Jan. 10, 1933. O. W. WIKSTROM 1,894,209

BOX FOLDING MACHINE

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Fig. 1.

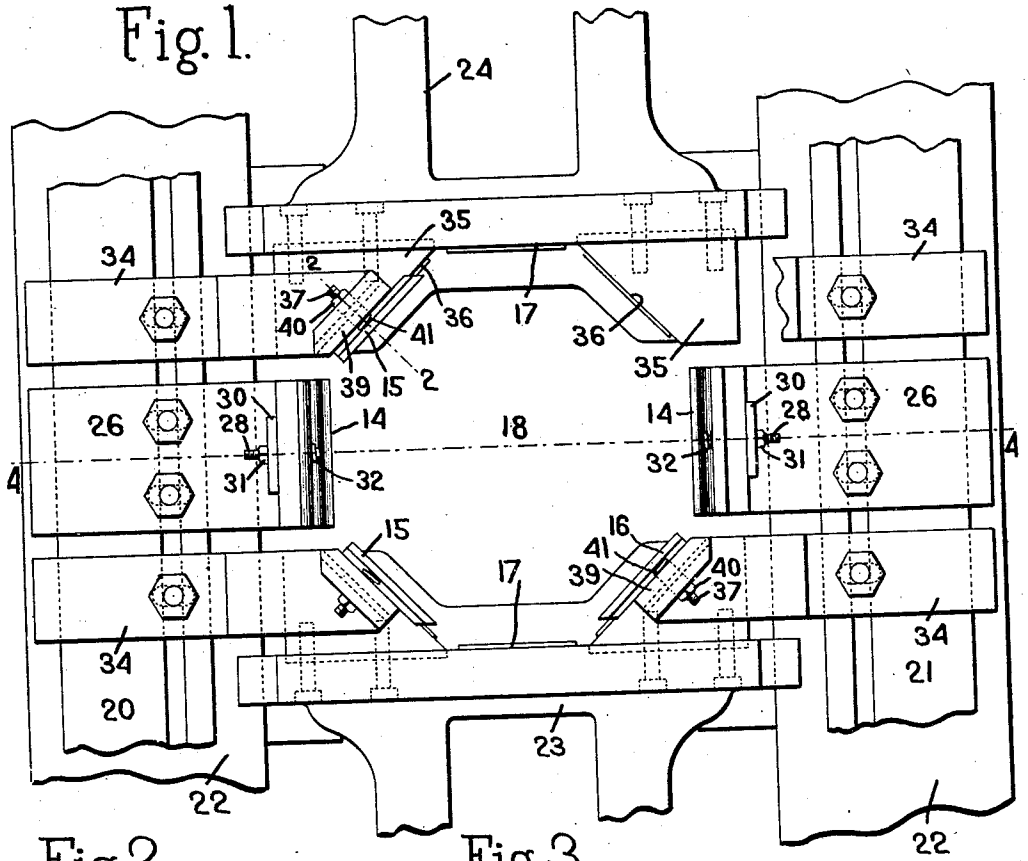


Fig. 2.

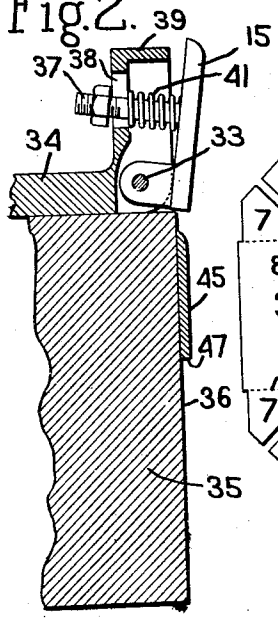
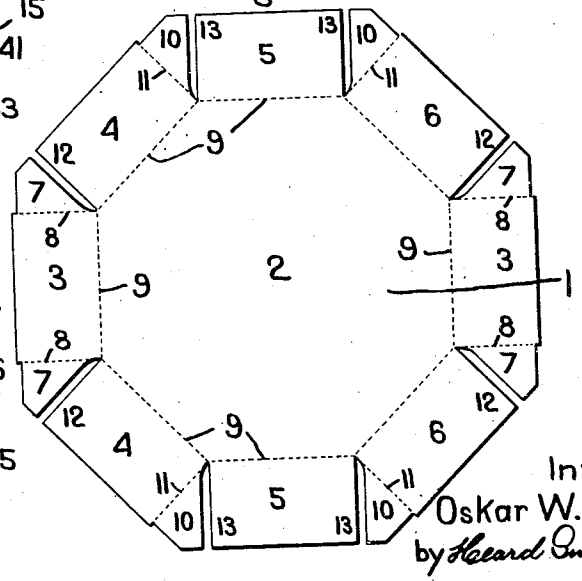


Fig. 3.



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Fig. 4.

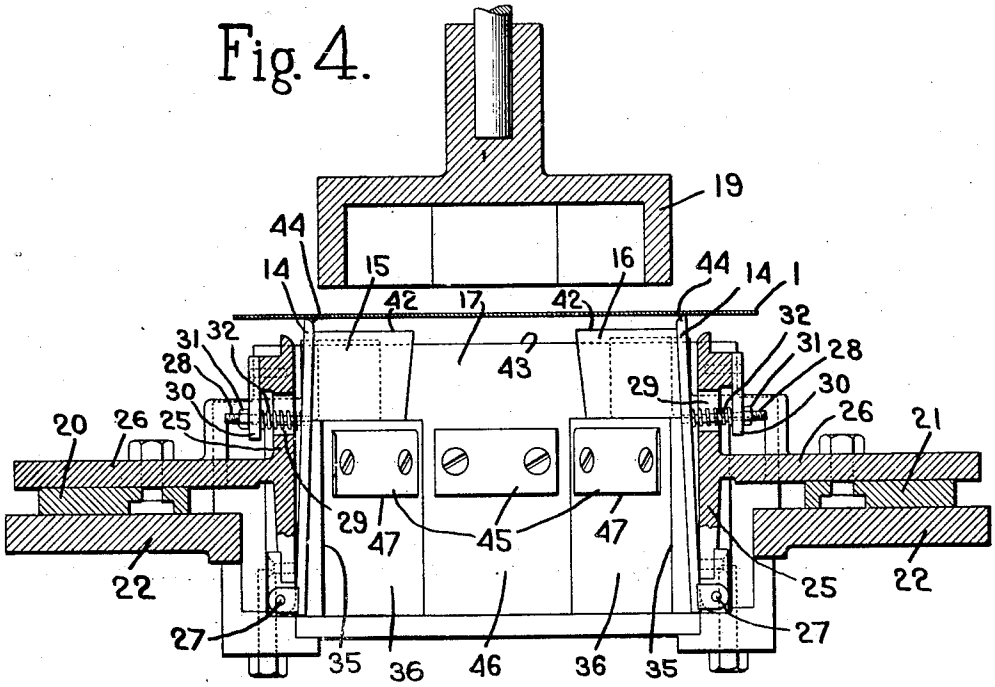
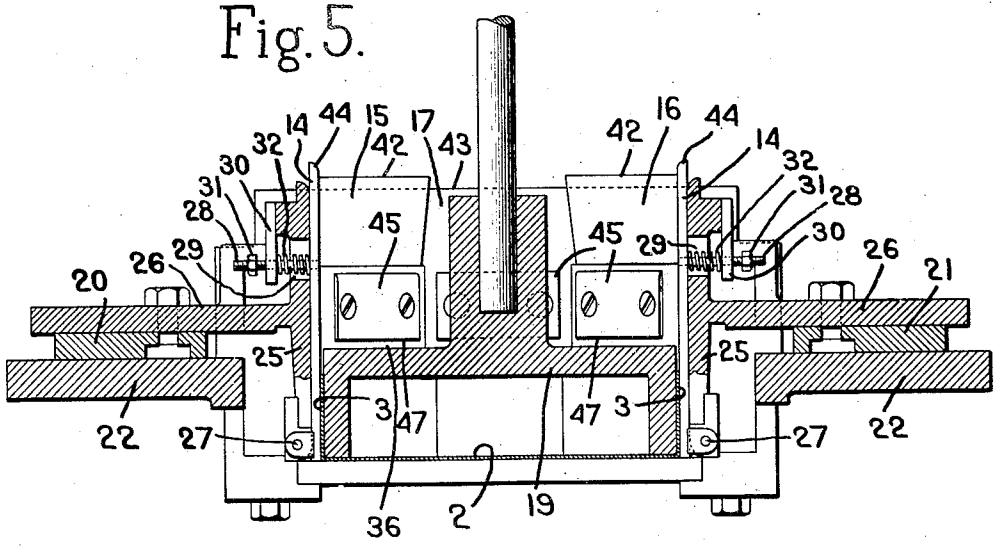


Fig. 5.



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BOX FOLDING MACHINE

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Fig. 6.

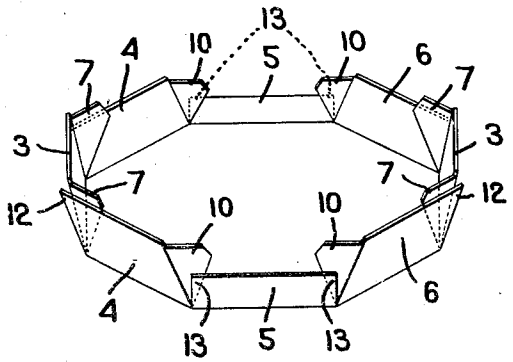


Fig. 7

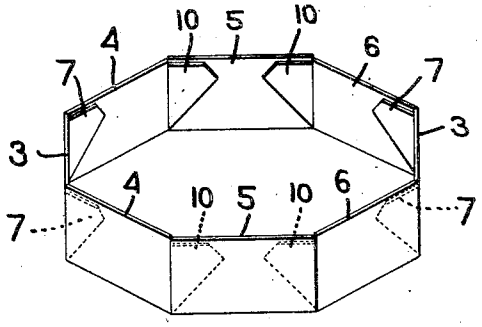


Fig. 8.

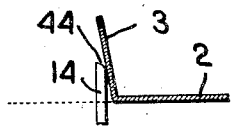


Fig. 9.

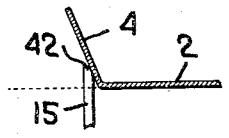
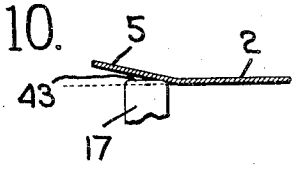


Fig. 10.



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UNITED STATES PATENT OFFICE

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BOX-FOLDING MACHINE

Application filed July 27, 1929. Serial No. 381,491.

This invention relates to machines for folding paper boxes from blanks which have been previously cut and scored and one of the objects of the invention is to provide a novel machine by which a box having a different number of sides than four can be formed.

Another object of the invention is to provide a novel machine for so folding a box that of the three walls which bound or enclose a corner of the box two walls will be at an angle of other than 90° to each other but both will be at an angle of 90° to the third wall.

The ordinary box-folding machine which is adapted to form a four-sided box comprises a so-called four-sided throat or well of a size corresponding to the box to be formed and the four sides of which are constituted by upright folding elements.

The box blank which has been previously cut and scored is folded into proper shape by being placed over the throat and then being depressed into the throat by a plunger, during which operation the bottom of the box is forced down into the throat while the four upright folding elements forming the four sides of the throat cause the four sides of the box to be folded up into their upright position.

After the plunger has completed its descent the four sides of the throat are moved inwardly slightly to bring the overlapping glued portions of the box side into contact to cause them to adhere. In such a box each of the three sides or walls which enclose an angle is arranged at right angles to the other two sides. A machine having this general construction is illustrated in United States Patent No. 681,652, dated August 27, 1901.

As stated above my present invention involves novel means by which a box having a different number of sides than four can be formed and this is accomplished by employing a throat having as many sides as there are sides to the box to be formed, these sides being constituted by folding elements which operate successively on the sides of the box.

The invention also involves novel box-folding means which can be employed in connection with the mechanism for folding a four-sided box and by which a box having a different number of sides than four can be formed.

Furthermore, the box-folding arrangement involving my invention is so constructed that of the three sides or walls bounding or enclosing a corner of the box two of the walls are at an angle of other than 90° to each other but both are at an angle of 90° to the third wall.

The invention further includes various improvements in box-forming machines all as will be more fully hereinafter set forth.

In order to give an understanding of the invention I have illustrated in the drawings a selected embodiment thereof adapted to form an eight-sided box but it is to be understood that the invention is equally applicable for forming a box having a different number of sides other than four.

In the drawings, Fig. 1 is a plan view of the throat portion of a box-folding machine adapted to form an eight-sided box;

Fig. 2 is an enlarged section on the line 2—2, Fig. 1;

Fig. 3 is a view of the blank adapted to be folded into an eight-sided box by the mechanism herein shown;

Fig. 4 is a vertical section through the throat on the line 4—4, Fig. 1 showing the blank in position above the throat;

Fig. 5 is a similar section showing the plunger in its lowered position and the box folded;

Fig. 6 is a perspective view illustrating the manner in which the octagonal box is folded;

Fig. 7 is a perspective view of the completely folded box;

Figs. 8, 9 and 10 are views illustrating the portion of the primary, secondary and final folder operating successively on the adjacent sides of the box;

This invention is herein shown as embodied in a machine adapted to fold an eight-sided box such as shown in Fig. 7. This box is made from a blank 1 which is cut and scored in the manner illustrated in Fig. 3, said blank comprising the eight-sided body portion 2 forming the bottom of the box and the eight flaps 3—3, 4—4, 5—5, 6—6. The blank is scored along the lines 9 which form the division between the flaps and the body 2 all as usual in box blanks.

The two flaps 3 which are situated opposite from each other and form opposite sides of the box are each provided at each end with a wing 7, the blank being scored along the lines 8 forming the junction of the wings with the box side 3. Each of the flaps 4 and 6 are also provided on that side adjacent the flap 5 with a wing 10 which is adapted to be folded relative to the flap along the score line 11.

The box can be formed either by folding the various flaps so as to bring the wings 7, 10 either on the inside of the box or on the outside of the box. In the drawings the folding operation is illustrated so as to place the wings on the inside of the box and in doing this the two opposite flaps 3 are first bent upwardly into a partially folded position, this operation carrying the wings 7 upwardly and partially over the corners 12 of the flaps 4 and 6. When the flaps 3—3 are partially folded the folding of the flaps 4—4, 6—6 is begun and as these flaps fold upwardly the outer corners 12 thereof pass in under and engage the wings 7 as shown in Fig. 6. As the flaps 4—4, 6—6 are folded the wings 10 thereof will be lifted over the corners 13 of the flaps 5 and after said flaps 4—4 and 6—6 have been partially folded then the folding of the flaps 5 begins, during which operation the corners 13 thereof engage the wings 10 of the flaps 4—4, 6—6.

This partially folded stage of the box is shown in Fig. 6 wherein the opposite flaps 3 have been brought nearly to their vertical position while the flaps 4—4 and 6—6 are about half folded and the folding of the flaps 5 is just beginning. As the folding operation is completed the engagement of the corners 12 of the flaps 4—4, 6—6 with the wings 7 bend said wings inwardly so that they lie flatly against the sides 4—4, 6—6 of the completed box and similarly the engagement of the corners 13 of the flaps 5 with the wings 10 fold said wings inwardly against the inside of the flaps as shown in Fig. 7. Either these wings 7 and 10 or the sides of the box with which they contact will be provided with a coating of glue or other adhesive so that when the box is completely folded the contacting faces of the flaps and box sides will adhere together and thus retain the box in its permanent shape.

While the adjacent side walls of the box are at angles other than 90° to each other yet each is at an angle of 90° to the bottom of the box. In other words, of the three walls which bound any corner of the box (for instance two adjacent side walls and the bottom of the box) two of the walls, to wit, the two side walls are at an angle of other than 90° to each other but each of these walls is at an angle of 90° to the third wall, which is the bottom of the box.

The folding of the first pair of flaps, which is the pair 3 in the drawings, is accomplished by a pair of primary folders and the folding of the flaps 4—4, 6—6 is accomplished by two pairs of secondary folders while the folding of the last flaps, which are the flaps 5 in the drawings, is accomplished by end followers or folders.

In Fig. 1, which is a plan view of the throat or well adapted to fold a box with the wings 7, 10 on the inside, the two primary folders are indicated at 14, one pair of secondary folders are indicated at 15 and the other pair at 16 while the end folders or followers are indicated at 17. These primary and secondary folders and end followers form the side walls of an eight-sided well or throat 18 into which the box blank is folded by means of a plunger 19 as usual in box-folding machines.

One feature of the present invention relates to a construction by which this arrangement of folders for folding a box having a different number of sides than four can be applied to the slides and carriers of the ordinary box machine that is constructed to fold a four-sided box. In such ordinary box machine two opposed folders are usually carried by two slides movable toward and from each other while the end folders or followers are carried by two other slides or carriers movable toward and from each other in a direction at right angles to that of the first-named slides. In the present embodiment of my invention, which is adapted to fold an eight-sided box, I have provided a construction wherein the primary and secondary folders are carried by two of the slides while the end folders or followers are carried by the other two slides or carriers.

In Fig. 1 for instance, 20 and 21 are two slides supported on the frame 22 and movable toward and from each other. The slide 20 carries one of the primary folders 14 and the two secondary folders 15 while the slide 21 carries the other primary folder 14 and the other two secondary folders 16. The frame is also provided with the usual two carriers 23, 24 that are movable toward and from each other on the frame 22 in a direction at right angles to the movement of the slides 20 and 21. The end folders or followers 17 are carried by these carriers 23, 24.

Each of the primary folders 14 is shown as in the form of a plate which is pivoted at its lower end to the head portion 25 of a supporting member 26 as shown at 27. The supporting member is adjustably secured to one of the slides in any usual way. Each of the primary folders is capable of a limited swinging movement about its pivot 27 and is acted on by a spring which normally holds it to the forward limit of its movement.

As herein shown each folder 14 has a screw-threaded stem 28 secured thereto, said stem extending through an opening 29 in the head

25 and also through an opening in a flange 30 depending from the head, said stem having a nut 31 screw-threaded thereto, which by engagement with the flange 30 limits the forward movement of the folder. A spring 32 surrounds the stem and is situated between the flange 30 and the folder, said spring thus yieldingly holding the folder in its forward position with its upper end away from the head as shown in Fig. 4.

Each of the secondary folders 15—15, 16—16 is in the form of a plate pivotally mounted at its lower end as shown at 33 to a supporting member 34 which is also adjustably secured to one of the slides 20, 21. The secondary folders, however, are of less vertical dimension than the primary folders and terminate at their lower end considerably above the lower ends of the primary folders.

Each supporting member 34 which carries a secondary folder rests on a block 35 which is secured to one of the carriers 23, 24. Each block is so shaped that the active face 36 thereof stands at an angle of 45 degrees to the faces of the primary folder and end follower. These secondary folders 15, 16 are also acted on by springs which normally hold them in their forward position such as shown in Fig. 2 and for this purpose each folder has a screw-threaded stem 37 extending rearwardly therefrom which passes through a slot 38 formed in the head 39 of the supporting member 34, each projection 37 having a nut screw threaded thereto which limits the forward swinging movement of the folder. The spring 41 surrounding the stem and confined between the folder and the head 39 yieldingly holds the folder in its forward position.

The final or end followers 17 are rigid with the carriers 23, 24 and are merely constituted by walls upstanding from said carriers.

With this arrangement of folders there will be a secondary folder situated each side of each primary folder and also each side of each end folder. These folders are all situated in planes substantially perpendicular to the plane of movement of the slides and the folders form between them a well or throat, the adjacent sides of which form angles other than a right angle. In the illustrated embodiment of the invention the well has eight sides so that any two adjacent sides makes an angle greater than a right angle. The design of the folders is such that the upper edge 44 of each primary folder 14 is at a higher level than the upper edges 42 of the secondary folders while the upper edges 43 of the final or end folders are at a lower level than the upper edges of the secondary folders. This relation between the folding edges of the folders is clearly shown in Figs. 4 and 5.

When a box blank 1 is placed in position above the well or throat 18 as shown in Fig. 4 it will rest and be sustained on the upper edges 44 of the two primary folders 14. The nuts 31 will be so adjusted that normally the upper edges of these folders will engage the box blank just outside of the score lines 9.

The folding of the box is done as usual by the movement of the plunger 19 downwardly from the position shown in Fig. 4 to that shown in Fig. 5. If the box is to be folded with the wings 7 and 10 on the inside of the box then the primary and secondary folders may have the arrangement shown in the drawings and the box blank will be so placed in the machine that the flaps 3, or the flaps which are to be first folded, will rest on the primary folders 44.

With the parts thus arranged then during the downward movement of the plunger immediately following its engagement with the blank the body of the blank will be forced below the upper edges 44 of the primary folders with the result that the flaps 3 will be bent upwardly slightly along the score lines 9. The flaps 4—4, 6—6, however, will have no upward bending movement at this time. As soon as the plunger has depressed the body of the blank to a position in which the flaps 4—4, 6—6 engage the upper edges 42 of the secondary folders 15—15, 16—16 then upon further downward movement of the plunger the bending upward of the flaps 4—4, 6—6 will begin, the flaps 5, however, still remaining unbent. As the plunger in its continued descent brings the body of the blank into position where the flaps 5—5 engage the upper edges 43 of the end folders 17 then upon further downward movement of the plunger the flaps 5—5 will begin to fold as shown in Fig. 10. By this time, however, the flaps 3—3 have received a considerable portion of their folding movement as shown in Fig. 8 and the flaps 4—4, 6—6 are partially folded as shown in Fig. 9.

The folding of the flaps, therefore, is a sequential operation, the flaps 3 first being given a folding movement, then the flaps 4—4, 6—6 and finally the flaps 5, but by the time the flaps 5 begin to fold the flaps 3—3 are nearly folded while the flaps 4—4 and 6—6 are about half folded, the relative stages of the flaps at this time being shown in Figs. 8, 9 and 10.

Because the flaps 3—3 are folded ahead of the flaps 4—4, 6—6 the wings 7 of the flap 3 will be carried above and always in advance of the corners 12 of the flaps 4—4, 6—6 and similarly the wings 10 of the flaps 4—4, 6—6 will be carried above and always be in advance of the corners 13 of the flaps 3. As the folding proceeds the corners 12 of the flaps 4—4, 6—6 engage the wings 7 and serve as means for folding said wings inwardly along the score lines 8 and similarly the corners 13 of the flaps 5 engage the wings 10

and constitute the means for folding said wings inwardly along the score line 11. This sequential folding of the flaps is secured by having the upper edges of the folders with a stepped relation, the upper edges 44 of the primary folders being at a higher level than the edges 42 of the secondary folders and said edges 42 in turn being higher than the edges 43 of the end followers. As the folding proceeds and is completed the wings 7 are folded against the inside of the flaps 4—4, 6—6 and the wings 10 against the inside of the flaps 5 as shown in Fig. 7.

After the plunger 19 has been fully depressed as shown in Fig. 5 then the corners 12 of the flaps 4—4, 6—6 are firmly pressed against the outside faces of the wings 7 and the corners 13 of the flaps 5 are also pressed against the outside faces of the wings 10.

It will be understood that either these wings 7 or the sides of the box with which they contact are provided with suitable adhesive so that when the box sides and wings are pressed together as above described the contacting faces will adhere. The pressing together of the contacting faces of the flaps and wings is secured by a movement of the carriers 23, 24 towards each other.

It will be remembered that the secondary folders 15—15, 16—16 are relatively short in a vertical direction and do not extend to the bottom of the well or throat 18 and that the corner faces 36 of the well or throat are formed on the extensions 35 of the slides 23, 24. When the plunger is fully depressed the flaps 4—4, 6—6 are engaging the faces 36 of the extensions 35 while the flaps 5 are, of course, engaging the faces of the final folders 17. When the plunger 19 is in its lowered position shown in Fig. 5 the slides 23, 24 are given a slight movement toward each other during which movement the faces 36 of the extensions 35 bring pressure to bear against the flaps 4—4, 6—6 and thus press the corners 12 of these flaps against the wings 7. At the same time the lower faces 46 of the end folders 17 apply pressure to the end flaps 5 thereby pressing the corners 13 thereof firmly against the wings 10. After this pressure has been applied the carriers recede slightly as usual in box-forming machines and the plunger is then raised.

The faces 36 and the face of the folder 17 are provided with stripping plates 45, the lower edges 47 of which lie above the upper edges of the walls of the box when the box is in its completed condition. These stripper plates 45 prevent the box from being lifted up by the upward movement of the plunger. After the plunger has been elevated to its raised position shown in Fig. 4 the completed box is discharged from the well in any usual way.

It will be noted that the folders for folding the corner flaps 4—4, 6—6 are on the slides 20—21 while the faces which press these flaps against the wings 7—7 are on the slides 23, 24. The folding of these flaps 4—4, 6—6 is thus done by one set of slides and the application of pressure to the folded flaps for completing the box is accomplished through the other slides 23, 24.

The advantage of having the folders 14, 15, 16 pivoted and spring pressed is that when they are in their forward position the upper edges thereof will engage the blank immediately outside of the score lines 9 so as to make certain that the flaps will fold on the score lines. As the folding proceeds these yieldable folding members can swing backwardly to allow the plunger to enter between them and when in their rearward position they are solidly backed by the supporting members and are in a true vertical position which is necessary for properly forming the box sides.

I have described above the operation of folding the box blank so as to bring the wings 7, 10 on the inside of the box. If it is desired to fold the box with the wings 7, 10 on the outside then the position of the primary folders and end folders will be reversed, the primary folders occupying the position of the end folders 17 in Fig. 1 and the end folders occupying the position of the primary folders 14 in said figure.

The primary folders, whether located in one position or the other, have their folding edges at a higher elevation than the secondary folders, and the end folders have their folding edges at a lower elevation than the secondary folders. With the suggested reversal in position of the primary and end folders there will be a reversal in the sequential operation because when the plunger is depressed the sides 5 of the box will first be folded and then the sides 4, 6 and finally the sides 3, this operation resulting in placing the wings 7, 10 on the outside of the box.

While I have described above a construction adapted to make an eight-sided box yet I wish to state that the invention is not limited to the making of an eight-sided box but may be used in the making of boxes having a different number of sides than four by arranging the requisite number of folders one for each side of the box on the four slides 20, 21, 23, 24. Where the machine is arranged to fold a box having a different number of sides than four the folders will be so arranged that each vertical face of the folder makes an angle other than 90 degrees with the adjacent folders, and the pressing faces by which the wings 7, 10 are pressed against the flaps will be so arranged that each pressing face will have an angle other than 90 degrees with the adjacent pressing faces.

I claim:

1. In a box-folding machine, the combination with two pairs of opposed slides ar-

ranged at right angles to each other, of a primary folder and secondary folders carried by each slide of one pair and an end folder carried by each slide of the other pair, said folders being in planes substantially at right angles to the plane of the slides and forming between them a well or throat, the adjacent sides of which form angles other than 90° and a plunger movable into and out of the well and co-operating with the folders to fold a box blank, the upper edge of the primary folders standing at a higher level than those of the secondary folders, whereby when the plunger is operated the sides of the box will be folded successively.

2. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, of a primary folder and secondary folders carried by each slide of one pair and an end folder carried by each slide of the other pair, said folders being in planes substantially at right angles to the plane of the slides and forming between them a well or throat, the adjacent sides of which form angles other than 90° and a plunger movable into and out of the well and co-operating with the folders to fold a box blank, the upper edges of the secondary folders being at a lower level than those of the primary folders but at a higher level than those of the end folders.

3. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, of a plurality of folders carried by each slide of one pair and a single folder carried by each slide of the other pair, said folders being in planes substantially at right angles to the plane of the slides and forming between them a well or throat, the sides of which form angles other than 90° and a plunger movable into and out of the well and co-operating with the folders to fold a box blank.

4. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, of a plurality of folders carried by each slide of one pair and a single folder carried by each slide of the other pair, said folders being in planes substantially at right angles to the plane of the slides and forming between them a well or throat any two adjacent sides of which form between them an angle greater than 90° and a plunger movable into and out of the well and co-operating with the folders to fold a box blank, the upper edge of adjacent folders having a stepped relation whereby, when the plunger is operated, the sides of the box will be folded successively.

5. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, each slide of one pair having a primary folder and two secondary folders and each slide of the other pair having an end folder, said folders being in planes at substantially right angles to the plane of the slides and forming between them a well or throat, any two adjacent sides of which form between them an angle greater than 90° of a plunger movable into and out of said well and co-operating with the folders to fold a box blank, each of the slides carrying an end folder having pressing surfaces in substantially the planes of the secondary folders to press against the plunger a plurality of the box sides which are folded by folders carried by the first-named pair of slides.

6. In a box-folding machine, the combination of two pairs of opposed slides arranged at right angles to each other, each slide of one pair having a primary folder and two secondary folders, and each slide of the other pair having an end folder, said folders being in planes at substantially right angles to the plane of the slides and forming between them a well or throat, any two adjacent sides of which form between them an angle greater than a right angle of a plunger movable into and out of said well and cooperating with the folders to fold a box blank into box shape, the slides carrying the end folders having pressing surfaces to cooperate with the plunger in applying pressure to the sides of the box which are folded by the secondary folders.

7. The method of making a box having more than four sides which consists in providing a box blank with a body portion and separate flaps, one for each side of the box, certain of the flaps having two wings, one at each end, other adjacent flaps having a single wing at one end and other flaps being without wings, folding the flaps to form the sides of the box and in so doing folding the two-wing flaps in advance of the one-wing flaps, and the latter flaps in advance of the flaps without wings.

8. The method of forming an octagonal box which consists in providing a box blank having an octagonal body portion and a foldable flap for each side of the box, two opposed flaps each having two wings, one at each end, the flaps adjacent the two-wing flaps each having a single wing and then folding the flaps to form the sides of the box and in so doing initiating the folding movement of the one-wing flaps subsequent to that of the two-wing flaps but prior to that of the remaining flaps.

9. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, of a plurality of folders carried by said slides, said folders forming between them a well or throat, each side of which is disposed at an angle other than 90 degrees with the adjacent sides, and a plunger movable into and out of said well and co-operating with said folders to fold a box having each of its vertical walls disposed at an angle other than 90 degrees to adjoining vertical walls.

10. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, of a plurality of folders carried by said slides, said folders forming between them a well or throat, each side of which has an angle other than 90 degrees with the adjacent sides, a plunger movable into and out of said well and co-operating with said folders to fold a box blank into box shape, and means associated with said slides and having a plurality of vertical pressure faces disposed at an angle other than 90 degrees to the direction of movement of said slides, said pressure faces serving to press the box sides against the plunger.

11. In a box-folding machine, the combination with two pairs of opposed slides with the slides of one pair arranged at right angles to the slides of the other pair, of a plurality of folders carried by said slides and forming between them a well or throat, there being a different number of folders than four, and a plunger movable into and out of said well and co-operating with said folders to fold a box blank thereby to form a box in which of the three walls bounding any corner of the box two of the walls are at an angle of other than 90° to each other while the third wall is at an angle of 90° from each of the other two.

12. In a box-folding machine, the combination with two pairs of opposed slides arranged at right angles to each other, each slide of one pair having a primary folder and two secondary folders, and each slide of the other pair having an end folder, said folders forming between them a well or throat having eight sides, of a plunger movable into and out of said well, and co-operating with the primary and secondary folders to fold from a box blank six sides of an eight-sided box and with the end folders to fold the remaining two sides, the slides carrying the end folders having pressing surfaces to co-operate with the plunger in applying pressure to six sides of the box.

In testimony whereof, I have signed my name to this specification.

OSKAR W. WIKSTROM.