

[54] **PRINTER CARRIER DRIVE**
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[22] Filed: **Aug. 30, 1971**

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[52] **U.S. Cl.** **197/49, 101/93 C**
[51] **Int. Cl.** **B41j 1/22**
[58] **Field of Search** **74/57; 197/49; 101/93 C**

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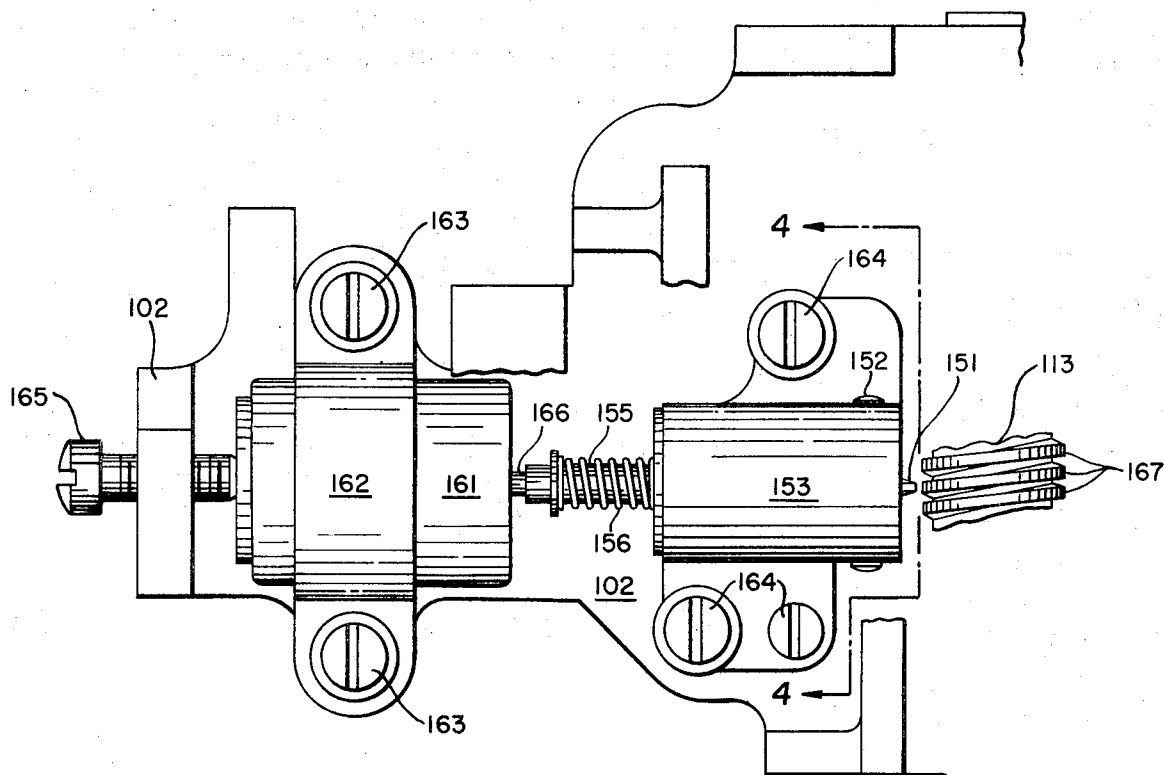
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[57] **ABSTRACT**

A new and improved technique and device is disclosed for selectively coupling a print wheel carrier with a constantly rotating lead screw. The engaging device comprises a rotatable engaging member which is in rolling engagement with the lead screw. This relationship reduces the friction and wear between the members. The technique also facilitates rapid decoupling and minimizes carrier over-travel.

9 Claims, 7 Drawing Figures



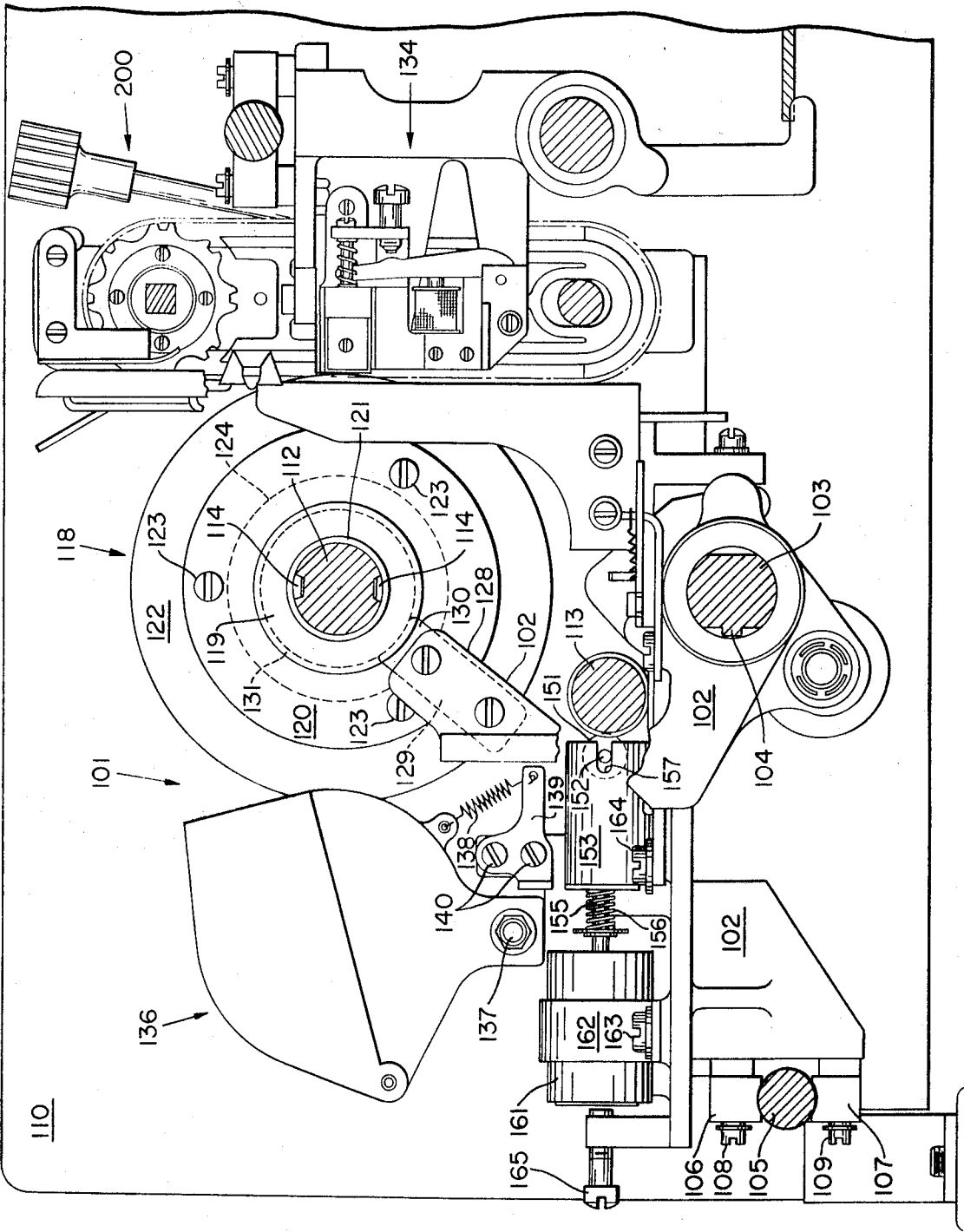


FIG. 1

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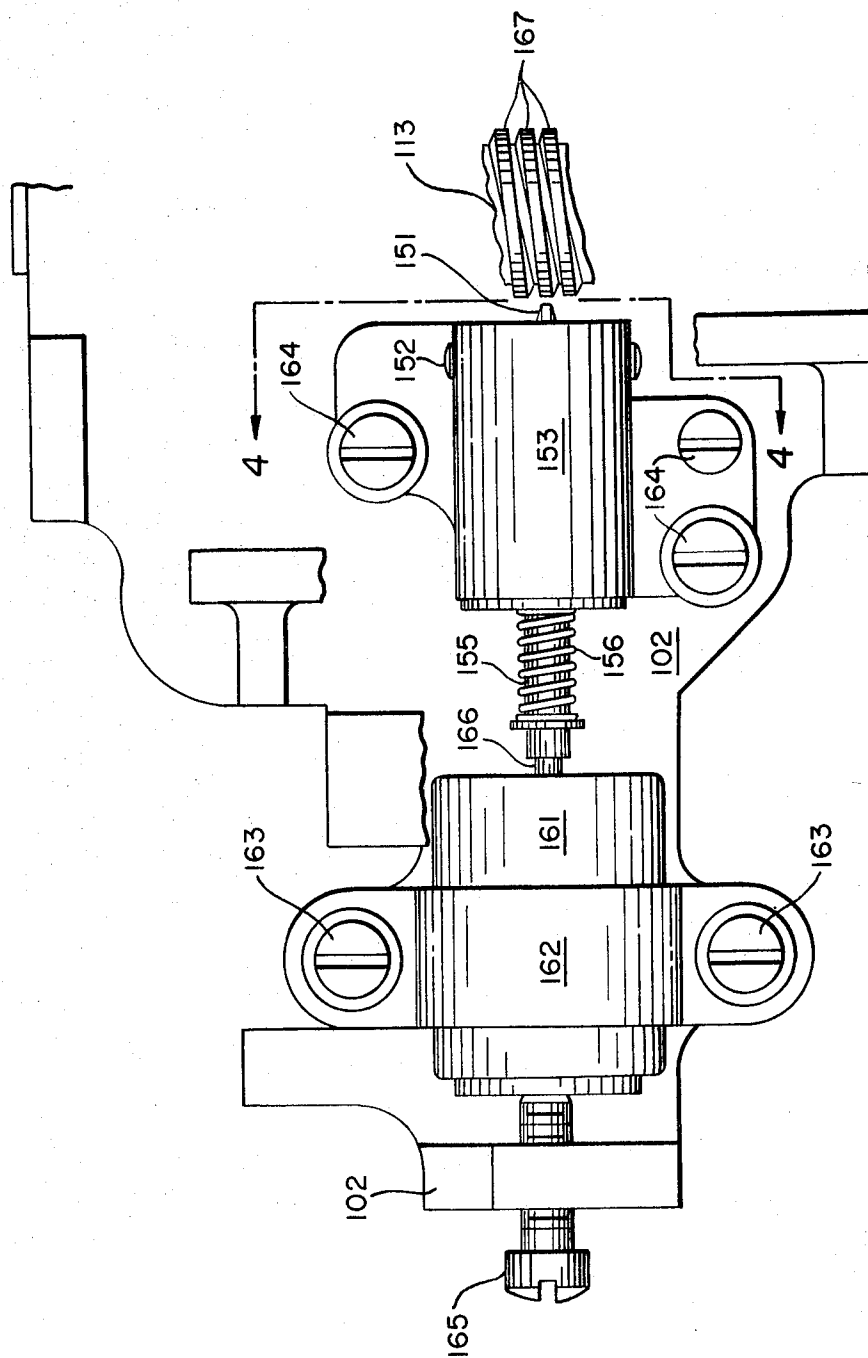


FIG. 2

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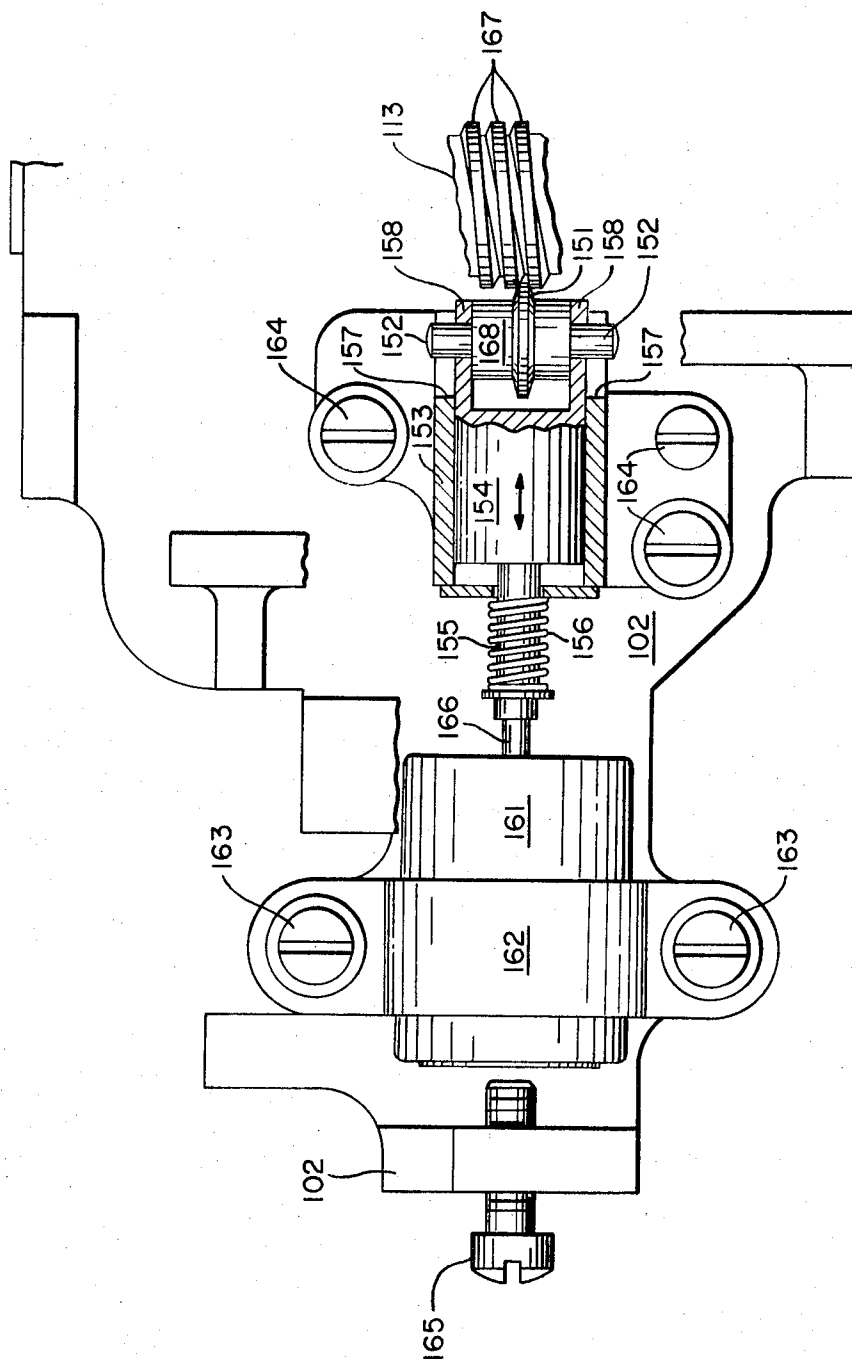


FIG. 3

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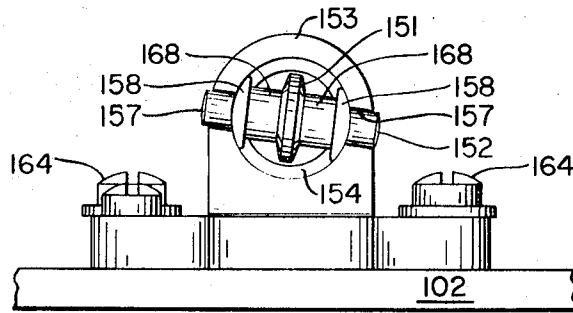


FIG. 4

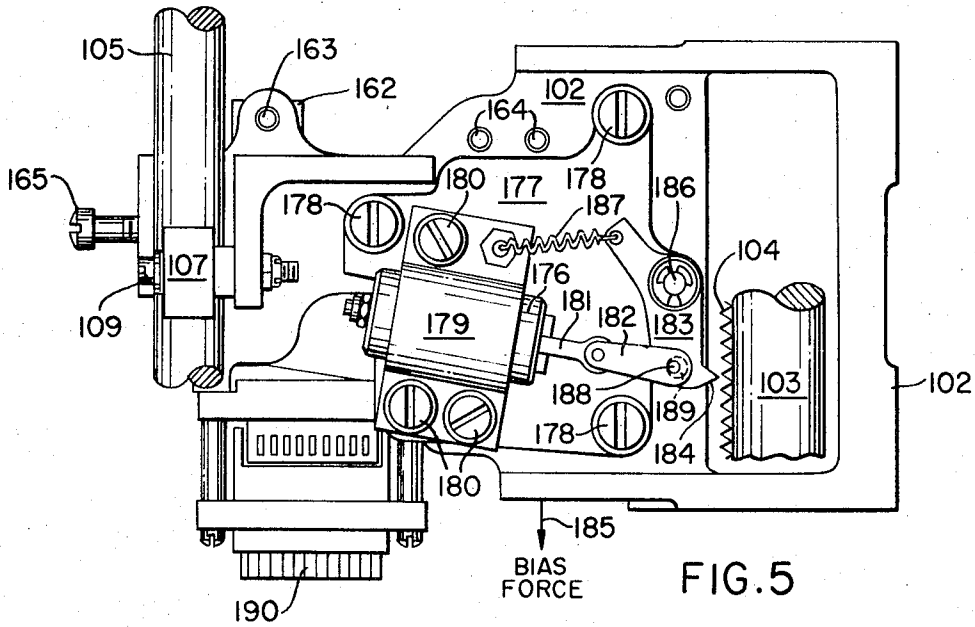


FIG. 5

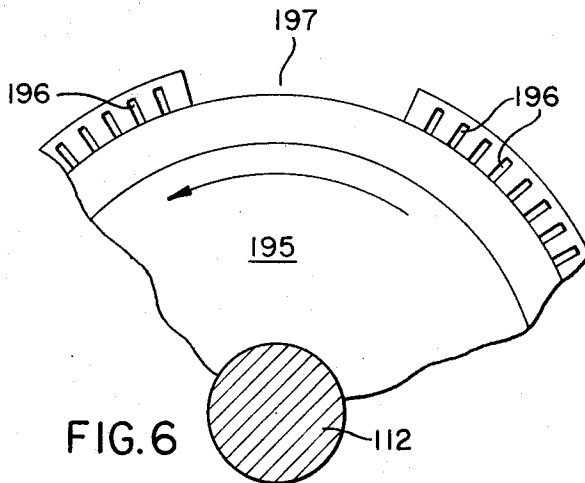


FIG. 6

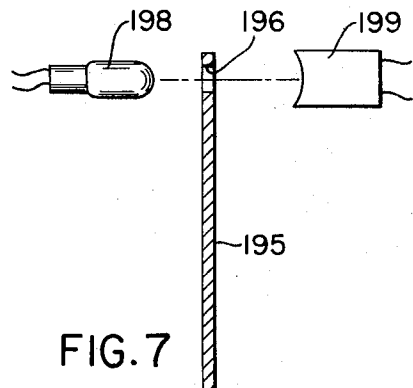


FIG. 7

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PRINTER CARRIER DRIVE

CROSS REFERENCE TO RELATED APPLICATIONS

The invention disclosed herein is suitable for use in a printing mechanism which may also incorporate the inventions disclosed and described in the co-pending applications of Donald G. Hebert, filed Dec. 7, 1970, assigned Ser. No. 95,645, and entitled BALLISTIC PRINT HAMMER MECHANISM and also the co-pending application of Donald G. Hebert and Richard G. Dobner filed May 12, 1971, assigned Ser. No. 142,702, and entitled PRINTER PAPER GUIDE WHICH COMPENSATES FOR THICKNESS OF DOCUMENT PACK. Both of these co-pending applications are assigned to the same assignee as the present application.

FIELD OF THE INVENTION

This invention relates to a high speed on-the-fly printing mechanism and more particularly to a character-by-character printer employing a rotatable print wheel with alphanumeric characters arranged in a helical pattern. Even more particularly, the invention relates to a means whereby a carrier for supporting the rotatable print wheel may be selectively engaged with a constantly rotating lead screw for moving the carrier and the rotatable print wheel in a path of travel which is parallel to the axis of rotation of the print wheel.

DESCRIPTION OF PRIOR ART

U.S. Pat. Nos. 3,442,364, issued May 6, 1969, to Robert A. Ragen; 3,406,625, issued Oct. 22, 1968, to L. D. Chamness et al.; and 3,424,291, issued Jan. 28, 1969, to A. F. Marion, disclose printers of the general character described. However, the cited patents do not disclose a carrier which may be selectively coupled with the driving means at any point intermediate of the ends of the printing line. The Chamness et al. patent does disclose a pin 58 which is urged into an engagement with the lead screw for moving the carrier in the printing direction. The Chamness et al. pin is subjected to sliding friction with the lead screw and therefore, may experience wear and a large force may be necessary to withdraw it from engagement with the lead screw.

SUMMARY OF THE INVENTION

The present invention discloses a new and improved means for selectively coupling a carrier to a constantly rotating lead screw. The coupling means comprises a rotatable engaging disc designed to mate with the lead screw threads and means for urging the rotatable engaging disc towards the lead screw only when the instantaneous angular position of the lead screw is such that the rotatable disc will engage with the threads of the lead screw with a non-interfering fit. The engaging disc rotates on its axis during the time that it is in engagement with the lead screw and therefore, the friction between the engaging member and the lead screw is greatly reduced over that of the prior art which employed sliding members. The reduced friction means reduced wear. In addition, because of the reduced friction between the engaging disc and the lead screw, it is easier to withdraw the engaging disc from the lead screw when it is desired to effect a disengagement.

An improved single pawl backspacing means is also disclosed. The carrier is maintained at any attained position, and against a return bias force, by the engagement of a retaining pawl with the teeth of a stationary rack. When it is desired to achieve a backspacing operation, the retaining pawl is electromagnetically withdrawn from the rack and released immediately after the carrier commences its return motion. Accordingly, the retaining pawl will return to a retaining position and stop the carrier when the carrier moves sufficiently far in the return direction for the pawl to engage the next tooth of the rack. With such a backspacing system, it is important that the carrier does not experience significant over-travel. That is, if the carrier should experience over-travel, there is a possibility that a backspace signal could be received, the retaining pawl withdrawn from the rack and released, all in less time than it would have taken the carrier to fall back the amount of the over-travel. Thus, under such circumstances, there would have been a failure of the carrier to achieve an actual backspacing operation. The present structure provides a means for assuring that there is minimum over-travel of the carrier and thereby assures that there will be proper backspacing action in response to each backspacing signal.

It is an object of this invention to provide a new and improved means for selectively coupling a print wheel carrier to a constantly rotating lead screw.

It is a more particular object of this invention to provide a coupling means of the character described which is subject to reduce wear.

It is another object of the invention to provide a new and improved means for coupling a print wheel carrier to a lead screw wherein the coupling means comprises a rotatable disc.

It is another object of the invention to provide a new and improved print wheel carrier coupling means which has reduced frictional forces during engagement.

It is another object of the invention to provide a print wheel carrier coupling means for selective engagement and disengagement with a constantly rotating lead screw.

It is another object of the invention to provide a new and improved print wheel carrier means which may be disengaged from a lead screw with a minimum over-travel of the carrier.

It is another object of the invention to provide in combination with a new and improved print wheel carrier coupling means a positive action single pawl backspacing mechanism.

BRIEF DESCRIPTION OF THE DRAWING

The invention both as to its organization and method of operation will best be understood by reference to the following detailed description taken in connection with the accompanying drawing in which like numerals always refer to like parts and in which:

FIG. 1 comprises a side view of a printer mechanism incorporating the invention;

FIG. 2 comprises a more detailed view of the invention and more particularly a view showing the engaging disc out of engagement with the rotating lead screw;

FIG. 3 is similar to FIG. 2 but shows the engaging disc in engagement with the rotating lead screw;

FIG. 4 shows an end view of the engaging disc and the supporting structure;

FIG. 5 shows the backspacing mechanism; and

FIGS. 6 and 7 show a timing mechanism for determining the instantaneous angular position of the lead screw and/or of the print wheel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawing, and specifically to FIG. 1, there will be seen a side view of a portion of a printer which incorporates the invention. The printer employs a print wheel carrier 101 comprising a carrier frame casting 102 a portion of which is broken away to more clearly show other elements. The carrier frame casting 102 is slideably supported on the detent and support rail 103. As the name suggests the detent and support rail 103 includes a detent rack 104 which, as will be seen, cooperates with a detent pawl, to be described later, to retain the print wheel carrier 101 at any position along the length of the detent and support rail 103. The print wheel carrier 101 is additionally supported by the main carrier guide rail 105. Coupled to the carrier frame casting 102 are guide shoes 106 and 107 which slideably engage the main carrier guide rail 105. The position of the guide shoes 106 and 107 relative to the carrier frame casting 102 may be adjusted by screws 108 and 109 to thereby provide some control over the positioning of the print wheel carrier 101. The detent and support rail 103 and the main carrier guide rail 105 are supported by end frame members 110.

A print shaft 112 is also supported by the machine end frame members 110 and journaled for rotation. The print shaft 112, the detent and support rail 103 and the main carrier guide rail 105 are substantially parallel. A lead screw 113 is also supported by the machine end frame members 110 and journaled for rotation. The print shaft 112 and the lead screw 113 are coupled together by gears, or cog belts, so that there is a predetermined relationship relative to their angular rotation. In one embodiment of the printer the print shaft 112 makes two revolutions for each revolution of the lead screw 113. Any suitable and conventional means may be provided for selectively rotating the print shaft 112, and the lead screw 113, at a predetermined angular velocity. It should be noted that the print shaft 112 has key slots 114. Mounted on the print shaft 112 is a print wheel assembly 118 which comprises a unitary hub 119 and a flange 120. Between the print shaft 112 and the hub 119 is a sleeve bearing 121. A print wheel 122 is secured to the flange 120 by means of screws 123. As seen in the view of FIG. 1 the print wheel 122 is on the far side of the flange 120 and has an inner diameter as shown by the dotted line 124. In addition to the print wheel 122, which is coupled to the flange 120, there is coupled thereto a pair of keys (not shown) which engage the key slots 114. The coupling keys are not shown as they do not form a significant feature of this invention and would only tend to obscure the drawing. However, it should be understood that the print wheel assembly 118 is keyed to the print shaft 112 and that, therefore, the print wheel assembly 118 will rotate with the same angular velocity as the rotation of the print shaft 112. Furthermore, although the print wheel assembly 118 is keyed to the print shaft 112 it should be understood that the print wheel assembly 118 will slide along the length of the print shaft 112. The sleeve bearing 121 is provided to reduce the friction and wear as

the print wheel assembly 118 slides longitudinally on the print shaft 112.

As will be seen the print wheel carrier 101 slides longitudinally on the detent and support rail 103 and is guided and kept from rotational motion by the sliding relationship between guide shoes 106 and 107 with the main carrier guide rail 105. Arm 128 of carrier frame casting 102 supports a print wheel drive plate 129 which has a portion 130 which extends into a slot 131 in hub 119. The width of the print wheel drive plate portion 130 and the width of the slot 119 are substantially equal. Accordingly, as the print wheel carrier 101 is moved longitudinally of the detent and support rail 103 the print wheel assembly 118 will undergo corresponding longitudinal motion. That is, when there is longitudinal motion of the print wheel carrier 101 the print wheel drive plate portion 130 which engages slot 131 of hub 119 causes longitudinal movement of the print wheel assembly 118.

It should be understood that the print wheel 122 is a disc and that on the outer surface of its periphery will be found alphanumeric characters. The print wheel 122 and the print hammer assembly 134 (described more fully in the cited Hebert application) will cooperate to print selected alphanumeric characters on a document (not shown) located between the print wheel 122 and the print hammer assembly 134. Ink is applied to the alphanumeric characters of the print wheel 122 by means of an ink cartridge 136. The ink cartridge 136 houses an ink roller (not seen) which is rotationally supported within the ink cartridge 136. The ink cartridge 136 is pivotally supported at pivot support 137 and is biased towards the print wheel 122 by spring 138 which has one end coupled to the ink cartridge 136 and the other end coupled to arm 139 which is fastened to a part of the carrier frame casting 102 by screws 140.

The print wheel carrier 101 is moved in the print direction by coupling the print wheel carrier 101 to the constantly rotating lead screws 113 by the letter space roller 151. That is, the lead screw 113 has a helical thread and when the letter space roller 151 is engaged with the threads of the lead screw 113 the print wheel carrier 101 will be moved longitudinally in the letter spacing direction. The letter space roller 151 is rotationally mounted on a roller shaft 152 (FIG. 4) which is supported in roller housing 153 by roller shaft yoke 154 (best seen in FIG. 4) and having a yoke tail portion 155 which extends to the left of the roller housing 153 as seen in FIG. 1. Spring 156 biases the roller shaft yoke 154, and hence the letter space roller 151, away from, and out of engagement with, the lead screw 113. When it is desired to engage the letter space roller 151 with the lead screw 113 the letter space solenoid 161 is electrically energized and it drives the roller shaft yoke 154, and hence the letter space roller 151, to the right as seen in FIG. 1. The letter space solenoid 161 is mounted on the carrier frame casting 102 by mounting loop 162 and a pair of screws 163, only one of which is seen in FIG. 1.

Considering now more specifically FIG. 2 wherein there is shown an enlarged and more detailed view of the elements associated with the letter space roller 151 it will be seen that the roller housing 153 is securely but adjustably positioned on the carrier frame casting 102 by screws 164. Back stop screw 165 limits the leftward motion of the solenoid plunger 166 and thereby determines the maximum leftward position of the roller shaft

yoke 154 and accordingly determines the clearance between the letter space roller 151 and the teeth 167 of the lead screw 113.

Consideration should now be given to FIG. 3 which is similar to FIG. 2 except that a portion of the roller housing 153 has been cut away to more clearly show the roller shaft yoke 154 and the letter space roller 151. In addition, in FIG. 3 the letter space solenoid 161 is operated and therefore it has urged the letter space roller 151 towards the lead screw 113 so that the letter space roller 151 will engage the threads 167 of the lead screw 113. The letter space roller 151 is designed to mate with the threads 167 of the lead screw 113 and so that the letter space roller 151 touches the sides of adjacent teeth 167 of lead screw 113 but not the root of the teeth. As may be seen by comparing FIGS. 1 and 3 the roller shaft 152 is supported by the roller shaft yoke 154 and guided by slots 157 in the roller housing 153.

FIG. 4 is a view taken along line 4—4 of FIG. 2. As may be seen from FIGS. 3 and 4 the letter space roller 151 is centered between the arms 158 of the roller shaft yoke 154 by the roller bosses 168. It should be particularly noted from FIG. 4 that the roller shaft 152 is not horizontal. That is, the roller shaft 152 is tilted from the horizontal a few degrees so that the letter space roller 151 can mate properly with the helical teeth 167 of the lead screw 113. Or phrased differently the axis of the roller shaft 152 is at right angles to the angle of lead of the helical thread 167 of the lead screw 113. Furthermore, when the letter space roller 151 is engaged with the teeth 167 and the lead screw is rotated there will be a rolling contact between the letter space roller 151 and the teeth 167.

FIG. 5 illustrates the backspace and carrier return solenoid 176 which is located on the print wheel carrier 101 and supported on the underside of the carrier frame casting 102. These elements are not shown in FIG. 1 as they would not be seen clearly and would only tend to obscure FIG. 1. A solenoid base plate 177 is attached to the carrier frame casting 102 by screws 178 and the backspace and carrier return solenoid 176 is attached to the solenoid base plate 177 by a mounting loop 179 which is secured to the solenoid base plate 177 by screws 180. In response to the electrical operation of the backspace and carrier return solenoid 176 the plunger 181 is moved from right to left as viewed in FIG. 5. Coupled to the plunger 181 is a detent pawl linkage 182 which is also coupled at its other end to detent pawl 183. The detent pawl 183 includes a pawl dog 184 which, when the back-space and carrier return solenoid 176 is not energized, will engage the teeth of detent rack 104 on the detent and support rail 103. The engagement of the pawl dog 184 with the teeth of detent rack 104 will inhibit the longitudinal motion of the print wheel carrier 101 in a carrier return direction. That is, the print wheel carrier 101 is biased towards a carrier return direction by a bias force indicated schematically at 185. Accordingly, when it is desired to initiate a carrier return actuation the backspace and carrier return solenoid 176 may be actuated to thereby pivot the detent pawl 183 about its pivot point 186 and withdraw the detent pawl dog 184 away from engagement with the teeth of detent rack 104. Spring 187 is coupled to the solenoid base plate 177 and the detent pawl 183 to bias the detent pawl 183 so that the pawl dog 184 will engage the teeth of the detent rack 104.

The detent pawl linkage 182 comprises two identical parts with one on each side of the detent pawl 183 and coupled to the detent pawl 183 by a pin 188 which passes through a hole 189 in the detent pawl 183. It should be noted that the hole 189 is oversized with respect to the pin 188. Accordingly, as the print wheel carrier 101 moves in a letter spacing direction the detent pawl 183 is enabled to pivot about pivot point 186 and ride over the teeth of the detent rack 104 without imparting a motion to the detent pawl linkage 182 and the plunger 181.

The various electrical connections that must be made to the electrical components on the print wheel carrier 101 are made through a flexible ribbon 190 which carries a plurality of electrical conductors.

FIG. 6 shows an end view of the print shaft 112 and a timing wheel 195 which is attached to the print shaft 112. Towards the outer perimeter of the timing wheel 195 are located a plurality of timing slots 196 with one slot 196 for each character located on the periphery of the print wheel 122. In addition, there is a wide timing slot 197 which corresponds to the space between the last and first character on the print wheel 122 and provides a reset signal for the associated equipment. The spaces on the timing wheel 195 between the timing slots 196 are opaque.

FIG. 7 shows a side view of the timing wheel 195 and indicates that a light source 198 can shine through the timing slots 196 and/or the wide timing slot 197 and be detected by the light detector 199 to provide a signal indicative of the instantaneous position of the print wheel 122. By standard techniques, which are well known to those skilled in the related arts, counters may be used together with comparison circuits for providing a signal to operate the print hammer assembly 134 to affect the printing of a desired character. In an actual application the light source 198 may comprise a light emitting diode.

The timing wheel 195 and associated equipment provide another signal which is very important to the effective and efficient utilization of the invention. More specifically, the structure of the present invention is designed to permit the selective coupling of the print wheel carrier 101 with the constantly rotating lead screw 113. When the print wheel carrier 101 is not engaged with the lead screw 113 the detent pawl 183 retains the print wheel carrier 101 at its attained position. When it is desired to engage the print wheel carrier 101 with the lead screw 113 the letter space solenoid 161 is energized to move the letter space roller 151 into engagement with the teeth 167 of the lead screw 113. Obviously, such engagement between the roller 151 and the teeth 167 can only be affected when the angular position of the lead screw 113 is such that a valley between two of the teeth 167 is presented to the roller 151. That is, if an attempt were made to move the roller 151 towards the lead screw 113 at any other time there would be an interference and possible damage. It will be recalled that the print shaft 112 and the lead screw 113 are coupled together. Accordingly, if the angular movement of one relative to the other is known it is possible to determine the angular position of one if the angular position of the other is known. The timing wheel 195, and its associated equipment, always provides information relative to the instantaneous angular position of the print shaft 112. Accordingly, with the angular position of the print shaft 112 known the angu-

lar position of the lead screw 113 is also known. Accordingly, a signal derived from the timing wheel 195 and a selected one of the timing slots 196 may be used to indicate a appropriate time for operating the letter space solenoid 161 for engaging the letter space roller 151 with the lead screw 113.

In one embodiment of a machine incorporating the present invention the lead screw 113 makes only half a revolution for each revolution of the print shaft 112. However, the lead screw 113 is double threaded. That is, there are two parallel spiral threads on the lead screw 113 so that alternate teeth 167 form one thread and the remaining teeth 167 form the other thread. Accordingly, once each half revolution of the lead screw 113 a valley between adjacent teeth 167 is presented to the roller 151 and the letter space solindoid 161 may be actuated to engage the roller 151 with the lead screw 113. Or, phrased differently, once per revolution of the print wheel 122 there is an opportunity to engage the print wheel carrier 101 with the lead screw 113.

It should be understood that the characters on the print wheel 122 are arranged thereon in a helix. That is, when the print wheel 122 is engaged with the lead screw 113 the print wheel carrier 101 will be moved a small amount in the letter space direction for each increment of rotation of the lead screw 113. More specifically, the print wheel 122 will be moved one letter space width in the letter space direction for each complete revolution of the print wheel 122. Phrased differently, adjacent teeth 167 on the lead screw 113 are spaced apart by an amount equal to the letter space distance; usually 0.1 inch. To compensate for the constant motion of the print wheel 122 in the letter spacing direction, and to be enabled to print each character on the print wheel 122 within a predetermined letter space position, the successive alphanumeric characters on the print wheel 122 do not have their center lines in a common plane which is at right angles to the axis of the lead screw 113. That is, each successive one of the alphanumeric characters has its center in a plane which is parallel to, but removed from, the corresponding plane of adjacent characters by an amount which corresponds to the longitudinal motion of the print wheel 122 that results from the angular rotation of the print wheel 122 as the print wheel 122 rotates the number of degrees necessary to bring successive characters to the printing point. Accordingly, every one of the alphanumeric characters on the print wheel 122 will be presented within the limits of each letter space position on the document. Characters displaced on a print wheel in this manner are sometimes said to be placed in a helical pattern and therefore printers having this characteristic are sometimes referred to as helical printers.

It should be observed that the roller 151 is rotatably mounted on the roller shaft 152 and that while the roller 151 is in contact with the teeth 167 of the lead screw 113 there is rolling contact between the roller 151 and the sides of the teeth 167. Accordingly, the wear between the roller 151 and the teeth 167 is greatly reduced over what it would be if there were a sliding contact. The roller 151 is maintained in contact with the threads 167 of the lead screw 113 by the force applied by the letter space solenoid 161 acting through the roller shaft yoke 154. As soon as the letter space solenoid 161 is de-energized the continued rotation of the lead screw 113 will apply a force to the roller 151 to eject the roller 151 from contact with the lead screw

113. In addition, the spring 156 provides a force to extract the roller 151 from its contact with the lead screw 113. Accordingly, when it is desired to terminate the coupling between the print wheel carrier 101 and the lead screw 113 such termination may be affected quite rapidly. It should be noted that in a preferred embodiment of the invention the roller 151 is not extracted from the lead screw 113 at an indiscriminate time. More specifically, the extraction of the roller 151 from the threads 167 of the lead screw 113 is affected in response to the receipt of a signal from a predetermined slot 196 of the timing wheel 195 such that there has been enough travel of the print wheel carrier 101 in the letter space direction to assure that the detent pawl dog 184 will engage the next tooth on the detent rack 104. However, as will be seen, a minimum amount of over-travel is desired.

In a preferred embodiment of the machine the detent pawl 183 is used to initiate a backspacing actuation. Consider first the backspacing operation in response to a signal which occurs at a time while the roller 151 is not engaged with the lead screw 113. In response to the receipt of the backspacing signal the backspace and carrier return solenoid 176 may be actuated by any convenient means familiar to those acquainted with such mechanisms. In response to the actuation of the backspace solenoid 176 the detent pawl 183 will be pivoted away from the detent rack 104 and the bias force indicated at 185 will start to move the print wheel carrier 101 in a backspacing direction. Before the print wheel carrier 101 has had time to move as much as one letter space in a backspacing direction the backspace and carrier return solenoid 176 will be released and the detent pawl 183 will pivot about pivot point 186 in response to the force of spring 187 and caused the detent pawl dog 184 to engage the very next tooth of the detent rack 104 thereby limiting the motion of the carrier 101 to one letter space.

Consider now a situation wherein the print wheel carrier 101 has been coupled to the lead screw 113 for a series of successive characters and that immediately after the printing of one character a backspace signal is received. In normal operation the coupling between the print wheel carrier 101 and the lead screw 113 will be maintained as long as there is a signal indicating that there is information indicative of the identity of the next alphanumeric character which it is desired to print. As soon as a backspace signal is detected it is an indication that the printing is to be temporarily halted and therefore, soon after the last character before the backspacing signal has been printed the letter space roller 151 will be removed from its coupling with the lead screw 113. The decoupling action occurs in response to a signal from a predetermined timing slot 196 of the timing wheel 195. Immediately after receipt of this de-coupling signal the backspace signal will be allowed to actuate the backspace and carrier return solenoid 176. Should the solenoid 176 be actuated too fast or should the print wheel carrier 101 experience an over-travel in the letter spacing direction, there is a possibility that the detent pawl 183 might be pivoted away from the detent rack 104 and returned so fast that the print wheel carrier 101 will not have moved sufficiently far in the backspacing direction to assure a successful backspacing operation. That is, the detent pawl dog 184 might engage the same tooth of the rack 104 that it would have engaged had there been no back-

spacing operation. From the foregoing discussion it can be seen that the rapid withdrawal of the roller 151 from the lead screw 113 is important to prevent any over-travel of the print wheel carrier 101 in the letter spacing direction. As indicated, the rolling contact between the roller 151 and the teeth 167 of the lead screw 113 facilitates the rapid ejection of the roller 151 and therefore assures a successful backspacing operation even when the backspacing signal immediately follows a print signal.

The print wheel carrier 101 may be returned to its left margin position in response to an actuation of the backspace and carrier return solenoid for a sufficiently long time to allow the bias force 185 to return the print wheel carrier 101 to its lefthand position. A means, not shown, may be used to indicate when the print wheel carrier 101 has reached its left-hand position and/or to decelerate the print wheel carrier 101 during the last portion of its return motion. Other means, not shown, may be employed to uncouple the print wheel carrier 101 from the lead screw 113 in the event that the print wheel carrier 101 is advanced to the right beyond a predetermined point.

The print hammer assembly 134 is, in affect, coupled to the print wheel carrier 101 so that the print hammer assembly 134 is always in a position to affect the printing of any selected alphanumeric characters. A paper feed mechanism 200 which does not form a part of the present invention and which therefore is not described in detail is provided for handling and indexing the document upon which the printing is being affected.

While there has been shown and described what is considered at present to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the art. It is not desired, therefore, that the invention be limited to the embodiment shown and described, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In an on the fly printer:

a print wheel having alphanumeric characters and symbols arranged helically on the periphery of said print wheel and with a pitch of one letter space, for sequentially presenting any one of said alphanumeric characters and symbols at successive letter space positions along a print line;

a carrier for supporting said print wheel and including means for rotating said print wheel;

a lead screw having a predetermined pitch along the length thereof and constantly rotating in time relation with said print wheel;

an engaging mechanism supported on said carrier for selective engagement with said lead screw;

said engaging mechanism comprising:

a rotatable disc selectively engageable and disengageable with said lead screw anywhere along the length thereof for advancing said carrier and said print wheel from one letter space position to successive letter space positions when said rotatable disc is engaged with said lead screw; and

control means responsive to the relative angular positions of rotation of said lead screw and said means for rotating said print wheel for selectively moving said rotatable disc into engagement with said lead screw only when the instantaneous angular position of said lead screw will result in a

noninterfering engagement with the thread of said lead screw.

2. The combination as set forth in claim 1 wherein said control means comprises:

detecting means for detecting the instantaneous angular position of said lead screw and for generating a command signal when said lead screw is at a predetermined angular position; and

electromagnetic means for urging said disc into engagement with said lead screw in response to said command signal.

3. The combination as set forth in claim 1 wherein: said rotatable disc is mounted on a shaft whose axis is at right angles to the angle of lead of the thread of said lead screw.

4. The combination as set forth in claim 1 wherein: said control means comprises electromechanical means.

5. The combination set forth in claim 1 further including:

an escapement rack parallel to said lead screw and having teeth separated by a pitch distance which has a fixed relationship with the thread pitch of said lead screw;

said carrier coupled to said escapement rack and mounted for reciprocal motion parallel to the axis of said lead screw;

first bias means for urging said carrier to move in a first direction;

a selectively pivoted escapement pawl coupled to said carrier and for engagement with any of the teeth of said escapement rack to prevent the motion of said carrier in said first direction when said escapement pawl is engaged with any of the teeth of said escapement rack and to enable movement of said carrier in said first direction when said escapement pawl is disengaged to provide a back space or a carriage return function.

6. The combination as set forth in claim 5 further including:

pawl bias means for urging said escapement pawl towards engagement with the teeth of said escapement rack;

electromagnetic means for pivoting said escapement pawl away from engagement with the teeth of said escapement rack;

said first bias means coacting with said carrier for moving said carrier in said first direction an amount equal to said pitch distance in response to the pivoting of said escapement pawl out of engagement with said escapement rack by said electromagnetic means followed by the pivoting of said escapement pawl towards engagement with said escapement rack in response to the urging of said pawl bias means when said electromagnetic means is de-activated before said carrier has moved an amount equal to said pitch distance.

7. The combination as set forth in claim 5 wherein: said alphanumeric characters arranged on the periphery of said print wheel in a helical arrangement are such that when said disc is engaged with said lead screw to move said carrier, the combined motion of said carrier and the rotation of said print wheel causes each of said alphanumeric characters on said print wheel to be sequentially presented one time with their approximate midpoints at approximately the same point with respect to a refer-

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ence point along the length of said escapement rack.

8. The combination as set forth in claim 5 wherein: said control means comprises electromagnetic means.

9. The combination as set forth in claim 8 wherein:

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said electromagnetic means is energized to affect engagement between said disc and said lead screw and including second bias means for urging said disc away from engagement with said lead screw when said electromagnetic means is de-energized.

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