

July 7, 1970

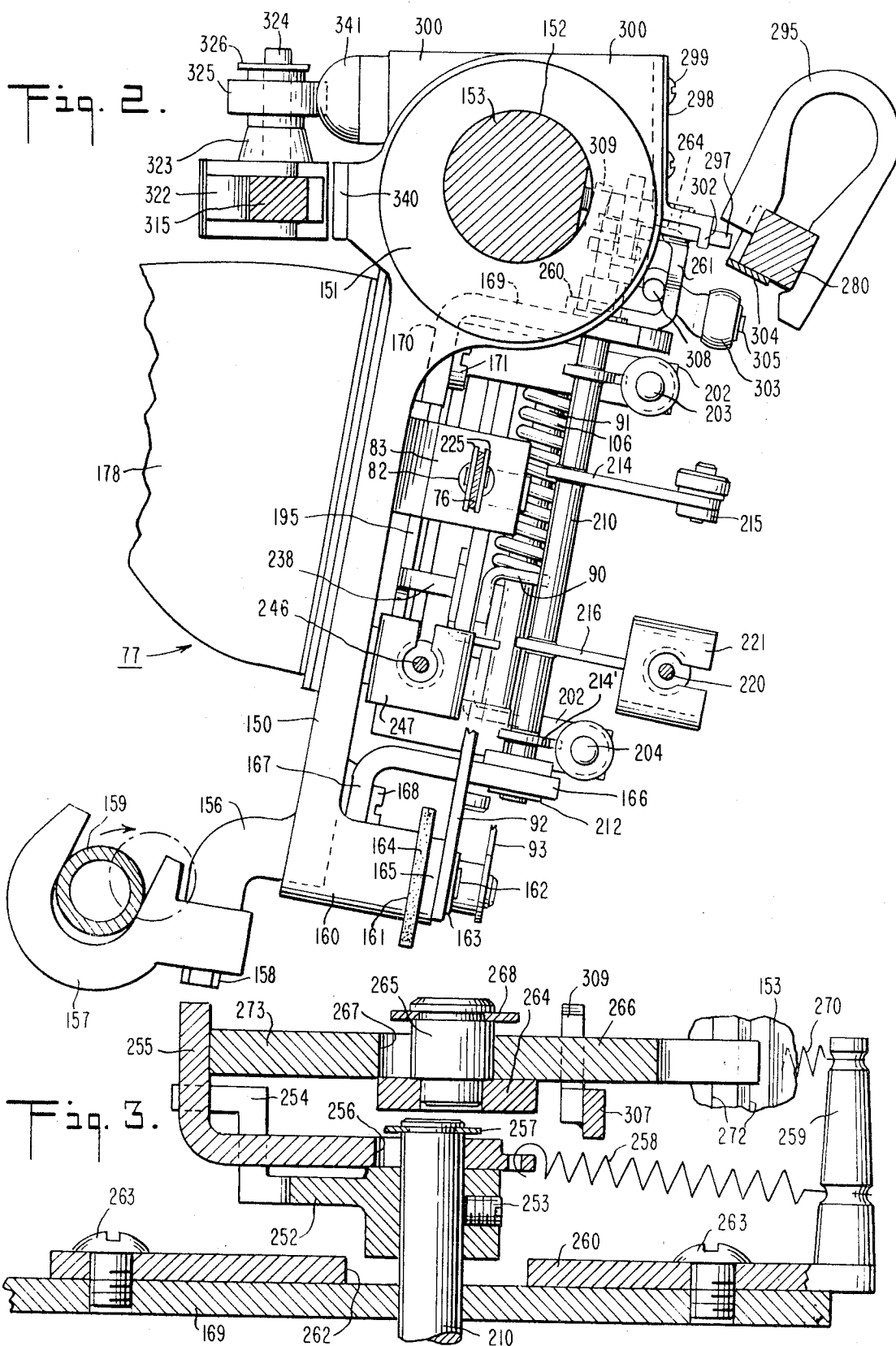
H. E. SMITH

3,519,115

ESCAPEMENT MECHANISM RESPONSIVE TO THE RETURN PORTION
OF A RECIPROCAL ROTARY MOTION

Filed Sept. 11, 1967

5 Sheets-Sheet 3



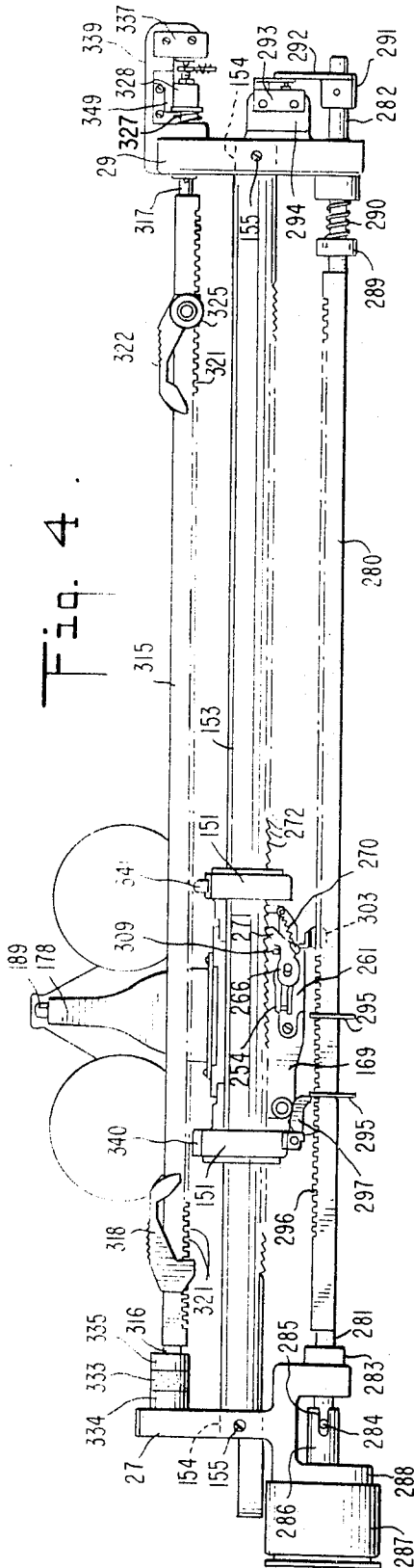
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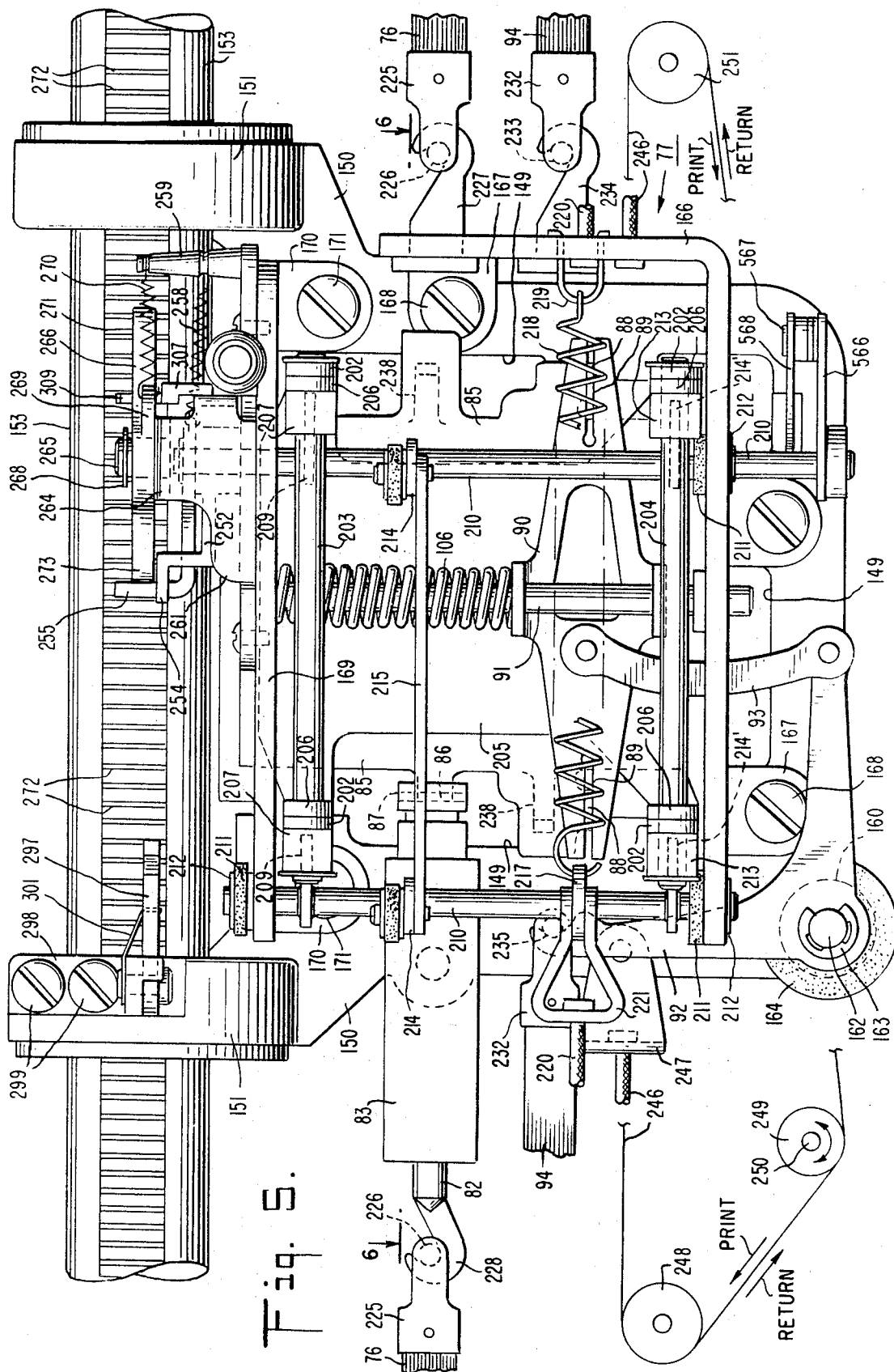


Fig. 5.

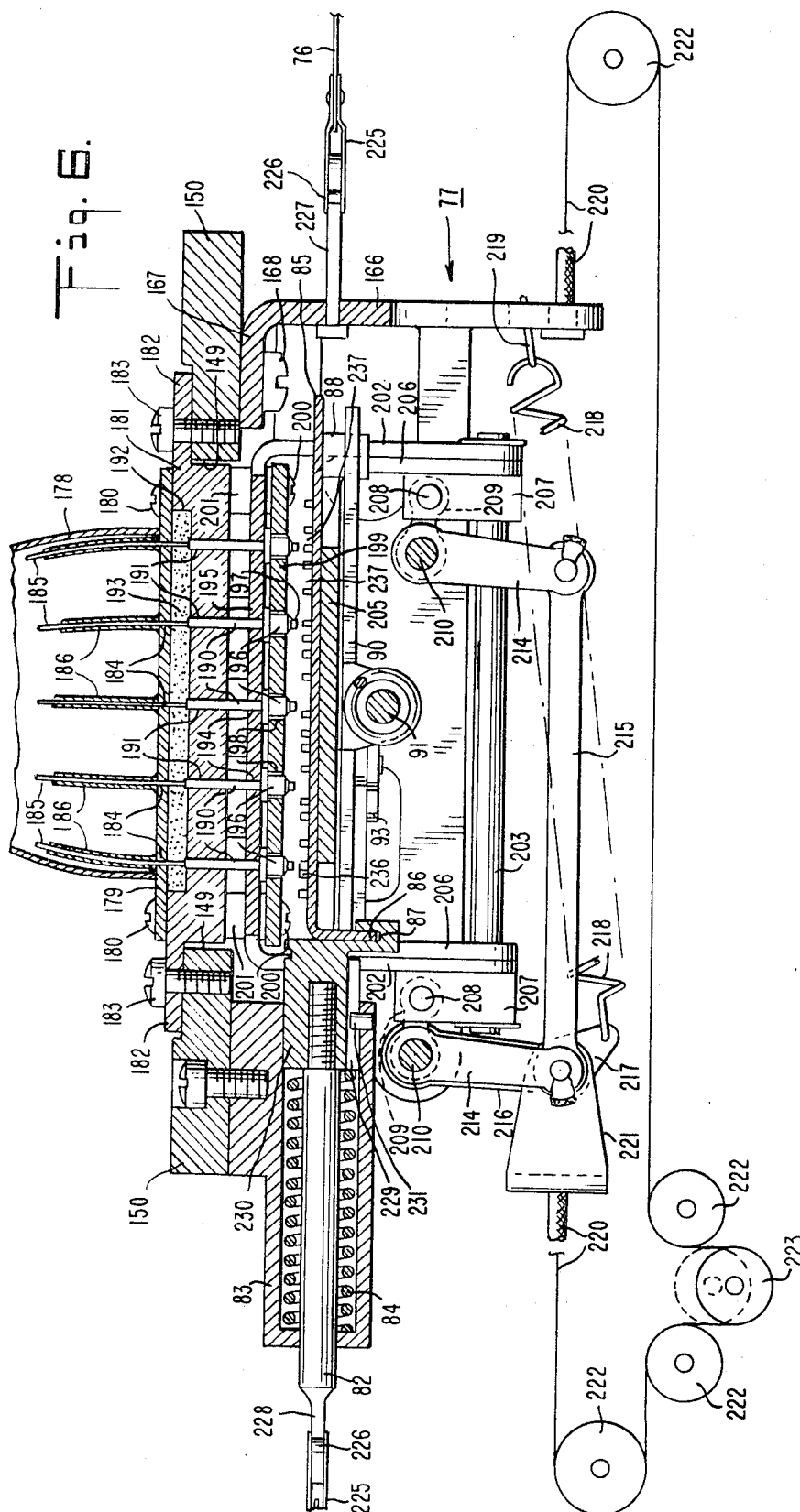
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3,519,115

ESCAPEMENT MECHANISM RESPONSIVE TO THE RETURN PORTION OF A RECIPROCAL ROTARY MOTION

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U.S. Cl. 197—82

4 Claims

ABSTRACT OF THE DISCLOSURE

An escapement mechanism for use with a character-by-character printer having a single pawl engaging the associated escapement rack. A pawl mounted for longitudinal and pivotal movement on the carrier to be escaped is pivoted out of engagement with a rack tooth in response to the completion of a print cycle and moved in the letter spacing longitudinal direction and then in a reverse pivotal direction by a bias means. In response to the reverse pivotal movement of the pawl, it engages the next successive tooth of the rack. The carrier, which is slower to move because of its greater inertia, moves in a letter spacing longitudinal direction as urged by a different bias means and until its movement is impeded by the pawl which is engaged with the next tooth of the rack.

The present invention relates to serial character page printers and, more specifically, to power operated printers which respond to data presented in coded form and automatically prints such data in serial character form at desirably high printing rates, and even more particularly, to a character space escapement structure for providing letter space escapement motion between the printing mechanism and the platen structure. Many forms of letter spacing escapement mechanism are employed in the ubiquitous manual and electric typewriters. Printers which print in response to human control are seldom required to print at a rate faster than approximately fifteen characters per second and then only for a brief period. However, as printers were developed which are capable of responding to input coded signals and printing at a much higher printing rate, it became necessary to develop improved letter escapement spacing means which can provide the necessary relative motion between the platen and printing elements at the necessary speed.

In copending application Ser. No. 630,904, filed Apr. 15, 1967, by Edwin O. Blodgett and assigned to the same assignee as the present application, now U.S. Pat. 3,426,880, there is disclosed the complete details of a high speed serial character matrix page printer which is capable of printing at a much higher sustained printing rate. The letter spacing escapement structure disclosed and claimed herein is suitable for use with the printer disclosed in the cited copending application, and/or with other printers which may be required to print on a character-by-character basis and/or with printers having a wide range of printing speeds.

Prior art letter escapement mechanisms were perfectly satisfactory for use with printers that responded to manual input. However, they exhibited a variety of faults when used with high speed printers. For example, some prior art escapements tended to be too slow and when used with high speed printing, a new character would be printed before the escapement had been completed. This caused uneven printing and/or overlapped characters. Some escapements could be made to operate with sufficient speed but in so doing their adjustment became critical and difficult to maintain. Other escapement mechanisms subjected the moving members to such violent shock that wear and loss of adjustment caused difficulty.

Accordingly, it is a principal object of this invention to provide a new and improved escapement mechanism.

It is a more specific object to provide a new and improved letter escapement mechanism for use with a high speed character-by-character printer.

It is another object of this invention to provide an escapement mechanism which comprises a minimum number of parts and which is easy to assemble and adjust.

It is a more particular object of this invention to provide an escapement mechanism which is activated after printing.

It is another object of this invention to provide an escapement mechanism which operates at, or close to, the center of gravity of the carrier, thereby minimizing torsional forces during escapement.

Other objects and advantages of the present invention will appear as a detailed description thereof proceeds in the light of the drawing forming a part of this application and in which:

FIG. 1 and FIG. 3 illustrate in a plan view and in an elevational cross-section view, respectively, the construction of the novel letter escapement structure utilized in a printer for effecting letter escapement spacing between the print head carrier and the platen;

FIG. 2 illustrates some details of the assembly of the escapement structure together with the carrier;

FIG. 3, mentioned above, is a cross-section view taken along section line 3—3 of FIG. 1;

FIG. 4 illustrates in plan view the carrier support and its cooperative arrangement with the letter spacing structure and the horizontal tabulation paper margin structures included in the printer;

FIG. 5 shows an elevational view of the construction of the carrier and the associated letter escapement structure; and

FIG. 6 shows the cross-sectional view taken along section line 6—6 of FIG. 5 and illustrates the construction of a wire-matrix print head and the associated carrier utilized in the printer embodying the letter space escapement structure.

To aid the reader who may be interested in obtaining more details concerning the printer in which the present invention is illustrated, the above-identified figures include some figures which are identical to some of those in the cited Blodgett application. More specifically, FIGS. 1, 2, 3, 4, 5, and 6 in the present application correspond to FIGS. 15, 10, 14, 12, 9, and 11, respectively, of the cited Blodgett application. Identical reference numerals are used in the two applications for the convenience of the reader.

The print head carrier 77 (FIG. 5) during printing of successive characters of a line of copy is urged by a spring motor drive to move in a direction from left to right as viewed in FIG. 5, and upon completion of a line of copy the carrier 77 is rapidly driven in the opposite direction. The spring motor power means is symbolically indicated at 249 and the direction of the forces exerted thereby are indicated by the "Print" and "Return" force arrows shown to the right and left of idler pulleys 248 and 251, respectively. A preferred means of providing the bidirectional motion of carrier 77 is shown in FIGS. 19 and 26 of the cited copending Blodgett application, now Pat. No. 3,426,880, and the related text including that in columns 17 to 22. The bidirectional movement is represented schematically in FIG. 5 of this application wherein cable 246 is connected by a yoke 247 to carrier base casting 150. The cable 246 extends over an idler pulley 248 and is wrapped about drive pulley 249, of the spring motor represented thereby, at least once. 250 is the supporting shaft for the spring motor represented by drive pulley 249. The bidirectional power driven nature of drive pulley 249 is represented by a two headed arrow to indicate power driven rotation in either direction. The

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other end of the same cable 246 is extended over idler pulley 251 and is coupled to bracket 166 of carrier 77. Accordingly, when drive pulley 249 is urged in a clockwise direction (as viewed in FIG. 5) cable 246 pulls on the right side of carrier 77 and urges the carrier 77 to move to the right. As will be seen the motion of the carrier 77 to the right is selectively restrained by the interaction of pawl 266 with the teeth 272 of rack 153. When drive pulley 249 is driven in a counterclockwise direction, the cable 246 pulls on the left side of carrier 77 and the carrier 77 is driven to the limit of its leftward motion. During the printing of the successive characters of a line of copy, the drive pulley 249 is urged in a clockwise direction thereby providing a force which urges or biases the carrier 77 to move to the right. The arrows designated "Print" and "Return" indicate the direction of motion of cable 246 during printing and carrier return, respectively. As stated, the double headed arrow on drive pulley 249 indicates that drive pulley 249 may be selectively rotated in either direction to urge cable 246 and thereby carrier 77 in the required direction. The spaced points at which the ends of the cable 246 are connected to the carrier structure lie on a line parallel to the axis of a rail 153 so that drive forces exerted by the cable 246 have no tendency to twist or rock the carrier 77 on the rail 153. After each print operation to effect printing of an alpha numeric character, symbol or punctuation mark, and after each word space operation effected by what would otherwise be a print operation except that the character selection plate 85 remains both horizontally and vertically stationary at its at rest or home position, a letter escapement movement of the carrier 77 takes place under spring motor drive of the carrier 77 to the right. This escapement movement is accomplished by an escapement structure illustrated in FIGS. 1 to 6 and which is more fully described hereinbelow.

The printer in which the present invention is incorporated includes a tabulation structure including a tab rack 280 which, as shown in FIG. 1 and FIG. 4, is provided with cylindrical end portions 281 and 282. The end portion 281 is supported for longitudinal displacement and rotational motion by a journal aperture provided in one forwarding projecting arm 283 of the cast pedestal 27, and has a fixed ratio pin 284 slidably received in a longitudinal slot 285 provided at the end of rotary shaft 286 of the rotary electromagnet 287 supported on a second arm 288 of the cast pedestal 27. The end portion 282 of the tab rack 280 is similarly supported for longitudinal displacement in rotational motion by an aperture provided in cast pedestal 29. A collar 289 secured on the end portion 282 anchors one end of a helical spring 290 having its other end anchored by the cast pedestal 29 to bias the tab rack 280 to the left as seen in FIG. 4 and rotated to the deenergized stop position of the electromagnet 287 at which position the tab rack 280 occupies the angular position shown in FIG. 2. A collar 291 affixed to the end portion 282 of the tab rack 280 carries an arm 292 which at either of two tab rack angular positions, corresponding to the deenergized and energized states of the rotary electromagnet 287, operates a microswitch 293 supported on an integral laterally extending flange 294 of the cast pedestal 29. Conventional tab stop members 295 (FIGS. 1 and 4) are manually positioned on the tab rack 280 at preselected tab positions as defined by conventional slide slots 296 of the tab rack 280. A tab pawl member 297 pivotally supported, as shown more clearly in FIGS. 1, 2, and 5, on a bracket 298 secured by machine screws 299 on a radially extending flange 300 of the left-hand cast flange 151. The pawl member 297 is biased by spring 301 to engage a dependent stop portion 302 of the bracket 298. As will be explained more fully hereinbelow, the pawl 266 and the pawl nose 271 thereof engages the rack teeth 272 of the support rail 153 to restrain the letter spacing motion of the carrier 77. When it is desired to have a tabular motion, it is

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necessary to extract the pawl nose 271 from the teeth 272. This is accomplished in the manner briefly described below and more fully disclosed in the cited copending Blodgett application. In response to a signal indicating a tabular operation, the electromagnet 287 is energized and thereby rotates the tab rack 280 through a small counterclockwise angle as seen in FIG. 2 and thus positions the tab stop members 295 in engageable relation with the tab pawl member 297. At the same time, the tab code effects the energization of an electromagnet of a last character visibility structure described more fully in the copending Smith application Ser. No. 661,915, now U.S. Pat. 3,400,798 issued Sept. 10, 1968 on an Aug. 21, 1967 filing and this structure rotates the eccentric shaft 159 to its position shown in broken lines in FIG. 2 to pivot the carrier 77 through a small counterclockwise angle as seen in FIG. 2. This pivotal position of the carrier 77 and the rotated position of the tab rack 280 effected by energization of the rotary electromagnet 287 engages a roller 303 with a track strip 304 secured along the lower surface of the tab rack 280 as shown. The roller 303 is rotationally supported by a stud 305 provided on the over-turned end 306 (FIG. 1) of a lever 307 pivotally secured at 308 on the escapement bracket 261 and has an up-turned end 309 which engages the rear edge of the pawl 266 to withdraw the pawl nose portion 271 from engagement with the rack teeth 272 upon pivotal motion of the lever 307 by engagement of the roller 303 with a track strip 304. If the rotary electromagnet 287 should remain energized during power driven movement of the carrier 77 from the right margin position to the left margin position of the platen, a cam surface 310 (FIG. 1) of the pawl member 297 pivots this member 297 counterclockwise as seen in FIG. 1 to permit passage of the tab stop members 295 past it.

The margin control structure is shown in plan view in FIG. 4 and is shown in more detail in FIGS. 1 and 2. It includes a margin stop rack 315 having cylindrical end portions 316 and 317 supported for longitudinal displacement to the left as seen in FIG. 4 and for rotational motion by journal apertures provided in the respective cast pedestals 27 and 29. A conventional left-hand margin stop member 318, biased by a leaf spring 319 to engage internal teeth 320 with edge slots 321 of the track 315, may be manually depressed for setting at any desired left-hand marginal stop position. A similar right-hand margin zone control member 322 may be manually set at any desired right-hand marginal stop control position. One side of the stop control member 322 has an integral boss 323 (FIG. 2) having a stud 324 upon which a roller 325 is rotationally supported and retained in position by a C-spring 326. The stop rack 315 is biased to the right as seen in FIG. 4 by a compression spring 327 held in position by a collar 328 and secured to the cylindrical portion 317 of the stop rack 315. Longitudinal displacement of the stop rack 315 to the left (as seen in FIG. 4) from its at rest position is premitted by compression of a washer 333 of an elastomer material positioned between a boss 334 on the pedestal 27 and a collar 335 secured on a cylindrical end portion 316 of the stop rack 315. As more fully disclosed in the cited copending Blodgett application, the structure including the present invention incorporates a carrier right margin return zone structure and system. The zone indication is provided in response to an electrical signal from microswitch 337 mounted on bracket 339 when rack 315 is moved to the right.

As illustrated in FIG. 2 the left-hand flange 151 of the carrier 77 has an integral projection 340 which during power drive movement of the carrier 77 to the left engages the left-hand stop margin 318 and displaces it stop rack 315 to the left. This displacement operates the microswitch 337 which is included in an electrical control circuit more fully disclosed in the cited copending Blodgett application. The right-hand flange 151 of the carrier 77 is provided with

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a projecting nose member 341 which, during spring motor print escapement of the carrier 77 to the right, engages the roller 325 of the right-hand margin stop control member 322 to pivot the stop rack 315 about its axis. When the latter is rotated, microswitch 349 is operated to perform a function more fully disclosed in the cited copending Blodgett application. The flange 151 includes an aperture 152 through which guide rail 153 passes.

The lower end of the base casting 150 has a central rectangular aperture 149 and an integral depending arm 156 (FIG. 2) to the end of which a yoke 157 is secured by a machine screw 158. The lower end of the base casting 150 is provided with a short pedestal 160 terminating in the shoulder 161 with projecting stud 162 upon which the bell crank 92 is pivotally supported and retained in place by a C-spring 163, a felt oil washer 164 and a metal washer 165 being positioned between the shoulder 161 and bell crank 92 as shown. Bracket 166 has out-turned feet 167 to secure said bracket 166 to the base 150 by machine screws 168. In a similar manner, bracket 169 having out-turned feet 170 is secured to the base 150 by machine screws 171.

The print head is of the wire printer type and includes a funnel housing 178 of U-shaped transverse cross section open at the bottom and which is affixed by brazing or solder to a plate 179 (FIG. 6) secured by machine screws 180 to a mounting plate 181. The latter is positioned in the central rectangular aperture 149 of the base casting 150 and is provided with edge flanges 182 which are secured to the base casting 150 by machine screws 183. Equally spaced apertures 184 receive the print wires 185. The print wires 185 are guided by hollow tubes 186. The tubes 186 converge at the nose block 189. Each of the print wires 185 has secured on its non-print end a sleeve 190, and these sleeves 190 are received and guided by apertures 191 of the mounting plate 181 aligned with the apertures 184 of the plate 179. The mounting plate 181 has a central well 192 in which an oil felt pad 193, apertured to receive the print wires 185 is placed to provide lubrication for the print wires 185 as the latter reciprocate through the apertures 184 of the plate 179 and guide tubes 186 in a manner more fully disclosed in the cited copending Blodgett application. The sleeves 190 also slidably extend through individual apertures 194 of the stripper plate 195 and terminate in a flanged head 196 having a central nose portion 197. The heads 196 are slidably positioned within apertures 198 of a plate 199 which is affixed by machine screws 200 to short pedestals 201 provided on the forward face of the mounting plate 181. The stripper plate 195 has upper and lower pairs of forwardly extending arms 202 by which it is supported upon and reciprocally moved by an upper rod 203 and a lower rod 204. Arms 206 of pressure plate 205 are also supported upon the rods 203 and 204. Also supported on the rods 203 are a pair of metal blocks 207 which are pivotally connected at 208 to the ends of individual ones of a pair of arms 209 secured at the upper end of a pair of spaced shafts 210 rotatably journaled, as shown in FIG. 5, by the brackets 166 and 169. The shafts 210 are provided with oil felt washers 211 and are retained in position by C-springs 212. The lower rod 204 similarly supports metal blocks 213 which are pivotally connected to arms 214' secured on the lower ends of the shafts 210. In the middle of each shaft 210 is an arm 214 the ends of which are pivotally connected by a link member 215 for angular rotation in unison. The left-hand one of the shafts 210 are seen in FIG. 5 and 6 also has secured thereto an arm 216 having an extended portion 217 and a tension spring 218 anchored between the arm portion 217 and a U-shaped staple 219 secured to the bracket 166, biasing the shaft 210 for counterclockwise rotation as seen in FIG. 6. Such rotation is restrained, however, until the midpoint of a print cycle under control of a pressure plate permissive restrictive actuation pressure. The actua-

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tion is schematically shown in FIG. 6 as comprised by a cable 220 which is connected between a yoke 221 on the arm 216 and a diametrically opposed point on the bracket 166 and extends over a pulley system including a pair of remotely spaced and fixedly positioned idler pulleys 222 and a group of closely spaced pulleys including two closely spaced idler pulleys 222 and an intervening movable print control idler pulley 223 as shown. The diametrically opposed points at which the ends of the cable 220 are connected to the carrier structure lie on a line parallel to the axis of the rail 153 so that the cable bias forces balance one another and have no tendency to twist or rock the carrier 77 on the rail 153.

The character selection plate 85 is retained in slidable engagement with the pressure plate 205 by spaced flanges 238 extending from the stripper plate 195 to engage the adjacent surface of the character selection plate 85. The horizontal selection plate positioning band 76 has one end secured to the print head carrier structure 77 and its other end secured to the piston 82. More particularly, as seen in FIG. 5, a yoke 225 is secured to each end of the band 76 and the remote end of the yoke 225 has a pin 226 secured between the arms of the yoke 225 to engage a hook member 227 secured to the bracket 166 and a diametrically opposed hook end portion 228 of the piston 82. The piston 82 is guided for longitudinal motion by a groove 229 (FIG. 6) formed longitudinally of a piston member 230 and by a pin 231 secured to and projecting internally of the housing 83 into the groove 229. The ends of the band 94 have yokes 232 secured thereto and yoke end pins 233 engage a hook member 234 secured to the bracket 166 and a diametrically opposed hooked end portion 235 of the arm 92.

As more fully explained in the cited copending Blodgett application, the selection plate 85 is provided with a plurality of plateaus and valleys 236 and 237, respectively, which actuates selected print wires 185 when the selection plate 85 is moved vertically and horizontally by selection bands 94 and 76, respectively. As previously indicated, and as more fully explained in the cited copending Blodgett application, the bands 94 and 76 are effective to move the code selection plate 85 in the vertical and horizontal directions, respectively. The bands 94 and 76 are retained under constant pressure by springs 106 and 84, respectively.

The selection plate 85 has a turned over ear 86 which engages a vertical groove 87 of the piston 82 to permit vertical displacement of the plate 85 in respect to the piston 82, and has side position turned over ears 88 which are engaged by end grooves 89 of a positioning arm 90 vertically guided on a guide rod 91 carried by the carrier structure 77 and vertically moved by a bell crank 92 mechanically coupled to the arm 90 by a link member 93.

Members 566, 567 and 568 illustrated in FIG. 5 cooperate with other elements shown in the cited copending Blodgett application and more fully explained therein to reverse the ribbon which lies between the print wires 185 and the document being printed.

As shown in FIG. 3, the escapement structure includes an arm 252 secured by a set screw 253 upon the upper end of the right hand one of the two shafts 210 shown in FIG. 5 and which is angularly reciprocated as explained in the cited Blodgett application to reciprocate the pressure plate 205 between non-print and print positions during each print operation. The arm 252 has a Z-shaped slotted end portion 254 to receive the end of an L-shaped arm 255 having an elongated slot 256 by which it is supported for longitudinal pivotal and reciprocal motion on the shaft 210 as shown more clearly in FIG. 3. The arm 255 is retained in position on the shaft 210 by a C-spring 257, and is biased to the right as seen in FIG. 3 by a tension spring 258 having one end anchored by a pedestal 259 mounted upon the base

portion 260 of a U-shaped bracket 261 (FIG. 2) which is provided with an aperture 262 to receive the shaft 210 and is secured by machine screws 263 on the carrier bracket 169. The upper portion 264 of the U-shaped bracket 261 has affixed thereto a stud 265, and an escapement pawl 266 is provided with an elongated aperture 267 by which it is mounted upon the stud 265 and is secured in position thereon by a C-spring 268. As shown more clearly in FIG. 1, the pawl 266 has an apertured side projecting portion 269 anchoring one end of a tension spring 270 which is anchored at its opposite end on the pedestal 259 and by which the pawl 266 is biased to the right and in a counterclockwise direction as seen in FIG. 1. The pawl 266 has a pawl nose portion 271 which normally engages rack teeth 272 milled longitudinally along a side length of the support rail 153, and has an arm 273 which may engage the upturned end portion of the arm 255. The support rail 153 is supported in apertures 154 in pedestals 27 and 29 and retained by set screws 155.

The operation of the escapement structure just described will now be considered in more detail. Upon initial rotational drive of the shafts 210 to move the pressure plate 205 and character selection plate 85 to their print positions as more fully described in the cited copending Blodgett application, the arm 252 of the escapement structure is rotated by its supporting shaft 210 counterclockwise as seen in FIG. 1. Its slotted end portion 254 correspondingly rotates the arm 255 in a counterclockwise direction to displace the latter to one side of the pawl arm 273. That is, as seen in FIG. 1, the arm 255 is moved below the pawl arm 273. As soon as the upturned end portion of the arm 255 clears the end of the pawl arm 273, the arm 255 is moved by the spring 258 longitudinally to the right as viewed in FIG. 1 to engage the end of the slot 256 with the shaft 210. This places the upturned end of the arm 255 on the bottom side of the pawl arm 273 as viewed in FIG. 1. The pressure plate 205 and character selection plate 85, having been moved to their print positions are now moved in reverse direction toward their non-print positions of rest by reverse rotational drive of the shaft 210 as more fully explained in the cited copending Blodgett application. This causes reverse rotation of the arms 252 and 255 in clockwise direction as seen in FIG. 1, and the upturned end portion of the arm 255 now engages the side of the pawl arm 273 to pivot the pawl 266 clockwise about the stud 265 as seen in FIG. 1. In response to the rotational motion of the pawl 266, the pawl nose portion 271 moves out of engagement with the rack tooth 272 with which it was engaged, and the carrier 77 is no longer restrained by the pawl 266 against spring motor displacement drive longitudinally of the rail 153. Due to the inertial mass of the carrier 77, it starts from rest and begins to move with small but increasingly larger velocity to effect a letter space operation. At the time this occurs, all print wires 185 previously selected by the character selection plate 85 for the print operation have been partially restored to their non-print positions by action of the stripper plate 195 (FIG. 6) operated in a manner more fully described in the cited copending Blodgett application. In particular, each print wire 185 at this time is sufficiently restored toward non-print position that it no longer engages the print ribbon (all as described more fully in the cited copending Blodgett application) with the paper on the printer platen and hence there is no tendency of a print wire 185 to cause blurring of the character just printed upon initiation of letter space movement of the carrier 77 after its release by the pawl 266. The pawl nose portion 271, having been disengaged from the previously engaged rack tooth 272 and having relatively small inertial mass, is now rapidly moved by the pawl spring 270 longitudinally to the right as seen in FIG. 1. As soon as the end of the pawl arm 273 clears the upturned end portion of the

arm 255, the pawl spring 270 pivots the pawl 266 in a counterclockwise direction about the stud 265 to engage the pawl nose portion 271 with the next succeeding rack tooth 272. The letter escapement movement of the carrier 77 moves the stud 265 toward the right-hand end of the pawl aperture 267 as seen in FIG. 1 and the letter escapement motion of the carrier 77 is halted upon engagement of the stud 265 with the right-hand end of the pawl aperture 267. While this is occurring, the end of the pawl arm 273 reengages the upturned end portion of the arm 255 and displaces the latter to the left against the tension of the spring 258, thus restoring the arm 255 to its initial position in readiness to initiate a further letter space operation. The pawl 266 engages the racket teeth 272 close to the center of gravity of the carrier 77 and thus minimizes torsional twisting of the carrier 77 due to its mass and also minimizes any vibration tending to be developed by the escapement operation.

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 related arts. For example, in another structure a moving platen could be used; or an escapement wheel could be used instead of a rack. It is believed that no further analysis or description is required and that the foregoing so fully reveals the gist of the present invention that those skilled in the applicable arts can adapt it to meet the exigencies of their particular requirements.

What is claimed is:

1. An escapement mechanism comprising:

- (a) a rack having a plurality of spaced teeth,
- (b) supporting elements for supporting said rack at the ends thereof,
- (c) a carrier structure mounted on said rack for motion along said rack between said supporting elements,
- (d) first bias means for urging relative motion between said carrier structure and said supporting elements,
- (e) a pawl being mounted on said carrier structure for pivotal motion relative to said carrier structure and for engaging the teeth of said rack to impede said relative motion between said carrier structure and said supporting elements,
- (f) second bias means for urging said pawl to pivot towards said rack and to move longitudinally in the direction said carrier structure is urged by said first bias means,
- (g) the force of said first bias means combining with the force of said second bias means to create a resultant force for restraining said pawl, when engaged with one of the teeth of said rack, from longitudinal motion in the direction urged by said second bias means,
- (h) a shaft having initial and return rotary motion reciprocating within one revolution,
- (i) control means responsive to the return rotary motion of said shaft for engaging said pawl and pivoting said pawl against the pivotal urging of said second bias means and therefore out of engagement with said teeth of said rack,
- (j) longitudinal motion limiting means associated with said pawl for allowing limited longitudinal motion of said pawl in response to the force of said second bias means when said pawl is disengaged from said rack,
- (k) disengaging means associated with said control means and said pawl to disengage said control means and said pawl for allowing said pawl to pivot into engagement with another one of the teeth of said rack in response to the pivotal urging of said second bias means when said pawl has moved the limited amount controlled by said longitudinal motion limiting means, and

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- (l) guide means associated with said carrier structure for guiding said carrier structure to move in response to the force of said first bias means and subsequent to the pivoting of said pawl against the urging of said second bias means.
2. The combination as set forth in claim 1 wherein said control means includes:
- (a) an arm mounted on said carrier structure for pivotal and longitudinal movement;
 - (b) third bias means for urging said arm in said longitudinal direction;
 - (c) pivoting means including said shaft for rotating said arm in an initial direction and for thereafter rotating said arm in a return direction; and
 - (d) an extension member of said pawl for restraining said arm from longitudinal movement before said arm has been rotated by said pivoting means in an initial direction.
3. An escapement mechanism for a character-by-character printer comprising:
- (a) a longitudinal rail having rack teeth,
 - (b) a carrier supported for longitudinal movement parallel to said rail,
 - (c) first bias means for urging said longitudinal movement of said carrier,
 - (d) an escapement pawl secured to said carrier for limited pivotal and longitudinal motion with respect thereto and having a nose for selectively engaging one of the teeth of said rail to thereby restrain the longitudinal movement of said carrier,
 - (e) a cyclically reciprocating member having initial and return rotary motion,
 - (f) disengaging means for withdrawing the nose of said escapement pawl from engagement with one of the teeth of said rail in response to the return rotary motion of said cyclically reciprocating member, and
 - (g) second bias means for urging said escapement pawl to move longitudinally in the direction of potential motion of said carrier and pivotally towards engagement with another one of the teeth of said rail when the nose of said escapement pawl is withdrawn from engagement with the engaged one of the teeth of said rail by said disengaging means.

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4. The combination as set forth in claim 3 wherein said disengaging means comprises:
- (a) a first member, including an arm, mounted on said carrier for limited reciprocal rotary and longitudinal motion in initial and return directions,
 - (b) said escapement pawl including an extension for engaging the arm of said first member and restraining longitudinal motion of said first member in said initial direction until said first member is rotated in said initial direction.
 - (c) a second member coupled to said cyclically reciprocating member for initial and return rotary motion with said cyclically reciprocating member,
 - (d) said second member including engaging means to engage said first member for transmitting the initial and return rotary motion of said second member to said first member, and
 - (e) third bias means for moving said first member longitudinally in said initial direction after the said restraining relationship between said arm of said first member and said escapement pawl extension was broken by the initial rotary motion of said first member, whereby the nose of said escapement pawl is withdrawn from engagement with the engaged one of the teeth of said rail in response to the return rotary motion of said cyclically reciprocating member.

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197—65, 86, 176