United States Patent

[11] **3,552,280**

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[54] **DEVICES FOR SQUARING TUBULAR FOLDING BOX BLANKS**
5 Claims, 5 Drawing Figs.

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[51] Int. Cl. **B31b 1/76**
[50] Field of Search 93/53, 53PSD, 53OR, 53M

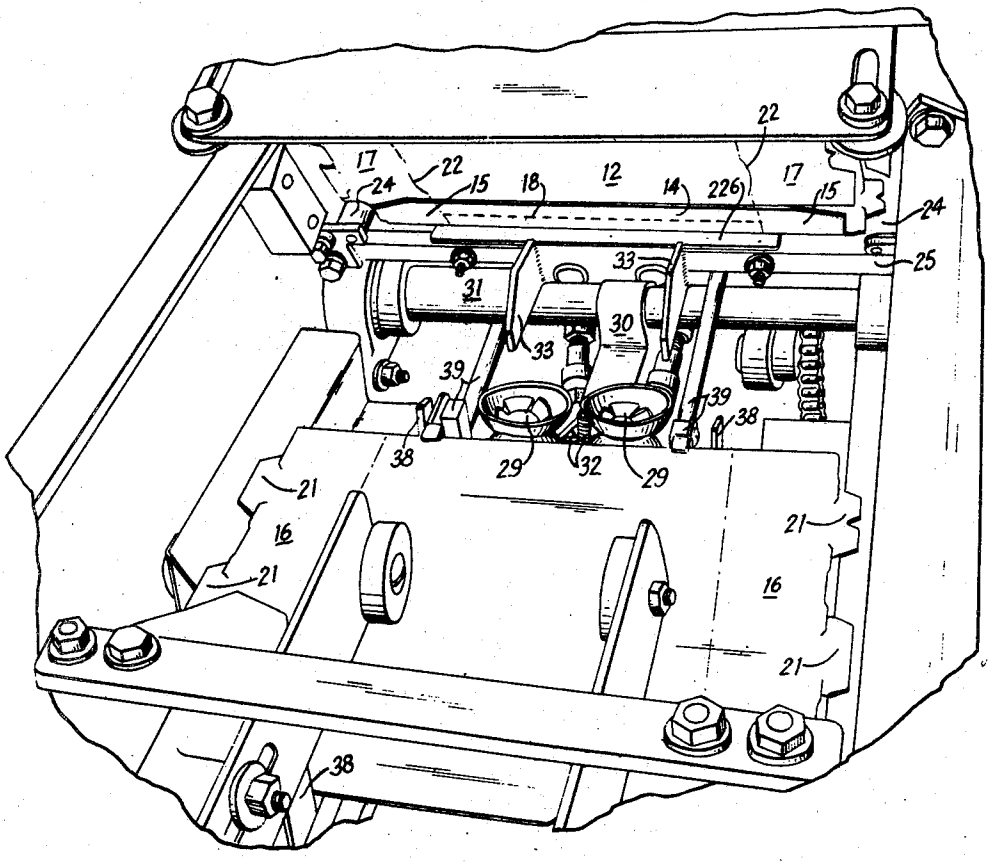
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3,142,232	7/1964	Pierce et al.	93/53
3,420,037	1/1969	Villemure et al.	93/53X
3,210,072	10/1965	Baker et al.	93/53

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ABSTRACT: A device is disclosed for squaring flat collapsed tubular folding box blanks disposed upright in a horizontally extending stack in which the endmost blank is retained by lugs overlapping the blank marginally. A suction cup draws the blank out of the grip of retaining elements and drags the lower blank portion over a cam, thus causing the minor panel which is engaged by the cam to assume an angular position to the cup-held major panel. An abutment element is provided above the cam for engaging the upper portion of the withdrawn blank in a position in which the blank has sufficient space behind it to expand. The abutment element also catches second blanks in case of accidental double feeding.



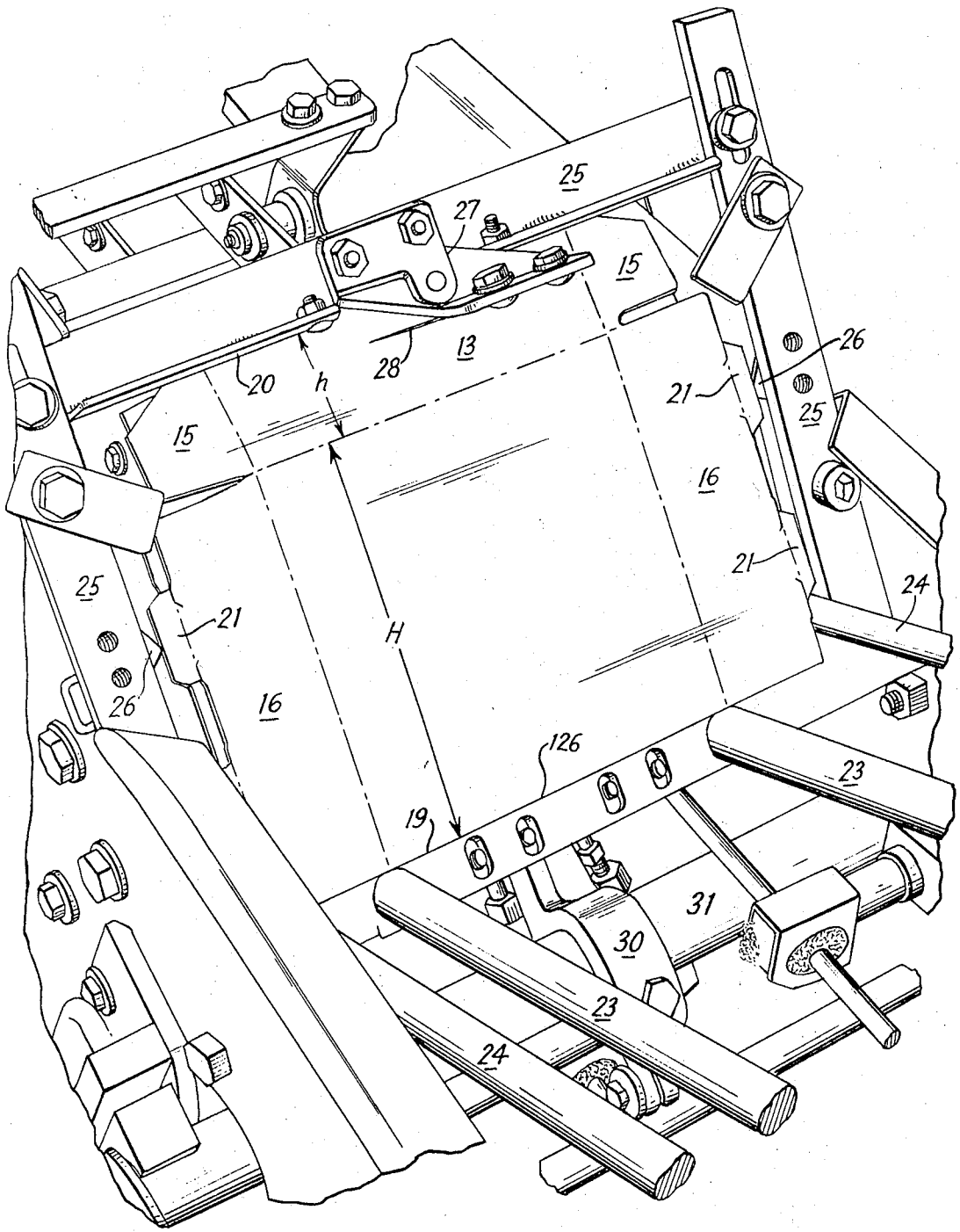


Fig. 1

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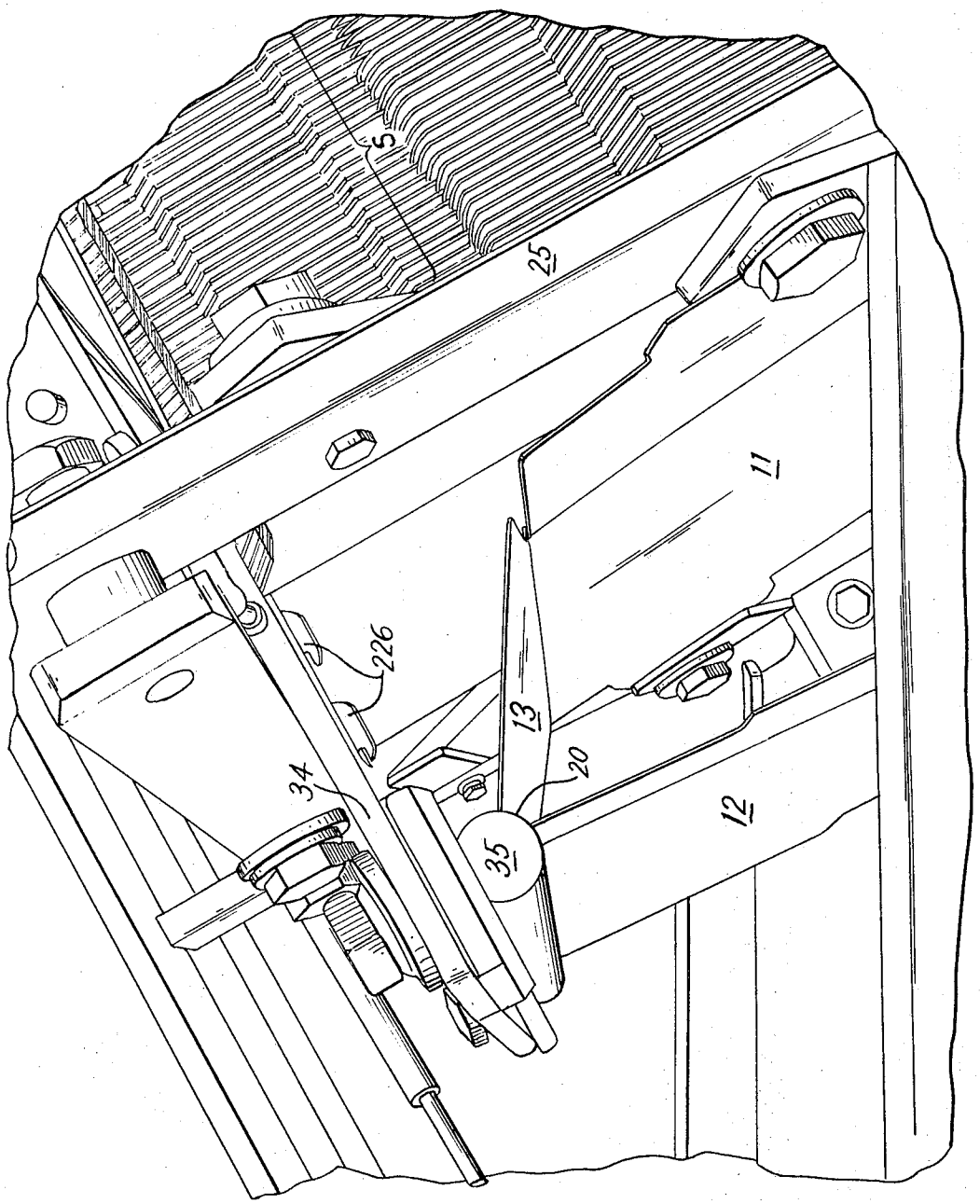


Fig. 2

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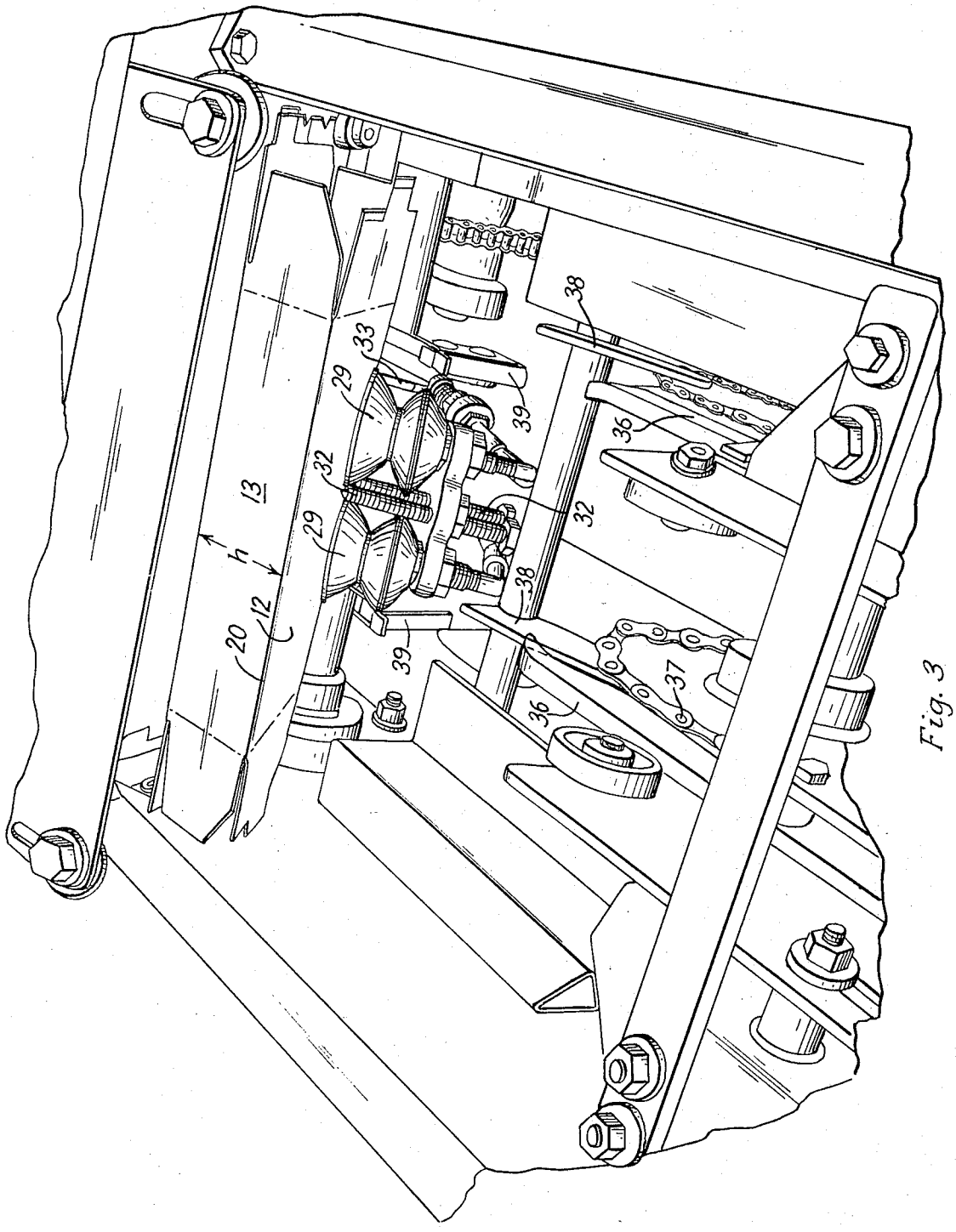


Fig. 3

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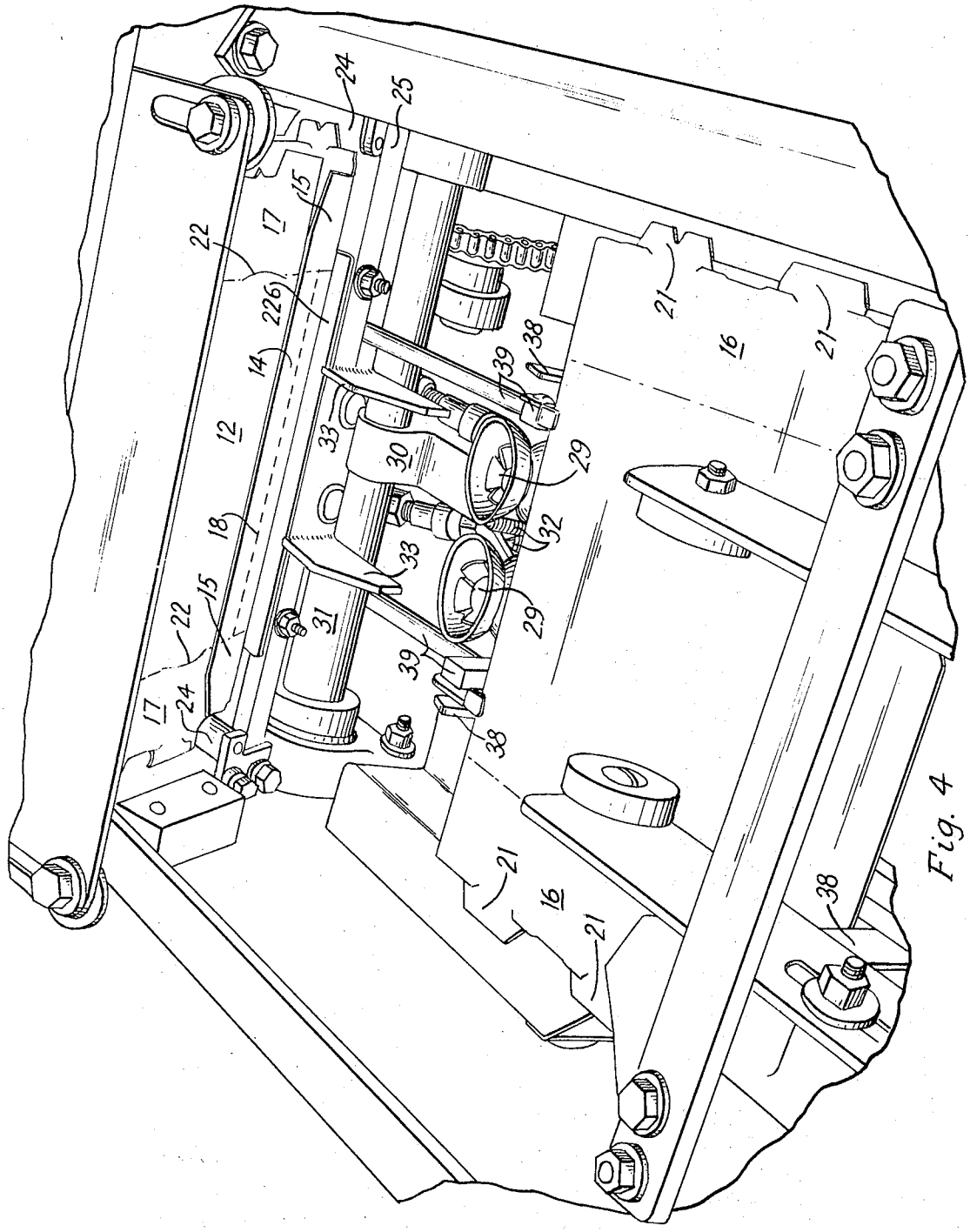


Fig. 4

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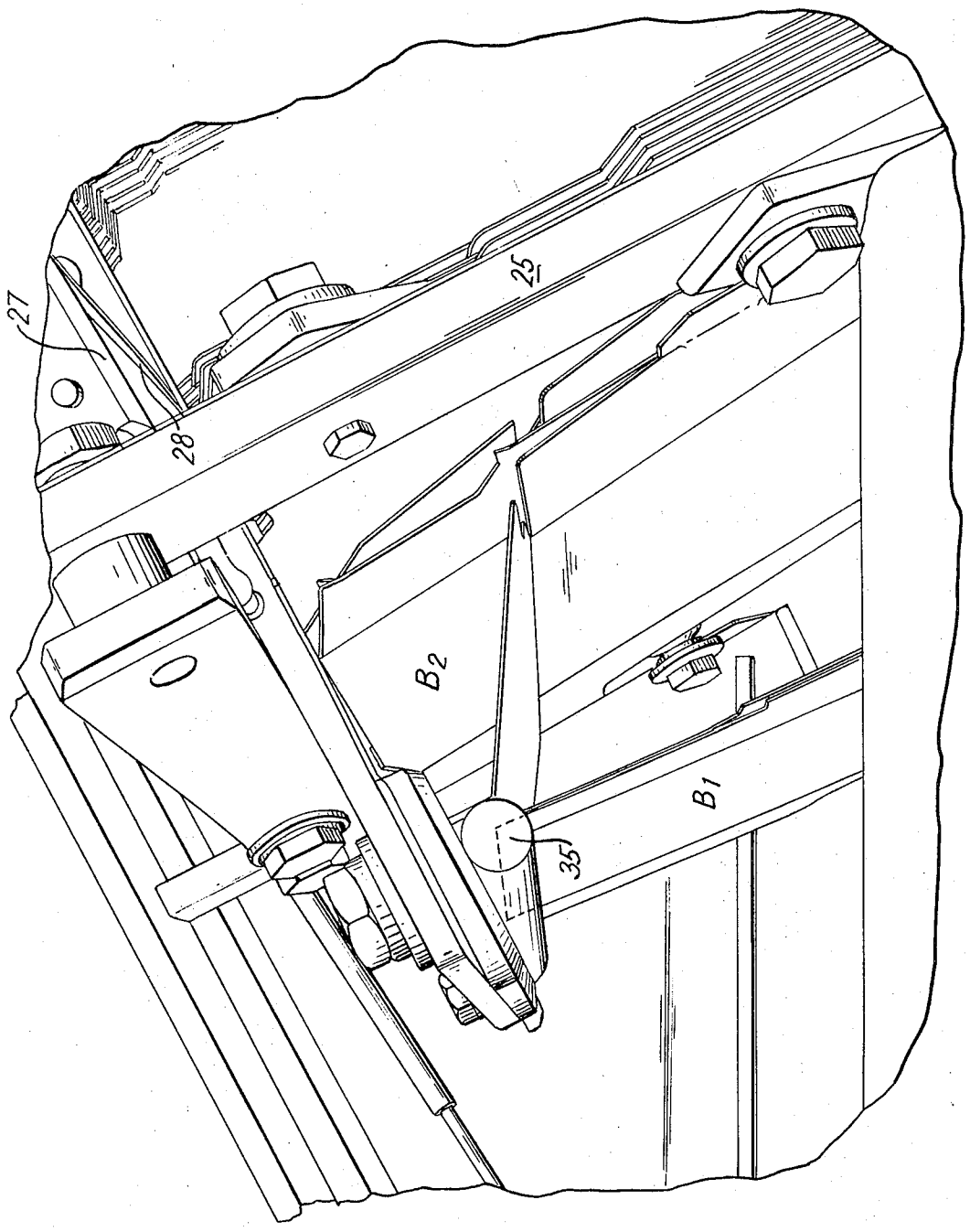


Fig. 5

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DEVICES FOR SQUARING TUBULAR FOLDING BOX BLANKS

The present invention is directed to the improvement of devices for squaring flat collapsed tubular folding box blanks disposed upright in a horizontally extending stack of blanks, the devices being of the type in which primary lug elements marginally overlap the foremost blank of the stack and in which a vacuum cup mounted for oscillation on an arc about a substantially horizontal axis parallel to the collapsing creases of the blank grasps the forwardly facing major panel of the foremost blank and draws it out of the grip of the primary lug elements. The cup then draws the lower blank portion at, and adjacent to, the lower collapsing crease over a cam, thereby causing the blank to be squared as the panel which is gripped by the vacuum cup approaches a horizontal position.

The squared blank is finally delivered to a suitable conveyor which maintains it squared and moves it past filling and closing stations.

Difficulties are encountered in the squaring of the blanks if the operation is carried out with great rapidity, a representative rate being 300 blanks per minute. At this rate less than one-fifth of a second is available for the withdrawal of the blank, the squaring operation and the transfer to the conveying device, whereafter the vacuum cup returns to the magazine to grasp the next blank.

The squaring of the blank involves the separation of the major panels, which become the top and the bottom, respectively, of the resulting box and the folding of the minor panels into right angular position to the major panels. This folding operation is performed basically by dragging one of the minor panels over the cam surface. The folding of the other minor panel occurs indirectly by reason of the fact that the tubular blank is a parallelogram in end view.

The folding of the second minor panel is interfered with if the major panel grasped by the vacuum cup is bowed excessively, for example as a result of an uneven flow of air into the space between the rapidly separating major panels which are of considerable size.

Another difficulty is presented by the fact that the blank whose squaring beings with its withdrawal from the retaining lugs cannot square properly until there is sufficient space behind the blank.

A third difficulty is presented by accidental misfeeding of a second blank which may be drawn through the magazine gate together with the first blank, either by failure of the air to enter between the blanks rapidly enough or by interlocking of laterally projecting flaps and panels which form the closure.

The aforementioned problems are remedied by the provision of abutment means which engage the blank adjacent its upper collapsing crease after the upper blank position has escaped the retaining lugs of the magazine gate. The abutment means is located above the cam and is preferably so spaced from the magazine gate that the blank travels less than the dimension of the minor panel and more than half that dimension from the gate before striking the abutment means.

The abutment means performs several functions:

It provides, together with the cam, a restricted escape passage for the withdrawn blank through which the blank can pass can only pass if both the lower minor panel, engaged by the cam and the upper minor panel are folded into angular position with respect to the major panels. The folding of the upper minor panel is assisted by the abutment means, as the latter prevents forward bowing of the cup-held major panel, thereby making the folding of the upper minor panel a more positive operation.

In the event of accidental misfeeding of a second blank, the second blank is arrested by the abutment means and is subsequently grasped by the feeder rather than allowed to fall into, and jam, the box conveyor.

The abutment means strikes and causes the flat blank to expand at a point of its travel where sufficient space for such expansion is provided between the withdrawn blank and the next blank in the stack. Compared to the operation of prior devices, the expansion of the blank occurs at a slightly later, but controlled, point of the blank travel.

It is for this reason advantageous to place the abutment means ahead of the foremost blank in the stack by less than the dimension by which the blank expands but more than half that dimension. The dimension referred to is also the height of the minor panel.

The various objects, features and advantages of this invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, a preferred embodiment of the invention. The invention also resides in certain new and original features of construction and combination of elements hereinafter set forth and claimed.

Although the characteristic features of this invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages and the manner in which it may be carried out may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:

FIG. 1 is a perspective view of the magazine portion of a blank squaring device containing a single blank;

FIG. 2 is a perspective view of the upper portion of the magazine gate showing a blank in the process of being squared, the magazine containing a stack of blanks;

FIG. 3 is a perspective downward view showing details of the mechanism in front of the magazine gate, the blank being at an advanced stage of squaring;

FIG. 4 is a perspective view of the mechanism of FIG. 3 showing the blank released at the point of entering a conveying device, and

FIG. 5 is a view similar to FIG. 2 illustrating a condition of accidental misfeeding of blanks.

In the following description and in the claims various details will be identified by specific names for convenience. The names, however, are intended to be generic in their application. Corresponding reference characters refer to corresponding parts in the several figures of the drawings.

The drawings accompanying, and forming part of, this specification disclose certain specific details of construction for the purpose of explanation of broader aspects of the invention, but it should be understood that structural details may be modified in various respects without departure from the principles of the invention and that the invention may be incorporated in other structural forms than shown.

Details of the blank B to be handled by the illustrated device are best seen in FIGS. 1 and 4. The blank comprises two major panels **11** and **12** of a dimension H and two minor panels **13** and **14** of a dimension *h*, the dimensions H and *h* being girth dimensions of the blank. In the completed box panels **11** and **12** become the top and the bottom, respectively, and the minor panels **13**, **14** are the sides.

The ends of the box are formed by corner flaps **15** articulated to the minor panels and outer and inner end panels **16**, **17**, respectively, articulated to the major panels.

A glue lap **18** is articulated to one of the major panels **12** and is adhered to the inside surface of the side panel **14**, as indicated in FIG. 4. This makes the blank B a tubular structure which is delivered in flat collapsed condition by the blank manufacturer, the collapsing creases being a lower crease **19** and an upper crease **20**. The distance between the collapsing creases is $H + h$.

The box ends may be locked by T-shaped tabs **21** on the outer end panels **16** insertable into slits **22**. All of the described blank details are conventional.

The blanks are stored in a magazine in stacked condition as indicated at S in FIG. 2. The magazine is best seen in FIG. 1 and comprises inclined rods **23** and **24** terminating at a magazine gate **25**, the gate being essentially a frame carrying retaining element or lugs **26** marginally overlapping the foremost blank to prevent it from falling out of the gate under the pressure of the inclined stack S behind it. Additional

retaining elements may have the form of a lip **126** at the bottom and semispherical buttons **226** at the top (FIG. 2).

The blanks rest on the rods **23** at their lower collapsing creases and are kept in line by the lateral rods **24**.

Only one blank is shown in the magazine in FIG. **1**, as a stack of blanks would have obscured the retaining elements **26, 126**.

The stack S of blanks in the magazine is subject to pounding by a reciprocating vacuum cup feeder later to be described. In order to prevent blanks from tipping over under such pounding, a rearward catch is provided comprising a bracket **27** carrying a flat blade **28** on the underside which snaps behind the top edge of a certain blank and prevents it, and the blanks in front of it, from tipping over. This construction is basically known and is described in greater detail in U.S. Pat. No. 3,210,072 of Oct. 5, 1965 to Baker et al.

Turning to FIG. **4**, a pair of vacuum cups **29** are mounted on the end of an arm **30** fixed on a transverse oscillating shaft **31** parallel to the collapsing crease **19** of the blank. The oscillating shaft **31** moves the cups **29** on an arc about the shaft axis, the lower end position being the one shown in FIG. **4**, the upper end position being one in which the cups contact the panel **12** of the foremost blank of the stack. A pointed element **32**, best seen in FIG. **3**, digs slightly into the panel **12** and prevents it from slipping relatively to the cups.

The arm **30** of the vacuum cups **29** is flanked by a pair of cams **33** over which the panel **14** is dragged after removal of a blank by the cups (see FIG. **3**).

The cups **29**, which are connected to a valve-controlled vacuum line in a known manner, attach themselves to the foremost blank in the magazine and pull it out of the grip of the marginal retaining elements **26, 126, 226**. Shortly thereafter the lower collapsing crease **19** of the blank strikes the cams and is progressively forced upwardly until the surface of the panel **14** comes to rest on the cam surfaces and is folded into angular position with respect to the panel **12** (FIG. **3**).

As the blank has the form of a parallelogram in side view (FIGS. **2** and **3**) the upper minor panel **13** is also moved towards an angular position with respect to the panel **12**. The panels **11** and **12** separate as the blank is being squared.

The dragging of the blank generally causes considerable flexing of the major panel **12**, as a result of which the folding of the upper minor panel **13** is not always certain and sufficient.

In order to prevent failure, and in order to make the squaring operation positive, a secondary lug or abutment means is provided forwardly of the magazine gate above the cams **30**.

As best seen in FIG. **2**, a bracket **34** is attached to the upper portion of the magazine frame **25** and carries a transverse bar **35** on its underside. The bar **35** represents a secondary abutment means or obstruction which is in the way of the upper collapsing crease **20** and strikes the panel **12** adjacent the crease **20**.

The distance between the bar **35** and the cam surfaces **33** is such that a nonexpanded blank of the dimension $H + h$ cannot clear it, but that an expanded blank of the dimension H or slightly more than H can pass through the restricted passage between bar and cams.

The major portion of the squaring operation of the blank occurs when the blank is in contact with the bar **35** at which point there is sufficient space between the panel **12** and the next blank in the magazine to permit the grasped blank to expand, i.e., the panel **11** to move rearwardly with respect to panel **12**. This is best seen in FIG. **2**.

The secondary abutment means **35** thus positively forces the blank to square, which is not always the case if the upper portion of the blank is permitted to move freely and the folding of the panel **13** is depended on to occur indirectly as a result of the hinged parallelogram construction of the blank.

At high production rates the separation of the panels **11** and **12** is opposed by a suction effect between these two panels. This is a consequence of the relatively slow flow of air into the initially narrow gap between the panels. A blank withdrawn from the magazine may therefore move as far as the bar **35** in unexpanded condition until the bar forces the panels **11** and **12** to separate.

A similar suction effect exists between individual blanks and may occasionally cause a second blank to be drawn out of the magazine. This condition is shown in FIG. **5**.

The blank B_1 is grasped by, and is under the control of, the vacuum cups but a second blank B_2 was accidentally withdrawn by suction between, or cohesion of, the blanks.

The blank B_2 would normally cause jamming of the machinery into which the squared blanks are delivered. The abutment element **35** catches accidentally withdrawn blanks and thus renders such instances of double feeding harmless.

The blank B_2 comes to rest on the cams **33** at the bottom at the abutment element **35** at the top and remains arrested until the returning vacuum cups **29** pick it up. It will be remembered in this connection that the spacing of the bar **35** with respect to the cams **29** is less than $H + h$ and is therefore insufficient to permit the flat blank B_2 to pass.

The squared blank (FIG. **3**) is moved into a substantially horizontal position by the vacuum cups **29** and comes to rest on rails **36** of a conveyor whose chains **37** and lugs **38** remove it in a direction towards the observer.

As the blank assumes a horizontal position the vacuum at the cup **29** is relieved in the usual manner to release the blank.

Pushers **39** then move forward and push the squared blank into a conveyor pocket, a pocket being defined between two successive lugs **38** of the conveyor chain.

In the position shown in FIG. **4** the pushers **39** are nearly fully extended and are about to be retracted. Conveyor lugs **38** are seen to rise behind the pushers to advance the squared blank. The conveyor **37, 38** then transports the squared blank to filling and closing stations in a known manner.

I claim:

1. In a device for squaring flat collapsed tubular blanks disposed upright in a horizontally extending stack of blanks, the device comprising primary lug elements marginally overlapping the foremost blank for retention of the blank at the end of the stack in a position in which the upper and the lower crease along which the blank is collapsed are substantially horizontal, a vacuum cup mounted for oscillation on an arc about a substantially horizontal axis parallel to said lower collapsing crease to grasp the forwardly facing panel of the foremost blank and draw the blank out of the grip of said primary lug elements, and a cam in advance of said lug elements over which cam said cup draws the lower collapsing crease thereby causing the blank to be squared as the said panel approaches a horizontal position, the improvement which comprises secondary lug means above said cam for engaging the blank adjacent its upper collapsing crease after the upper blank portion has escaped said primary lug elements, said cam and said secondary lug element engaging diagonally opposed portions of the parallelogram which the blank presents in side view.

2. A device according to claim **1** in which the secondary lug element is spaced from the plane of the foremost blank held by said primary lug elements by less than the expansion of the blank and more than one-half that distance.

3. A device according to claim **1** in which the secondary lug element is a bar.

4. In a device for squaring tubular folding box blanks in which a suction cup movable on an arc of substantially 90° about a substantially horizontal oscillating axis grasps the forwardly facing panel of the foremost blank of a substantially horizontal stack of blanks resting upright on the lower of the two creases along which the blanks are collapsed and draws the said foremost blank out of the grip of primary retaining elements which marginally overlap and normally retain the blank in an upright position and thereafter draws the said lower crease of the blank over a cam causing the blank to square, whereafter the squared blank is released by said cup with the said facing panel in a substantially horizontal posi-

tion, the improvement which comprises a secondary abutment means forward of said primary abutment means in a position to engage the blank adjacent its upper collapsing crease after the upper portion of the blank is drawn by said cup out of said primary retaining elements.

5. In a device for squaring tubular folding box blanks in which a suction cup movable on an arc of substantially 90° about a substantially horizontal oscillating axis grasps the forwardly facing panel of the foremost blank of a substantially horizontal stack of blanks resting upright on the lower of the two creases along which the blanks are collapsed and draws the said foremost blank out of the grip of primary retaining elements which marginally overlap and normally retain the blank in an upright position and thereafter draws the said lower crease of the blank over a cam causing the blank to square, whereafter the squared blank is released by said cup with the said facing panel in a substantially horizontal position, the improvement which comprises a secondary abutment means forward of said primary abutment means above said cam at a distance from said cam less than the vertical dimension of the collapsed blank and more than the vertical dimension of the major panel of the blank, and at a distance from the foremost blank of the stack less than the dimension of the minor panel and more than one-half the dimension of the minor panel to engage the blank adjacent its upper collapsing crease after the upper portion of the blank is drawn by said cup out of said primary retaining elements.