

3871#853B

**20-PULSE PEN REGISTERS**  
**KS-3106 (SINGLE PEN) AND KS-3107 (DOUBLE PEN)**  
**AND SIMILAR PEN REGISTERS MANUFACTURED BY**  
**FOOTE-PIERSON CO. OR J. H. BUNNELL CO.**  
**REQUIREMENTS AND ADJUSTING PROCEDURES**

**1. GENERAL**

1.01 This section covers the 20-pulse KS-3106 single pen registers and the 20-pulse KS-3107 double pen registers and similar pen registers manufactured by the Foote-Pierson Co. or J. H. Bunnell Co.

1.02 This section has been reissued to revise Paragraph 2.13, changing the minimum amount of paper to be driven per 30 seconds, re-

word Paragraph 2.14, and to bring the section up to date.

1.03 Reference shall be made to Section 020-010-711, covering General Requirements and Definitions, for additional information necessary for the proper application of the requirements listed herein.

1.04 *Operate:* A register is said to operate if when current is connected to its windings, the armature moves sufficiently to touch at least

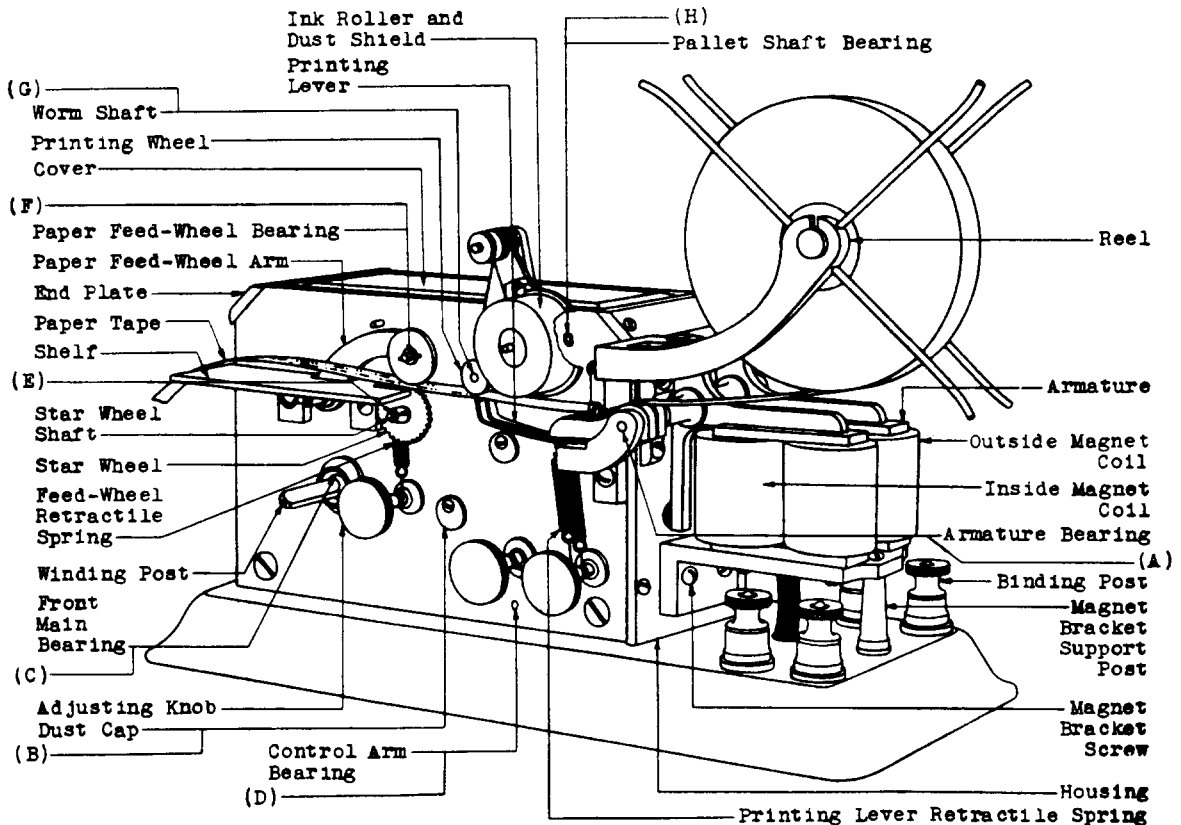


Fig. 1 - KS-3107 Pen Register

one of the stop pins (KS-3106 single pen register) or the core of the associated outside magnet coil (KS-3107 double pen register) and the mechanism moves and inks the tape.

**1.05 Operated position** is that position in which the armature touches the stop pin or magnet core and the printing wheel is in position for inking the tape.

**1.06 Normal position** is that position in which the armature backstop screw rests against the pen register housing and the magnet coils are de-energized.

**1.07 One drop of KS-6232 oil** for the purpose of this section, is the amount of oil retained on a KS-14164 brush after being dipped into the lubricant to a depth of 3/8" and then scraped on the edge of the container to remove the surplus oil. There should not be sufficient oil adhering to the brush to form a drop on the end of the bristles.

## 2. REQUIREMENTS

### 2.01 Cleaning

- (a) All parts of the pen register outside the housing shall be kept free of oil and dirt and shall be cleaned in accordance with approved procedures.
- (b) Parts enclosed in the pen register housing shall not be cleaned.

### 2.02 Lubrication

- (a) The following points shall be adequately lubricated with KS-6232 oil. When lubrication is necessary, the oil shall be applied with the KS-14164 brush. One dip of the brush shall be applied to each 4 or 5 of the following points.

Two armature bearings — Fig. 1 (A)

Seven small bearings and one large external bearing, rear main bearing, accessible by raising dust caps — Fig. 1 (B)

One front main bearing — Fig. 1 (C)

Two control arm bearings — Fig. 1 (D)

One star wheel shaft bearing — Fig. 1 (E)

One paper feed-wheel bearing — Fig. 1 (F)

Two worm shaft bearings — one under dust shield — Fig. 1 (G)

Two pallet shaft bearings — Fig. 1 (H)

### (b) Recommended Lubrication Intervals:

After turnover it is recommended that the parts listed in requirement (a) be lubricated at intervals of one year. This period may be extended if periodic inspections have indicated that local conditions are such as to insure that requirement (a) will be met during the extended interval.

**2.03 Record of Lubrication:** During the period of installation, a record shall be kept, by date of the lubrication of the pen register and this record shall be turned over to the Telephone Company with the equipment. If no lubrication has been done, it shall be so stated.

**2.04 Inking:** There shall be sufficient ink on the roller to permit the printing wheel to make distinct marks on the tape when the armature is operated.

Gauge by eye.

### 2.05 Control Arm Position — Fig. 2 (A)

- (a) On pen registers mounted in a silencing box, the control arm shall be set so that the marked portion of the tape moves from the ink roller to the outside of the box after the armature is released.

Gauge by eye.

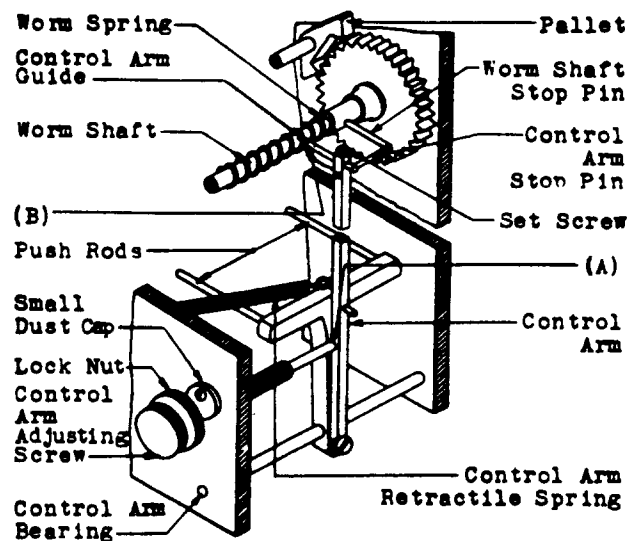


Fig. 2

(b) Where the pen registers are not mounted in a silencing box, the control arm shall be set so that it engages the stop pin on the worm shaft on the second revolution of the shaft after the armature is released.

Gauge by eye.

### 2.06 Worm Shaft Stop Pin Position

(a) **Fig. 3 (A):** With the armature in the normal position, the worm shaft stop pin shall rest on the control arm stop pin so that the edge of worm shaft stop pin nearest the control arm overlaps the free end of the control arm stop pin

Approximately  $3/64''$ .

Gauge by eye.

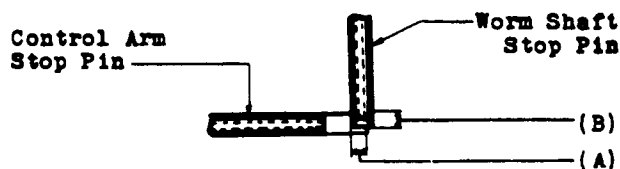


Fig. 3

(b) **Fig. 3 (B):** With the armature in the normal position, the worm shaft stop pin shall rest on the control arm stop pin so that the free end of the worm shaft stop pin overlaps the edge of the control arm stop pin nearest the worm shaft

Min  $.030''$

Max  $.060''$

Gauge by eye.

### 2.07 Control Arm Retractable Spring Tension

Fig. 2 (B): The tension of the control arm retractile spring, measured as the control arm guide just clears the worm spring, shall be

**Test** Min 20 grams, Max 60 grams

**Readjust** Min 25 grams, Max 55 grams

Use the 68B gauge. This tension shall be measured with the gauge applied at the setscrew on the control arm.

**2.08 Armature Travel** — Figs. 4 (A) and 5 (A): With the armature in the normal position, there shall be a gap of

**Test** Min  $.015''$ , Max  $.025''$

**Readjust** Min  $.015''$ , Max  $.024''$

between the armature and the stop pins on the cores of both magnets (KS-3106) and between the armature and the cores of the associated outside magnets (KS-3107).

Use the 66D gauge.

**2.09 Printing Lever Position** — Figs. 4 (A) and 5 (A)

(a) With the magnets electrically energized against a  $.010''$  gauge inserted between the armature and stop pin of each magnet (KS-3106) or between the armature and the core of each outside magnet (KS-3107), the mechanism may or may not start but shall not mark the tape.

Use the 66D gauge.

(b) With the magnet electrically energized against a  $.004''$  gauge, inserted between the armature and stop pin of each magnet (KS-3106) or between the armature and the core of each outside magnet (KS-3107), the mechanism shall start and shall mark the tape.

Use the 66D gauge.

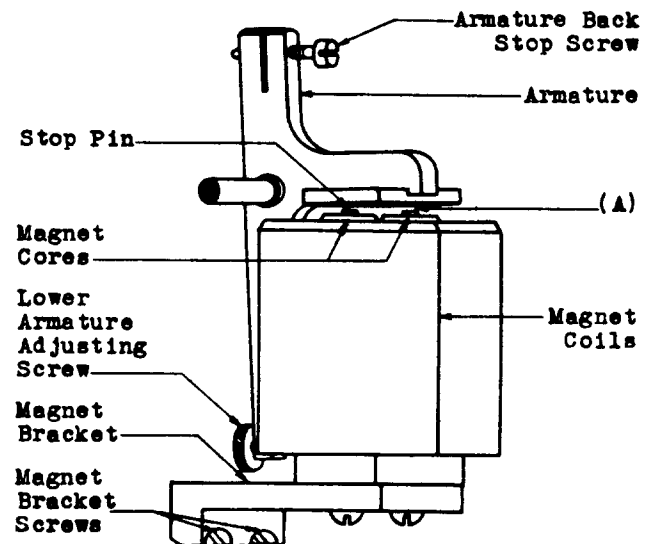


Fig. 4 - KS-3106 Register

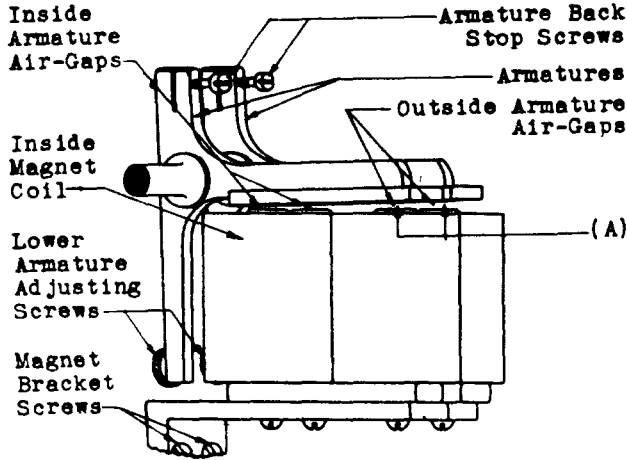


Fig. 5 - KS-3107 Register

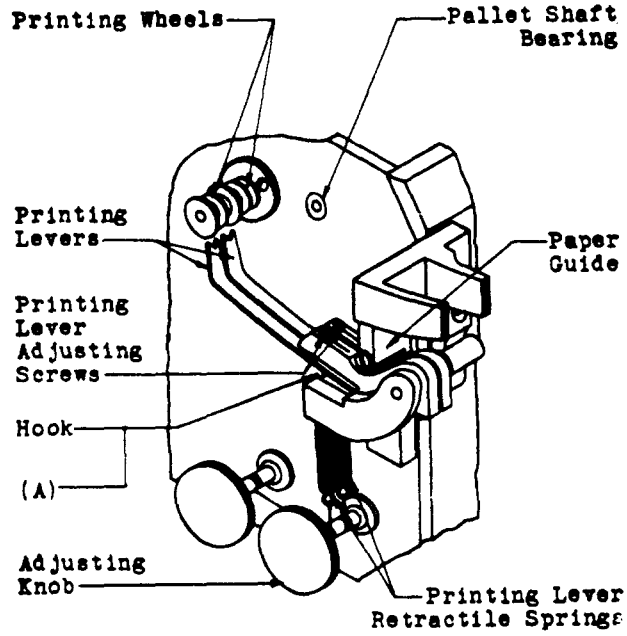


Fig. 7 - KS-3107 Register

2.10 **Printing Lever Retractable Spring Tension** — Figs. 6 (A) and 7 (A): The tension of each printing lever retractile spring measured as the lever starts to move shall be

**Test** Min 200 grams.

**Readjust** Min 225 grams.

This tension shall be measured at the hook on the printing lever.

Use the 79B gauge.

**Caution:** In no case shall the spring be wrapped around the knob.

2.11 **Paper Feed-Wheel Pressure** — Fig. 8 (A):

The pressure of the paper feedwheel against the star wheel measured at the hook on the paper feed-wheel arm shall be

**Test** Min 80 grams, Max 120 grams

**Readjust** Min 90 grams, Max 110 grams

Use the 79C gauge.

**Caution:** In no case shall the spring be wrapped around the knob.

2.12 The register, when connected in its circuit, shall be capable of operating satisfactorily at a speed of at least 19 pulses per second.

2.13 **Speed** — Fig. 8 (B): The mechanism shall drive the paper tape at a speed of minimum 6-1/4 feet per 30 seconds measured as the tape passes between the star wheel and the paper feedwheel.

**Note:** Two complete cycles of unwinding and rewinding the register shall be made prior to testing the requirement for speed. After being rewound again, the mechanism shall then be capable of driving the paper tape at the speed specified.

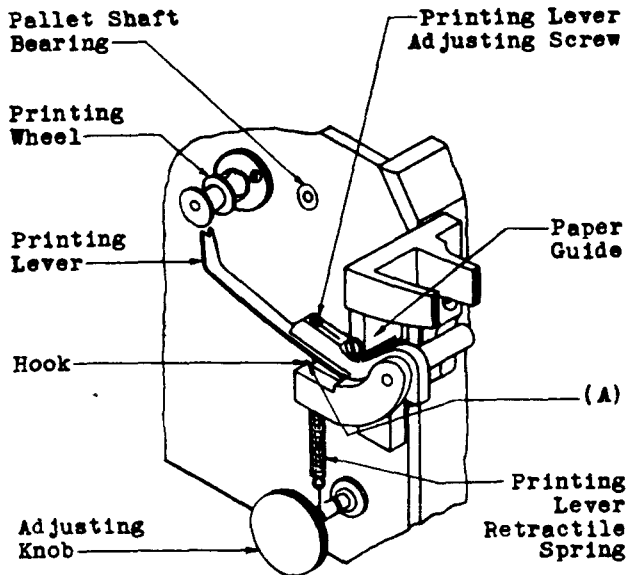


Fig. 6 - KS-3106 Register

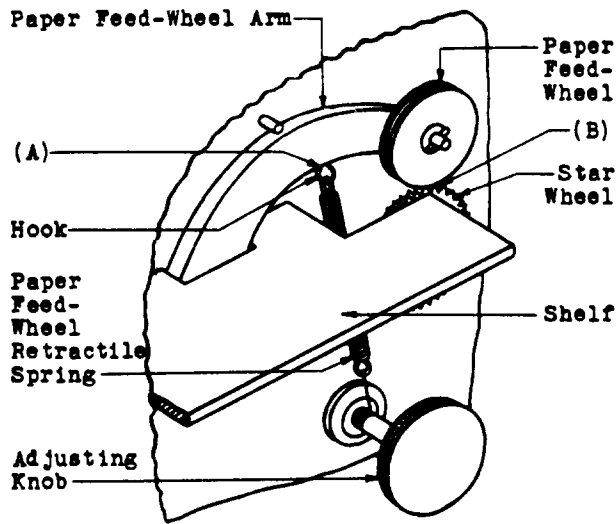


Fig. 8

2.14 The register shall be capable of delivering up to a minimum of 12 inches of paper after the electromagnet has been operated and released.

**3. ADJUSTING PROCEDURES**

**3.001 List of Tools, Gauges and Materials**

CODE NO.	DESCRIPTION
<b>TOOLS</b>	
KS-6015	Duck-bill Pliers
KS-6854 (or the replaced 35)	Screwdriver 3-1/2"
—	Bell System Regular Screwdriver 4" per A.T.&T.Co. Drawing 46-X-34
—	Bell System Cabinet Screwdriver 3-1/2" per A.T.&T.Co. Drawing 46-X-40
—	Bell System Long-Nose Pliers — 6-1/2" per Specification 6267
—	Bell System Diagonal Pliers 5" per Specification 6268
—	KS-14164 Brush ←

CODE NO.	DESCRIPTION
<b>GAUGES</b>	
66D (2 Reqd)	Thickness Gauge Nest
68B	70-0-70 Gram Gauge
74D	Thickness Gauge Nest
79B	0-1000 Gram Push-Pull Tension Gauge
79C	0-200 Gram Push-Pull Tension Gauge

<b>MATERIALS</b>	
KS-2423	Cloth
KS-6232	Oil
—	Ink Dropper (Glass Medicine Dropper)
—	Foote-Pierson Co Register Ink
—	Blotting Paper
—	Toothpicks-Hardwood, flat at one end and pointed at the other
—	22-Gauge Bare Tinned Copper Wire ←

**3.002 General**

(1) **Removing Cover:** To adjust a register and in some cases to check a register to meet the requirements covering control arm position, worm shaft stop pin position and control arm retractile spring tension, it will be necessary to remove the cover. To do this on registers equipped with glass covers, remove the end plate mounting screws with the 3-1/2" cabinet screwdriver, remove the end plate and slide the glass cover from the grooves in the register housing. On registers equipped with brass instead of glass covers, do not remove the end plate. Instead, remove the brass cover mounting screws with the 3-1/2" cabinet screwdriver and remove the cover.

(2) After the adjustments are satisfactorily made, remount the glass or brass cover, inserting and tightening the mounting screws, if they were removed. Then remount and securely tighten the end plate if it was removed.

(3) **Blocking Register:** To block a register nonoperated, insert a toothpick between the star wheel and the shelf as shown in Fig. 9. After the adjustments are satisfactorily made, remove the toothpick.

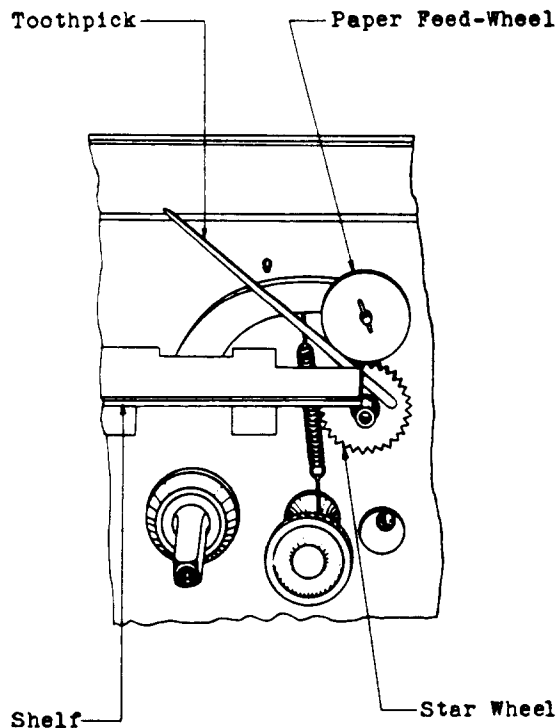


Fig. 9 - Method of Blocking Star Wheel

### 3.01 Cleaning (Reqt 2.01)

(1) Clean all external parts of the register with the KS-2423 cloth taking care to remove all oil, dust, lint particles, etc, that have accumulated outside of the register housing. Do not remove the cover or attempt to clean any parts inside of the housing.

### 3.02 Lubrication (Reqt 2.02)

(1) Turn the register on its side when lubricating bearings to insure that the oil enters the bearings and to prevent it from running down the side of the register housing.

(2) Lubricate the various parts of the register with KS-6232 oil applied with the KS-14164 brush. Distribute the oil retained by the brush after each dip, as specified.

(3) To lubricate the bearings, having small dust caps, loosen the screws holding the small dust caps sufficiently with the KS-6854 screwdriver to permit them to be turned aside, thereby exposing the ends of the shafts. Apply the oil to each bearing with the brush, replace the dust caps, and tighten the screws. Wipe off any oil appearing outside of the dust caps, with a clean, dry KS-2423 cloth.

(4) To oil the rear main bearing, remove one of the screws which holds the large dust cap in place and loosen the other sufficiently with the KS-6854 screwdriver to permit the cap to be turned aside. Apply the oil between the shaft and the housing with the brush. Slide the cover in position and insert and tighten the cap screws securely.

### 3.03 Record of Lubrication (Reqt 2.03) (No Procedure)

### 3.04 Inking (Reqt 2.04)

(1) To check the marking on the tape, observe the operation of the register under service conditions and note that the printing wheel makes distinct marks on the tape which do not smudge easily or require an excessive length of time for drying. If the register fails to meet the requirement and there is a question of the register being in the proper adjustment, press upward against the printing lever with sufficient force to simulate the operating conditions.

(2) If more ink is required on the ink roller, raise the ink roller and dust shield and, with an ink dropper or the KS-14164 brush, apply several drops of Foote, Pierson & Company's register ink to the felt ink roller, rotating the roller as the ink is applied. Position the ink roller and dust shield and repeat the check as indicated under (1). If necessary, apply more ink in the manner specified above.

(3) If there is an excessive amount of ink on the roller, remove the paper tape, operate the armature manually and, while the roller is rotating, wipe the excess ink from the printing wheel with a piece of blotting paper.

### 3.05 Control Arm Position (Reqt 2.05)

(1) Operate the armature manually by tapping it quickly. Observe the operation of the control arm and note that the position in

which it intercepts the stop pin on the worm shaft, after the armature is released, allows for satisfactory movement of the tape.

(2) To adjust the control arm block the star wheel, as covered in 3.002, loosen the locknut on the control arm adjusting screw with the fingers and turn the screw in a clockwise direction until the control arm begins to move. Then, with one hand, hold the armature operated and, with the other, turn the control arm adjusting screw in a counterclockwise direction until the arm has passed over a sufficient number of turns on the worm spring to guarantee satisfactory movement of the tape. Allow the armature to restore to normal and turn the control arm adjusting screw in a clockwise direction until the guide just touches the worm spring. Tighten the locknut with the fingers.

### 3.06 *Worm Shaft Stop Pin Position* (Reqt 2.06)

(1) Block the star wheel as covered in 3.002. To adjust the worm shaft stop pin so that the edge of the pin nearest the control arm is located satisfactorily on the control arm stop pin, grasp the worm shaft stop pin with the long-nose pliers and adjust the pin to the right or left, as required. If the lengthwise position of the worm shaft stop pin with respect to the control arm stop pin is not satisfactory, adjust the control arm stop pin, as required, toward or away from the worm with the long-nose pliers.

### 3.07 *Control Arm Retractable Spring Tension* (Reqt 2.07)

(1) If the tension is not satisfactory, cut off several turns of the spring. To do this proceed as follows.

(2) Block the star wheel with a toothpick. Remove the pallet shaft bearing on the side opposite the pallet, with the 4" regular screwdriver. Slide the pallet shaft through the bearing hole until the end nearest the pallet is free of its bearing hole. Then remove the shaft and pallet from the housing. Grasp the lower end of the spring with the long-nose pliers and remove it from the hook that is mounted in the side of the register housing. Grasp the other end of the spring with the pliers and remove it from the hook on the control arm.

(3) Grasp the second full coil of the spring with the duck-bill pliers, grasping the coil so that the ends of the jaws of the pliers just halves the coil. Cut the spring with the diagonal pliers at the top of the coil which extends in front of the duck-bill pliers so that only one half of a coil will remain at the end of the spring in front of the pliers. Bend this one-half coil of the spring out with the long-nose pliers so that a semicircular loop will be formed at right angles to the spring.

(4) Thread one end of a piece of 22-gauge bare tinned copper wire about 6 inches long through the loop at the end of the spring, bending the wire in a small loop so that the spring cannot slide off. Lower the spring into the housing between the control arm and the worm until the loop at the lower end of the spring can be grasped with the long-nose pliers. Hook the end of the spring over the hook in the side of the housing and then secure the other end over the hook on the control arm. Straighten the loop in the wire with the long-nose pliers and remove the wire from the retractile spring. Check the tension of the spring measuring it with the gauge at the set-screw on the control arm as shown in Fig. 10. If it is not satisfactory, proceed as outlined above in removing additional coils of the spring. If the tension of the spring still is unsatisfactory, give consideration to replacing the spring.

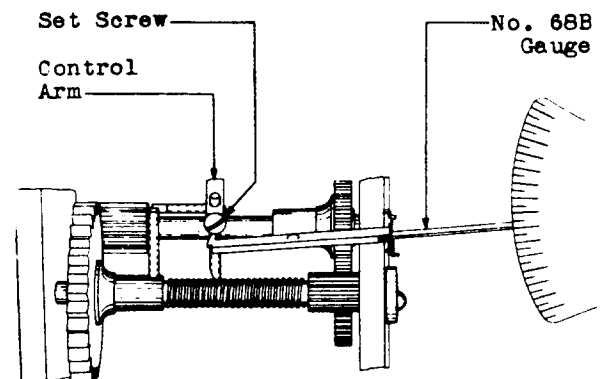


Fig. 10 - Method of Checking Control Arm Retractable Spring Tension

(5) Remount the pallet shaft, inserting the free end of the shaft through the bearing hole from the inside of the register housing, and slide the shaft down through this hole until the end of the shaft nearest the pallet can be inserted into its bearing hole. Then insert and secure the pallet bearing that was removed.

### 3.08 Armature Travel (Req't 2.08)

(1) If the gap is not satisfactory, turn the armature back stop screw in a clockwise or counterclockwise direction, as required, with the 3-1/2" cabinet screwdriver. If a satisfactory armature travel cannot be obtained on a single pen register by adjusting the armature back stop screw, the trouble is probably due to the position of the magnet bracket.

(2) To reposition the bracket, loosen the magnet bracket screws with the 4" regular screwdriver. Insert a minimum thickness gauge between each core and the armature and raise the magnet bracket so that the

gauges are held snugly in position. Then back off the bracket slightly, until the gauges can be removed without binding. Hold the bracket in this position and tighten the bracket screws securely.

### 3.09 Printing Lever Position (Req't 2.09)

(1) If the position of the printing lever of a KS-3106 register or the position of either printing lever of a KS-3107 register is such that the printing wheel marks the tape when a .010" gauge is inserted between the armature and a core and the magnets are operated, remove the tape from under the paper guide and turn the printing lever adjusting screw associated with the lever at fault one complete turn in a clockwise direction with the KS-6854 screwdriver. On some KS-3106 registers, the adjusting screw is threaded through the printing lever and in these cases it will be necessary to turn the adjusting screw in a counterclockwise direction instead of a clockwise direction. After making the adjustment, insert the paper under the guide and recheck. If the condition still exists, repeat the operation until a satisfactory adjustment is obtained. If a satisfactory adjustment cannot be obtained on the KS-3106 register by adjusting the position of the printing lever, the trouble is probably due to the location of the magnet bracket. To remedy this condition, check the armature travel and if the travel is not approximately the same on both magnets, position the magnet bracket as outlined in 3.08.

(2) If the mechanism operates but the printing wheel fails to mark the tape when a .004" gauge is inserted between the armature and a core, remove the tape from under the paper feedwheel and turn the printing lever adjusting screw in the opposite direction to that described in (1). As in the first case, turn the screw only very slightly before replacing the tape and again repeating the test. If it is necessary to adjust the printing lever in order to meet the requirement, recheck the procedure outlined above to insure that the adjustment previously made has not been destroyed.

(3) If the mechanism does not operate, it is an indication that either the armature travel is unsatisfactory or there is excessive clearance between the adjusting screw, if any, on the lower part of the armature and the

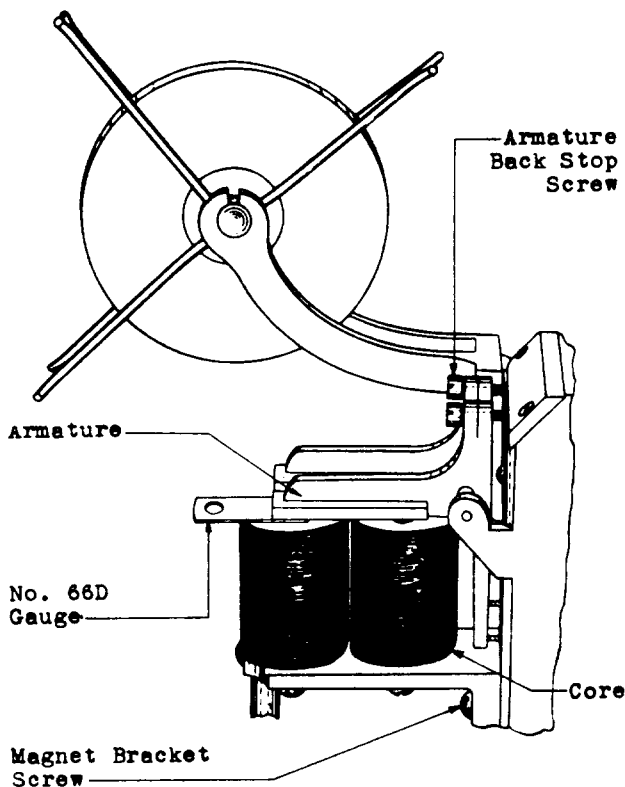


Fig. 11 - Method of Gauging Armature Travel



push rod which actuates the control arm. If the armature travel is unsatisfactory, adjust as outlined in 3.08. If there is excessive clearance between the adjusting screw and the push rod, reduce the clearance by turning the knurled adjusting screw in a counterclockwise direction until the control arm just releases the mechanism when the armature is operated against the gauge. If it is necessary to change the position of the adjusting screw as specified above, take care to insure a clearance between the adjusting screw and the push rod when the armature is in its unoperated position.

(4) In order to meet this requirement on registers not equipped with the adjusting screws on the lower armature extensions, it may be necessary to lower the position of the coils so that when the armature is operated the push rod will be moved a greater distance. If this is necessary, loosen the magnet bracket screws with the 4" regular screwdriver and allow the magnet coils to drop toward the base of the register. Locate both magnets so that the cores are approximately parallel and with the armature operated there is an appreciable clearance between the stop pin and the worm shaft, and tighten the screws. After changing the position of the magnets it will be necessary to readjust for the armature travel requirement.

(5) After meeting the adjustments specified above, remove the gauge and, with the armature electrically operated, check that there is clearance between the head of the adjusting screw on the lower part of the armature and the register housing.

### 3.10 *Printing Lever Retractable Spring Tension* (Req't 2.10)

(1) To check the tension of the printing lever retractile spring, attach the 79B gauge to the printing lever at the hook to which the retractile spring is attached, as shown in Fig. 12, and pull in a direction directly opposing the pull of the spring.

(2) If the spring tension is not satisfactory it may be increased by turning the knurled adjusting knob in a clockwise direction. When increasing the tension take care not to wind

the spring around the knob. If sufficient tension cannot be obtained after making this adjustment, remove the spring from the printing lever and cut off several turns and then form a loop in the end as outlined in 3.07. Remount the spring in place on the printing lever and if the tension is still unsatisfactory, replace the spring.

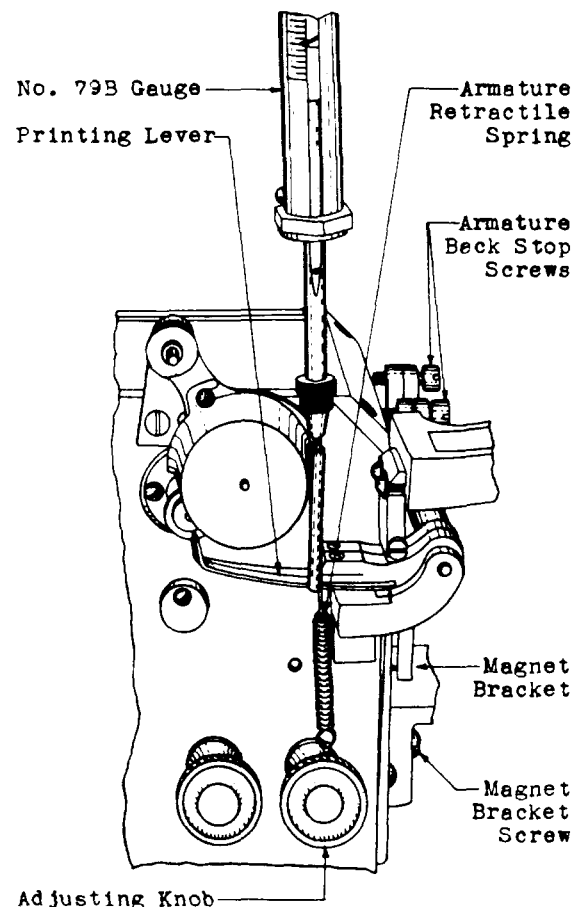


Fig. 12 – Method of Checking Printing Lever Retractable Spring Tension

### 3.11 *Paper Feed-Wheel Pressure* (Req't 2.11)

(1) To check the pressure of the paper feed-wheel against the star wheel, attach the 79C gauge to the paper feed-wheel arm at the hook to which the feed-wheel retractile spring is attached as shown in Fig. 13 and pull in a direction opposing the pull of the spring.

(2) If the spring tension is not satisfactory it may be increased by turning the knurled adjusting knob in a clockwise direction and decreased by turning the knob in a counter-clockwise direction. When increasing the tension, take care not to wind the spring around the knob. If sufficient tension cannot be obtained after making this adjustment, remove the spring from the paper feed-wheel and cut off several turns and then form a loop in the end as outlined in 3.07. Remount the spring in place on the feedwheel and if the tension is still unsatisfactory, replace the spring. If the tension of the spring is such that the tape is torn as it moves between the star wheel and the feedwheel, reduce the tension of the spring toward the minimum.

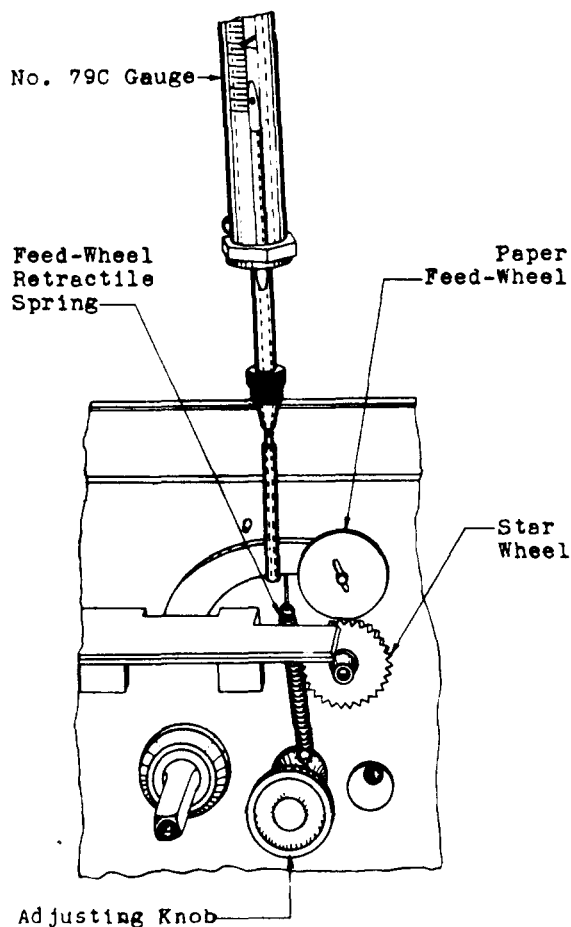


Fig. 13 – Method of Checking Paper Feed-Wheel Pressure

### 3.12 Operation (Reqt 2.12)

### 3.13 Speed (Reqt 2.13)

- (1) In checking the registers, use a dial that has been checked with a 51-type dial tester and is known to be within approved limits.
- (2) To check the register for operation, use a dial known to give pulses within the specified limits and, if possible, one which approaches the maximum limit, rather than the minimum limit. Check the dial to be used to determine that it pulses within the specified limits.
- (3) Connect the register in the circuit as described in requirement 2.12, or under service conditions.
- (4) Dial the digit zero. The register should follow the dial pulses, making 10 distinct marks on the tape. Failure to respond properly to the dial pulses will be indicated if the marks are run together in one or more places or if one, or more, of the marks is faint, noticeably shortened or entirely missing.
- (5) If the marks are run together in one or more places, it indicates that the armature is sluggish in restoring, in which case increase the printing lever retractile spring tension slightly. If, on the other hand, one, or more, of the marks is faint, shortened or missing, it indicates either that the printing lever is improperly adjusted or that the armature travel exceeds the maximum limit. To determine whether the printing lever is at fault, recheck its adjustment as outlined in 3.09. If the adjustment of the printing lever is correct, reduce the printing lever retractile spring tension and the armature air-gap slightly toward their minimum values.
- (6) Whenever it is necessary to change the printing lever retractile spring tension or the travel of the armature in making the above adjustment for operation, a recheck of these requirements must be made in order to insure that they are within their specified limits.
- (7) If the register cannot be made to function satisfactorily by adjusting according to the procedures outlined herein, the matter shall be referred to the supervisor for further consideration and shall be returned to the Western Electric Company for repairs.