

July 25, 1944.

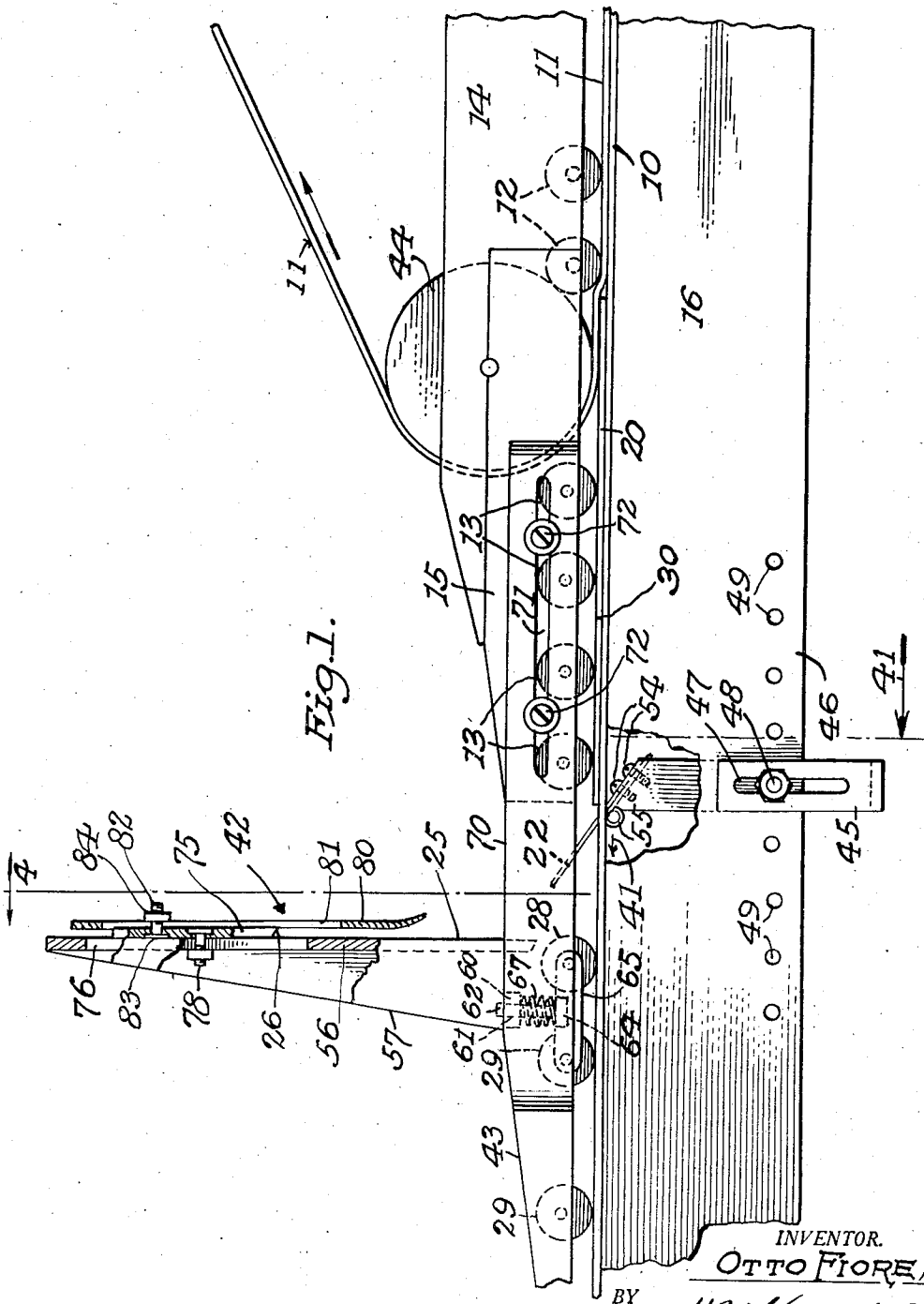
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2,354,251

FOLDING DEVICE

Filed Aug. 15, 1942

5 Sheets-Sheet 1



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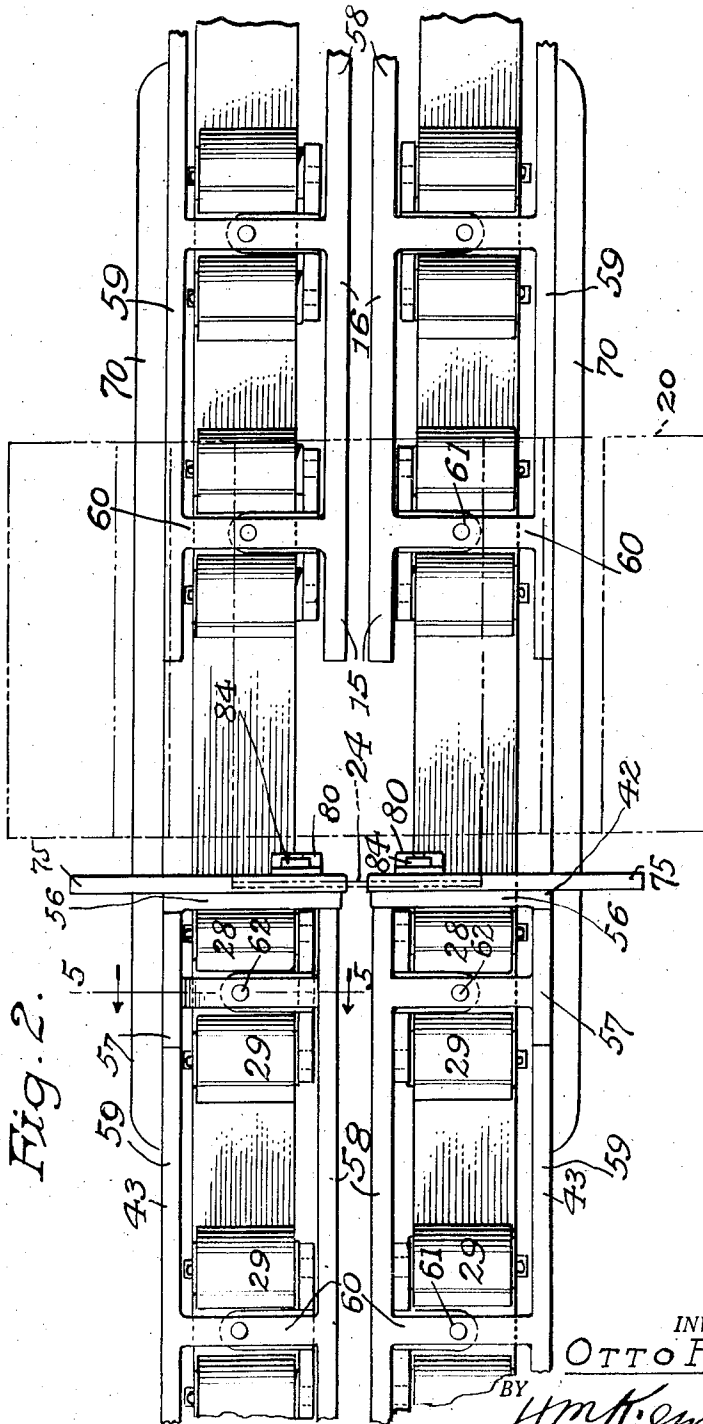
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5 Sheets-Sheet 2



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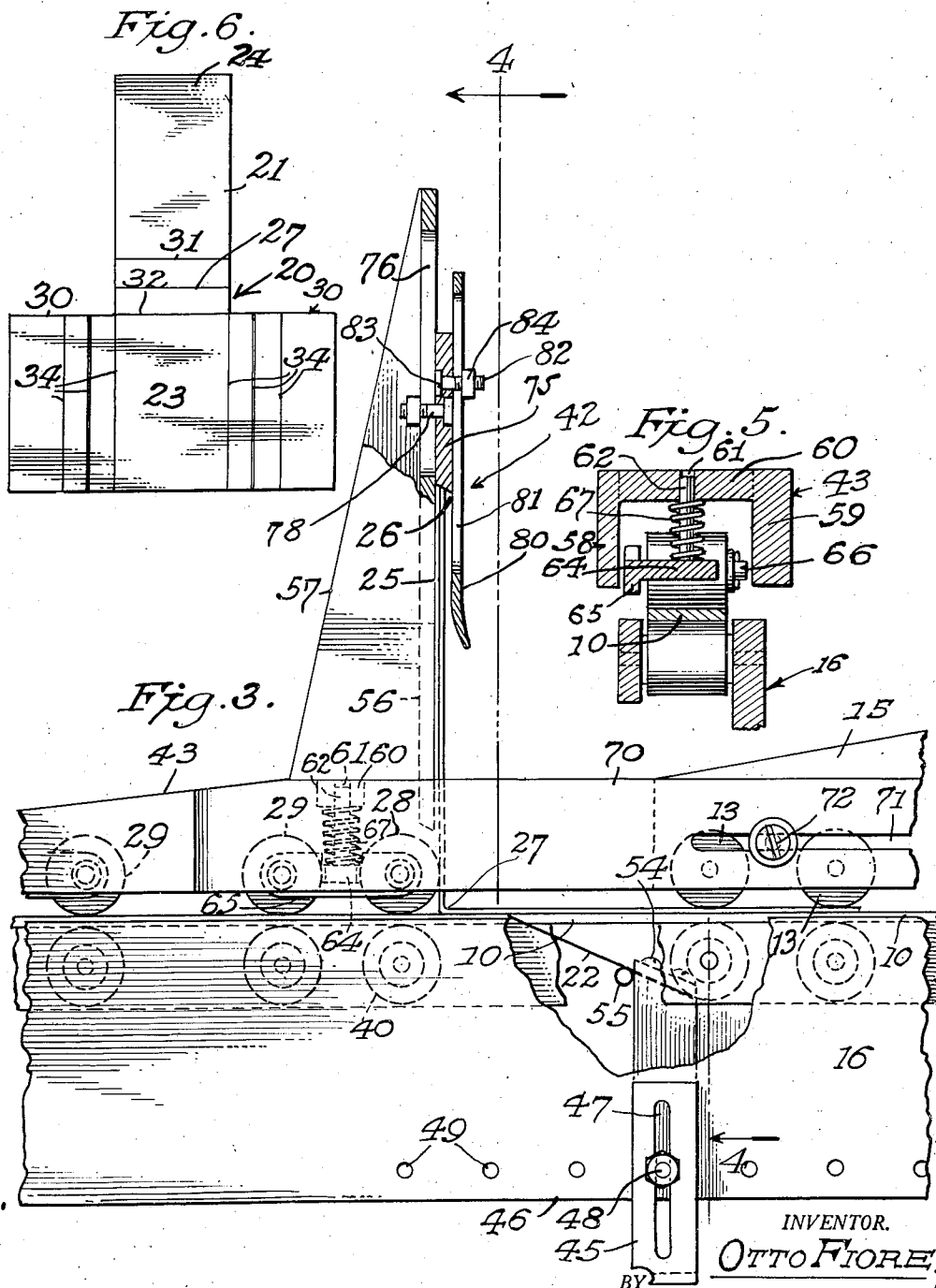
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5 Sheets-Sheet 3



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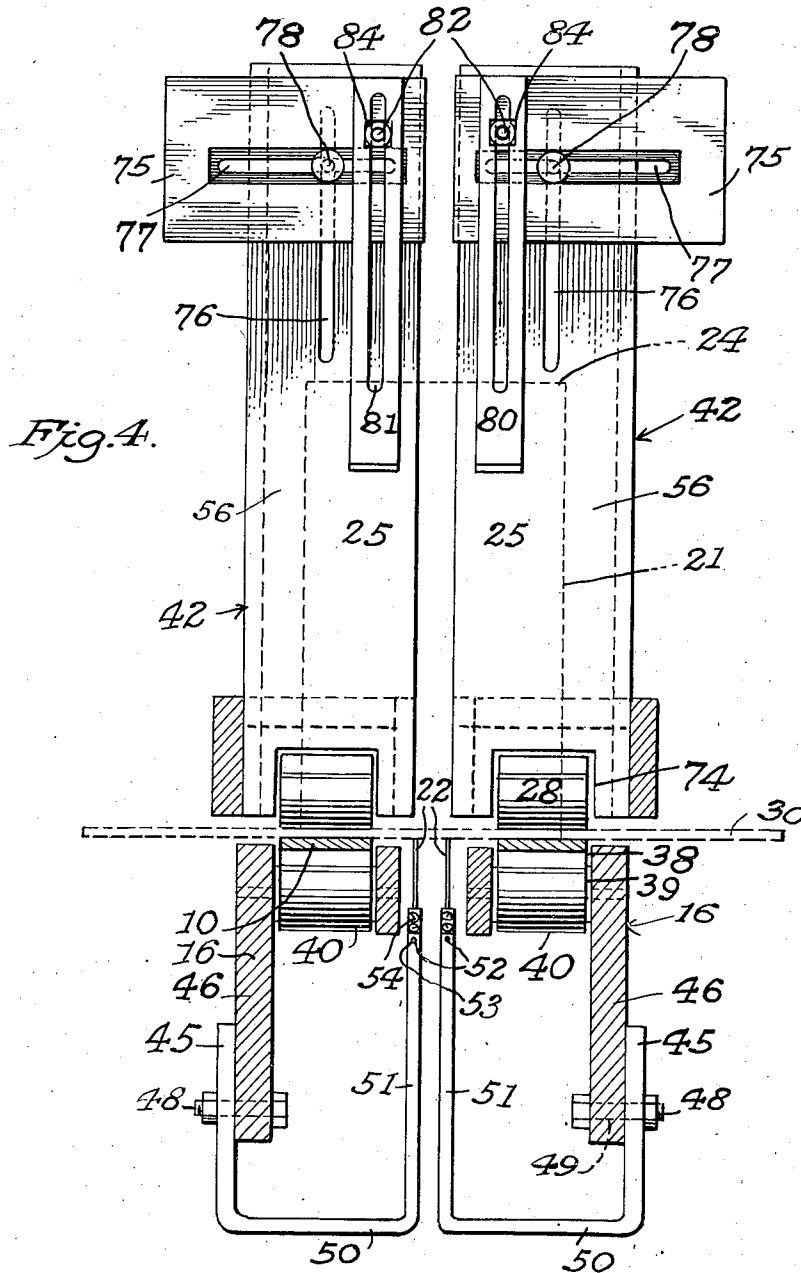
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5 Sheets-Sheet 4



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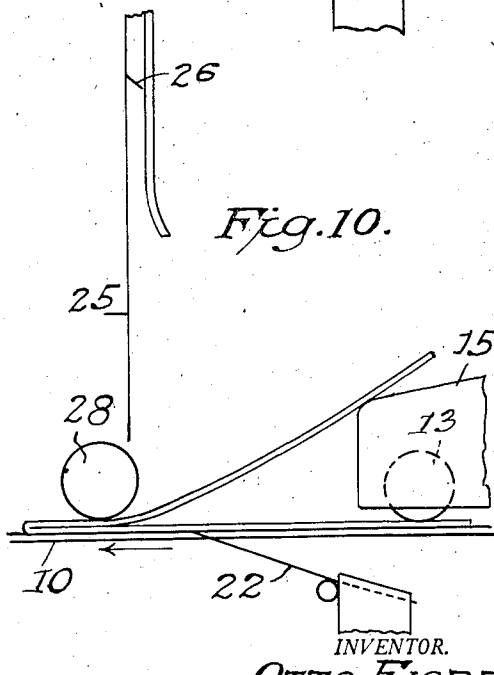
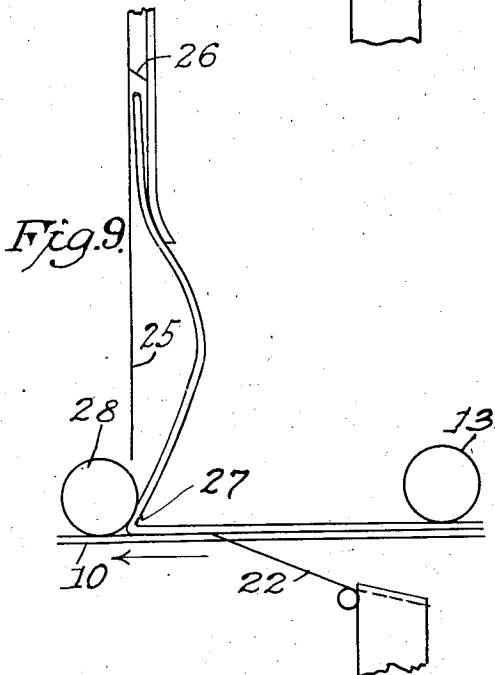
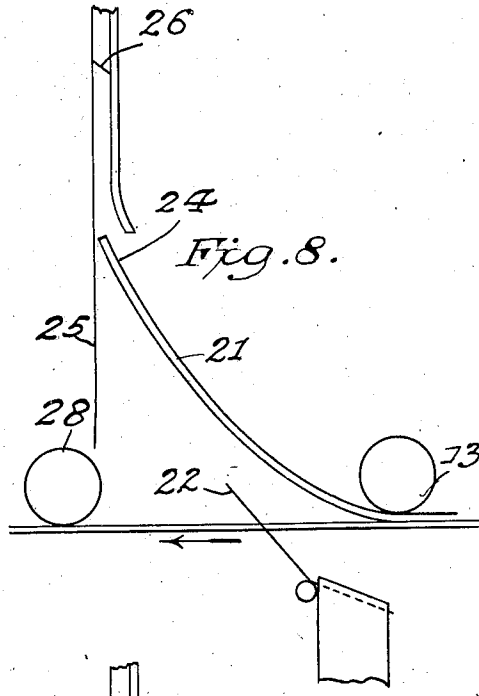
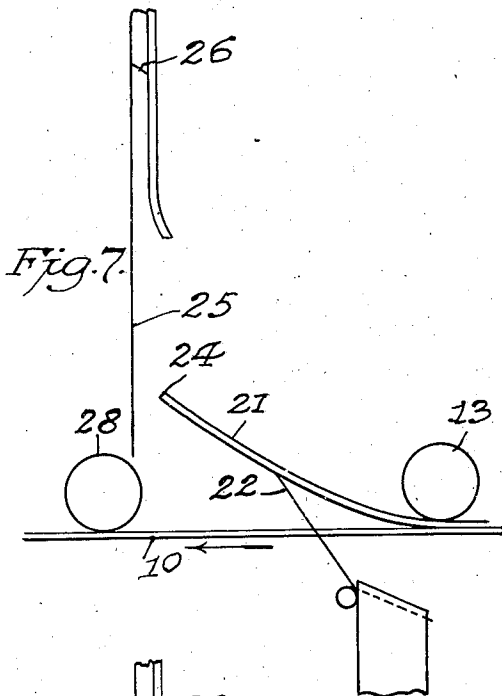
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FOLDING DEVICE

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5 Sheets-Sheet 5



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2,354,251

FOLDING DEVICE

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12 Claims. (Cl. 270—68)

This invention relates to folding machines and paper box and envelope making machines and to means and methods for transversely folding blanks and more particularly to methods and devices for folding on a transverse line an advance part of a blank traveling through a folding machine though it is noted that in some of the claims the invention is not limited to a traveling blank or any particular type of machine nor even to folding an advance part nor to folding on a transverse line.

One object of the invention is to provide an improved device and method of this kind by which the blank is folded when traveling at high or low speed, without the necessity of synchronizing the blank or the folding with any other movement or operation of the machine or blank.

Other objects of the invention are to provide an improved device of this kind which is free of any reciprocating part, which comprises principally fixed parts and which may be adjusted or adapted for folding a large variety of shapes and sizes of blanks, and is adaptable to a large variety of machines and blank carriers.

Additional objects of the invention are to effect simplicity and efficiency in such methods and devices and to provide an extremely simple device or apparatus of this kind which is very speedy, economical, durable and reliable in operation, and costs very little to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described in the specification and some of the claims, the invention as described in some of the broader claims is not limited to these, and many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

The inventive features for the accomplishment of these and other objects are shown herein by way of example in connection with machine parts and folding means which briefly stated include means for folding a blank comprising a rear body portion and a forward flap provided with a transverse score line near the body portion; said machine parts including means including lower and upper belts and rollers for supporting and forwardly moving the blank in a horizontal plane with the flap forward. The blank folding means includes an adjustable spring or springs adapted to engage and yieldably slightly upwardly deflect the forward part of the flap as the blank is moved forwardly after which the deflected flap comes into engagement with an upright deflecting plate or plates positively deflecting substantially vertically upwardly the forwardly moving flap until adjustable fixed stops at the upper part of the plates positively stop the free end

of the upwardly moving flap a distance above the plane of the body portion about equal to the distance between the score line and said end thereby positively holding the flap in the stopped position as the body portion still in said plane is forced forwardly thereby to cause the flap to fold at the score line; after which the flap is drawn under a folding roller at the lower part of the plate which then folds and presses the flap onto the body portion as the body portion is moved forwardly.

In the accompanying drawings showing, by way of example, one of many possible embodiments of the invention,

Fig. 1 is a fragmental side end elevation showing a portion of a folding machine provided with my folding device;

Fig. 2 is a fragmental plan on a larger scale than Fig. 1 showing the device and adjacent parts of the machine, a blank in partly folded position being indicated therein;

Fig. 3 is a fragmental side elevation showing the folding device;

Fig. 4 is a fragmental transverse vertical sectional view, showing the deflector plate in front elevation, the section being taken substantially on the line 4—4 of Fig. 3, looking in the direction of the arrows of said line;

Fig. 5 is a transverse vertical sectional view, partly in elevation, showing the part of the mounting means of the folding roller, the section being taken substantially on the line 5—5 of Fig. 2, looking in the direction of the arrows of said line;

Fig. 6 is a plan or face view showing one example of many possible blanks that may be folded by this device;

Figs. 7 to 10 are diagrammatic side elevations showing steps in the folding method.

My improved device may be applied to various types of machines or fixtures, and is here shown by way of example, in connection with the type of machine wherein the blank is conveyed, from suitable feeding means (not here shown), past suitable gluing means (not shown) on lower carrier belts 10 (Fig. 1), the blanks being pressed upon the lower belts by upper belts 11 and rollers 12, 13 carried in housings 14 and 15 suitably supported from the frame of the machines. In this type of machine the race bars 16 carrying the lower belts together with the housings are adjustable various distances apart; and such machines have various adjustments for various styles and sizes of blanks or articles made therefrom. But the invention is not limited to use with any type of machine or any particular type of blank.

The operation and relations of the principal features of my folding device and the machine

will first be briefly indicated, after which they will be described in detail.

Many different types of blanks may be used, and the blank 20 (Fig. 6), shown by way of example, is fed forwardly as in Fig. 1 by the lower belts 10, the upper belts 11 and rollers 12, 13 until the forwardly directed flap 21 engages and is upwardly deflected by the springs 22 (Fig. 7), the body portion 23 of the blank being pushed on by the conveying means until the forward end 24 of the flap rides up the deflector face 25 (Fig. 8) until stopped by the stop shoulder 26 (Fig. 3), the further feeding of the body portion causing the blank to fold on the score line 27, after which the body of the blank being further pushed by the belt and rollers (Fig. 9) pushes the fold at the score line under the rollers 28, as in Fig. 10 after which the folded blank is carried by the belt 10 and rollers 28, 29 to further mechanism (not shown) of the machine for further folding and stacking.

My improved folding device and its relation to the machine will now be described more in detail and is here described by way of example for folding the blank 20 having a body portion 23 having side flaps 30 and the forward flap 21, all flaps being provided with several adjacent transverse score lines 21, 31, 32 on the front flap and 34 on the side flaps all adjacent to the body portion, though it is noted that the device can be used for folding almost any kind of blank.

The new device is shown by way of example applied to a folding machine of the usual type having a pair of suitably supported parallel belt-race bars 16 which as is usual may be relatively adjustable one from the other, each bar being provided with an upwardly opening belt race 38 (Fig. 4), and roller receiving openings 39 in the bottom of the race in which are rotatably disposed axially transverse rollers 40 for supporting the suitably driven forwardly longitudinally moving lower supporting carrier belt portions 10 movable in the race in the direction of the arrow 41 of Fig. 1 on which portions the blanks may be conveyed from the blank feeding means and a gluing means or other operating mechanism, not shown and not a part of the present invention.

My improved device includes a main flap deflecting means 42 (Fig. 3) above said belts 10 to, against and under which the blanks may be conveyed by the lower belt portions 10 in cooperation with the upper rollers 12, 13, and the rollers 28, 29 in roller housings 43. Pulleys 44 at the advance end of the housings 14 support the advance portions of the upper pressure belts 11 which have their lower courses engageable with and moving in the same direction as the lower belts 11, or the blanks thereon, whereby the blanks may be engaged between the upper and lower belts and conveyed toward the main deflective means 42.

The roller housing 15 is secured to the advance end of the pulley housing 14 and carries the downwardly spring pressed rollers 13 for pressing the blank into good driving contact with the lower belt whereby the blank is firmly pushed into cooperation with one or more springs 22 and the main deflector means 42.

The springs 22 are carried on adjustable strap-metal brackets 45, 50, 51, (Figs. 3 and 4) carried on said race bar 16. Each bracket comprises a vertical outer portion 45 engaged against the outer flange 46 of the race bar and having a vertical slot 47 therein in which is received a clamping screw 48 passed through said slot and

screwed into one of a plurality of tapped holes 49 in said flange for adjustably clamping the bracket against the flange. Said bracket includes a lower yoke portion 50 under the race bar near the advance end of the roller housing 15 and an upright arm 51 extending upwardly to near the path of the blank, and provided with a small bore 52 inclined upwardly toward the main deflector means and receiving a spring wire 53 held in said bore by set screws 54 and comprising a spring coil 55 adjacent to the upright 51 and the upwardly and forwardly inclined preliminary deflector spring 22 biased to cross the path of the blank, and adapted to engage and upwardly deflect the forward flap 21 before the latter reaches the main deflector means 42.

The main deflecting means 42 (Figs. 3 and 4) comprises a pair of members 42 one over each race bar as the latter are adjusted toward or from each other in accordance with the width of the blank to be folded. Each member 42 comprises an upright deflector plate 56, having a deflector face 25 facing said roller housing 15 in a plane transverse to the length of said bars 16, said plate joining or being integral with the rear roller housing 43 joining the lower part of the deflector plate 56, and a tapering flange 57 extending rearwardly of the outer edge of the plate.

Said roller housing 43, comprises side walls 58, 59 (Fig. 5) and transverse cross-pieces 60 spaced along the housing and connecting the upper part of the side walls and each provided with a central vertical bore 61 in which is slidably received an upright stud 62 of a roller truck 64, 65 under each cross-piece comprising a transverse intermediate piece 64 joining the lower end of the stud and a longitudinal side piece 65 joining the outer end of the intermediate piece, adjacent and parallel to a side wall 58 and provided at its ends with spindles 66 transverse to the housing and receiving pressure rollers 28, 29 rotary on the spindles and pressed into engagement with the lower belts 10 or blanks thereon, by means of a spring 67 on each stud compressed between the cross-piece 60 and intermediate piece 64 for pressing the rollers against the belt beneath, thereby to hold a blank in firm driving engagement with the lower belt. Other means for pressing the roller downwardly may be used and similar means may be used for pushing down the rollers 12, 13.

A longitudinal supporting bar 70 (Figs. 2 and 3) formed on or secured to each rear roller housing 43, plate 56 and flange 57 extends along and is adjustably engaged with the outer face of each roller housing 15 and provided with a longitudinal slot 71 in which is received an adjusting screw 72 received in tapped holes in the side of the roller housing, for clamping the deflector member different distances from the roller housing depending upon the length of the blank flap.

The pressure roller 28 nearest the deflector face 25 is substantially tangential to the deflector face, the lower part of the deflector face being cut away as at 74 (Fig. 4) to expose said roller. The springs 22 engage the forwardly moving front flap 21 (Fig. 7) and raise its advance end 24 to engage the deflector faces 25 somewhat above the adjacent roller 28, whereby continued movement of the blank causes the flap to slide up upon the deflector face 25.

A stop plate 75 adjustably disposed across the upper part of said deflector face 25 is provided with an inwardly beveled lower face forming transverse stop shoulder 26 against which the

advance end 24 of the forward flap is pushed and stopped as the blank is advanced (Fig. 3).

Said deflector face and stop plate are respectively provided with slots 76, 77 crossing at right angles and receiving a clamping bolt 78 and having a nut behind the deflector and a head engaging the stop plate in the countersunk slot 77, whereby the plate may be adjusted both laterally and vertically. An adjustable vertical retaining bar 80 disposed on the exposed face of the stop plate 75 and extending below the stop plate and diverged away from the deflector face is provided with a vertical slot 81 in which is received a clamping bolt 82 passing through the stop plate and having an inner head 83 engaged in a countersink in the stop plate. A nut 84 engaged with the bar serves to adjustably clamp the bar on the stop plate with its lower end projecting to serve as a precautionary means to guide the flap to the stop shoulder 26 (Figs. 8 and 9). The retaining bar 80 may be omitted if desired.

The operation of the folding device will be easily understood from the foregoing and need now be only briefly summarized as follows;

As is usual in machines of the type indicated, the race bars 16 are positioned or adjusted a distance apart to accommodate the blank to be folded, so that parts acted upon will be firmly held and driven. The distance between the housing 15 and the deflector plate 56 is also adjusted by means of the screw 72 (Fig. 3) in accordance with the length of the blank. The plates 75 are pushed laterally to approach each other in accordance with the width of the front flap, and are adjusted vertically to make the distance from the shoulder face 26 to the top of the belt portions 10 equal to the distance between the free edge of the flap and the fold line, in this case the middle fold line 27 on which it is desired to fold the blank.

The finger piece 80 may be omitted if desired, but may be used as an extra precaution. If used it is adjusted as conveniently as possible not to interfere with the flap positions of Figs. 8 and 9, and prevents the flap from accidentally missing contact with the shoulder 26.

The cards are fed one at a time by the feeding means (not shown) and pass along on the lower belts 10 past the gluing means (not shown) or other operating device, if any, and then pass along in the direction of the arrow 41 (Fig. 1) with the flap 21 forward, the blank being pressed on the lower belts by the upper belts 11 and rollers 12, 13.

The blank is then carried forward until the flap is upwardly deflected by the springs 22 and rides up on the face 25 until stopped by the shoulder 26, causing the flap to fold on the line 27 (Fig. 6). Further travel of the blank causes the fold line 27 to be pushed under the roller 28 and be folded, the bolt 10 and rollers 13 firmly conveying the blank until they are firmly engaged by the rollers 28 and passed on under the rollers 29 for further operations or stacking.

The very light weight very yieldable spring 22 cooperates with parts 56 to 84 in a way to allow such parts to be heavy and very strong and to be stationary in use, to allow these parts to operate on cardboard blanks passing in close succession at extremely high speed, and at much higher speed than would be possible if the assembly of parts 56 to 84 were required to oscillate. The spring 22 being very light and yieldable can be depressed by cardboard blanks moving at very high speed without injury to the

cardboard; and because of its lightness, the spring can quickly regain its normal position before the arrival of the next blank.

The invention claimed is:

1. A method of folding a cardboard blank having a rear body portion and a forward flap provided with a transverse score line near the body portion; said method comprising supporting and forwardly moving, until folded, the cardboard blank in a flat horizontal plane with the flap initially forward; yieldably slightly upwardly deflecting the forward part of the flap as the blank is moved forwardly; then positively deflecting substantially vertically upwardly the forwardly moving flap; engaging and positively stopping the free end of the upwardly moving flap a distance above the plane of the body portion equal to the distance between the score line and said end, while the body portion in said plane is forced forwardly thereby to cause the flap to fold at the score line; and then folding and pressing the flap onto the body portion while the body portion is moved forwardly.

2. A machine for folding a cardboard blank having a rear body portion and a forward flap provided with a transverse score line near the body portion; said machine comprising means for supporting and forwardly moving until folded, the blank in a horizontal flat plane with the flap initially forward; means for yieldably slightly upwardly deflecting the forward part of the flap as the blank is moved forwardly; means for then positively deflecting substantially vertically upwardly the deflected forwardly moving flap; means for positively stopping the free end of the upwardly moving flap a distance above the plane of the body portion equal to the distance between the score line and said end while the body positioned in said flat plane is formed forwardly thereby to cause the flap to fold at the score line and means for then folding and pressing the flap onto the body portion while the body portion is moved forwardly.

3. A device for folding blanks each comprising a forward flap provided with a transverse score line; said device comprising means for supporting the blank as it is moved forwardly with the flap forward; a stationary flap deflecting means adjacent to the path of the flaps and positioned and constructed to engage and deflect the flap as the blank is moved forwardly; a yieldable deflector before said stationary means; said deflecting means including a guide means to constrain the deflected flap to maintain its deflected position; and a stationary stop to stop the forward end of the flap as the deflected blank is forced along and positioned a distance from the plane of the supporting means a distance equal to the distance from the free end of the flap to the score line to cause the flap to fold at the score line as the blank travels to the guide means.

4. A device for folding a blank comprising a forward flap provided with a transverse score line; said device comprising means for conveying and supporting the blank as it is moved forwardly with the flap forward; flap deflecting means adjacent to the path of the flap and positioned and constructed to engage and deflect the flap as the blank is moved forwardly; said deflecting means including a fixed member having a deflecting face facing substantially the direction from which the blank comes; a yieldable deflector before said fixed member; and a stop means associated with said face and positioned to engage and stop the forward end of the flap

as the blank is moved on said face, the stop means being positioned to cause the flap to fold at the score line as the part of the blank to the rear of the score line is forced forwardly.

5. Mechanism for folding blanks each comprising a forward flap provided with a transverse score line; said mechanism comprising means for conveying the blank forwardly with the flap forward; yieldable means to engage and slightly deflect the forward end of the flap as it is conveyed; flap deflecting means near the path of the flap, and positioned to be engaged by the deflected flap as the blank is conveyed; said deflecting means comprising a fixed member having a deflecting face facing the direction from which the blank comes; and a stop disposed across said face and positioned to engage and stop the forward end of the forward flap as the blank is conveyed to cause the flap to fold at the score line and cause the flap to fold back on the blank and pass adjacent to the deflecting means.

6. A folding device for use with a means for conveying a transversely scored blank, said device comprising a substantially upright member; means for mounting the member over the path of the blank; said member having a deflecting face faced toward the on-coming blank; a pressing means mounted at the lower end of said face substantially to press a folded blank to the conveying means; a downwardly faced stop shoulder at the upper part of said face; yieldable means to deflect upwardly the forward end of the blank before it reaches said face.

7. A folding device for use with a machine having belts for conveying a blank forwardly with a flap of the blank forward, said folding device comprising one or more upright deflecting plates; means for relatively laterally adjustably mounting each upright plate over the path of the conveyed blank; said plate having a deflecting face faced toward the on-coming blank; a roller mounted at the lower end of said face substantially to the rear of the deflecting face thereof above the belt and substantially flush with said deflecting face; and an adjustable stop plate disposed across the upper part of said face and forming a lower stop shoulder positioned to engage the forward end of the forward flap.

8. A device as in claim 7 including an upwardly inclined spring; and means to mount the spring on the machine in position to deflect the flap upwardly before it reaches said face.

9. Mechanism for folding a blank provided with a transverse score line forming rear and forward portions, said mechanism comprising conveying means for conveying the blank forwardly with the forward portion forward; a device to deflect the forward end of the forward portion from the plane of the rear portion and adapted to be depressed to allow the rear portion to remain undeflected; deflecting means having a deflecting face facing said device and positioned to be engaged by, and to deflect further, said forward portion as the blank is conveyed; and a stop across said face positioned to engage the forward end of the forward portion and positioned from said plane a distance to cause the blank to fold at the score line while said rear portion is in said plane; and means to press the forward portion back upon said rear portion as the rear portion is conveyed forwardly by the conveying means.

10. Mechanism for folding a blank comprising a body and a forward flap, said mechanism com-

prising conveying means disposed side by side for conveying the blank forwardly with the flap forward; a device between said conveying means projecting into the path of the body with enough force to deflect the forward end of the flap from said path and adapted to be disposed to allow the body to remain in said path; flap deflecting means having a deflecting face facing said device and positioned to be engaged by the deflected flap as the blank is conveyed; guide means adjacent to said path and substantially to the rear of said face to engage and hold the blank on said conveying means; and a stop disposed across said face positioned to engage the forward end of the flap and positioned from said path a distance to cause the flap to fold at a predetermined line while said body portion is in said path and the device is depressed to cause the forward flap to be engaged by said guide means, as the blank moves forward, and be folded back upon said body and pass under the guide means with said body.

11. Mechanism for folding blanks each comprising a body portion and a forward flap provided with a transverse score line, said mechanism comprising conveying means including supporting means movable in spaced parallel paths in the same plane for conveying the blanks forwardly substantially in said plane with the flap forward, and pressing means for pressing the blanks to the supporting means; a forwardly inclined wire spring between said paths yieldably projecting in the path of the flap and adapted to yieldably engage and deflect away from said plane the forward end of the flap as it is conveyed; a stationary deflecting means having a deflecting face at right angles to said plane and facing said spring; a roller mounted at the lower end of said face substantially to the rear thereof and positioned and mounted to engage the blanks passing under the roller; and a stop disposed across the upper part of said face and positioned to engage the forward end of the forward flap and positioned from said plane a distance to cause the flap to fold at the score line while said body portion is in said plane and the spring is depressed to cause the forward flap to be engaged by said roller, as the blank moves forward, and be folded back upon said body portion and pass under the roller.

12. A method of folding a cardboard blank provided with a transverse score line forming a rear portion and a forward portion, said method comprising supporting and forwardly moving until folded, the blank in a flat plane with the forward portion initially forward; yieldably slightly deflecting, from said plane, the forward portion as the blank is moved forwardly; then positively further deflecting the deflected forwardly moving forward portion to a position substantially at right angles to said plane; maintaining the forward portion in the plane of said position while positively stopping the free end of the upwardly moving forward portion a distance above said flat plane of the rear portion equal to the distance between the score line and said end, while the rear portion in said plane is being forced forwardly thereby to cause the blank to bend at the score line while the portions are in planes at right angles to each other; and then folding and pressing the forward portion onto the rear portion while the rear portion is moved forwardly in said flat plane.

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