

[54] APPARATUS FOR ERECTING CARTONS

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[75] Inventors: **Edwin Naul Deering; Wickliffe Jones**, both of Covington, Ky.

[73] Assignee: **R. A. Jones & Company, Incorporated**, Covington, Ky.

Primary Examiner—Evon C. Blunk
 Assistant Examiner—Bruce H. Stoner, Jr.
 Attorney—Edmund P. Wood et al.

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Related U.S. Application Data

[60] Continuation of Ser. No. 875,762, Sept. 29, 1969, abandoned, which is a division of Ser. No. 662,978, Aug. 14, 1967, Pat. No. 3,476,024.

[52] U.S. Cl. **271/12, 271/102**

[51] Int. Cl. **B65h 3/08**

[58] Field of Search 271/12, 13, 14, 32, 271/44 A, 26

[56] **References Cited**

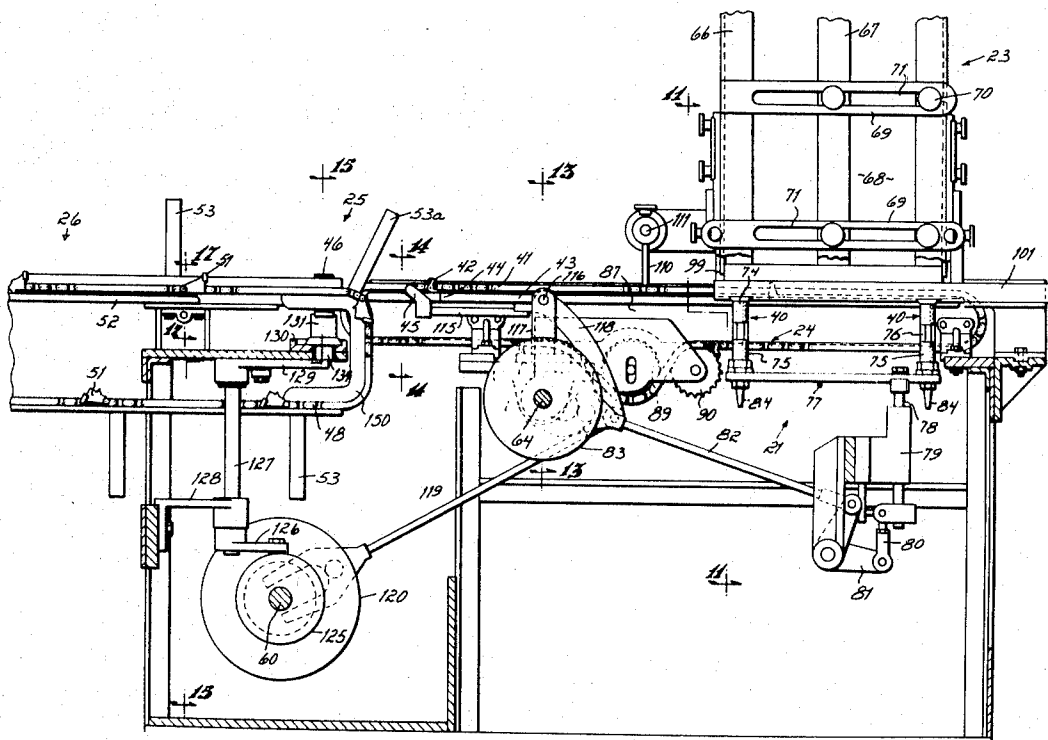
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[57] **ABSTRACT**

An apparatus for erecting cartons including a mechanism for separating one carton blank from a stack of carton blanks. The separator mechanism includes vacuum cups for drawing one carton blank downwardly from the stack in timed relation with a feeder mechanism. The cups themselves are mounted on long elastic stems permitting contact with a carton blank even after the blank is contacted and moved by the feeder mechanism.

3 Claims, 11 Drawing Figures



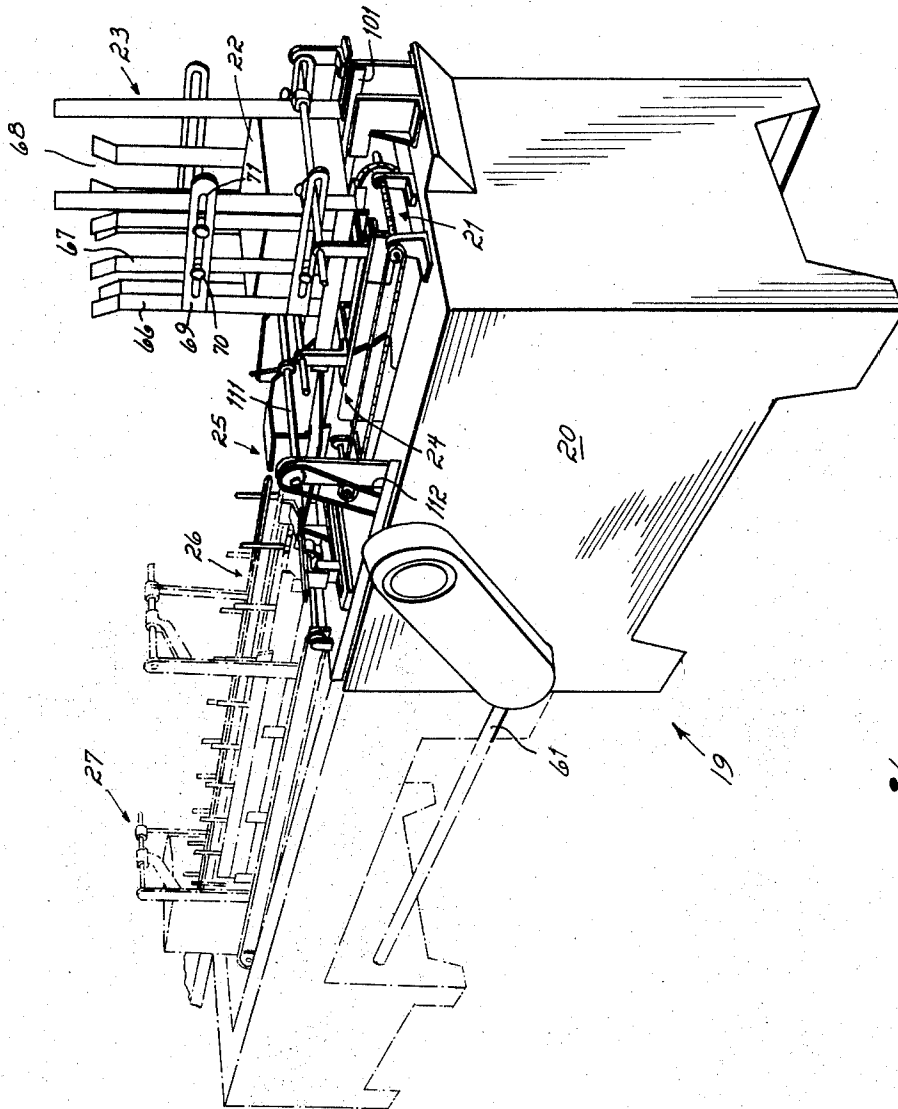


Fig. 1

INVENTORS
Wickliffe Jones
Edwin W. Deering
Wood, Heron & Evans
ATTORNEYS

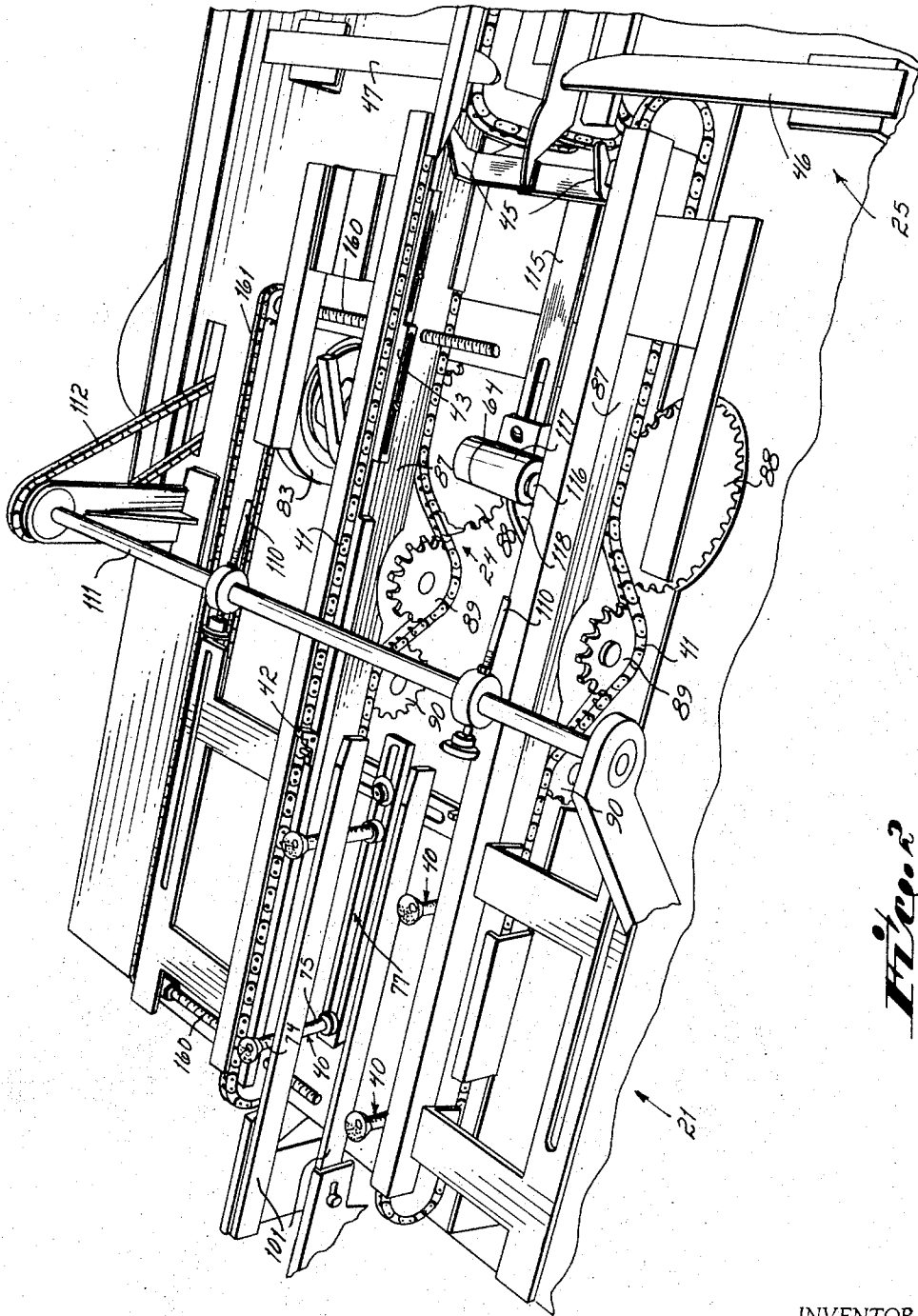


Fig. 2

INVENTOR'S
Wickliffe Jones
BY *Edwin N. Deering*
Wood, Heron & Evans
ATTORNEYS

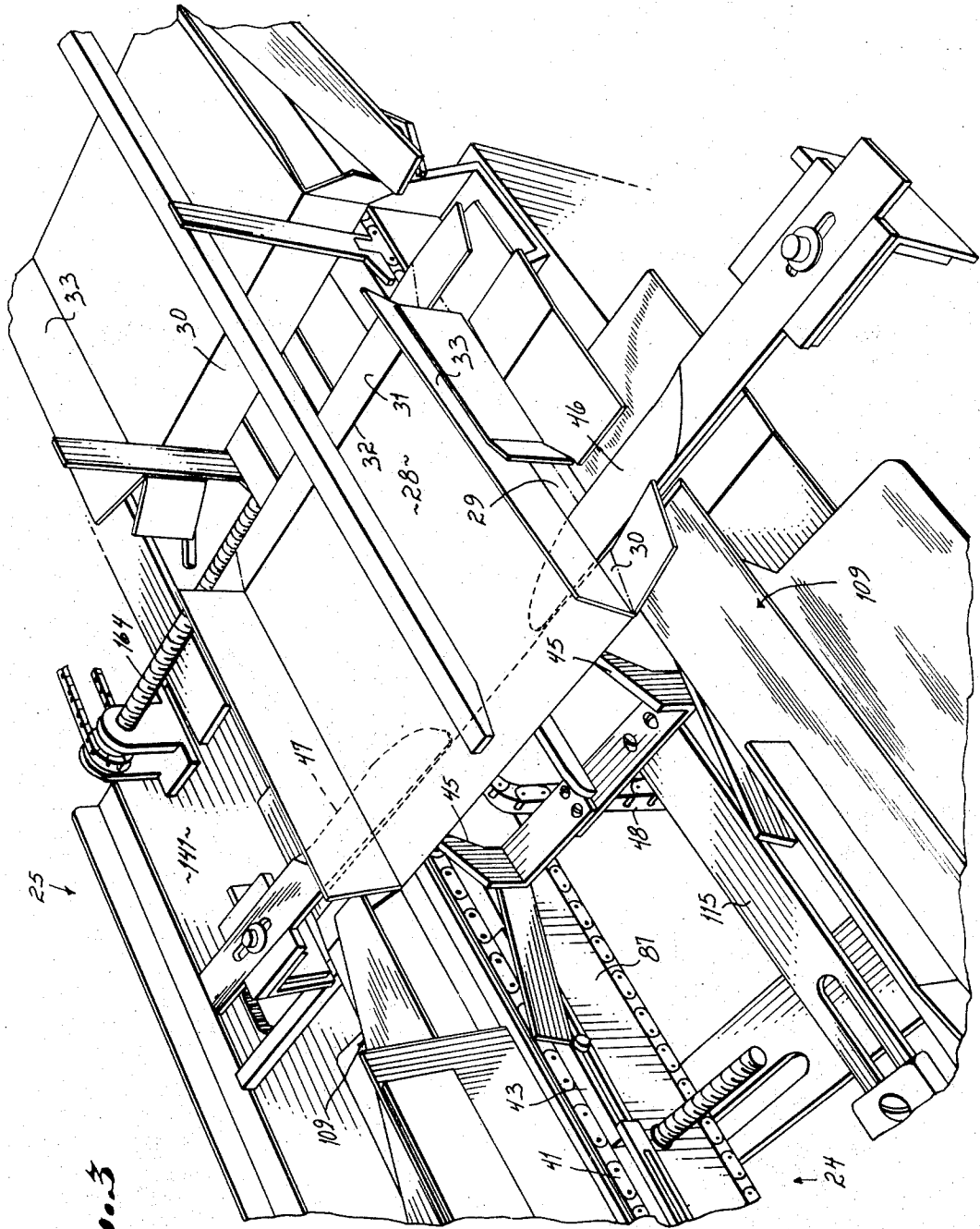


Fig. 3

INVENTORS
Wickliffe Jones
BY *Edwin N. Deering*
Wood, Heron & Evans
ATTORNEYS

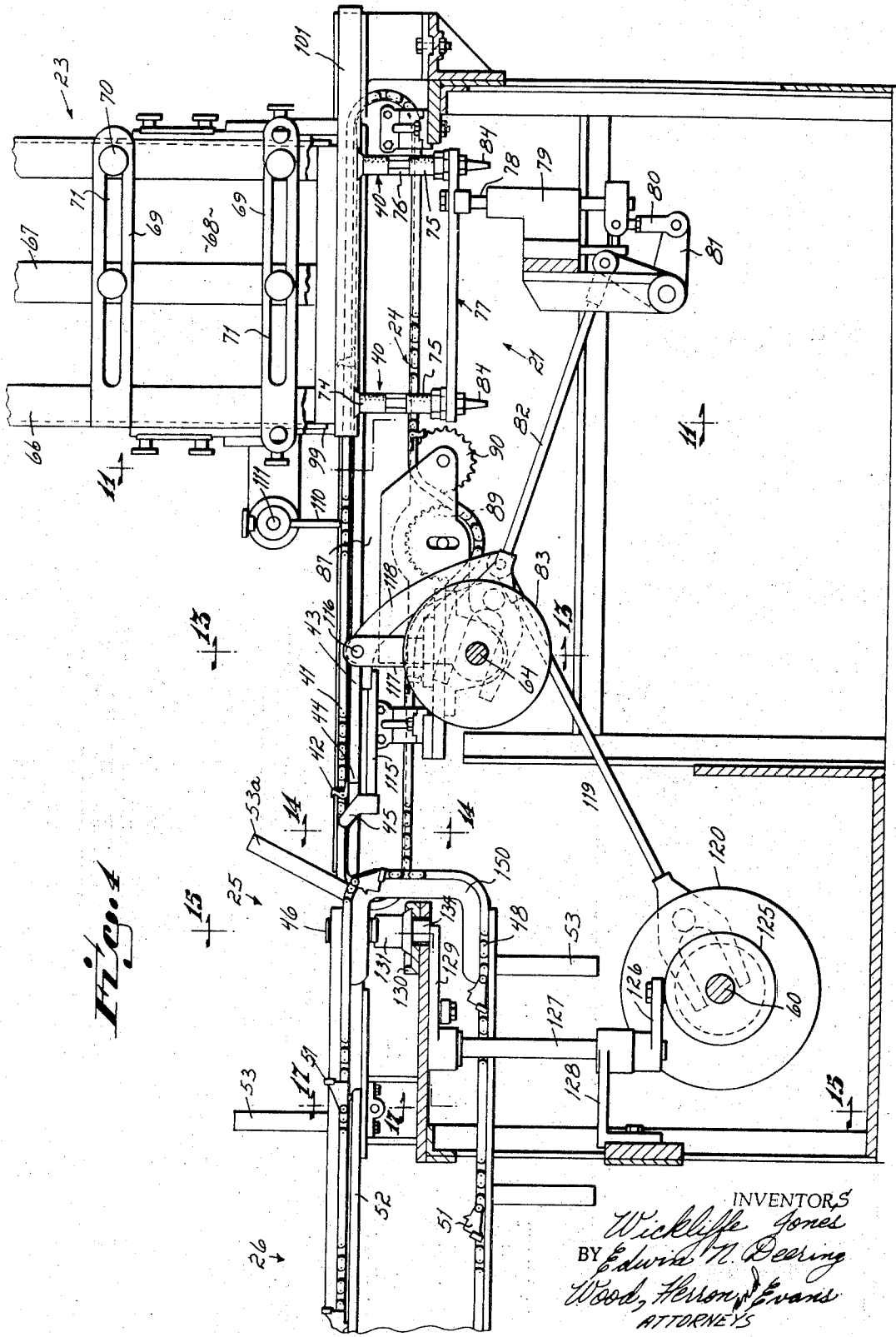
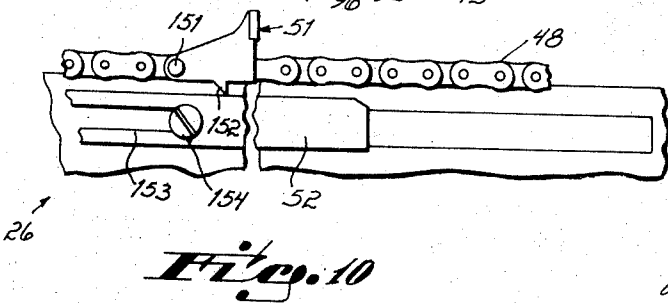
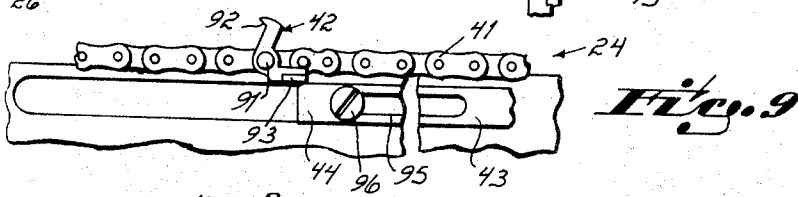
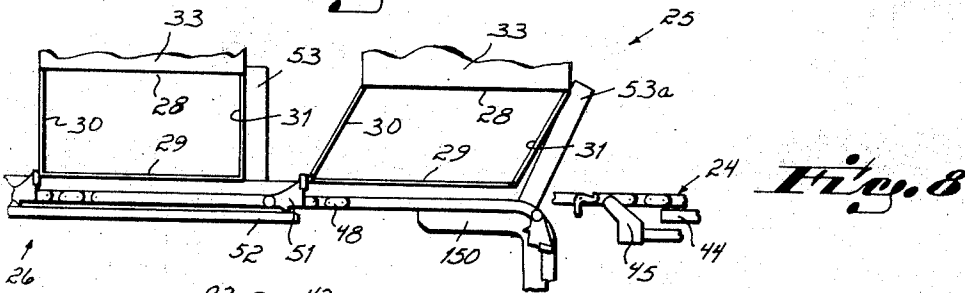
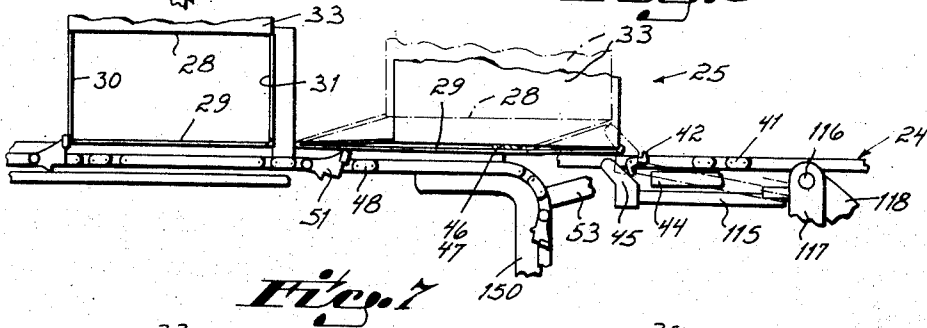
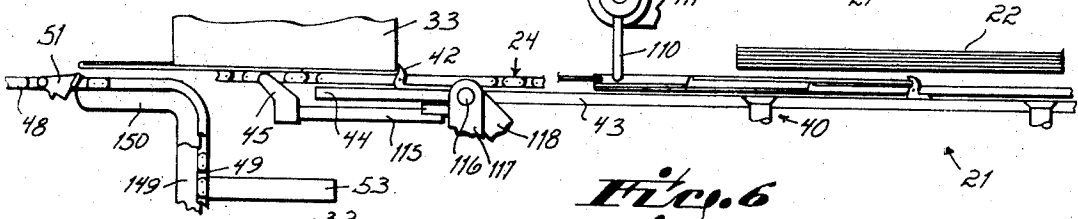
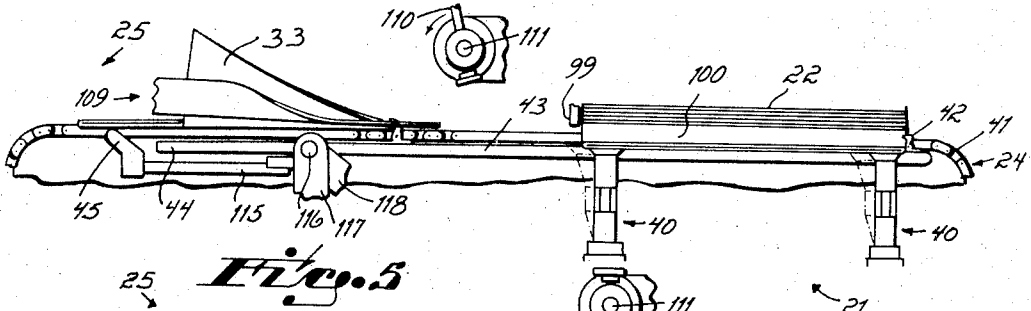


Fig. 4

INVENTORS
Wickliffe Jones
BY *Edward M. Deering*
Wood, Herron & Evans
ATTORNEYS



INVENTORS
Wickliffe Jones
BY Edwin M. Deering
Wood, Heron & Evans
ATTORNEYS

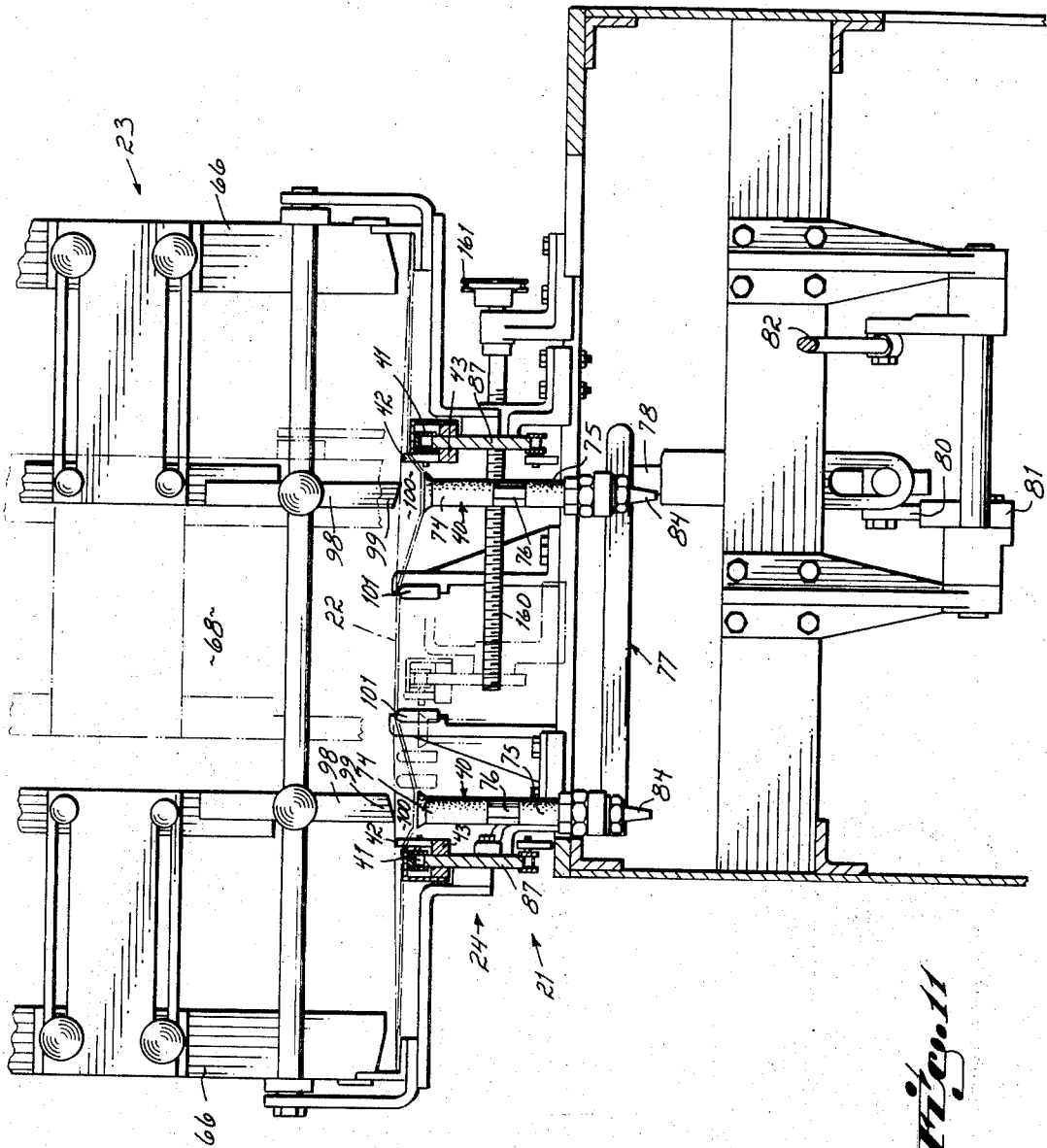


Fig. 11

INVENTOR, S.
Wickliffe Jones
BY *Edwin M. Deering*
Wood, Ferron & Evans
ATTORNEYS

APPARATUS FOR ERECTING CARTONS

This application is a continuation of U.S. Pat. application Ser. No. 875,762 filed on Sept. 29, 1969, now abandoned, which was itself a division of U.S. Pat. application Ser. No. 662,978 filed on Aug. 14, 1967, now U.S. Pat. No. 3,476,024, the disclosure of that patent is herein incorporated by reference.

BACKGROUND OF THE INVENTION

The invention is particularly directed to apparatus in which flat folded carton blanks are stacked in a magazine, are fed one at a time from the magazine and are then conveyed to an erecting station. At the erecting station, the carton is erected and then captured between a leading transport lug mounted on its endless conveyor and a trailing transport lug mounted on another endless conveyor. The two endless conveyors carry the erected carton downstream from the erecting station for further processing, that is, loading, gluing and closing the carton.

The carton blank includes upper and lower major walls interconnected by leading and trailing side walls and is adapted to be erected to a tubular form with the axis of the tube oriented transversely of the machine direction.

Many machines of different types for erecting cartons are disclosed in prior patents. In one of the principal machines now enjoying widespread use, it has been the practice to convey such blanks with the leading side wall facing downwardly and the trailing side wall facing upwardly. At the erecting station, the upper major wall is supported while the trailing side wall is swung down, thereby forcing the bottom major wall and leading side wall down to erect the carton. Simultaneously, the leading transport lug is brought up into position to engage and hold the leading side wall in an erect position as the carton is conveyed downstream of the erecting station. The leading transport lug must project high enough to engage a substantial portion of the leading side wall for otherwise the resilience of the carton material would tend to cause the carton to collapse with the leading side wall sliding over the leading lug. However, as the leading lug is made higher, a greater space must be provided between adjacent cartons in order to provide a sufficient space, at least equal to the height of the lug, to permit the lug to swing up in front of the carton. This tends to impose a limitation on the size of the carton which can be economically handled in the machine for the larger the carton, the greater is the requirement of space between the cartons in order to accommodate a high lug for engaging and supporting the leading side wall.

SUMMARY OF THE INVENTION

The invention is also directed to apparatus for feeding the blanks from a stack to the erecting station. It has been the practice to engage the undersurface of the cartons with suction cups which pull the carton blanks down. The carton blanks are then engaged at their rearward edges by a reciprocating knife which thrusts them forward out of the magazine.

An objective of this invention has been to provide an improved and simplified mechanism for separating one carbon blank from a stack of carbon blanks.

In accordance with the invention, the feeding mechanism includes a suction cup which is freely supported on an elongated flexible stem. The suction cup can

draw the carton blank down-wardly out of the magazine and, with the vacuum maintained, stay with the carton as it is advanced a short distance out of the magazine as it is being stripped away from the cartons remaining in the magazine. Through the use of the flexible stemmed suction cup, in combination with an endless conveyor, the need for reciprocating knives to thrust the carton out of the magazine, as well as the complex mechanism for reciprocating the knives, is eliminated.

The several features of the invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the machine employing the invention,

FIG. 2 is a perspective view of the carton feeding and erecting stations with the magazine removed for clarity,

FIG. 3 is a perspective view of the erecting station with a carton blank being shown at the beginning of the erecting operation,

FIG. 4 is a side elevational view, partly in section, of the erecting station,

FIGS. 5-8 are diagrammatic side elevational views illustrating the sequence of operations in erecting a carton,

FIG. 9 is a fragmentary side elevational view of a conveyor lug for the feeding section,

FIG. 10 is a fragmentary side elevational view of the forward transport lug,

FIG. 11 is a cross sectional view taken along lines 11-11 of FIG. 3 illustrating the feeding section of the invention.

In the following description, the term "machine direction" will refer to the direction of movement of the cartons as they are being erected and transported for further processing; the length of the carton is its dimension measured in the machine direction; the width of the carton is the dimension measured horizontally in the direction transverse of the machine direction; and the depth of the carton is the dimension measured vertically of the machine direction.

GENERAL ORGANIZATION

The apparatus is illustrated at 19 in the perspective view of FIG. 1. The apparatus which is supported on an elongated frame 20 includes a feeding section 21 where carton blanks 22 are stacked in a magazine 23 and are fed one at a time from the bottom of the stack in the machine direction. Downstream of the feeding section is a feed conveyor section 24 which may be as long as is necessary to perform any intermediate operations such as printing on the carton before it is erected. Downstream of the feed conveyor section is an erecting station 25 where the cartons are opened from flat folded blanks to tubular cartons open at each end. Downstream of the erecting station is a transport conveyor section 26 which carries the cartons to the area indicated at 27 for further processing including filling or loading, gluing, and sealing.

As shown in FIG. 3, each carton blank 22 includes upper and lower major walls 28 and 29, a leading side wall 30, and a trailing side wall 31. The walls are defined by transverse score lines 32 and are connected together to form the generally tubular carton. Suitable flaps 33 are connected along score lines to the edges of the walls and are adapted to be glued and folded upon

one another to close the carton after it has been erected and filled.

At the feeding section (FIGS. 2, 4, and 11), suction cups 40 are mounted below the magazine 23 for vertical movement. Two suction cups are located on each side of the machine and two laterally spaced feed conveyor chains 41 of the feed conveyor 24 pass between them. The feed conveyor chain 41 extends from the magazine 23 to the erecting station 25. Each chain carries a pivotally mounted conveyor lug 42 which normally rides on a lug cam 43 and which holds the conveyor lug in operative position (FIG. 9) until the lug passes over the downstream end of the cam indicated at 44.

At the erecting station 25 (FIGS. 2 and 3), an initial opening finger 45 is mounted for oscillatory motion and is adapted to engage the trailing side wall 31 of a carton blank to begin its pivotal movement in the erecting operation (FIG. 7). A pair of opening blades 46 and 47 are slidably mounted for transverse movement to project in and out of the tubular carton. The blades engage the carton, during the erecting movement, adjacent the score line 32 of the trailing wall 31 to hold the blank as the trailing wall is pivoted toward its vertical position.

A forward transport conveyor chain 48 passes under the erecting station. On each side of the chain 48 is a rearward transport conveyor chain 49. (See FIG. 15). The chains 48 and 49 carry lugs which are adapted to engage the forward and rearward ends of a carton respectively and convey it into the area 27 for further processing.

Referring to FIGS. 4 and 10, lugs 51 on the forward transport chain 48 are pivotally mounted and are engageable with a cam track 52 which causes the lugs to pivot upwardly into operative position as the carton is erected. Lugs 53 on the rear transport chain 49 are rigidly mounted perpendicular to the length of the chain. As each lug swings upwardly as indicated at 53a, it engages the trailing side wall of the carton and pivots it to its perpendicular position. Thus, each lug 53 combines the function of assisting in the erection of the carton and assisting in transporting the carton from the erecting station.

OPERATION

The operation generally is as follows, reference being made in part to FIGS. 5-8.

As shown in FIG. 5, the suction cups 40 engage the lowermost carton blank 22 and draw it down from the stack. The lugs 42 on feed conveyor chain 41 engage the blank and carry it forward toward the erecting station. During the conveying of the blank, plows, which will be described generally below, open the lateral side flaps 33 of the carton and the opening blades 46 and 47 are projected into the interior of the carton blank (FIG. 3). When the blank is conveyed to the position in which the rearward edges of the blades 46 and 47 coincide with the lower score line of the trailing wall 31, the conveyor lug 42 drops from its track 43 and the forward movement of the blank stops.

During the momentary dwell of the movement of the carton blank (FIGS. 6 and 7), the forward transport lug 51 of chain 48 passes under the carton until it engages the cam track 52 which pivots it upwardly into operative position. The rearward end of the cam track 52 is positioned so that the lug is pivoted to its operative po-

sition just as the erecting of the carton is completed. As the transport lug 51 is being positioned and prior to the removal of blades 46 and 47, the nudging finger 45 partially ejects the carton blank by tapping the trailing wall. (Shown in phantom lines in FIG. 7).

After the carton has been partially erected, the rearward transport lug 53 swings through the position indicated at 53a (FIG. 8) during which it pivots the trailing wall 31 of the carton to a vertical position as the carton is held by the blades 46, 47. The blades are immediately withdrawn and the erected carton is carried by the transport conveyors whose lugs 51 and 53 engage the forward and rearward sides of the carton respectively out of the erecting station.

DRIVE SYSTEM

The drive for the apparatus including the feeder section is derived from a main drive shaft 60 which is in turn driven by a shaft 61 through gearing 62 (FIG. 15), the shaft 61 being driven from the downstream end of the machine.

A chain 63 (see also FIG. 13) transmits power from the shaft 60 to a second drive shaft 64 from which the drive to the operating elements of the feeder section is taken.

FEEDER SECTION

As stated above, the feeder section includes the magazine 23 which is fixed to the frame 20. The magazine includes vertical angle members 66 and vertical flat members 67 which define a rectangular chamber 68. The vertical members are interconnected by horizontal braces 69 through screws 70 passing through slots 71. The screw and slot interconnection permits the vertical members to be adjusted relative to each other in both longitudinal and transverse directions in order to accommodate different sizes of cartons.

Immediately below the magazine 23 are the four suction cups 40. Each cup is a flexible elastomer such as rubber which has an integral upper stem 74 which is flexible and has a lower stem 75 which is also flexible. The stems are interconnected by a metallic sleeve 76. The sleeve 76 maintains the necessary structural rigidity of the stem while the flexible upper and lower stems permit the cup to move forward a short distance while remaining in engagement with the carton blank. (See FIG. 5).

The vacuum cups 40 are secured to a movable 77 which is fixed to a vertical rod 78 slidable in a bracket 79. The rod 78 is reciprocated through a linkage including a link 80, a bell crank lever 81, and a rod 82 which is reciprocated by a cam 83 mounted on the drive shaft 64.

The cups 40 can be shifted with respect to the frame 77 longitudinally and transversely in order to accommodate carton blanks of varying sizes. Each cup has a spigot 84 by which it is connected to flexible tubing (not shown) through which the vacuum is applied to the cup.

The application and relief of the vacuum in the suction cups is timed by the mechanism as shown at 54 in FIG. 13. The vacuum is applied to a stationary block 55 mounted on a bracket 56 fixed to the frame. The block has a port 57 which connects it directly to a header (not shown) which distributes the vacuum to the four suction cups. Intermediate the ends of the port 57 is an exhaust port 58 which is normally covered by a disc 59

fixed to the drive shaft 64. The disc has a transverse slot which is alignable with the exhaust port 58 once during each revolution of the shaft. The vacuum remains applied to the suction cups during the major portion of each cycle, but at the instant that the feed conveyor chains have thrust the blanks out of the magazine, the exhaust port 58 of the port block 57 is connected to atmosphere via the aligned slot in disc 59 and the vacuum is relieved.

The feeder section 21 also includes the upstream end of the conveyor chain 41. The chain 41 is mounted on a track 87 and passes over a drive sprocket 88 fixed to drive shaft 64 (FIGS. 2 and 13) and around idler sprockets 89 and 90. Each chain carries a plurality of the conveyor lugs 42 which are pivoted at 91 to a chain link. Each lug, as shown in FIG. 9, includes a carton engaging hook 92 and a follower 93 the follower 93 riding on the cam track 43 which holds the hook 92 in its upper operative position. As shown in FIG. 9, the cam track 43 is longitudinally adjustable by the slot 95 and screw 96 connection so as to permit adjustment in the instant that the hook 92 drops away from engagement of the carton.

A pair of stripper fingers 98 (FIG. 11) are mounted in the front of the magazine 23 and have lower extremities indicated at 99 projecting just below the lowermost carton in the stack. The stripper fingers are aligned with the suction cups so that as the suction cups draw a carton down, two intermediate portions of the carton indicated at 100 drop below the stripper fingers. Horizontal adjustment of the stripper fingers is provided to permit them to be positioned immediately above the suction cups 40 when the suction cups are moved transversely to accommodate cartons of different widths

A pair of rails 101 extend longitudinally from beneath the magazine to a position a few inches downstream of the magazine to provide support for the cartons stacked within the magazine as well as support for the carton blank as it is fed from the magazine.

The cooperation of the elements is such that the suction cups 40 engage the lowermost blank and pull the intermediate portions 100 down below the level of the stripper fingers 98. While held in this position, the hook 92 of the lug 42 on each conveyor chain engages the carton and begins to convey it out of the magazine. During the initial fraction of an inch of travel, the vacuum remains applied to the suction cups and the suction cups stay with the carton until it clears the stripper fingers. As indicated above, the suction cup is permit-

ted to move with the carton by the elongated flexible stem.

What is claimed is:

1. In a mechanism for feeding carton blanks from a stack and having conveyor lugs passing under the stack in the machine direction to engage the lowermost carton,

at least one suction cup mounted below said stack for engagement with the lowermost carton, an actuator for raising and lowering said cup in timed relation to said conveyor lug whereby said cup is in a lowered position when said lug is in position to engage the trailing edge of a carton,

the improvement comprising,

means for applying a vacuum to said cup and maintaining the vacuum on said cup at least until a carton has been engaged by a lug and advanced by the lug in the machine direction, and

a long flexible hollow stem of an elastomer connecting said cup to said vacuum applying means and providing the sole means for mounting said cup on said actuator so that the cup is freely supported for swinging on its stem with respect to said actuator.

2. In a carton erecting machine according to claim 1, said long stem including a rigid sleeve intermediate its ends.

3. In a mechanism for feeding carton blanks from a stack and having carton advancing means passing under the stack in the machine direction to engage the lowermost carton,

at least one suction cup mounted below said stack for engagement with the lowermost carton,

an actuator for raising and lowering said cup in timed relation to said carton advancing means whereby said cup is in a lowered position when said advancing means is in position to engage the trailing edge of a carton,

the improvement comprising,

means for applying a vacuum to said cup and maintaining the vacuum on said cup at least until a carton has been engaged by said advancing means and advanced by the advancing means in the machine direction, and

a long flexible hollow stem of an elastomer connecting said cup to said vacuum applying means and providing the sole means for mounting said cup on said actuator so that the cup is freely supported for swinging on its stem with respect to said actuator.

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