon spool bracket** shall be parallel to the left edge of the base plate. Gauge by eye.

(a) To adjust, reposition bracket.

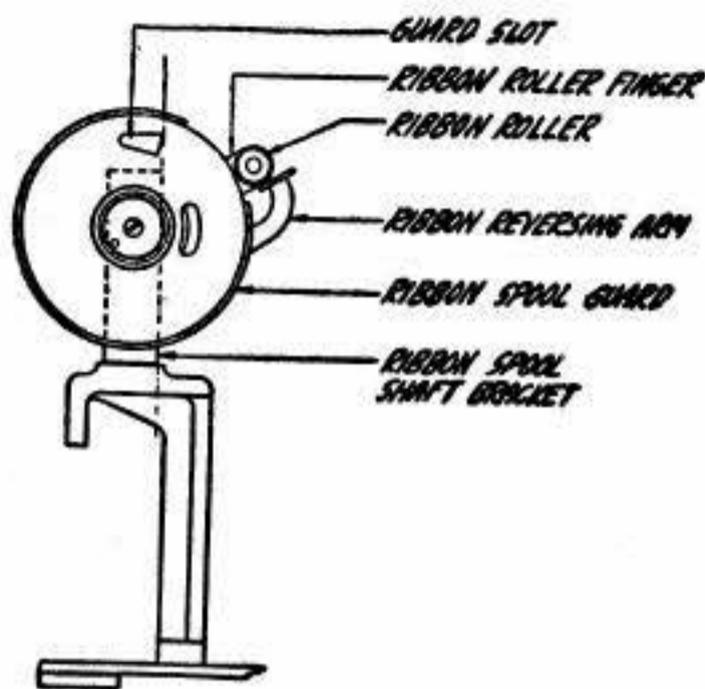


Fig. 36

4.71 **Ribbon spool shafts** shall have perceptible end play, but not more than .004".

(a) To adjust, reposition spool shaft gears.

4.72 **Ribbon Spool Shaft Springs:** The resistance to turning caused by the ribbon spool shaft springs shall be Min. 3-1/2 ozs. (100 gms.), Max. 5 ozs. (140 gms.) measured as in Fig. 37 by pulling on the pin, with ribbon feed shaft disengaged from ribbon spool shaft.

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

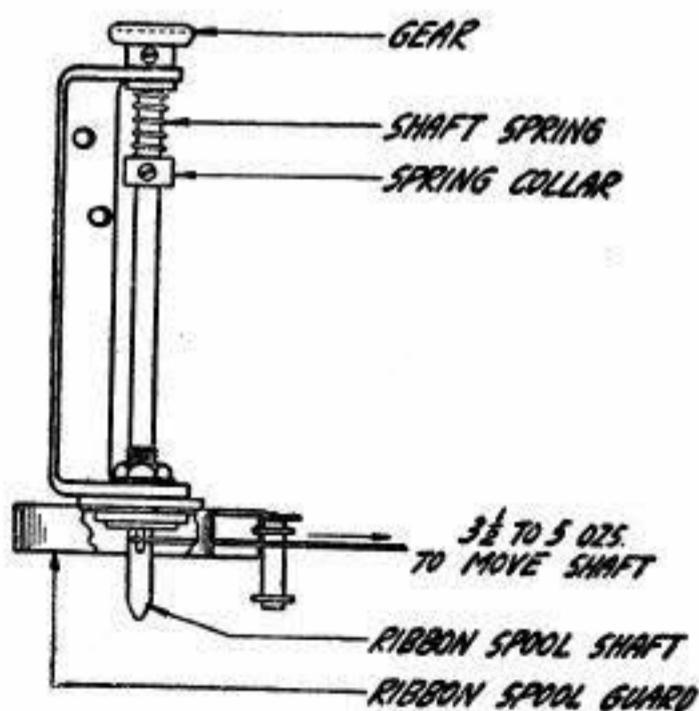


Fig. 37

4.73 **Ribbon reverse shafts** shall (1) clear their respective ribbon spool cups by Min. .010", Max. .020" when the reverse arms are held against the ribbon spool shaft bracket so as to make the clearance a minimum and (2) have not more than .004" end play as gauged by eye and feel.

(a) To adjust clearance, reposition ribbon reverse arms; to adjust end play, reposition collar at rear bearing of bracket.

Note: If clearance is changed check 4.75.

4.74 **Ribbon reverse pawl links** shall not bind on their shoulder screws.

(a) To adjust, reposition ribbon reverse levers at rear end of reverse shafts and check 4.75.

4.75 **Ribbon reverse pawls** shall clear the ribbon reverse bail by Min. .015", Max. .025", as in Fig. 38 when the associated ribbon reversing arm is against its ribbon spool guard.

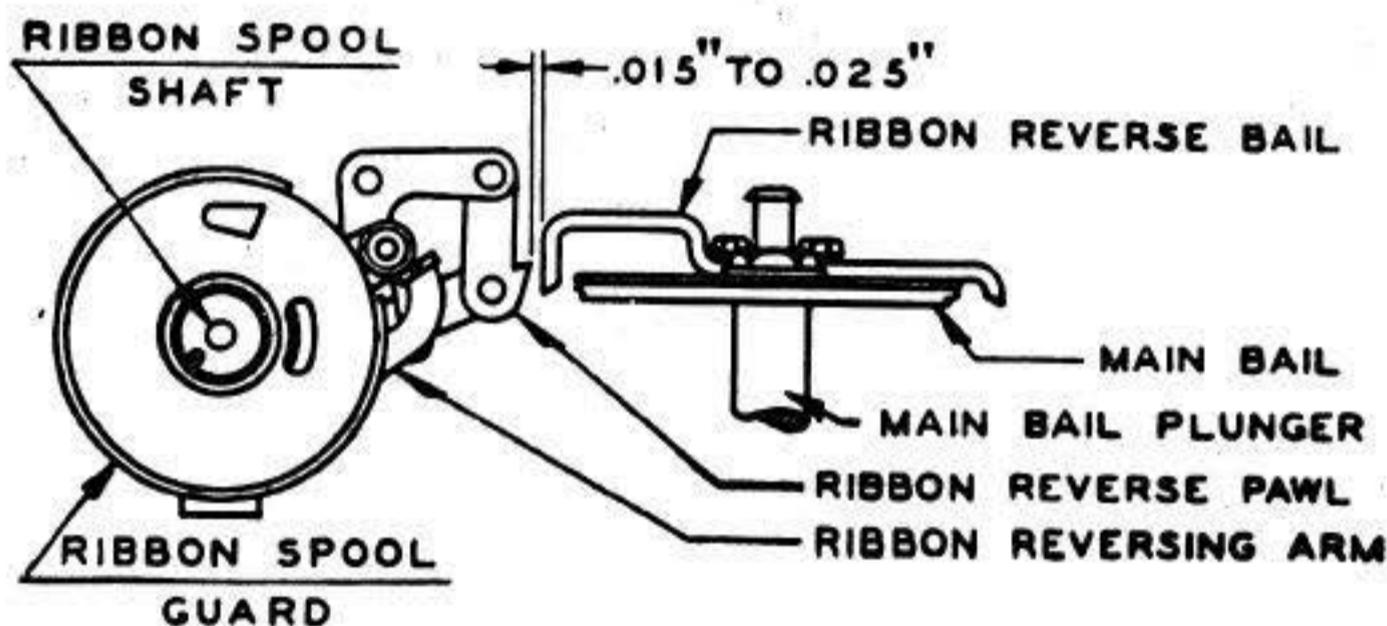


Fig. 38

(a) To adjust, reposition reversing arms on their shafts and recheck 4.73.

4.76 **Ribbon feed shaft springs** shall exert a pressure of Min. 3 lbs. Max. 5 lbs. measured on the ribbon reverse pawls as in Fig. 39 when the feed shaft is held in engagement with the opposite spool shaft gear and the main bail is in its uppermost position.

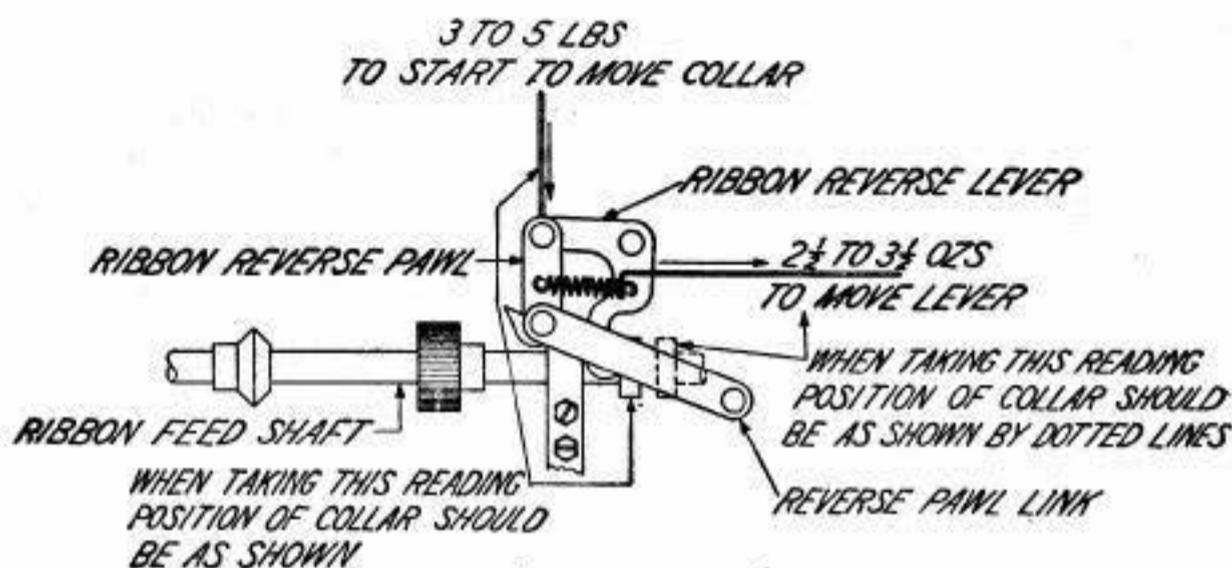


Fig. 39

4.77 **Ribbon feed shaft detent plunger** shall press against the detent so that it requires a force of Min. 1-1/2 lbs., Max. 3-1/2 lbs. to push the detent over the plunger as in Fig. 40 when the ribbon feed and check pawls are held clear of the ratchet.

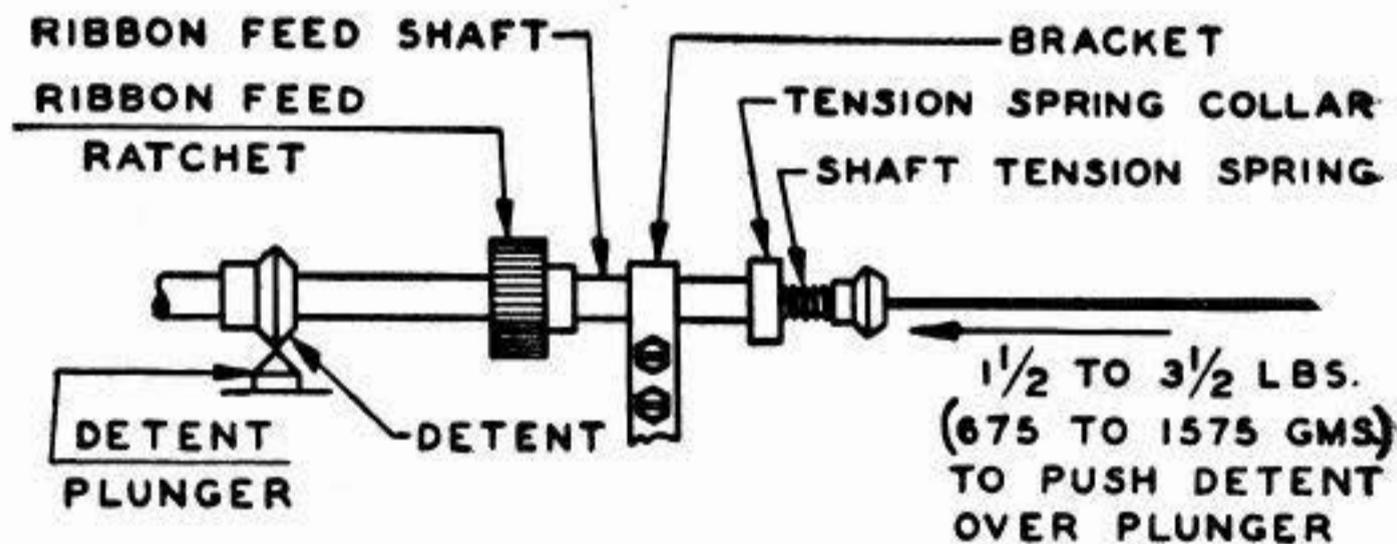


Fig. 40

4.78 **Ribbon check pawl** (top end) shall clear the pull bar guide by Min. 3/64", Max. 5/64" gauged by eye.

(a) To adjust, reposition check pawl.

4.79 **Ribbon check pawl spring** tension shall be Min. 6 ozs. (170 gms.), Max. 8 ozs. (225 gms.) measured as in Fig. 41.

Fig. 41.

(a) To adjust, bend spring.

4.80 **Ribbon feed pawl** position shall be such that the ratchet is moved one or two teeth at a time.

4.81 **Ribbon feed pawl spring** tension shall be Min. 6 ozs. (170 gms.), Max. 8 ozs. (225 gms.), measured as in Fig. 41.

(a) To adjust, bend spring.

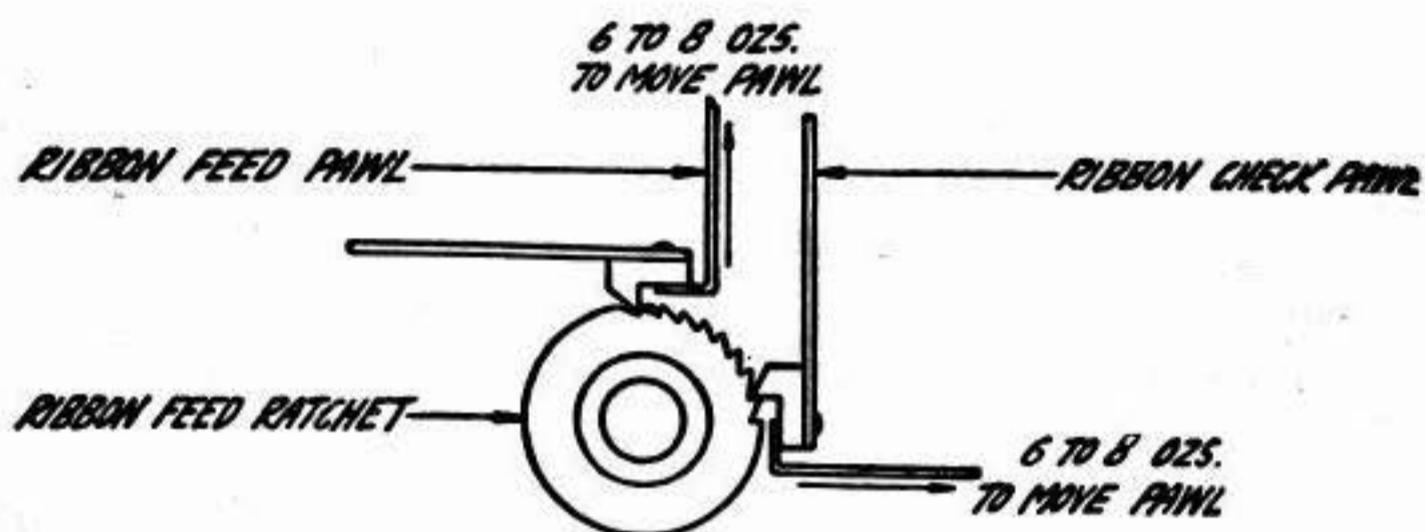


Fig. 41

4.82 **Ribbon reverse pawl spring** tension shall be Min. 2-1/2 ozs. (70 gms.), Max. 3-1/2 ozs. (100 gms.) measured as in Fig. 39, with ribbon feed shaft collar moved away from ribbon reverse lever as shown dotted.

4.83 **Ribbon spools** shall be tight on their shafts so as not to slide off.

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

4.84 **"Letters" pull bar spring** tension shall be Min. 1 oz. (30 gms.), Max. 1-1/2 ozs. (40 gms.) measured as in Fig. 42 when the main bail is in the "down" position.

(a) To adjust, reposition spring bracket.

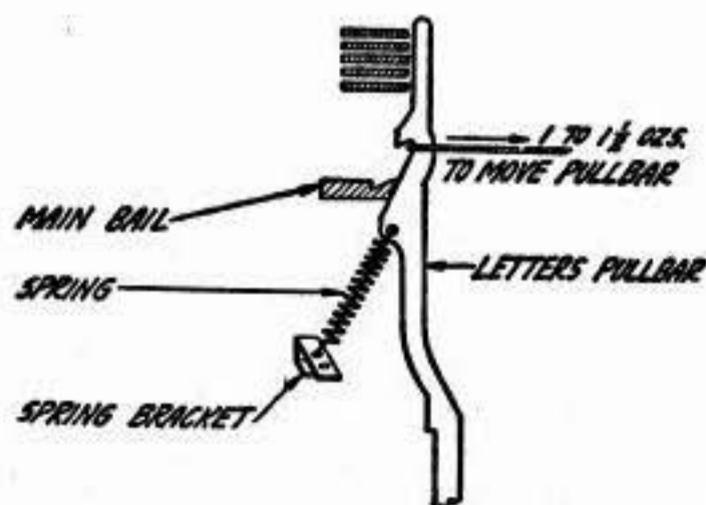


Fig. 42

4.85 **Code bar lock lever spring tension** shall be Min. 5 ozs. (145 gms.), Max. 6 ozs. (170 gms.) measured as in Fig. 43 when the main bail is in the "down" position.

(a) To adjust, reposition spring bracket.

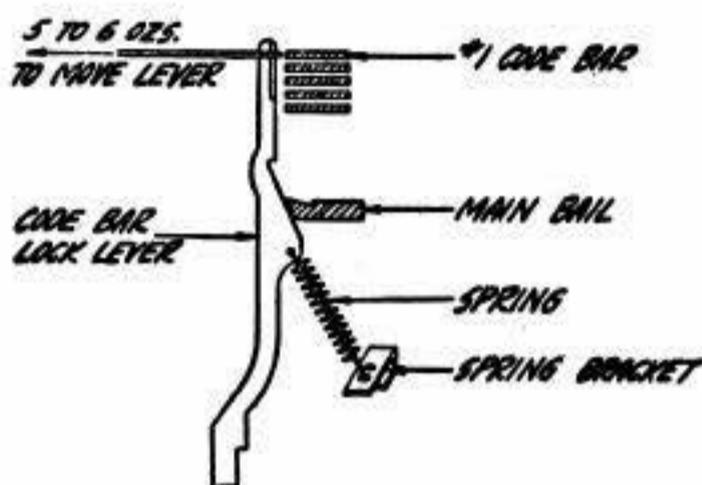


Fig. 43

4.86 **Signal bell hammer lip** shall clear bell hammer post by Min. .045", Max. .075" as in Fig. 44 when the platen is in "figures" position and the bell selection has been set up and motor rotated by hand until bell pull bar has reached its uppermost position. End of bell pull bar toe shall be in alignment with outer side of eccentric on bell hammer. Gauge by eye.

(a) To adjust clearance, reposition eccentric screw. To adjust alignment, reposition bell hammer post.

4.87 **Signal bell** shall clear bracket base and bracket mounting screws by at least .010" and shall also ring reliably. Bell shall clear tape chute by at least .010". Gauge by eye.

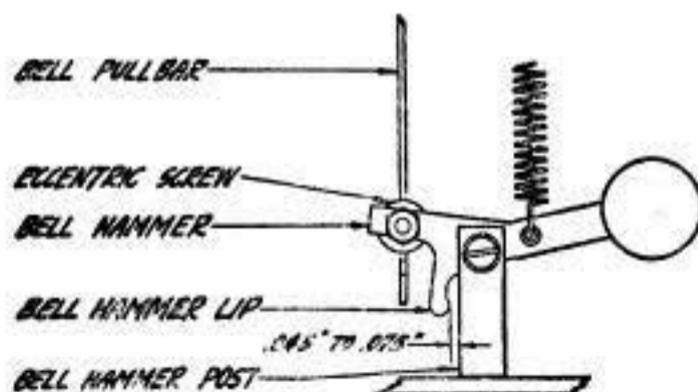


Fig. 44

4.88 **Main Bail Cam Friction Clutch Torque:** After motor has been run for at least 10 minutes a pull of 24 ozs. (680 gms.) applied to main bail cam perpendicular to radius as in Fig. 45, shall move cam in a direction opposite normal rotation when motor is running, selector magnet is operated and main bail roller is held away from its cam. A pull of 18 ozs. (510 gms.) applied under the same conditions shall not move cam.

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 main bail roller away from cam by pressing upon lid of oil cup at top of the main bail plunger, block magnet armature in operated position so that main clutch will not engage, hook scale into screw hole as in Fig. 45, and pull in direction reverse to normal rotation until cam just starts to move.

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 stop arm against driven jaw to prevent main clutch engaging and winding scale around main shaft so either keep armature operated to avoid tripping clutch stop arm, or block or clamp clutch stop arm so that main clutch cannot engage.

(b) To adjust, replace compression spring, steel disc, and felt washer of clutch.

Note: If torque is too high, lubricate clutch and re-check before replacing parts.

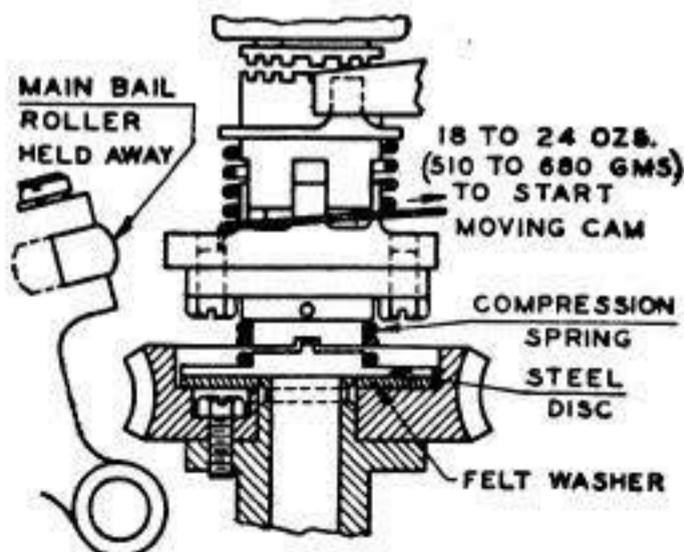


Fig. 45

4.89 Selector Clutch Torque: After motor has been run for at least 10 minutes and clutch has been freshly lubricated a pull of 18 ozs. (510 gms.) applied as in Fig. 46 when motor is running shall hold selector cam sleeve from rotating when selector arm is held just clear of its stop. A pull of 14 ozs. (395 gms.) similarly applied shall not hold sleeve from rotating.

- (a) To adjust, recondition or replace felt friction washers, add spring adjusting washers, or replace spring as follows:

Note: Reconditioning of washers by removing them and kneading with the fingers to soften them, or their replacement by new washers will usually be satisfactory in most cases since the spring holds its adjustment over long periods. Before replacing spring, consideration should be given to the addition of washer shims, 96763M, 96764M, or 96765M around the shoulder of the 72515M nut at the end of the spring nearest the bearing.

(1) To recondition felt washers; remove range finder assembly, detach locking lever spring and remove retaining disc noting that it has a left-hand thread and unscrews to right (clockwise); remove outer felt washer, cam sleeve assembly, cam sleeve disc, and inner felt washer holding selector levers away from shaft and rotating cam sleeve disc until notch in its edge registers with points of selector levers; knead felt washers with fingers and saturate with oil as specified in Section P35.601.

(2) To remove clutch spring or add adjusting washers, proceed as in (1) remove countershaft bearing, main shaft, clutch driving disc and spring.

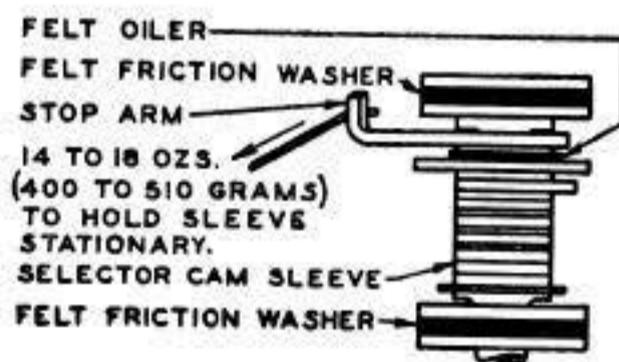


Fig. 46

4.90 **Remote signal bell contacts** on typing units so equipped shall meet the following requirements:

(a) Contact lever shall fully engage the heel of the bell pull bar and clear its side by at least .010" when the "Bell" combination is set up and the motor has been rotated by hand until the pull bar bail is in its extreme upper position. Gauge by eye.

(1) To adjust, reposition contact bracket.

(b) Contact lever shall clear the insulator on the upper contact spring by not more than .006" when the contact lever is held against the bell pull bar after the motor has been rotated by hand until the pull bar bail is in its extreme lower position.

(1) To adjust, bend upper contact spring.

(c) Contact gap shall be Min. .025", Max. .030" when contact lever is held clear of the upper contact spring, and it shall require Min. 1-1/2 ozs. (40 gms.), Max. 2 ozs. (56 gms.) pressure at the end of the lower contact spring to move the spring from its stiffener.

(1) Gauge gap by eye and tension by feel.

(2) To adjust gap, bend stiffener; to adjust tension, bend spring.

Note: It may be necessary to remove contact assembly to make this adjustment, in which case contact adjustments may be checked before reassembling in typing unit.

4.91 **Bell and break signal mechanism** on units so equipped shall meet the following requirements:

Note: Contact springs of bell and break signal mechanism shall meet the requirements of Section P35.620.

(a) Tension of detent arm spring shall be Min. 18 ozs. (500 gms.), Max. 22 ozs. (625 gms.) when finger arm is against upper stop. This should be measured by unhooking spring from spring post and stretching spring to its operating length.

(b) Bell hammer shall clear bell by approximately .010" when finger arm is against lower stop. This may be obtained by bending bell hammer wire.

(c) When assembled on a standard 14 teletypewriter base the contact arm shall clear ends of contact spring covers by at least .020" with play in contact arm taken up in a direction to make this clearance minimum.

(1) Gauge clearances by eye.

4.92 Upper case blank contact mechanism 86563M on typing units so equipped shall meet the following requirements:

- (a) Bracket assembly and contacts shall be adjusted in accordance with 4.90.
- (b) Blank pull bar projection shall clear all edges of blank pull bar lever by at least .030" when the carriage is in the "Letters" position. Gauge by eye.
 - (1) To adjust, bend blank pull bar lever.

4.93 Mechanical end-of-line indicator 87593M on typing units so equipped shall meet the following requirements:

- (a) Worm shaft shall not bind but shall have just perceptible end play. Gauge by eye and feel.
 - (1) To adjust, unfasten shaft spring from contact bracket, loosen collar set screw and reposition collar.
- (b) Front lamp contact spring shall press against its stiffener with a pressure of Min. 3 ozs. (85 gms.), Max. 4 ozs. (115 gms.) measured by pushing perpendicular to the spring at the contact point when the contacts are in the unoperated position.
 - (1) To adjust, remove spring from pile up and bend it.
- (c) Rear lamp contact spring shall clear the front spring contact by Min. .015", Max. .025" when the front spring is resting against its stiffener.
 - (1) To adjust, bend rear spring.
- (d) Front lamp contact spring shall clear the lower edge of its stiffener by Min. .010", Max. .020" when the worm follower rests in the groove at the end of the worm.
 - (1) To adjust, reposition contact bracket.
- (e) Worm follower bail shall not bind, shall have just perceptible end play and shall close the lamp contacts when Min. 62 characters, Max. 66 characters have been received.
 - (1) To adjust, reposition collar and adjusting bracket and recheck (d).
- (f) Worm follower spring tension shall be Min. 1-1/2 ozs. (40 gms.), Max. 3-1/2 ozs. (100 gms.) measured by pulling parallel to the spring at the end of the worm follower as the follower comes in contact with the rear contact spring, holding the bail so that the follower pin clears the worm.

(g) Release bail spring tension shall be Min. 7 ozs. (200 gms.), Max. 11 ozs. (310 gms.) measured by pulling vertically upward at the edge of the release bail near the spring hole as the bail starts to move from its unoperated position.

(h) Feed pawl spring tension shall be Min. 3 ozs. (85 gms.), Max. 5-1/2 ozs. (155 gms.) measured by pulling in line with the spring at the spring hole near the end of the feed pawl as the pawl starts to move, when the feed lever roller is on the high part of its cam.

(i) Feed lever spring tension shall be Min. 28 ozs. (795 gms.), Max. 38 ozs. (1075 gms.) measured on the feed lever at the spring hole as the lever starts to move when the feed lever roller is on the low part of its cam.

4.94 **Mechanism for preventing printing and spacing on lower case blank**, on typing units so equipped, shall meet requirements of Section P35.612.

4.95 **Mechanical motor control mechanism which functions on upper case "H,"** on typing units so equipped, shall meet requirements of Section P35.611.

4.96 **Monitoring range scale, 83562M**, on typing units so equipped, shall meet requirements of Section P35.613.

4.97 **Main Bail Spring:** Typing units shall type characters without embossing the back of the copy of single copy work or the last copy of multiple copy work except that embossing of punctuation marks is permissible.

Note: On typing units operated at 75 speed it may be necessary to increase this tension to minimize irregular spacing. On some machines it will not be possible to get even spacing at this speed.

(a) To adjust, back off main bail adjusting screw counter-clockwise with typing unit running until machine fails to type, then turn adjusting screw clockwise until satisfactory copy is obtained. See Fig. 25.

4.98 **Platens** which are cracked, broken or badly pitted by type shall be replaced by new or repaired platens.

4.99 **Alignment of Type:** Characters shall not be noticeably out of line or misspaced as determined from the copy.

(a) All characters are compared with the letter "N." A good procedure is first to adjust characters to proper height and then align them to be straight and properly spaced. First write a series of characters such

as "NANBNC," etc., and adjust "N" so as to require a minimum of adjustment of the other type to bring them in proper alignment with it.

Note: If only a few type require adjusting it can probably be done by bending or twisting the type bar with ordinary pliers or by unsoldering type pallet from type bar and moving pallet slightly. If many type require adjusting it will be found advantageous to secure the following type aligning tools and proceed as described herein:

- (1) Short Nose Pliers.
 Nine Prong Pliers 78591M.
 Three Prong Pliers 78589M.
 Parallel Pliers 78590M.
 Two Side Type Cutting Pliers 78587M.
 One Side Type Cutting Pliers 78588M.
 Electric Soldering Copper.
- (2) If type requires raising or lowering an appreciable amount (more than a few thousandths of an inch) type pallet should be unsoldered. To do this, pull type bar forward slightly and place a small block behind it to hold it forward from other bars. Then heat type pallet with an electric soldering copper until solder just begins to melt. Take soldering copper away and move pallet up or down slightly as required. After solder has reset, remove block and let type bar return to normal position, but do not use it for printing until solder is thoroughly set. For very small vertical adjustments a peener may be used to squeeze type bar slightly in the crook just below type pallet. Peening inside of crook lowers characters and peening outside raises them.
- (3) To straighten type so sides of letter will be vertical and upper case character will print properly when compared with lower case character, hold type bar at top of its straight shank with parallel jaw pliers and grasping top of bar with short nose pliers, correct bend in bar to right or left as required. If any type prints with improper spacing from "N," and if one side of character prints heavier than other side, hold type bar as above and twist top of bar slightly in a direction to correct fault. Three-pronged pliers may be used to bend type bar to secure this adjustment where twisting will not answer or where some bending is required to make type bars lie properly spaced when against leather stop. If any part of

a character prints faintly after above alignment has been completed use double cutter to cut into type pallet just back of low part of type so as to raise low portion.

(4) After finishing type alignment, a piece of cardboard should be placed on platen and pallets which were unsoldered should be moved down against cardboard and have their slots refilled with solder where required, using a small brush to remove excess solder.

4.100 **Ribbons** which are worn or defective shall be replaced by new ribbons.

4.101 **Orientation Range and Distortion Tolerance.** Typing units shall be capable of meeting the teletypewriter station orientation range and distortion tolerance requirements given in another section of the "P" series covering this subject.