

Sept. 28, 1971

D. G. REICHERT ET AL

3,608,440

MACHINE FOR OPENING SHIPPING CASES FROM THE FLAT

Filed Sept. 17, 1969

8 Sheets-Sheet 1

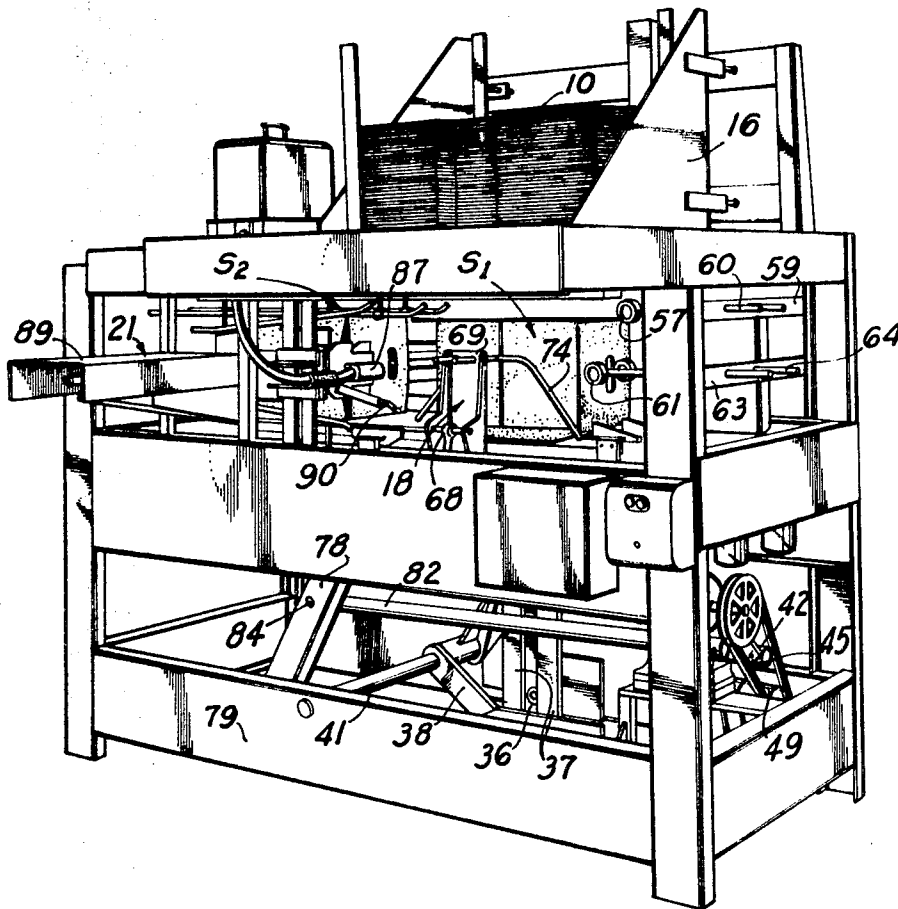


FIG 1

INVENTORS

DONALD G. REICHERT

EARL PETRIKIN

BY: *Newton, Hopkins, & Ormsby*
ATTORNEYS

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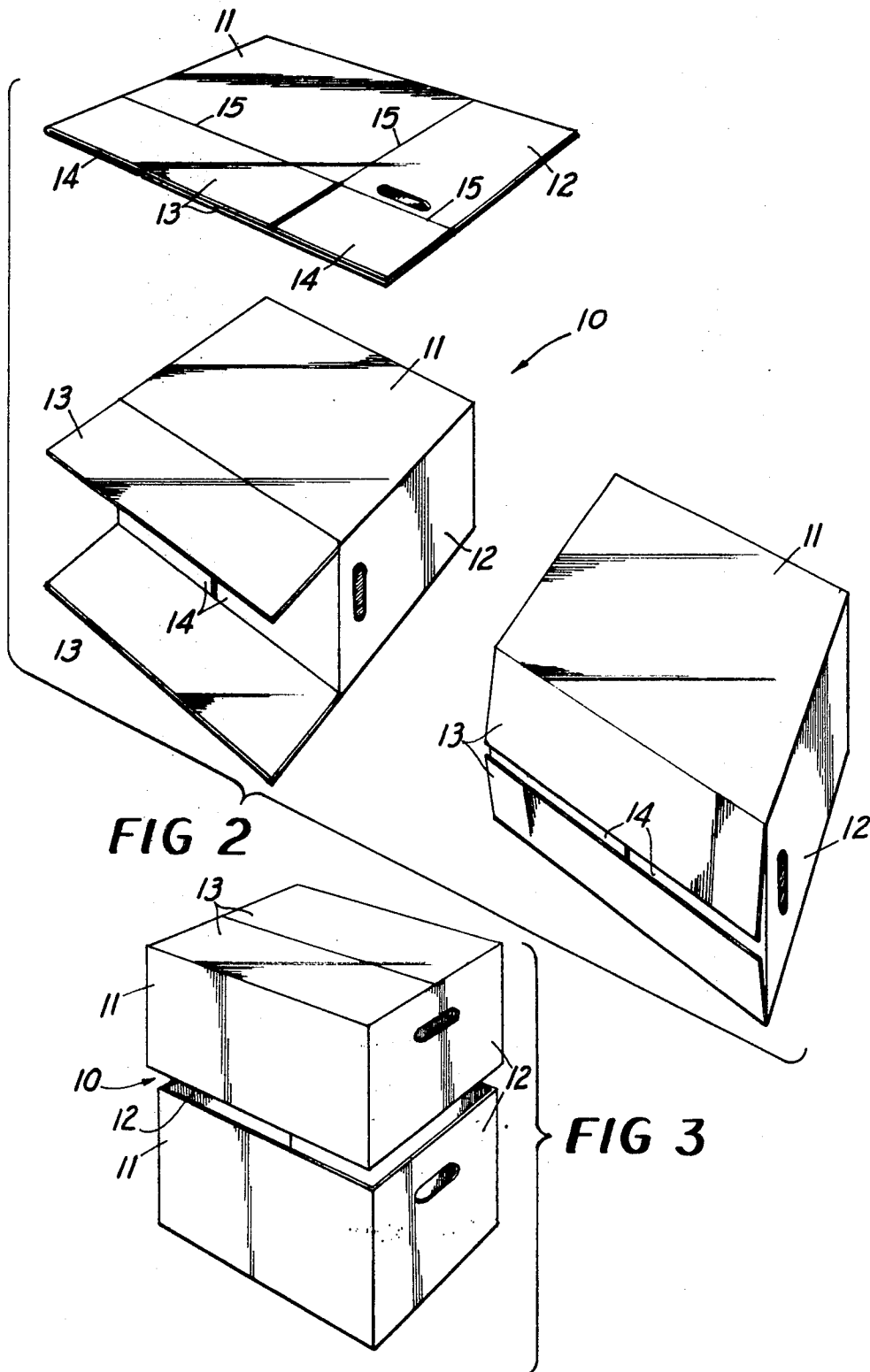
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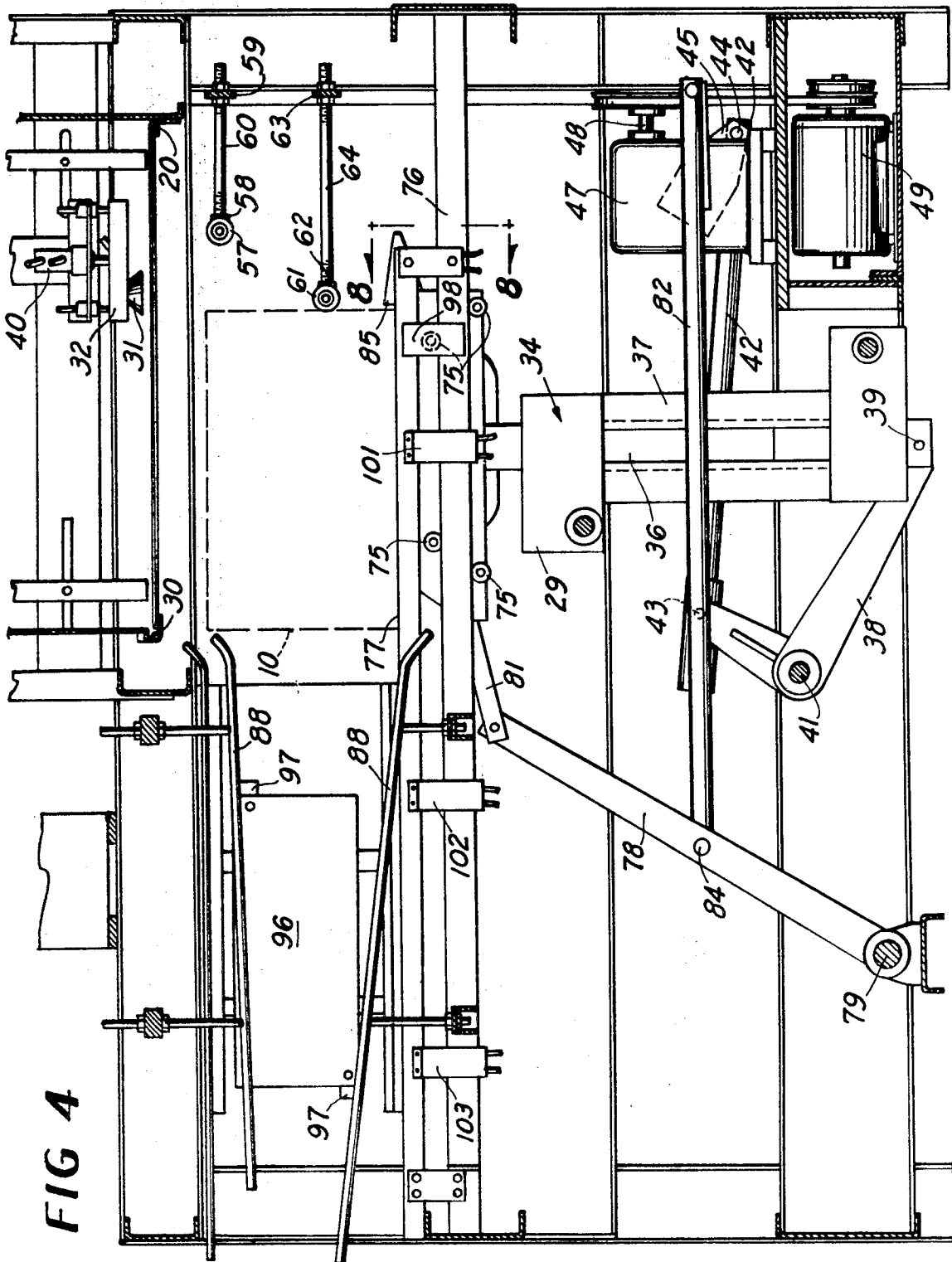
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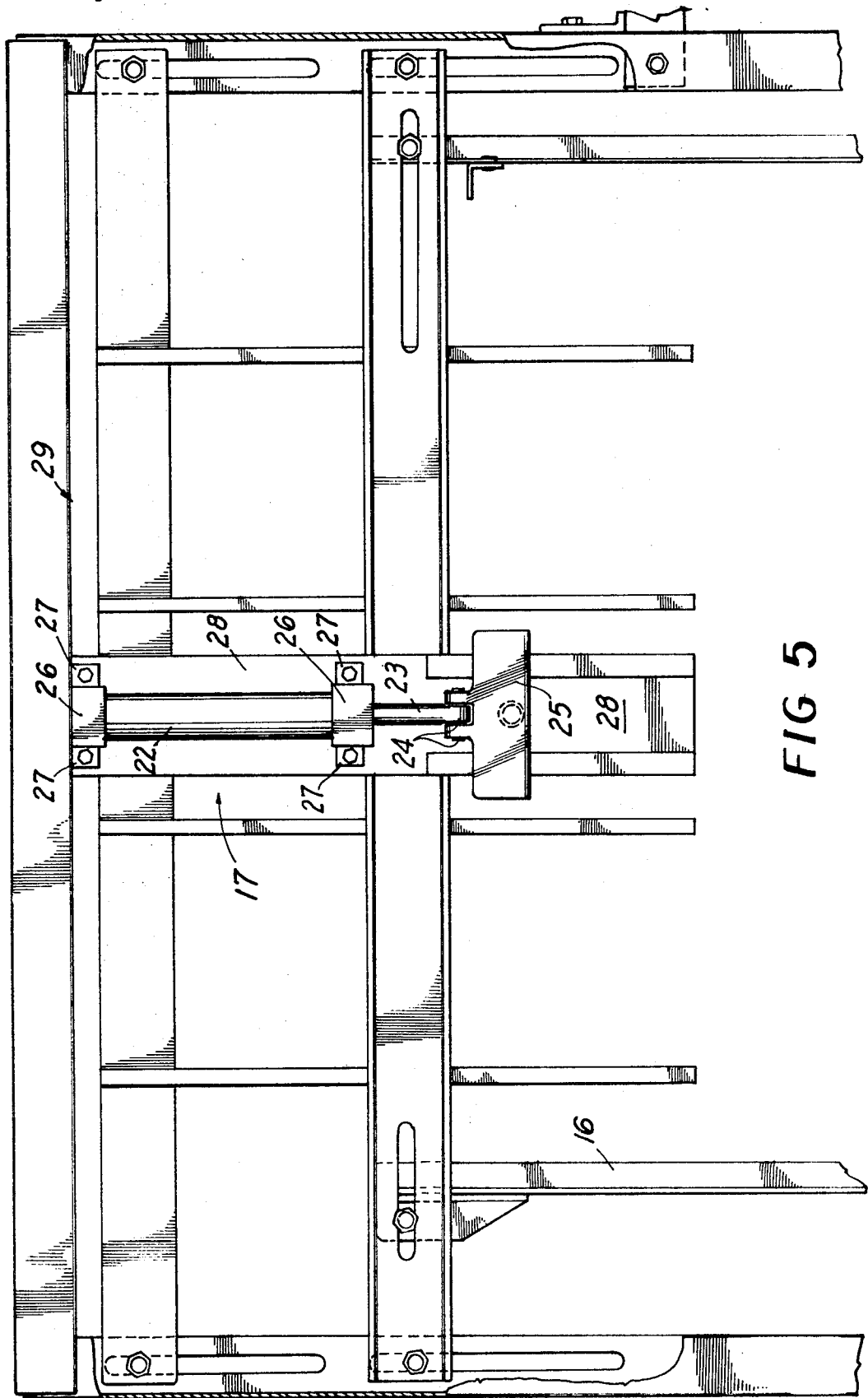
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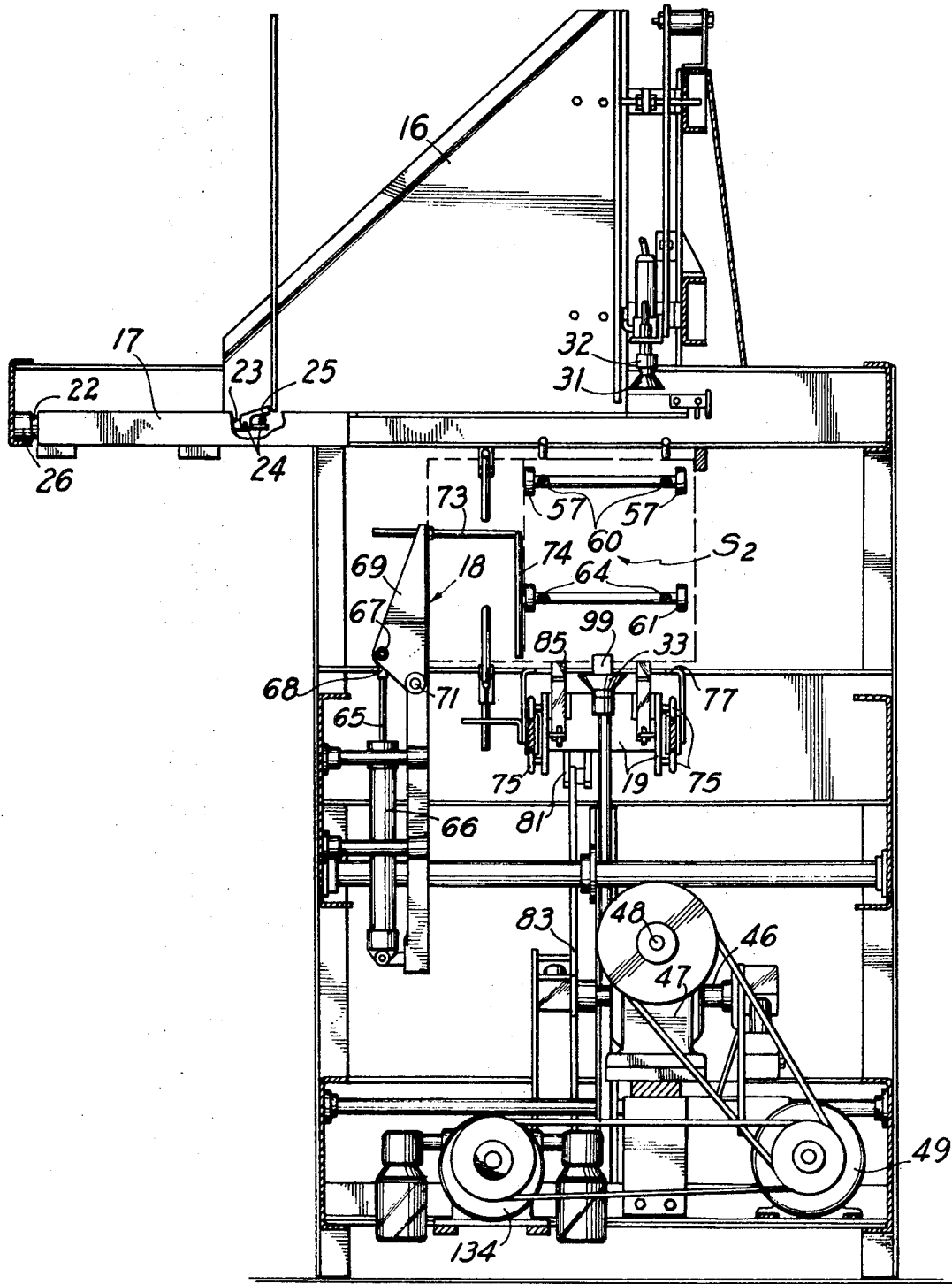
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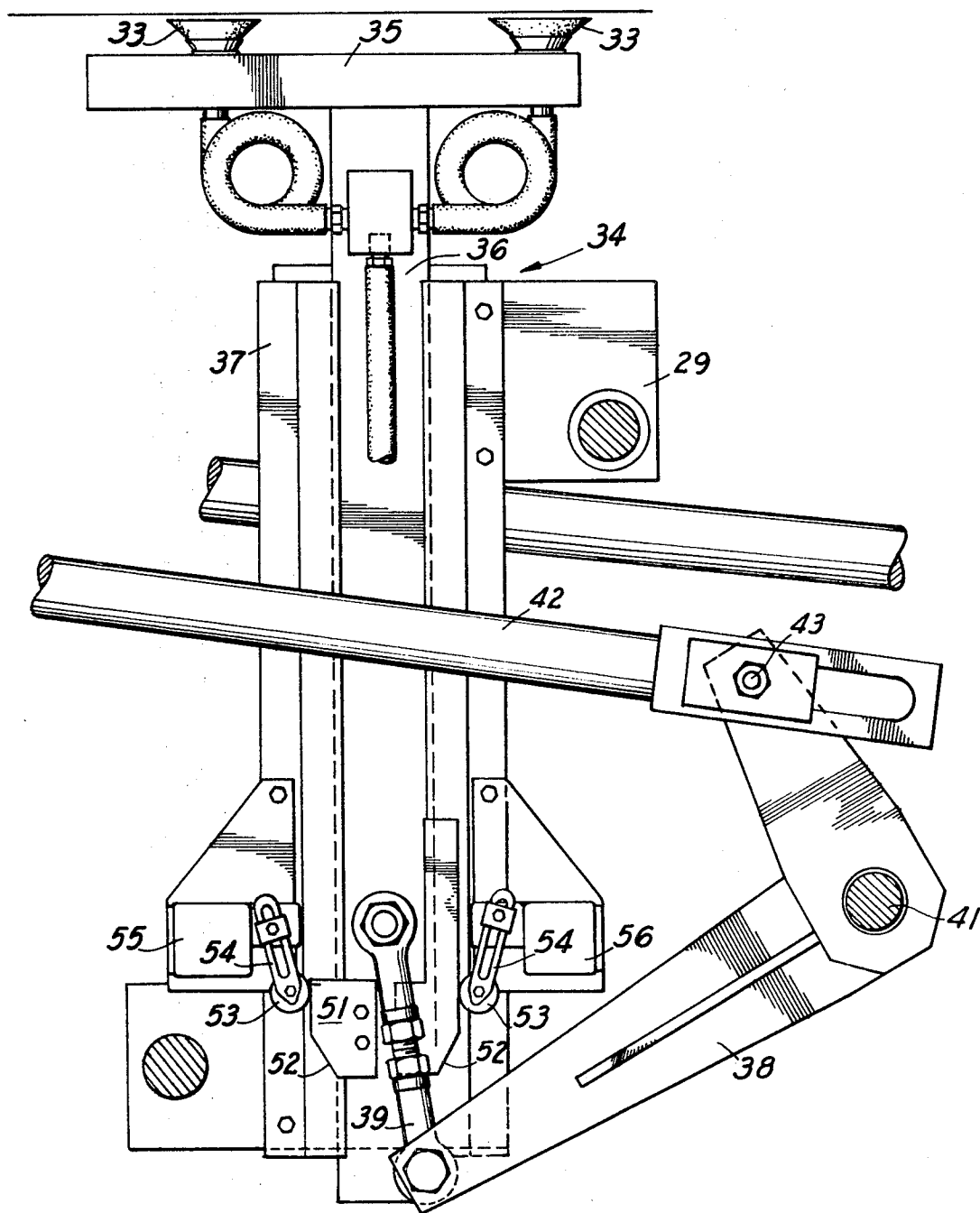


FIG 7

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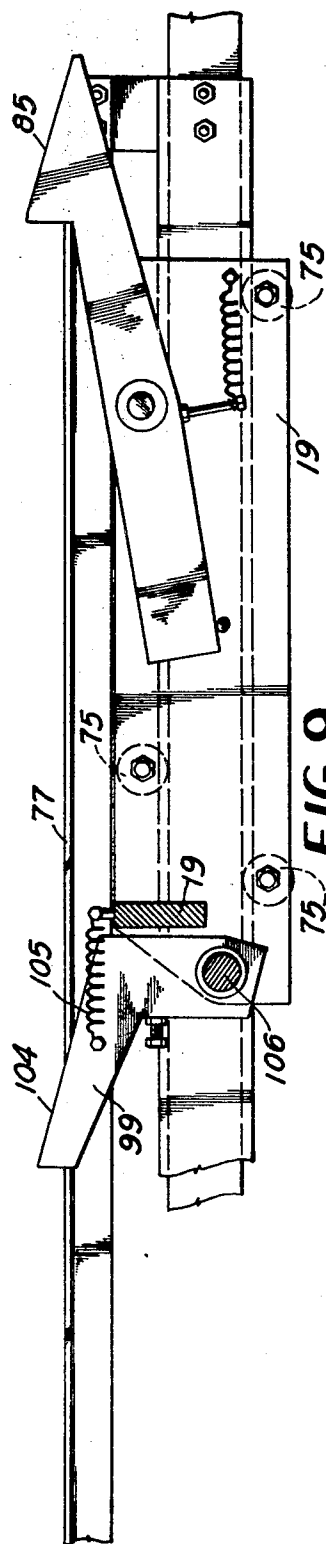


FIG 9

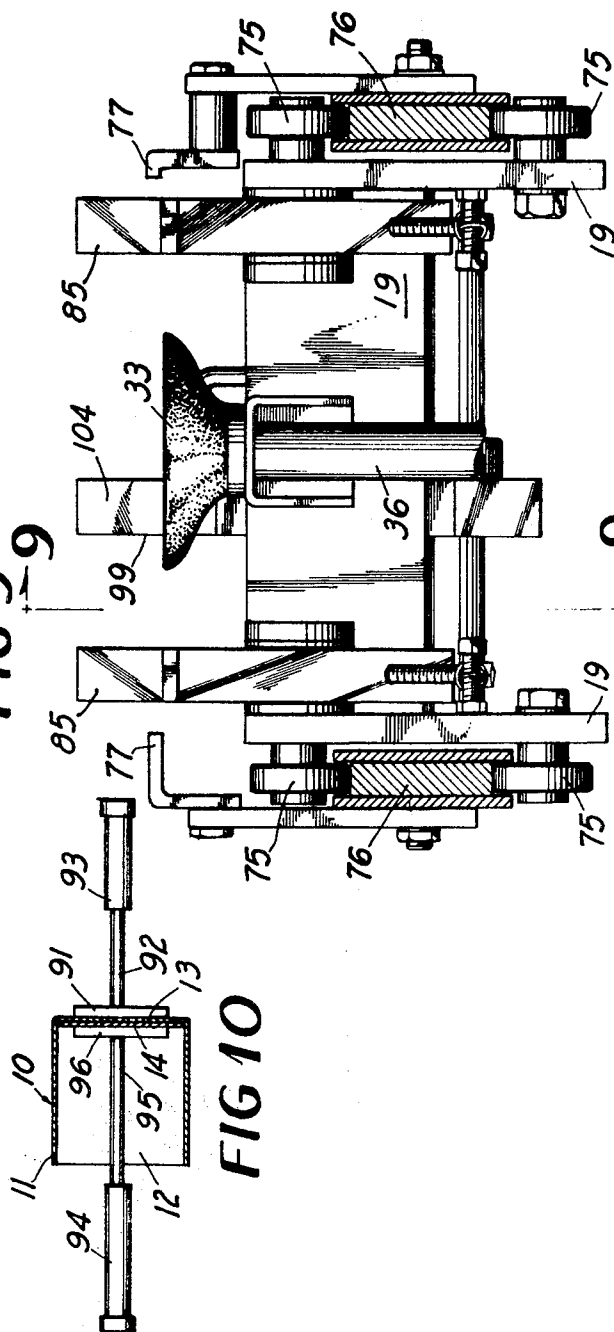


FIG 10

FIG 8

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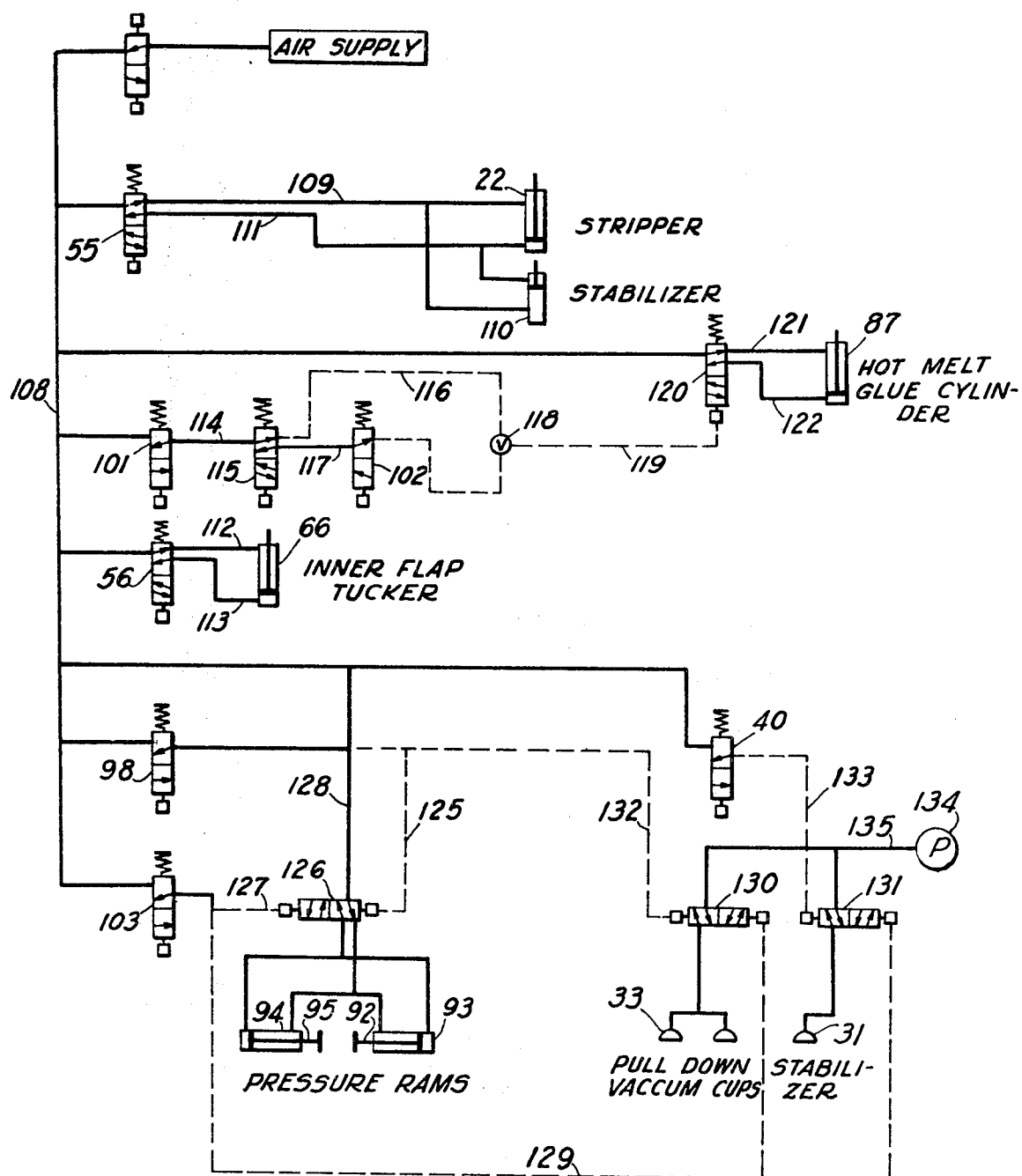


FIG 11

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MACHINE FOR OPENING SHIPPING CASES FROM THE FLAT

Donald G. Reichert, Tarpon Springs, and Earl Petrikin,
St. Petersburg, Fla., assignors to ABC Packaging
Machine Corporation, Largo, Fla.

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U.S. Cl. 93—36.3

11 Claims

ABSTRACT OF THE DISCLOSURE

A device for opening collapsible shipping cases, closing the foldable flaps thereof, and gluing the flaps in a closed position including a magazine for receiving the cases in a flat, collapsed condition, a stripper for displacing cases individually from the magazine, a vacuum assembly for opening each case while vertically moving the same, a folding assembly for closing the end flaps of the opened case, an indexing assembly for advancing each opened case with the end flaps thereof folded closed, a glue applicator for applying adhesive to the closed end flaps, another folding assembly for closing the side flaps of each case over the glued end flaps thereof, and a sealing assembly for pressing the end and side flaps together in a closed position until the adhesive sets.

BACKGROUND OF THE INVENTION

This invention relates generally to machines for opening folded or collapsed shipping cases and more particularly to a machine for successively opening flat, collapsed shipping cartons, partially folding the flaps of one end in a desired manner, and gluing the foldable flaps in a closed position.

Machines for opening collapsible shipping cases and sealing the flaps thereof in a closed position are available on the market today. These machines, however, are bulky and require complicated camming and gearing arrangements. This results not only in a high cost of production for these machines, but in extremely high maintenance costs as well. Moreover, the machines that are now available operate slowly and require skilled operators to properly manage their use.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved machine for opening or squaring up shipping cases received in a collapsed condition and folding and gluing together the flaps thereof.

Another object of this invention is to provide a machine for opening folded or collapsed shipping cases which will operate without attention other than keeping the storage magazine thereof filled with the folded or collapsed cases in the condition in which they are received from the manufacturer.

Still another object of this invention is to provide a machine for opening collapsed shipping cases which is fast and economical in operation, has few moving parts and is durable in construction. The foregoing and other objects, advantages and features are attained by a machine wherein the vacuum system and the mechanical components thereof are operated by a single prime moving element so that only one external fluid pressure source and an electrical source are required to operate the machine. The construction is such that only a minimum amount of floor space is required for the machine and the movement of the shipping case during the forming operation is also kept to a minimum.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a machine constructed in accordance with the teachings of the present invention;

FIG. 2 is a sequential schematic view showing one-half of a case being formed;

FIG. 3 is an exploded perspective view showing how the two halves of the case fit together;

FIG. 4 is a longitudinal cross-sectional view taken through the machine illustrated in FIG. 1;

FIG. 5 is a partial top view of the machine showing the storage magazine and the stripper assembly;

FIG. 6 is a cross-sectional view taken along the line 6—6 of FIG. 4;

FIG. 7 is an enlarged side view of the pull-down assembly;

FIG. 8 is an enlarged cross-sectional view taken along the line 8—8 of FIG. 4;

FIG. 9 is an enlarged view of the carriage taken along the line 9—9 of FIG. 8;

FIG. 10 is a schematic view showing the carton half being compressed for the glue to set; and,

FIG. 11 is a fluid circuit for the machine of the disclosed invention.

DESCRIPTION OF AN ILLUSTRATED EMBODIMENT

Referring now to the drawings, one-half of a shipping or packing case indicated generally by the reference numeral **10**, constructed of corrugated board, or pasteboard, or the like, is shown in FIG. 2 in a collapsed, or flat, and folded condition as received from the manufacturer and in the various successive stages in which it is normally opened and set up for use. The shipping case **10** comprises side walls **11** and end walls **12**, forming the body thereof, and corresponding side flaps **13** and end flaps **14**. Although illustrated herein as being generally rectangular in configuration, the cases or cartons may also be square, if desired.

The collapsed case **10** is designed to be opened or squared up by bending the material of the side and end walls along creases or score lines **15** which are provided at the corners. The end flaps **14** are folded to a closed position first and will be referred to hereinafter as the inner flaps, while the side flaps **13** are closed over them and will hereinafter be referred to as the outer flaps. When folded in the manner indicated and secured as by gluing, the flaps **13** and **14** form the bottom or top end wall of the carton being assembled, as by sliding one case-half **10** over another case-half **10** as shown in FIG. 3.

In reference first to the general operation of the case opener of the present invention, and tracing the progress of a case **10** through the machine, the collapsed cases are fed one at a time from a storage magazine **16** by means of a reciprocating plunger or stripper **17** to a case opening or squaring up station indicated generally by the reference character **S**₁. At the opening station **S**₁, after the case has been squared up, the two inner flaps **14** thereof are folded to the closed position by a flap tucking assembly **18**, whereupon the case is advanced in a direction perpendicular to the feeding movement of the stripper **17** by means of a reciprocating carriage **19** to a glue application and outer flap tucking station generally indicated by the reference character **S**₂. A sealing assembly **21** positioned in the station **S**₂ presses the inner and outer flaps together in a closed position for a sufficient period to permit the adhesive to set. The case **10**, having been opened and set up for use, is discharged from the machine and the cycle continuously repeated.

Referring now more particularly to the case opening or squaring up station **S**₁, the collapsed case halves **10** are

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placed in the storage magazine 16 and are removed therefrom one at a time by the pressure-actuated reciprocating stripper 17 which comprises a pneumatic cylinder 22 having a piston rod 23 thereof connected to a support 24 for a flat plate or feeding bar 25. The cylinder 22 is connected at each end thereof to back plates 26 having integral bracket portions 27 secured to a beam or brace 28 of the main frame 29 by bolts or the like. When the rod 23 is withdrawn to its limit within the cylinder 22, the feeder plate 25 secured thereto and reciprocably movable therewith engages the edge portion of the collapsed case 10 at the bottom of the stack contained in the magazine 16 whereby, upon extension of the rod 23, the feeder plate 25 forces the lowermost case or carton 10 from the storage magazine 16 to the opening or squaring up station S₁.

The storage magazine 16 is generally rectangular in configuration, slightly larger in its dimensions than the folded cartons 10 and of a suitable height to hold a comparatively large quantity of these flat cartons lying one upon another. It is constructed of sheet metal sides, one of which is preferably omitted to permit access to the cases should they fail to properly feed downwardly. A guide rail 20 and a spring gate unit 30 maintain the case 10 level as it is fed to the station S₁ until it is moved perpendicularly downward by a pull-down assembly positioned therein.

Referring now principally to FIG. 4, an upper vacuum cup 31, which is pivotally mounted to prevent wear to a support bar 32, engages the upper surface of a side panel 11 of the carton 10 and lower vacuum cups 33, which comprise a part of a pull-down assembly generally indicated by the reference numeral 34, engage the opposite side panel 11 of the carton 10.

The pull-down assembly 34 comprises a support bar 35 for the lower vacuum cups 33 connected to an upright elongated rod 36 movably disposed in a vertical direction within an upright column 37 of the main frame 29. Movement of the rod 36 is effected by means of an oscillating elbow-shaped lever 38 to which it is pivotally connected at one end thereof by a link 39. The oscillating lever 38 is keyed to a horizontal shaft 41 journaled in bearings, not shown, on the main frame 29 and is pivotally connected at its other end to a connecting link 42 at 43, which in turn is pivotally connected 44 to a crank 45. Crank 45 is fixed to one end of a slow speed shaft 46 of a speed reducing gearing which is contained within a housing 47. The high speed shaft 48 of this gearing is belted to a driving motor 49.

Connected to the lower end of the upright rod 36 and movable therewith is a member 51 having camming surfaces 52 disposed on opposite sides of the rod 36 against which rollers 53 of spring-loaded valve-actuating links 54 bear. The links 54 are associated with limit valves 55 and 56 of a pneumatic control system for the machine.

A pair of rollers 57 are rotatably mounted in a bracket 58 secured to a beam 59 of the main frame 29 on shafts 60 bolted therethrough and are positioned directly beneath the lowermost disposed end panel 12 of the collapsed case 10 which has been injected into the opening and squaring up station S₁. The rollers 57 lie on a line adjacent to and paralleling the score line 15 separating the end panel 12 and the side panel 11 on the bottom surface of the case 10. Thus, when lowering of the case 10 by the pull-down assembly 34 is initiated, the lower end panel 12 wipes across the rollers 57 and is squared up or opened thereby. When the carton or case 10 is opened a predetermined small amount the support 32 for the upper vacuum cup 31 is pivoted to deactivate a pneumatic switch 40 for releasing the vacuum therein, thereby permitting the case to be fully opened by the descending motion of the lower vacuum cups 33 and the wiping action of the lower end panel 12 on the adjacent rollers 57.

Disposed below the level of the rollers 57 is a second set of rollers 61 also rotatably mounted on a bracket 62 which is secured to a beam 63 of the main frame 29 on shafts 64 bolted therethrough. The lower rollers 61 lie in

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another line parallel to the score line 15 separating the lower end panel 12 and side panel 11 of the case 10 and in the same vertical plane, so that the edges of the rollers 61 abut the end panel 12 when the case has been fully squared up.

Downward movement of the pull-down assembly 34 causes the rollers 53 to move from the inclined surface 52 of the camming member 51 on the pull-down rod 36 to the vertically oriented surface thereof, whereupon the valve 56 is actuated to operate the flap tucking assembly 18. Simultaneously, the valve 55 is actuated to operate the stripper mechanism 17 for removing another case 10 from the bottom of the supply in the storage magazine 16.

The flap tucking assembly 18 is best illustrated in FIGS. 1 and 6 wherein there is shown an air-actuated piston rod 65 reciprocably disposed in a cylinder 66. A horizontal shaft 67 is rotatably disposed in a collar 68 formed on one end of the rod 65 and is vertically displaceable therewith. The shaft 67 is connected to a support 69 pivotally mounted on another horizontal shaft 71 to which is secured a rod-like or tubular tucking element having arms 73 perpendicularly oriented with respect to the line of motion of the rod 65 and arm extension 74 on the ends thereof which fan out from a perpendicular connection therewith and are oriented at approximately 45° angles thereto. When the rod 65 is withdrawn into the cylinder 66, the arms 74 lie in a plane perpendicular to the line of motion of the descending case 10 and the ends thereof extend beyond the ends of the squared-up case in an arms-open or embracing fashion. Thus, upon actuation of the rod 65, the support 69 is pivoted toward the descending case 10 and the arms 74 move in an arc having an ever-decreasing separation therebetween in the plane of the end and side flap creases or score lines 15, whereby the end or inner flaps 14 are folded shut during the passage thereacross of the pivoting tucking element.

Movement of the squared up case 10 from the station S₁ to the subsequent station S₂ is accomplished by the carriage 19 supported on upper and lower wheels 75 secured thereto and movably disposed on upper and lower surfaces, respectively, of a pair of parallel rails or channels 76, between which near one end thereof the pull-down assembly 34 operates to bring the case in its squared up condition onto a set of smooth tracks 77 horizontally disposed above and in parallel relationship with the rails 76. A lever 78 is keyed at one end thereof to a horizontal shaft 79 journaled in bearings, not shown, on the main frame 29 and is pivotally connected at its other end to a link 81 pivotally connected in turn to the carriage 19. A connecting link 82 from a crank 83 fixed to the end of the slow speed shaft 46 of the speed reducer 47 on the opposite side of the housing thereof from the drive for the pull-down assembly 34 is pivoted to the lever 78 at 84. Thus, rotation of the shaft 46 effectively cranks oscillatory movement into the lever 78, which causes the carriage 19 to be moved reciprocably within the rails 76. A pair of advance lugs 85 secured to the end of the carriage 19 facing the squaring up station S₁ and projecting slightly above the tracks 77 engage the case 10 at one end of the reciprocable path of the carriage and, upon movement thereof, advance the case 10 slidingly along the smooth tracks 77.

Turning now to the glue application and outer flap tucking station S₂, and referring more particularly to FIG. 1, there is shown a glue head assembly 87 secured to the main frame 29 and disposed adjacent to the path of travel of the case 10 as it leaves the station S₁. The glue head 87 is connected with a supply of hot melt adhesive and applies the hot melt in a spray form from nozzles therein to the outside surface of the folded inner flaps 14 of the case 10 along a predetermined length thereof controlled by pneumatic limit switches in a manner to be set forth hereinafter.

A set of elongated upper and lower rods or tubular elements 88 are supported from the main frame 29 for re-

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ceiving the case 10 therebetween as it exits the station S₁. At the case entrance point, the rods 88 are equal in separation to the width of the two outer flaps 13, from which point they curve gently inward toward each other in a plane perpendicular to the traveling surface defined by the tracks 77 on which the case 10 is advanced and substantially coincident with or closely paralleling the plane of the closed surface of the case 10 after the outer flaps are closed. The rods 88 thereby engage the upper and lower disposed outer flaps 13 as the case 10 advances from the inner flap tucking station S₁, and forces the outer flaps 13 smoothly to a closed or folded position in accordance with the advancement of the case 10.

Disposed on the main frame 29 and mounted in a housing 89 for reciprocable motion along a line perpendicular to the plane of the closed surface, or folded inner and outer flaps, of the case 10 is a flat compression head or plate 91. The plate 91 is fixed to one end of a piston rod 92 movably disposed in a cylinder 93 connected with a pneumatic control system.

On the opposite open side of the case 10, there is secured to the frame 29 another pneumatic cylinder 94 having a piston rod 95 movable in a line of motion substantially coincident with the line of motion of the rod 92 on the compression plate 91. A substantially flat compression head or plate 96 is also secured to the end of the rod 95 and is dimensioned so as to fit within the open end of the case 10 and substantially cover the surface of the folded inner flaps 14. Adjustably attached to the rear surface of the plate 96 opposite that facing into the open end of the case 10 is a pair of curved stand-off braces 97. The braces 97 are secured to diagonally opposite corners of the plate 96 and are curved outwardly and rearwardly thereof for engaging the inside surfaces of the end walls 12 of the case 10 as the plate 96 is moved thereinto, for bracing the sides thereof during the sealing operation and for insuring proper alignment on the advancement therein.

Accordingly, as the case 10 is advanced from the squaring up and inner flap tucking station S₁ to the glue application and outer flap tucking station S₂, any lateral displacement from its defined path of travel is precluded initially by the inner flap tucking arms 73, 74 and thereafter by a horizontally disposed, curved bar 90 positioned beneath the glue head 87. Immediately upon movement of the carriage for advancing the case 10 with the lugs 85 thereof, a camming device, not shown, on the carriage 19, disengages a limit valve 98 secured to the side of one of the tracks 77 in the area of station S₁.

The valve 98 is associated with a pneumatic control system for the machine and operatively effects the actuation of compression plates 91 and 96 for withdrawing the same in preparation for receiving a newly folded and glued case 10.

A second limit valve 101 in the path of travel of the carriage 19 is actuated thereby for initiating the glue spray operation by glue head 87 as the case 10 passes thereby. In operating sequence, another limit valve 102 in the path of the carriage and associated with the pneumatic control of the glue spraying operation is actuated thereby as the case 10 is further advanced along the spray path of the nozzles on the glue head 87.

Still another limit valve 103 is tripped by the carriage adjacent the end of its travel in advancing the case 10 for actuating the compression plates 91 and 96.

Thus, when the case 10 is advanced by the carriage 19, it is engaged between the outer flap tucking arms 88. As the flaps 13 are slowly folded or closed, the case 10 is moved past the glue spraying head 87 which applies the hot melt to the folded inner flaps 14 before any significant folding of the outer flaps 13 occurs. After the glue is applied, the outer flaps are folded by the rods 88 and as the case 10 reaches the end of the index stroke of the carriage 19, the pressure plate 96 enters the inside of the case 10 while the other pressure plate 91 pushes against the outside of the case thereby applying pressure, both inside and

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out, to the flaps for a sufficient period of time to permit the adhesive to set. During the pressure application period, the carriage 19 is returned to the station S₁ to receive another case 10, the squaring up of which is initiated during the carriage return. With reference to FIG. 9, it may be seen that the second advancing lug 99 is tapered on the upper surface thereof at 104 and is biased in the direction of return by a spring 105. Thus, on the carriage return, the lug 99 is pressed downwardly to the level of the tracks 77 by the case 10 under compression thereabove and upon passage by the case, the lug 99 is biased upwardly about the pivot 106 to prepare for the next advancing cycle of the carriage 19, whereupon the lug 99 pushes the sealed case 10 forward and discharges it from the machine.

A fluid circuit illustrating a control system for the case opening machine disclosed herein is shown in FIG. 11. As shown therein, an air supply under pressure is provided in a main line 108. The 4-way valve 55 is shown connecting the line 108 to a line 109 feeding the rod side of air cylinder 22 of the stripper mechanism 17 and the piston side of an air cylinder 110 for moving the support 32 of the upper vacuum cup 31. Upon cam actuation of the valve 55 by the crank-driven member 51 as it moves downward and the roller 53 rides up onto the vertical surface thereof, the supply line 108 becomes connected through the valve 55 with a line 111 leading to the piston side of the air cylinder 22 and the rod side of the air cylinder 110, thereby actuating the stripper mechanism for feeding a new-collapsed case 10 from the magazine and pivoting the upper vacuum cup support 32 out of the operative position. Upon upward movement of the member 51, when the roller 53 rides onto the inclined surface 52, the valve 55 is returned to the position shown, retracting the stripper feeding plate 25 and returning the upper vacuum cup or stabilizer 31 to an operative position.

The 4-way valve 56 is actuated simultaneously with valve 55 by the same actuating cam mechanism for connecting the supply line 108 with lines 112 and 113, alternately, for operating the inner flap tucking assembly 18.

The valve 101 is shown disposed between the supply line 108 and another line 114 connected to a 4-way valve 115 which is actuated by a pair of short camming surfaces on a disc, not shown, fixed to the speed reducer shaft 46. The limit valve 101 is shown in a non-passing position. Two lines 116 and 117 are connected to the other side of the limit valve 115, one passing directly to a shuttle valve 118 and the other passing through the limit valve 102 enroute to the shuttle valve 118. A single fluid line 119 exits from the shuttle valve 118 and is connected with an actuating air cylinder of a spring-loaded valve 120 which connects the supply line 108 on one side thereof alternatively and successively to lines 121 and 122 on the other side thereof. The lines 121 and 122 are connected, respectively, to the rod side and the piston side of a hot melt glue cylinder for the glue head 87 for operating the glue application to the folded inner flaps as the case 10 is indexed thereby.

Limit valves 98 and 103 control the operation of the pressure plates 91 and 96. As shown, the valve 98 is disposed in a fluid non-passing stage between the supply line 108 and a line 125 leading to one side of an air-actuated valve 126, and valve 103 is disposed in a similar fluid non-passing condition between the supply line 108 and a line 127 to the other side of the actuator for valve 126. The valve 126 provides fluid communication between the supply line 108 and either side of the pistons in the pressure cylinders 93 and 94, depending upon the position thereof, and in the position shown is providing fluid pressure to the rod side in both cylinders via the line 128.

Accordingly, upon actuation of the valve 103 when the carriage 19 advances a folded and glued case 10 into the station S₂, fluid pressure flows through line 127 from the supply 108 to operate the valve 126, whereby connecting the line 128 to the piston side of the cylinders 93 and

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94 to extend the pressure plates 91 and 96. On the carriage return, when pressure is removed from line 127 on disengagement of the cam operating the valve 103, the valve 126 remains in the same position since there is no pressure acting on either side thereof to displace it. When the carriage approaches its traveling limit on its return to station S₁, it trips the cam actuating the valve 98 to supply fluid pressure through line 125 to restore the valve 126 to the position illustrated, wherein the line pressure in 128 causes the pressure plates 91 and 96 to be retracted. Upon initial movement in the case advancing direction, the carriage 19 disengages valve 98, restoring it to the position illustrated.

A branch line 129 leading from the line 127 between valves 103 and 126 connects line pressure from 108 to one side of an air-actuated valve 130 for the pull-down assembly 34 and to one side of another air-actuated valve 131 for the upper vacuum cup 31. The opposite side of the valve 130 is connected to supply 108 by a branch line 132 from the line 125 between the valves 98 and 126. The opposite side of the valve 131 is connected by line 133 to the cam-operated valve 40 of the upper vacuum cup assembly which is in communication with line pressure from 108. Both valves 130 and 131 will in one position thereof provide communication with a vacuum pump 134 by a line 135 thereto, for creating a vacuum in the upper and lower vacuum cup assemblies 31 and 33, respectively. It may be seen, therefore, that the operation of the vacuum cups 31 and 33 is coupled with the operation of the pressure plates 91 and 96.

The operation of the case-opening apparatus has been described along with the description of the construction and a fluid control circuit therefor so that a repetition is believed unnecessary. Obviously, many modifications and variations of the present invention may be made in the light of the above teachings. It is to be understood, therefore, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a machine for opening shipping cases from a flat, collapsed condition, the combination comprising:

a magazine for supporting a supply of said cases;

means for selectively removing said cases one at a time from said magazine and feeding said cases to an opening station;

means for opening each of said cases at said opening station by moving the side panels thereof apart along a line of motion perpendicular to the plane of said case in said collapsed condition in said magazine;

inner flap folding means for folding the end flaps of said case to a closed position upon opening of said case;

indexing means for advancing each of said opened cases along a line of motion perpendicular to said first line of motion;

means for applying glue to said folded end flaps during said advancement of said cases by said indexing means;

outer flap folding means for folding the side flaps of said case to a closed position during said advancement of said case by said indexing means and after glue has been applied to said folded end flaps by said glue applying means; and,

sealing means for pressing said folded end and side flaps together.

2. The machine of claim 1, wherein said means for removing said cases from said magazine comprises a stripper element reciprocable along a line of motion perpendicular to said lines of motion of said opening means

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and said indexing means and disposed below said magazine for removing the lowermost case in said magazine in each complete reciprocating motion.

3. The machine of claim 1, wherein said opening means comprises:

first vacuum means for gripping one panel of said flat, collapsed case;

second vacuum means for gripping the opposite panel of said case; and,

means for moving said second vacuum means away from said first vacuum means.

4. The machine of claim 3, further comprising:

means for releasing the vacuum in said first vacuum means after said moving means moves said second vacuum means a predetermined distance therefrom.

5. The machine of claim 1, wherein said inner flap folding means comprises:

an elongate member having an arm at each end thereof disposed at equal angles and facing in the direction of the flapped, open case; and,

means for pivoting said member in the direction of said case until said member contacts the flat closed surface of said end flaps.

6. The machine of claim 1, wherein said indexing means comprises a carriage reciprocably mounted between said opening station and said sealing means station; and,

means for moving said carriage.

7. The machine of claim 1, wherein said sealing means comprises:

a first compression plate movable reciprocably in a line of motion perpendicular to said line of motion of said case advancement;

another compression plate movable reciprocably in a line of motion perpendicular to said line of motion of said case advancement, and disposed on an opposite side of said case advancement line of motion from said first compression plate in substantial alignment therewith.

8. The machine of claim 6, further comprising means responsive to said carriage movement for controlling said glue application means and said sealing means.

9. The machine of claim 3, further comprising means responsive to said second vacuum moving means for operating said magazine case removal means and said inner flap folding means.

10. The machine of claim 3, wherein said indexing means comprises a carriage reciprocably mounted on a path between said opening station and said sealing means; and,

motor drive means for moving said carriage and said moving means for said second vacuum means.

11. The machine of claim 8, wherein said glue application and said sealing means control means comprise a pneumatic circuit; and,

a source of fluid under pressure.

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WAYNE A. MORSE, JR., Primary Examiner

U.S. Cl. X.R.

93—36MM, 53AC