Nov. 12, 1963 A. FREI 3,110,232

FOLDING PROCESSES BY COMPRESSED AIR BLAST APPLICABLE TO A FOLDING GLUEING MACHINE AND DEVICES FOR SETTING THIS PROCESS INTO OPERATION

Filed Sept. 27, 1961 2 Sheets-Sheet 1

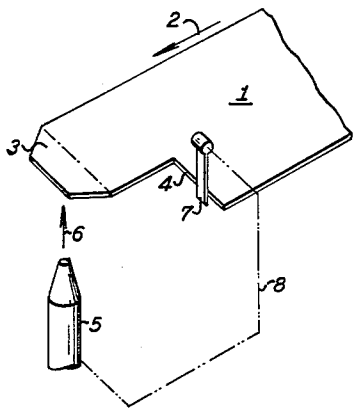


Fig. 1

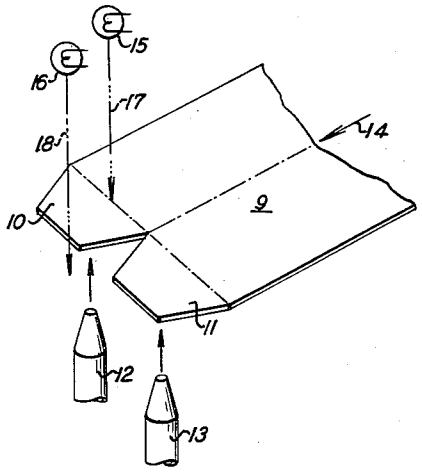


Fig. 2

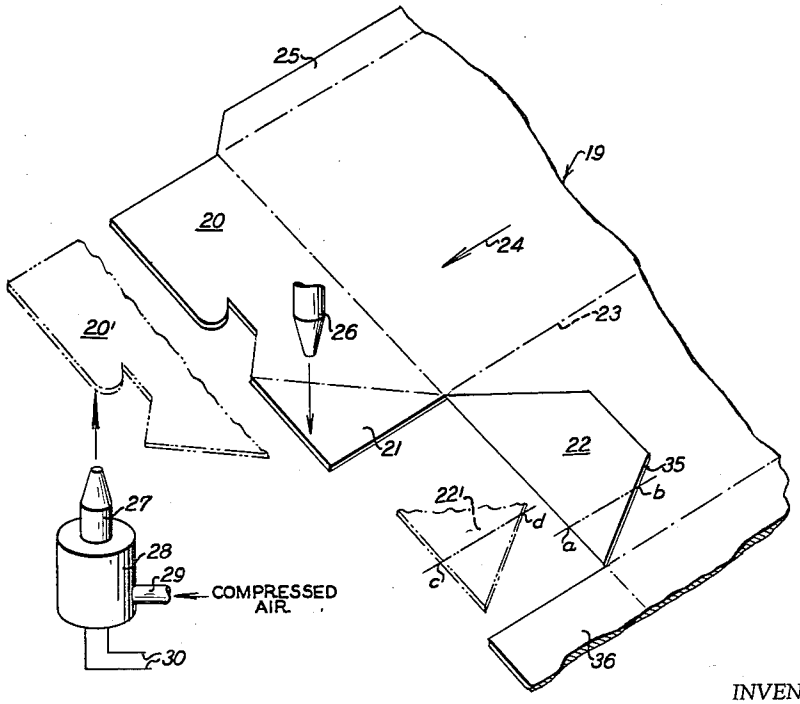


Fig. 3

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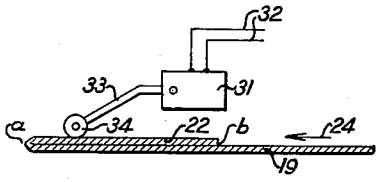


Fig. 4

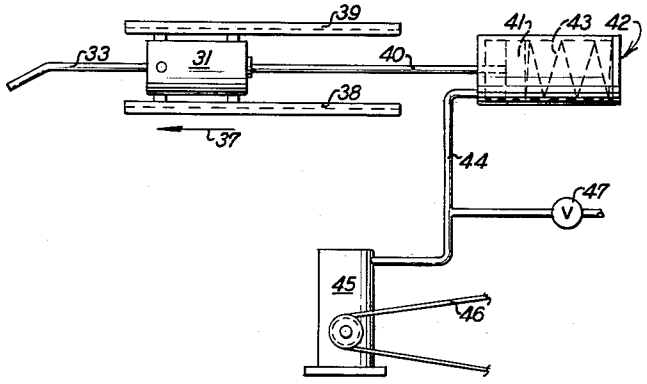


Fig. 5

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United States Patent Office 3,110,232 Patented Nov. 12, 1963

3,110,232

FOLDING PROCESSES BY COMPRESSED AIR BLAST APPLICABLE TO A FOLDING GLUEING MACHINE AND DEVICES FOR SETTING THIS PROCESS INTO OPERATION

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Filed Sept. 27, 1961, Ser. No. 141,115
Claims priority, application Switzerland Oct. 6, 1960
12 Claims. (Cl. 93—49)

This invention relates to the folding of cardboard blanks for the purpose of forming boxes or containers therefrom.

In so-called folding-glueing machines, pieces of cut cardboard generally designed to form boxes, are submitted to folding and glueing operations.

The foldings may, for instance, be carried out by generally shaped rigid or elastic parts entering into the trajectory of the parts crossing the machine.

In some cases, however, a solution avoiding the setting of folding members across the said trajectory proved to be more simple, even necessary, which has led to the use of properly directed nozzles projecting a compressed air blast against the parts, as for instance, glueing or joining parts to be folded. A folding carried out in this way can only be initiated and finished by means of stationary elements which after the folding are beyond the trajectory of the so-called cardboard pieces.

A disadvantage of the aforementioned compressed air blast lies in its continuity, so that it lifts not only the parts of the cardboard piece to be folded, but tends to raise the latter therewith on its passage.

The most apparent solution is to interrupt the action of the compressed air blast outside the times of passage of the parts on which it has to operate.

However, the accurate determination of these periods of time introduces a problem not only on account of the speed to which the cut up cardboard pieces are passing through a folding-glueing machine, but also as regards the frequency of this passage which is by no means constant but rather which is, for instance, the property of a press or printing press, the rhythm of which is a constant depending only on the working speed adopted and to which it is possible to adapt without further all the auxiliary operations, as for instance, the ejection of waste in a press.

The folding process by a compressed air blast according to the present invention sets up the required interdependence between the passage of each cardboard piece and the operation of at least one compressed air blast, due to the fact that the blasts are controlled by means detecting the passage of each cardboard pieces and which open the air-gates simultaneously in relation to said passage.

A device allowing such operation will comprise at least one nozzle distributing the compressed air in relation to the opening and closing of an air-gate governed by adjustable positioning means, proper to detect the passage of the cardboard pieces and to operate the gate in relation to this passage.

The attached drawing shows three embodiments of such devices, given by way of example:

FIG. 1 refers to first embodiment and serves at the same time to describe the process in its broadest form, applied under the circumstances to a symbolical cardboard piece.

FIG. 2 refers to a second embodiment.

FIGS. 3 and 4 concern a third embodiment applicable to the folding of cardboard pieces designed for the making of so-called automatic bottom boxes.

FIG. 5 relates to an improvement shown in conjunction with the third embodiment.

In the view in perspective of FIG. 1 concerning the first embodiment a cardboard piece represented symbolically by the simplified form 1, conveyed in the direction of the arrow 2, presents a glueing flap 3 and, behind this latter in relation to the conveying direction, an edge 4.

A nozzle 5 capable of supplying a compressed air blast 6 upwards serves to lift the flap 3 on its passage, so as to initiate its folding in that direction.

This nozzle 5 is governed by an air-gate not represented, designed to allow passage of the compressed air only during the time the glueing flap 3 is in the trajectory of the blast.

For this reason, this gate is dependent on a feeler 7, placed on the trajectory of the edge 4, at a point determined in such a way that at the time the glueing flap 3 passes over the nozzle 5, the edge will meet the feeler. The dashed and dotted line 8 indicates that a relation is provided for between the said feeler and the nozzle, so that when working the feeler causes the gate of the nozzle to open.

Thus, the air blast 6 will be projected against the glueing flap 3 only at a determined moment of passage of the latter in the field of influence of the said blast.

However, the blast from nozzle 6 has to be interrupted after the passage of the glueing flap 3, while the feeler 7 will remain displaced from its rest position during the passage of the cardboard surface. This requires the provision of means to close again without delay at the appropriate moment the controlling gate of the air distribution.

The feeler 7 will close an electric circuit, the dotted and dashed line 8 symbolizing the connection, for instance, to a gate controlling electro-magnet. There may also be provided in the circuit a time-lag relay. The feeler 7 could also be given a suitable length such that the edge 4, on its passage, lifts the feeler 7 and makes it turn through an angle of a value sufficient to allow an engagement at the beginning of the turning, followed by a disengagement at the end of the turning such that between these two positions, the glueing flap 3 is given time to be folded by the required quantity from its initial plane. Finally, it may be possible for the feeler to impart to the gate one impulse giving rise to an instantaneous air blast only, sufficient to lift the glueing flap.

It is clear that the mechanical controlling means already described will not be adapted to high speed operation, due to the inertia of the mechanical means.

In the second embodiment of FIG. 2 a cardboard piece 9 is provided with two glueing flaps 10 and 11, which have to be lifted by compressed air blasts from the nozzles 12 and 13. The conveying direction corresponds to the arrow 14.

Above the trajectory of the cardboard piece are placed two light sources 15 and 16, projecting light beams perpendicularly to the trajectory of the cardboard piece 9 on photoelectric cells (not shown) which are beneath the plane of the cardboard piece. Thus, the piece 9 interrupts the light during passage thereof between the light sources and the cells.

The beam 17, from the light source 15, is interrupted by passage of the glueing flap 10. As soon as the said flap cuts the beam, the corresponding photo-electric cell causes the gates of the two nozzles 12 and 13 to open, which is arranged to occur just before the two glueing flaps enter into the action area of the two corresponding nozzles.

The second beam 18 from the light source 16 crosses the longitudinal axis of the cardboard pieces at the bottom

of the notch separating the two glueing flaps **10** and **11**. By construction, the source **16** is placed so as to have the light beam thereof interrupted just when the glueing flaps **10** and **11** have reached the required raised position.

The interruption of beam **18**, causes the shutting of the gates of the two nozzles **12** and **13**.

The arrangement is such that opening of the nozzles **12**, **13** will take place only in consequence of an interruption of the beam **17** following a previous illumination of the photo-electric cell associated therewith, which operation be the same for the control of the nozzles by source **16** and the photo-electric cell associated therewith.

An arrangement of this kind is virtually uninfluenced by inertia forces, the only inertia forces being the inconsequential inertia of the gates which can be controlled by relatively powerful and rapid electro-mechanical means, whereby the arrangement allows running at very high speeds.

In the already described second embodiment, as in the first, it is obvious that the mechanical or luminous feeling elements will be supported by means allowing their lengthwise as well as crosswire displacement, as this will indeed be the case for the nozzles, so as to make it possible to adapt the distribution of these members to any kind of desired folding.

The third embodiment, according to FIGS. 3 and 4 is more particularly designed for folding back glueing and joining flaps of cardboard pieces designed for the making of so-called automatic bottom boxes. The cardboard piece **19** is partially shown in perspective in FIG. 3. The piece **19** has along the side adapted to form the automatic bottom, two groups of flaps.

One of the groups of flaps includes flap **20** and angle flap **21**. The latter flap is a glueing flap and is adapted to cooperate with the other glueing flap **22**.

In the position represented, the glueing flap **22** has to be folded back on the box body, as represented in FIG. 3 by known mechanical means which is capable of performing this folding. Further, the glueing flap **21** is to be folded back under the joining flap **20** and this latter on its turn on the box body, in line with the flap **22**. By a subsequent folding along the line **23**, the glueing flaps **21** and **22** are finally faced to one another and joined together.

The feeding direction of the piece **19** is shown by the arrow **24**. The side flap **25** serves to join the two edges of the box body together, so as to make a prism of it when unfolded.

The lowering of the glueing flap **21** is caused by a downward compressed air blast issuing from the nozzle **26** (see arrow). The joining flap **20**, with the glueing flap folded beneath it, will be in its turn and downstream of nozzle **26** lifted by an upward blast of compressed air issuing from the nozzle **27**, which has been shown with its electro-magnetic valve **28**, supplied with compressed air by the pipe **29** and with current by leads **30**.

When the cardboard piece reaches the position represented with its already folded back glueing flap **22** (as represented and previously described), the edge formed by the corresponding fold will contact a first feeling element *a*, located in the path of the edge and controlling the valve of the nozzle **26**, for folding the glueing flap **21** down. The contact between element *a* and the edge of fold **22** will cause the compressed air blast to issue from nozzle **26**.

The section of FIG. 4 shows the type of feeler which will be preferably employed. It includes an electric switch **31** of a very sensitive type controlling an electric circuit **32**, by the action of a lever **33** bearing a roller **34**. It is when passing over the folded back glueing flap **22** that the overthickness resulting therefrom breaks or opens the circuit, according to the adopted controlling type. This means that the action of the feeler to cause the air blast from nozzle **26** will last only the period of time of passage of the feeler on the glueing flap **22**, i.e. from *a* to *b* (shown in enlarged size in FIG. 4).

Thus, not only will the automatic interruption of the compressed air blast be achieved when the roller reaches the end of flap **22** be achieved, but also the duration of time of the closing of circuit **32** and the consequent length of time of the air blast from nozzle **26** can be controlled by taking advantage of the inclined edge **35** of flap **22** by laterally adjusting the position of the feeler **34** with respect to the flap **22**. Thus the length *a*—*b* is a function of the lateral position of the feeler **34** and it is merely necessary to laterally adjust the position of the feeler to vary the time of closing of circuit **32**.

After glueing flap **21** is lowered, and the piece **19** has advanced, the joining flap **20** has to be lifted.

This more advanced position of piece **19** is represented at **20'** and **22'** respectively by interrupted dashed lines.

Once again, the edge formed by the fold of the glueing flap **22** will control the duration of the compressed air blast, this time through the nozzle **27** (see arrow).

The feeler will be situated at *c*, but laterally displaced in relation to the feeler at *a*, so as to prolong the action of the nozzle **27** proportionately to the length *c*—*d*, since the duration of the action of the compressed air blast has to be longer to lift the joining flap **20** than to lower the glueing flap **21**.

The flap **36**, partly represented, will be similar to the flap **20** and will play the same part in the second group of joining and glueing flaps. The described arrangements will then be provided for twice for the folding of the represented automatic bottom box.

As previously, the feelers and nozzles will have to be fixed in a removable and adjustable way, i.e. so that their number and position may be modified.

Finally, it apears that the electro-magnetic gate **28** of the nozzle **27** is located immediately behind this latter. This disposition is to be preferred, owing to the fact that too long pipes between these members would introduce delays in the execution of the signals transmitted by the feelers.

Since a folding-glueing machine is called upon to perform widely varying duties, it is evident, as has been previously noted, that the position of the air blast as well as that of the means detecting the passage of sheets, i.e., the feelers, are to be adjustable, adaptable to each particular case.

However, experience has demonstrated that a simple adaptation to the form and kind of work to be carried out is insufficient and that the factor of the conveying speed also is important. In high working speeds, it is necessary that the means detecting the passage of the sheets be more distant from the compressed air blast than at low speeds, i.e. farther back in relation to the conveying direction.

Thus, when the machine is started it is accelerated from rest to its maximum speed, which in machines of high output results in large speed differences between starting and running, which causes improper foldings of blanks and jammings, which requires stopping the machine.

The aim of the improvement according to FIG. 5 is to remedy this disadvantage by providing for the addition of means to shift in ratio to the working speed, the means detecting the passage of the cardboard pieces, this displacement increasing with the conveying speed but in the opposite direction of the latter.

On a somewhat larger scale, FIG. 5 shows the switch **31** and its control lever **33**, partially represented. The conveying direction of the sheets is indicated by the arrow **37**. Two slides **38** and **39** extend parallel to the direction of advancement of the sheets and the switch **31** is supported for sliding movement along the slides **38** and **39**.

A rod **40** connects switch **31** to a piston **41** which is movable in a cylinder **42** against the action of a drawback spring **43** tending to displace the piston, rod and switch

in the conveying direction 37. This means that when at rest, the switch 31 will be urged to a maximum forward position with respect to the conveying direction.

Opposite the spring 43 is a tube 44 which conveys a fluid, for instance, compressed air, to operate the piston for moving the same rearwardly (to the right on the drawing).

In the case of use of compressed air, tube 44 is in connection with a small compressor 45, which is driven by a belt 46 or other suitable means connected to the drive of the main machine.

This means that the pressure in the compressor 45 increases with the working speed of the said machine and that, in consequence, the piston 41 will move back in ratio to this pressure. Therefore, the desired effect to make the switch 31 move rearwardly relative to the conveying direction as the main machine runs faster is achieved, the spring 43 bringing the switch forwardly when the speed decreases.

An easy adjustment is obtained by escape valve 47 on the tube 44, which makes it possible to adapt this arrangement to the various kinds of working speeds contemplated.

What I claim is:

1. In a method of folding an advancing blank to form a box by compressed air blasts, the steps of folding a first flap on the blank into face-to-face relation with the rest of the blank to provide a zone of increased thickness, sensing the increased thickness of the blank in said zone as said blank is advanced past a fixed location and controlling the duration of an air blast which is adapted to perform a folding function on another flap in accordance with the increased thickness which is sensed in said zone.

2. In a method of folding an advancing blank to form a box by compressed air blasts, the steps of folding a first flap into face-to-face relation with the rest of the blank along a fold line extending substantially perpendicular to the direction of advancement of the blank to form a zone of increased thickness defined by the extent of said flap, said flap having a lateral edge which is inclined with respect to the direction of advancement of the blank, and controlling the duration of an air blast which is adapted to perform a folding function on another flap in accordance with the length of the flap measured in the direction of advancement of the blank at a given lateral location, the duration of the air blast being regulable in accordance with the lateral location at which the length of the flap is measured.

3. In a method of folding an advancing blank to form a box by compressed air blasts, the steps of folding a first flap having a lateral edge which is inclined with respect to the direction of advancement of the blank, into face-to-face relation with the rest of the blank along a fold line extending substantially perpendicular to the direction of advancement of the blank to form a zone of increased thickness defined by the extent of said flap, and controlling the duration of an air blast which is adapted to perform a folding function on another flap in accordance with the time of passage of a length of the flap in the direction of advancement of the blank at a given lateral location past a location which is fixed relative to the direction of advancement of the blank, the duration of the air blast being regulable in accordance with the lateral location at which the time of passage of the flap is measured.

4. In a method of folding an advancing blank by compressed air blasts in which a first flap having a lateral edge which is inclined with respect to the direction of advancement of the blank has been folded into face-to-face relation with the rest of the blank along a fold line extending substantially perpendicular to the direction of advancement of the blank to form a zone of increased thickness defined by the extent of said flap, the steps of sensing the increased thickness in said zone of

the overlapped flap along a length of the flap measured in the direction of advancement of the blank and regulating the duration of an air blast which is adapted to perform a folding function on another flap of the blank in accordance with the lateral location at which the length of the flap is measured.

5. In apparatus for folding an advancing blank by blasts of fluid and wherein a first flap has been folded into face-to-face relationship with the rest of the blank, fluid discharge means located along the path of the blank for directing a blast of fluid against another flap on the blank to cause the latter flap to be folded with respect to the remainder of the blank, feeler means extending into the path of the blank at a location whereat the first flap is folded into face-to-face relation with the rest of teh blank, switch means normally open and controlled by said feeler means, said feeler means being operatively positioned relative to said blank to sense the increased thickness caused by said first flap being folded into face-to-face relation with the rest of the blank and to close said switch in accordance with the increased thickness whereby said feeler means closes said switch upon initial contact with the blank at the increased thickness thereof and maintains said switch closed only during passage of the zone of increased thickness past said feeler means, means connecting said switch to said fluid discharge means to cause operation of the latter only with the switch closed whereby the duration of time that the fluid is discharged from the fluid discharge means is dependent upon the duration of time of the closing of the switch, and means for moving the switch means and the feeler means together away from the fluid discharge means along a line extending in the direction of advancement of the blank by an amount which is a function of the speed of advancement of the blank.

6. In apparatus for folding an advancing blank by air blasts in which a first flap having a lateral edge which is inclined with respect to the direction of advancement of the blank has been folded into face-to-face relationship with the rest of the blank along a fold line extending substantially perpendicular to the direction of advencement of the blank, air discharge means located along the path of the blank for directing an air blast against another flap on the blank to cause the latter flap to be folded with respect to the remainder of the blank, feeler means supported for lateral adjustment and extending into the path of the blank at a location whereat the first flap is folded into face-to-face relation with the rest of the blank, a switch normally open and controlled by said feeler means, said feeler means including a yieldingly supported member operatively positioned relative to said blank for being displaced by said first flap to close said switch when said member contacts the first flap, means connecting said switch to said air discharge means to cause operation of said air discharge means only with the switch closed whereby the initiation of the discharge of the air from the air discharge means and the duration of time that the air is discharged from the air discharge means is dependent respectively upon the initial closing of the switch and the duration of time of the closing of the switch, said feeler means being effective to vary the duration of time of the closing of the switch in accordance with the lateral position of the feeler means relative to the first said flap and means for moving the switch and the feeler means together away from the air discharge means along a line extending in the direction of advancement of the blank by an amount which is a function of the speed of advancement of the blank.

7. In apparatus for folding and advancing blank by air blasts in which a first flap having a lateral edge which is inclined with respect to the direction of advancement of the blank has been folded into face-to-face relationship with the rest of the blank along a fold line extending substantially perpendicular to the direction of advancement of the blank, a nozzle located along the path of the

blank for directing an air blast against another flap on the blank to cause the latter flap to be folded with respect to the remainder of the blank, feeler means supported for lateral adjustment and extending into the path of the blank whereat the first flap is folded into face-to-face relation with the rest of the blank, a switch normally open and controlled by said feeler means, said feeler means including a roller adapted to contact the blank and a control lever supporting said roller and connected to said switch, said feeler means being operatively positioned relative to said blank such that said roller and control lever are together displaced and are effective to close said switch only when said roller contacts the first flap which is folded on the blank, means connecting said switch to said nozzle to cause operation of said nozzle with the switch closed whereby the duration of the air discharged from the nozzle is dependent upon the duration of the closing of the switch, said feeler means being effective to vary the duration of the closing of the switch in accordance with the lateral position of the feeler means relative to the first said flap, and means for shifting the switch and feeler means together away from the nozzle along a line extending in the direction of advancement of the blank by an amount which is a function of the speed of advancement of the blank.

8. In apparatus as claimed in claim 7 comprising spring means urging the switch and feeler means together to an initial rest position with respect to the nozzle.

9. In a method as claimed in claim 4 wherein the air blast is initiated by the sensing of the increased thickness of the blank.

10. In a method as claimed in claim 4 wherein the air blast is initiated in advance of the passage of the advancing blank past the air blast by an amount which is a function of the speed of advancement of the blank.

11. In a method as claimed in claim 9 wherein the sensing of the increased thickness of the blank for initiating the air blast is adjusted with respect to the position of the advancing blank along its path as a function of the speed of the advancing blank.

12. In a method as clamed in claim 11 wherein the sensing of the increased thickness of the blank is advanced with respect to the position of the advancing blank along its path in proportion to the speed of the advancing blank.

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