

- [54] **CARRIAGE INDEXING MECHANISM**
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[57] **ABSTRACT**

A carriage for a printer or the like comprises a movable carrier which is indexed by cooperating, sliding and stationary racks lying just beneath the circumference of an axially fixed carrier support shaft. Drive and hold latches on the carrier are spring biased into contact with respective racks. Solenoid oscillation of the sliding rack one column position causes like incrementation of the carrier. Angular rotation of the shaft moves the drive and hold latches from their racks into contact with smooth shaft surfaces, causing automatic return of the carrier under dashpot action to the first column print position.

7 Claims, 6 Drawing Figures

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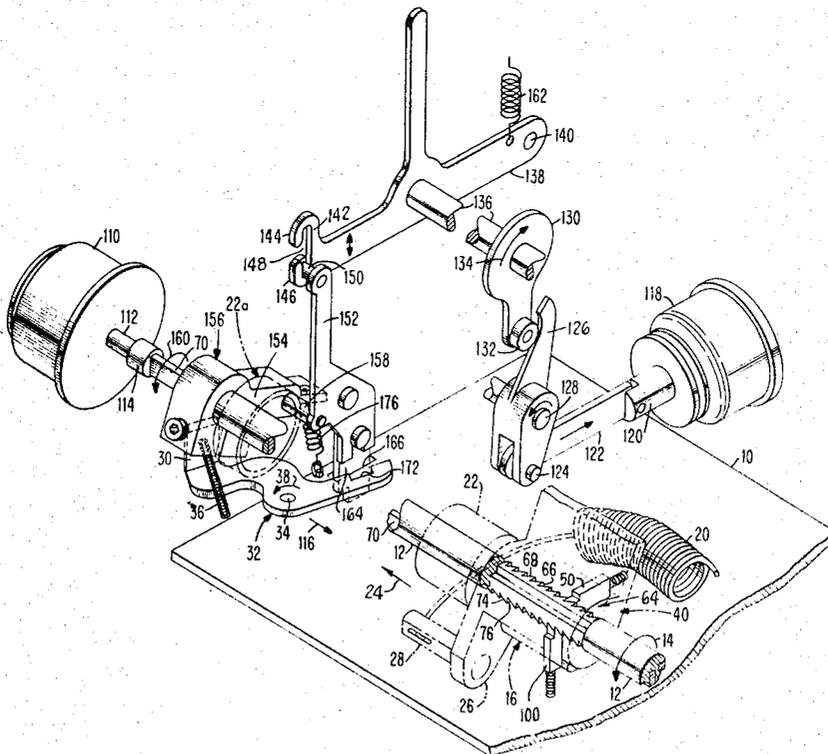
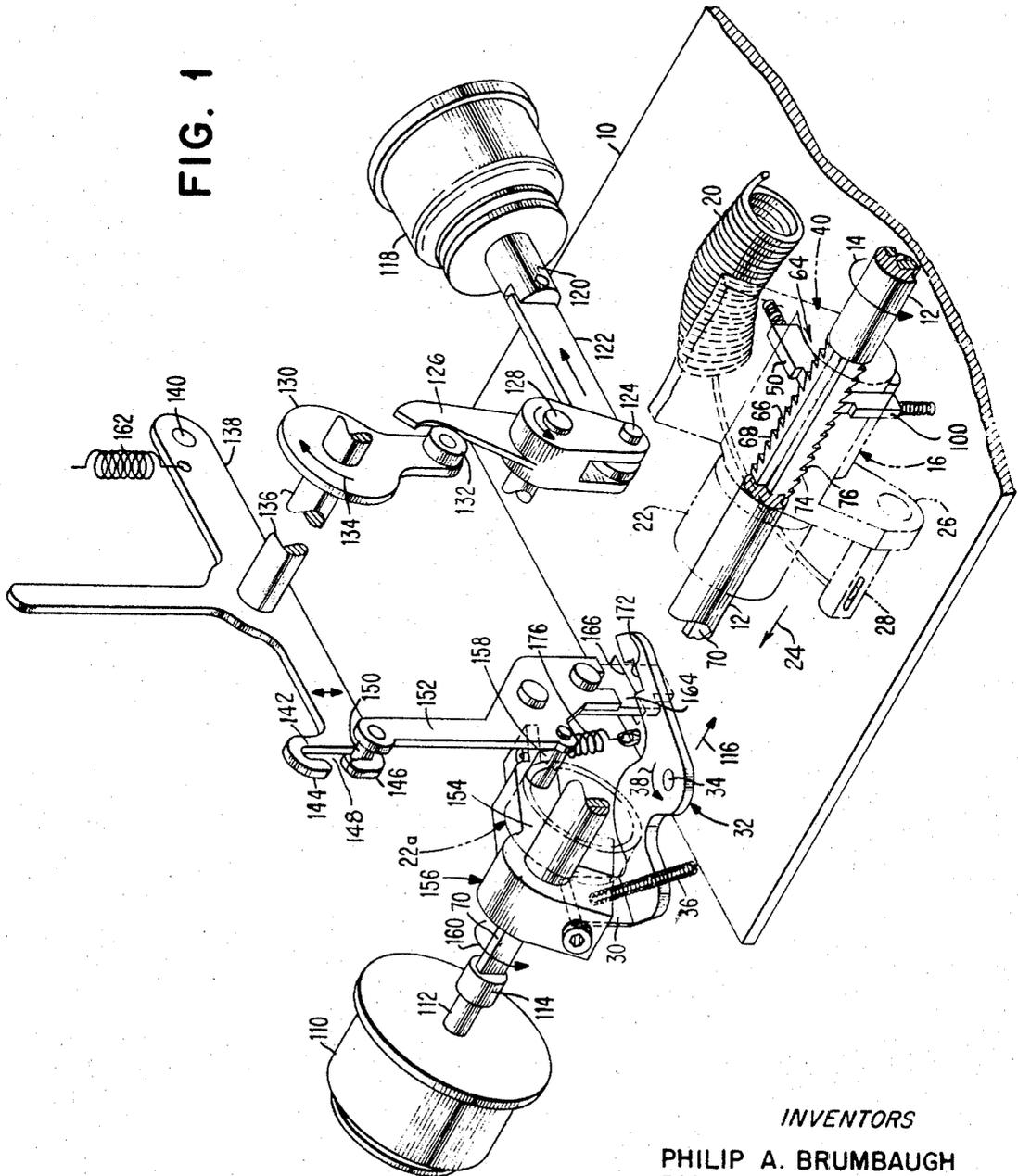


FIG. 1



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CARRIAGE INDEXING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to incrementing devices in general, and more particularly to an incrementing device for spacing the carriage of a printer along a print line.

2. Description of the Prior Art

In the past, printers have employed an indexable carriage which moves parallel to the print line and to one side of the print media opposite the platen and, in some cases, have employed a continuously rotating print wheel and a selectively energized hammer on the carriage. Energization of the hammer is synchronized with rotation of the print wheel to achieve imprinting at spaced locations along the print line with the carriage being stepped column by column after imprinting. One particular type of printer employs a cable actuated by a spring driven capsule which in turn is coupled to the carriage to index the same along the print line. Such arrangements for incrementing the carriage provide capable action, but are subject to cable breakage and spring wear.

SUMMARY OF THE INVENTION

The present invention is directed to a carriage indexing mechanism for effecting incremental movement along a print line and comprises an axially fixed carrier support shaft, a carrier movably supported on said shaft which in turn supports the carriage and means for spring biasing the carrier towards the home column print position on said shaft. A first sliding rack is carried by the shaft and a first spring biased drive latch on the carrier is spring biased into engagement with the sliding rack to cause the carrier to shift axially along the shaft during movement of the sliding rack in a direction away from the home columnar position. A second stationary rack is carried by the shaft and a second spring biased hold latch on the carrier engages the stationary rack to act as a detent to normally prevent return movement of the carrier after column incrementation by the sliding rack. Means are provided for oscillating the sliding rack at least one column position to effect incremental movement of the carrier a corresponding distance thereto.

Both racks are circumferentially spaced about the shaft, preferably 90°, and lie just beneath the circumference thereof. Further means are provided for selectively rotating the shaft to simultaneously release both latches from the respective racks and allow the latches to slide on smooth shaft surfaces adjacent thereto, allowing return of the carrier towards the home columnar position under the bias of a constant force spring. A dashpot acts on the moving carrier near the end of carriage return.

Preferably a line space solenoid causes initial 30 degree rotation of the shaft to release both the drive and hold latches for initiating carrier return and a spring biased interlock latch associated with the lever means for effecting the 30° rotation of the shaft, maintains the shaft in the 30° rotated position after de-energization of the line space solenoid. An abutment movable with the carrier causes the interlock latch to be released automatically at home position to restore the shaft to its initial angular position. The drive rack, solenoid associated with the drive rack is again energized intermit-

tently to cause single or multiple column spacing of the carrier

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view, partially in section, of the improved carriage indexing mechanism of the present invention;

FIG. 2 is a side view, partially in section, of a portion of the carrier support shaft illustrated in FIG. 1 showing the spring biasing arrangement for the sliding rack;

FIG. 3 is a sectional view of the carrier support shaft and carrier with the drive and hold latches in engagement with respective sliding and stationary racks;

FIG. 4 is a similar sectional view of the carrier support shaft and the carrier illustrating the drive and hold latch in release position after rotation 30° from the rack engaging position shown in FIG. 3;

FIG. 5 is an end view of the carriage indexing mechanism with the shaft in incrementing position;

FIG. 6 is a similar view to that of FIG. 5 with the shaft rotated 30° to release position and mechanically interlocked.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The printer with which the illustrated embodiment is associated, includes a fixed base plate 10 of metal or the like which has mounted thereon a carrier support shaft 12 by means of suitable bearings (not shown) which allows the shaft 12 to rotate as indicated by arrow 14, but prevents axial shifting of the same. The carrier support shaft 12, in turn, holds carrier 16 a portion of which, as indicated in FIGS. 3 and 4, is generally cylindrical in form and may be formed of cast metal or the like. It is provided with an integral axial projection 28 which, in addition to being coupled to a constant rate bent helical carrier return spring 20 which tends to move the carrier 16 from right to left towards the home columnar position, that is, the number one column print position, also operates as a bumper to assist in restoring the shaft 12 to its normal position.

In this respect, one end of carrier return spring 20 is coupled to the axial projection 28, while the other end is coupled to the fixed base plate 10 of the printer by means (not shown). As seen in FIG. 1, the carrier 16 is provided at its left hand end with a dashpot piston 22. A co-operating dashpot cylinder 22a, shown in phantom lines in FIG. 1, is secured to a sideplate (not shown) on base 10. Dashpot piston 22 on carrier 16 contacts with dashpot cylinder 22a to slow down carrier 16 just before it reaches the home columnar position when moving from right to left as indicated by arrow 24 in FIG. 1. Extending outwardly from the side of the carrier 16 is an arm 26 which carries the axial projection 28 which extends axially toward the left to contact latch projection 30. Projection 30 is carried by shaft rotation interlock latch 32, which in turn is mounted for pivoting about the vertical axis of a mounting pin 34 fixed to the upper side of base plate 10. A second tension spring 36 is coupled at one end to the base plate 10 and at the opposite end to the latch projection 30, tending to bias the shaft rotation interlock latch 32 counterclockwise, as indicated by arrow 38 in FIG. 1.

The present invention is particularly directed to a specific means for incrementing the carrier 16 and thus the carriage itself in columnar fashion across the face of the print medium, that is, along the axis of shaft 12

which is parallel to the print line of the printer. In this respect, FIG. 3, the cylindrical body portion 40 of the cast or otherwise formed carrier 16, is provided with an axially extending bore 42 of a diameter approximately that of the rod-like shaft 12 which extends axially therethrough, the cylindrical body 40 being further provided with a pair of radially extending bores 44 and 46, respectively, which are offset angularly by 90°. Bore 44, for instance, carries a specially formed cylindrical casing 48 which in turn carries a spring biased hold latch 50. In this respect, casing 48 is bored at 52 and counterbored at 54 with the hold latch 50 carried within the counterbore portion 54 and a compression spring 56 is carried within the counterbore 54 of casing 48 and bore 58 extending partially through the hold latch 50. The front end of the hold latch 50 is provided with a projecting portion 60 for selected engagement with either a flattened, smooth surface portion 62 of shaft 12 or a stationary rack 64, circumferentially adjacent thereto. In this respect, the carrier support shaft 12 has its integrally formed, stationary rack teeth lying just beneath the circumference of the same, as does the smooth sliding surface 62 adjacent thereto. The individual teeth of the stationary rack 64 are defined by surfaces 66 which are at right angles to the axis of the shaft 12 and surfaces 68 which slope toward the home columnar position of the carrier 16, i.e., surfaces 68 partially defining the teeth of the stationary rack 64 slope inwardly and toward the left end of the machine.

In addition to the stationary rack 64, the carriage support shaft 12 also carries a sliding rack 70. The sliding rack 70 comprises an elongated, sliding bar with the rack teeth located only along a portion of its length and comprising sloped surfaces 74 and right angle surfaces 76 defining teeth similar in configuration to those of the stationary rack 64. The sliding rack 70 is carried by a rectangular recess 78 formed within the shaft 12, extending parallel to the recess or slot 78 and being of a depth such that the rack teeth extend radially towards the outer periphery of the shaft 12 but lie just beneath the circumference thereof. Reference to FIG. 2 illustrates the manner in which the sliding rack 70 is carried within the slot 78 of shaft 12 with its outer end 72, FIG. 2, being somewhat enlarged and fitting within an enlarged recess area 80 defined by bore 82 which is threaded at 84 at its outer end to receive a threaded plug 86. Bore 82 carries a headed plunger 88 having one side abutting the end of the rack projection 72 while the opposite side carries an axially projecting reduced diameter portion 90 about which is positioned, in concentric fashion, a compression spring 92. One end of the spring 92 abuts the headed end of the plunger 88 while the opposite end abuts the plug 86. The plug 86 is adjusted axially to increase or decrease the applied compressive force acting on the sliding rack 70.

In similar fashion to the stationary rack, 64 the radial bore 46 of carrier body 40 carries an open-ended casing 94 which in turn is provided with a bore 96 and a counterbore 98, the counterbore 98 receiving the drive latch 100 which in turn is axially bored at 102 to receive one end of a compression spring 104 while the opposite end of the spring 104 is received within bore 96 of casing 94. The projecting end 106 of the drive latch 100 contacts either rack 70 or a flat surface portion 108 of shaft 12, circumferentially adjacent thereto. The flat surface portions 108 for the sliding rack 70,

and 62 for the stationary rack 64, extend the full length of the carriage movement portion of shaft 12 so that once the shaft 12 is rotated from the position of FIG. 3 to the position of FIG. 4, and the hold latch 50 and the drive latch 100 are released from respective racks 64 and 70, the carrier 16 is free to slide under the spring bias of the constant rate carrier return spring 20 towards the home columnar position.

Referring again to FIG. 1, a drive rack solenoid 110 is fixedly mounted with respect to base plate 10 by means (not shown) and has protruding therefrom a solenoid armature 112 which is coupled by coupling means 114 directly to the sliding rack 70. Thus, energization of the drive rack solenoid 110 causes incremental shifting of rack 70 as indicated by arrow 116, FIG. 1, to the right an extent slightly greater than one column position for the printer against the bias of spring 92. Since the drive latch 100 is in engagement with the sliding rack 70, necessarily the carrier 16 is moved from left to right to a slightly greater extent than one columnar position. Upon de-energization of the drive rack solenoid 110, armature 112 and thus the coupled rack 70, move under the bias of spring 92 back to their initial position. However, the hold latch 50 acts on the shaft 12 and its stationary rack 64 as a detent and maintains the carrier 16 in the new columnar position while the sliding rack 70 is returning one column position to the left. This causes the drive latch 100 to slide over one of the sloping tooth surfaces 74 and fall into the next valley adjacent a vertical surface 76. In this fashion, the carrier 16, and thus the carriage, are incremented across the print medium along the print line in step by step columnar fashion.

To reiterate, to move the print wheel carrier 16 to the next column position, the drive rack solenoid 110 is energized and thus moves the sliding rack 70 a distance slightly greater than one column. The drive latch 100 that slides inside the carrier body 40 latches onto the slide rack 70 so that the rack movement to the right moves the carrier 16 with it. When the sliding rack 70 returns, the hold latch 50, which is also within the carrier body 40 and is approximately 90 degrees from the drive latch 100, locks on a tooth of the stationary rack 64 and the carrier return spring 20 holds the carrier 16 in its new position. Thus, registration depends on the inherent accuracy of the stationary rack 64. This operation is repeated column by column until line space is required, either at the end of the line, that is, when the carriage moves all the way from left to right, or otherwise, as desired.

To achieve line spacing and automatic return of the carriage to the number one column or home column position, the mechanism of the present invention is provided with a line space solenoid 118 which is fixedly positioned with respect to base plate 10 by means (not shown). Solenoid 118 has protruding therefrom a solenoid plunger or armature 120 which is pin coupled to arm 122 which acts as an extension thereof. The outer end of arm 122 is pivotably coupled via pin 124 to an oscillating camming member 126 which pivots about fixed pin 128 in a clockwise direction, FIG. 5, upon energization of solenoid 118. This in turn causes a cam follower 130, carrying cam follower roller 132, to rotate shaft 136 counterclockwise, FIG. 5, as indicated by arrow 134, FIG. 1. Shaft 136 is fixedly coupled to a T-shaped lever 138 intermediate of a pivot pin 140 and a double hooked outer end 142. The hooks 144 and

146 define an open-sided vertical slot 148 which receives a pin 150, fixed to the upper end of a pivotable lever 152. Lever 152 is in turn pivotally coupled to one arm 154 of a shaft rotation rocker arm 156 via pin connection 158. The rocker arm 156 is fixedly coupled to shaft 12 such that by raising lever 152, the shaft 12 is rotated counterclockwise, FIG. 1, as indicated by arrows 160 and 14. A coil spring 162 is coupled to the T-shaped lever 138 intermediate of the pivot support pin 140 and the shaft 136 carrying the fixedly coupled cam follower 130. Lever 152 has an offset, downward projection 164, FIGS. 5 and 6, which passes through a rectangular opening 166 within base plate 10 with the lower end 168 carrying a lateral notch 170 on one side thereof. In this respect, the pivotable shaft rotation interlock latch 32 has a rectangular notch 172 within the edge facing lever projection 164 and being spring biased by spring 36, effects, as evidenced in FIG. 6, a mechanical interlock when lever 152 is raised to its upper limit by energization of the line space solenoid 118.

Thus operation of the line spacing and automatic mechanical interlock of the shaft 12 in the rotated position allows the carrier 16 to return to home position prior to automatic release and shaft re-rotation to latch engagement position with respect to the stationary and sliding racks 64 and 70, respectively. Energization of the line space solenoid 118 causes the platen 173, FIGS. 5 and 6, actuated by pawl and ratchet means 175 to move the paper one line space and also rotates the carrier support shaft 12, 30° through the various linkages. Specifically, energization of solenoid 118 results in movement of extension arm 122 from left to right in FIG. 1 and right to left in FIGS. 5 and 6. This in turn causes pivoting of camming member 126 clockwise, FIG. 5, causing the cam follower 130 to rotate counterclockwise, lifting the double hooked end 142 of lever 138 and raising lever 152 via pin 150 from the position shown in FIG. 5 to the position shown in FIG. 6. Due to the pin connection 158 between lever 152 and the rocker arm 156, the shaft 12, which is coupled therewith, rotates approximately 30° as seen in FIG. 6 wherein both latches 50 and 100 are released allowing the carrier 16 to move from right to left, FIG. 1, to the home columnar or number one column print position. Further, as lever 152 moves from the position shown in FIG. 5 to the position shown in FIG. 6, the end 168 of lever 152 moves above the base plate 10 such that the spring biased shaft rotation interlock latch 32, which abuts the same, moves into a position where notch 172 engages the end 168 of lever 152 maintaining the same in raised position. Meanwhile, solenoid 118 is de-energized and spring 162 tends to move lever 138, cam follower 130, camming member 126, and armature extension 122 back to their initial positions prior to re-energization of solenoid 118. The slot 148 of course allows the pin 150 to rise within the same while lever 152 is maintained in raised position due to the interlock latch 32. This of course maintains shaft 12 rotated clockwise, FIG. 6, as indicated by arrow 174. The ends 60 and 106 respectively of latches 50 and 100, engage the flattened surface portions 62 and 108 of shaft 12, respectively. The carrier 16 moves rapidly under the bias of spring 20 from right to left, FIG. 1, towards the home columnar position. As carrier 16 approaches the leftmost position, dashpot piston 22 enters dashpot cylinder 22a and coacts therewith to damp the final movement of carrier 16 into the home columnar position of

the carrier. Further, when the carrier 16 reaches the home columnar position, the abutment 28 affixed to carrier arm 26 pushes against latch projection 30 to cause the shaft rotation interlock latch 32 to rotate counterclockwise FIG. 1, moving the latch notch 172 from the end 168 of lever 152 and allowing lever 152 to move downward under the bias of coil spring 176.

Spring 176 biases arm 156 such that it will automatically rotate back to the latch engaging position of FIG. 5 from the position of FIG. 6 after the interlock latch 32 is rotated.

With the support shaft 12 rotating to normal by spring action, the sliding hold and drive latches 50 and 100 re-engage their respective racks 64 and 70, thus completing the cycle.

While the racks 64 and 70 and slide surfaces 62 and 108 on the shaft 12 are illustrated as lying just beneath the circumference, they may in fact be projections as long as means are provided for readily allowing shifting of the latches 50 and 100 from its rack 64 and 70 to its adjacent slide surfaces 62 and 108. Further, while a specific lever system is illustrated as effecting initial rotation of the shaft 12 to release the latches 50, 100 and rotation to the same degree in the opposite direction subsequent to arrival of the carrier 16 at home position, such means are illustrative only of one arrangement for accomplishing this result.

WHAT IS CLAIMED IS:

1. A mechanism for indexing a printer type wheel carrier or the like along a print line, said mechanism comprising:

- an axially fixed carrier support shaft,
- a carrier concentrically carried by said support shaft and movable axially along said shaft,
- means for spring biasing said carrier towards one end of said shaft defining a home columnar print position,
- a sliding rack carried by said shaft within the periphery thereof,
- a drive latch movably mounted on said carrier and spring biased for radial engagement with said sliding rack to cause said carrier to move axially with said sliding rack during incremental movement of said sliding rack in one direction,
- a stationary rack carried by said shaft within the periphery thereof,
- a hold latch movable mounted on said carrier and spring biased for radial contact with said stationary rack to act as a detent in preventing return movement of said carrier after incremental movement in said one direction by said sliding rack, and
- means for oscillating said sliding rack a distance of at least one column position to effect incrementing of said carrier a corresponding distance thereto.

2. The mechanism as claimed in claim 1 wherein said racks are circumferentially spaced about said shaft and lie beneath the circumference thereof, said shaft includes smooth surfaces adjacent respective racks, and said mechanism further includes means for selectively rotating said shaft to simultaneously release both latches from their respective racks and to cause said latches to slide on said smooth shaft surfaces adjacent thereto and thereby return said carrier toward said one end of said shaft under the bias of said spring biasing means.

3. The mechanism as claimed in claim 2 further comprising dashpot means carried by said carrier and oper-

7

ative to slow movement of said carrier as said carrier
nears said home columnar position.

4. The mechanism as claimed in claim 2 further comprising means operable in response to the return of said carrier to said home columnar position for rotating said shaft to a position where said latches re-engage said respective racks to allow controlled incrementation of said carrier in stepwise fashion away from said home columnar position.

5. The mechanism as claimed in claim 2 wherein said means for selectively rotating said shaft to simultaneously release both of said latches, comprises a line space solenoid, a rocker arm fixedly coupled to said shaft, and linkage means responsive to energization of said solenoid for causing rotation of said rocker arm from latch engaging position to latch release position.

6. The mechanism as claimed in claim 5 wherein said linkage means includes a first lever coupled to said rocker arm and movable therewith from said latch engaging position to said latch release position, spring bi-

8

asing means tending to bias said rocker arm and said first lever to rack latch engaging position, a spring biased shaft rotation interlock latch for locking said first lever in rack latch release position and means responsive to movement of said carrier to said home columnar position to release said shaft rotation interlock latch.

7. The mechanism as claimed in claim 6 wherein said linkage means includes a second spring biased lever loosely coupled to said first lever and operable to move to a first position and to move said first lever to said latch release position during energization of said solenoid,

said second lever being movable to a second position under spring bias upon de-energization of said solenoid thereby causing said first lever to remain in said rack latch release position and to be held by said interlock latch until released thereby to contact between said carrier and said fixed rotation interlock latch.

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