United States Patent

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[45] Patented **Mar. 30, 1971**
[73] Assignee **The Singer Company**

[54] **MARGIN CONTROL STRUCTURE**
1 Claim, 8 Drawing Figs.

[52] **U.S. Cl.** **197/63,** 197/176
[51] **Int. Cl.** **B41j 21/02**
[50] **Field of Search** 197/12, 63, 64, 65, 66, 67, 68, 70, 82, 84, 92, 94, 96, 120, 176, 177, 178, 179, 183, 187, 188, 189, 190, 191, 192

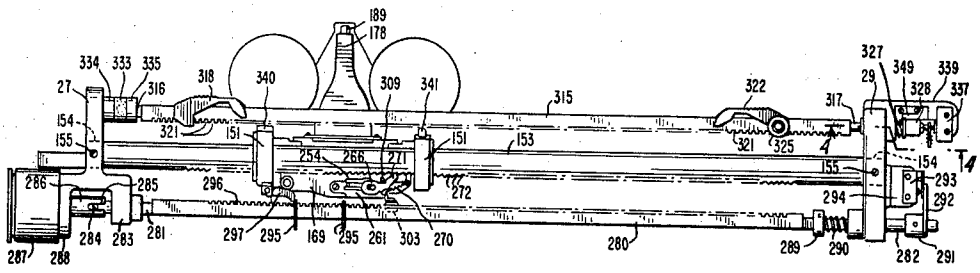
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ABSTRACT: A margin control structure for use with a character-by-character printer having a margin stop rack supported for pivotal and longitudinal motion away from a home position. In response to the carrier entering a zone defined by the position of the right-hand margin stop member, the margin stop rack is pivoted and an electrical signal provided indicative of entry into the zone. In response to a carrier return signal, the carrier is moved to the left until a projection on the carrier engages the left-hand margin stop member, thereby moving the margin stop rack longitudinally. In response to said last mentioned longitudinal motion, an electrical signal is generated to terminate the carrier return motion.



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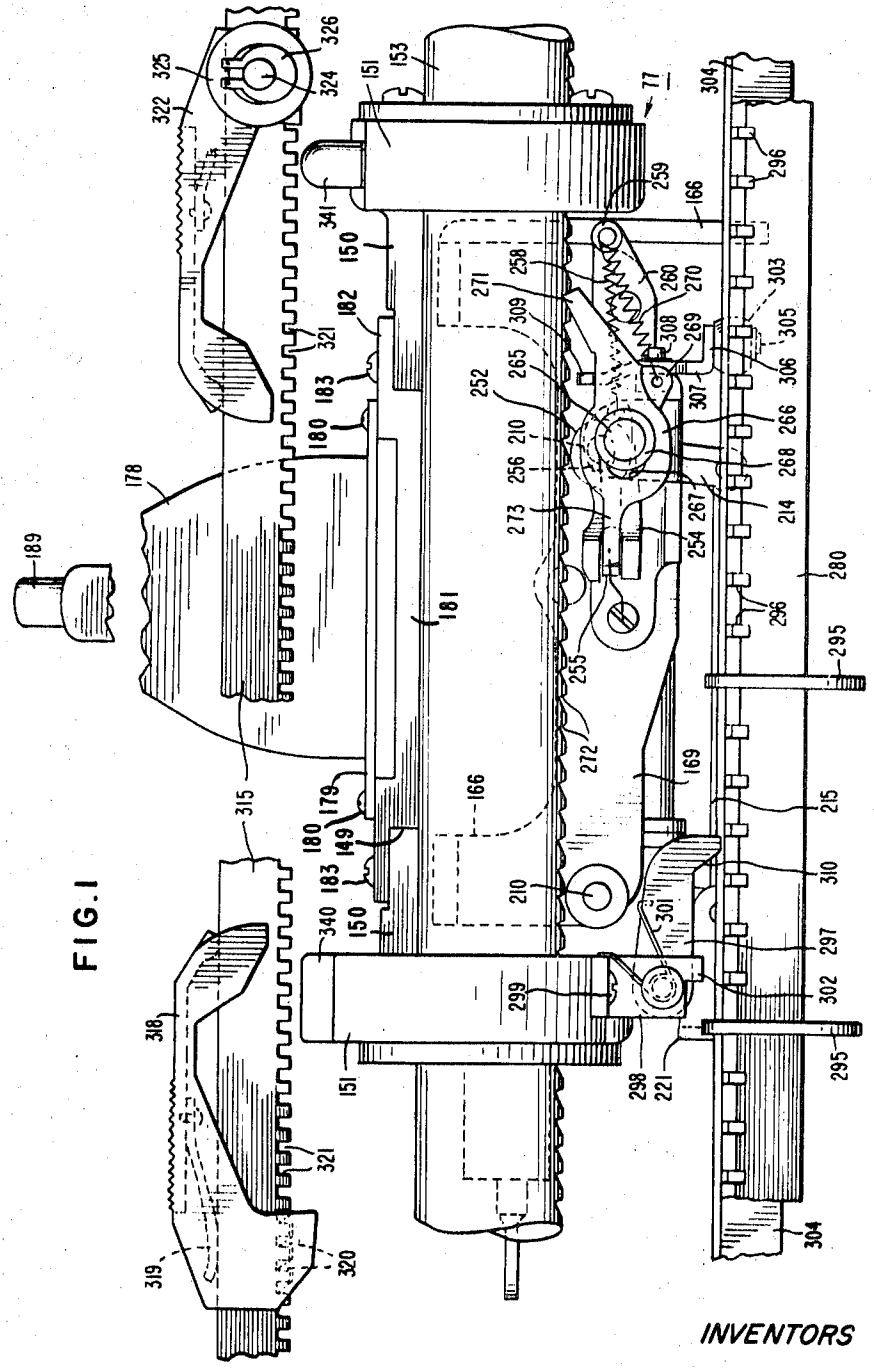


FIG. 1

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FIG. 2

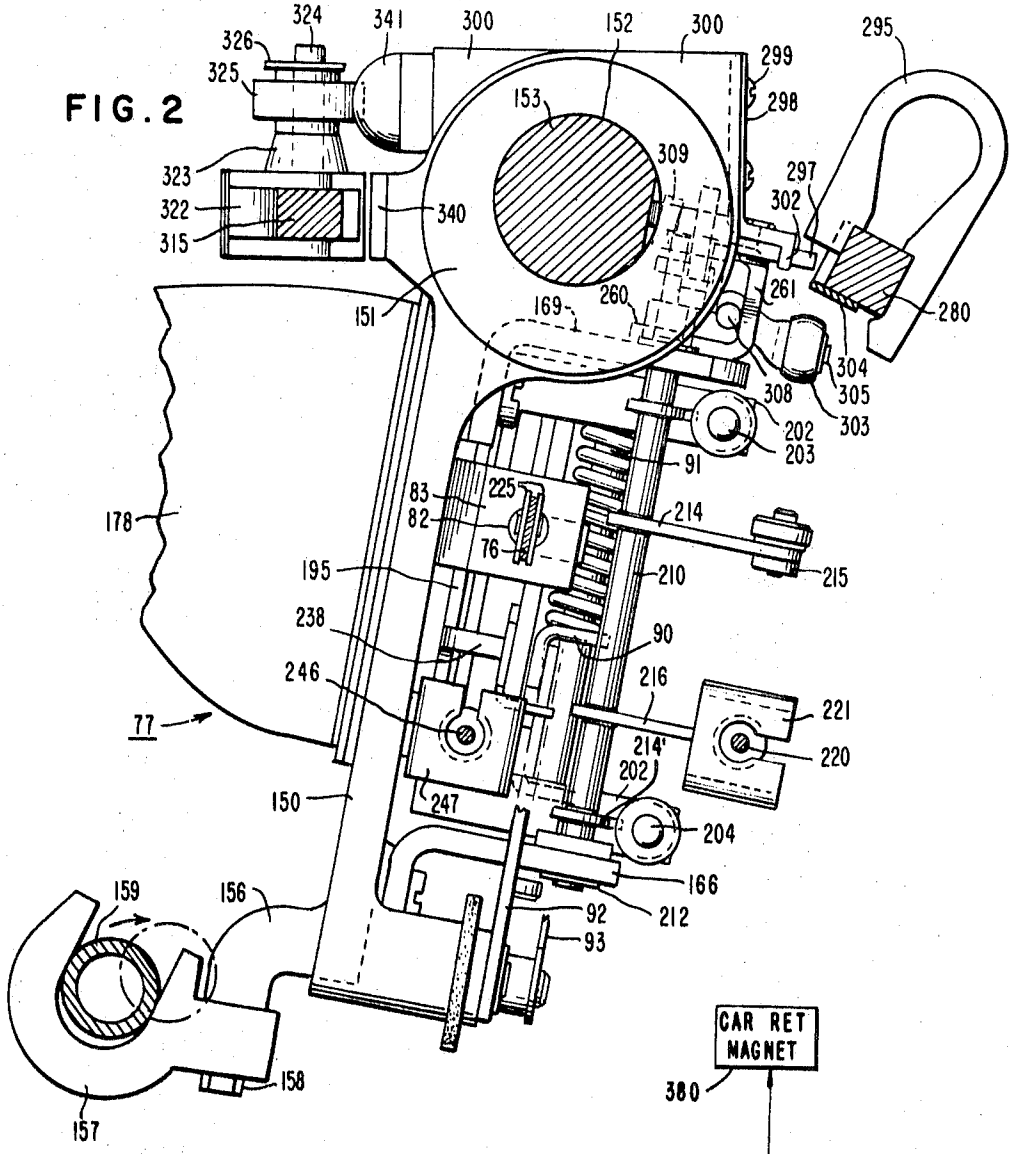

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77
214'
220
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150
247
204
166
159
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92
212
93
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CAR RET MAGNET
380
830
829
821
SPACE
CAR RET CONTROL
349
337
END C.R.

FIG. 8

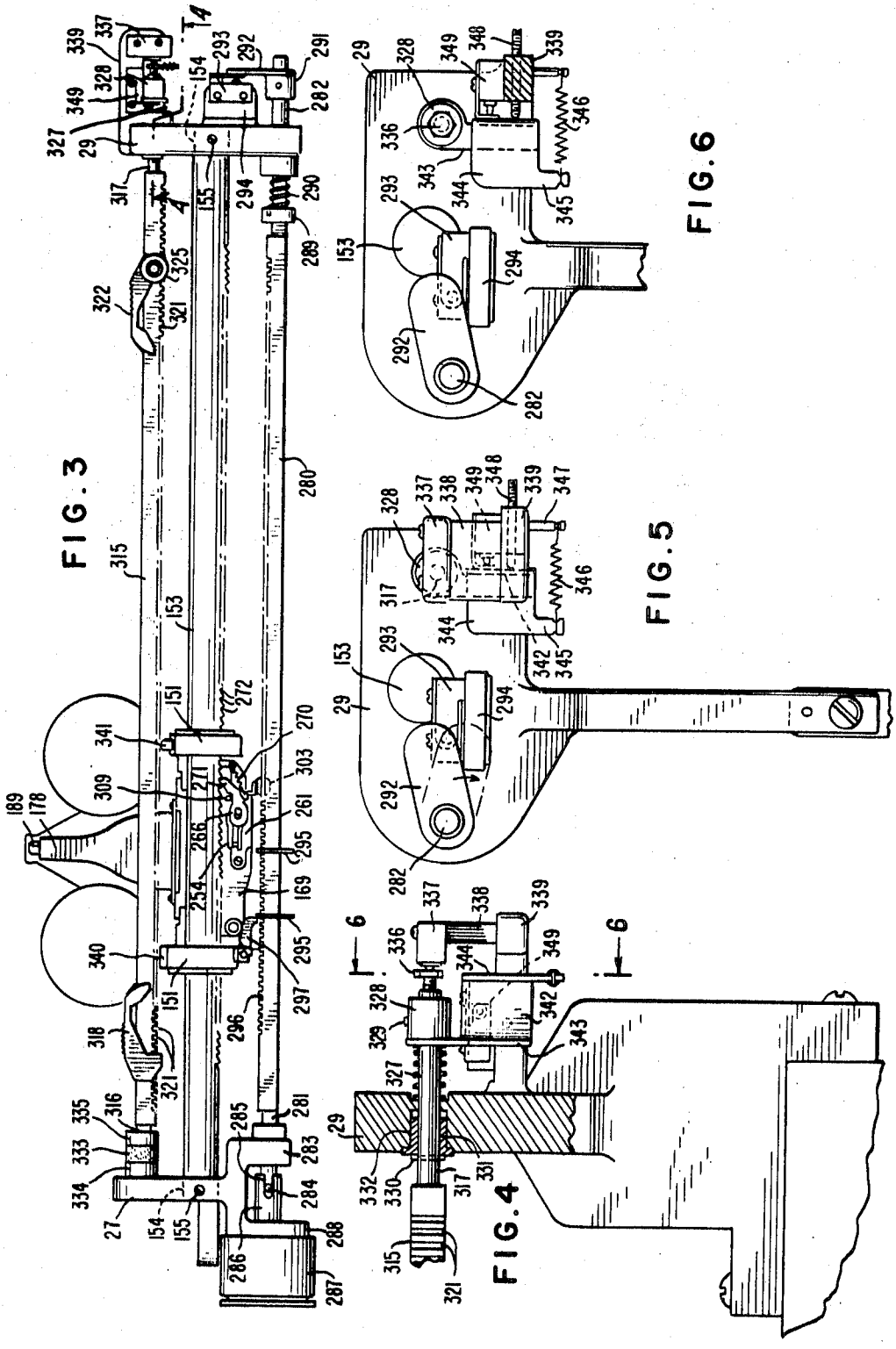


FIG. 3

FIG. 6

FIG. 5

FIG. 4

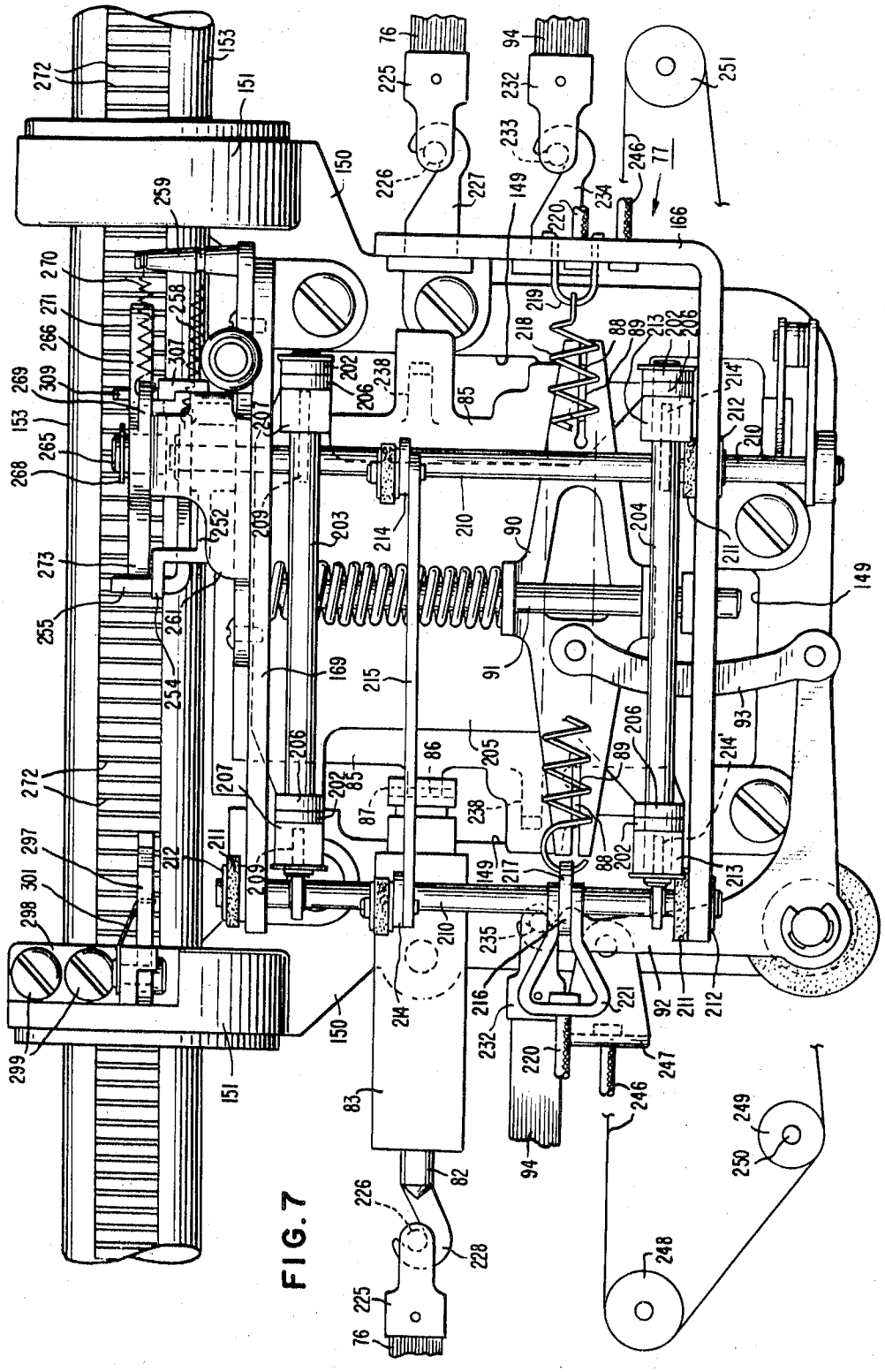


FIG. 7

MARGIN CONTROL STRUCTURE

CROSS REFERENCE TO RELATED APPLICATION

This is a division of copending U.S. Pat. application Ser. No. 673,440, filed Oct. 6, 1967, for TABULATION AND MARGIN CONTROL STRUCTURE and assigned to the same assignee as the present invention.

SUMMARY OF THE INVENTION

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 from at desirably high printing rates, and even more particularly, to a margin control structure and electrical control system therefor. Many forms of margin control structures have been employed in the ubiquitous manual and electric typewriters. The structure of the present invention employs a margin control rack which is mounted for limited selected pivotal and longitudinal motion and which is biased to one limit of each of these motions. When the right-hand limit of the writing line is approached, a mechanism is caused to pivot the margin control rack against the cited bias. The pivoting action actuates a switch which conditions the carrier to return to the left in response to the receipt of a word space signal. When the carrier moves to its left margin, the margin rack is moved longitudinally against the cited bias and actuates another switch to indicate that the carrier has reached the left-hand margin limit and thereby stop the leftward driving of the carrier.

Printers which print in response to human control are seldom required to print at a rate faster than approximately 12 to 15 characters per second and then only for a brief period. However, as printers were developed which were capable of responding in input coded signals and printing at much higher printing rates it became necessary to develop improved tabulation and margin control structures which could provide the necessary relative motion between the document and the printing elements at the necessary speed.

REFERENCE PATENT

In copending application Ser. No. 630,904, filed Apr. 14, 1967, by Edwin O. Blodgett, and now issued as U.S. Pat. No. 3,426,880, and which is hereby incorporated by reference and which is assigned to the same assignee as the present application, 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 than the conventional manual or electric typewriters. The tabulation and margin control 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 margin control structures have been perfectly satisfactory for use with printers that respond to manual input. However, the prior art devices exhibited a variety of faults when used with high speed printers. For example prior art techniques tended to be so slow that when used with high speed printing techniques a significant amount of time was expended in tabulation, thereby resulting in an equivalent reduction in printing speed. The simple and obvious expedient of using stronger springs or other driving forces to obtain faster tabulation created difficulties; not the least of which was the additional shock transmitted to the system and an increased tendency for the carrier to bounce after hitting the stop, thereby resulting in the ultimate positioning of the carrier at a different position from that which is desired. That is, the carrier might bounce one or more full character units away from the stop and be held in the wrong position by the escapement mechanism.

Accordingly, it is a principle object of this invention to provide a new and improved margin control structure.

It is a more specific object to provide a new and improved tabulation and margin control structure for use with a high speed character-by-character printer.

It is another object of this invention to provide a margin control structure 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 a margin control structure for providing rapid and accurate tabulation control.

It is another object of the invention to provide a margin control system wherein an electrical signal is generated when the right-hand margin is approached.

It is another object of the invention to provide a margin control system which produces an electrical signal indicative of the carrier having been restored to the left-hand margin position. In accordance with this invention there is provided a tabulation rack and margin stop rack both of which are biased to home positions and both of which may be independently moved from said home position by either or both pivotal or longitudinal motion.

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

FIG. 1 illustrates in plan view the construction of the letter escapement structure, parts of the tabulation structure and margin control structure utilized in a printer for effecting letter escapement spacing, tabular motion and margin control between the print head carrier and the platen;

FIG. 2 illustrates additional details of the carrier, the tabulation rack and the margin control;

FIG. 3 illustrates in plan view the carrier support and its cooperative arrangement with the letter spacing structure and the horizontal tabulation and paper margin structure included in the printer;

FIGS. 4—6 in conjunction with FIGS. 1 and 3 illustrate the novel horizontal tabulation structure and the novel paper margin control structure employed in the printer with FIG. 4 being taken along section line 4–4 of FIG. 3 and FIG. 6 taken along section line 6–6 of FIG. 4;

FIG. 7 shows the construction of the carrier utilized in the printer; and

FIG. 8 is an abbreviated schematic form of a portion of the electrical control system.

To aid the reader who may be interested in obtaining more details concerning the printer in which the present invention is illustrated, most of the above-identified FIGS. are identical to some of those in the cited Blodgett application. More specifically, FIGS. 1—7 in the present application correspond to FIGS. 15, 10, 12, 17, 16, 18, and 9, respectively, of the cited Blodgett application and FIG. 8 is an abbreviated version of FIGS. 48*a* and 48*b* of the cited Blodgett patent. For convenience, identical reference numbers are used in the present application and the cited Blodgett application.

The tabulation structure includes a tab rack 280 which, as shown in FIG. 3, is provided with cylindrical end portions 281 and 282. The end portion 281 is supported for longitudinal displacement and pivotal motion by a journal aperture provided in one forwardly projecting arm 283 of the cast pedestal 27, and has a fixed radial pin 284 slidably received in a longitudinal slot 285 provided at the end of the rotary shaft 286 of a 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 and pivotal motion by an aperture provided in the 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. 3 and pivoted 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, shown in full

and broken lines in FIG. 5 corresponding to the deenergized and energized state 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 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 is pivotally supported, as shown more clearly in FIGS. 1, 2, and 7, on a bracket 298 secured by machine screws 299 on a radially extending flange 300 (FIG. 2) of the left-hand cast flange 151 as seen in FIGS. 1 and 3, the pawl member 297 being biased by a spring 301 normally to engage a dependent stop portion 302 of the bracket 298. The deenergized state of the rotary electromagnet 287 angularly positions the tab rack 280 as shown in FIG. 2 at which the pawl member 287 normally does not engage the tab stop members 295 during movement of the carrier 77 longitudinally along the rail 153.

A tab function code supplied to the printer is decoded by a decoder unit of the printer electrical control system more fully described in the cited Blodgett application and effects energization of the rotary electromagnet 287 to pivot 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 deenergization of an electromagnet of a last character visibility structure more fully described in the cited copending Blodgett application, 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. That is, the carrier 77 is pivoted on rail 153 which passes through apertures 152 of flanges 151 and the pivoting motion is transmitted from shaft 159 through yoke 157 which is secured to arm 156 by screw 158. This pivoted position of the carrier 77 and the pivoted 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 overturned ends 306 (FIG. 1) of a lever 307 pivotally secured at 308 on the escapement bracket 261 and has an upturned 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 the track strip 304. This enables the carrier 77 to be spring motor driven in a direction from left to right of the printer platen (not shown) until the tab pawl member 297 engages one of the tab stop members 295 on the tab rack 280. When such engagement occurs, the tab rack 280 is moved longitudinally to the right (FIG. 3) against the compressive force of the spring 290 and through the arm 292 operates the microswitch 293 to deenergize the rotary electromagnet 287. Such deenergization permits the rotational bias force of the spring 290 to pivot the tab rack 280 to the position shown in FIG. 2. This permits the pawl spring 270 once more to move the pawl nose portion 271 to a position where it can engage the next succeeding rack tooth 272 of the rail 153. The disengagement of the pawl member 297 with tab stop 295 permits the carrier 77 to move a character space to the right as controlled by the earlier described engagement of the pawl nose portion 271 with the next succeeding rack tooth 272 of the rail 153 under bias of the pawl spring 270, thus completing the tabulation operation. (More complete details of the letter escaping mechanism may be seen in the cited copending Blodgett application and/or in the copending application of Henry E. Smith, Ser. No. 666,583, filed Sept. 11, 1967, and now issued as U.S. Pat. No. 3,519,115 and assigned to the same assignee as the present application.) If the rotary electromagnet 287 should remain energized during the power driven movement of the carrier 77 from the right margin position to the left margin position of the platen (not shown), a cam surface 310 (FIG. 1) of the tab pawl member 297 pivots this member 297 counterclockwise to permit passage of the tab pawl member 297 past the tab stop members 295.

During normal printer action when the carrier 77 reaches the right-hand margin stop 322, an electrical signal is generated which defines the start of a printing zone within which a carrier return operation takes place in the manner more fully described in the cited Blodgett patent. Within this zone, the printer continues printing and character spacing successive alphanumeric characters, symbols, and punctuation until the next word space code is received, whereupon the carrier 77 is rapidly power driven until it engages the left-hand margin stop 318. This zone character of carrier return operation prevents interruption of printing before the entire last word of the line has been printed. The novel structure and electrical system for accomplishing such zone character of carrier return from right to left of the printer platen is shown and claimed in copending application of David W. Engdahl, Ser. No. 702,305 filed Feb. 1, 1968, and assigned to the same assignee as the present application. More specifically, reference may now be had to FIG. 8, which is abstracted from FIGS. 48*a* and 48*b* of the reference Blodgett patent. As illustrated, there is an AND gate 829 which controls automatic carrier return and which has two inputs; a first, or conditioning input, which is energized in response to the operation of switch 349 when the margin stop rack 315 is rotated; and a second, or triggering "space" signal, which is subsequently applied to lead 830. The signal passed through AND gate 829 provides one of a plurality of possible inputs to carrier return control circuit 821. The signal passed through circuit 821 causes the carrier return magnet 380 to be operated to initiate return of the carrier 77. Upon return of the carrier 77 switch 337 is operated to provide another signal to the carrier return control circuit 821 to cause it to release the carrier return magnet 380. The margin control structure is shown in plan view in FIG. 3 and is shown in more detail in FIGS. 1, 2, and 4—6. It includes a longitudinal margin stop rack 315 having cylindrical end portions 316 and 317. Said longitudinal margin stop rack 315 is supported for longitudinal displacement to the left as seen in FIG. 3 and for rotational motion about its axis by journal apertures provided in the respective cast pedestals 27 and 29, which also has apertures 154 for supporting rail 153 which is held in position by set screws 155. A conventional left-hand margin stop member 318, biased by a leaf spring 319 (FIG. 1), to engage internal teeth 320 with edge slots 321 of the rack 315, may be manually depressed for setting at any desired left-hand margin stop position. A similar right-hand margin zone control member 322 may be manually set at any desired right-hand marginal 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 margin stop rack 315 is biased to the right as seen in FIGS. 3 and 4 by a compression spring 327 positioned between the cast pedestal 29 and a collar 328 secured by a set screw 329 on the cylindrical portion 317; but its right-hand at rest position is fixed by a pin 330 projecting through and secured to the cylindrical portion 317 and which engages a flanged bushing 331 seated in an aperture 332 of the cast pedestal 29 as shown. Longitudinal displacement of the stop rack 315 to the left (as seen in FIG. 3) from its at rest position is permitted by compression of a washer 333 of an elastomer material positioned between a boss 334 on a pedestal 27 and a collar 335 secured on the cylindrical end portion 316 of the stop rack 315. The right-hand end of the cylindrical end portion 317 has an internally threaded axial bore receiving a flatheaded machine screw 336, shown more clearly in FIG. 4, which in the at rest position of the stop rack 315 operatively engages a microswitch 337 supported upon an upstanding flange 338 of an L-shaped bracket 339 cast on the side of the pedestal 29 as shown.

As illustrated in FIGS. 1, 2, and 3, 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 margin stop 318 and displaces the stop rack 315 to the left. This displacement operates the microswitch 337 which is included in an electrical control circuit described more fully in the cited Blodgett application and effects termination of the power drive of the carrier 77. A more complete description of the action responsive to the operation of microswitch 337 may be found in the cited Blodgett U.S. Pat. No. 3,426,880, starting at column 34, line 4. The right-hand flange 151 of the carrier 77 is provided with a projecting nose member 341 which, during spring motor print escapement of the carrier 77 to the right, or during tabular motion to the right, engages the roller 325 on the right-hand margin stop control member 322 and thereby pivots the margin stop rack 315 about the axis of its end portions 316 and 317 but without longitudinal displacement of the stop rack 315 to the right since such movement is restrained by the pin 330 of the end cylindrical portion 317. Thus, pivotal motion of the stop rack 315 effects corresponding rotational movement of the collar 328 (FIGS. 4—6). A platform 342 has an upturned side flange 343 which is extended upwardly and is secured to the collar 328, and has a further upturned side flange 344 having a downwardly extending arm 345 which anchors one end of a tension spring 346. The latter has its opposite end anchored by a stud 347 carried by the bracket 339 and biases the platform 342 to a position engaging the end of an adjusting screw 348 threaded through the bracket 339. The position of the platform 342 as established by the setscrew 348 places the platform 342 in an operative engagement with a microswitch 349 supported on the bracket 339 and also by the connection of the platform flange 343 to the collar 328 establishes the at rest angular position of the marginal rack 315. When the latter is rotated by engagement of the carrier nose member 341 with the roller 325 of the right-hand margin stop control member 322, the platform 342 is angularly displaced to operate the microswitch 349 which is included in an electrical control circuit described more fully in the cited Blodgett application and causes the next received word space code to effect power driven return movement of the carrier 77 to the left-hand margin position as established by the left-hand margin stop member 318. Reference may be had to the Blodgett U.S. Pat. No. 3,426,880 and the last paragraph of column 21 together with other sections of the patent cited in the reference paragraph for a more complete description. Reference should also be had to column 34 starting at line 25 for a complete description of the manner in which a word space signal can initiate a return movement of the carrier 77.

As alluded to hereinabove and as more fully described in the cited copending application of Blodgett, the carrier structure 77 includes an escapement mechanism which will be herein described briefly as it cooperates with the tabulation structure for terminating a tabular motion. The escapement structure includes an arm 252 secured upon the upper end of the right-hand one of the two shafts 210 as shown in FIG. 7 and which is angularly reciprocated as more fully explained in the copending cited Blodgett application to reciprocate the pressure plate 205 between nonprint and print positions during each print operation. A C-shaped slotted end portion 254 of arm 252 receives 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. Bias spring 258 anchored at one end by a pedestal 259 mounted upon the base portion 260 biases arm 255 to the right as viewed in FIG. 1. The 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 as seen in FIG. 1. The pawl 266 has an arm 273 which may engage the upturned end portion of the arm 255.

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 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 end flanges 182 which are secured to the base casting 150 by machine screws 183. As more fully described in the cited copending Blodgett application, the actual printing is done by means of a plurality of print wires which extend through nose block 189. The print wires are projected to their printing position by a character selection plate 85 and withdrawn from the printing position by a stripper plate 195. The character selection plate 85 is driven to print position by spring 218 when the tension in cable 220 which is anchored by yoke 221 is relaxed. 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 upon the rods 203 are a pair of metal blocks 207 which are pivotally connected to the end of individual ones of a pair of arms 209 secured at the upper ends of a pair of spaced shafts 210 rotatably journaled as shown in FIG. 7, 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 as seen in FIG. 7 also has secured thereto an arm 216 (FIG. 2) having an extended portion 217 (FIG. 7) 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.

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. 7, 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 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. 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 hook end portion 235 of the arm 92.

The print head carrier 77 (FIG. 7) during printing of successive characters of a line of copy is urged by spring motor drive 249 and cable 246 connected to carrier 77 to move in a direction from left to right of the printer platen (not shown), and upon completing a line of copy, is rapidly driven in the opposite direction. This bidirectional drive motion of the carrier 77 is accomplished by a drive structure more fully disclosed in the cited patent of E. O. Blodgett (see column 21, line 68 and following) and is shown schematically in FIG. 7 herein as comprised by the cable 246 which is connected by a yoke 247 to the carrier base casting 150, extends over an idler pulley 248, is wrapped about the spring motor drive 249 supported upon a drive shaft 250, extends over an idler pulley 251 and is secured to the carrier bracket 166 as shown. The spaced points to which the ends of the cable 246 are connected to the carrier structure 77 lie on a plane parallel to the axis of the 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.

The character selection plate 85 is displaced vertically and horizontally for character selection. To this end the selection plate 85 has a turned-over ear 86 which engages a vertical groove 87 of the piston 82 guided within a cylinder 83 to permit vertical displacement of the plate 85 with respect to the piston 82, and has side positioned turned-over ears 88 which are engaged by end grooves 89 of a positioning arm 90 verti-

cally guided on a guide rod **91** carried by the carrier structure **77** and vertically moved by a pivoted bellcrank **92** mechanically coupled to the arm **90** by a link member **93**.

While there has been shown and described what is considered at present to be 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.

We claim:

1. In a character-by-character printer, a margin control assembly comprising:

a. a longitudinal margin stop rack supported for separately controlled and initiated limited independent rotational and longitudinal motion about and along, respectively, the longitudinal axis of said margin stop rack;

b. first and second bias means for retaining said margin stop rack at first limits of its limited rotational and longitudinal motions, respectively, during character printing;

c. first and second margin stop members selectively positionable on said margin stop rack for controlling and influencing the left- and right-hand margins, respectively;

d. carrier means, including character printing means, mounted for letter escapement motion parallel and relative to said margin stop rack;

e. controlled bidirectional drive means for selectively urging said carrier means in a letter space direction, and a return direction, wherein:

i. said letter space direction is towards said second margin stop member; and

ii. said return direction is towards said first margin stop member;

f. projecting means on said carrier means for engaging said second margin stop member when said carrier means has been escaped to a position wherein said projecting means and said second margin stop member become engaged;

g. first signal generating means for providing a first signal indicative of conditioning for carrier return in response to the pivotal motion of said margin stop rack away from its said first limit of rotation in consequence of the engagement of said projecting means and said second margin stop member;

h. second signal generating means for providing a second signal in response to an escapement action of said carrier means when there is no character printing;

i. said controlled bidirectional drive means being responsive to the generation of said second signal after the generation of said first signal for driving said carrier means in said return direction;

j. engaging means on said carrier means for engaging said first margin stop member when said drive means drives said carrier means sufficiently far towards said first margin stop member;

k. said engaging means and said first margin stop member coacting to longitudinally move said margin stop rack away from its said first limit of longitudinal motion in response to the engagement of said engaging means and said first margin stop member; and

l. control means responsive to said longitudinal motion of said margin stop rack for terminating the driving of said carrier means in said return direction.