Feb. 15, 1955 W. P. FERGNANI 2,701,990

BOX BLANK FOLDING MACHINE

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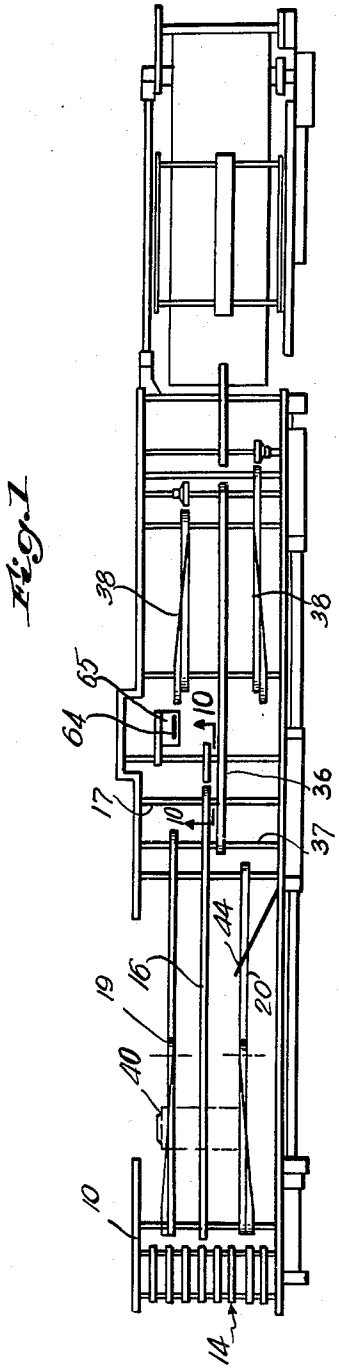


Fig. 1

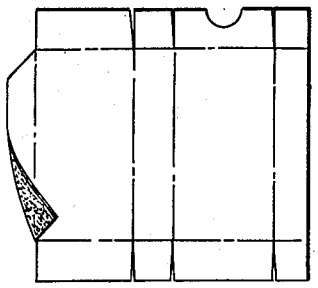


Fig. 5

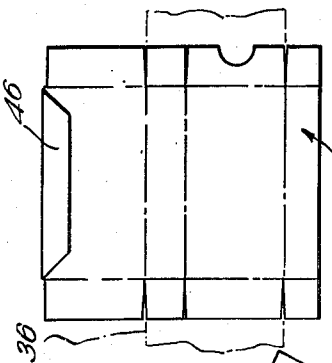


Fig. 4

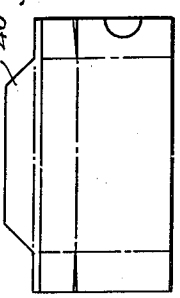


Fig. 3

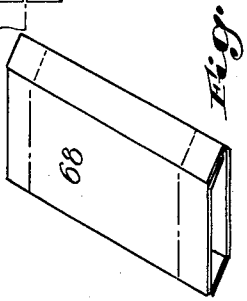


Fig. 7

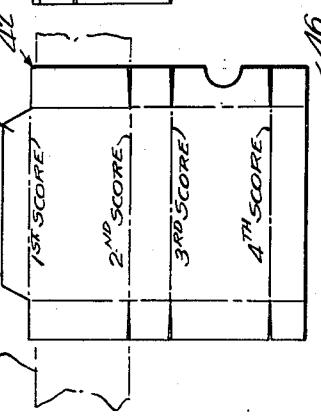


Fig. 2

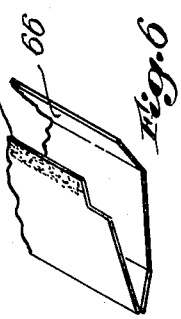


Fig. 6

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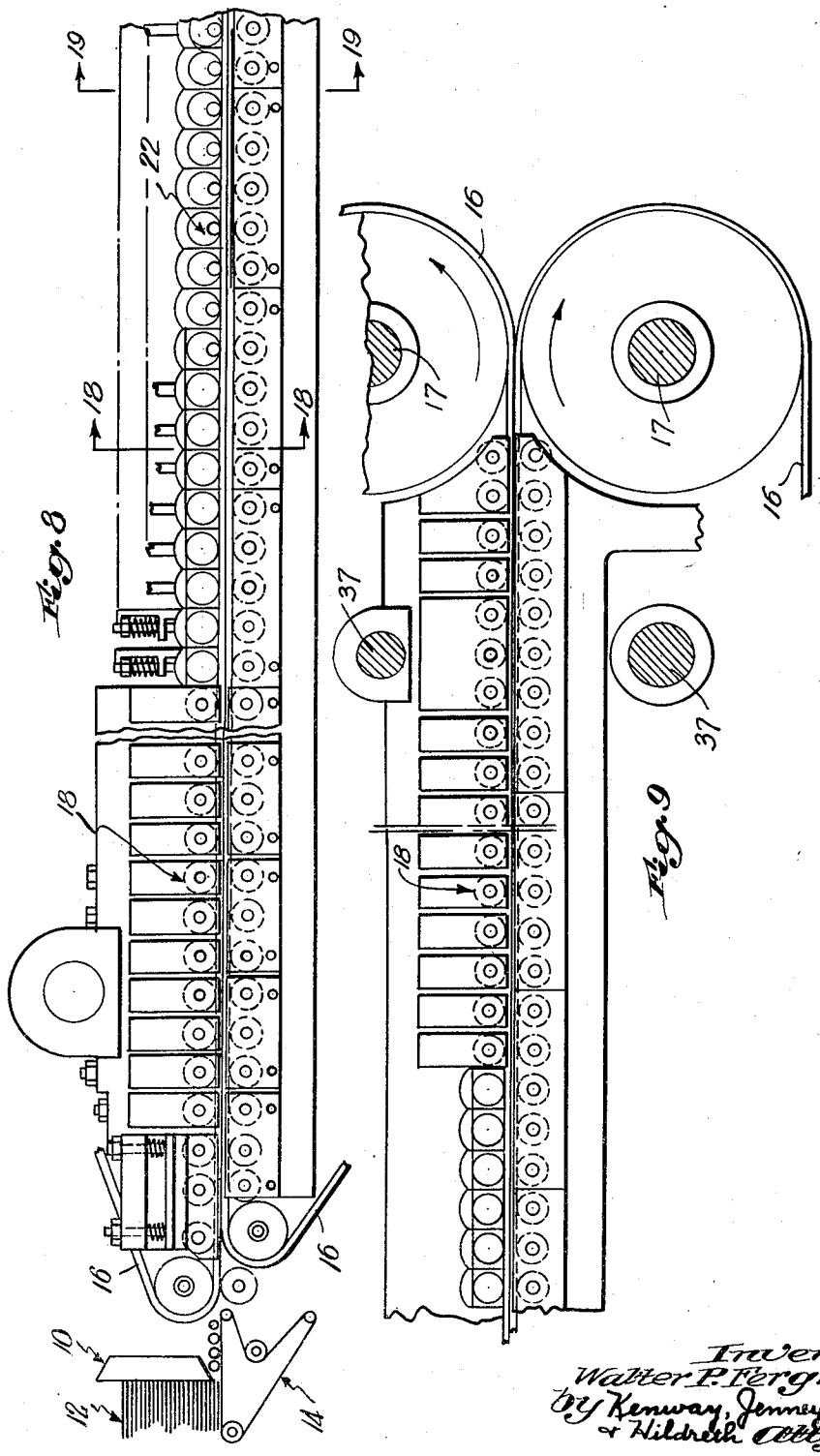


Fig. 8

Fig. 9

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Fig. 10

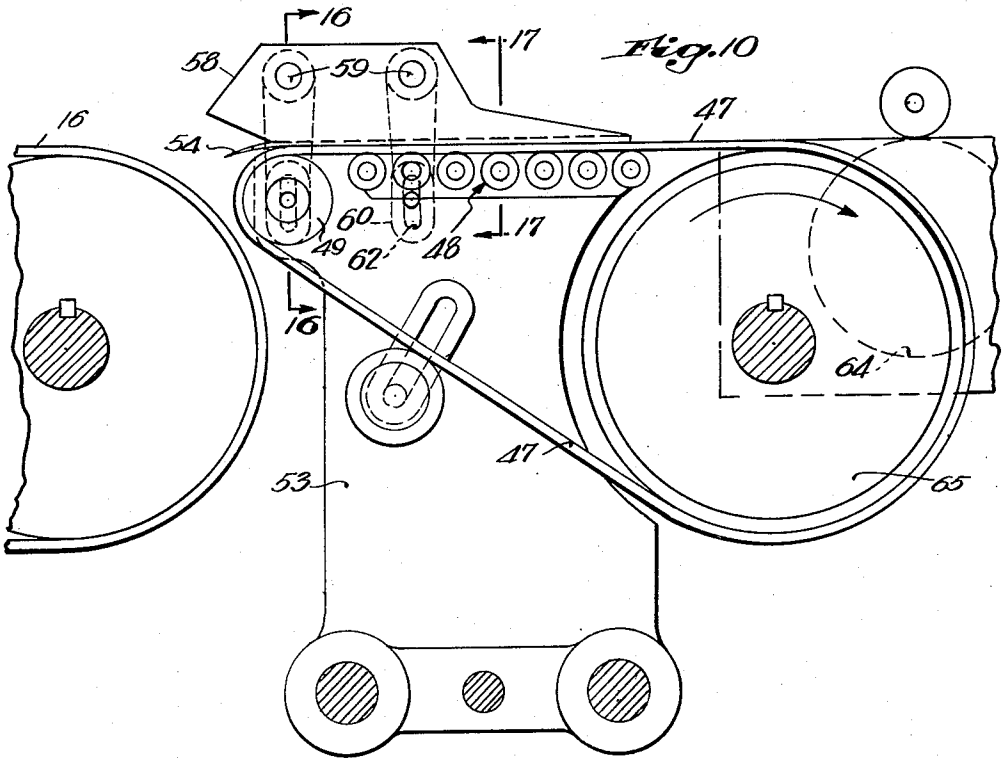


Fig. 11

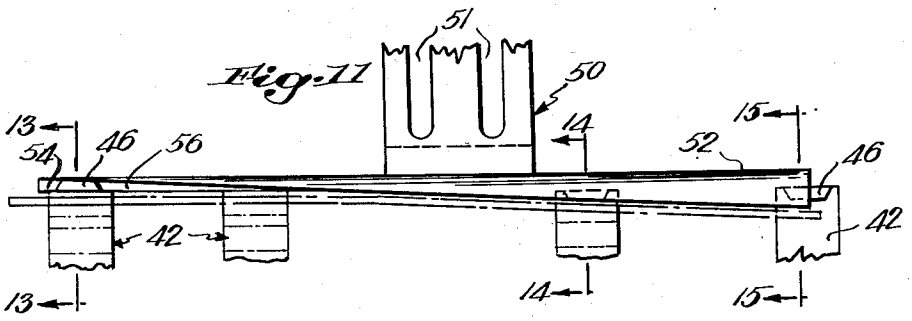


Fig. 12



Fig. 13

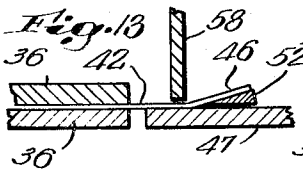


Fig. 14

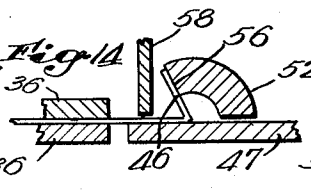
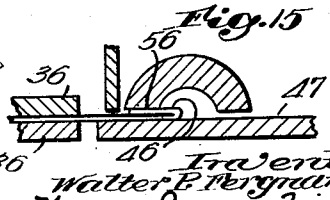


Fig. 15

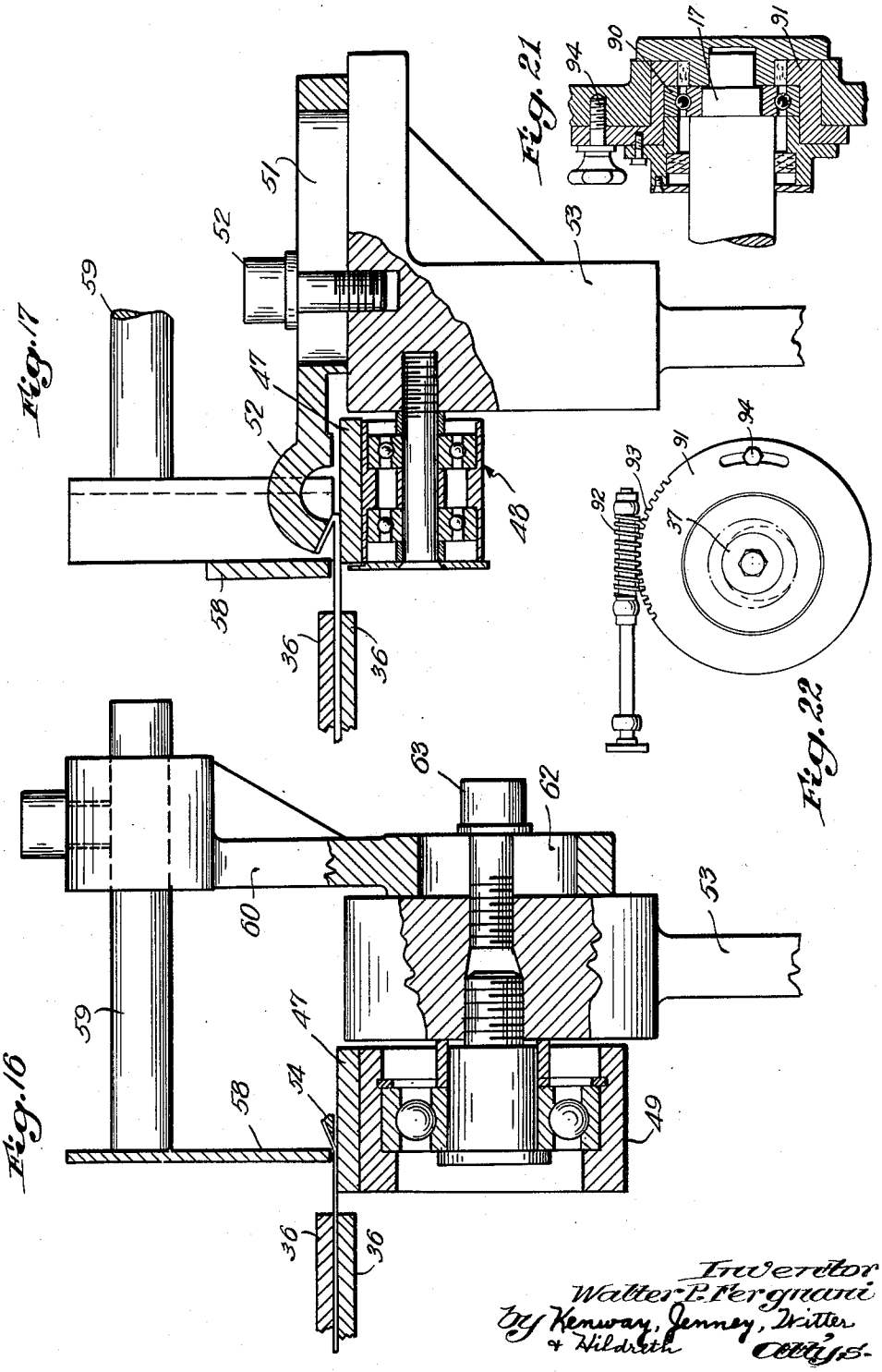


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BOX BLANK FOLDING MACHINE

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BOX BLANK FOLDING MACHINE

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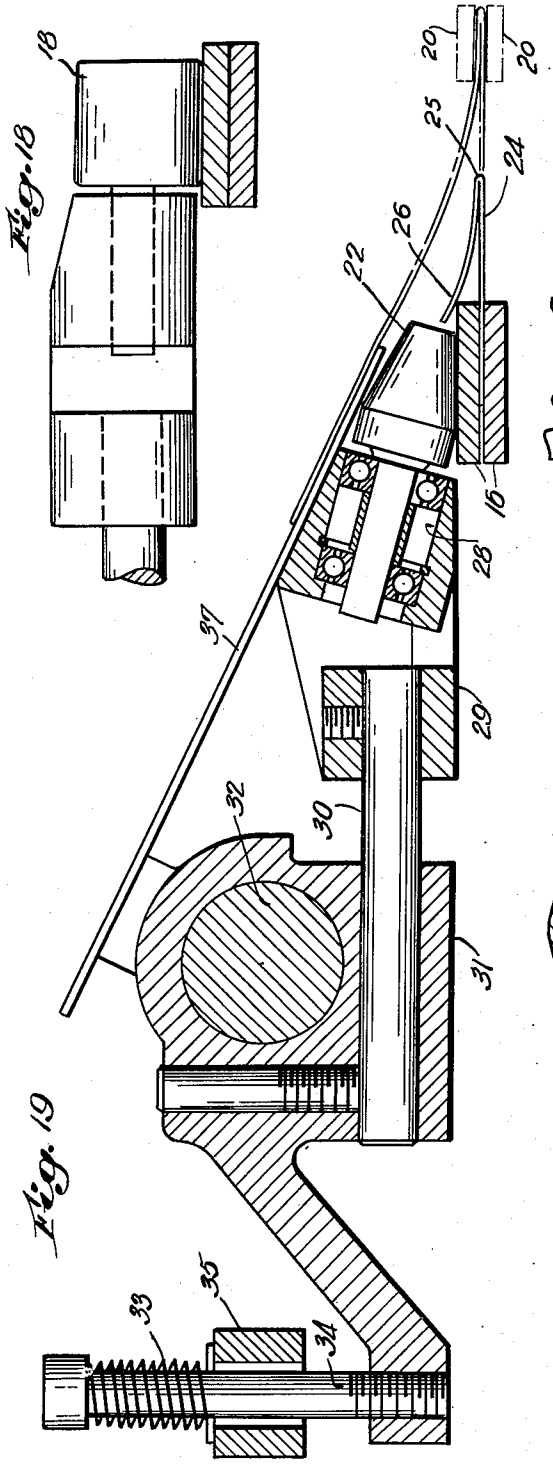


Fig. 18

Fig. 19

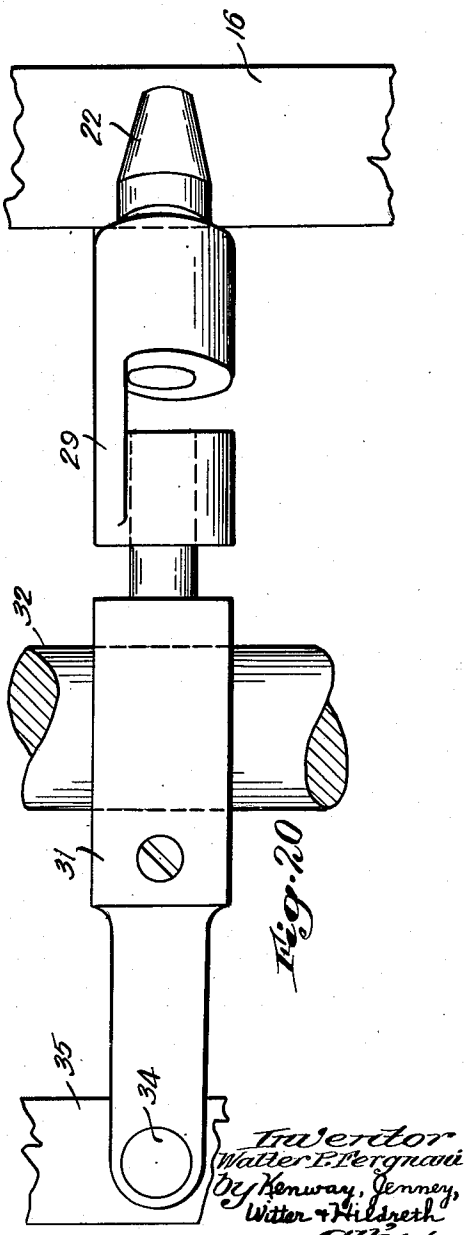


Fig. 20

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United States Patent Office

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Patented Feb. 15, 1955

2,701,990

BOX BLANK FOLDING MACHINE

Walter P. Fergnani, Beverly, Mass., assignor to Post Machinery Corporation, Beverly, Mass., a corporation of Massachusetts

Application August 30, 1951, Serial No. 244,319

4 Claims. (Cl. 93—52)

This invention relates to certain improvements in the box blank folding machine shown in my copending application Serial No. 35,385, filed June 26, 1948, now Patent 2,584,855, February 5, 1952, for feeding flat box blanks successively from a stack to and along a predetermined path and folding the blanks into overlapped and sealed relation during their passage through the machine.

The machine is constructed to feed flat blanks from a magazine along a predetermined path and automatically to fold each blank on scored lines during its travel along the path. The blanks are supported at all times between cooperating carrier belts during their travel along the path and are automatically transferred from one pair of carrier belts to an overlapping pair of carrier belts without releasing their engagement with the blanks. The employment of a plurality of pairs of carrier belts permits the supporting of the blanks by engaging different portions thereof, thus exposing the scored lines on which the blanks are to be folded. This provision of overlapped carrier belts which continuously engage and support the blanks during the folding of different portions thereof comprises one object of the invention.

The inner reaches of each pair of carrier belts are in face to face contact to engage and support the blanks therebetween and each belt is backed up by a series of supporting rolls. Heretofore these rolls have been of cylindrical configuration. A further novel feature of my invention comprises the provision of conical rolls along a portion of the top belt that provide clearance for the folded flaps of the blanks and permits the same to be folded a full 180° about the scored line.

A further feature of the invention resides in novel mechanism for pre-folding small glue flaps on the blanks to a full 180°, these small flaps being thereafter opened and the glue applied for the succeeding sealing operation. This novel mechanism includes a rigid bar having a spiral face for engaging and folding the flap 180° about a scored line as the blank is moved along the path together with a cooperating stop for supporting the body of the blank against upward movement with the flap being folded.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings in which—

Fig. 1 is a plan view of a machine embodying my invention,

Fig. 2 is a plan view of a small flat blank scored longitudinally along four fold lines,

Fig. 3 shows the blank folded on the third score,

Fig. 4 shows the blank folded on the first score,

Fig. 5 shows the blank with glue applied to the glue flap,

Fig. 6 shows the blank folded on the second score,

Fig. 7 shows the blank completely folded and sealed,

Fig. 8 is an enlarged side elevation of the entrance end portion of the machine,

Fig. 9 is a continuation of Fig. 8,

Fig. 10 is an enlarged side elevation taken on line **10—10** of Fig. 1,

Fig. 11 is a fragmentary plan view of a portion of Fig. 10,

Fig. 12 is a side elevation of a portion of Fig. 11,

Figs. 13, 14 and 15 are sectional views taken on lines **13—13**, **14—14** and **15—15** of Fig. 11,

Fig. 16 is an enlarged sectional view taken on line **16—16** of Fig. 10,

Fig. 17 is an enlarged sectional view taken on line **17—17** of Fig. 10,

Fig. 18 is an enlarged sectional view taken on line **18—18** of Fig. 8,

Fig. 19 is an enlarged sectional view taken on line **19—19** of Fig. 8,

Fig. 20 is a plan view of Fig. 19,

Fig. 21 is a fragmentary sectional view showing the bearings for the belt supporting shafts, and

Fig. 22 is a front elevational view of the bearing as shown in Fig. 21.

The machine shown in Figs. 1, 8 and 9 of the drawings includes a magazine **10** at the entrance end of the machine for supporting a stack **12** of blanks to be folded. Means including a plurality of belts **14** are provided for feeding the blanks from the bottom of the stack to and between two cooperating carrier belts **16**. These belts, backed by rolls **18** and more specifically illustrated and described in my said Patent 2,584,855, feed the blanks through the first portion of the machine. Folding belts **19** and **20**, flanking the carrier belts, are provided for folding the blanks during their travel with the carrier belts. All belts are supported on independent pulleys and shafts and are independently adjustable laterally of the machine to accommodate blanks of different sizes and configurations. The supporting of the belts on independent shafts also permits the independent vertical adjustment of the belts to give the desired contact belt pressure against the blanks on each pair of belts independently of the other pair.

The function of the belts **19** and **20** is to fold the blanks about scored lines during their travel with and by the carrier belts. The rolls **18** are of cylindrical form as illustrated in Fig. 18 and they support the carrier belts with the proper amount of pressure to hold the blanks therebetween. An important feature of my invention comprises the employment of conical rolls **22** along a portion of the folding path as illustrated in Figs. 8, 19 and 20, for the purpose of facilitating the folding operation. The blank **24** (Fig. 19) carried by the carrier belts **16** is folded inwardly about a scored line **25** and the conical rolls permit the flap **26** to be folded to an extent closely approaching 180° whether the flap be short or long as illustrated in both full and broken lines. The folding belts **20** fold the flaps **26** about the scored line **25** and as the folded margins of the blanks pass between the belts **20** (Fig. 19) the fold is brought and prebroken to a full 180°, the flap being adapted to bend to the curvature indicated during this operation.

Each conical roll **22** is rotatably mounted at one end in bearings **28** on a bracket **29** adjustable along a stud **30**. The stud is carried by a bracket **31** loosely mounted on a rod **32**. A spring **33** on a bolt **34** carried by the bracket **31** and extending through a fixed part **35** of the machine normally pivots the bracket **31** in a direction pressing the roll against the belt. A shield **37** extends downwardly over the rolls **22** and prevents contact of the folded flap with the rotating rolls.

The carrier belts **16** are relatively narrow and it will be appreciated that the scored portions of the blanks to be folded must project outwardly of the belts. It is therefore necessary to engage and grip the blanks at different areas thereof to accommodate the folding along different scored lines. Provision for thus supporting the blanks is shown in Fig. 1 wherein a second pair of carrier belts **36** overlaps the carrier belts **16**. Folding belts **38** are provided along the belts **36**. The belts **36** receive the blanks from the belts **16** and both pairs of belts engage and support the blanks simultaneously during transfer of the blanks from the belts **16** to the belts **36**. Since the belts are relatively narrow it is essential that the blanks shall not be released from firm grip of the belts **16** until they are firmly gripped by the belts **36** as otherwise the blanks are likely to become displaced during the transfer. As illustrated in Fig. 1, the overlapping looped ends of the belts **16** and **36** are supported on spaced shafts **17** and **37** respectively to provide a substantially long overlap along which both belts simultaneously engage and support the blanks during transfer and thereby eliminate

any possibility of blank displacement. The belts are independently adjustable to desired positions laterally of the machine.

The overlapping of the belts 16 and 36 provided by the relatively spaced and independently supported shafts 17 and 37 is of particular importance in the folding of small and short blanks. As shown in Fig. 9, a portion of the two belts 16 between the belt supporting wheels on the shafts 17 and the next adjacent rolls 18 is not pressure supported at the outer faces of the belts and a like gap between the belts 36 at the other side of the shafts 17 would be likewise not pressure supported if belts 16 and 36 were mounted on common shafts. This gap between the rolls 18 at opposite sides of the common belt supporting shafts is an extremely critical section of the machine since a small blank of a length approximating or less than this portion would not be pressure engaged between the belts and is apt to shift sufficiently to spoil the blank. In my machine however the belts 36 overlap this portion so that even small blanks are gripped tightly between the belts 36 in this gap and cannot therefore shift or twist. It is also pointed out that it is necessary to adjust the pinch of the belts at their overlapping ends and my improved construction permits the independent belt adjustments through independent adjusting of the shafts 17 and 37. The belt thicknesses are not always alike, due to wear and this independent adjustment is therefore very important to secure uniform gripping action and eliminate shifting and twisting of the blanks in the transfer area. The upper shafts 17 and 37 are supported in eccentric bearings, as shown and described in my Patent 2,563,596, which provide for vertical adjustment of the shafts to secure uniform gripping of the blanks. As shown in Figures 21 and 22 the ends of shaft 17 may be mounted in bearings 90 which in turn are mounted in the eccentric bushings 91. The vertical adjustment of the shafts may be made by rotating the eccentric bushings 91 by means of a worm gear 92 meshing with tooth segments 93 formed on bushing 91, after which the bushing may be locked in adjusted position by any suitable means, such as set screws 94.

The machine is adapted to operate on large blanks, as the blanks 40 indicated in Fig. 1, or on small blanks, as the blanks 42 illustrated in Figs. 2–7. The carrier belts will be adjusted laterally to proper positions for conveying the blanks to be folded and such folding belts will be employed as are required to perform the folding operations. The folding and sealing of very small blanks (Figs. 2–7) however presents unusual problems and a further object of the invention resides in the provision of the following described mechanism for performing this operation.

Each blank 42 is scored longitudinally along four fold lines indicated in Fig. 2. The carrier belts 16 are adjusted to engage the blank in the area shown in Fig. 2 and the belt 20 is adjusted to a position to fold the blank on the third score to the position illustrated in Fig. 3. A fork 44 is mounted on the machine in position thereafter to engage the folded blank and return it to the open position of Fig. 2. The blank is then transferred from the carrier belts 16 to the carrier belts 36 which latter belts are disposed to engage the blanks in the area illustrated in Fig. 4.

The belts 36 carry the blanks through the folding mechanism illustrated in Figs. 10–17 which prefolds the glue flap 46 about the first score to the position illustrated in Fig. 4. This mechanism includes a belt 47 having a short horizontal top reach supported on a series of rolls 46 and in a common plane with the bottom carrier belt 36. The belt 47 is supported on an idler 49 and a driving pulley 55.

Supported for lateral adjustment on an integral bracket 50 is a relatively long bar 52 disposed over and along the belt 47. The bracket 50 is slotted at 51 and tap bolts 52 extending through the slots and threaded into the frame 53 serve to secure the bracket in laterally adjusted position. The end 54 of the bar forwardly of the belt 47 is bent downwardly beneath the oncoming blank 42 and has an upwardly facing surface 56 disposed beneath the glue flap 46 of the blank. This surface gradually twists spiral-like to the other end of the bar where it faces downwardly as illustrated in Fig. 15. This surface serves to fold the flap 46 upwardly-downwardly about the first score as the blank is carried along the bar.

A plate 58 carried on two rods 59 adjustable in a bracket 60 provides a stop for supporting the body of the blank against upward movement by the bar as the flap is folded about the crease line. The bracket 60 is vertically slotted at 62 and tap bolts 63 extend through the slots and thread into the frame 53, thus providing vertical adjustment for the plate 58. When adjusted to the position shown in Figs. 16 and 17, the plate 58 is disposed closely adjacent to the downwardly bent end 54 of the bar and diverges laterally away from the bar in the direction of the carrier belts 36 to the other end of the bar, as illustrated in Figs. 11–17, to provide clearance for the flap.

Following this prefolding of the flap 46, the flap is reopened into the plane of the blank and is passed over a glue pot roll 64 which applies a coating of glue to the flap as illustrated in Fig. 5. The glue box 65 (Fig. 1) is adjustable laterally of the machine to proper position relative to the blank. The blank thereafter continues through the machine and is (1) folded on the second score to the position of Fig. 6 and thereafter (2) folded on the fourth score to the sealed position in which the flap 66 is brought into sealing contact with the glue coated surface of the flap 46. The folding operations are now completed to produce the box 68.

Having thus disclosed my invention what I claim as new and desire to secure by Letters Patent is:

1. Box folding mechanism comprising a pair of carrier belts having superposed reaches for engaging and conveying a blank along a predetermined path therebetween, a relatively long element having a blank engaging surface disposed along and laterally adjacent to the belts, said surface being disposed beneath said path and facing upwardly at one end and gradually twisting spiral-like therefrom to the other end which faces downwardly, said twisting surface being adapted to engage a flap projecting laterally from a blank carried by the belts and fold the flap upwardly-downwardly about a creased line as the blank is carried along the element, and a stop extending along said path above and adjacent to its top surface and between the belts and said element for supporting the body of the blank against upward movement by said element, said stop being a plate supported above and depending downwardly toward said path and being disposed closely adjacent to the upwardly facing end of said element and diverging laterally away from the element in the direction of the belts to said other end of the element.

2. Box blank feeding mechanism comprising a pair of carrier belts having superposed reaches for engaging and conveying a blank along a predetermined path therebetween, a series of rolls disposed along and beneath and supporting the lower reach, a series of rolls disposed in lateral alignment along the upper reach and having conical faces in rolling contact with its top surface, means disposed laterally of the belts and rotatably supporting the conical rolls solely from their larger ends, and means adjacent to and laterally of the reaches and the smaller ends of the conical rolls for folding downwardly toward the reaches and rolls a laterally extending portion of a blank carried by the reaches.

3. The blank feeding mechanism defined in claim 2 in which the means supporting the conical rolls includes roll supporting bearings carried by pivotally mounted brackets, and means operative resiliently on the brackets to pivot them in a direction holding the conical rolls in resilient pressure contact with the upper reach.

4. Box blank feeding mechanism comprising a pair of endless narrow carrier belts having adjacent and superposed reaches for gripping a blank therebetween and conveying it along a predetermined path, a like pair of endless narrow carrier belts having like opposed blank-gripping reaches disposed parallel with and having one end thereof overlapping one end of the first named reaches and offset laterally with respect thereto, two series of rolls in opposed relation respectively engaging the outer faces of each pair of reaches and pressing them together to grip the blank therebetween, two pairs of shafts, at least one shaft of each pair being vertically adjustable relative to the other, said pairs of shafts being spaced apart longitudinally of the belts and having pulleys thereon respectively supporting the overlapping end loops of the two pairs of belts whereby a blank gripped and carried by said reaches of one pair of the belts and fed thereby to said reaches of the other pair of belts is gripped at opposite faces by both pairs of belts at said reaches

simultaneously in the area disposed between said two pairs of shafts during transfer of the blank from one pair of gripping belts to the other pair of belts, and means for vertically adjusting one shaft of each pair relative to the other.

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