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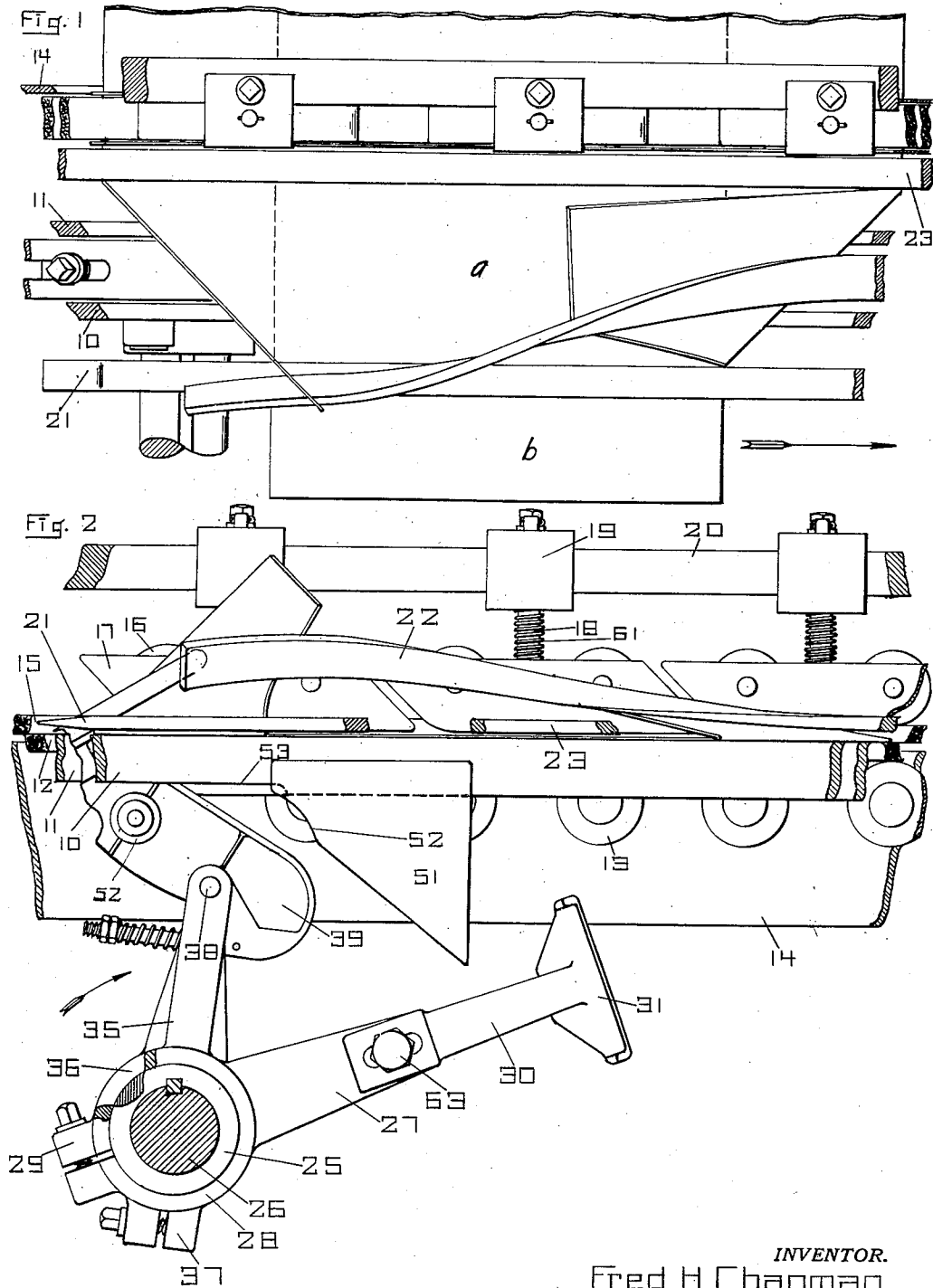
F. H. CHAPMAN

2,261,018

MACHINE FOR FOLDING BLANKS

Filed Aug. 20, 1940

5 Sheets-Sheet 1



Oct. 28, 1941.

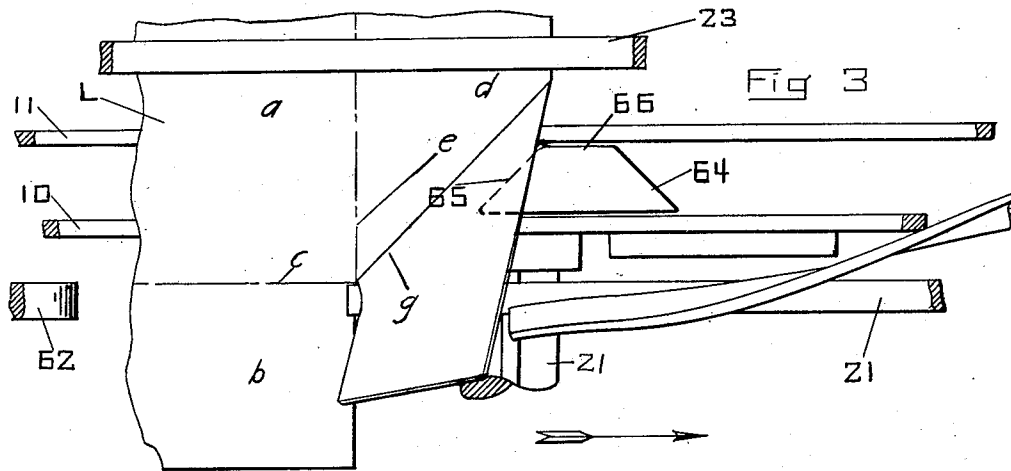
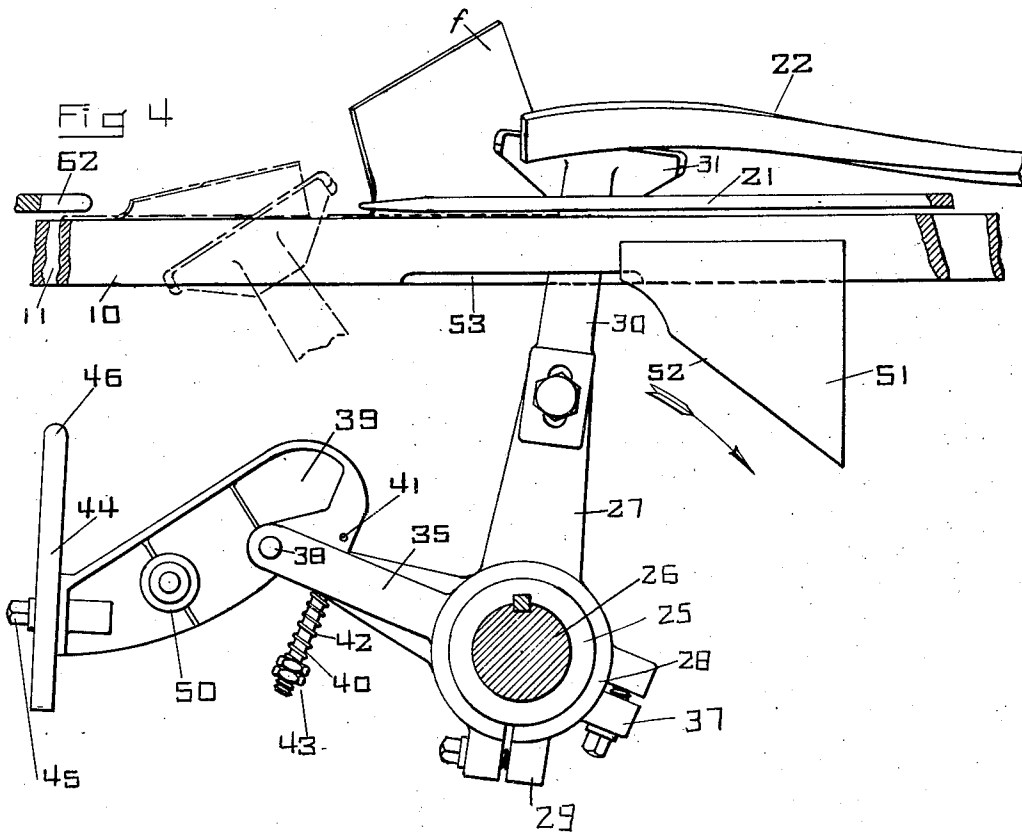
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5 Sheets-Sheet 2



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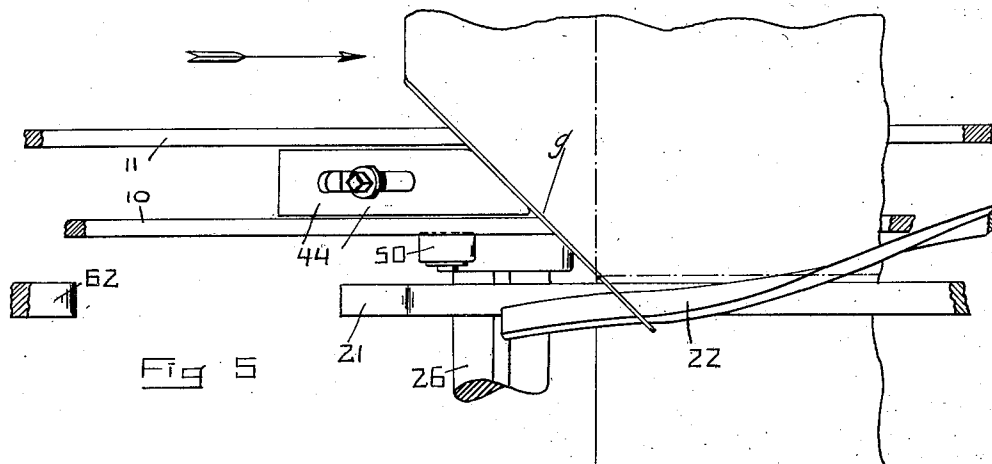
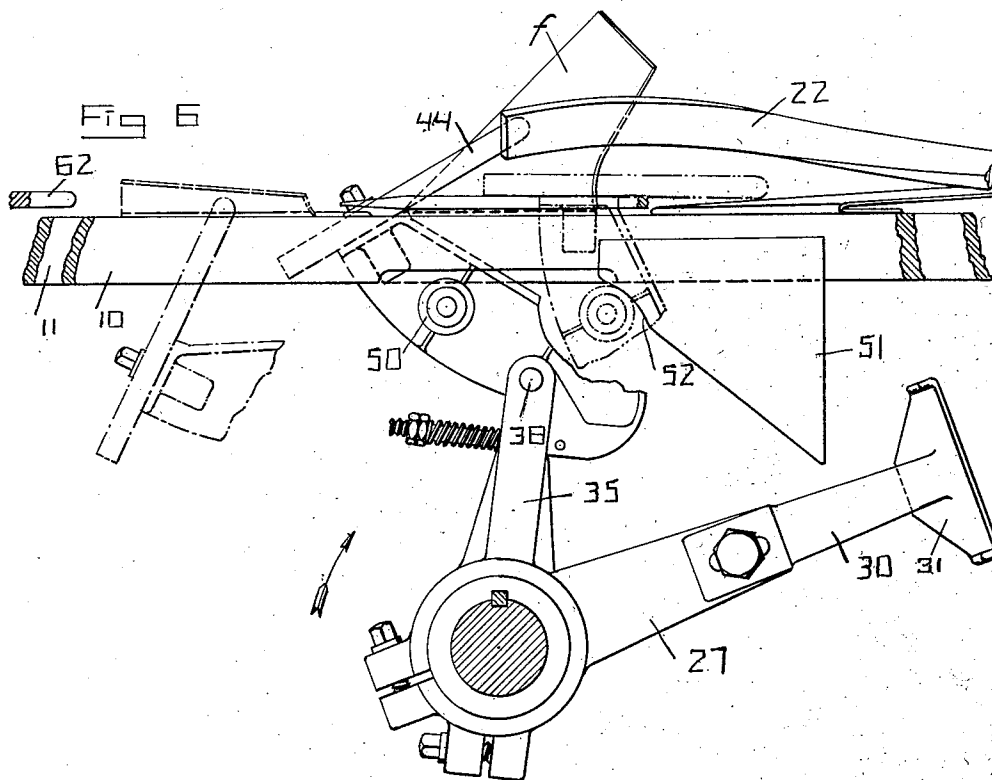
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MACHINE FOR FOLDING BLANKS

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5 Sheets-Sheet 3



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MACHINE FOR FOLDING BLANKS

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5 Sheets-Sheet 4

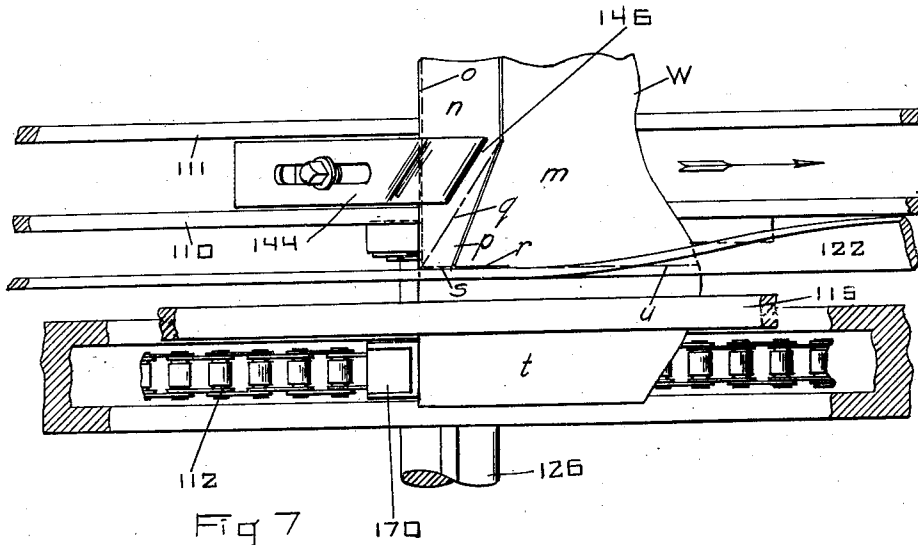


Fig 7

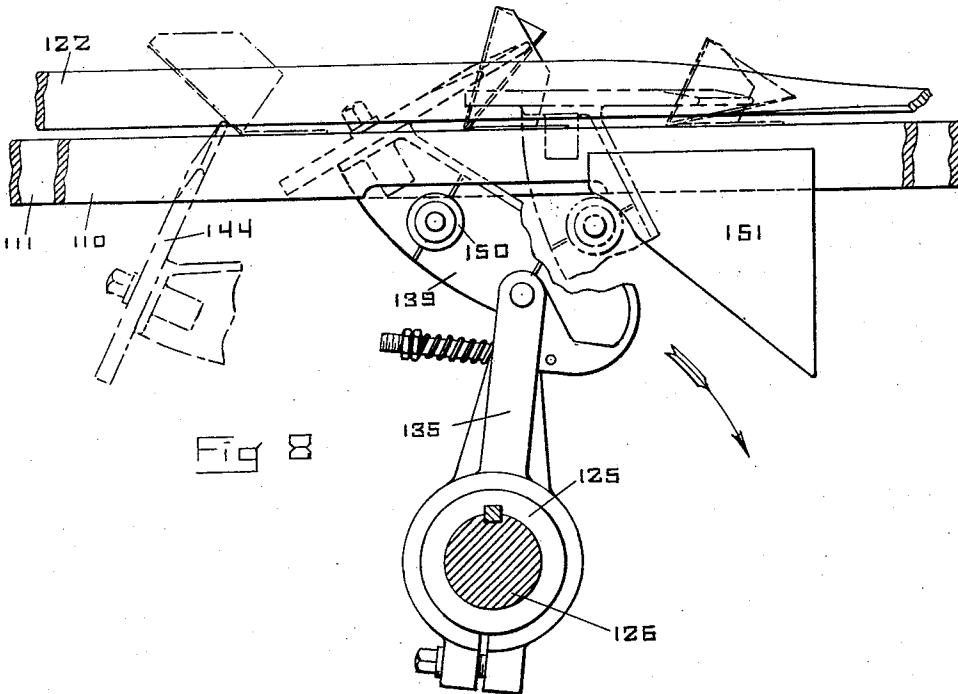


Fig 8

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MACHINE FOR FOLDING BLANKS

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Fig. 9

Fig. 10

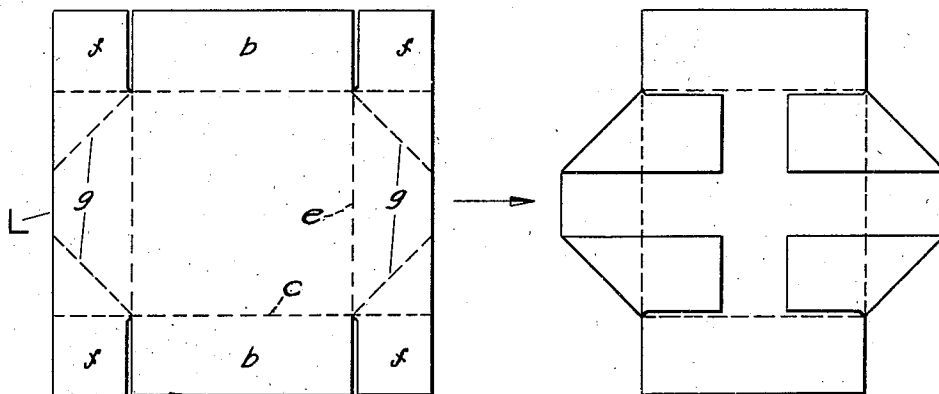
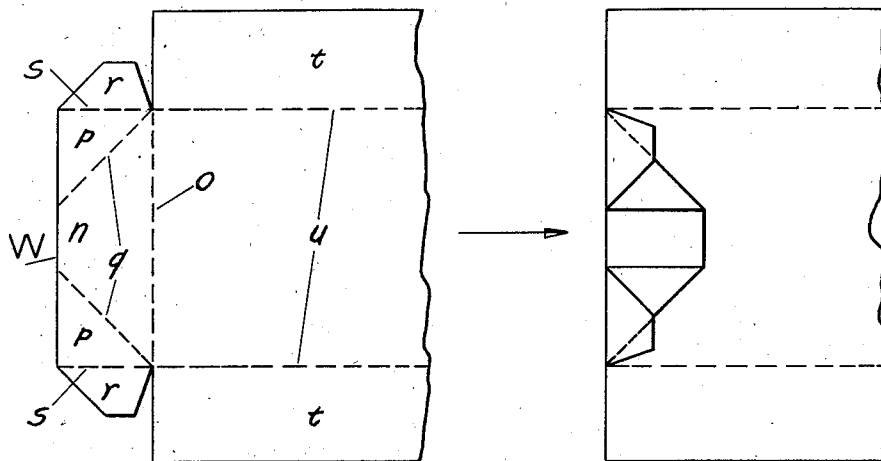


Fig. 11

Fig. 12



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2,261,018

MACHINE FOR FOLDING BLANKS

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9 Claims. (Cl. 93—49)

This invention relates to machines for folding blanks.

In the manufacture of boxes and generally similar articles from paperboard, boxboard or similar sheet material, it is necessary to make certain folds in the blank. It is usually desirable that the folds be made while the blank is traveling in order to provide a high rate of production. It has been found relatively difficult to make the so-called diagonal folds wherein the blank is folded along fold lines making an acute angle with the lines of juncture between the main body of the blank and the side wall flaps.

In accordance with the present invention, a folding mechanism is provided wherein a relatively simple but positively acting and efficient mechanism is provided for making diagonal folds in blanks while the blanks are being advanced through the mechanism.

In accordance with an illustrative embodiment of the invention, the blanks are suitably advanced through the mechanism by a conveyor of such construction that it engages the portions of the blank other than the portions to be folded. A rotatable folding arm carrying an angularly yielding head is rotated to engage a rearward flap of the blank and fold it forwardly over against the body of the blank; when the fold is substantially made, the head is rocked away from the blank to allow the latter to be advanced by the conveyor. Where a front fold is to be made, a second folding head is rotated somewhat in advance of the rearward folding head and engages and turns a forward flap or flaps rearwardly. Suitable means, such as folder bars, are provided for completing the folds.

An object of the present invention is the provision of a simple and efficient mechanism for making diagonal folds in blanks while they are traveling.

Still another object of the invention is the provision of a simple and efficient mechanism for folding forwardly a trailing flap of a blank while the blank is being advanced through the mechanism.

Still another object of the invention is the provision of a simple and efficient mechanism for making forward and rearward diagonal folds on a blank during the forward movement of the blank.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

Although the novel features which are be-

lieved to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to 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 hereof, in which

Figs. 1 and 2 are fragmentary top plan and side elevational views respectively, showing a portion of a folding mechanism constructed in accordance with the present invention;

Figs. 3 and 4 are fragmentary top plan and side elevational views respectively, illustrating particularly the folding of a forward flap backwardly onto the body of the blank, certain parts of the structure being omitted to simplify the showing;

Figs. 5 and 6 are fragmentary top plan and side elevational views respectively, illustrating particularly the folding of a rear flap forwardly, certain parts being omitted for simplicity;

Figs. 7 and 8 are top plan and side elevational views respectively of another embodiment of the invention and representing a portion of a mechanism for folding forwardly a rear center flap having diagonal folds therein, certain parts of the structure being omitted for simplicity;

Fig. 9 is a top plan view of one form of blank which the mechanism illustrated in Figs. 1 to 6 is adapted to fold;

Fig. 10 is a top plan view of the blank shown in Fig. 9 after folding;

Fig. 11 is a top plan view of one form of blank which the mechanism illustrated in Figs. 7 and 8 is adapted to fold; and

Fig. 12 is a top plan view of the blank in Fig. 11 after folding.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit. Like reference characters denote like parts in the several figures of the drawings.

It will be understood that the present invention is adapted to many uses in connection with folding mechanisms and that the mechanism itself, while capable of being used as an independent machine for merely making folds in blanks, will more usually be employed as a component part of a machine for folding and gluing blanks to make complete boxes. It will be understood, therefore, that while a showing of such combined machine is omitted for simplicity, the mechanism herein disclosed may be combined

with other known folding and/or gluing mechanism to provide a complete box making machine.

It will be also understood that while the present invention is primarily directed to a mechanism for making diagonal folds, nevertheless, the mechanism, with certain modifications as hereinafter more fully explained, may be employed for making regular folds along fold lines parallel to or at right angles to the direction of movement of the blank.

Before describing the machine it should be noted that it is shown in connection with two forms of blank having diagonal fold lines therein.

One form of blank is illustrated in Fig. 9, to which reference now is made. The blank L includes a base *a* having side walls *b* foldable along fold lines *c* and end walls *d* foldable along fold line *e*. The end walls *d* have diagonal corner flaps extending therefrom and foldable about the fold lines *g*.

Referring now particularly to Fig. 1, there is shown in a somewhat diagrammatic manner, a mechanism for folding blanks. The mechanism is adapted to be mounted on a suitable frame (not shown) which may be the principal frame on the machine. Inasmuch as the two side portions of the machine are similar, only one such portion is described herein, it being understood that the other is similar but reversed, in order to provide right hand and left hand portions; the right hand portion is illustrated herein.

Extending longitudinally of the mechanism are supporting bars 10 and 11 which serve to support the blank thereon. Any suitable means may be provided for advancing the blank but for purposes of illustration there is shown upper and lower belts 12 and 15, which are trained around suitable pulleys (not shown) and are suitably driven.

Supporting rolls 13 rotatably mounted in a lower bracket 14 are disposed under the lower belt 12. Upper presser rolls 16, carried in carriages 17, bear against the upper belt 15 and press it against the lower belt 12. Each of the carriages 17 supports two rollers and is mounted for vertical movement by a rod 18 extending through a block 19 adjustably mounted on a bracket 20. Compression springs 61 resiliently urge the carriage 17 downwardly to yieldingly press the rolls 16 against the upper belt 15.

Top bar 62 (see Figs. 3 and 4) is provided for resisting the folding pressure of the forward flap, as will be explained more fully hereinafter. A second top bar 21 (see Figs. 1 and 2) is provided for resisting the folding pressure on the rearward flap.

A curved folder bar 22 is provided for folding down the forward flap and retaining the fold of the rearward flaps, after the forward flap has been initially raised and partially folded and the rearward flap has been folded.

A rotating folder is mounted adjacent the path of the blank and includes a rear flap folder and, where desired, also a forward flap folder. A sleeve 25 is mounted on a shaft 26 which is rotated by suitable means (not shown) in timed relation to the movement of the blanks. The forward flap folder arm 27 is carried by a hub 28 rigidly secured to the sleeve 25 by a clamp 29 which permits angular adjustment of the arm 27 on the sleeve 25. A head 31 of suitable shape is carried by a shank 30 which is adjustably secured as by a bolt 63 to the arm 27.

In the present case the head 31 is of generally trapesoidal shape with its forward and rearward edges 64 and 65 converging inwardly to avoid the inner side edge 66, as illustrated particularly in Fig. 3.

The rearward flap folder arm 35 is carried by a hub 36 rigidly secured to the sleeve 25 by a clamp 37 which permits angular adjustment of the arm 35 on the sleeve 25. Pivotally carried at the end of the arm 35 as by a pivot pin 38 is an extension 39 carrying a head 44 which is adjustable on the extension as by a bolt 45. The extension 39 is normally urged in a clockwise direction relative to its pivot by a spring 42 bearing against the arm 35 and against one or more nuts 43 threaded on a stud 40 which stud 40 is pivotally connected to the extension 39 as by a pin 41.

The extension 39 carries a cam follower 50 adapted to strike against a cam 51 when the arm 35 is rotated and rotate the extension 39 about its pivot in a counter-clockwise direction for a purpose hereinafter described. The cam 51 has a suitably shaped surface 52 for effecting this rocking of the extension 39. The lower portion of the bar 10 may be cut away or indicated at 53 to permit the follower 50 to pass under it.

The operation of the mechanism thus far described is as follows:

The blank L is advanced by the conveyor, and the rotating folder is rotated in suitably timed relation to the movement of the blank. The speed of rotation is such that the folder heads 31 and 44 have a slightly greater lineal speed than the blank.

The forward flap folder head 31 engages the forward corner flap *f* and raises it prior to the time that the blank reaches the folder portion of the folder and fold retaining bar 22. As the blank continues forward, the forward corner flap *f* is engaged successively by the forward edge 64, the inner edge 66 and the rearward edge 65 of the forward folder head 31 and finally is engaged by the folder bar 22 which folds the corner flap *f* rearward and downwardly against the body of the blank as illustrated particularly in Fig. 1 of the drawings. Owing to the shape of the head 31, the flap is raised and folded about the 45° diagonal fold line *g*. The head 31 is shown with a double face of approximately 45° so that it may be used at either side of the machine.

The top bar 62 under which the flap *b* rides restrains this portion of the blank against raising when the head 31 engages and lifts the flap *f* and thus provides folding resistance. The top bar 62 is suitably disposed in advance of the folder so that the flap *f* clears the bar before it is raised.

The rearward flap folding arm 35 is rotated in following angular relation with the arm 27 and the head 44 engages the rearward corner flap *f* and raises it before it comes opposite the end of the folder bar 22. The head 44 is formed with a forward inclined edge which extends at a 45° angle to the direction of the movement of the blank and thus movement of this head insures that the folded portion of the blank is folded along the 45° diagonal line of fold *g*. When the head has turned the rearward corner flap *f* approximately 180° and under the folder bar 22, the follower 50 engages the cam 51 and rocks the head out of engagement with the blank L and thereby prevents the head 44 from binding or clamping the blank against the supporting bars 10 and 11.

The top bar 21 is positioned to engage the side flap *b* after the forward corner flap *f* is raised and before the rearward corner flap *f* is raised. This bar 21, in a sense, constitutes a continuation of the bar 62 and serves in an analogous manner to provide folding resistance during the folding of the rear corner flap.

The blank *L* then is advanced away from the head 44 and the folder bar 22 maintains the folded front and rear flaps in folded condition.

The blank is then ready for such further operations as may be desired.

A second embodiment of the invention is especially well adapted for folding a rear center flap forwardly and simultaneously making a diagonal fold in such flap. One form shown by the rear portions of a blank *W* illustrating this folder operation is shown in Fig. 11 to which reference now is made. The blank includes a base *m* having end walls *t* foldable about fold lines *u* and side walls *n* about fold lines *o*. The side walls *n* have diagonal fold lines *q* therein defining triangular corner portions *p*. Corner flaps *r* extend from the edges of the side walls *n* and are foldable about fold lines *s*.

Referring now particularly to Figs. 7 and 8, the folding mechanism illustrative of the second embodiment is generally similar to that shown in Figs. 1 to 6, inclusive, and described hereinbefore, the principal difference being that the folder arm is positioned to engage the rearward flap instead of the corner flap. Also, in the particular embodiment illustrated, no forward folder arm is employed.

The blank is supported on supporting bars 110 and 111 and is advanced therealong by a chain 112 having spaced lugs 170, one of which is shown. The lugs are so spaced that each one engages a blank to advance it along the supporting bars 110 and 111 when the chains are suitably driven.

A top bar 115 is provided under which the blank rides and which resists the folding pressure on the blank as hereinafter explained.

It will be understood that conveyor means other than that illustrated herein can be employed for advancing the blank. It is important, however, that the blank be advanced by means which engages it outside of the line of fold of the rear flap so as not to interfere with the folding operation. For example, cooperating belts, such as previously described herein, can be employed instead of the chains.

A shaft 126 mounts a folder arm 135 which pivotally mounts an extension 139 generally similar to the extension 39 hereinbefore described. The extension 139 carries a follower 150 adapted to cooperate with a cam 151 in a manner generally similar to the operation described in connection with the previously described embodiment of the invention.

The extension 139 carries a head 144 which is adjustable on the extension and which is provided with a forward edge 146 inclined rearwardly and outwardly at an angle of approximately 45°. The arm 135 is so mounted that the head 144 is positioned to engage the rear wall flap *n* of the blank inwardly of the diagonal fold line *q*, the inclined edge being shaped to permit the triangular portion *p* to be folded rearwardly onto the remainder of the rear flap *n*.

A folder bar 122 is disposed along the path of movement of the blank in position to support the rear corner flap *r* and to fold down this corner flap and the triangular portion *p*.

The operation of the second embodiment is as follows: The blank is advanced past the folder by the lug 170, carried by the chain 112, and the lug and chain (not shown) at the other side of the machine.

Prior to the time that the blank reaches the folder, the rear corner flap *r* is raised to a position perpendicular to the plane of the remainder of the blank by suitable means (not shown). The flap *r* is held in elevated position by the folder bar 122.

The folder arm 135 is rotated at a suitable speed such that the lineal velocity of the head 144 is greater than the velocity of the blank past the folder. The forward edge 146 of the head engages the rearward flap *n* and raises it and thereafter turns it down about the fold line *o*. During the turning down of the rearward wall flap *n*, the rearward corner flap *r* bears against the base *m* and prevents the triangular corner portion *p* from being lowered; thus the blank folds about the diagonal score line *q*. As the rearward wall flap *n* is folded downwardly against the base *m*, the blank is carried into a position wherein the folder bar 122 folds the rearward corner flap *r* downwardly and inwardly; the triangular corner portion *p* is, by this action, folded downwardly and rearwardly about the diagonal fold line *q*.

Thus the blank leaves the folder with the rearward wall flap *n* folded forwardly against the base *m*, the triangular corner portion *p* folded in a reverse direction against the rearward wall flap *n* and the rearward corner flap *r* folded inwardly onto the triangular corner portion *p*.

During the folding of the rearward wall flap *n*, the head 144 is cammed away from the blank in a manner generally similar to that previously described. The cam 151 engages the follower 150 and rocks the head rearwardly away from the blank, toward the completion of the fold in order to permit the blank to be withdrawn from under the head, thus preventing jamming of the machine or injury to the blank.

It will be noted that the head 144, in this form of the invention, serves to resist the raising of the rear flap as the triangular corner portion and rear corner flap *r* are folded by the folder bar 122.

While both embodiments of the invention have been described as being similar but reversed at the right hand and left hand sides of the machine, it will be understood that cases where blanks are to be folded which are not symmetrical with respect to their right and left hand portions, the mechanism herein described may be employed at one side of the blank and some other type of folder mechanism employed at the other side of the blank. Where a folding mechanism similar to that shown in either of the present embodiments is employed at both sides of the blank, the folding operation preferably is carried out simultaneously at both right hand and left hand sides of the blank.

It will be understood that other forms of supporting members may be employed instead of the folder arms for supporting the folder heads; if desired, a single member may be supplied for supporting both heads but the heads should be adjustable thereon.

The rear flap folder head may be attached to its support by other means than the pivoted arm shown, but it is important that it be yieldingly attached in order to permit it to be moved out of engagement with the blank to permit the

blank to be advanced after the rear fold has been completed.

It has been previously noted that each of the folder arms is angularly adjustable on its supporting shaft and that each of the heads is adjustable on its supporting arm. Thus, the mechanism lends itself readily to various adjustments for operating upon blanks of various shapes and sizes. Where a shorter blank than that shown is employed, the angular distance between the two folder arms is correspondingly decreased and where a longer blank is to be folded the angular distance is increased.

Where the mechanism is to be used for folding relatively short blanks, additional folder arms carrying suitable heads may be mounted on the shaft so that more than one blank is folded during a single revolution of the folder. In certain cases moreover, it may be desirable to perform more than two folding operations on each side of a single blank in which case a suitable number of folder heads carried by folder arms is provided.

The apparatus also is capable of being adjusted readily for operating upon blanks of varying widths. This adjustment is accomplished by laterally adjusting the folder arms on their supporting shaft and adjusting the lateral positions of the top bars, folder bars and conveyor mechanism.

Where the term "box" is used herein without qualification, it will be understood that this includes either a box or a cover therefor or analogous structures formed from paperboard or like material. Where the term side wall or end wall is employed without qualification, it is understood that this is merely for convenience and not in limitation, inasmuch as it is well known that the relative dimensions of a box can be varied and that the wall that might be considered an end wall in certain cases would, in a box be different dimensions, be considered a side wall.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A machine for folding blanks along diagonal fold lines including, means for advancing a blank, a rotatably mounted support, a head pivoted to said support and yieldingly maintained in predetermined angular position relative to said support, means for rotating said support to engage said head with a blank to fold a rearward flap forwardly, means active to rock said head on said support in a direction opposite the direction of rotation of said support to disengage said head from said blank at the completion of the folding of said flap, and means for retaining the fold of said flap.
2. A machine for folding blanks along diagonal fold lines including means for advancing a blank, a rotatably mounted folder member having a portion formed with a blank engaging surface inclined angularly to the plane of rotation of said folder member, means for rotating said folder member in a plane parallel to the direction of travel of said blank, and means for rocking said portion in said plane to clear said blank after folding.

3. A machine for folding blanks comprising means for advancing blanks, a rotating folder arm, a folder head pivotally carried by said arm, means resiliently positioning said head on said arm, means for rotating said arm, and cam means engageable by said arm during a portion of its rotation for rocking said head against the resistance of said resilient means, and reversely to the direction of rotation of said arm.

4. A machine for folding blanks and the like comprising means for advancing blanks, a rotatable folder including an arm, a folder head yieldingly carried by said arm, means for rotating said arm to cause said head to fold a flap of said blank, and means rocking said head on said arm reversely to the direction of rotation of said arm to disengage said head from said blank.

5. A machine for folding blanks and the like comprising means for advancing the blanks, a rotatable folder including a first member engageable with a forward flap to fold it rearwardly and a second member engageable with a rearward flap to fold it forwardly, and means for rotating said folder at a lineal speed of said members greater than the lineal speed of said blank.

6. A machine for folding blanks and the like comprising means for advancing the blanks, a rotatable folder head, means for actuating said folder head to lift a rearward portion of the blank from the plane of the blank and move said portion forward and over to an arc of approximately 180°, means for receiving and retaining the fold, and means to cause a rearward yielding of said head at the completion of the fold to permit the blank to move away from said head.

7. A machine for folding blanks and the like comprising means for advancing the blank, a rotatable, yielding folder head, means for moving said head forwardly at a lineal speed greater than the speed of the blank, whereby said head contacts a rearward diagonal creased portion of the blank and turns the same forward on an arc of approximately 180°, and means to cause a yielding of the head in a rearward direction at the completion of the folding of said flap.

8. A machine for folding blanks and the like comprising means for advancing the blanks, a rotatable folder including a first member engageable with a forward flap, and a second and yielding member engageable with a rearward flap, means for rotating said folder at a lineal speed of said members greater than the lineal speed of the blank, means for finishing the fold of the forward flap after being raised by said first member, said second member moving the rearward flap forward on an arc of approximately 180°, means for retaining the fold, and means to cause a yielding of the second member rearwardly before passing below the plane of the blank.

9. A machine for folding blanks and the like comprising means for advancing the blank, a rotatable member, a folder head mounted on said rotatable member and means for moving said folder head at a greater lineal speed than the blank, whereby said folder head contacts a rearward portion of said blank to fold the portion on an arc forwardly over upon another portion of the blank, and means at either side of the fold to resist both the upward and downward folding pressure on said rearward portion.

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