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Daily et al.

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[54] **METHOD AND APPARATUS FOR FEEDING FLAT BLANKS TO MAKE BOXES**

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[21] Appl. No.: **67,490**

[52] **U.S. Cl.**.....**271/32,** 271/44 A, 271/DIG. 7

[51] **Int. Cl.**.....**B65h 3/08,** B65h 5/16

[58] **Field of Search** .....271/32, 44, 5, 62 B, DIG. 7

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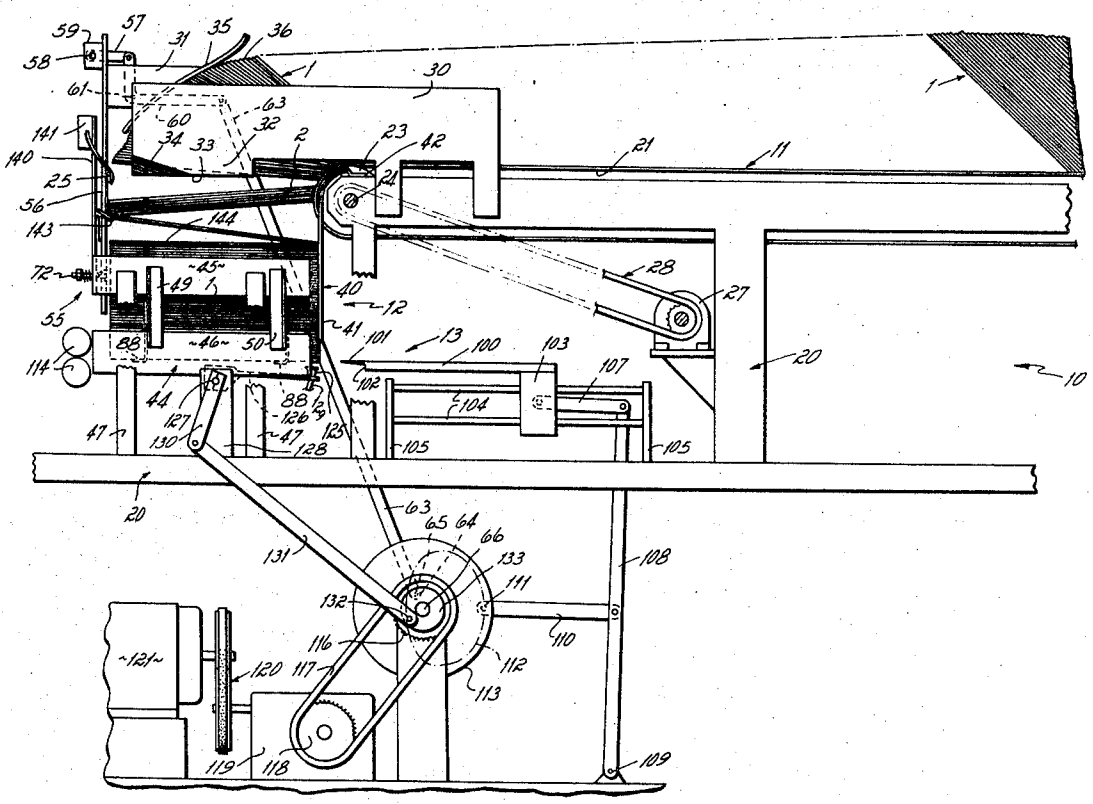
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[57] **ABSTRACT**

Apparatus for feeding blanks, particularly pre-slotted, double-face corrugated blanks, the apparatus having an elongated horizontal conveyor having a discharge end overlying a vertical magazine, said magazine for intermittently advancing blanks in a vertical attitude on said conveyor, causing them to fall to a horizontal attitude at the upper end of said magazine where their descent is temporarily arrested and thereupon permitting them to drop into said magazine.

14 Claims, 10 Drawing Figures



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SHEET 1 OF 4

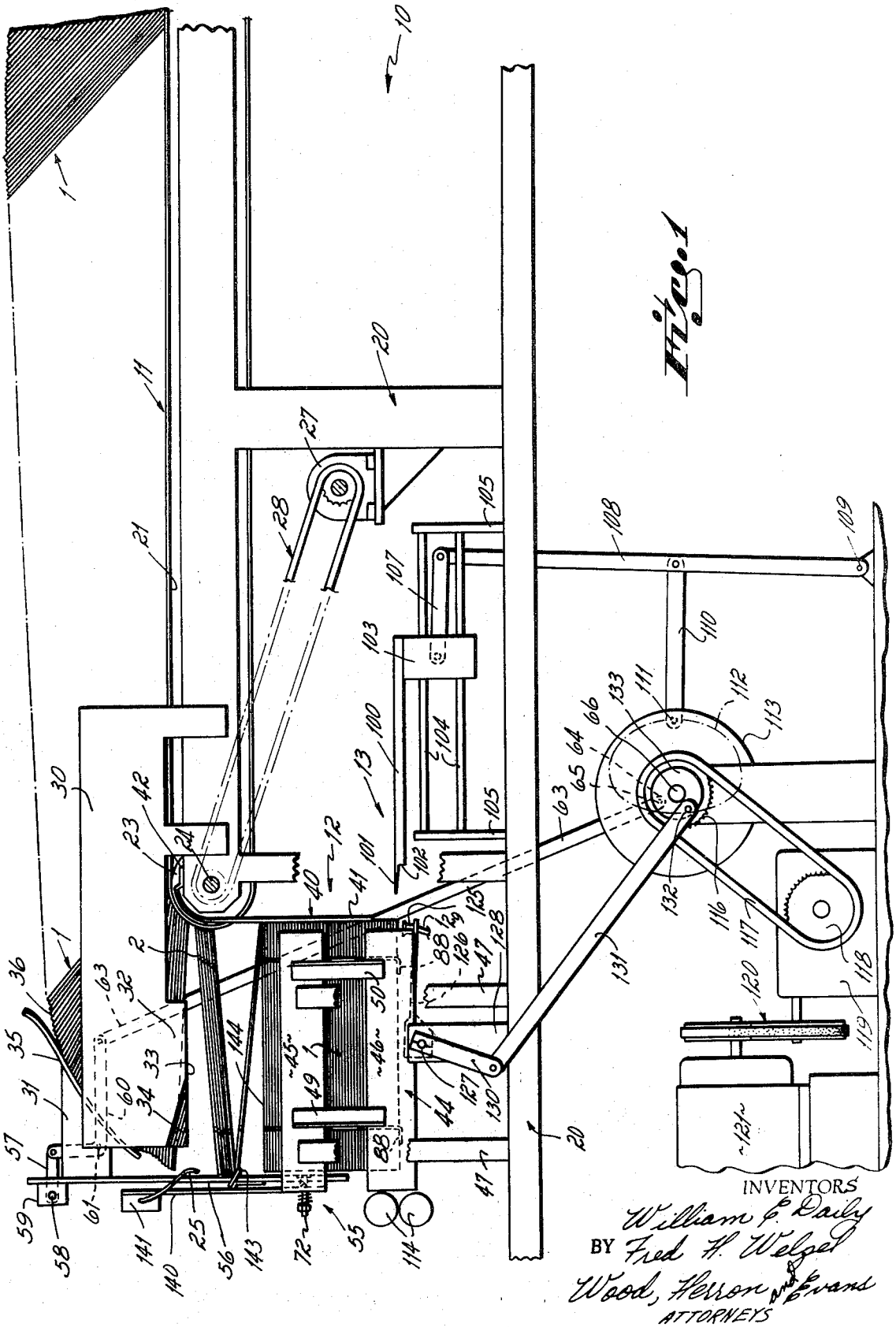


Fig. 1

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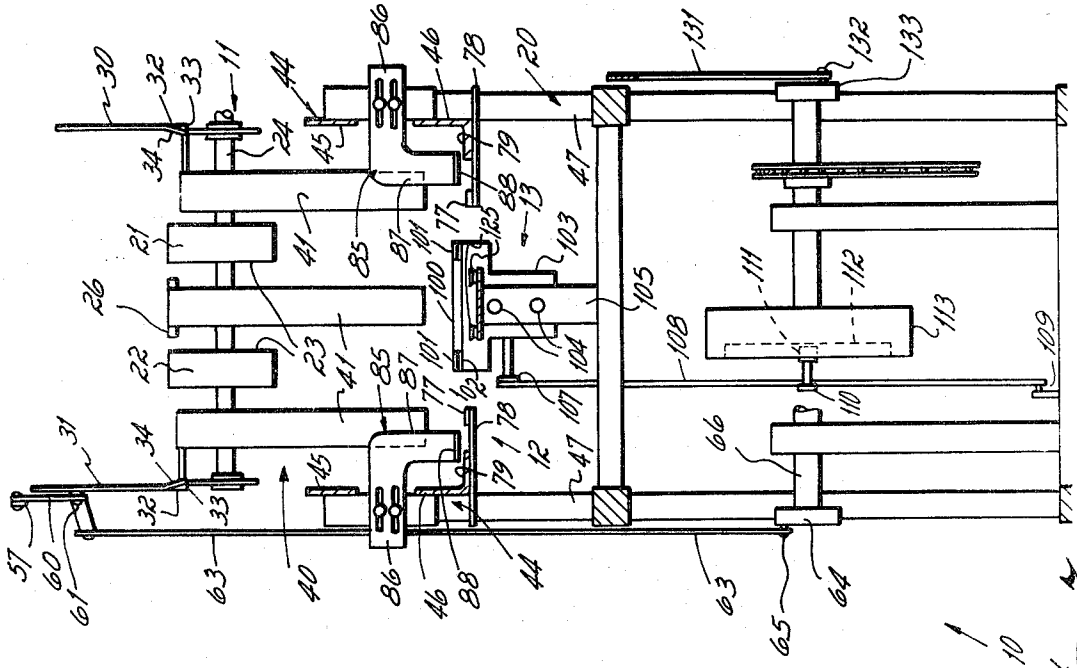


Fig. 3

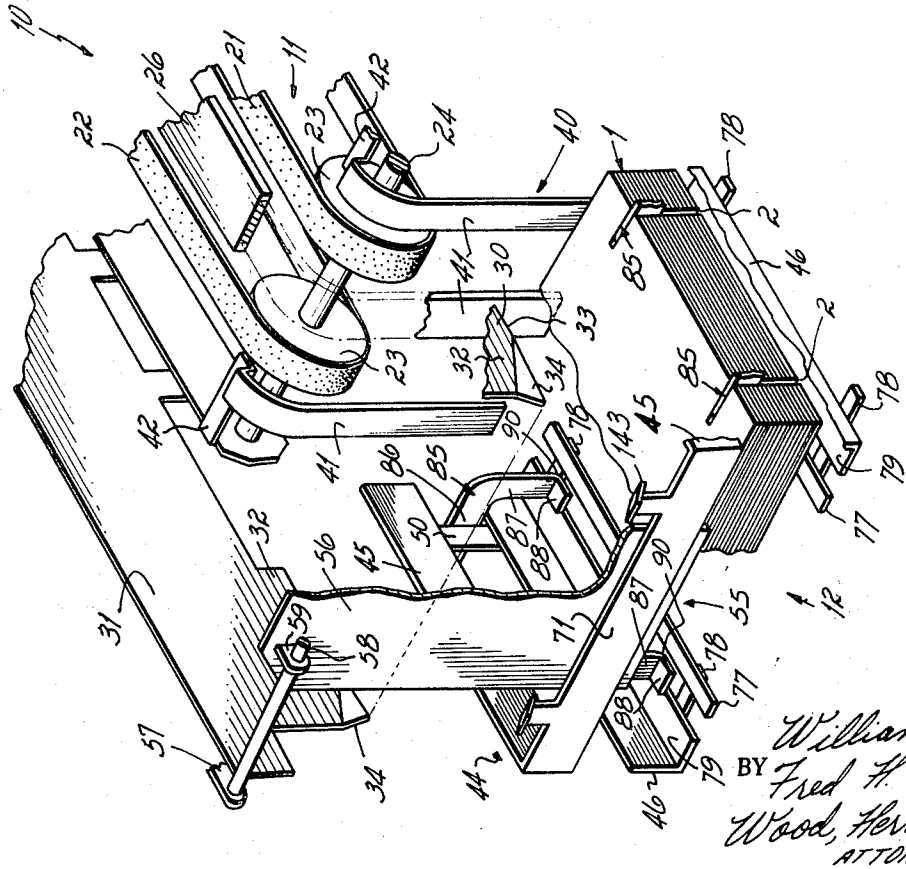


Fig. 2

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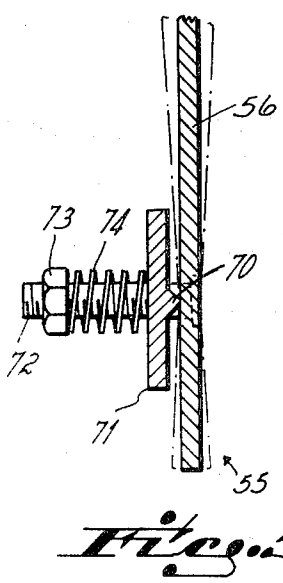


Fig. 5

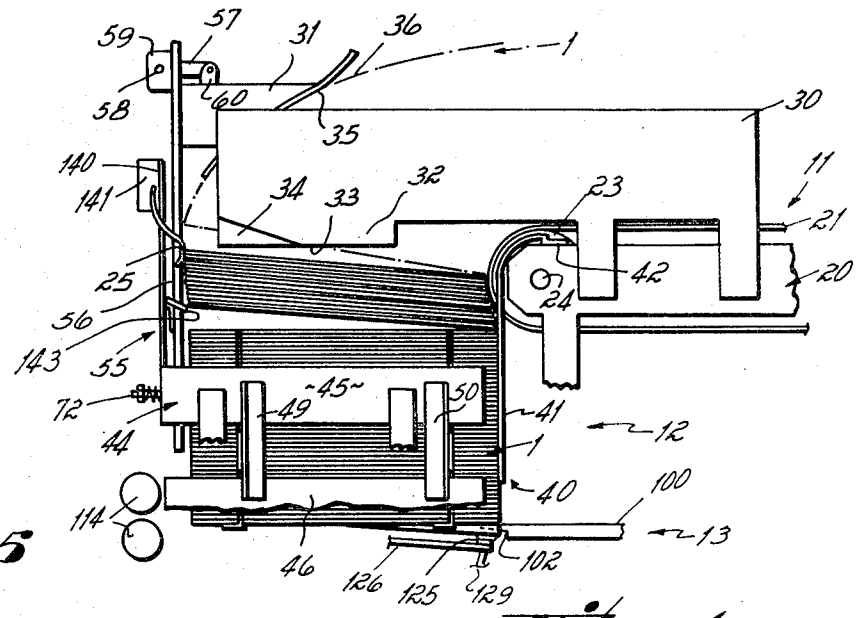


Fig. 4

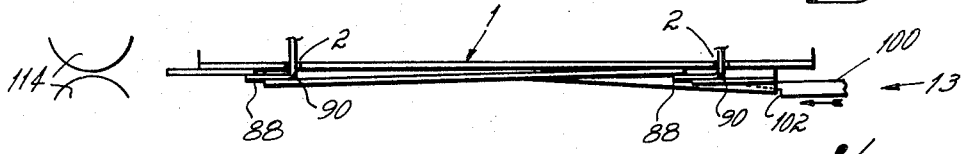


Fig. 6

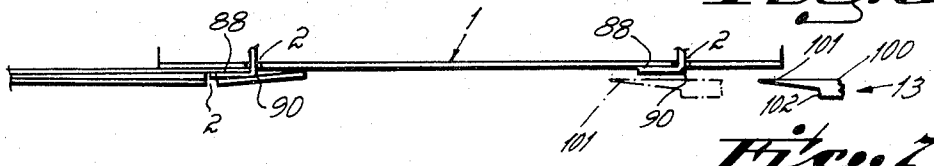


Fig. 7

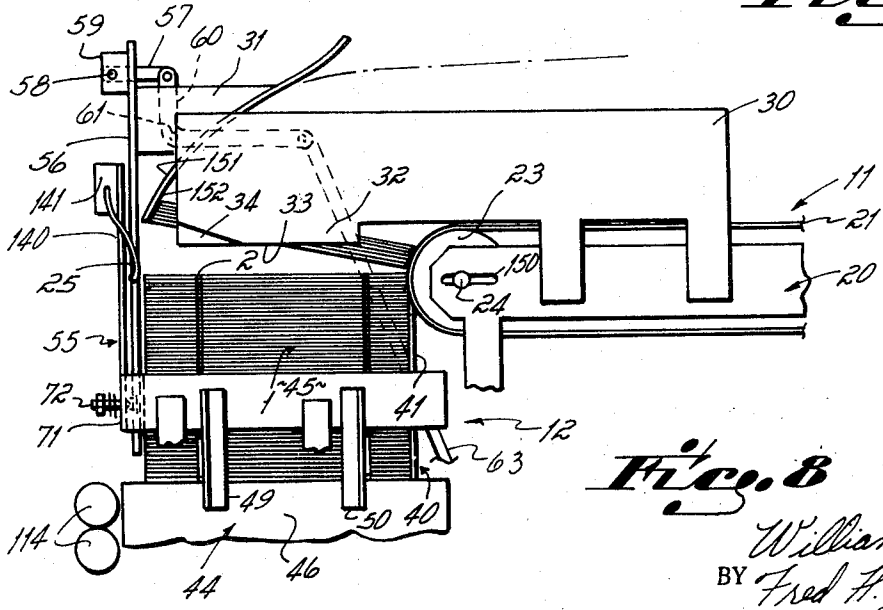


Fig. 8

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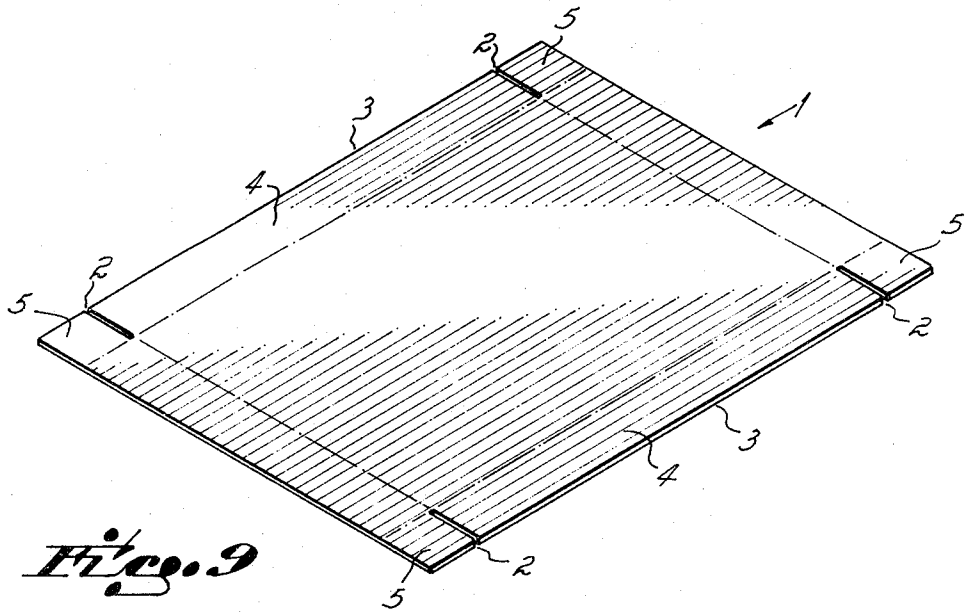


Fig. 9

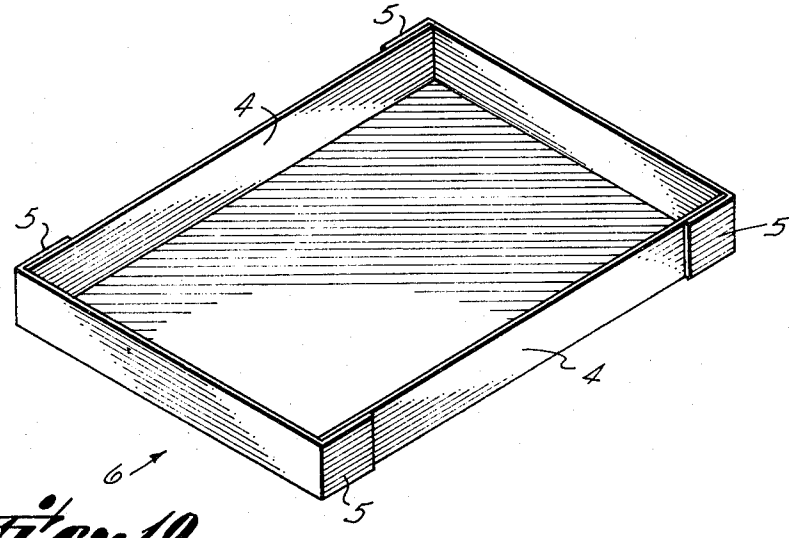


Fig. 10

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METHOD AND APPARATUS FOR FEEDING FLAT BLANKS TO MAKE BOXES

This invention relates to method and apparatus for feeding flat blanks and more particularly, the invention is directed to the feeding of double-face corrugated blanks having two spaced slots, the slots forming side walls and glue flaps from the blank for a tray-type case.

The present practice is to load such blanks manually into a vertical magazine having an ejecting mechanism ejecting blanks horizontally out of the magazine and conveyed outwardly toward case-filling and forming apparatus. While the mechanism of the present practices operates satisfactorily, it is necessarily a slow speed operation and necessarily rather awkward in that it requires a workman to lift blanks over the top of the magazine and drop them into the magazine in a more or less continuous manner to replenish the supply which is exhausted by the mechanism below. Further, and perhaps more importantly, it is impossible to load the magazine with a great many blanks since the magazine would have to be too high and a great number of blanks would place too much weight on the lowermost blank thereby impeding the efficiency of the ejecting operation.

It has been an objective of the present invention to provide apparatus for loading into feeding apparatus many times the number of blanks normally contained in a vertical magazine presently being used. This objective of the invention has been achieved broadly by the use of a horizontal conveyor which carries vertically oriented blanks to a position adjacent a vertical magazine and then permits them to swing horizontally and drop into the vertical magazine. That broad combination is old generally in apparatus for feeding small single-ply blanks used in the making of cartons. That combination is very useful in achieving the objectives of the present invention for it permits the loading of a very large supply of blanks onto an elongated horizontal conveyor while at the same time having a rather short vertical magazine which contains at any one time only a small supply of blanks thereby minimizing the weight of the blanks on the lowermost blank to be ejected.

The present invention is directed in part to the adaptation of that combination to double-face corrugated blanks of the type described above. The double-face corrugated blanks present a problem arising out of the slotted edges of the blanks. When those blanks are conveyed on the horizontal conveyor in line with the direction of ejecting and further processing of the blanks, the slots appear on the side edges of the blank. As those blanks are transferred from the horizontal conveyor to the vertical magazine, the process of swinging about their lower edges and dropping into the vertical magazine tends to cause an interference of the blanks with each other, particularly from the interengagement of the slot edges of adjacent blanks. This interengagement causes the blanks to hang up upon one another and jam rather than falling neatly and in a horizontal attitude into proper alignment into the magazine.

It has been an objective of the present invention to provide apparatus to control the transfer of the blanks from the horizontal conveyor into the vertical magazine so as to minimize the interference described

above. To this end, the invention provides apparatus for horizontally conveying blanks in a generally vertical attitude, for swinging the blanks about their lower edges to a horizontal attitude, over the magazine, and for temporarily restraining the blanks in their horizontal attitude before permitting them to drop into the vertical magazine. The feature of temporarily restraining the blanks in a horizontal attitude before permitting them to drop into the magazine is important in avoiding the tendency of the blanks, through the momentum picked up in swinging about their lower edges, to swing past a horizontal attitude and to drop into a magazine in a shingled relationship. It is the shingled relationship which is important to avoid for the misalignment of the shingled relationship causes the interference between slot edges, it being realized that the slot edges are approximately one-fourth inch apart, that is the slots are approximately only one-fourth inch wide.

In the preferred form of the invention, the restraining means is provided simply by providing opposed inturned edges on the side walls of the magazine which provides a slight frictional resistance to the dropping of the blanks into the magazine. That resistance may be overcome by the weight of several stacks of blanks or alternatively, the blanks may be forced past the inturned edges by the thrust of the horizontal conveyor pushing the blanks with their forward edges sliding down an inclined guide.

It has been another objective of the invention to provide a two-stage drop for use with larger blanks so as to maintain an adequate supply of blanks while minimizing the weight of that total supply of blanks on the lowermost blank.

It has been another objective of the invention to provide a detector located within the magazine, the detector controlling an intermittent operation of the conveyor so as to operate the conveyor only when the height of the supply of blanks falls below a predetermined level.

It has been still another objective of the invention to provide a magazine having internal vertical guides for receiving the slots in the side edges of the blanks thereby to properly align the blanks and in conjunction therewith to provide a vibrating wobbler plate which jostles the blanks into proper alignment on the vertical guide.

These and other objectives 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 side elevational view of the invention,

FIG. 2 is a fragmentary perspective view of the invention illustrating the magazine and the conveyor leading into the magazine,

FIG. 3 is a cross-sectional view taken along lines 3—3 of FIG. 1,

FIG. 4 is a fragmentary side-elevational view of the forward end of the apparatus which, when taken in conjunction with FIG. 1, illustrates the operation of the invention,

FIG. 5 is a fragmentary cross-sectional view of the wobble plate,

FIG. 6 is a diagrammatic view illustrating the ejecting of the blanks off their vertical guides and out of the bottom of the magazine,

FIG. 7 is a view similar to that of FIG. 6, illustrating a further stage in the operation,

FIG. 8 is a fragmentary side-elevational view illustrating an alternative form of the invention for use with smaller blanks,

FIG. 9 is a perspective view of a blank, and

FIG. 10 is a perspective view of a case formed from the blank.

The apparatus is adapted to feed blanks indicated at 1 in FIG. 9, the blanks being made of double-face corrugated board, The blanks 1 have slots 2 in their side edges 3 so as to provide side walls 4 and glue flaps 5. After being ejected or fed from the apparatus of the present invention, the blanks are formed into a tray indicated at 6 in FIG. 10, the tray being used as a container for cans and the like.

The apparatus for feeding the blanks 1 is indicated generally at 10 in FIG. 1 and includes a horizontal conveyor 11 which feeds blanks into a vertical magazine 12. Ejecting mechanism 13 is located adjacent the lower end of the magazine and is adapted to eject blanks horizontally one at a time from the bottom of the magazine.

The blanks 1 are shown in a generally vertical, somewhat inclined, attitude on the conveyor 11 and the objective is to convey the blanks 1 from the upstream or rearward end of the conveyor 11 in a forward direction and permit them to swing to a horizontal attitude and thereafter drop into the magazine 12.

The apparatus is supported on a structural framework indicated generally at 20. Referring to both FIGS. 1 and 2, the conveyor includes two endless belts 21 and 22 which are spaced apart and which pass around pulleys 23 for the respective belts at the forward end thereof, the pulleys 23 being fixed to a drive shaft 24 journalled in the framework 20. Similar pulleys and drive shafts are mounted at the rear of the apparatus. A dead plate 26 is mounted to the framework 20 and extends the length of the conveyor between the belts 21 and 22 to provide a main support for the blanks as they are being conveyed.

The drive shaft 24 is driven by an electric motor 27 through a chain and sprocket drive 28. The operation of this motor 27 is controlled by a detector 25, to be described in more detail below, and is either intermittently energized or may be continuously running and intermittently connected to the drive shaft through a clutch operated by the detector 25 25.

The belts 21 and 22 are preferably coated with an antifriction material so as to permit them to slide with respect to the blanks 1 which they engage while at the same time then frictionally urge the blanks forward. Low friction belts are or have been found to be desirable to enable the upper flights of the belts to move forwardly rapidly enough to supply the demand for blanks quickly while at the same time avoiding applying such a great force to the lower edges of the blanks as would cause them to slip over to a rearward angle of inclination as contrasted to the illustrated forward angle of inclination.

Side walls 30 and 31 are mounted on the framework 20 at the forward end of the conveyor 11, the walls having forwardly projecting side guides 32 overlying the upper end of the magazine 12. Each side guide 32 has a lower edge portion 33, the forward end portion of which is bent inwardly to form a restraining means 34. The distance between the two restraining means 34 is slightly less than the width of the blanks passing therebetween so as to impede the drop of the blanks into the magazine when they swing to a horizontal attitude.

An upper edge guide 35 is mounted between two walls 30 and 31 and is inclined downwardly and forwardly to dilineate the path of movement of the upper edges 36 of the blanks 1 as they swing from a generally vertical attitude to a horizontal attitude.

The magazine has a rear wall 40 which is formed by three vertical plates 41 which are curved about the shaft 24 at their upper ends. The outermost plates 41 have laterally projecting flanges 42 which are fixed to the framework 20 to provide support for the plates 41. The center plate 41 is continually of the dead plate 26.

The magazine has side walls 44 formed by an upper horizontal plate 45 and a lower horizontal angle member 46. The members 45 and 46 are mounted on posts 47 which are in turn mounted to the framework 20. Front and rear angle members 49 and 50 are secured between the horizontal members 45 and 46 to support vertical blank guides to be described below.

The magazine has a front wall 55 which is formed by a wobble plate 56. The wobble plate is pivotally supported on a horizontal plate 71 secured at its ends to the horizontal member 45. At its upper end it is vibrated by an arm 57, which is connected to it by means of a rod 58 fixed to a bracket 59 mounted at the top of the wobble plate. The arm 57 is pivoted to a bell crank lever 60 which is in turn pivoted to the framework 20 at 61. The other end of the bell crank lever is connected by an elongated link 63 to a wheel 64 at an eccentric pivot point 65. This wheel 64 is fixed to a shaft 66 journalled in the framework 20. Rotation of the shaft causes rotation of the wheel 64. This in turn oscillates the rod 63 which, through the bell crank lever 60 and arm 57, causes the rod 58 and wobble plate 56 to vibrate.

The horizontal plate 71 has a fulcrum 70 about which the wobble plate oscillates. A bolt 72 passes through a hole in the plate 71 and is secured to the wobble plate (see FIG. 5). A nut 73 threaded on the bolt 72 compresses a spring 74 against the plate 71 and holds the wobble plate 56 against the fulcrum 70.

The magazine has a bottom wall which is formed by a pair of slats 77 secured by brackets 78 which are mounted on horizontal legs 79 of the angle members 46. Together, the slats 77 and the horizontal legs 79 of the angle members 46 form the upper surface of the bottom wall.

Four vertical blank guides 85 project into the interior of the magazine. Each guide has a horizontal leg 86 secured to the respective angle member 49 or 50. The horizontal leg 86 suspends a vertical leg 87 downwardly. The leg 87 is terminated in a foot 88 which is connected to the leg 87 by a radius 90. The feet 88 are spaced above the surface of the bottom wall a distance slightly greater than the thickness of the blank so as to permit the blank to pass under the feet 88. The blanks are aligned with their slots 2 receiving the vertical legs 87, the stack of blanks resting on the four feet 88. When the blanks are ejected, the blank portion immediately rearward of each vertical leg 87

rides downwardly on the radius **90** until the blank is free of the feet **88**. (See FIGS. **6** and **7**).

The blanks are ejected by the ejector mechanism **13** which includes a blade **100** having a pointed end **101** which is thin in order to project between the lowermost blank and the blank immediately above it. Adjacent the pointed end **101** is a downwardly projecting shoulder **102** which engages against the rearward edge of the blank and as the blade **100** moves forward thrusts the blanks out of the magazine.

At the forward end of the magazine are a pair of pinch rollers **114** which are continuously rotating and which receive in their nip the blank as it is thrust from the bottom of the magazine by the blade **100**.

The blade **100** is mounted on a bearing block **103** which is slidable with respect to rods **104** which are mounted on brackets **105**, the brackets **105** being mounted on the framework **20**. The bearing block and the blade it carries are reciprocated by a linkage which includes a horizontal link **107** pivoted to a vertical link **108** whose lower end **109** is pivoted to the framework **20**. A cross link **110** is pivoted to the vertical link **108** and has an end **111** functioning as a follower riding in an elliptical cam surface **112** in a wheel **113**. It can be appreciated that rotation of the wheel **113** causes the cross link **110** to reciprocate as the follower **111** rides in the cam **112** thereby oscillating the vertical arm **108** and reciprocating the bearing block **103** which carries the ejector blade **100**.

The wheel **113** like the wobble plate drive wheel **64** is fixed to the shaft **66**. This shaft **66** carries a sprocket **116** which is driven by a chain **117** passing around a sprocket **118**. The sprocket **118** is driven through a gear box **119** by a V belt and pulley system **120** connected to an electric motor **121**.

Preparatory to engagement by the blade **100**, the rear edge portion of each blank is bowed downwardly by a pair of centrally located suction cups **125** mounted on an arm **126** which is fixed to a shaft **127** to pivot around the axis of the shaft **127**. The shaft is journalled in posts **128** fixed to the framework **20**. Tubes **129** connect the suction cups to a source of vacuum not shown, the source of vacuum being intermittently connected to the suction cups by valves also not shown. The shaft **127** is connected to an arm **130** whose free end is connected to a link **131** the opposite end of which is eccentrically connected at **132** to a wheel **133** fixed to the shaft **66**. Thus in cooperative fashion, and with each revolution of the shaft **66**, the suction cup swings downwardly to bow the rear edge portion of each blank downwardly and while it is held downwardly it is engaged by the forwardly moving ejecting blade **100**.

At the front end of the magazine, the detector **25** is mounted on a bracket **140** which is connected at its lower end to the horizontal plate **71**. At the upper end of the bracket is a microswitch **141** to which the detector **25** is connected. The microswitch **141** is connected to a circuit in the drive motor **27** for the conveyor belts **21** and **22** so that when the detector **25** is depressed, that is swung clockwise outwardly, the motor is deenergized. When the detector is free, by the absence of blanks, to swing counterclockwise inwardly, the motor is energized to drive the conveyor in such a manner as to advance the supply of blanks.

Positioned below the detector is an inwardly projecting abutment **143** adapted to be engaged by the forward edge portions of the blanks to arrest them momentarily to provide a two-stage drop of the blank as will be described below.

In the operation of the invention, a great many blanks are stacked on the horizontal conveyor and the magazine is primed with a number of blanks bringing it up to the level indicated at **144**. The blanks are generally vertically oriented on the conveyor but are inclined slightly forwardly as shown so that gravity will tend to cause them to swing around to a horizontal attitude as they pass over the end of the conveyor.

When the machine is started, the ejector mechanism works as described above by drawing the rearward end of the lowermost blank whereupon it is engaged by the reciprocating by the ejector blade which thrusts it out between the pinch rollers and sends it on its way for forming and being loaded. By drawing down just the rearward edge portion of the lowermost blank, the vacuum created between the lowermost blank and the one immediately above it is minimized as contrasted to conventional practices wherein the blank is bowed along its length by suction cups located centrally of the blank. This feature facilitates the high speed operation where the blank must be drawn down very quickly.

In the beginning of the operation, the detector **25** is at its inward position and calls for an additional supply of blanks. The horizontal conveyor is caused to operate and thereby advancing the supply of blanks. The blanks, as their lower edges ride around the curvature at the end of the conveyor belt are guided at their upper edges by the guide **35** to swing to a horizontal position. As the incoming blanks achieve an approximately horizontal position, their downward swinging movement is arrested by the inwardly projecting lower ends or restraining means **34** of the side guides **32**. When a sufficient weight of blanks collects on the inwardly turned edges **34**, the force of the blanks causes the restraining means **34** to spread outwardly slightly to permit a group of blanks to fall. The forward edges of the blanks drop down until they engage the inwardly projecting abutment **143**. As the conveyor continues to rotate, additional blanks fall until the supply required by the detector **25** is met, that condition being illustrated in FIG. **4**. It can be seen from FIG. **4** that the full weight of the incoming blanks does not rest on the stack, but rather is temporarily arrested by the abutment **143**. As the supply of blanks is diminished, the main stack descends until the blanks slide off the abutment **143** and lie horizontally on the main stack below. Thus there is a two-stage drop of the blanks which provides assurance of an adequate supply of blanks for a high speed operation while also providing assurance that the weight of the stack of blanks will not be so great as to create frictional forces between blanks which would make difficult the horizontal ejection of the blanks.

An alternative form of the invention is illustrated in FIG. **8**. In this embodiment, the magazine **13** is sized to accommodate smaller blanks **1** and consequently the frictional characteristics, insofar as ejecting is concerned, are different because of the weight differential. Hence, a different method of filling the magazine from the horizontal conveyor **11** is utilized and does not require the abutment **143** and the two-stage drop.

In order to facilitate size change, the forward end shaft **24** of the conveyor **11** is rotatably journalled in a slot **150**. A similar adjustment feature not shown, is also provided at the rear of the conveyor. Adjustment of the conveyor shafts in these slots **150** effectively shortens the length of the magazine by bringing the rear wall **40** closer to the front wall **55**. Additionally, the forward end **151** of the guide **35** is extended to provide downwardly angulated slope or surface **152**.

In operation this embodiment functions in the same manner as the preferred embodiment wherein the movement of the conveyor **11** is controlled by the stack of blanks actuating the detector **25**. As the blanks **1** are fed by the conveyor **11** into the magazine **12**, they are forced through the side walls **30, 31** and guided onto the stack by the slope **152** of guide **35**. The blanks may be forced through the restraining means **34** by the weight of the blanks or by the curved end of the conveyor applying force to the lower edges of the blanks causing their upper edges to be cammed downwardly by the angle of the surface **152** of the forward end **151** of the guide **35**.

We claim:

1. A blank feeder comprising,

a vertical magazine having an open upper end for receiving and feeding blanks in a horizontal attitude,

a horizontal conveyor having a discharge end adjacent the upper end of said magazine for conveying blanks in a generally vertical attitude to said magazine,

said discharge end of said conveyor including at least one endless belt portion passing about a pulley, said blanks having lower edges engaging said endless belt portion as said blanks swing from a vertical to a horizontal attitude,

and restraining means at the upper end of said magazine to temporarily block the drop of blanks into said magazine, said restraining means releasing blanks at least one at a time to drop said blanks in a generally horizontal attitude into said magazine.

2. A feeder according to claim **1**, in which said restraining means comprises

two opposed side walls at the upper end of said magazine, the lower ends of said walls being bent inwardly to restrict the opening through which said blanks fall into said magazine whereby said blanks will assume a horizontal attitude at the upper end of said magazine temporarily restrained by said lower ends until the pressure of incoming blanks forces one or more blanks to drop past said lower ends into said magazine.

3. A feeder according to claim **1**, further comprising,

a motor for driving said conveyor,

a detector in said magazine intermediate the upper and lower ends thereof and connected to said motor to energize said motor when the height of said blanks in said magazine drops below a predetermined level and to de-energize said motor before the blanks in said magazine build up to said restraining means, thereby maintaining a space between blanks in said magazine and upcoming blanks in said restraining means.

4. A feeder according to claim **1**, further comprising,

an abutment projecting into said magazine at the downstream side thereof to temporarily arrest the fall of the downstream edges of said blanks as they drop into said magazine whereby the upstream edges of said blanks drop first onto the existing stack in said magazine.

5. A feeder according to claim **4**, further comprising a detector mounted above said abutment, and below said restraining means said detector causing the operation of said conveyor when the supply of blanks falls below said detector,

whereby said blanks drop into said magazine in two stages, in the first the forward edges resting on said abutment and rear edges resting on said blanks below, and in the second said blanks dropping flat on the blanks below thereby maintaining the weight of the total supply of blanks below a predetermined amount.

6. A blank feeder comprising,

a vertical magazine having an open upper end for receiving and feeding blanks in a horizontal attitude,

a horizontal conveyor having a discharge end adjacent the upper end of said magazine for conveying blanks in a generally vertical attitude to said magazine,

restraining means at the upper end of said magazine to temporarily block the drop of blanks into said magazine, said restraining means releasing blanks at least one at a time to drop said blanks in a generally horizontal attitude into said magazine,

and vibrating means on said magazine to urge said blanks into proper alignment for subsequent discharge from the bottom of said magazine.

7. A feeder according to claim **6**, in which said vibrating means comprises,

a generally vertical plate forming at least one wall of said magazine and being movably mounted with respect to said magazine,

and means for wobbling said plate.

8. A feeder according to claim **6**, in which said vibrating means comprises

a generally vertical plate forming the front wall of said magazine

said plate being movable at its upper end and pivotally mounted on said magazine well below its upper end,

and means for oscillating the upper end of said plate.

9. A blank feeder comprising,

a vertical magazine having an open upper end for receiving and feeding blanks in a horizontal attitude, said magazine having guides extending vertically within said magazine, said guides being adapted to receive slots in the side edges of said blanks,

means for vibrating said magazine to urge said blanks to align themselves with said slots mating with said guides,

a horizontal conveyor having a discharge end adjacent the upper end of said magazine for conveying blanks in a generally vertical attitude to said magazine,

and restraining means at the upper end of said magazine to temporarily block the drop of blanks into said magazine, said restraining means releas-

ing blanks at least one at a time to drop said blanks in a generally horizontal attitude into said magazine.

10. A feeder according to claim **1**, further comprising

a guide overlying the upper end of said magazine and engageable by the outer edges of said blanks as they swing from said conveyor to a horizontal attitude overlying said magazine.

11. A feeder according to claim **10** in which said guide is downwardly and forwardly inclined whereby the forward thrust of the conveyor on said blanks causes the outer edges of said blanks to slide downwardly on said guide past said restraining means to drop into said magazine.

12. A feeder according to claim **10**, in which said conveyor comprises at least one endless belt and a pulley adjacent the upper end of said magazine about which said belt passes, the lower blank edges being forced forwardly as they pass around said belt and pulley.

13. A feeder according to claim **1**, said conveyor comprising,

at least one endless belt, said belt having a low friction surface which enables the belt to advance the blanks without driving their lower edges so far forward to cause said blanks to fall backwards.

14. A feeder according to claim **1**, said conveyor comprising,

a pair of elongated endless belts,

and a dead plate between said belts.

* * * * *