July 26, 1932. S. BERGSTEIN 1,868,872

PAPER BOX MAKING MACHINE

Filed Aug. 5, 1929 3 Sheets-Sheet 1

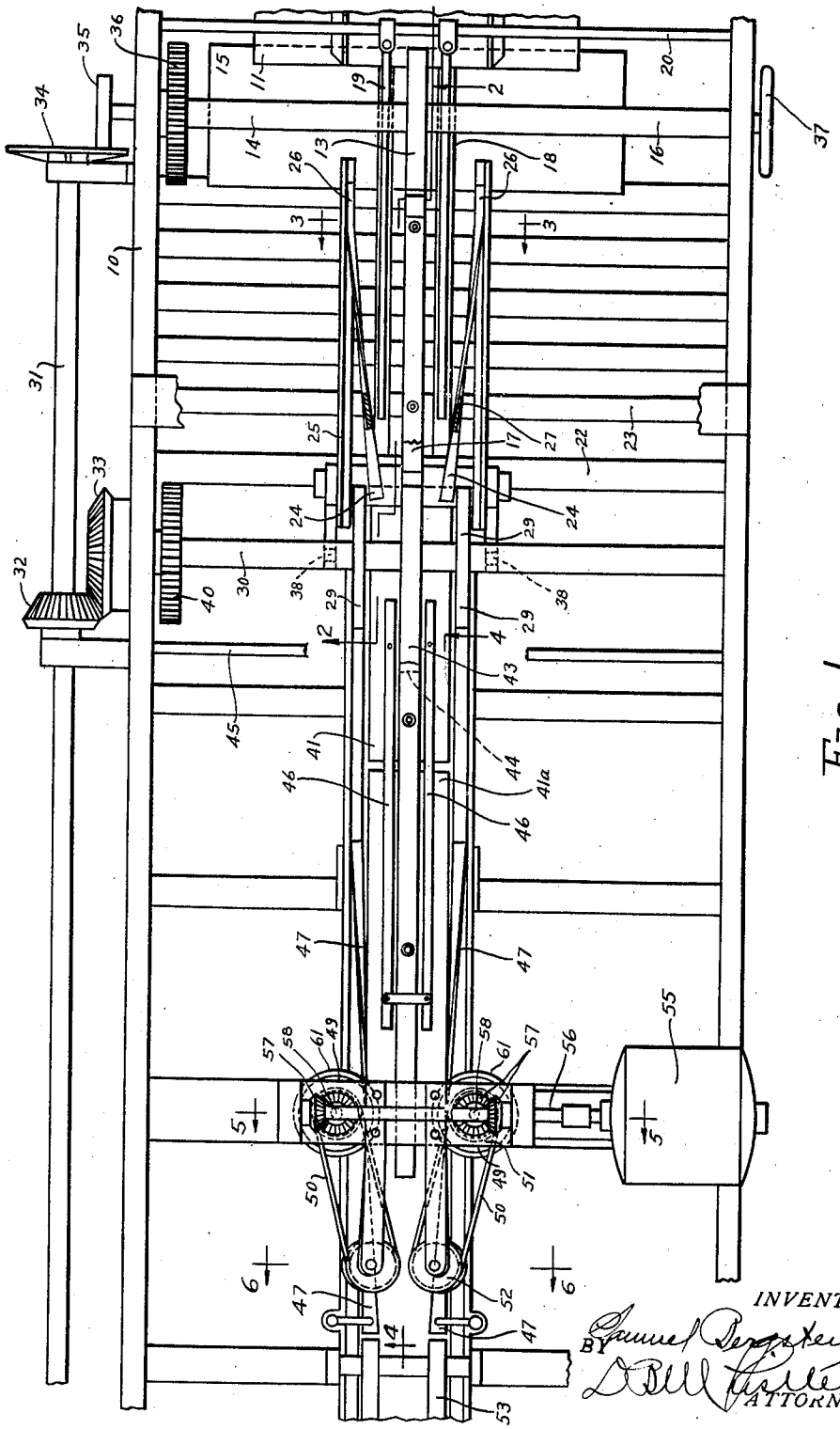


FIG. 1.

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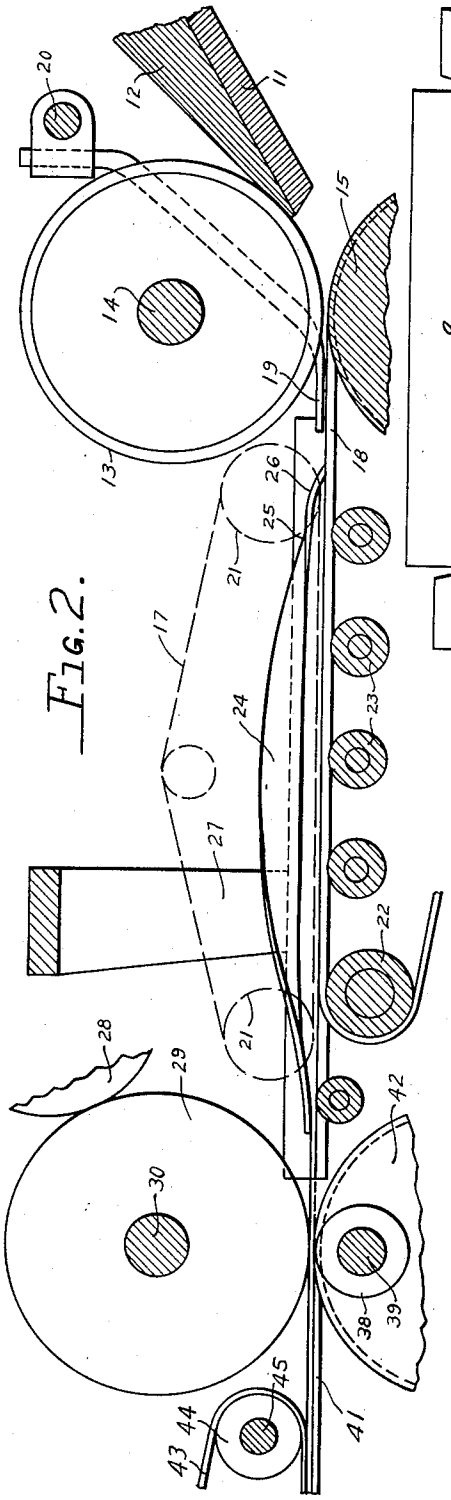


FIG. 2.

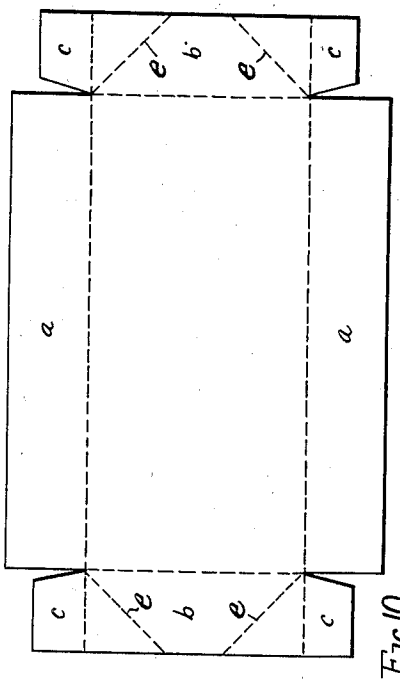


FIG. 8.

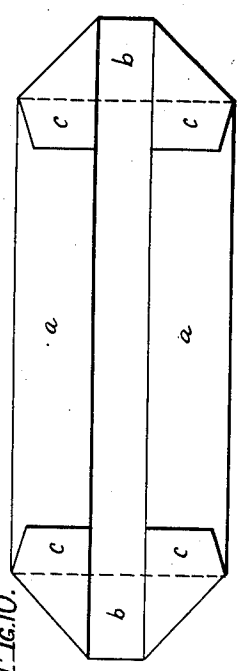


FIG. 10.

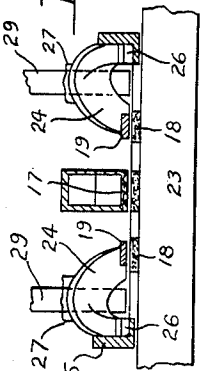


FIG. 3.

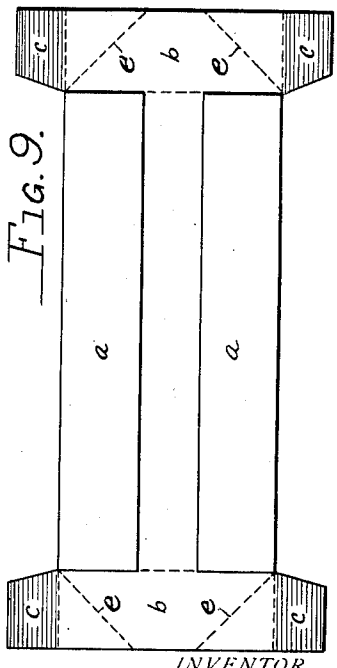


FIG. 9.

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PAPER BOX MAKING MACHINE

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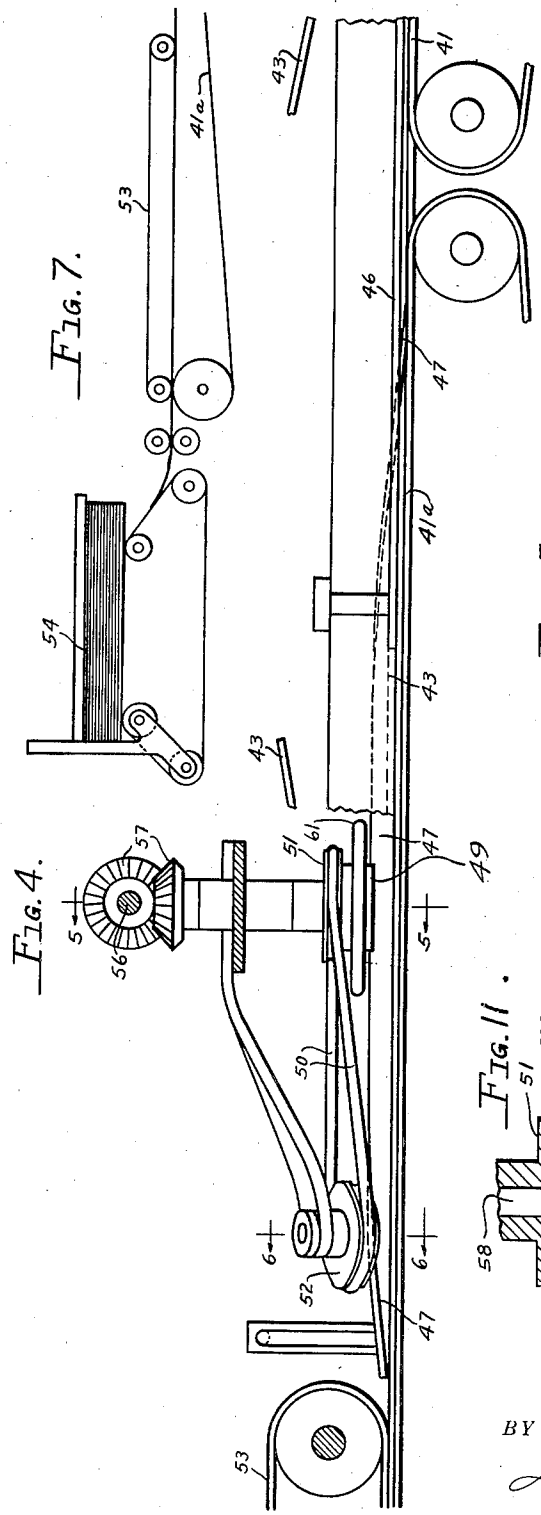


FIG. 7.

FIG. 4.

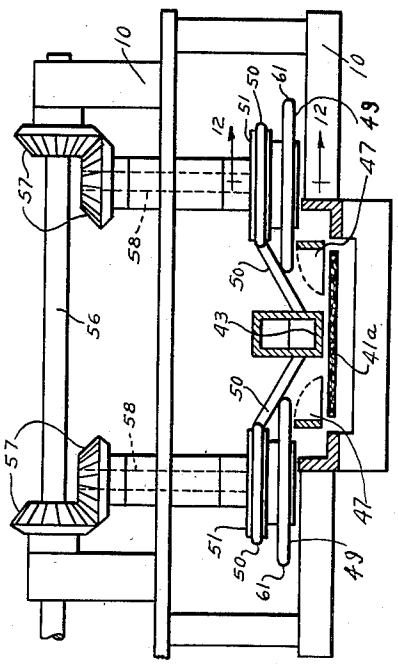


FIG. 5.

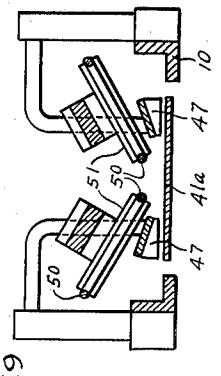


FIG. 6.

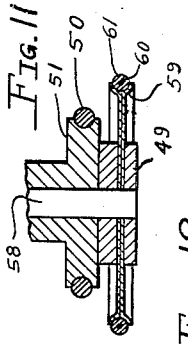


FIG. 11.

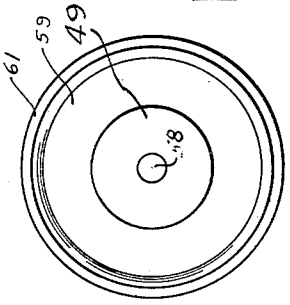


FIG. 12.

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Patented July 26, 1932 1,868,872

UNITED STATES PATENT OFFICE

SAMUEL BERGSTEIN, OF MIDDLETOWN, OHIO

PAPER BOX MAKING MACHINE

Application filed August 5, 1929. Serial No. 383,679.

This invention relates to improvements in machines for making paper boxes, of the type set forth in my copending application for Letters Patent of the United States, Serial No. 355,039, filed April 15, 1929.

A feature of the machine set forth in the above identified application for patent, consists in novel means for folding front and rear flaps for joining the end and side walls of the box together adhesively, the flaps being folded on diagonal score lines, inversely one flap to another, opposite flaps at the forward ends of the box blanks, as the blanks are moved on the machine for forming the boxes, being folded inversely to the direction of movement, and corresponding flaps at the rear of the blanks being folded in the direction of the movement of the blanks.

In the machine of the earlier application for patent referred to, folding of the flaps at opposite ends of the blanks is effected by different mechanisms and which requires certain adjustments, according to the length of the blanks, for accomplishing the folds in their required relation one to another.

In the improved machine herein set forth folding of the flaps at both ends of the box blanks is made by the same mechanism. Thus the machine is universally adaptable for making boxes of this character from blanks of any length without reference to the spacing between the front and rear end flaps.

These later improvements, which have been applied in a group installation of machines for large production, are highly effective for producing the boxes knocked-down ready for packing, better formed and with much greater output of the machines than has been possible in the practice heretofore in the manufacture of boxes of this character wherein the machines used were capable only of relatively small output, and the machine work had to be supplemented by hand work.

In the accompanying drawings, which serve for illustrating the improved machine:

Fig. 1 is a plan view of the portion of a box making machine embodying the invention;

Fig. 2 is an enlarged detail sectional view on line 2—2 of Fig. 1;

Fig. 3 is a detail sectional view on line 3—3 of Fig. 1;

Fig. 4 is a sectional view on line 4—4 of Fig. 1;

Fig. 5 is a sectional view on line 5—5 of Figs. 1–4;

Fig. 6 is a sectional view on line 6—6 of Figs. 1–4;

Fig. 7 is a detail view of the delivery mechanism;

Fig. 8 is a view of a box blank;

Figs. 9–10 are views illustrating progressive foldings of the box blank;

Figs. 11–12 are detail views of the mechanism for effecting the inverse foldings of the box flaps.

The machine as here shown and described consists of a frame structure 10. The usual angularly adjustable table 11 for supporting a stack of box blanks 12 is supported on the frame structure at the front end of the machine, the arrangement being best shown in Fig. 2.

The box blanks are fed to the machine from table 11 by a friction roll 13 on shaft 14 coacting with a feed roll 15 on shaft 16, the feed roll being traversed by carrier belts 18 operating in annular recesses in the rolls for presenting the outer faces of the belts flush with the peripheries of the rolls. Another feed belt 17 spaced from the belts 18 slightly in the plane of movement of the boxes, cooperates with the feed belts 18 for engaging the box blanks frictionally therebetween and moving the blanks through the first folding operation. Opposite guards 19 supported on a shaft 20 and extended downward to near the periphery of the lower feed roll and thence rearward on the machine serve for preventing the portions of the box blanks extended laterally on the opposite sides of the upper feed roll and the carrier belts from flaring upward, the lower feed roll and a series of carrier rolls 23 being of the required length for supporting the full length or width, as the case may be, of the box blanks on their under side as the blanks are moved on the machine.

The upper carrier belt 17 traverses rolls 21 in clockwise direction and the lower car-

rier belt 18 traverses rolls 15—22 over rolls 23 in counter-clockwise direction, the belts running parallel one with the other in the plane of movement of the box blanks.

A common form of box blank for boxes adapted to be produced on the machine is illustrated in Fig. 8, the blank being cut and scored for folding and provided with the usual side walls —*a* and end flaps *b*—*c* which are scored diagonally on score lines —*e* for effecting folding of the flaps parallel to the adjacent edges of the blanks, these scores being weaker than the longitudinal scores on said flaps *b*, *c*. As the blanks pass from the feed rolls and are moved along lengthwise by the carrier belts the outer edges of the side walls —*a*, which are substantially wider than flaps —*c* are engaged by opposite fixed folders 24, supported by members 25 and brackets 27, which act to fold the side flaps flat over the upper face of the blanks. For effecting positive action on the side flaps by folders 24, the front ends 26 of the folders are extended downward into the plane of movement of the box blanks. The front and rear end flaps —*c*, being narrower than the side flaps, move within the forward ends of the folders, out of engagement therewith, and under the folders toward the rear converging ends thereof, flaps —*c* being thus presented unfolded, or flat, for receiving an application of glue in the operation which immediately follows.

The adhesive applying mechanism is of a common type and is shown conventionally only for illustrating the successive steps of forming the boxes. As shown, liquid glue is supplied from a container of any well known form (not shown) by intermediate rolls 28 to the gluing rolls 29, supported on shaft 30, which contact with the box blanks and apply glue to the end flaps —*c*.

The operating mechanism for the portion of the machine described consists of a drive shaft 31 geared to shaft 30 as indicated at 32—33, and operably connected to shaft 16 of the lower feed roll by a variable friction drive 34—35, feed roll shafts 14—16 being geared together as indicated at 36. The friction drive is adjustable for regulating the speed of the feed rolls by a hand mechanism 37 which serves for moving shaft 16 axially for adjusting the driven disc 35 relative to the driving disc 34. Any suitable means may be employed for effecting the axial movement of shaft 16 when the member 37 is manipulated.

Upon folding of the side walls —*a* of the box blanks, as shown in Fig. 9, the end flaps —*c* extend laterally beyond the folded flaps. Walls —*a* being within the planes of the glue rolls 29, glue is applied only to flaps —*c*, and as there are no intervening portions of the box blanks between the front and rear flaps —*c*, the peripheries of the glue rolls may be unbroken, or continuous, and no timing between the feed rolls and the glue rolls is required.

Coacting with glue rolls 29 is a pressure roll 38 on shaft 39. Carrier belts 41 and 41—*a*, a roll 42, shown in broken detail in Fig. 2, and a belt 43 operable over a roll 44 on shaft 45 comprise the second unit of carriers for the box blanks, roll 42 being driven from shaft 30 by gear 40. The belt 43 is a continuous belt being provided with upward inclination by passing up over an idler pulley in an arrangement similar to that of the belt 17 shown in Figure 2. As the glue coated and partially folded blanks are moved along by the second carriers, the folded side walls —*a* move under opposite guards 46 and are held by the guards in their folded relation. The front end flaps —*c* are engaged by opposite fixed folders 47 and are turned upward to vertical position. In the further movement of the box blanks, the opposite flaps —*c* pass out of engagement with the fixed folders 47 into engagement with rotatable wheels 49, arranged on opposite sides of the plane of movement of the blanks, which act on flaps —*c*, which are then extended substantially in vertical positions, to fold the flaps on diagonal score lines —*e* inverse to the direction of movement of the box blanks, and substantially parallel to the folded side walls —*a*. The wheels in this instance act purely as abutments to be engaged by the partially folded flaps.

Rear end flaps —*c* are also turned to vertical position by folders 47, and are acted on in turn by opposite rotatable folders 49 which act to fold the rear flaps —*c* on diagonal score lines —*e* over and parallel with the folded side walls —*a* in the direction of movement of the box blanks as they pass between the rotatable folders, final folding of front and rear flaps —*c* into engagement with side walls —*a* being effected by opposite belts 50 operable over pulleys 51—52 which are arranged angularly to the plane of movement of the blanks and in close proximity thereto for completing the folds. From the folder belts 50 the completely folded blanks, or boxes in knocked down form, are moved into engagement with the usual pressure mechanism 53—54 for completing sealing of the glued portions of the blanks and delivering the blanks from the machine.

The rotatable folders 49 may be operably connected in any suitable manner. As here shown in Figs. 1-4 the folders are driven by an independent motor 55, drive shaft 56, gears 57, and vertical shafts 58 upon which the folders are supported, the operation of the folders being at relatively higher speed than the movement of the box blanks, timing of the folders to the movement of the blanks is unnecessary. Belts 50 are also operated

through the driving connection 55—58 and pulleys 51.

The rotatable wheel folders, as best illustrated in Figs. 12 and 13 preferably have annular channels 59 arranged at the peripheries of the wheels 49, with rubber bands or rings 60 supported in the channels for effecting frictional engagement with the vertically extended box flaps —*c*. The action of the friction bands 60 on front flaps —*c* is at the required angle for completing the fold of the flaps on the diagonal score lines —*c* at the base of the flaps, inverse to the direction of movement of the blanks. In like manner the frictional action of the bands on rear flaps —*c* is at an angle which completes the fold of the flaps in the direction of movement of the blanks. The frictional engagement of the wheel folders, the peripheries of which travel at much higher speed than the box blanks, acts to effect the folds in forward direction on the diagonal score lines —*e* at the base of the flaps. The diagonal score lines —*e* at the front and rear of the box blanks, being inverse one to another, coact with the friction wheels in making the folds in opposite directions and parallel to the direction of movement of the box blanks.

The successive folding operations of the box blanks are illustrated in Figs. 9–10.

An important feature of the machine consists in the sequence of the folding operations and in the arrangement of the feeding, gluing and folding mechanism, which does not require timing of one mechanism with another for effecting the operations of the several mechanisms on the box blanks or for bringing the folded portions of the blanks into exact registration one with another.

It will be observed that the folding of front and rear flaps —*c*, in the operation of the machine herein set forth, and in the machine set forth in my aforesaid copending application for patent, is inverse one flap to the other, and both parallel to the plane of movement of the box blanks. This feature permits of relatively high speed production and large output and is, accordingly, an important factor in producing boxes of this character by improved automatic machinery and a new process of forming and sealing paper boxes.

I claim as my invention:

1. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means for folding over said side flaps, means along the plane of movement of the blanks common to the front and rear end flaps for folding the flaps diagonally over said side flaps for effecting adhesion between said end and side flaps.

2. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps and extended laterally beyond the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means along the plane of movement of the blanks for engaging said laterally extended portions of the side flaps and for folding the same over the upper face of said blanks, means for applying adhesive to said front and rear end flaps, and means common to the front and rear end flaps for folding the flaps diagonally over said side flaps for effecting adhesion between said end and side flaps.

3. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means along the plane of movement of the box blanks for folding said side flaps out of the plane of said end flaps, means in the plane of said end flaps for applying adhesive thereto, and means common to the front and rear end flaps for folding the flaps over said side flaps for effecting adhesion between said end and side flaps.

4. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means along the plane of movement of the blanks for folding said side flaps over said blanks, means for applying adhesive to said front and rear end flaps, and means common to said flaps for folding the front end flaps and thereafter the rear end flaps over said side flaps for effecting adhesive joints between said end and side flaps.

5. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means along the plane of movement of the blanks for folding said side flaps over said blanks, means for applying adhesive to said front and rear end flaps, means fixed along the plane of movement of the box blanks for folding said front and rear end flaps upward, and operable means common to the front and rear end flaps for further folding the flaps for effecting adhesion between said side and end flaps.

6. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said

machine without pause for forming the boxes, means along the plane of movement of the blanks for folding said side flaps over said blanks, means for applying adhesive to said front and rear end flaps, means fixed along the plane of movement of the box blanks for folding said front and rear end flaps upward, operable means common to the front and rear end flaps for further folding the flaps, and means for pressing said folded flaps flat upon the box blanks for effecting adhesion between said folded portions.

7. A machine for making paper boxes of blanks having front and rear end flaps and side flaps intermediate the end flaps, as the blanks are moved on said machine, including means for moving said blanks on said machine without pause for forming the boxes, means fixed along the plane of movement of the blanks for folding said side flaps over said blanks, means for applying adhesive to said end flaps, means fixed along the plane of movement of the box blanks for partially folding said front and rear end flaps, means common to the front and rear end flaps operable for further folding the flaps, and means common to said flaps operable for pressing the flaps into engagement with said side flaps for effecting adhesion therebetween.

8. A machine for making paper boxes from blanks having front and rear end flaps and side flaps intermediate the end flaps, including opposite means fixed along the plane of movement of the box blanks for folding said side flaps over the blanks, a plurality of mechanisms common to the end flaps and arranged on opposite sides of the plane of movement of the blanks to act thereon, including means operable in the plane of movement of the box blanks for applying adhesive to said end flaps, means fixed along the plane of movement of the blanks for partially folding said end flaps, means operable in the plane of movement of said blanks for further folding said end flaps, and means operable in the plane of the box blanks for pressing said end flaps into engagement with said side flaps for effecting adhesion therebetween.

9. A machine for making paper boxes from blanks having front and rear end flaps scored diagonally at their base for folding, means arranged along the plane of movement of the blanks on said machine for partially folding said end flaps, and rotatable folders arranged on opposite sides of said plane of movement, and having frictional peripheries engaged by said partially folded flaps and acting to further fold said front and rear flaps on said score lines inversely one to another.

10. A machine for making paper boxes from blanks having front and rear end flaps scored diagonally at their base for folding, means arranged along the plane of movement of the blanks on said machine for partially folding said end flaps, and rotatable folders arranged on opposite sides of said plane of movement, having frictional peripheries traveling at a greater speed than the movement of the blanks, and acting to further fold said front and rear flaps on said score lines inversely one to another.

In testimony whereof, I affix my signature.

SAMUEL BERGSTEIN.