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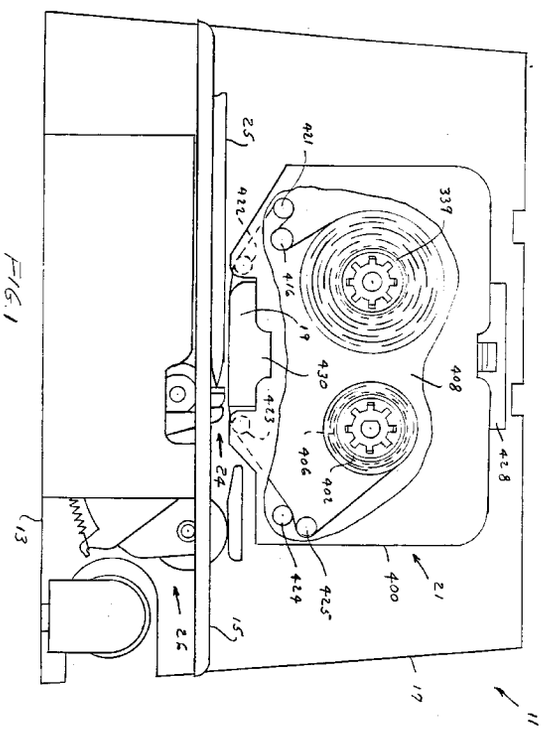
(54) Envelope position sensing assembly for a thermal postage meter.

(57) The position sensing assembly is employed in combination with a thermal printing postage meter having a base supporting a registration wall and a deck, and a thermal print head fixably mounted to the registration wall above a portion of the deck to define a print station for printing a postage indicia on an envelope. A position sensing lever is mounted to a positioning support arrangement for providing supporting the position sensing lever support in a first position such that the position sensing lever has a home position where in a portion extending generally perpendicular to the deck to encounter the leading edge of the envelope positioned on the deck. The position lever encounters the envelope leading edge such that the leading edge deflects the position sensing lever when positioned in the print station and for repositioning the position sensing lever in a second position which removes the position sensing lever from encountering the leading edge of the envelope. A microcontroller is in communication with a sensor acted upon by position sensing lever for causing the positioning support arrangement to position the position sensing lever in the second position when encountering the envelope leading edge and, as a result thereof, initial of a meter print cycle. After the print cycle is completed the position sensing lever is returned to the home position.



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The present invention relates to thermal printing postage meter and, more particularly, to an apparatus for sensing the presence of a properly positioned envelope on the feed deck particularly suited for thermal postage meter applications.

A new and novel thermal postage meter assembly includes a number of modules or systems. In was the objective of this thermal postage meter to function such that upon the placement of an envelope on the deck of the thermal printer by an operator, the envelope encounters a position sensing assembly which include an envelope stop arrangement to assure proper longitudinal envelope positioning. Upon proper positioning of the envelope on the deck, the position sensing assembly senses the presence of the envelope, a microcontroller is programmed to first duck the positioning sensing assembly out of the way, inclusive of the stop assembly, and initiate the print sequence. Upon initiation of the print sequence, a platen roller assembly should be positionable to bring the print area of the envelope is brought into contact with the print ribbon of a ribbon cassette. A thermal print head of the postage meter should be located to act as a backing to the print ribbon. The microcontroller is responsible for causing a positioning of the platen roller into a print position and for rotating the platen roller for printing. Following completion of the print cycle, it is necessary for the microcontroller to cause the envelope to be ejected from the postage meter.

Embodiments of the present invention present a postage meter printing apparatus utilizing thermal printing techniques having a mechanism for sensing the presence of a properly positioned envelope and cause initiation of the printing sequence thereafter.

Also, embodiments of the present invention present an envelope sensing mechanism assembly which further informs the microcontroller of the postage meter that the envelope has been ejected from the mailing machine.

The thermal postage meter is comprised of a number of modules or systems. Upon the placement of an envelope on the deck of the thermal printer by an operator, the envelope encounters a position sensing assembly which includes an envelope stop arrangement. The envelope stop arrangement prevents the envelope from being longitudinally mis-positioned. Upon proper positioning of the envelope on the deck, the position sensing assembly senses the presence of the envelope and informs a microcontroller to first duck the positioning sensing assembly out of the way, inclusive of the stop assembly, and initiate the print sequence. Upon initiation of the print sequence, a platen roller assembly is repositioned to bring the print area of the envelope into contact with the print ribbon of a thermal ribbon cassette. The thermal print head of the postage meter is positioned as a backing to the print ribbon and envelope. The microcontroller actuates a motor which in turns drives the platen roller. Rotation of the platen roller causes the envelope and cassette print ribbon to simultaneously traverse the print head while the microcontroller concurrently enables the thermal print head. Following completion of the print cycle, the microcontroller causes the platen roller to be ducked below the deck and a pressure roller to be engaged for ejection of the envelope.

The position sensing assembly is comprised of a U-shaped support bracket mounted to the base of the meter. The U-shaped support bracket has a bracket forward wall and a rear wall. Preferably, the bracket is mounted to a base support wall by any conventional means. It is noted that in the subsequent description, certain specific elements are apart of more than one assembly.

A shaft is rotatively mounted to extend between the bracket walls by any conventional means such as by a bearing assembly. A drive gear is fixably mounted to the shaft at one end. The motor has a output gear which is in constant mesh with the drive gear for causing the shaft to rotate under the influence of the motor. A position lever, which includes a envelope facing surface, camming surface, and sensor tab, is slidably mounted on hubs formed on the rear wall of the bracket. The position lever is mounted to the rear wall such that the hubs ride within the respective slots. A cam is eccentrically mounted to the shaft such that the camming periphery of the cam is opposite the camming surface of the position lever. A spring is detachably mounted to the position lever at one end and to a formed tab in the rear wall at the other end. The spring biases the position lever such that the camming surface is biased against the cam surface of cam.

A non-limiting embodiment of the present invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a frontal view of a thermal postage meter and ribbon cassette in accordance with the present invention,

Fig. 2 is a schematic of a microcontroller in accordance with the present invention,

Fig. 3 is a sectioned top view of the thermal postage meter in accordance with the present invention,

Fig. 4 is a sectioned end view of the thermal postage meter in accordance with the present invention,

Figs. 5A, 5B, 5C and 5D are side prospective views of a portion of a position sensing assembly in various positions in accordance with the present invention,

Figs. 6A and 6B are side prospective views of a portion of a stop assembly in an initial and a ducked positioned, respectively, in accordance with the present invention,

Figs. 7A, and 7B are schematic views of the platen and pressure roller assemblies in relative position during home position, print position and eject position, respectively, and

Fig. 8 is a top sectional view of the thermal postage meter in accordance with the present invention.

Referring to Fig. 1, a thermal postage meter, generally indicated as 11, includes a base 13 which supports a deck 15. The base 13 supports a registration wall 17, by any conventional means, to extend vertically upward from the deck. A thermal print head 19 is fixably mounted, by any conventional means, to the rear registration wall 17. The rear registration wall 17 has mounted thereto a thermal ribbon cassette 21. Mounted in the base 13 is a position sensing arrangement, generally indicated as 24, for sensing the position of an envelope 25 transported along the deck 15 by a platen roller assembly, generally indicated as 26.

Referring to Fig. 2, the thermal printing meter is under the influence of a system microcontroller, generally indicated as 28. The microcontroller system 28 is comprised of a programmable microcontroller 30 of any suitable conventional design, which is in bus 32 communication with a motor controller 34, a sensor controller 36, and the thermal print head controller 38. The motor controller 34, sensor controller 36 and thermal print head controller 38 may be of any suitable conventional design. The motor controller 34 is in motor bus 40 communication with a plurality of drive motors 42, 44 and 46. The motor control bus 40 also communicates the motor controller 34 to a tape encoder 48. The sensor controller 36 is in sensor bus 50 communication with a plurality of sensors 52-55 and the thermal printer controller 38 is in print head bus 58 communication with the thermal print head 19.

Referring to Figs. 3 and 4, the position sensing assembly 24 is comprised of a U-shaped support bracket 75 mounted to the base 13. The U-shaped support bracket 75 has a bracket forward wall 77 and a rear wall 79. Preferably, the bracket 75 is mounted to a base support wall 81 by any conventional means. It is noted that in the subsequent description, certain specific elements are apart of more than one assembly.

A shaft 83 is rotatively mounted to extend between the bracket walls 77 and 79 by any conventional means such as by a bearing assembly. A drive gear 85 is fixably mounted to the shaft 83 at one end. The motor 42 has a output gear 87 which is in constant mesh with the drive gear 85 for causing the shaft 83 to rotate under the influence of the motor 42. A position lever 89 which includes a envelope facing surface 91, camming surface 93, and sensor tab 95, and further includes slots 97, 98 and 99, is slidably mounted on hubs 101, 102 and 103 formed on the rear wall 79 of the bracket 75. The position lever 89 is mounted to the rear wall 79 such that the hubs 101, 102 and 103 ride within the respective slots 97, 98 and 99. A cam 105 is eccentrically mounted to the shaft 83 such that the camming periphery of the cam 105 is opposite the camming surface 93 of the position lever 89. A spring 107 is detachably mounted to the position lever at one end and to a formed tab 109 in the rear wall 79 at the other end. The spring biases the position lever 89 such that the camming surface 93 is biased against the cam surface of cam 105.

Mounted to the forward bracket wall 77 is an envelope stop lever 120 which includes a envelope facing surface 122, channeled main section 124, a collared tab 126 mounted within the channel section 124, a cam follower surface 127 and a interlock tab 128. The stop lever 120 is pivotally mounted on a hub 130 which is formed in the forward bracket wall 77. A spring 132 which has one end attachably mounted to a tab 134 formed on the forward bracket wall 77 and the other end attachably mounted to the collared tab 126 biases the camming surface 127 against the cam 135. A locking lever 136 which includes a locking tab 138 and 140 for securing the locking tab 128 of the envelope stop lever 120 between the locking tabs 138 and 140 of the locking lever 136. The locking lever 36 also includes a camming surface 142 opposite the cam 135 and a formed support ring 144 which is pivotally mounted to a tab 146 formed in the forward bracket wall 77. A spring 148 which is detachably mounted at one end to a tab 149 and at its other end to the envelope locking lever 136 is mounted for biasing the locking lever 136 in the direction of the cam 135.

Referring to Figs. 3, 7A and 7B, the platen roller assembly 26 includes a linking arm assembly 201 comprising a first link section 203 having a receiving channel 205 and a second section 207 having a portion matingly received in the receiving channel 205 of the first linking section 203. One end of the first linking section 208 is rotatively mounted around cam 208' which is eccentrically mounted to the shaft 83. A spring 210 having its respective ends detachably mounted in the first and second sections of the linking arm 203 and 207, respectively, biases the second section 207 within the receiving channel 205 of the first link section 203. The exposed end of the second section 207 includes a hub shaft 212. A second linking arm assembly 214 is constructed identical to the linking assembly 201 and is eccentrically mounted in cooperative alignment with the linking arm assembly 201 on the shaft 83.

A pivot link assembly, generally indicated as 218, is mounted to a shaft 216 which is rotatively mounted between the rearward and forward bracket walls 77 and 79, respectively. The pivot link assembly 218 includes a first link plate 220 pivotally mounted around shaft 216 at one point and pivotally mounted around the hub shaft 212 at another point. A second link plate 222 is pivotally mounted around the shaft 216 at one point and includes a slot 224 wherein the hub shaft 212 rides therein. A spring hook 223 is formed in the first link plate

220 and a spring hook 225 is formed in the second link plate 222. A spring 227 has its respective ends fastened around the respective spring hooks 223 and 225 in a conventional manner. A second pivot link assembly 226, identical to the pivot link assembly 228, is pivotally mounted to the shaft 216 in spaced apart relationship to the pivot link assembly 218. A platen shaft 228 is rotatively mounted by any conventional means to the link plates 220 of the respective pivot link assemblies, 218 and 226. A platen roller 230 is fixably mounted around the platen roller shaft 228, between the pivot link assemblies, 218 and 226.

A pressure roller shaft 232 is rotatively mounted by any conventional means to the link plates 222 of the respective pivot link assemblies 218 and 226. Pressure rollers 234 are fixably mounted around the pressure roller shaft 232 in spaced apart relationship.

A drive shaft 236 having a spool 238 fixably mounted to one end is responsive to the motor 44. A spool gear arrangement 240 which includes a hub 242 fixably mounted around the shaft 216, a spool 244 fixably mounted to the hub 242. A gear 246 is fixably mounted to shaft 216. A gear 248 is fixably mounted to the shaft 232 and a gear 250 is fixably mounted around the shaft 228. The gears 246 is constant mesh with gear 248 and 250, and an endless belt 252 extends around the spools 238 and 244.

Referring to Figs. 1 and 4, the thermal drive cassette assembly, generally 300, is comprised of a mounting platform 301 of any suitable construction fixably mounted, by any conventional means to the back side of the registration wall 17. A tape drive motor 46 is fixably mounted to the mounting platform 301, by any suitable conventional means. The output shaft 303 of the drive motor 46 has a drive gear 305 fixably mounted to the output shaft 303 of the drive motor 46. A conventional double gear set 307 having a first gear 309 in constant mesh with the drive gear 305 and a second gear 311 rotatively mounted to the back side of the registration wall 17. A conventional double idle gear set 313 having first gear 315 in constant mesh with the gear 311 and a second gear 317 is rotatively mounted by any conventional means to a gear hub 319. The gear hub 319 is fixably mounted to the mounting platform 317 by any conventional means and rotatively supports the idle gear set 313 by any suitable conventional means. A registration wall aperture 312 is formed in the registration wall 17. A conventional bearing hub assembly 323 is fixably mounted to the back side of the registration wall 17 aligned to the aperture 321. A tape drive shaft 325 extends through the aperture 321 rotatively supported by the bearing hub assembly 323. A gear 327 is fixably mounted by any conventional means to one end of the tape drive shaft 325 in constant mesh with the gear 317. A tape drive spool 329 is fixably mounted by any conventional means around a portion of the tape drive shaft 325.

A tape idle assembly, generally indicated as 331, is mounted to the back side of the registration wall 17 aligned to a registration wall aperture 333. The tape idle assembly 331 includes a conventional one way clutch and shaft assembly 335 of any suitable construction fixably mounted to the back side of the registration wall 17 aligned to the aperture 333. The assembly 335 includes an idle shaft 337 extending through the aperture 333. A tape idle spool 339 is fixably mounted by any conventional means around a portion of the idle shaft 337.

An encoding assembly, generally indicated as 341, is fixably mounted to a mounting spindle 343 which is fixably mounted to the back side of the registration wall 17, by any suitable conventional means, aligned to a registration wall aperture 345. The encoding assembly 341 includes collar 347 and a input shaft 349. A mating male shaft 351 is received by the shaft 349 such that the male shaft 351 can experience limited axially displacement within the shaft 349 and such that the male shaft rotatively drive the shaft 349 such as by any suitable conventional mating longitudinal gears arrangement. A spring 353 is placed around the shaft 351 and an end cap gear 355 is fixably mounted by any conventional means to the shaft 351 within the aperture 345.

The tape cassette 21 is comprised of a cassette housing 400 having a drive spool 402. The drive spool 402 has formed axial extending gear teeth 404. The drive spool 402 is rotatively mounted by suitable conventional means in the cassette housing 400 to be axially aligned to a opening 406 in the rear wall 408 of the housing 400. The gear teeth 404 of the drive spool 402 are configured to be mating to axial gear teeth 330 formed on the periphery of the tape drive spool 329. In like manner to drive spool 402, the cassette housing includes idle spool 410 having axial extending gear teeth 412 rotatively mounted to the rear wall 408 aligned to an opening 414 in the rear wall 408. The gear teeth 412 are configured to be mating to axial gear teeth 340 formed on the periphery of the tape idle spool 339. An encoding post 416 is rotatively mounted in the cassette rear wall 408, by any suitable conventional means, having a short shaft 418 extending through the rear wall 408 and into the aperture 345 in the registration wall 17. A gear 420 is fixably mounted to one end of the short shaft 418 to be in constant mesh with the gear 355 of the encoding assembly 341. A plurality drag post 421, 422, 423, 424 and 425 are strategically mounted fixably by any conventional means to the cassette rear wall 408.

The cassette housing 400 further has a cassette opening 426 and is mounted between upper clamp 428 and lower clamp 430 which extend from the registration wall 17.

The platen roller 230 has a length 2L and a radius of R at the center. The radius of the platen roller 230

has a linear surface transition to a end radius of (R + h). In the preferred embodiment of the present invention, the platen roller is comprised of a 25 to 35 durometer cellular urethane. The preferred dimensions are:

Length (2L)	3.000 inches
Center Radius (R)	0.849 inches
End Radius (R+h)	0.969 inches
Taper Angel	2.3 degrees

Referring to Figs. 1, 3, and 7A and 7B, the function of the thermal postage meter 11 is to accept an envelope 25, print an indicia using thermal transfer print technology, and eject the envelope 25 from the meter 11. The feed direction of the meter 11 is from left to right as view in Fig. 1. The the platen roller 230 feeds the envelope 25 at a constant rate and supplies the print head 19 sufficient backing pressure needed for transfer of thermal ink from the ribbon to the envelope 25 during the print cycle. The microcontroller 30 is programmed to instruct the print controller 38 to actuate the heating elements of the print head 19 synchronous to displacement of the envelope 25 to produce a postal image or other desired image.

As the platen roller 230 feeds the envelope 25, it also feeds the thermal transfer ribbon. Therefore, use of the platen roller 230 for ejection would lead to wasted ribbon. The ejection rollers 234 are used to feed the envelope out of the meter 11 after printing.

As previously described, the thermal transfer ribbon feeds around a urethane wrapped encoder roller 416 inside the cassette 21. As the ribbon feeds, the friction of the ribbon against the encoder roller 416 causes it to turn. The encoder roller 416 has a gear 428 which protrudes from the back side of the cassette and couples with a mating gear 355 in the meter 11. The mating gear 355 turns an optical encoder 341 which communicates with the microcontroller 30 for monitoring ribbon motion.

Referring particularly to Figs. 8A, 8B and 8C, the feed system consists of the platen roller 230 and ejection rollers 234. These rollers are provided with independent control of the envelope 25. They are mounted on a linking assembly 218 and 226 in a manner to produce a rocker type action which pivots about a fixed location, shaft 216. In the home position (Fig. 7A), the ejection rollers 234 are above the feed deck 15 and the platen roller 230 is below the feed deck. The envelope stop finger 124 and envelope trip finger 89 are above the feed deck in the path of the envelope 25. The shaft 83 is positioned at 0 degrees rotation. It should be readily apparent that the deck 15 is provided with suitable located openings to accommodate the motion of the platen roller 230, ejection rollers 234, trip finger 89 and stop finger 124.

An envelope 25 is placed onto the feed deck 15 by the operator and inserted into the feed throat. The envelope 25 hits the spring loaded trip finger 89 and the stop finger 124 which is retained by a locking lever 138. The purpose of the stop finger 124 is to keep the envelope 25 from feeding too far through the print path and also to assure proper alignment of the envelope 25. The trip finger 89 displacement by the envelope 25 actuates the sensor 106 mounted to the base 24 in response to the displacement of sensor tab 95. In response to actuation of the sensor 106, the microcontroller 30 begins the print cycle. When the trip finger 89 is pushed forward about 4mm, it unblocks an optical sensor 106. The microcontroller signals the motor 42 to rotate shaft 83 in a clockwise direction. The cam shaft 83 contains 2 independent cams 135 and 105 which drive the stop finger 124 and the trip finger 89, respectively, out of the feed path. The stop finger cam 135 first rotates the lock lever 138 out of the way. The shaft 83 then continues rotating to move the spring loaded stop finger 120 out of the feed path. The trip finger cam 105 directly drives the trip finger 89 from the path. The fingers 189 and 124 are completely out of the paper path after 180 degrees of shaft 83 rotation.

Concurrently with disengagement of the fingers 89 and 124, the eccentric shaft 83 rotation causes the spring loaded links 201 and 214 to move the ejection rollers 234 out of the feed path and the platen roller 230 toward the envelope 25. The platen roller 230 continues moving toward the envelope 25 until it closes the envelope 25 between the platen roller 230 and the print head 19 capturing the thermal ribbon therebetween. Depending on the envelope 25 thickness, the platen roller 230 will meet the envelope 25 at different points in the rotation of the shaft 83. The ejection rollers 234 may still be above the feed deck. The cam 83 will then continue to rotate, causing the links 208 to extend and both the link extension springs 210 and the ejection springs 227 to apply a load to the envelope 25. When the shaft 83 has rotated 180 degrees, the ejection rollers 234 are out of the feed path and the platen roller 230 is fully engaged. Printing can now begin.

As mentioned, the shaft 83 acts on the eccentric cam 208', the stop cam 135, the trip finger cam 105 and a set of flags 504. The flags 504 trigger the microcontroller 30 when the shaft 83 has rotated 180 degrees. In the most preferred embodiment, the shaft 83 is driven by a DC brush-type gear motor 42 via a set of gears. When the flag 504 signals the microcontroller 30 that it is time to stop the shaft 83 rotation, the motor 42 is electronically braked.

Once the platen roller 230 has fully engaged the envelope 25, the drive motor 44 and the ribbon drive motor 46 start under the direction of the microcontroller 30. It is noted that the motor 44 turns both the platen roller 230 and the ejection rollers 234. However, the ejection roller 234 is not in the supply path so it has no affect

on the envelope 25. Upon initiation of the print cycle, the envelope 25 and ribbon begins to feed as the motor 44 is brought up to speed. Printing then starts by loading data to the print head from the print head controller 38 under the command instruction of the microcontroller 30 at a constant rate. The speed is monitored and controlled through the conventional motor encoder (not shown) on the motor 44. In the most preferred embodiment of the present invention, the printing operation takes about 425mS.

While printing, the ribbon is driven through the print nip by the motion of the envelope 25. The ribbon take-up motor 46 winds up the ribbon on the take-up core and provides even tension without pulling the ribbon through the print nip. In order to provide the even tension desired, the back EMF of the motor 46 is monitored in the preferred embodiment. Changes in the back EMF indicate quantity of ribbon and the ribbon drive is modified accordingly by the microcontroller 30. In addition, a sharp change in the back EMF of the motor indicates that the ribbon is broken after the print head or the ribbon has stopped, in either case, the microcontroller 30 aborts.

Tension on the supply side of the print nip must also be maintained. The ribbon is fed through a series of posts 416 and 421 which provides drag to the ribbon through the friction of the ribbon against the posts 416 and 421. A light clutch load is provided by conventional clutch 335 on the ribbon supply core to provide tighter wrap of the ribbon around the posts 416 and 421. The ribbon encoder 341 is turned by the friction of the ribbon moving past the roller 416. The encoder motion 341 is monitored by the microcontroller 30 to determine if the ribbon breaks before reaching the print head or if the ribbon runs out, in which case, the microcontroller will abort. In addition, the encoder 341 can be used to monitor the speed of the ribbon, and therefore the envelope 25, through the print nip.

When printing has been completed, the shaft 83 rotates an additional 180 degrees back to its original home position. The drive link 208 becomes a solid assembly which pushes the ejection rollers 234 against the envelope 25. Since a lighter load is needed for ejection than for printing, the spring 210 becomes the only active spring. Again, flags 504 on the shaft 83 interrupt a optical sensor 506 to indicate 180 degrees of rotation. This 180 degree rotation engages the ejection roller 234 and disengages the platen roller 230. During the rotation, the stop finger 124 and trip finger 89 are also released to extend above the feed deck. Due to their very light spring load, the levers 89 and 124 will ride along the bottom of the envelope 25 until it clears the platen roller 230.

The motor 44 continues to drive both rollers 230 and 234. At this point, however, the platen roller 230 becomes inactive because it is below the feed deck. At the same time, the ribbon motor 46 is stopped. When the ejection roller 234 engages, it feeds the envelope 25 from the printer at 2 to 3 times the print speed in the preferred embodiment. Once the envelope 25 clears the print nip, the stop and trip fingers 124 and 89, respectively, return to their home position. The drive motor 44 is stopped and the process is complete.

Claims

1. A position sensing assembly for a thermal printing postage meter having a base supporting a registration wall and a deck, and a thermal print head mounted on said registration wall above a portion of said deck to define a print station for printing a postage indicia on an envelope having a leading edge positioned on said deck in said print station, comprising:

   a position sensing lever;

   positioning means for supporting said position sensing lever in a first position such that said position sensing lever has a home portion extending generally perpendicular to said deck to encounter said leading edge of said envelope such that said leading edge may deflect said position sensing lever when positioned in said print station and for repositioning said position sensing lever in a second position removing said position sensing lever from encountering said leading edge of said envelope; and

   microcontroller means in communication with said positioning means for causing said positioning means to position said position sensing lever in said second position when encountering said envelope leading edge upon the start of a meter print cycle and for causing said positioning means to position said position sensing lever in said home position when said print cycle is completed.

2. A position sensing assembly as claimed in claim 1, wherein said positioning means comprises:

   said base having a support bracket;

   a position sensing lever pivotally and slidably mounted to said bracket such that said position sensing lever is positioned in a first position presenting a lateral obstruction to an envelope positioned on said deck when said envelope is introduced to said print station and deflecting said position sensing lever when properly positioned in said print station; and

drive means responsive to instruction from said microcontroller for causing said position sensing lever to pivotally reposition to a second position unobstructed to an envelope positioned on said deck.

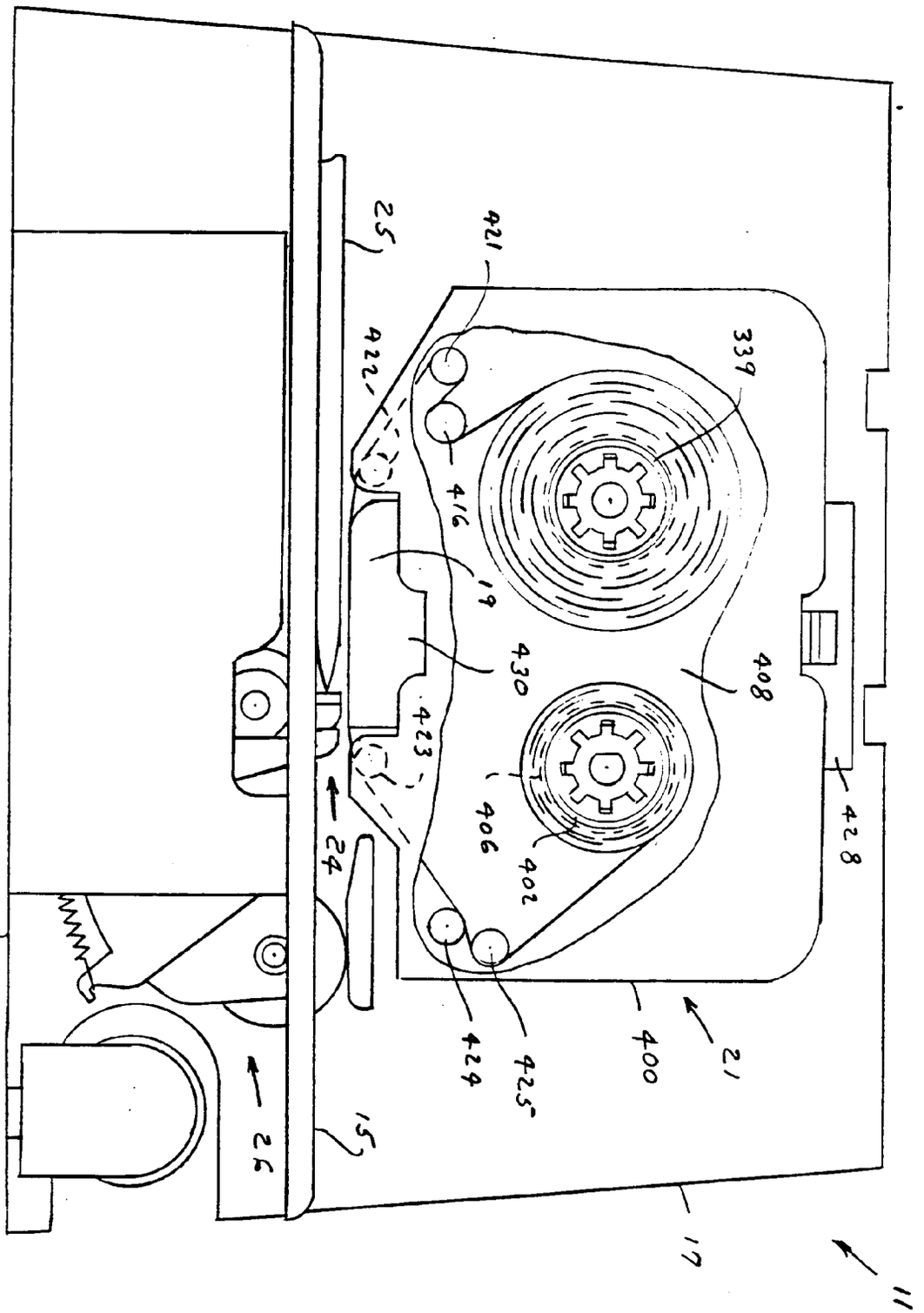
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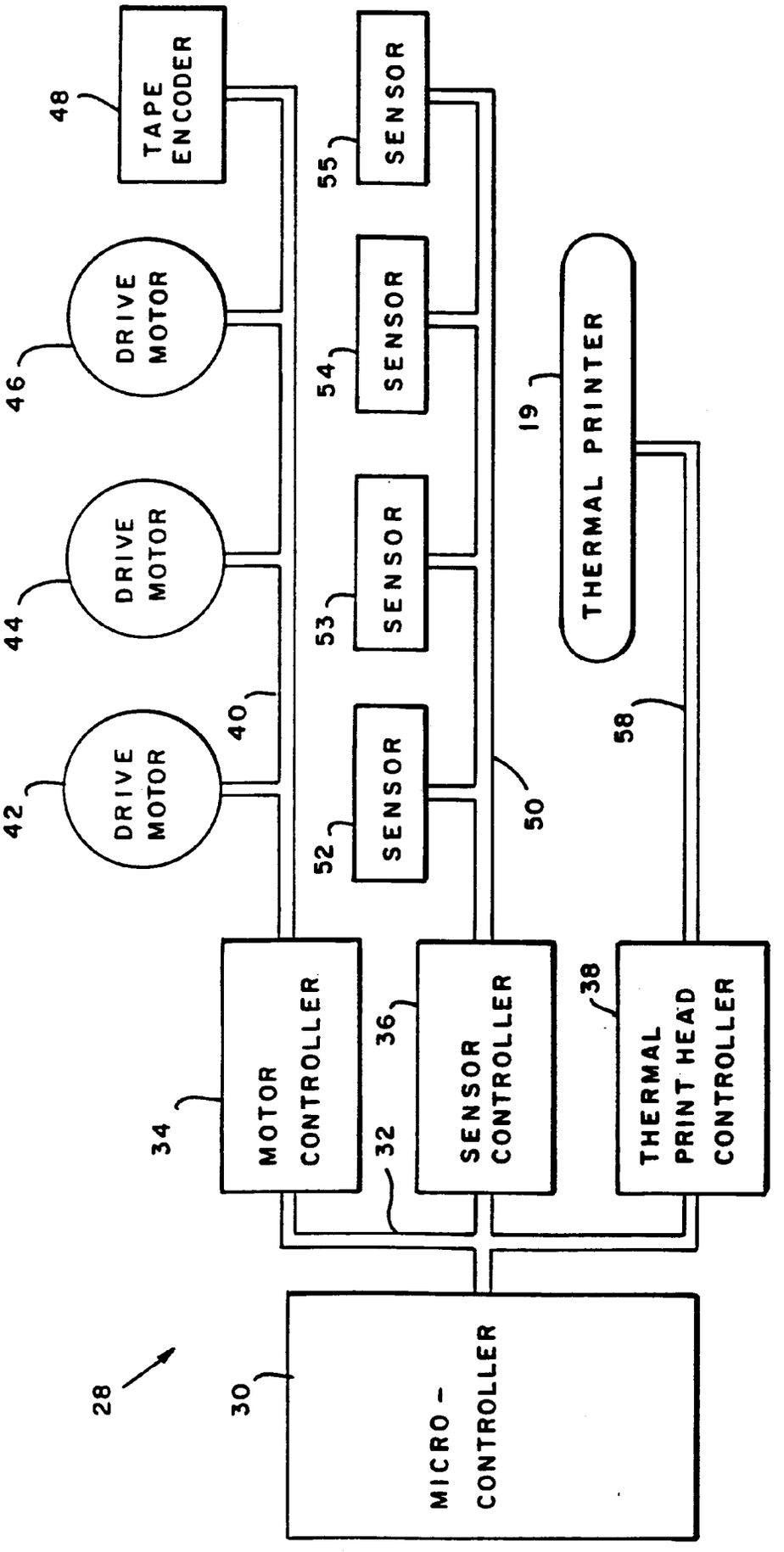
FIG. 1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30
MICRO-CONTROLLER
34
MOTOR CONTROLLER
36
SENSOR CONTROLLER
38
THERMAL PRINT HEAD CONTROLLER
32
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DRIVE MOTOR
44
DRIVE MOTOR
46
DRIVE MOTOR
48
TAPE ENCODER
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SENSOR
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SENSOR
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SENSOR
55
SENSOR
58
19
THERMAL PRINTER

FIG. 2

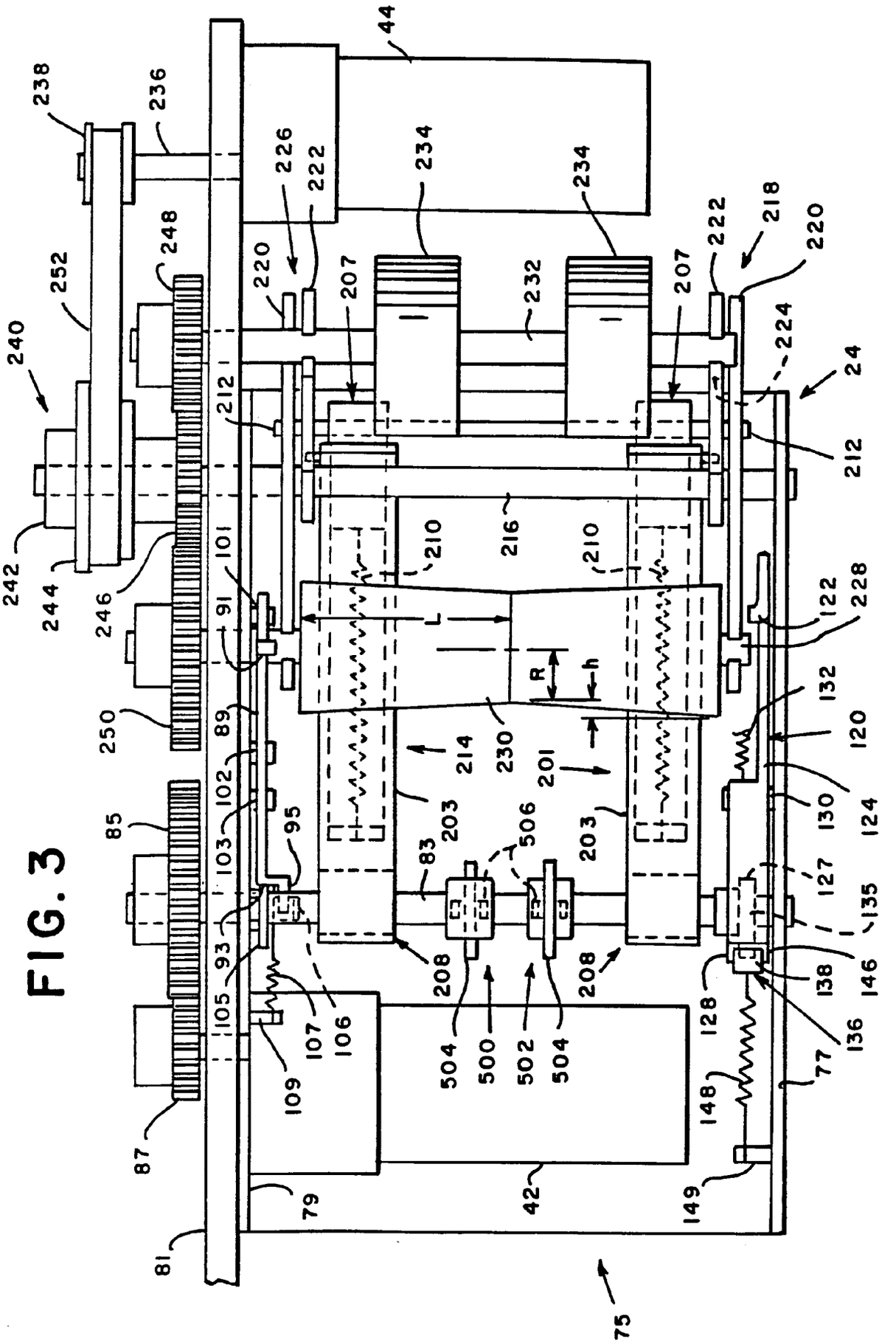
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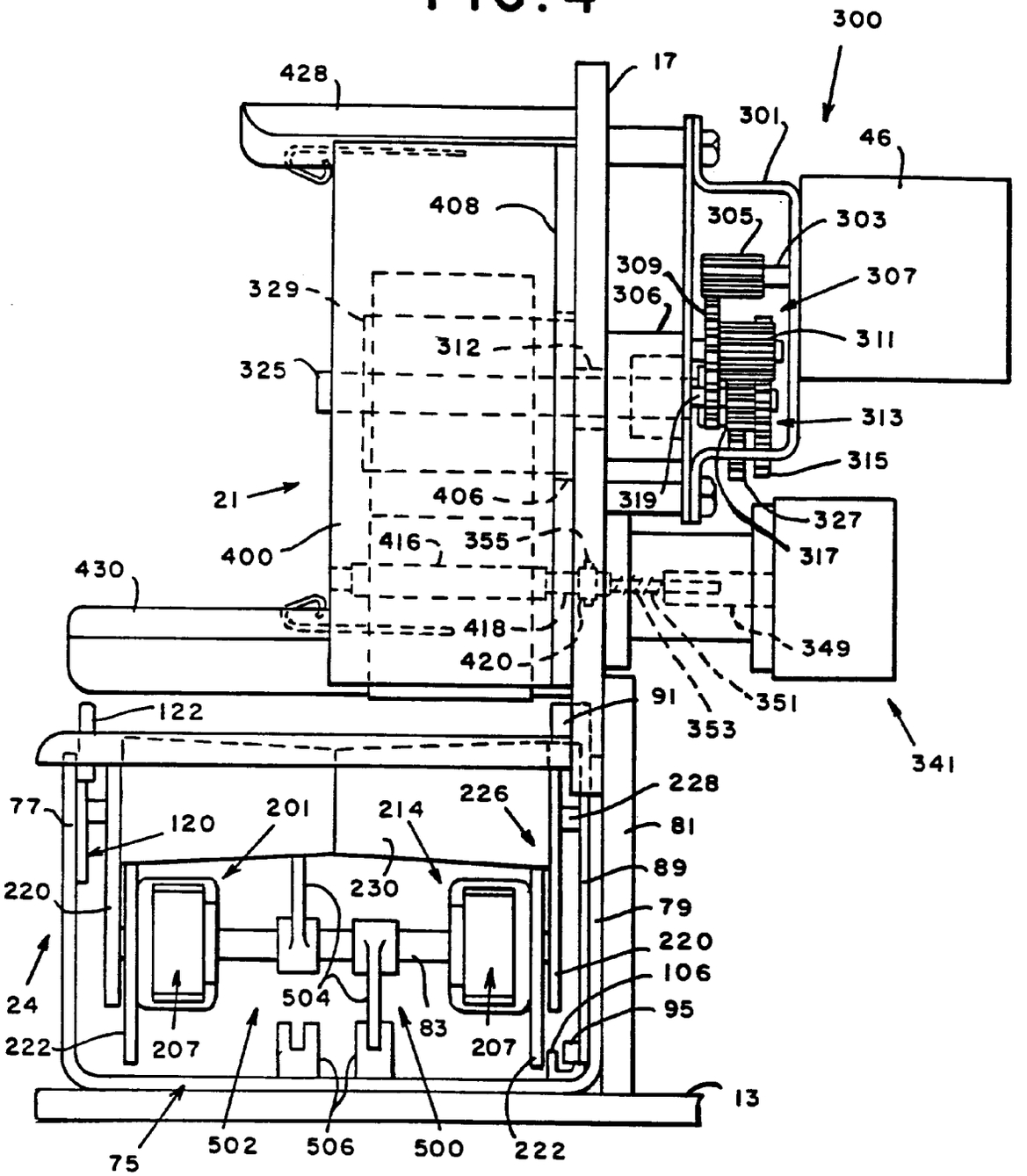
FIG. 3

FIG. 4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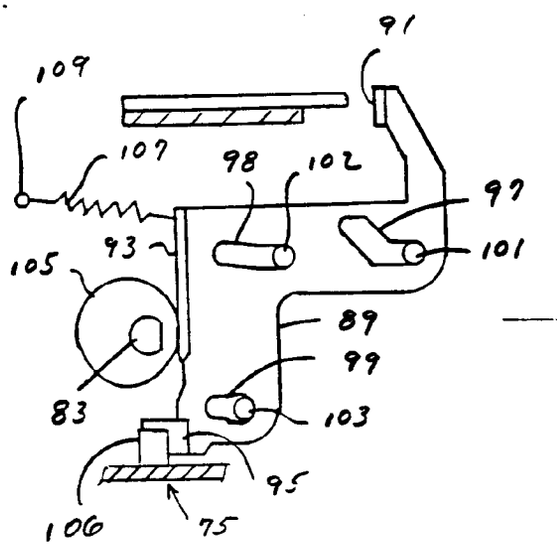

FIG. 5A

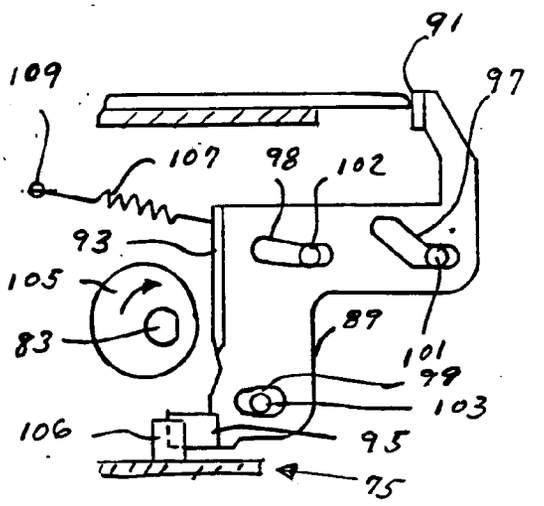

FIG. 5B

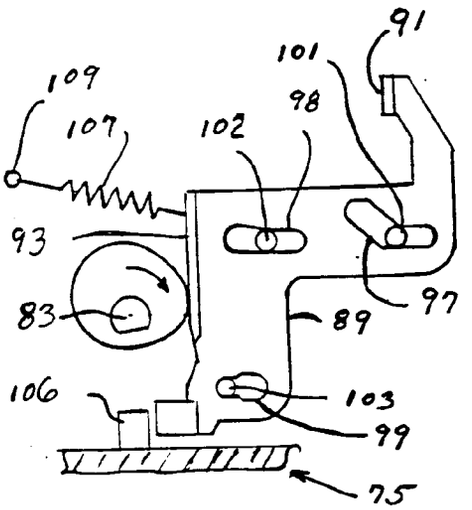

FIG. 5C

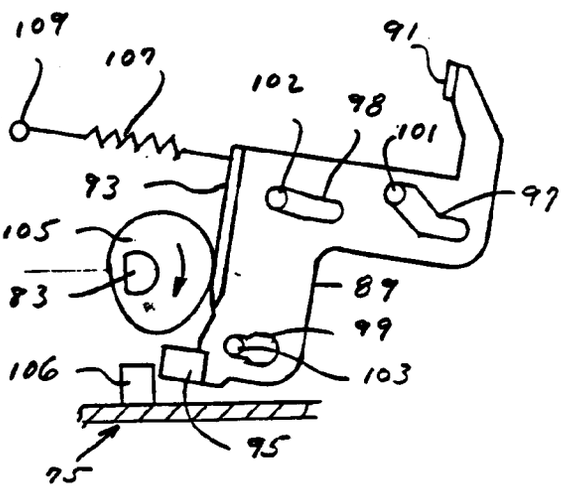

FIG. 5D

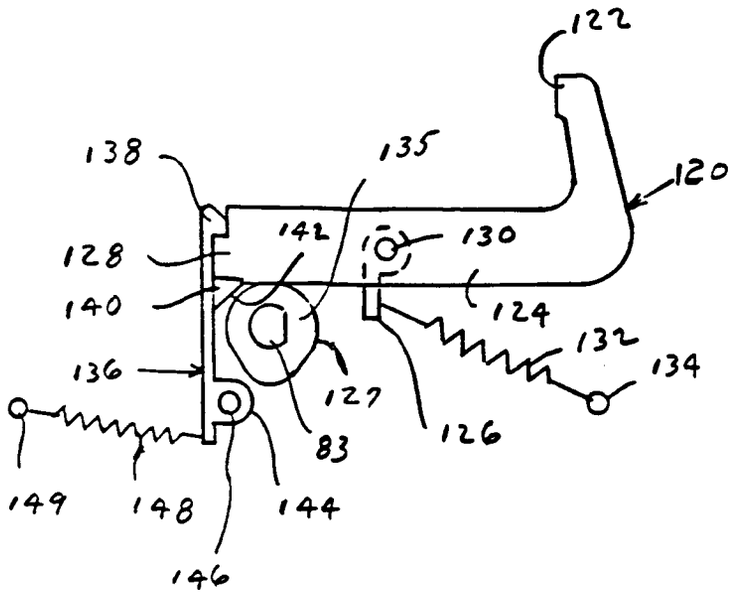
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FIG. 6A

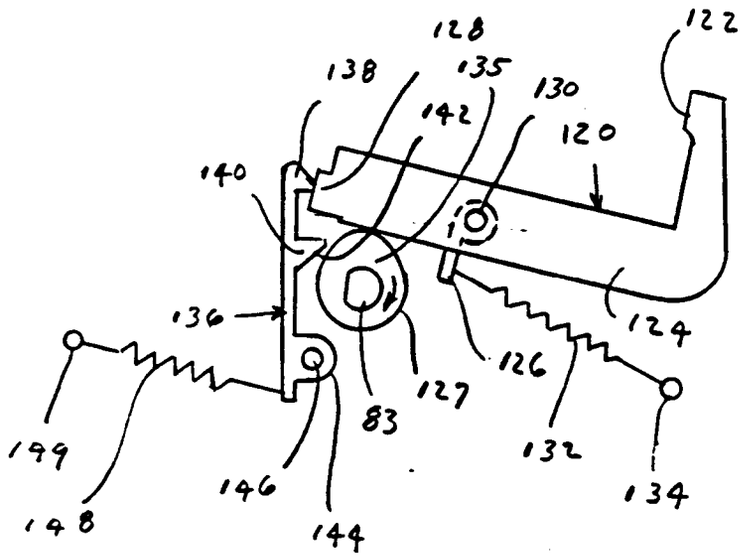
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FIG 6B

FIG 7A

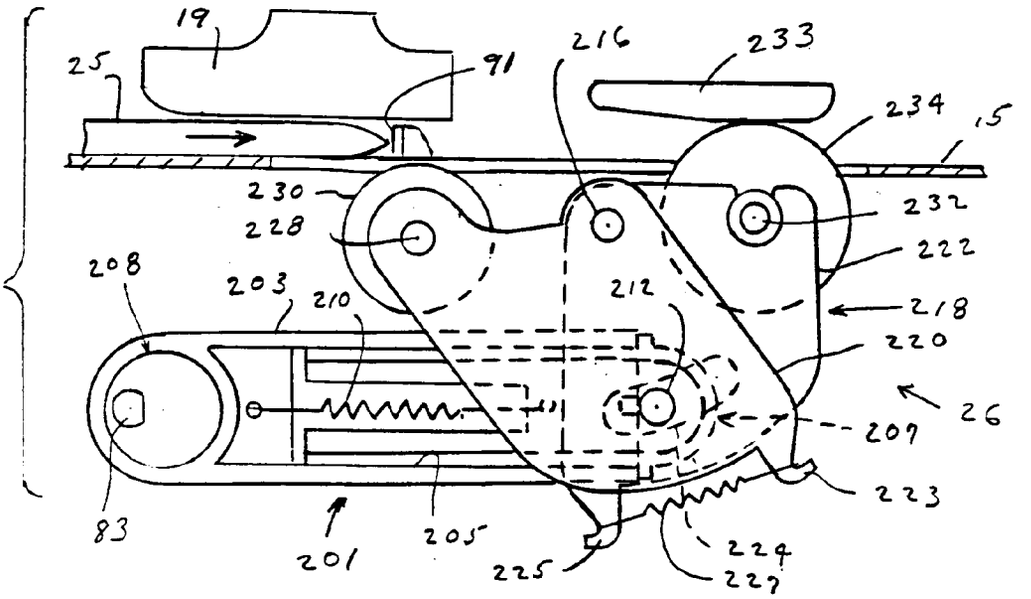
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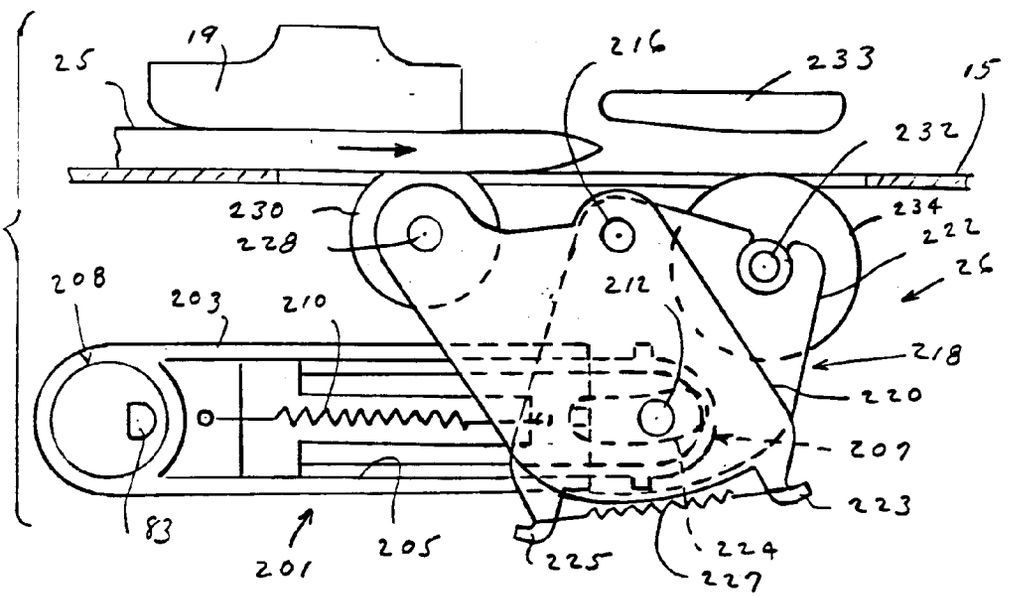
FIG 7B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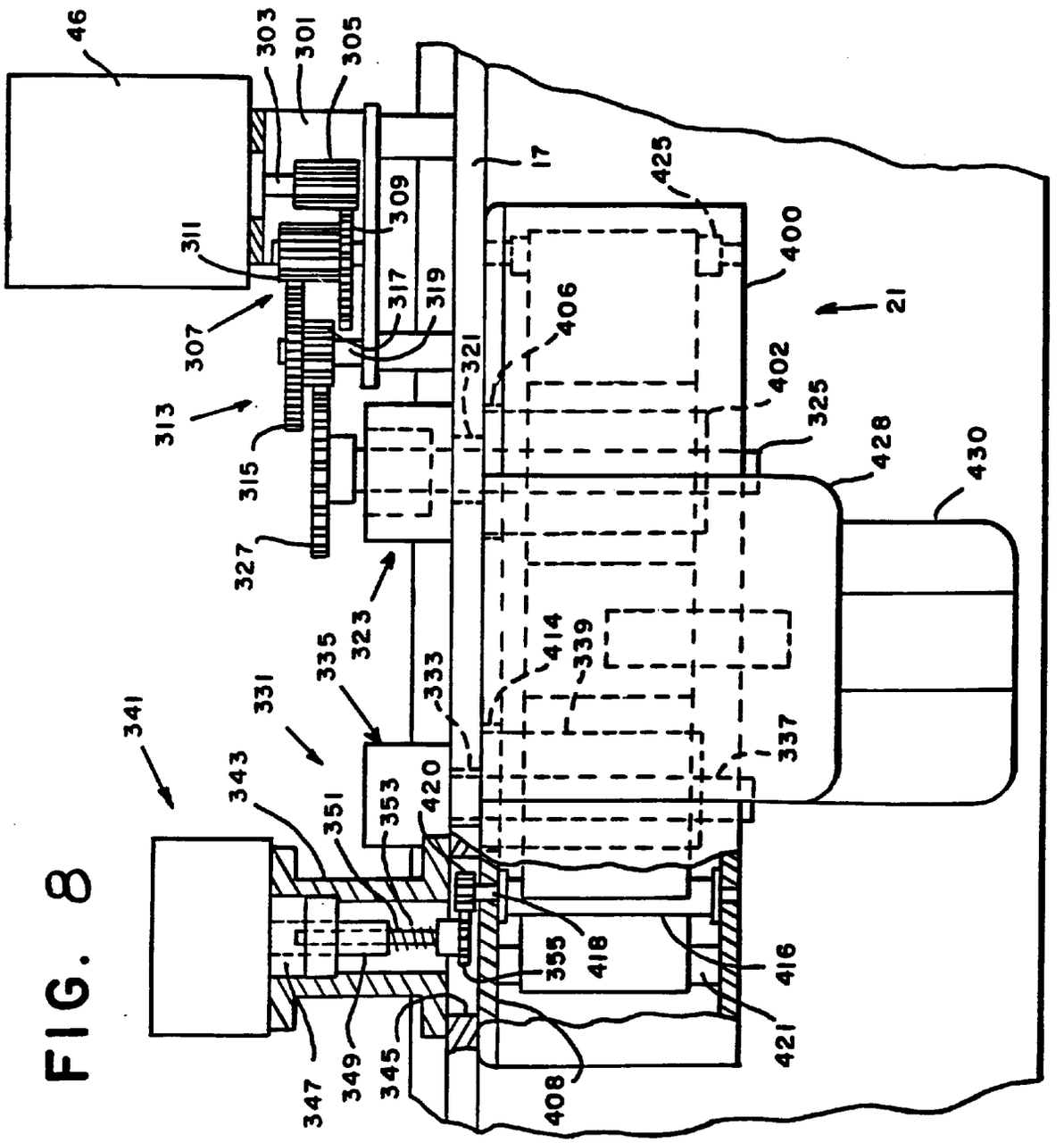
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FIG. 8