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(54) **Automatic/manual bail opener.**

(57) An automatic/manual shuttle mechanism is used to open and close the bail mechanism which holds a print sheet against the platen roller (36) of a typewriter/printer. The shuttle mechanism includes a shuttle member (218) fitted with a slot (224). The slot rides (or shuttles) against a pin (246) which is mounted to the frame of the typewriter/printer. The shuttle mechanism is coupled to the bail mechanism. In an automatic mode of operation, a motor/crank assembly (236, 238, 234, 232, 229, 230) drives the shuttle mechanism (218). In a manual mode of operation, a manual lever (216) drives the shuttle member.

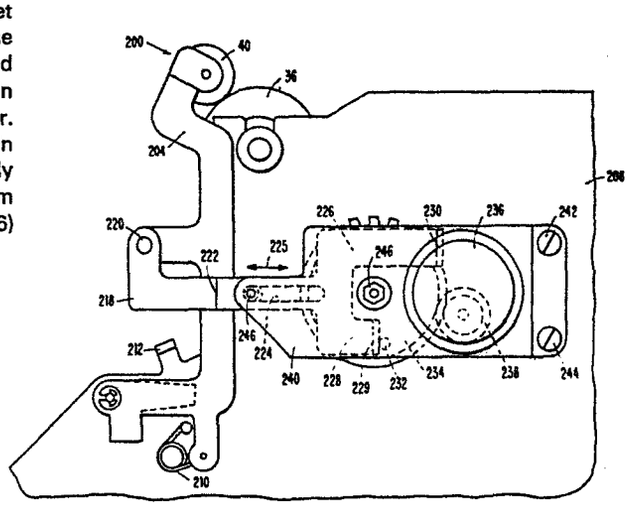


FIG. 9

EP 0 101 841 A2

Automatic/manual bail opener

The present invention relates to patent application Serial No. 412053 filed on March 27, 1982, by L. Adams, Jr. and K. P. Primmer. The title of the application is "Automatic Sheet Feed Device" and assigned to the same assignee as the present invention. Whereas the cross-referenced invention describes an automatic document feeder with reverse indexing features, the present application describes an automatic bail opening device. The device opens the bail so that paper sheets are supplied to the platen of the typewriter/printer.

The present invention relates to typewriter/printers in general, and more particularly to a bail opening device which is opened and closed manually and automatically.

Automatic devices for feeding cut sheets, one at a time, to a printing station of a copier, printer, typewriter, or the like, and to receive printed sheets from such machines are well known in the prior art. Such automatic devices usually consist of a paper supply tray and a paper receiving tray. A stack of blank sheets are usually placed into the paper supply tray. A sheet feed mechanism feeds blank sheets in seriatim into the print station. After printing, the sheets are fed, one at a time,

into the receiving tray. When the job is completed, an operator removes the sheet from the receiving tray.

In order to use the aforementioned automatic document feeder, an automatic method for loading paper into a typewriter/printer is needed. In the automatic loading method, the bail is opened automatically and a sheet is fed from the automatic document feeder onto the platen. Paper is also loaded by a manual technique. Such a manual technique requires an operator to release or open the bail, position the paper about the platen roller and close the bail.

U.S. Patent 4,211,499 is an example of the prior art devices used to control the feeding of paper about a platen. The apparatus is primarily made up of a rocker button, reed switches, a drive motor, a cam gear, a comb, and a paper bail. Upon operator manipulation of the rocker button, a drive motor is turned on for rotating the cam gear. Rotation of the cam gear effects bidirectional rotation of the comb and a paper bail arm carrying the paper bail. Rotation of the comb in a first direction results in (1) a rear feed roller being displaced from the platen to provide a feeding path for paper when inserted into the printer, and (2) a paper aligner being positioned for aligning the paper. Rotation of the comb in a second direction results in the rear feed roller causing engagement of the paper and platen and the paper aligner being brought out of the feeding path of the paper. Rotation of the paper bail arm in a first direction causes the paper bail to be displaced from the platen. Rotation in a second direction results in the paper bail causing engagement of the paper and platen.

U.S. Patent 4,266,880 is another example of prior art devices used to control the positioning of paper about a platen. The device is semiautomatic. An operator activates a lever which moves or disengages the bail from the surface of the platen roller. The operator then inserts a sheet of paper which is automatically driven by the platen roller to the first print line.

Still other types of bail controllers, both manual and automatic, are described in the following articles: IBM TECHNICAL DISCLOSURE BULLETIN, Vol. 19, No. 5, November 1976 (pgs. 1955-1956) describes a cam/motor assembly for automatically opening and closing a bail. IBM TECHNICAL DISCLOSURE BULLETIN, Vol. 22, No. 4, September 1979 (pgs. 1321-1322) describes a cam assembly for opening and closing a bail automatically. IBM TECHNICAL DISCLOSURE BULLETIN Vol. 22, No. 2, July 1979 (pgs. 661-663) describes a manually operated bail.

Although the prior art devices work satisfactorily for their intended purposes, they tend to be complicated and none of them can be operated manually and automatically.

It is therefore the main object and general purpose of the present invention to provide a mechanism which opens and/or closes the bail manually or automatically.

The mechanism includes a mounting bracket suited for mounting to the frame of a typewriter/printer. An outwardly extending fixed stud is fabricated on one surface of the bracket. An elongated shuttle member

is fitted with a slot. One end of the shuttle member is connected to the bail. The other end of the shuttle member is bifurcated and is driven by a stud which extends from the surface of a motor-driven crank assembly. The shuttle member is mounted so that the slot rides on the stud. In the automatic mode of operation, approximately one half crank revolution drives the bail to its close position against the platen roller. The opening and closing of the bail is achieved with the motor rotating in a single direction.

The other end of the bail is connected to a lever. The lever is used by an operator to open and close the bail. The sliding motion between the slot and the fixed stud enable manual or automatic operation of the bail.

In one feature of the invention, a sensing mechanism such as a microswitch, is placed relative to the bail. In the open position, the bail coacts with the sensing mechanism to generate a control signal. The signal indicates that the bail is in an open position.

The foregoing and other objects, features and advantages of the invention, which is defined in the attached claims, will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings, of which

FIG. 1 is a perspective view of an automatic paper feed device. The paper feed device is shown in operative relation with a typewriter/printer.

FIG. 2 is a vertical cross-sectional view of the paper feed device and a portion of the typewriter/printer.

FIG. 3 is a right side view of the automatic paper feed device. The view shows a motor assembly which drives the sheet feed mechanism of the automatic paper feed device.

FIG. 4 is a left side view showing a solenoid assembly. The solenoid assembly periodically drives a back-up roller into contact with a feed roller. The rollers feed printed sheets into the printed sheet receptacle.

FIG. 5 is a pictorial view of the cassette.

FIG. 6 is a flowchart of a program for a controller which controls a paper feed device and the sheet positioning mechanism.

FIG. 7 shows a pictorial view of the upper guide plate.

FIGS. 8A-8C show a clutch motor mechanism. The mechanism drives the D-rollers.

FIG. 9 shows a right side view of the sheet positioning mechanism with the bail rollers resting on the surface of the platen roller.

FIG. 10 shows a right side view of the sheet positioning mechanism with the bail rollers displaced from the platen roller. In this position, paper can be loaded by an operator (manual loading) or from the automatic document feeder (automatic loading).

FIG. 11 shows a top plane view of the sheet positioning mechanism.

FIG. 12 shows a left side view of the sheet positioning mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A. Automatic Sheet Feed Device

The automatic/manual sheet position device of the present invention can be used with several different types of reproduction office machines. It works well with a typewriter/printer mechanism and, as such, will be described in that environment. However, this association is for purposes of description only and should not be construed as a limitation on the scope of the present invention.

It should be noted that the above cross-referenced application is incorporated in Section A of the specification. The incorporation is for purposes of full disclosure. The automatic/manual paper positioning device is described in Section B of the specification.

The automatic/manual sheet positioning device includes a bail mechanism (FIG. 5) which is disposed relative to the platen roller. FIG. 1 shows a typewriter/printer which includes features according to the teachings of the present invention. The typewriter/printer assembly includes a device 10 supported above a schematically illustrated processing machine, such as a programmable typewriter 12. The programmable typewriter 12 is a conventional device which is known in the prior art, and as such, details will not be given. Suffice it

to say that only features of the typewriter which are necessary to understand the scope of the present invention to be described hereinafter will be given. To this end, the programmable typewriter 12 includes a keyboard 13A, 13B and 13C which is used by an operator to enter data in the memory of the typewriter. Once the data has been entered, a printing mechanism (not shown) which may be of the so-called daisywheel printer is controlled by a microcomputer to reproduce the stored data. It is worthwhile noting that data for printing may be transferred from a nonvolatile storage such as a disk file 14 to the memory and then printed on the recording media such as a sheet of paper.

The function of the sheet handling device 10 (to be described hereinafter) is to supply cut sheets to the printing mechanism and to receive printed sheets from the mechanism. To this end, the sheet handling device 10 includes a removable cassette 16 and a pack feed 18. The cassette functions, in part, as a paper storage and carries the stack of plain sheets on which data is printed. The cassette also functions to store print sheets outputted from the printer. The pack feed 18 contains the electrical and mechanical elements which move paper from the cassette to the platen roller of the typewriter/printer and for returning paper from the platen to the cassette. A mounting plate and locating pins are coupled to the pack feed 18 and mounts the pack feed to the programmable typewriter 12. The preferred orientation of the pack feed is perpendicular to the horizontal frame of the typewriter. The removable cassette 16 extends upwardly at an angle with respect to the pack feed. A paper feed channel is formed by upper guide plate 72 (FIG. 2) and lower guide plate 74 (FIG. 2). The

guide plates are connected to the pack feed and enable a sheet to be reverse-indexed into the sheet supply compartment. A guide plate 82 is mounted to the exit end of the cassette. The plate further ensures that paper is transported bidirectionally.

A horizontal mounting plate 30 is fastened to the frame of the typewriter. This mounting plate defines the reference plane between the typewriter 12 and the sheet handling device 10. Holes are fabricated within the typewriter cover and the mounting plate 30. In order to attach the sheet handling device to the typewriter, the locating pins 52 and 54 are placed in the holes which are disposed on the horizontal mounting plate. The locating pins mate with the holes and mount the sheet feeding device to the typewriter.

The typewriter includes a single connector block 34 through which electrical signals are transmitted from the typewriter to the sheet handling device. Similarly, the sheet handling device has a single connector block 32 through which communication between the typewriter and the sheet handling device is achieved. The connector block which is associated with the typewriter is identified by numeral 32 and is mounted on horizontal mounting plate 30. The connector block 34 is fixedly mounted on the undersurface of mounting plate 30. The connector block 34 is spring-loaded upwardly while the connector block 32 extends downwardly. As such, when the sheet handling device 10 is placed on the typewriter 12, the connector blocks (32 and 34) are self-aligned and electrical signals are transported between the units. In the preferred embodiment of this invention, the connector block 32 is a female connector block while the connector block 34 is a

male. Both connector blocks are conventional and fabricated by the 3M Company.

FIG. 2 shows a cross section of the sheet handling device 10 and a portion of the programmable typewriter 12. The programmable typewriter 12 includes a platen roller 36. The function of the platen roller 36 is to transport a sheet of paper (not shown) so that the print mechanism (not shown) can print data on the sheet. Since the use of platen rolls in a typewriter for driving sheets is well known, details will not be given. Suffice it to say that a motor, not shown, drives the platen roller 36 so that a sheet is indexed (forward and/or backward) to present a print line to the print mechanism. Pressure rollers 38 and 40, respectively, hold the sheet (not shown) against the surface of platen roller 36. Details of the bail mechanism will be described subsequently. Electrical signals are transmitted between the sheet handling device 10 and the programmable typewriter 12 by connector means 42. As stated before, connector means 42 comprises male connector 34 and female connector 32. The female connector is mounted to the undersurface of mounting plate 20, while the male connector 34 is spring-loaded and extends upwardly from horizontal mounting plate 31.

Still referring to FIG. 2, the sheet handling device 10 comprises removable cassette 16 and pack feed 18. The pack feed 18 carries the electrical and mechanical components of the sheet handling device, while the removable cassette functions as a paper supply and paper receiving receptacle. The pack feed 18 comprises side members 44 and 46, respectively (FIGS. 3 and 4). The side members are arranged in spaced-apart relationship and configured

so that when a viewer faces the machine, side member 44 is disposed to the left side of the viewer and side member 46 is disposed to the right side. Of course, the orientation may be reversed without departing from the scope of the present invention. Each of the side members is fabricated from a polygonally shaped metal plate with the lower edge identified by numeral 48 and 50 (FIGS. 3 and 4) flared outwardly and runs parallel to horizontal mounting plate 30. As stated previously, horizontal mounting plate 30 is bolted to the flared section of side members 44 and 46, respectively. A pair of locating pins 52 and 54 are fastened to the mounting plate 30 and the respective flared or horizontal sections of the side members. As stated previously, the locating pins fit into clearance holes which are drilled through cover members 56 and 58 to anchor into locating holes drilled in horizontal mounting plate 31 (FIG. 2) to mount the pack feed 18 in an upright position relative to typewriter 12.

Still referring to FIG. 2, a backplate identified by numeral 60 is mounted by screws 64 and 68 (FIGS. 2 and 3) to side members 44 and 46 respectively. The back plate is disposed at an angle relative to the mounting plate 20. The back plate is part of the pack-feed frame. It also functions as a guide and support surface for cassette 16. To this end, when the cassette is positioned in operating relationship with the pack feed, surface 70 of the cassette sits against the back plate. The cassette 16 comprises two compartments identified by numerals 80 and 84, respectively. The compartments form a unified structure stacked on top of one another. Compartment 80 supplies cut sheets to platen roller 36. The platen roller then transports the sheets

bidirectionally so that the print mechanism prints on the sheet. Compartment 84 accepts and stores sheets with printed data thereon.

As was stated previously, one aspect of the present invention is that the automatic sheet handling device allows the platen to transport the sheet bidirectionally (that is into and out of the sheet supply compartment). To achieve this function, a first sheet guide channel 76 is formed at the exit end of the pack feed. The first sheet guide channel 76 coacts with a second sheet guide channel 78 to guide sheets from the sheet supply cassette onto the platen roller 36. The first sheet guide channel is formed by a lower paper guide plate 74 and an upper paper guide plate 72. The lower paper guide plate 74 is fabricated from an elongated piece of relatively thin material. The geometry of the material is substantially U-shaped. Mounting flanges (not shown) are formed on the ends of the lower paper guide. The flanges are used for mounting the lower paper guide to side members 44 and 46, respectively. Similarly, upper paper guide plate 72 is fabricated from an elongated piece of material. FIG. 7 shows a pictorial view of the upper paper guide plate. The plate is fabricated from an elongated member which is configured so that the central section 22 slopes outwardly while the outer sections 23 and 24 slope inwardly. Flanges are fabricated on the opposite end of the upper plate guide. The flanges, one of which is shown in FIG. 2 and identified by numeral 26, are used to mount the upper plate guide onto side members 44 and 46, respectively. In FIG. 2, flange 26 mounts the upper paper guide plate 72 to side member 44. Likewise, the other end of the plate 72 is mounted to plate 46 (FIG. 3) by mounting means 25.

Referring to FIGS. 2 and 5, a set of spaced projecting fingers 82 and 81 extend from undersurface of sheet receiving receptacle 84. The free end 83 of the projecting fingers is chamferred. The projecting fingers are hereinafter referred to as the third guide means which functions to guide a sheet during reverse indexing into the supply compartment 80. The projections also function as retainers for the stack of cut sheets in compartment 80. The surface 86 of the sheet-receiving receptacle 84 is rounded or chamferred. This further allows sheets to be fed back into the supply compartment 80.

Still referring to FIG. 2, sheets are driven from sheet supply compartment 80 by a plurality of D-shaped rollers (only one of which is shown in FIG. 2 and identified by numeral 92). The rollers are mounted in spaced-apart relationship on shaft 94. The shaft is journalled for rotation inside side members 46 and 44, respectively. As will be explained subsequently, for each revolution of the shaft, the curved surfaces of the D-shaped rollers force the sheet out of the sheet supply tray until the leading edge of the sheet (not shown) is positioned between the drive platen roller 36 and the back-up roll 40. At that point, the flat surface of the D-shaped roller is again positioned in parallel relationship with the stack. Because of the gap which now exists between the flat surface of the roller and the top of the stack, the platen roller 36 which now controls (that is moves the sheet) may reverse index (that is move the sheet back into the stack) or forward index (that is move the sheet out of the stack). As the sheet is positioned either in the forward or backward position, the printing mechanism can perform

subscript, superscript, etc. as is needed. As will be explained subsequently, the bottom surface 96 of the sheet supply compartment is bias by a biasing means (not shown) in a direction upwardly towards the D-shaped rollers. Also, double sheet feed is prevented by corner bucklers which are disposed at the exit corners of the cassette.

Referring now to FIGS. 3, 4 and 8A-8B, the drive mechanism which drives the D-rollers so that the topmost sheet in a stack (not shown) is driven from supply compartment 80 onto platen roller 36 and printed sheets be driven by feed roller 88 into the receiving compartment 84, is shown. The mechanism is a motor-driven, one-revolution clutch device identified by numeral 83. The mechanism includes a clutch plate 98 which is fixedly mounted to shaft 94. A ratchet 100 is mounted on shaft 94 and in spaced relationship to clutch plate 98. A pulley 102 is mounted on the shaft of the ratchet. A pawl 104 is pivotally mounted to one surface of the clutch plate. A pick finger 106 is coupled to solenoid 108. The pick finger 106 is biased by biasing means 110 so that the finger is toward the pawl which rides on the clutch plate. As will be explained subsequently, whenever the solenoid 108 is energized, the pick finger 106 is driven away from the pawl allowing it to engage the ratchet. FIG. 8C shows the ratchet rotating as an independent unit. Rotation is in the direction shown by the arrow. Likewise, FIG. 8B shows the pawl rotating with the ratchet. Rotation is in the direction shown by the arrow. Because the D-wheels are rigidly coupled to shaft 94, as the pawl (or clutch plate) rotates the D-wheel also rotates with the curved surface contacting the topmost sheet in the stack and feeding the sheet therefrom. As the clutch assembly

completes a full rotation, the pick finger engages the pawl and disengages the clutch plate from the ratchet. Stated another way, for each revolution of the clutch plate, the topmost sheet is fed from the stack. This process continues until the sheets are fed from the sheet supply tray.

In order to drive the pawl ratchet assembly and its attached D-wheels, a DC motor (not shown) is mounted by mounting plate 111 to the side member 44. A pulley 112 rides on shaft 114 of the DC motor. A pulley belt 116 couples the output of the drive motor to pulley 104 and the pulley 118. The pulley 118 is mounted to shaft 120. Shaft 120 is journalled for rotation in side members 44 and 46, respectively. Drive roller 88 (FIG. 2), which feeds a sheet outputted from platen roller 36 into receptacle 84, is fixedly mounted to shaft 120. As can be seen in FIG. 3, when the drive motor (not shown) rotates shaft 112 and pulley 114, pulley 104 and pulley 118 are also rotated. The D-rollers which are coupled to shaft 94, are rotated intermittently, while the feed roll 88, which is coupled to shaft 120, is continuously rotating. This configuration enables printed sheets to be driven from the platen roller 36 into sheet receiving receptacle 84 and new sheets for printing are fed onto the platen roller. It should be noted that the configuration does not require synchronous timing between the mechanism which feeds paper from the printer and the device which supplies paper to the printer.

Turning to FIGS. 2 and 4, the back-up roller 90 (which coacts with the continuously rotating feed roller 88 to feed a sheet from the printer) is coupled to shaft 122 by mechanical linkage or spring

124. A mechanical linkage 123 is coupled to solenoid 126 and shaft 122. The shaft is pivotally mounted in side members 46 and 44, respectively. When the solenoid is picked, the back-up roller 90 contacts the surface of drive roller 88. However, when the roller is not picked there is a space (not shown) between the back-up roller 90 and the drive roller 88. With this space, the platen roller 36 can control a sheet into and out of the printed sheet receptacle 84. To this end, the solenoid 126 is controlled so that when a sheet is under the control (that is driven) by platen roller 36, the solenoid is deactivated which results in the space being formed between roller 90 and 88, respectively. However, when the sheet is no longer under the control of platen roller 36, the solenoid is picked and a sheet is driven by back-up roller 90 and drive roller 88 into the printed sheet receptacle.

Referring still to FIGS. 2 and 5, a cross-sectional view and a plane view of cassette 16 is shown. The cassette 16 comprises a sheet supply compartment 80 and a printed sheet receptacle 84. The sheet supply receptacle 80 carries a stack of sheets (not shown) while the printed sheet receptacle 84 receives and stores sheets outputted from the printer. The sheet feed receptacle 80 and the printed sheet receptacle 84 are arranged in a vertical plane one on top of the other. When the cassette is mounted in the pack feed 18, the cassette extends upwardly at an angle relative to the top surface of the typewriter. The sheet feed compartment is the low compartment and is fitted with a movable bottom 96 which is spring biased upwardly. The bottom outer surfaces 70 and 128 are inclined relative to each other with an obtuse angle form at the inside surface. Corner buckles 130 and 131 are disposed at opposite corners

of the exit end of the cassette. The floor 96 is biased so that the sheets rest on the underside of the corner bucklers. Front wall 132 is connected to the bottom 70. The front wall acts as a forward stop for sheets in the cassette. The printed sheet receptacle 84 is disposed above the sheet supply receptacle 80. The printed sheet receptacle 84 comprises bottom wall members 134 and 136, respectively. The members are inclined at an angle relative to each other. The inclination is such so that an obtuse angle is formed at the inside of the bottom wall members. A front wall member 138 is connected to bottom wall member 134. The function of the front wall member 138 is to support printed sheets as they are hurled and the stack is formed in the printed sheet receptacle tray 84. Put another way, the forward end of the sheets are supported against front wall member 148. The front wall member 138 is receded from lower front wall member 132 in a direction opposite to that of forward sheet feed. This configuration creates a space between the upper printed sheet receptacle and the lower supply sheet receptacle. This space is utilized by the D-shaped rollers to feed the topmost sheet from the stack into the printing machine.

Side walls 140 and 142 (FIGS. 2 and 3) extend upwardly from bottom member 128 and above bottom member 136. Inward projecting walls 146 and 144 are connected to the top surfaces of side walls 140 and 142. The projecting walls act as a sheet retainer so that the printed sheet receptacle 84 of the cassette retains sheets outputted from the printer. Bottom wall 134 has projecting fingers 82 and 81, respectively. As stated before, the under surface of the edge where members 134 and 138 meet is chamferred. Also, the free ends of projecting

fingers 82 and 81 are chamferred at an angle inclined to the top sheet on the stack. The chamferring enables a sheet to be reverse indexed into the supply tray. The radius of the corner bucklers are relatively large, and as such, the top sheet is driven around the radius as it buckles. This tends to help to feed a single sheet from the stack. More details of the bucklers can be found in an article entitled "Paper Feed System" published in IBM Technical Disclosure Bulletin Vol. 24, No. 10, March 1982 at pages 5028-5030. That article is incorporated herein by reference.

With reference to FIGS. 2 and 5, projecting fingers 82 and 81 are disposed in spaced relationship across the width of the paper stack. Stationary picker rollers, only one of which is shown in FIG. 2 and identified by numeral 92, are fitted to shaft 94. The shaft runs traversely to the direction of forward sheet motion. As stated before, the picker rollers are of a D-shape cross section and for each rotation, it separates and drives a sheet from the stack into the printer. The distance that a sheet moves in the forward direction is determined by the diameter of the drive rollers. When the rollers rotate, the sheets are driven from under the bucklers and into the feed channel towards the printer. The rollers are stationary and only one revolution is needed to corner buckle a sheet and pass it over the top surface of lower front member 132. The D-shaped rollers allow removal and insertion of the cassettes and also enable reverse indexing. Projecting fingers 82 and 81 maintain the sheet in a flat position and maintain clearance between the top sheet and the flattened surface of the D-roll.

The penetration of the cassette 16 into the pack feed 18 is controlled by a pair of stops 152 (FIG. 3) and 154 (FIG. 4). The stops are fastened to the side of the cassette. In order to hold the cassette firmly in the pack feed, and to force it into registry against the left side member 44 of the pack feed (FIG. 3), a pair of spring-like members 156 and 158 are molded in the upwardly extending side plate member of the cassette. Although the cassette can be manufactured from various manufacturing processes, in the preferred embodiment of this invention the cassette is molded from plastic or hard rubber. Of course, other materials can be used without departing from the scope of this invention.

B. Automatic Bail Opener

Referring now to FIGS. 2, 9, 10, 11 and 12, the sheet positioning control device (including bail roller 40, FIG. 2) which clamps a sheet (not shown) against the platen roller 36 is shown. Common elements in the figures will be identified by the same numerals. The sheet positioning control device, according to the teaching of the present invention, includes a bail mechanism 200. The function of the bail mechanism is to hold a sheet (not shown) against platen roller 36. FIGS. 10 and 11 show the bail mechanism in the open position. In this position, a sheet of paper (not shown) can be loaded onto platen 36. FIGS. 9 and 12 show the bail mechanism 200 in the closed position. In this position, the sheet of paper (not shown) is trapped between the bail mechanism and the outside surface of the platen roller 36. The bail mechanism 200 includes an elongated shaft 202 which runs parallel to the width of platen roller 36. A plurality of back-up rollers, one of which is shown in FIG. 11 and identified by numeral 40, is mounted in spaced relationship on shaft 202. The function of the

back-up rollers is to hold a sheet of paper (not shown) against the platen roller. A pair of mounting bracket assemblies 204 and 206 are coupled to each end of the bail mechanism. The mounting brackets, in turn, are pivotally coupled to the frame 208 of the typewriter/printer. An over-center spring mechanism 210 is connected to the mounting bracket assembly 204 and to the frame 208 of the typewriter/printer. Similarly, over-center spring mechanism 211 is connected to mounting bracket assembly 206 and to frame 208. The function of the over-center spring mechanism is to bias the bail mechanism in one of its two operational positions. For example, when the bail mechanism is open, as is shown in FIG. 10, then the over-center spring is positioned so as to bias the bail mechanism away from the platen roller 36. In this position, paper can be loaded against the platen. Similarly, when the bail mechanism is against the platen roller as is shown in FIG. 9, the over-center spring 210 is positioned so as to bias the bail rollers against the surface of platen roller 36. A stop means 212 is mounted to frame 208 and in relative position to mounting bracket assembly 204. The function of the stop means is to stop the movement of the mounting bracket assembly 204 as it transports the bail mechanism away from the platen roller 36. A sensing mechanism 214 is mounted to frame 208. The function of sensing mechanism 214 is to generate an electrical signal when the bail mechanism is in its open position. To this end, the sensing mechanism 214 is mounted relative to mounting bracket 206. When the mounting bracket is in the open position, that is away from the platen, the mounting bracket 204 coacts with the sensing mechanism 214 and an electrical signal is generated. As will be explained subsequently, the electrical signal is

utilized by the microcomputer which drives the automatic document feed and the bail mechanism to feed a sheet of paper onto the platen, Although different types of sensing mechanisms can be used, in the preferred embodiment of this invention, the sensing mechanism is a conventional microswitch.

Referring now to FIG. 12, the mechanical means which is used to open the bail manually is shown. The mechanical means includes a lever mechanism 216. The lever mechanism is pivotally coupled to the typewriter/printer frame and coacts with the mounting bracket assembly 206 to open and close the bail mechanism. The mechanical lever is coupled by mechanical means 215 to mounting assembly 206.

Still referring to FIGS. 9, 10 and 11, there is shown the automatic means which is used to open and close the bail mechanism relative to platen 36. The automatic means includes a bail linkage, hereinafter referred to as shuttle 218. The shuttle is an elongated member having a curved end which is mounted by mounting means 220 to mounting bracket assembly 204. The shuttle member 218 is further characterized by a stepped configuration 222 in the center of the member. An elongated slot 224 is fabricated in the shuttle member. As will be explained subsequently, the slot rides on a fixed pin 246 to shuttle the member in a direction shown by arrow 226 to open and close the bail. The shuttle member is further characterized by a bifurcated section having legs 226 and 228, respectively. In the preferred embodiment of this invention, leg 228 is shorter than leg 226. Also leg 226 includes an integral curved section 230. The section identified by numeral 230 is substantially perpendicular to leg 226. Also,

integral curved section 229 is fabricated on leg 228. As will be described subsequently, a transport mechanism coacts with element 230 and leg 228 to transport the shuttle member and its associated bail mechanism along the transport path. By way of example, when it is time to open the bail automatically, stud 232 pushes against element 229 (FIG. 9). Similarly, when it is time to close the bail, stud 232 pulls on the underside of element 230 (FIG. 10). To this end, for each rotation of crank 234, the bail mechanism goes through a complete cycle of opening and then closing. It should be noted that the drive motor 236 rotates in one direction only to effectuate the operation (that is closing and opening of the bail).

Still referring to FIGS. 9, 10 and 11, the mechanism which positions the bail when the machine is running in the automatic load mode, includes a drive motor 236 The motor has a gear member 238 rigidly mounted to its shaft. The motor and its attached gear is mounted to support frame 240. The support frame 240 is mounted by screws 242 and 244 to the frame of the typewriter/printer. A crank mechanism 234 is mounted by mounting means 246 to mounting frame 240. A stud 232 extends upwardly from the surface of crank 234. As crank 234 is driven by gear 238, the crank 232 is positioned to push or pull shuttle member 218 to open or close the bail. A second stud 246 extends upwardly from the surface of mounting bracket 240. Slot 244 rides against the rigid stud 246 to position the bail mechanism relative to the platen.

As stated before, the bail mechanism is primarily used to allow the automatic paper feed mechanism to feed paper into the paper entry path of the

typewriter/printer. When the automatic paper feed function is activated, a signal is sent from the controller, to be described hereinafter, to drive the bail motor 236. The crank 234 has a stud 232 which extends from its face and drives the shuttle 218. When the bail reaches its open position, the force exerted on the bail arm by spring means 210 keeps the bail in its open position (FIGS. 10 and 11). When the bail is in the open position, a signal is generated from the microswitch 214 and is transmitted back to the controller. The signal informs the controller that the bail is in the open position. The automatic paper feed then feeds paper onto the platen. After the paper is positioned about the platen 36, the motor continues its rotation in the same direction as it did to open the bail, to close the bail. Also in the manual mode of operation, the operator pulls on manual lever 216 to open the bail. Additional pulling in the same direction causes the lever to coact with switching means 213. The signal activates the bail motor (not shown) to feed the sheet (not shown) to the first print line.

By using this mechanism, several benefits inure to the user. The mechanism allows the rotation of the motor shaft to be in the same direction for opening and closing of the bail hardware.

The shuttle action of this mechanism allows inexpensive parts to be used as compared to expensive camming hardware of the prior art.

The shuttle approach allows normal manual actuation of the bail by lever 216 located outside the machine.

Referring to FIG. 6, there is shown a flowchart of a program which is used to program the controller which controls the automatic document feeder and the automatic manual sheet positioning device. Preferably the controller is a conventional microcomputer. The computer is programmed in accordance with the above flowchart shown in FIG. 6. Of course, combinational logic and other means can be used for driving the automatic document feeder without departing from the scope of the present invention.

In addition to the controller, a sensing device is provided at the platen. The device is referred to as the platen sensor which senses and generates signals indicative of the position of the paper relative to the platen. A paper bail is automatically driven to open and close and, as such, entraps and releases paper relative to the platen.

The above cross-referenced application describes an automatic document feeder which can be used with the present invention. The automatic document feeder is controlled so that when a sheet of paper is needed, it is fed automatically onto the platen roller. When the sheet is properly positioned on the platen, the bail is closed. The loading routine of the printer requires that a sheet of paper be driven from the paper supply tray 80 (FIG. 2) between platen roller 36 and back-up roller 40. Once the sheet is entrapped between the back-up roller 40, and the platen roller 36, forward motion of the roller and the paper is in the direction shown by arrow 160. As the platen rotates, the sheet is driven between back-up roller 38. A sensing device, preferably of the light-emitting/light-receiving type (not shown), is disposed on the machine frame,

preferably relative to the back side of the roller 36. The device is disposed so that as the leading edge of a sheet approaches the device, the light beam is interrupted and a signal is provided indicating that the leading edge of the sheet is present. Once that signal is generated, the platen roller 36 drives the sheet for a predetermined distance. The distance is sufficient to position the sheet at a first print line. The print head which is disposed on the front side of the platen roller 36 then begins to print. As the paper is indexed by the rotary motion of the platen 36, additional lines are printed. As soon as the trailing edge of the paper leaves the sensor, a change occurs in the signal level. This change is utilized to activate the solenoid which closes the back-up roller 90 against feed roller 88 (FIG. 2). As was stated previously, the feed roller 88 is always rotating when the motor is running. The back-up roller coacts with feed roller 88 to feed sheets from the print mechanism into the print receptacle tray.

Returning now to FIG. 6, there is shown a flowchart which drives the microcomputer which controls the automatic device and the automatic/manual sheet positioning device. Of course it is within the skill of the art to generate other programs without departing from the scope of the present invention. The structure of the program is as follows:

a) A start paper exit step. This step ensures that the drive motor (previously described) and the exit solenoid is on. The exit solenoid controls back-up roller 90.

b) A paper feed operation. This operation feeds a blank sheet of paper onto the platen roller. The pick solenoid is identified by numeral 108 (FIG. 3). The solenoid allows the pawl to engage the ratchet and as a result, the D-rollers feed sheets from the supply container.

c) A paper exit operation. The operation ensures that paper is removed from the printer.

d) An open bail operation.

e) A platen feed operation. The operation indexes the paper to the first print line.

f) A close bail operation. The operation closes the bail relative to the platen.

Each of the above steps or operations is identified by similar letters in FIG. 5. Where multiple blocks coact to perform a single step, the blocks are bracketed. The program includes a retry branch which is evident in FIG. 5 and the details will not be given. Suffice it to say that if the above steps were not completed on a first try, a retry cycle is initiated. If the retry is not successful, the system sends an error message to the operator and the operation ends. The steps in between are generally timing steps which are self-explanatory from the flowchart and, as such, will not be described on a block-by-block basis. Also, the bail switch is a microswitch which is mounted to the frame of the machine (not shown) and whenever the switch is made, informs the machine that the bail is now opened.

OPERATION

In operation, an operator removes the cassette from the pack feed. As stated before, the pack feed is mounted in an upright position on the top cover of the typewriter. The operator loads a pile of cut sheet paper which may include letterhead, etc. in the lower compartment of the cassette. The cassette is then placed back in the pack feed against the back wall of the back plate. The penetration of the cassette in the pack feed is controlled by the stops which are disposed on opposite, upwardly extending sides of the cassette. The spring-like members on one side of the cassette, forces the cassette against the left side registration side member and holds it firmly in the pack feed. When a sheet of blank paper is needed, a signal is generated from the main microprocessor which controls the printer. The signal is transmitted across the interface connectors to the pack feed motor. The pack feed motor is energized and the solenoid is energized. As the pack feed motor rotates with the shaft and attachments, the solenoid allows the pawl to contact the ratchet. This forces the clutch to rotate the D-rollers and the curved surface of the D-rollers forces the sheet out of the supply compartment onto the platen. At the end of the rotation, the solenoid is dropped and the clutch is disconnected from the rotating ratchet. At this point, the sheet is under the control of the platen, and the D-roll is positioned so that the flat surface is disposed in spaced relationship to the top sheet in the stack. The space enables the sheet to be indexed in and out of the sheet supply tray. As described above, the guide channel formed by the upper guide member, the lower guide member, the third guide member and the chamferred edges ensure that the sheet is reverse-indexed into the tray. As the trailing edge of the sheet passes the platen sensor,

a signal is generated which subsequently activates or picks the solenoid which coacts with the back-up roller to feed the sheet into the upper printer sheet receptacle.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

Claims:

1. In a typewriter/printer having a platen roller (36) for positioning a recording sheet and a bail (40) for holding the sheet against said platen roller and a device for opening and closing the bail, characterized by

an elongated lever means (204) having one end coupled to the bail (40) and constrained to shuttle along a substantially linear path;

a drive motor (236) and

a mechanical coupling means (218, ..., 238) disposed to transmit motion from the motor to the lever means so that for each revolution of the motor, the lever means is driven bidirectionally to open and close the bail.

2. The device of claim 1 further including a lever means coupled to the bail, said lever means (216, Fig. 12) being operable for manually closing and opening of the bail.

3. The device of claim 1 wherein the mechanical coupling means including a pinion gear (238) mounted to the shaft of the motor (236);

a crank gear (234) disposed relative to said pinion gear and operable to be driven thereby; and

a pin (232) extending from the surface of the crank gear, said pin being operable for driving the lever means (218, 204).

4. The device of claim 1, said device comprising a mounting bracket (208, 240) connected to the frame of the typewriter/ /printer, said mounting bracket having a first pin (246) extending from its surface:

said drive motor (236) mounted to said bracket;

a pinion gear (238) mounted to the drive shaft of said motor;

a rack gear (234) mounted to the bracket and in driving engagement with the pinion gear, said rack gear having a drive pin (232) extending from its surface; and

an elongated member (218) having one end connected to the bail (204) with a control slot for shuttling on the first pin (246) and a bifurcated end (226, 228) coacting with said drive pin (232) to drive said member to open and close the bail.

FIG. 1

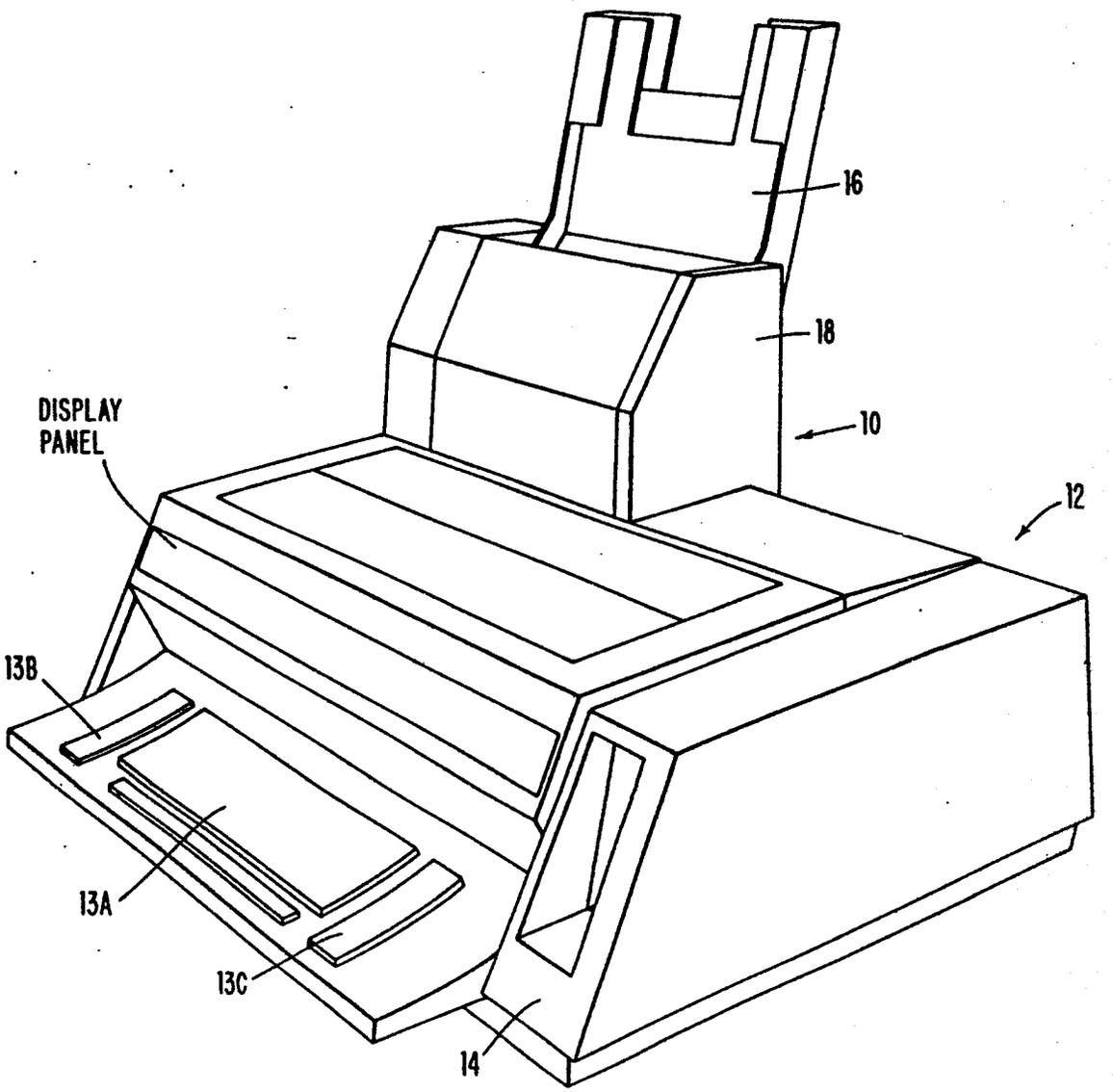
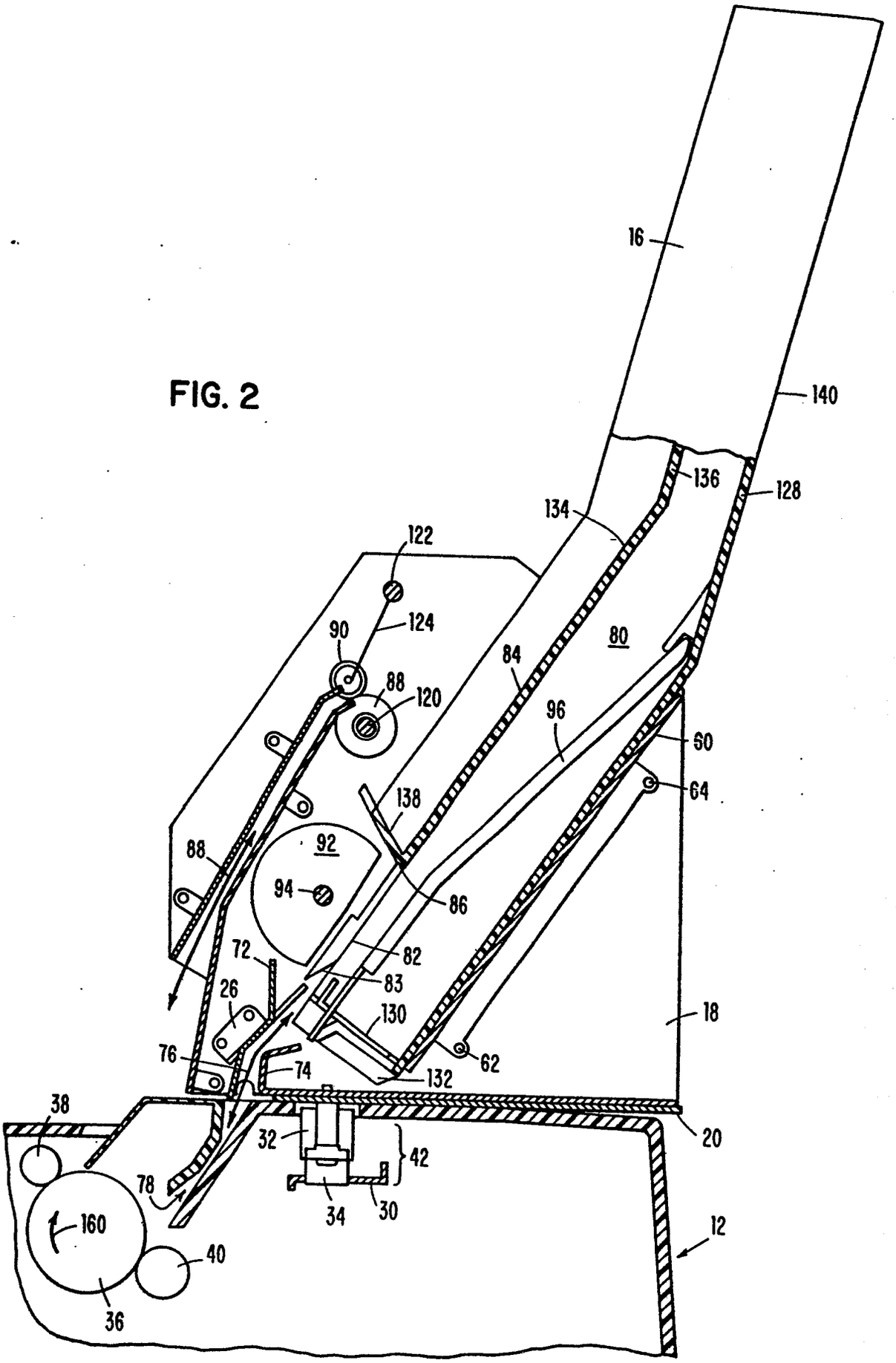


FIG. 2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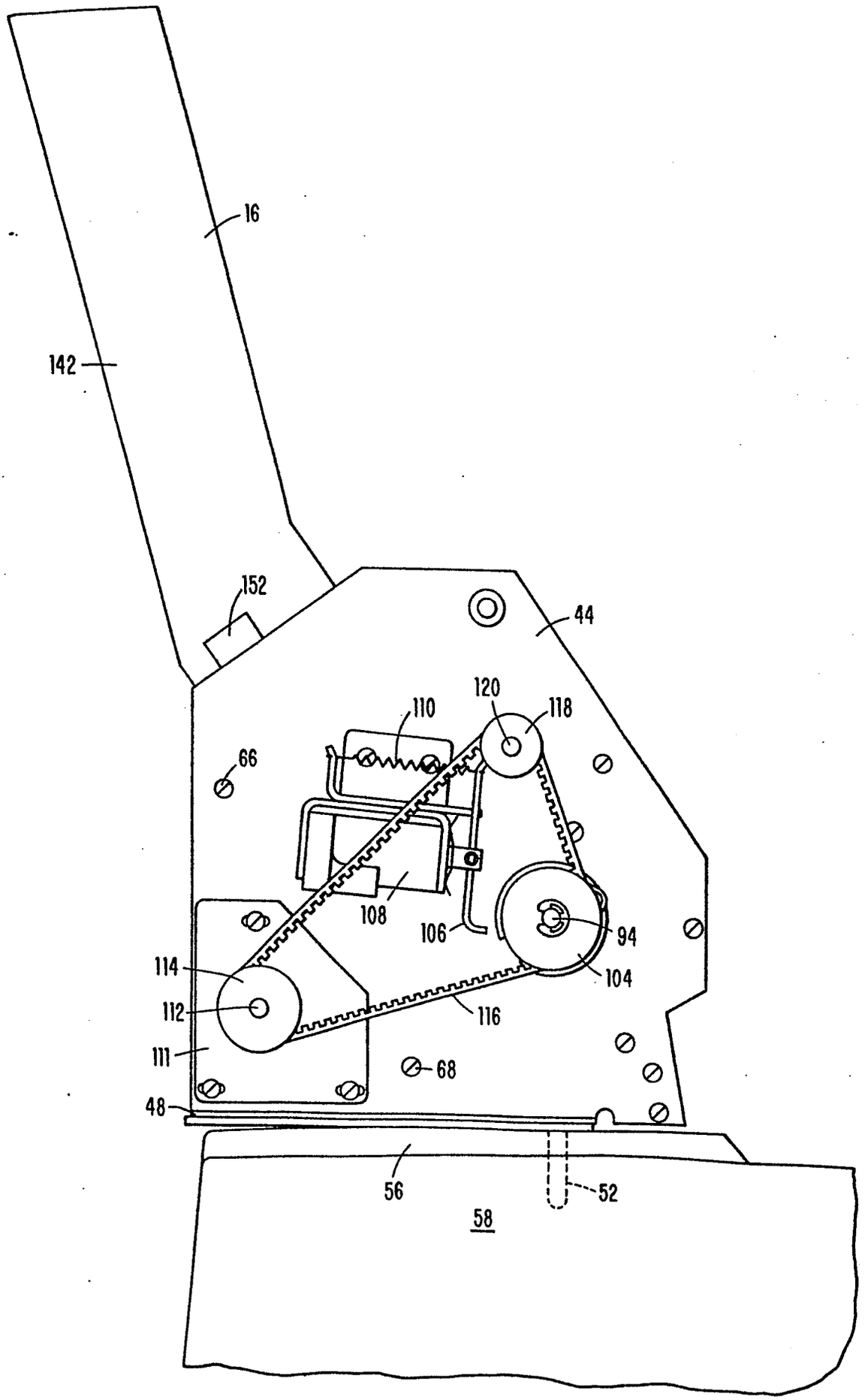
36

FIG. 3


16
142
152
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104
114
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111
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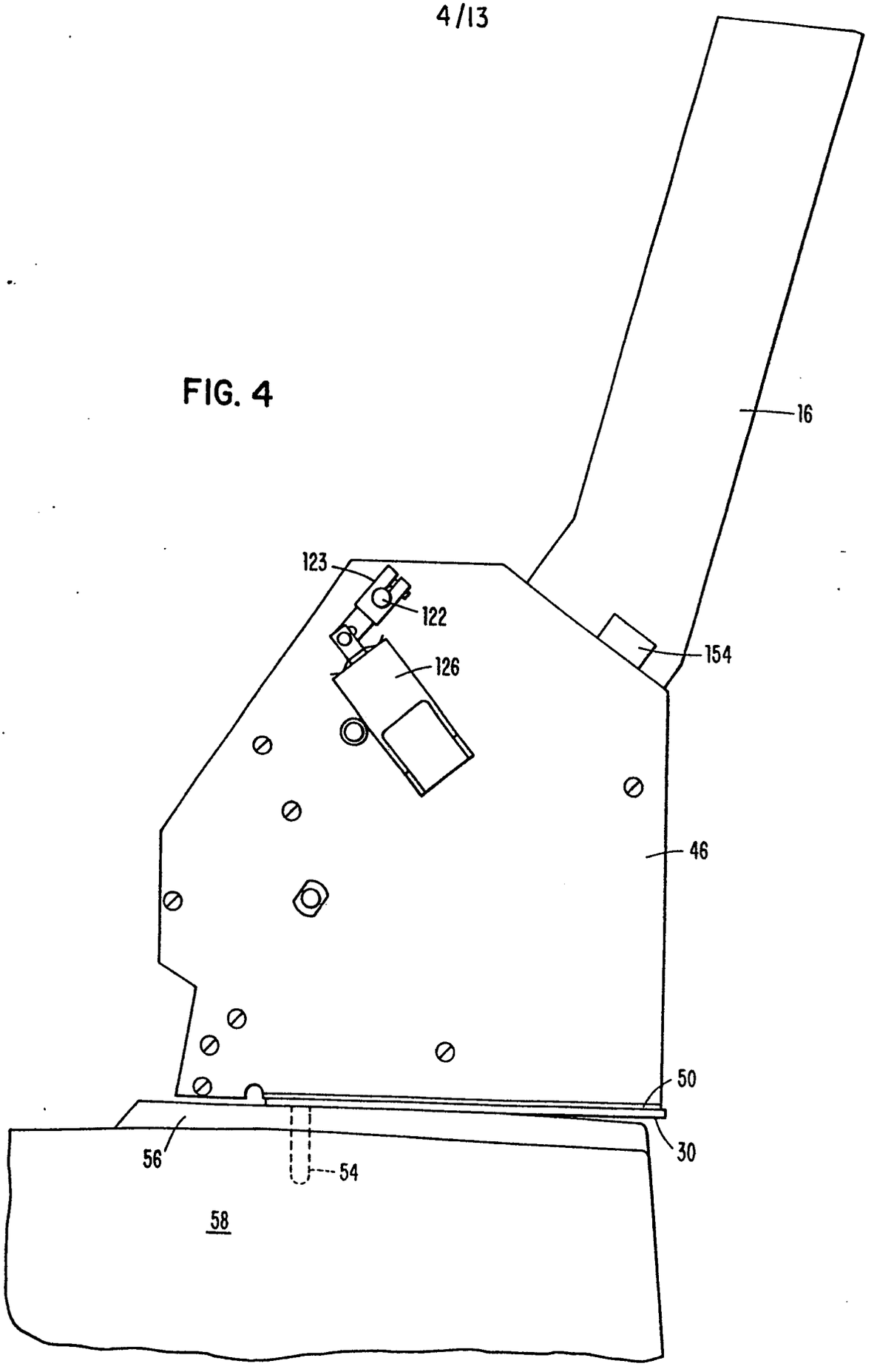
FIG. 4



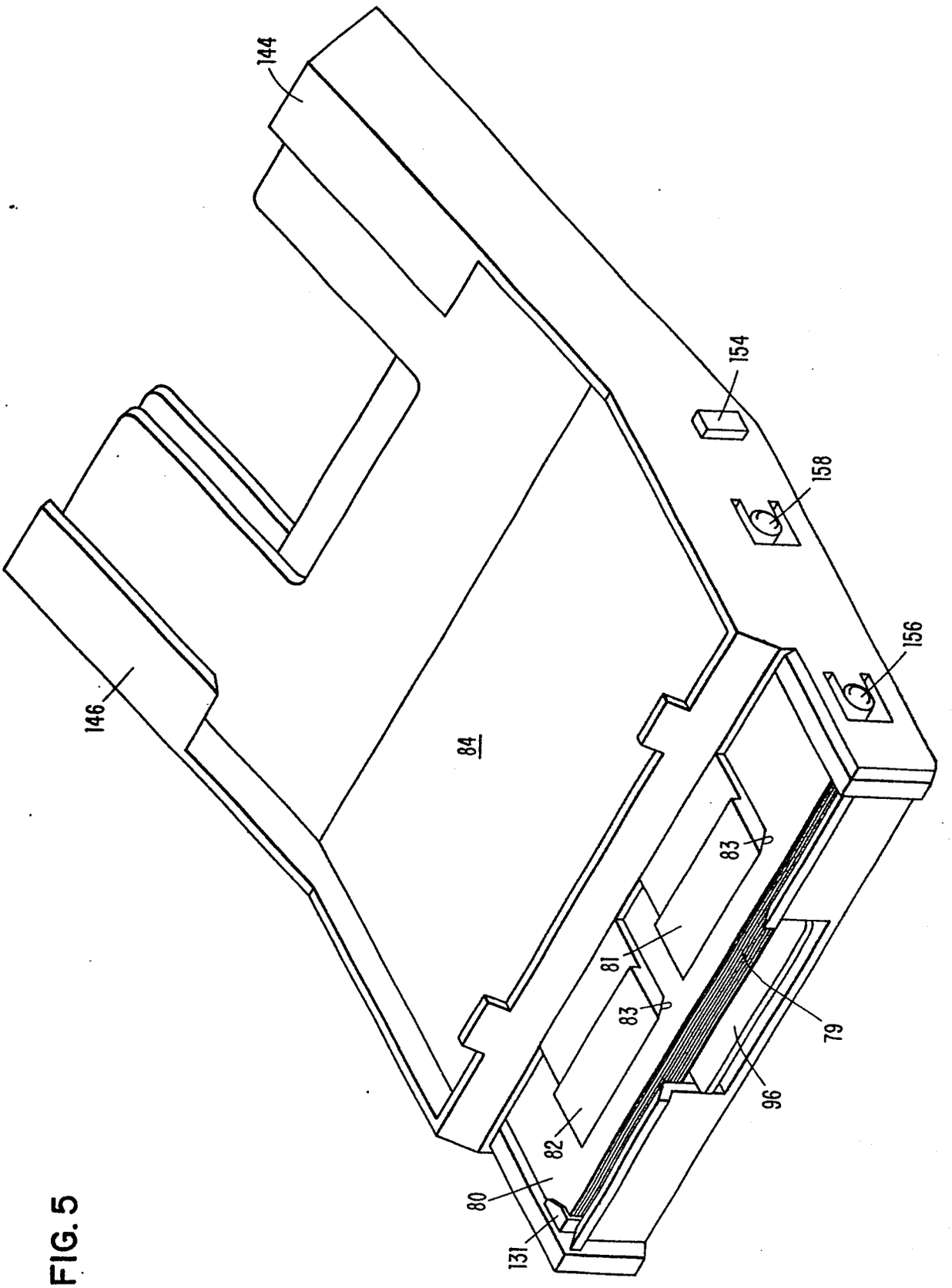
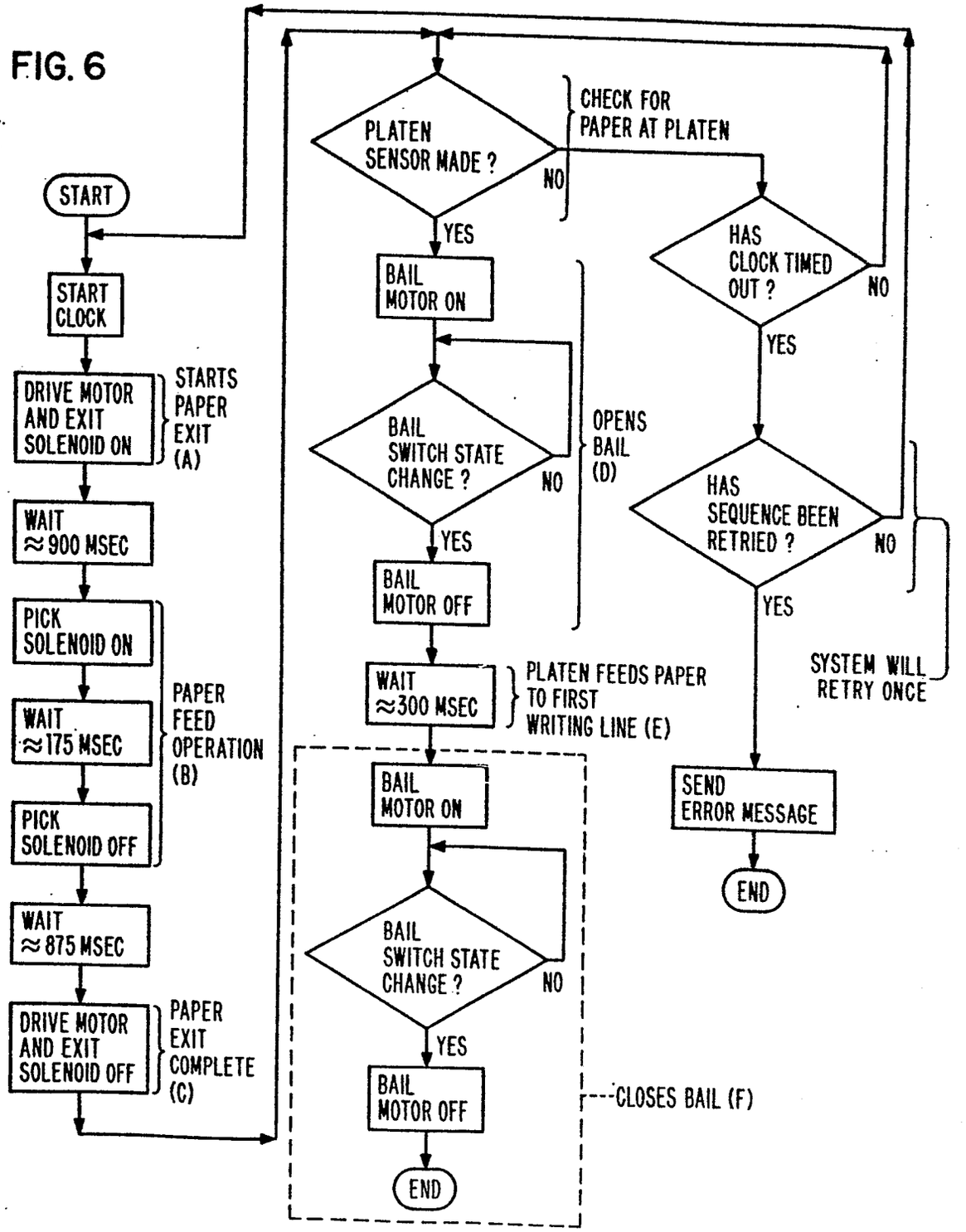


FIG. 5

FIG. 6


START
START CLOCK
DRIVE MOTOR AND EXIT SOLENOID ON
STARTS PAPER EXIT (A)
WAIT ≈900 MSEC
PICK SOLENOID ON
WAIT ≈175 MSEC
PICK SOLENOID OFF
PAPER FEED OPERATION (B)
WAIT ≈875 MSEC
DRIVE MOTOR AND EXIT SOLENOID OFF
PAPER EXIT COMPLETE (C)
PLATEN SENSOR MADE ?
CHECK FOR PAPER AT PLATEN
NO
YES
BAIL MOTOR ON
BAIL SWITCH STATE CHANGE ?
NO
YES
BAIL MOTOR OFF
OPENS BAIL (D)
WAIT ≈300 MSEC
PLATEN FEEDS PAPER TO FIRST WRITING LINE (E)
BAIL MOTOR ON
BAIL SWITCH STATE CHANGE ?
NO
YES
BAIL MOTOR OFF
END
CLOSES BAIL (F)
HAS CLOCK TIMED OUT ?
NO
YES
HAS SEQUENCE BEEN RETRIED ?
NO
YES
SYSTEM WILL RETRY ONCE
SEND ERROR MESSAGE
END

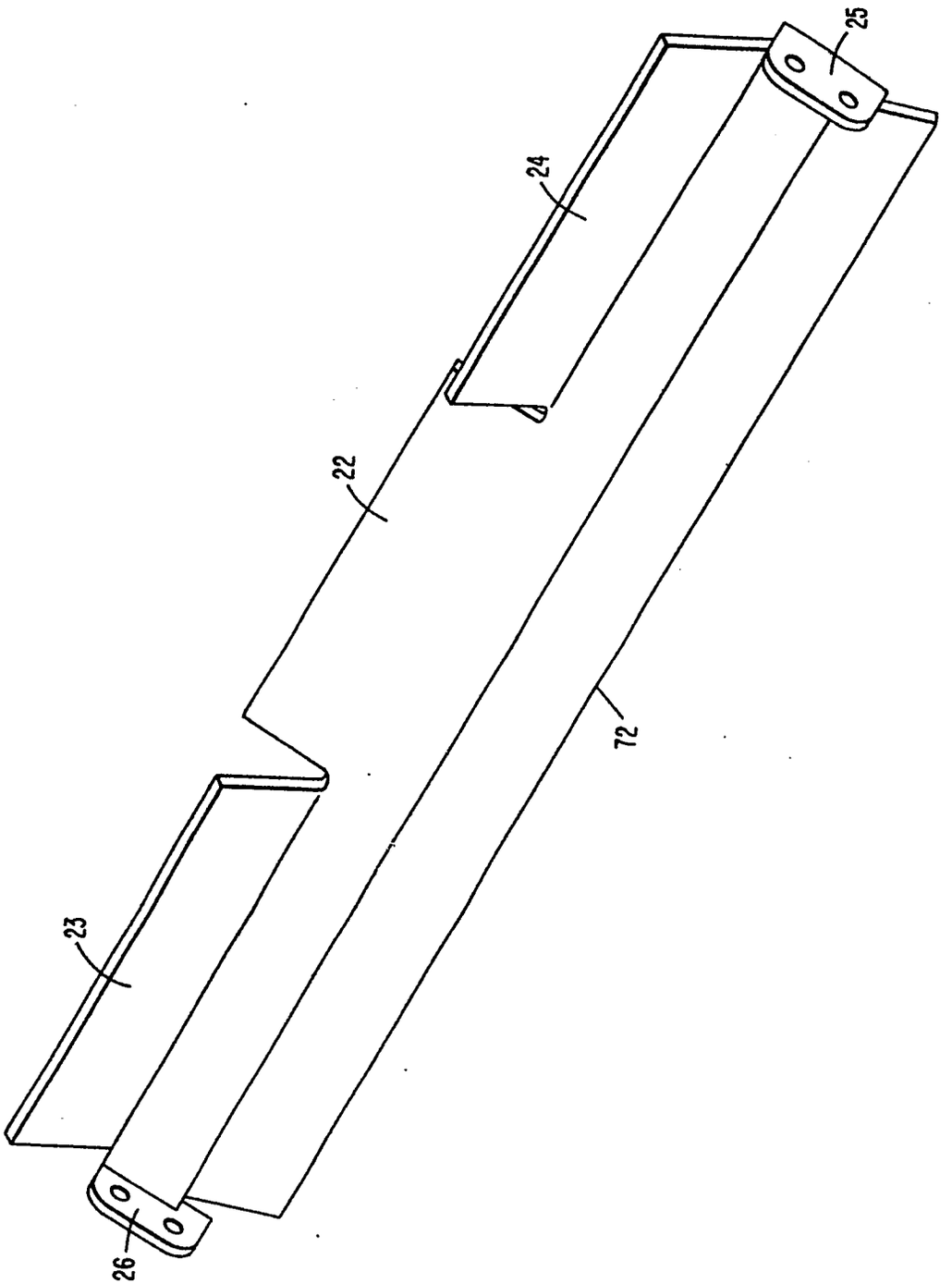


FIG. 7

FIG. 8A

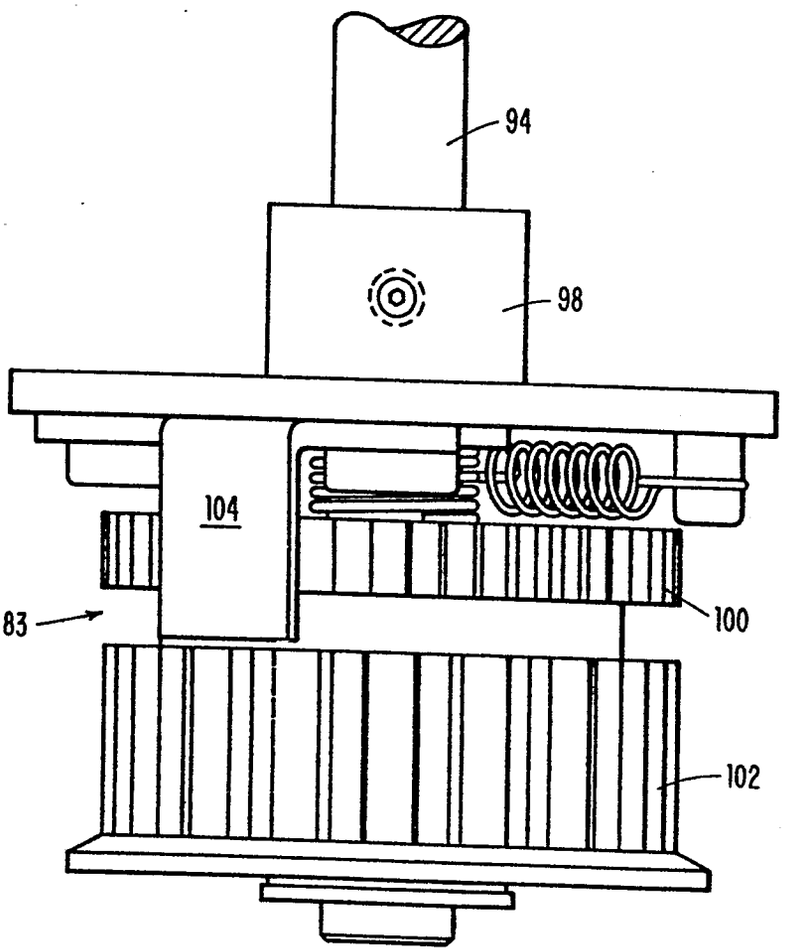


FIG. 8B

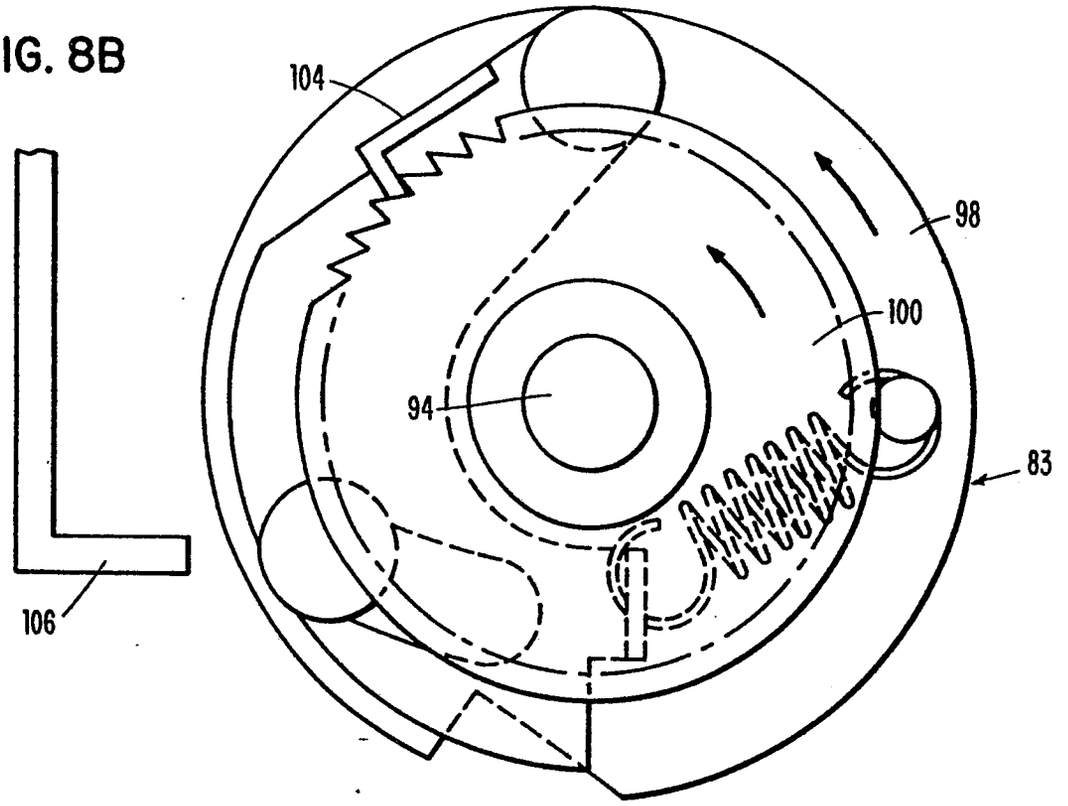
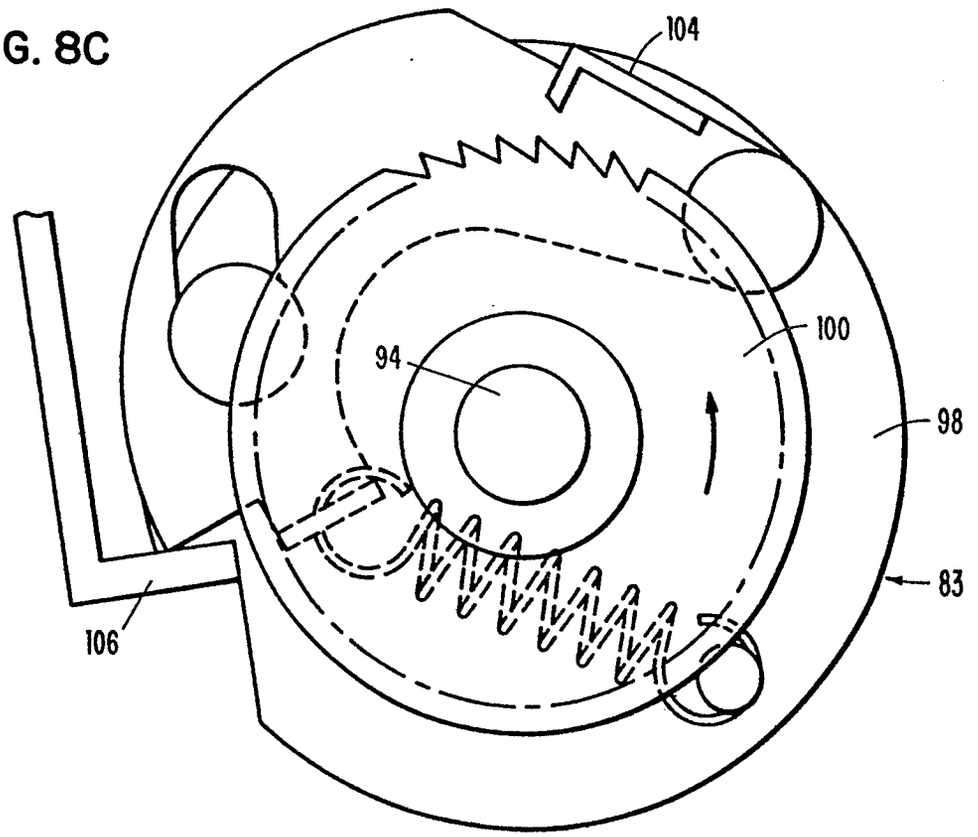
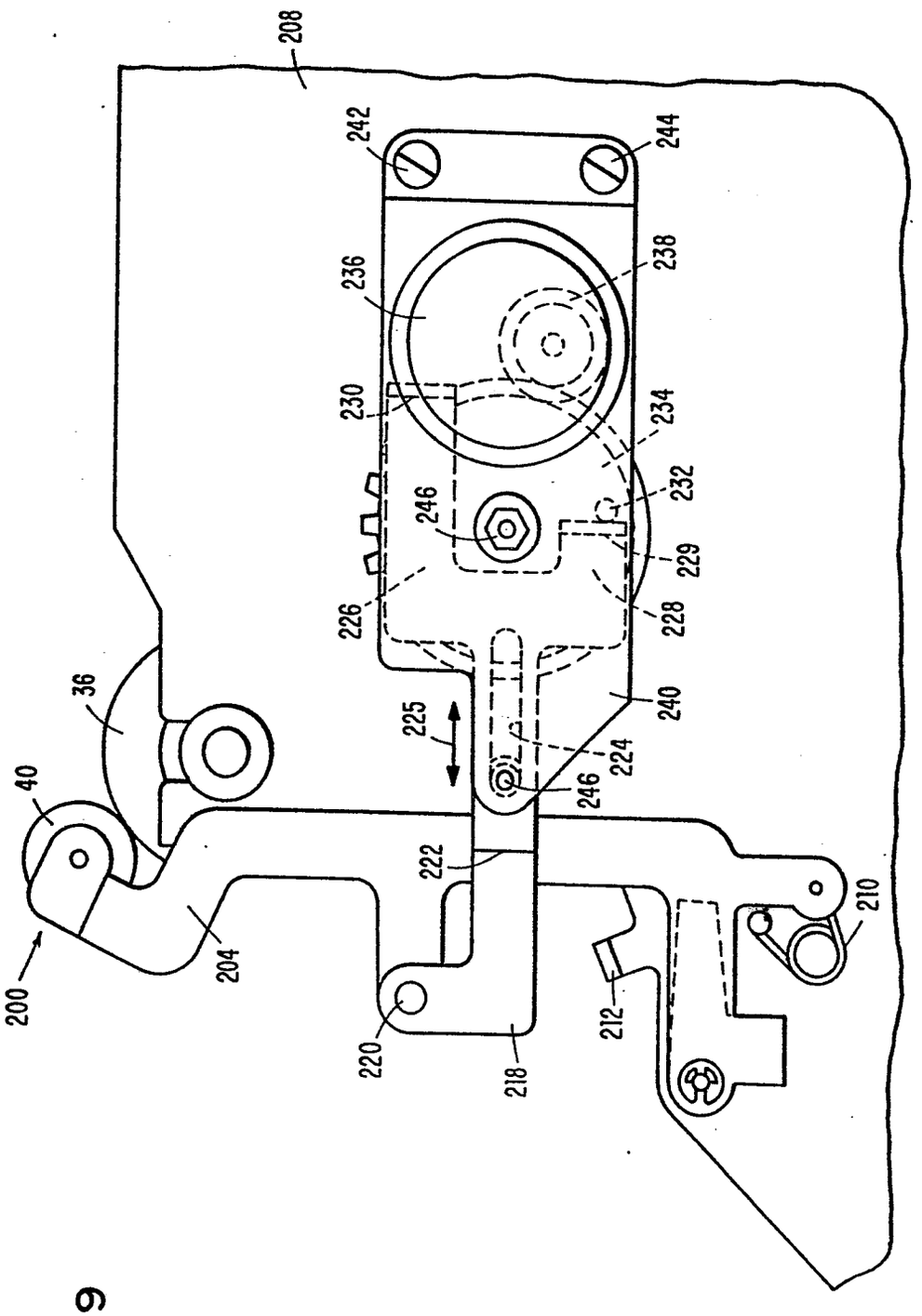


FIG. 8C




208
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218
212

FIG. 9

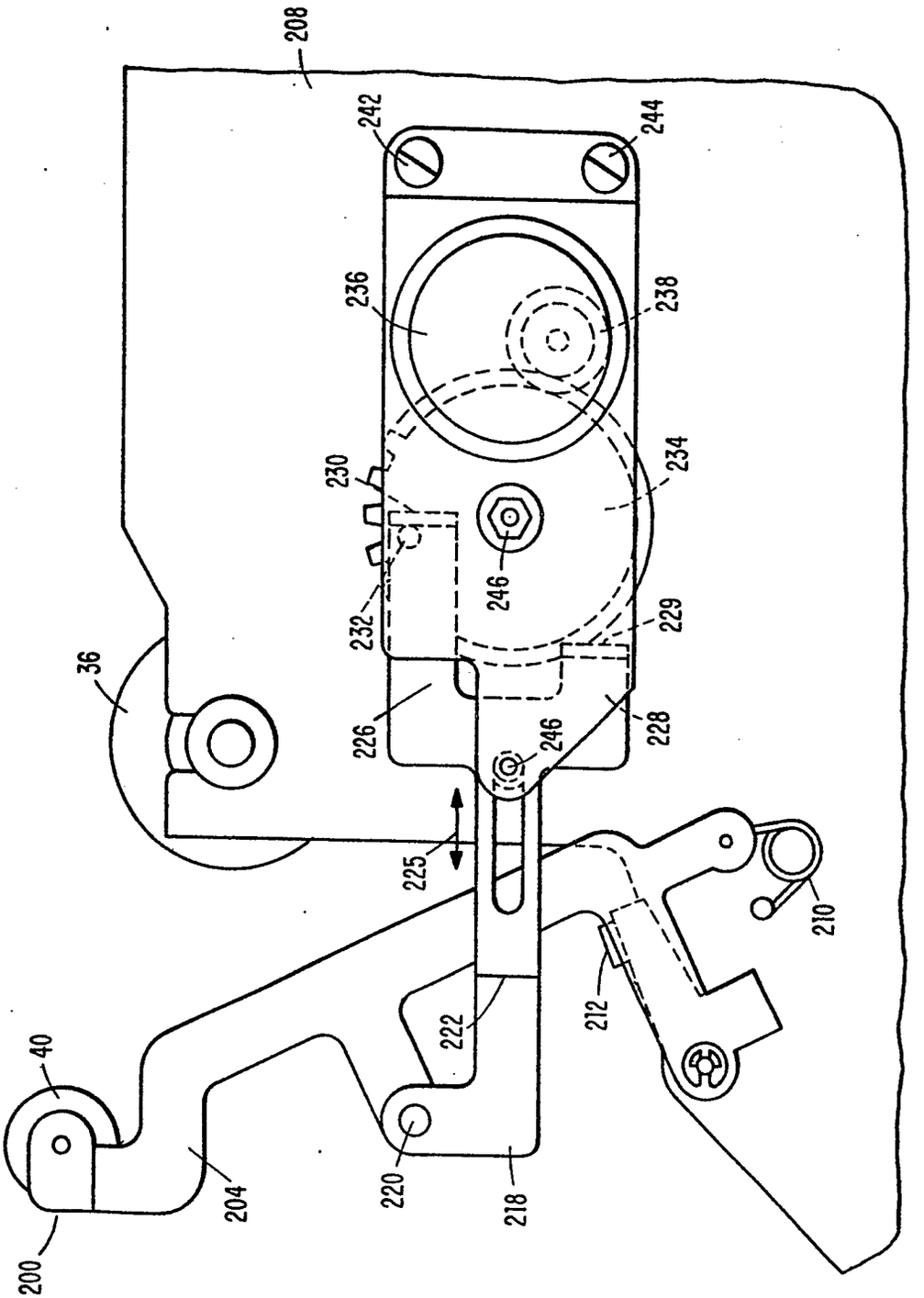
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FIG. 10

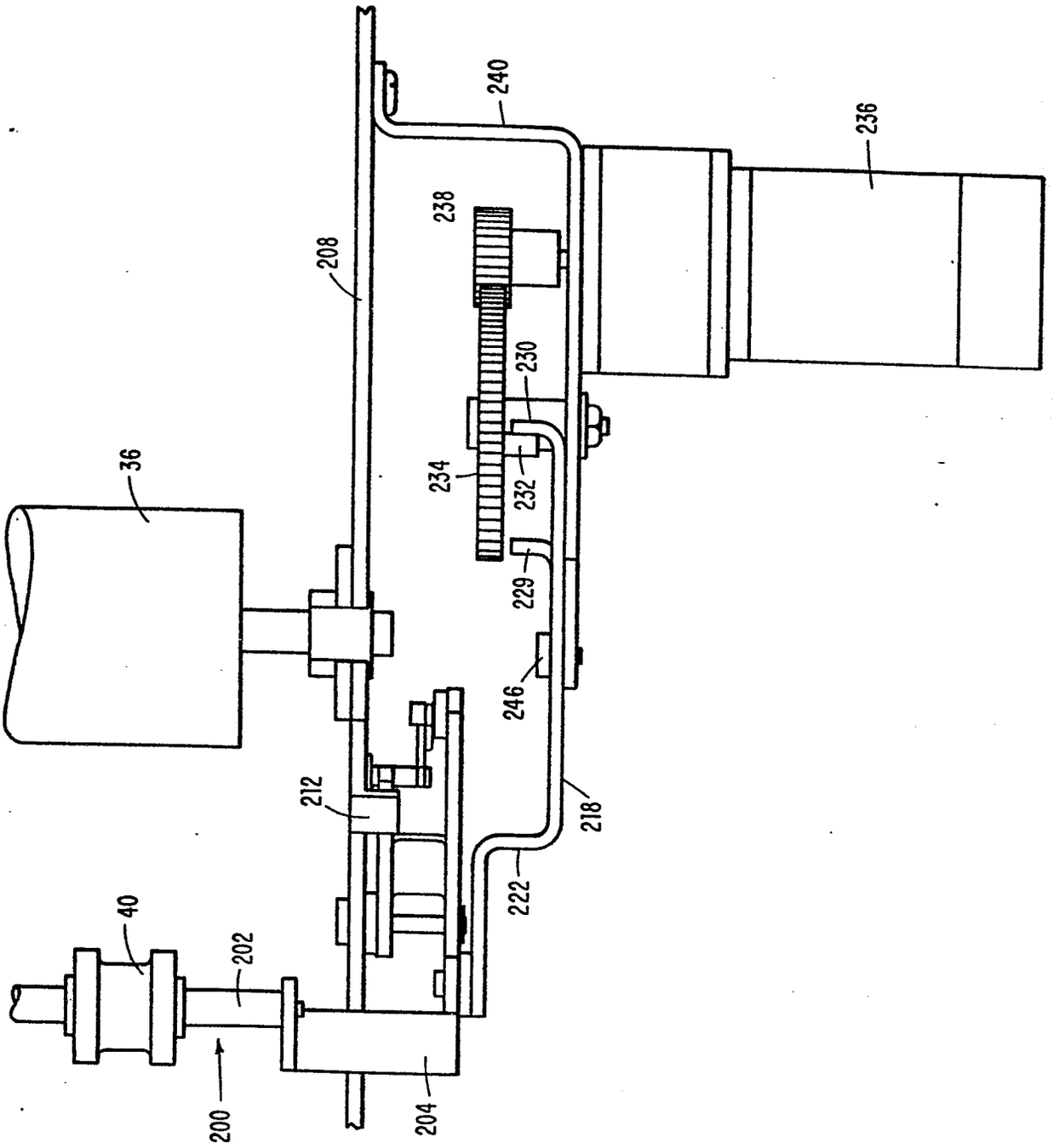

FIG. 11

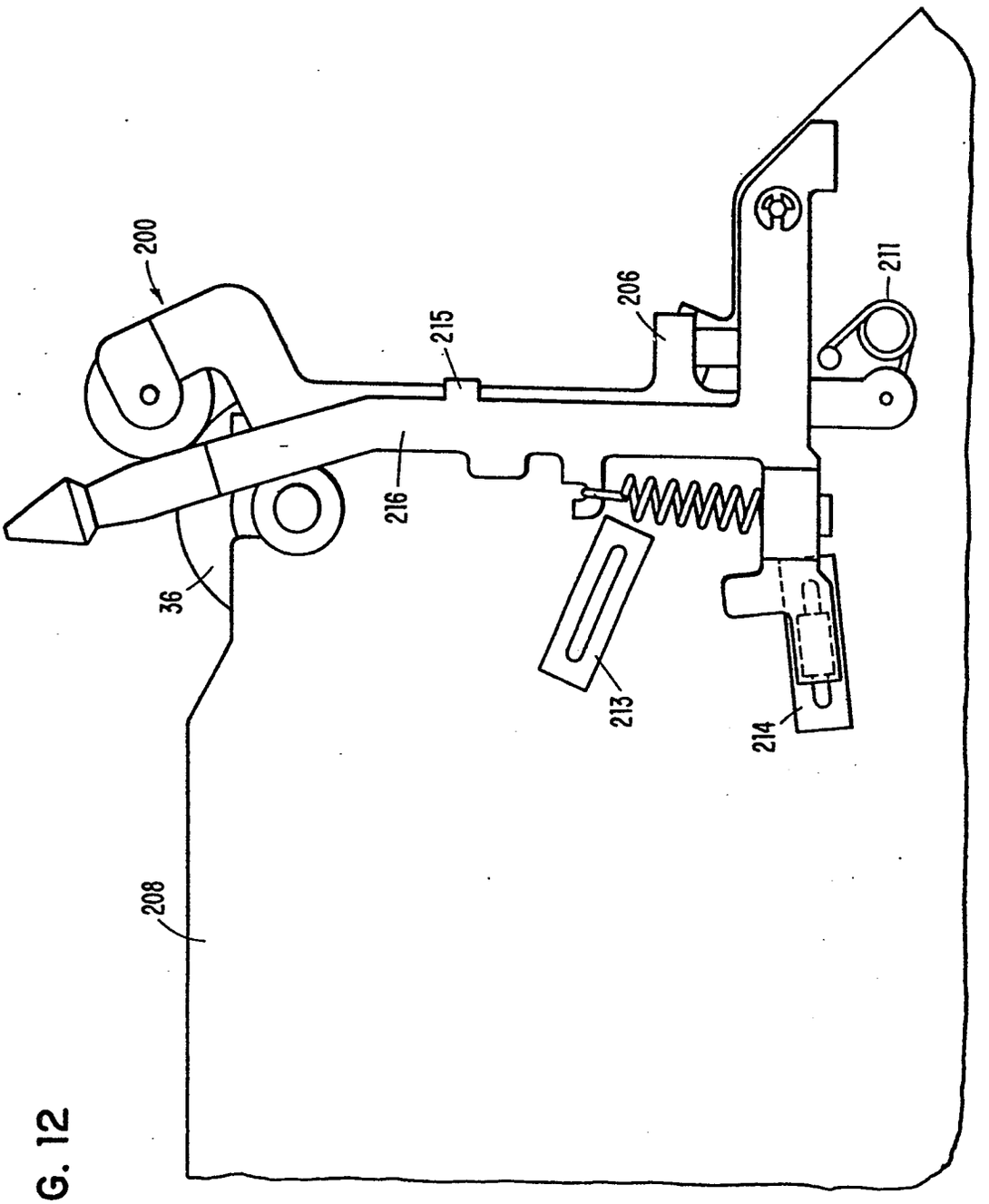

FIG. 12