

United States Patent

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[54] CARTON FORMING MACHINE

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93/51 R, 93/59 R

[51] Int. Cl. B31b 1/54, B31b 1/62, B31b 7/02

[58] Field of Search 93/36 MM, 36.3, 39, 51, 59

[56] References Cited

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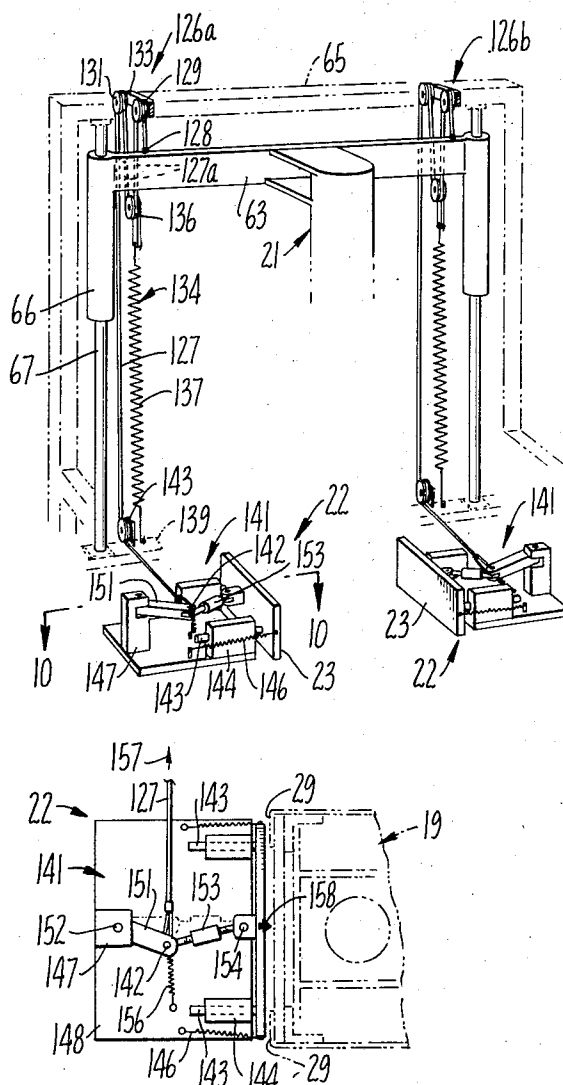
Attorney—Eckhoff and Hoppe

[57]

ABSTRACT

A machine for forming a carton by folding a carton blank around a pair of end panels and compressing the side tabs of the blank against the end panels wherein the feeding and folding functions are performed by cables driven by the ram.

3 Claims, 10 Drawing Figures



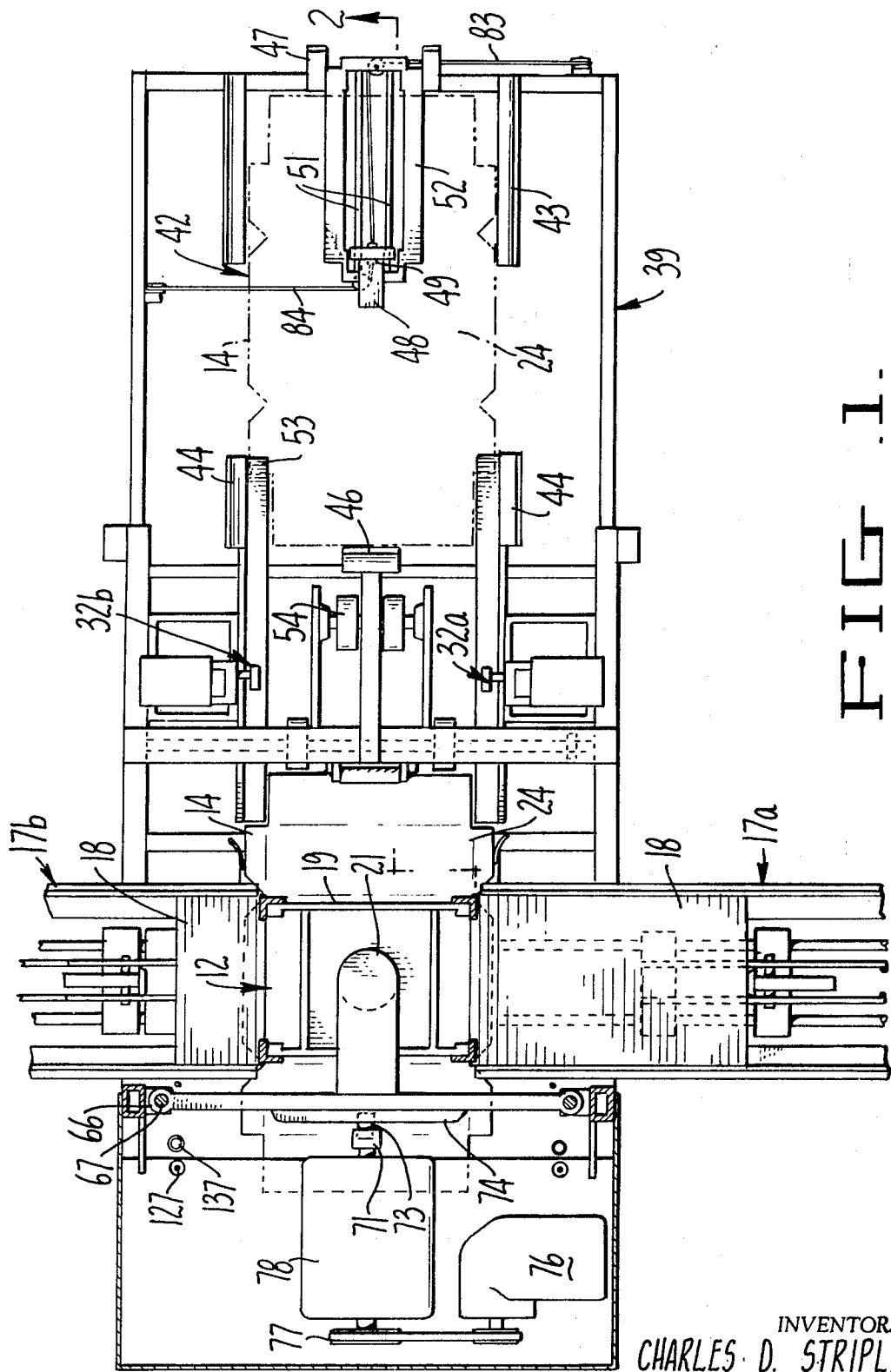


FIG. 1.

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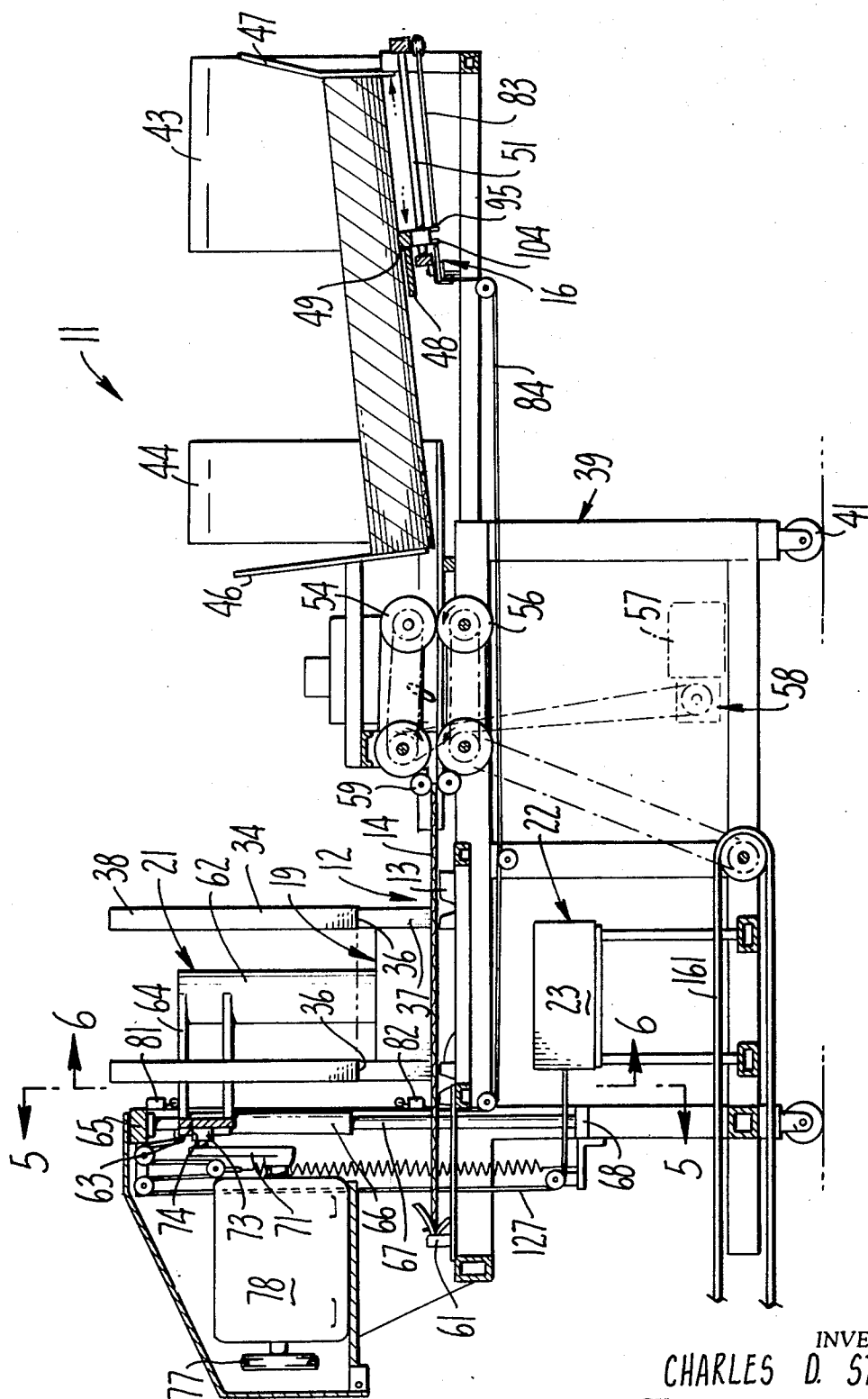


FIG. 2

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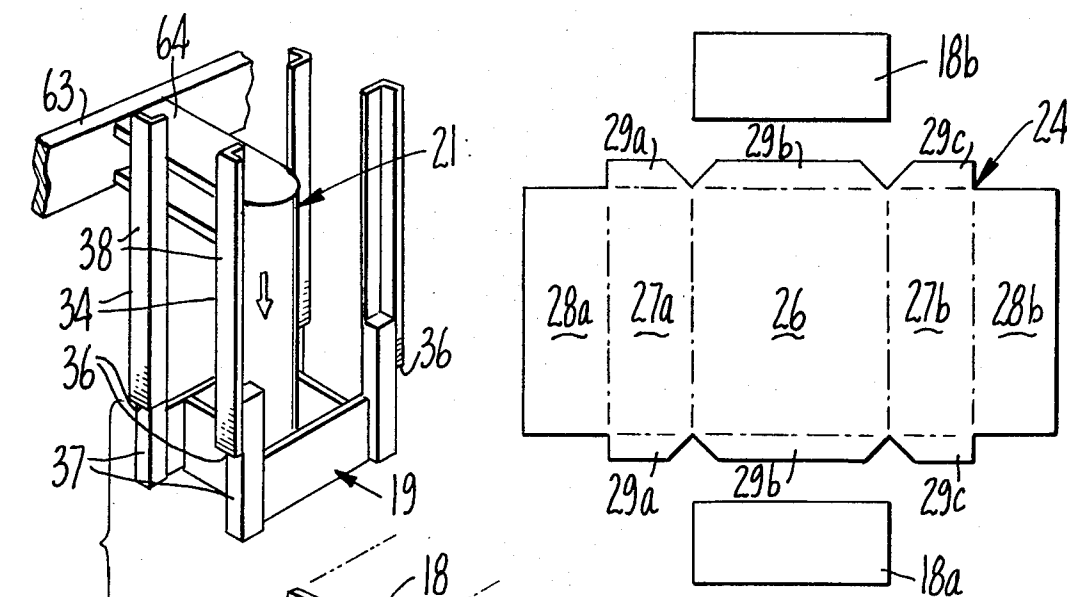


FIG. 3

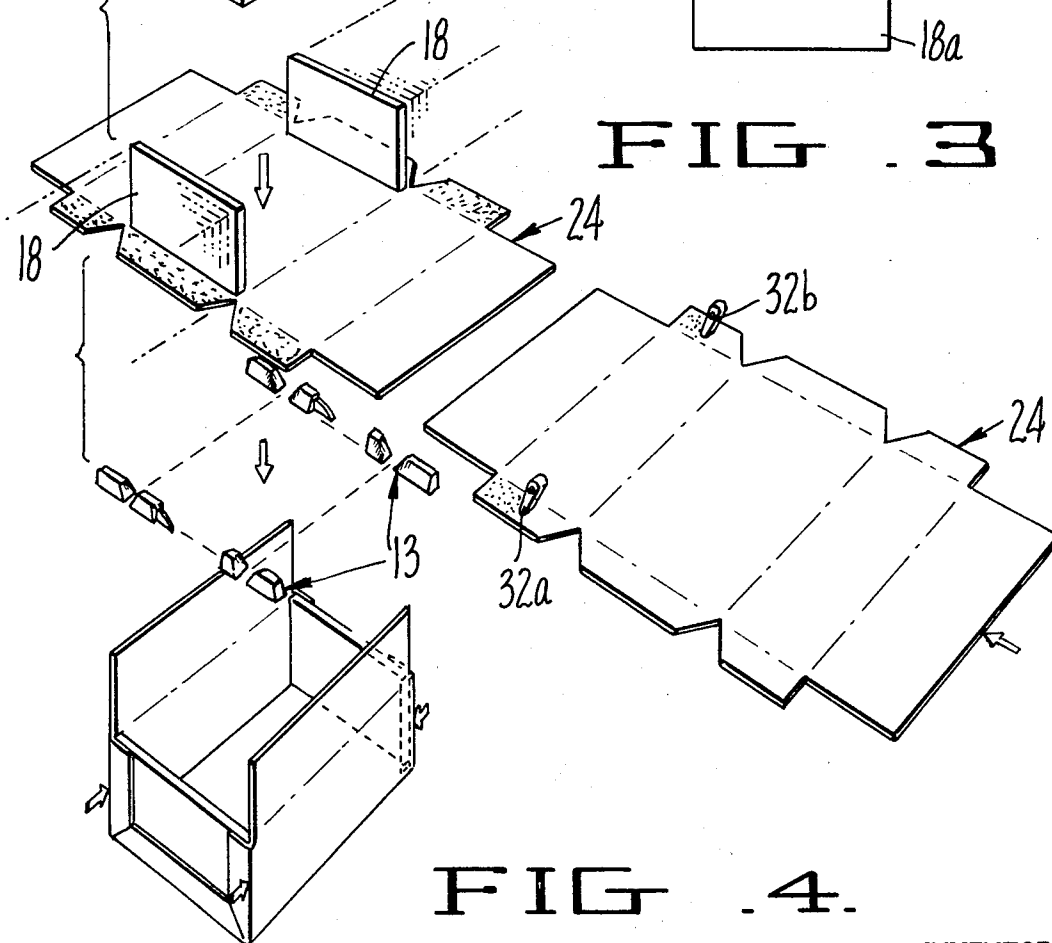


FIG. 4.

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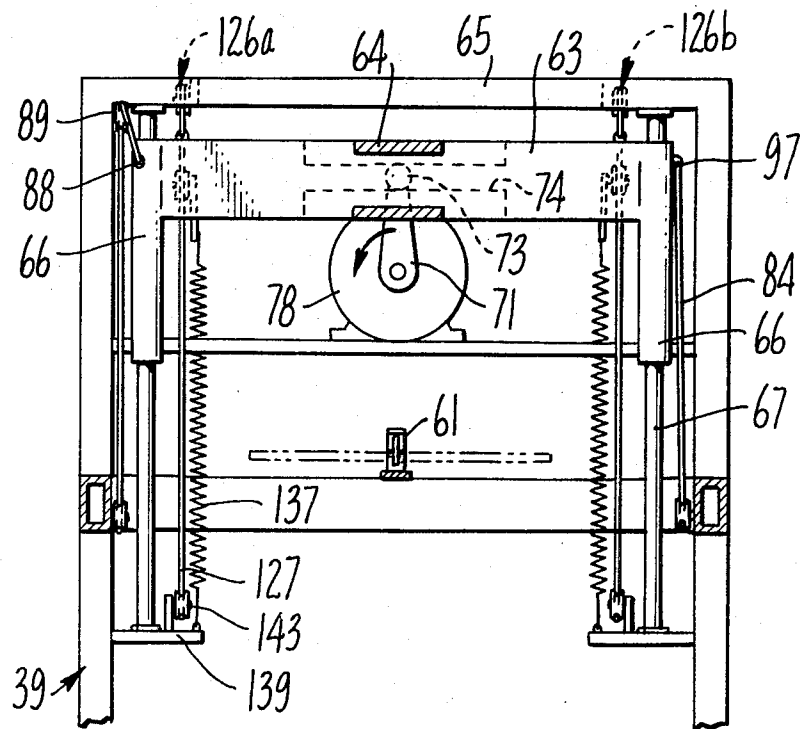


FIG. 5.

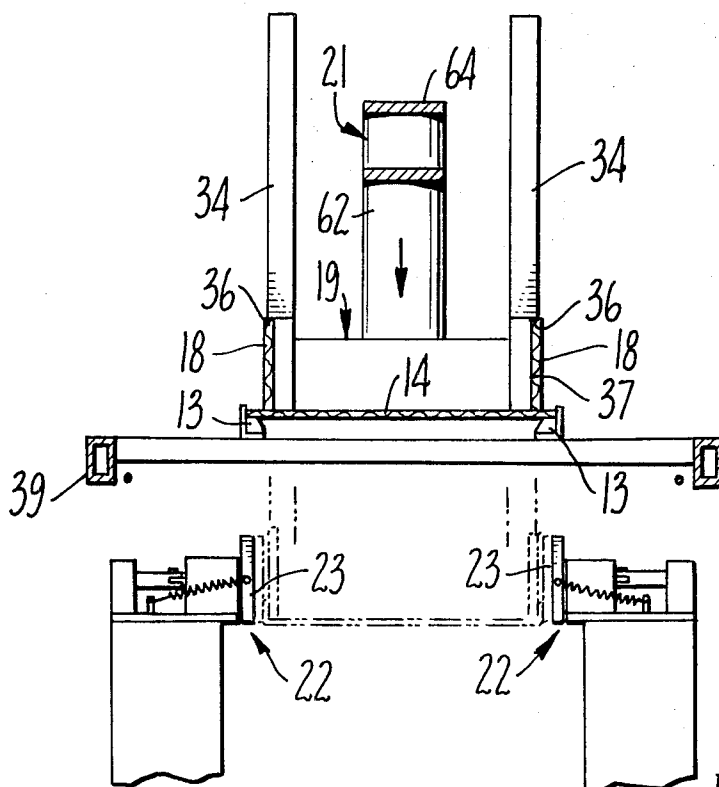


FIG. 6.

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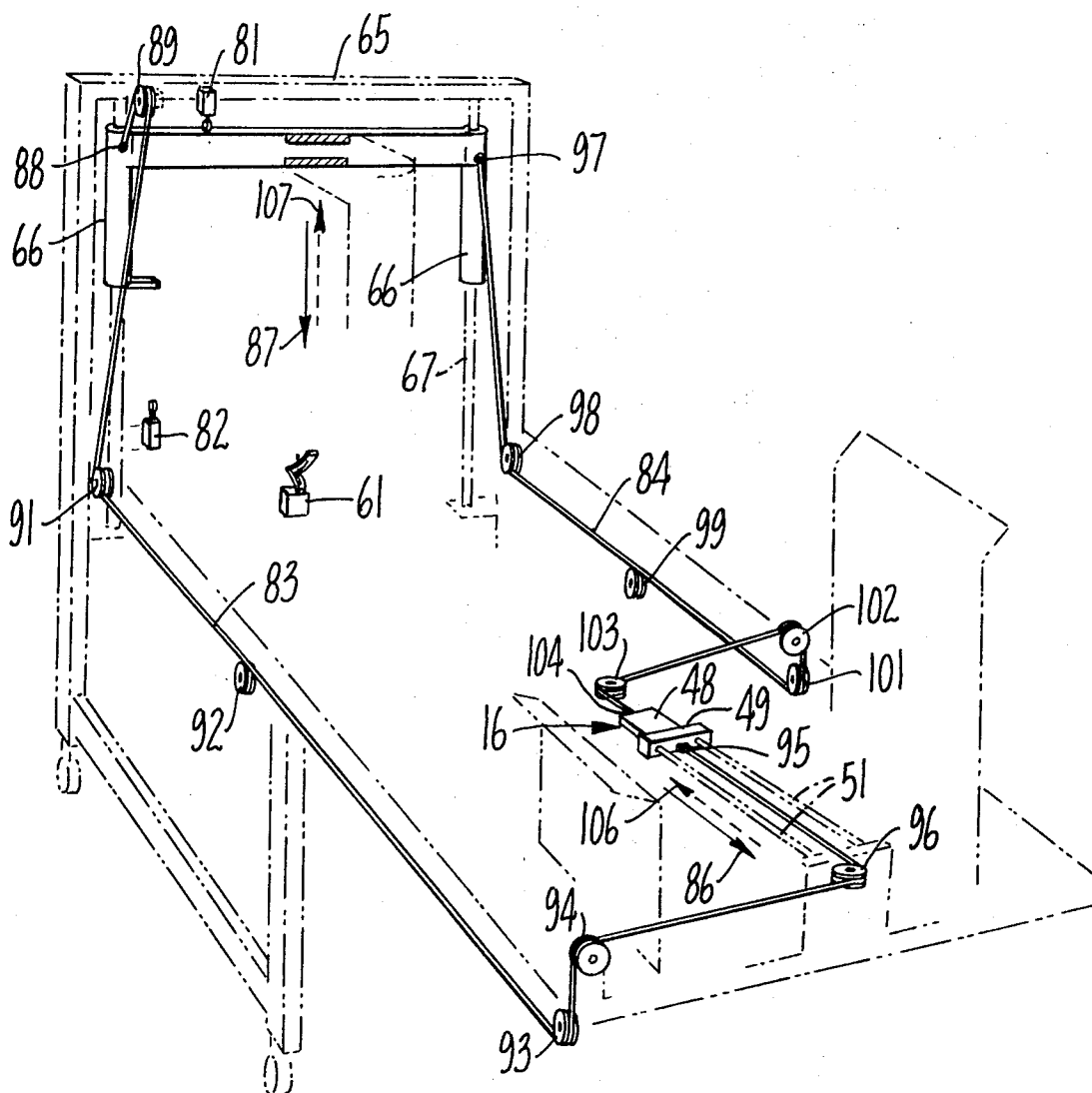


FIG. 7.

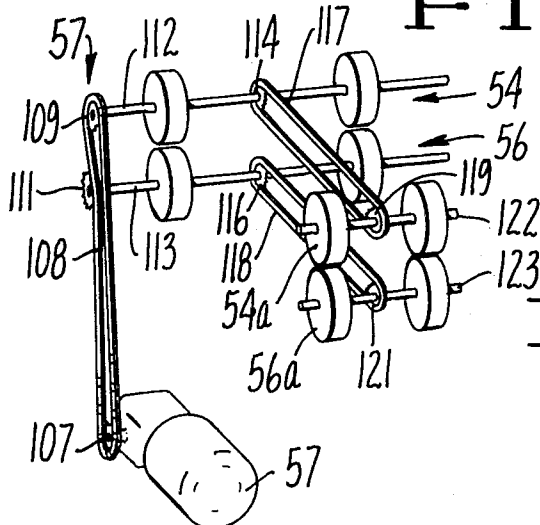


FIG. 8.

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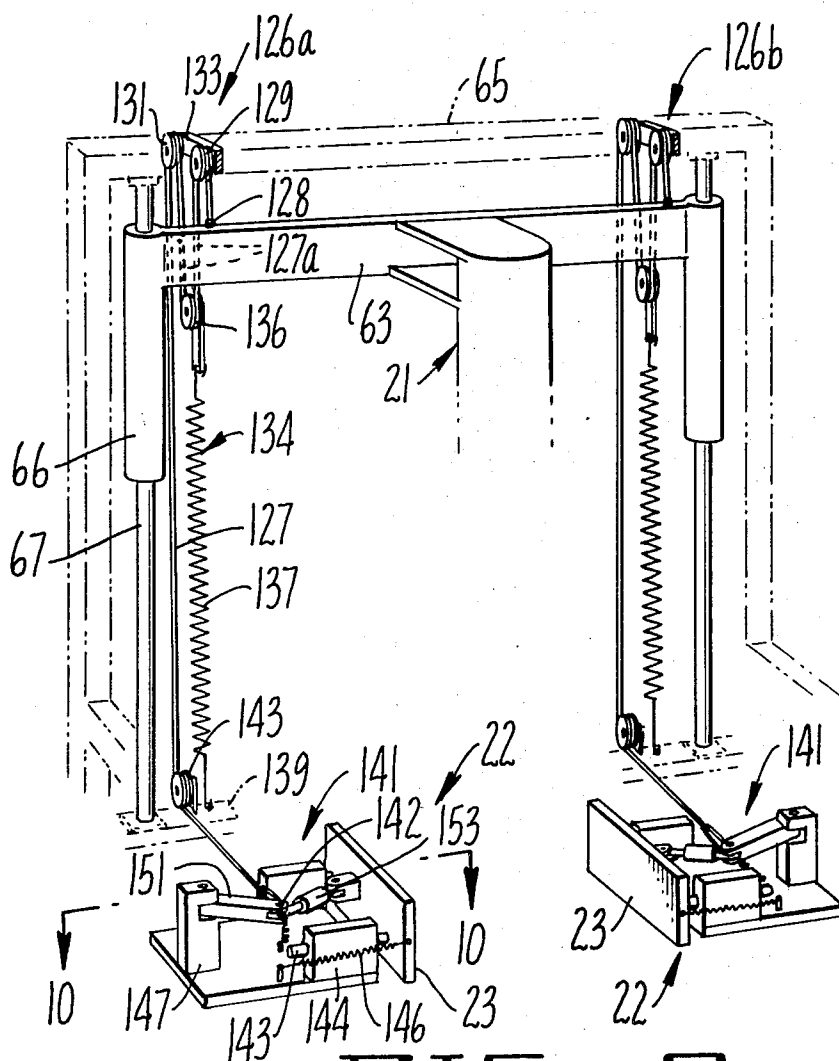


FIG. 9.

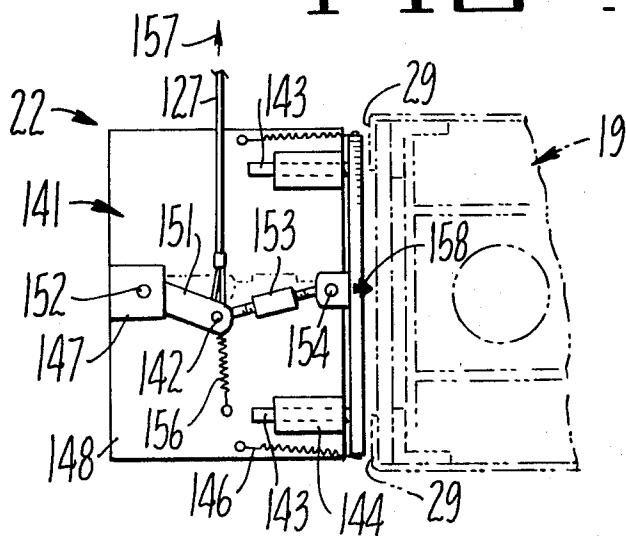


FIG. 10.

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CARTON FORMING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to a carton forming machine and more particularly to a machine for folding a carton blank having margin tabs around a pair of upstanding end panels and thereafter compressing the tabs against the end panels to form an assembled carton.

In general the operation of the machine is as follows:

The blanks are ejected from a stack of blanks in one at a time order by a feed slide. A set of power driven rollers advances the blank through a glue applying station to a folding station. Laterally disposed of the folding station is a pair of end panels magazines which support and advance a supply of panels to an upstanding position along the margins of the blank. At the folding station a mandrel strips a pair of end panels from the magazines and pushes the end panels and blank assembly through a set of folding plows such that the side panels of the blank are folded up and around the end panels with the margin tabs folded against the end panel exteriors thereof. A pair of compression plates advance to secure the glued tabs to the end panel. Subsequently the carton is stripped from the mandrel while the compression plates and mandrel retract. The mandrel is carried on a ram which supplies the drive for the feed slide and compression plates through a series of cables and pulley groups. A lost motion device is included in the compression plate drive to allow the mandrel held carton to be in proper position before the compression plates are advanced thereagainst.

This machine is used to form and assemble corrugated cardboard cartons of the type used for holding produce and the like. These cartons, commonly called lug cartons, generally have end panels of double or triple thickness to the body of the carton. As such, these cartons may be stacked while supporting the load on the end panels and thus not injure the included produce.

Since these cartons have multiple thickness end panels, they are difficult to form from a single carton blank. They are, therefore, assembled from a pair of end panels of desired thickness and a single thickness carton blank which includes a bottom panel, a pair of side panels, top flap panels and a series of margin tabs extending from the edges of the bottom and side panels. These tabs have adhesive applied to them and are folded around the end panels and secured thereto at assembly.

In the past, machines for forming such cartons have been very complicated and employed limit switches, valves and the like to time and perform the feeding and folding functions.

In contrast, the machine of the present invention is quite simple since the feeding and folding functions are actuated by the ram itself, so that no timing problem exists and the usual valves, pistons and the like are eliminated.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a machine for folding a carton blank around a pair of end panels and subsequently applying pressure to the joining tabs utilizing a simple mechanical linkage.

It is the principal object of the invention to provide such a machine wherein movement of a ram is translated to a feed slide and compression plates through a series of cables and pulleys to ensure proper sequencing of the assembly procedure.

It is a further object to form such a carton around a mandrel by supporting a pair of upstanding end panels along lateral faces of the mandrel and pushing them and a flat carton blank through a set of folding plows to fold the carton blank around the end panels and mandrel. At the end of the mandrel pushing stroke, a pair of compression plates engage the glued tabs and end panels to press them together against the mandrel.

It is another object of the present invention to provide a simplified machine for assembling and folding lug cartons from a flat carton blank and a pair of upstanding end panels brought together at an assembly and folding station. The car-

ton blank is ejected by a feed slide from a stack of blanks and conveyed by a set of driven rollers through a glue applying station to the folding station. The end panels are carried and advanced in a pair of magazines supported at each side of the folding station. A mandrel, carried on a ram above the folding station, strips a pair of end panels from the magazines and continues to push the blank through a set of folding plows. At the end of the pushing stroke, a pair of compression plates presses the carton blank tabs and end panels together against the mandrel. The completed carton is stripped from the mandrel and is conveyed away as the ram and compression plates retract.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred form of the invention is illustrated in the accompanying drawings forming a part of this specification, in which:

FIG. 1 is a plan view of a carton forming machine constructed in accordance with the present invention with portions broken away to show the mechanism therebeneath;

FIG. 2 is a side sectional view of the machine shown in FIG. 1 taken substantially along the plane of line 2—2 of FIG. 1;

FIG. 3 is a layout of the carton blank and end panels of a carton prior to assembly in the machine;

FIG. 4 is an exploded diagrammatic view of the carton folding sequence illustrating the relationship of the carton, mandrel and folding plows;

FIG. 5 is a transverse sectional view taken substantially along the plane of line 5—5 of FIG. 2;

FIG. 6 is a transverse sectional view taken substantially along the plane of line 6—6 of FIG. 2;

FIG. 7 is a diagrammatic perspective view of the cable drive between the ram and the feed slide;

FIG. 8 is a diagrammatic perspective view of the blank conveyor;

FIG. 9 is a diagrammatic perspective view of the cable drive between the ram and compression plates; and

FIG. 10 is a plan view of one of the compression plate mechanisms taken along the plane of line 10—10 of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly FIGS. 1, 2 and 4, it will be seen that the carton forming machine 11 of the present invention includes a carton folding station 12 having members 13 adapted to form the edges of a carton when a carton blank 14 is displaced therepast; a carton blank feed 16 adapted to supply a carton blank to the folding station; and a pair of magazines 17a and 17b adapted to supply a pair of end panels 18 in upstanding relation to the folding station. Also included is a mandrel 19 formed to support a pair of end panels along the sides thereof at station 12 with a ram 21 adapted to push mandrel 19 and included end panels and the carton blank 14 against the folding members 13 such that the carton blank is folded around the mandrel and end panels. A compression member 22 having a plate 23 is movable against the folded margins of the carton to join the carton blank to the end panels with the feed 16 and compression member 22 coupled to ram 21 and responsive of the movement thereof.

This machine has particular utility in forming cartons such as those used for packing produce and the like. In such use, the cartons are formed on site where the produce is to be packed and it is desirable that the carton forming machine be capable of automatic operation and yet be rugged, simple to operate and of economical construction.

Looking to FIGS. 3 and 4, it will be seen that a typical carton to be formed on this machine will have a body blank 24 having a bottom panel 26, a pair of side panels 27a and 27b, top flaps 28a and 28b and margin tabs 29a, 29b and 29c extending along the edges of the bottom and side panels. The panels are separated by score lines 31 in the usual manner. The body blank 24 is generally formed of a single thickness of corrugated cardboard. The end panels 18a and 18b are of

somewhat stiffer construction and are generally of double or triple thickness corrugated board.

In assembling the carton, a single body blank is conveyed through a pair of glue applying stations 32a and 32b to the folding station. The glue is applied to the margin tabs 29 of the blank, preferably with a glue dispenser system as described in my copending applications entitled VALVE, Ser. No. 54,744, filed July 14, 1970 and CUT-OFF VALVE, Ser. No. 54,745, filed July 14, 1970.

At the folding station a pair of upstanding end panels are positioned above the sides of the bottom panel. The end panels are carried and advanced in two columns extending from the sides of the folding station and are preferably supported in magazines 17 as described in copending application entitled SUPPORT CARRIAGES, Ser. No. 49,292 filed June 24, 1970.

With the body blank and end panels in proper position, the assemblage is displaced through the folding plows 13. Here the side panels 28 are folded upwardly along the edges of the end panels while the margin tabs 29 are folded inwardly toward the outer face of the end panels. Next, lateral pressure is applied in the direction of arrows 33 (see FIG. 4) to join the tabs with the end panels and complete the carton.

As is best shown in FIG. 4, a mandrel 19 is employed to supply the interior support for the carton forming process and is connected to and moved by ram 21 to push the blank and panels through the folding plows. Stripper members 34 are also carried on the mandrel and have shoulders 36 which engage the top of the end panel to displace them from the magazine while properly supporting them relative to the body blank along faces 37. Extensions 38 of the stripper hold the column of end panels in the magazine when the mandrel is in the down position.

Referring once again to FIGS. 1 and 2, the entire machine is carried on a frame 39 movable on wheels 41. The frame supports a supply of body blanks in hopper 42. Hopper 42 confines a stack of blanks between side walls 43 and 44 and front plate 26 and tail plates 47. Beneath the hopper is feed slide 16 which ejects the bottom blank from the stack. The slide includes support platform 48 and kicker shoulder 49 upstanding therefrom. The slide is journaled on a pair of guide shafts 51 carried by hopper base 52. With the slide retracted, the rear end of the lowermost blank will be engaged by shoulder 49 while supported on platform 48. As the slide advances, a single blank is dispensed from the stack onto guide rails 53. The leading edge of the dispensed blank engages driven rollers 54 and 56 which convey it through the glue apply stations 32 to the folding station 12.

Rollers 54 and 56 are spaced to engage the top and bottom of the blank and are continuously driven by motor 57 through chain and sprocket drive 58. Inertia rollers 59, engage the blank coming from the conveyor rolls and propel the blank into switch 61.

As the blank arrives at the folding station 12, its leading edge trips microswitch 61 to initiate the folding sequence as is later explained in detail. As mentioned, the folding is accomplished when mandrel 19 pushes against the blank under action of ram 21.

Ram 21 includes a mandrel carrying post 62 connected to crosspiece 63 by members 64. The crosspiece extends transversely of the machine and is journaled in ways 66 and at the ends thereof and vertically slidable along guide shafts 67. Guide shafts 67 are carried on frame 39 by transverse member 65 and brackets 68.

The crosspiece is moved vertically up and down between the guide shafts 67 by an eccentric arm 71 through roller 73 in slot 74. Eccentric arm 71 is rotated by gear motor 76 through belt and drive pulley 77 and an electric clutch brake 78. The movement of the ram is determined through an electric circuit of the electrical clutch brake. Microswitches 81 and 82 detect the up or down position respectively of the ram.

The cycle is initiated when the ram is in the upper position and a carton blank is detected at the folding station by trigger

switch 61. As ram 21 moves down, lower limit switch 82 is contacted and disengages clutch brake 78. A time delay device is included in the electric clutch brake circuit to allow a pause when the ram is in the down position to ensure time for the carton tabs to be properly secured to the end panels. After the specified time, the clutch re-engages to raise the ram and withdraw the mandrel.

Attached to crosspiece 63 of ram 21 are the terminal ends of a series of cables. These cables translate the motion of the ram to the feed slide 16 and compression member 22.

As best seen in FIG. 7, this motion is translated to the feed slide through double acting cables 83 and 84. Cable 83 retracts the slide as denoted by arrow 86 when the ram is on the down stroke as denoted by arrow 87. Cable 83 is attached to crosspiece 63 at 88 and is reeved over a reversing pulley 89 carried on transverse frame member 65 and over directing pulleys 91, 92, 93, 94 and 96 with the distal end attached to the tail end 95 of feed slide 16.

Cable 84 is attached to the crosspiece at 97 and extends therefrom over directing pulleys 98, 99, 101, 102 and 103 to the forward end 104 of the feed slide. Cable 84 advances the slide when the ram is elevated as denoted by arrows 106 and 107 respectively.

The distance and time of travel of the blank out of the hopper and through the roller conveyor is such that the mandrel will be out of the way of the folding station before the blank arrives thereat.

As shown in FIG. 8, the top and bottom conveyor rollers 54 and 56 are driven from a gear motor 57 through sprocket 107, chain 108 and driven sprockets 109 and 111 on cross shafts 112 and 113. Rearward conveyor rollers 54a and 56a are driven from cross shafts 112 and 113 by sprockets 114 and 116, drive chains 117 and 118 and driven sprockets 119 and 121 on shafts 122 and 123.

A second set of cable-pulley drives 126a and 126b are illustrated in FIG. 9. These drives actuate the compression member 22 to press the carton tabs against the end panels at the completion of the carton folding stroke. Since the drives and compression members as provided on opposite sides of the folding station are similar, only one will be described, the other being a mirror image.

The end of cable 127 is attached to the crosspiece 63 of ram 21 at 128 and from there reeved over a pair of pulleys 129 and 131 carried on bracket 133 extending rearward from frame member 65. Between the pulleys 129 and 131 is the lost motion device, generally designated 134. It is necessary that the compression members be advanced only at the end of the ram stroke in which case the lost motion device will pay out a length of cable 127a until this time. This device includes pulley 136 having a pay out portion 127 forming a loop therearound and spring 137 extending between pulley 136 and frame bracket 139. It will be noted that as the ram moves down the cable loop will be pulled up over pulley 129 by extending spring 137 until intermediate pulley 136 is raised to a position adjacent pulleys 129 and 131. During this downward motion of the ram, the mandrel will have stripped the end panels from the columns and pushed the body blank through the folding plows to fold the margin tabs around the end panels. As the ram continues downward, cable loop 127a will now be taut between pulleys 129 and 131 and cable 127 will translate any further downward movement to actuate compression member 22. This will occur when the ram is at its extreme down position and whereat the assembled carton is situated between the compression member.

The compression members 22 are in the form of toggles 141 with the cable attached at the medial pivot 142 as directed thereto by pulley 143.

As seen in the plan view of FIG. 10, the compression member 22 includes compression plate 23 engageable with the folded tabs 29. Plate 23 has rearward extending guide pins 143 carried in guide blocks 144 and is biased toward a retracted position by spring 146.

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Toggle 141 includes a tail block 147 carried on frame 148 and first link 151 pivoted at 152 to the tail block. A second link 153 is pivoted at 154 to the compression plate 23. The links 151 and 153 are pivotally connected at the medial pivot 142 as are the cable 127 and light retracting spring 156. Thus, as the cable is pulled in the direction of arrow 157, the compression plate will be extended in the direction of arrow 158 against the carton and mandrel.

With the carton thus formed, the ram 21 and compression members 23 are retracted and the carton stripped from the mandrel to fall and be carried away by conveyor 161.

From the foregoing, it will be seen that a novel carton forming machine has been provided which utilizes a rugged, simple and economical to construct system for assembling and folding cartons.

I claim:

1. A carton forming machine for assembling and folding a carton blank and a pair of end panels comprising in combination:

- a. a carton folding station having members adapted to form the edges of a carton when a carton blank is displaced therepast,
- b. a carton blank feed adapted to apply a carton blank to said folding station,
- c. a pair of magazines adapted to supply a pair of end panels in upstanding relation to said folding station,
- d. a mandrel formed to support said pair of end panels along the sides thereof at said station,
- e. a ram adapted to push said mandrel and included end

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panels and said carton blank against said folding members such that the carton blank is folded around the mandrel and end panels,

f. a compression member having a plate adapted to move against the folded margins of the carton to join the carton blank to the end panels,

g. wherein said compression member is coupled to said ram and responsive of the movement thereof, and

h. wherein said feed includes a reciprocating member and is coupled to said ram through a cable and pulley system wherein as the ram pushes the mandrel against the carton blank the feed retracts and as the ram withdraws the mandrel the feed advances to dispense another carton blank.

2. The device of claim 1 wherein said compression member is coupled to said ram through a cable and pulley system such that as the ram advances the mandrel past the folding member the compression plate advances to engage the carton ends and as the ram withdraws the mandrel the plate retracts, said cable and pulley system including a lost motion device wherein said compression advances only over the latter portion of the ram stroke.

3. The device of claim 2 wherein the lost motion device includes first and third fixed pulleys and a second movable pulley therebetween which is normally spring biased to draw the cable between the first and third pulleys into a U-shape and wherein the cable system transmits motion only when the cable is drawn taut between the first and third pulleys against the spring bias.

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