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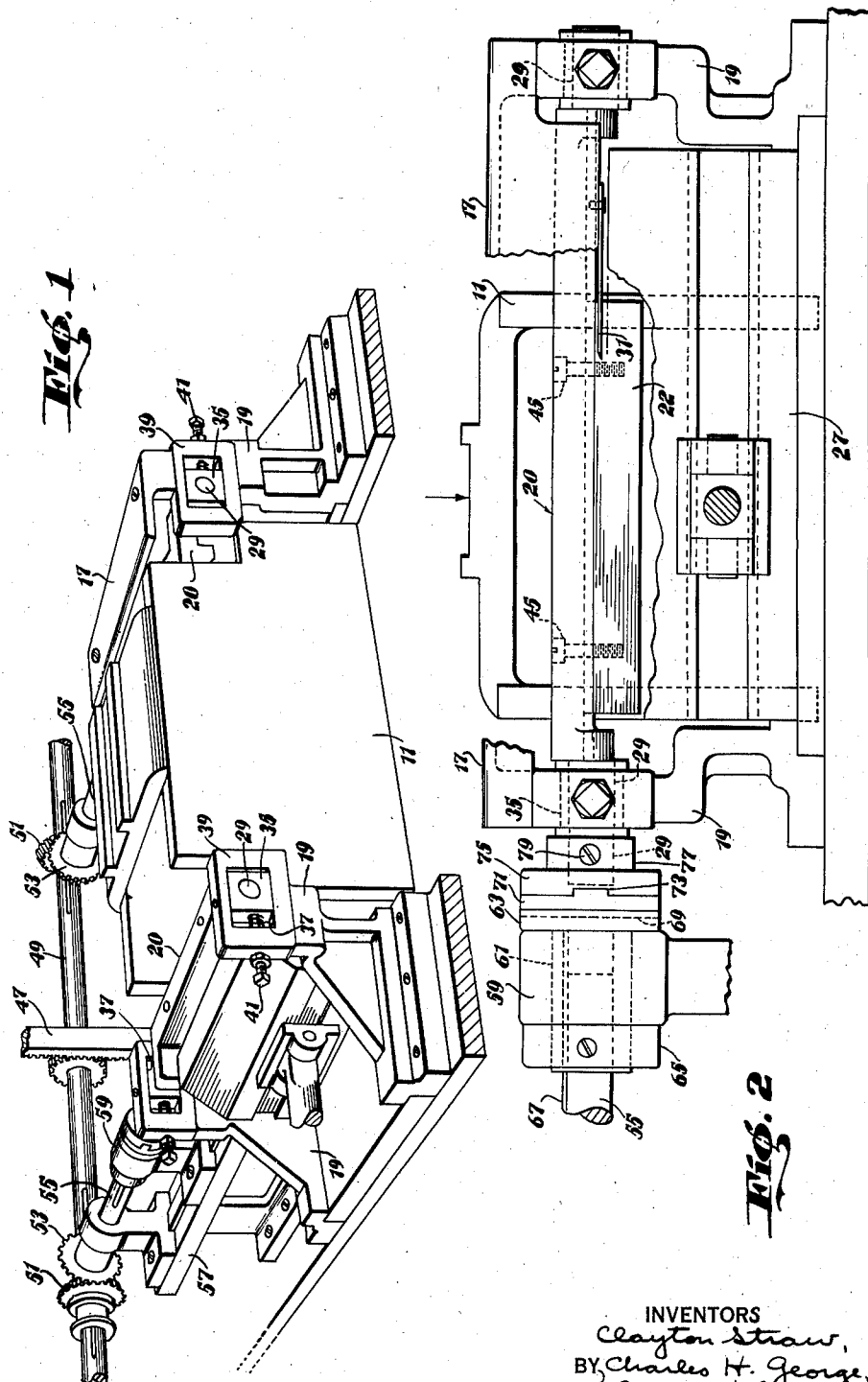
C. STRAW ET AL

2,232,932

BOX-MAKING MACHINE

Filed June 13, 1940

2 Sheets-Sheet 1



INVENTORS
Clayton Straw,
BY Charles H. George,
Robert K. Randall,
ATTORNEY

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2 Sheets-Sheet 2

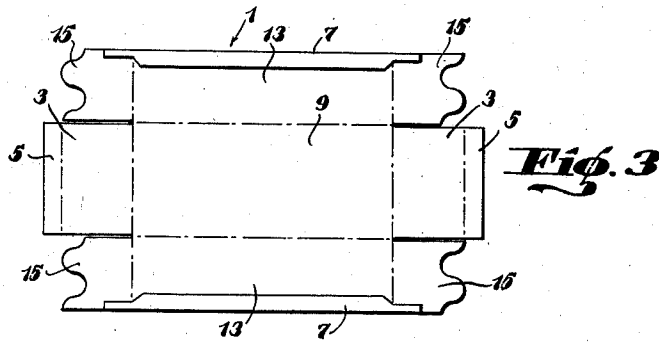


Fig. 3

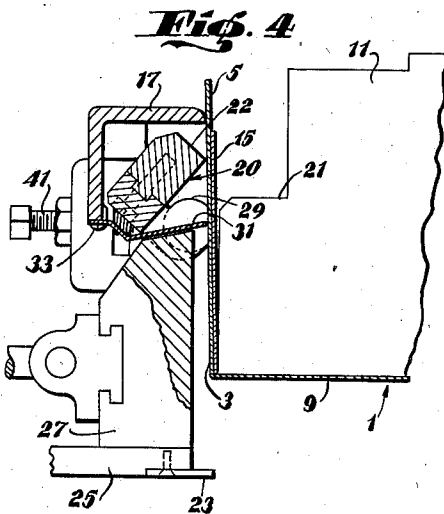


Fig. 4

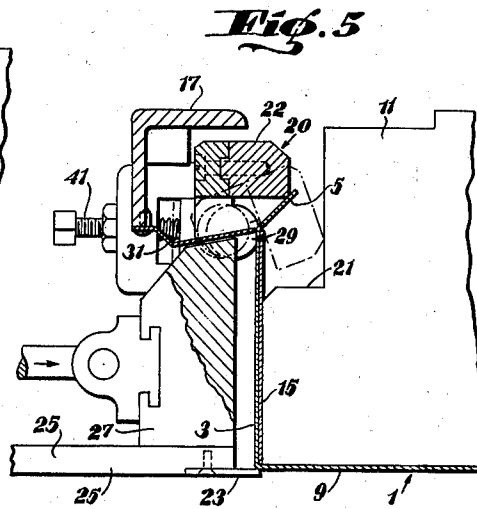


Fig. 5

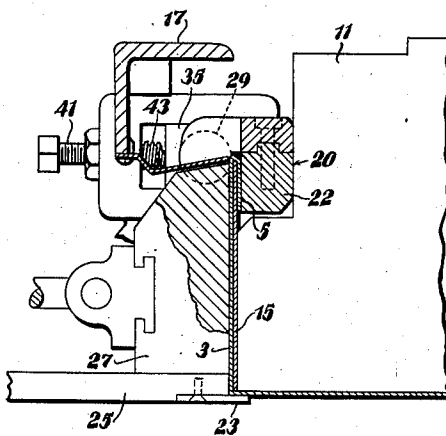


Fig. 6

INVENTORS
Clayton Straw,
Charles H. George,
BY
Robert K. Randall,
ATTORNEY

UNITED STATES PATENT OFFICE

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BOX-MAKING MACHINE

Clayton Straw, Henniker, and Charles H. George,
Contoocook, N. H., assignors to Kingsbury &
Davis Machine Company, Contoocook, N. H., a
corporation of New Hampshire

Application June 13, 1940, Serial No. 340,284

8 Claims. (Cl. 93—51)

This invention relates to automatic box-making machines, and in particular to machines for automatically setting up paper, cardboard, or equivalent boxes from flat blanks, these boxes characteristically being formed by folding end-wise extensions of the bottom of the box up and over tabs formed on the sides of the box after such tabs have been bent at right angles to the sides into a common plane, and thereafter folding the free extremities or top portions of the extensions down inside the box against the tabs and securing the parts in this relation.

The object of the present invention is to provide novel and improved mechanism of simpler, more reliable, and less expensive construction and operation for folding the free extremities of the end-ports over the tabs on the sides and down within the box. Additionally, the invention aims to provide means for exerting pressure on the fold-line and adjacent parts of the end-ports and the turned-down extremities thereon, to set the fold at the instant of its formation and thereafter to hold it firmly while the glue fixes the extremities in their intended downturned position. Other aims and objects of the invention, and the manner of attainment of all these ends, are as set forth hereinafter.

The invention is represented in the accompanying drawings as embodied in a machine of well known character and construction; but it should be understood that, so far as the construction of the machine in general is concerned, it is not material to the invention and may be varied in practice according to the exigencies of use and the views of machine builders and users.

In the drawings—

Fig. 1 shows in perspective the improved end-folding devices of the invention, together with their driving means, operatively combined with the form and one presser and other immediately related parts of the said well-known type of box-making machine, the end-bending rail co-operating with the left-hand end-folder being omitted for clarity.

Fig. 2 is an end elevation taken from the left-hand end of Fig. 1, showing a narrower form and end-folder in use for making a smaller box than in Fig. 1.

Fig. 3 shows the type of box-blank used by the machine.

Fig. 4 is a part-sectional elevation through the end-folder, its bending rail, a portion of the presser, and a portion of the box-blank, showing the relationship of the parts as the form

descends and before the end-folder goes into action.

Fig. 5 is a view corresponding to Fig. 4, showing the relationship at the beginning of the end-folding action.

Fig. 6 is a view corresponding to Figs. 4 and 5, showing the relationship at the completion of the end-folding action.

The invention is primarily intended for use in conjunction with the well-known Kingsbury & Davis paper box machine of U. S. Letters Patent No. 655,434, granted Aug. 7, 1900; No. 728,286, granted May 12, 1903; and No. 2,082,365, granted June 1, 1937, to which documents reference can be had for an understanding of the operation of all parts not specifically described herein.

As is well known, but not illustrated herein, in this prior machine the blanks 1, cut and scored, as shown in Fig. 3, are fed one by one from a stack thereof in the hopper of the machine, through a paster applying paste to the upper surface of portions 3 and 5 of the blank, and out onto guide-rails located between side-guides which engage the side edges 7 of the blank, a pusher then continuing to propel the blank along the guide-rails until the portion 9 forming the bottom of the box is beneath and in register with the vertically reciprocating form 11.

As the form 11 descends upon the blank positioned beneath it, the form forces the blank against the swinging side-benders shown in Patent 2,082,365, which fold the side-ports 13 against the sides of the form and into parallel relation with each other, while fingers swinging on the shafts of these side-benders press the tabs 15 on the ends of side-ports 13 into parallel planes to form parts of the ends of the box, all as set forth in such last named patent.

In accordance with the invention, continued downward travel of form 11 following the bending of the sides and tabs thereon just described, brings the end-ports 3 of the blank into engagement with stationary bending rails 17 mounted on the top of corner-stands 19 located near the four corners of the form, the ends of the form just comfortably clearing the inward edges of bending-rails 17 with sufficient latitude as shown in Fig. 4 to admit the two plies of stock comprising the tabs 15 and the end-ports 3 between them, whereby the end-ports 3 are bent up into contact with tabs 15 as shown in Fig. 4.

As the form and the box approach the limit of their downward travel, an end-folding mem-

ber 20, up to now retracted beneath each of the two bending-rails 17, comes into action to fold the free extremity 5 of each end-portion 3 accurately over the aligned top edges of the two tabs 15 at each end of the box. This end-folder 20 remains motionless while the form and the box are passing through the relationship shown in Fig. 4; but as soon as the double-thick part of the end of the box has passed below the proximate corner of member 20, member 20 starts to swing inward over the rim of the box as shown in Fig. 5, folding the extension 5 accurately over the top line of the meeting tabs 15 forming a part of one end of the box. A recess 21 is formed in the side walls of form 11 to admit the end-folding member 20 and the extremity 5 pushed inward and downward thereby, and after the form and the box have reached the limit of their downward travel and brought up against supporting plate 23 fixed across the bottom edge of slide-plate 25 moving with the presser 27, the end-folding member 20 continues its downward travel until it reaches the position shown in Fig. 6, in which one of its faces is pressed flatwise against the now inward surface of extension 5 while another surface parallel thereto is presented against the vertical parts of recess 21 in form 11. Just after this position shown in Fig. 6 is reached by member 20, the presser 27 in its inward travel reaches the end 3, pressing the two ply portions of the ends between itself and the opposing end of form 11, and also pressing the three-ply top portion of such end tightly between itself and the opposing surface of end-folder 20, to cause the glue between these plies to fix the latter together.

End-folder 20 is enabled to perform its function through being equipped at its opposite ends with pintles 29 arranged in offset relation to the intermediate working parts of the end-folder. Through this eccentric mounting, rotation about the common axis of the two pintles 29 makes it possible for the end-folder 20 to reach over the intended fold-line at the rim of the end of the box and down below such rim into the interior of the box. However, this common axis of the pintles, about which the end-folder swings, is not fixed in space, but is yieldingly located nearer to the vertical wall of notch 21 in the end of form 11 than the longest radius of eccentricity of such end-folder. In making its downward swing, the corner line at the end of such longest radius encounters the vertical part of the notch 21 as indicated in dotted lines in Fig. 5, forcing the pintles 29 to shift from the solid-line position into the dotted-line position also shown in Fig. 5. This causes the outward face of end-folder 20 to pull outward on the end of the box across the entire width of such end and exactly at the fold-line where extremity 5 is being bent down over the tabs 15. Outward deflection of the parts at this fold-line is prevented by a brace 31 of sheet-metal or other stiff and resilient stock, attached by screws 33 to the bottom edge of the vertical flange of bending-rail 17, and providing at its free inner end a straight edge which extends across the width of the box just below and just outside the fold-line at the rim of its ends. Thus, when the end-folder 20 is cammed outward through encountering the vertical parts on form 11, the parts forming the end are pressed and creased tightly together between the edge of the brace 31 and the outer surface of folder 20 so as to set the fold by localized pressure in almost the same manner in which

a person would undertake to do this with the pressure of his thumbs and fingers.

To provide for the yielding mounting of the end-folder in suitable bearings, the pintles 29 are fitted within boxes 35 sliding horizontally in ways 37 formed in the elongated tops 39 of corner-stands 19. Stop-screws 41, threaded through the ends of top-portions 39 of the stands, and equipped with lock-nuts, limit the outward movement of the boxes 35 and pintles 29 under the resistance of the box-end to bending, to exactly enough scope to let the corner of each end-folder pass by the form. Expanding springs 43 coiled around the inward portions of these screws and confined between the boxes 35 and the ends of the slots, urge the end-folders inward.

The loose mounting of the pintles of end-folder 20 for movement toward and from the form makes it possible to provide a flat surface on 20 the end-folder to fit against the vertical wall of notch 21 of the form during the application of pressure to the end of the box by presser 27. This means that the pressure has no effect of rotating the end-folder reversely out of its notch 25 in the form, but merely presses its flat inward surface against a conforming surface on the form. The interrupted axle of the end-folder makes it possible to have its axis of rotation almost exactly on the fold-line along the top rim of the end of the box, thus giving it maximum efficiency in forming the fold accurately at this point. As shown in Fig. 2, the permanent part of the offset middle section of end-folder 20 to which the part 22 is fastened is made of the full width of the widest box for which the machine is adapted, just as is the length of presser 27 and the spacing of corner-stands 19. This permanent part never descends below the rim of the box being formed. The part 22 which enters the box is removably attached thereto by screws 45, and is made of the proper length to suit the width of the particular box which is being made. Thus, in changing the machine for boxes of different sizes, the form 11 and the part 22 of the end-folder are changed, but the rest of the end-folder, the presser 27, and the position of the corner-stands 19, remain unchanged.

To drive the end-folder in accurate timed relation to the movements of the form and other parts of the machine, the cam-operated-rack 47 and the horizontal shaft 49 actuated thereby to drive the end-folders in our prior Patent 2,082,365 are utilized, the shaft being equipped with bevel gears 51 mounted thereon with suitable capacity for adjustment lengthwise of the shaft to provide for changes in length of the boxes being made. These bevel gears respectively mesh with other bevel gears 53 on the ends of jack-shafts 55 mounted in bearings in small brackets fixed on stands 57 at each end of one side of the machine. In each inward bracket 59 is rotatably mounted a sleeve 61 having a solid flanged head 63 at one end, and a collar 65 fixed on its protruding other end, the interior sleeve 61 having a keyway to receive a spline 67 on jack-shaft 55, so as to be driven by such shaft. The head 63 of this sleeve has a groove 69 across its diameter, in which stands a tongue on the face of a disk 71, the disk having a second tongue 73 extending diametrically across its other face at right angles to the first tongue. This second tongue 73 is received in a correspondingly fitting slot across the face of the flanged head of a fit-

ting 75 fixed by means of its hub 77 and set-screw 79 on the end of one pintle 29 of end-folder 20, just outside the box 35 forming the movable bearing for such pintle. Owing to the right-angle relationship of the two tongues on the intermediate coupling member 71, a flexible drive permitting disalignment of the axis of end-folder 20 with respect to jack-shaft 55 is provided without loss of the driving relation.

In this way, outward displacement of the pintles during entry of the part 22 on the end-folder between the rim of the box and the form is provided for, and similarly the displacement of the axis of the pintles inwardly toward the form when pressure is applied by presser 27 to set the glued parts forming the end of the box.

After the setting pressure has been applied by pressers 27 and thereafter relieved, the end-folders 20 are rotated reversely through downward movement of rack 47, retracting them entirely out of the path of the form 11 into their waiting position shown in Fig. 4. Thereupon the form rises, while strippers of customary type hold the box against accompanying upward movement as the form is withdrawn from within it. The next descent of the form with a new blank folded about it expels the finished box from the machine, the pressers 27 being retracted far enough at such moment to have removed the supports 23 from the path of the descending completed box.

What is claimed as the invention is:

1. In a box-making machine, in combination, means for folding up the end-portions of a box-blank into box shape including a vertically reciprocating form, and folders rotating on axes located at fixed levels in the travel of the form, the folders being wholly outside the path of the form until after the latter has descended and carried the rim-line of the box below them, and thereupon swinging inward over portions of the form and downward within the box and folding the extremities of the end-portions of the box-blank over parts of the sides and down within the box.

2. In a box-making machine, in combination, means for folding up the end-portions of a box-blank into box shape including a form, and a folder folding the extremity of an end-portion of the blank down within the box, the folder rotating inwardly and downwardly over the rim-line of the box and after entry within the box being forced outwardly through engagement with the form.

3. In a box-making machine, in combination, means for folding up the end-portions of a box-blank into box shape including a form, and a folder having pintles disposed on an axis outside and closely adjacent the rim-line of the end of the box and an offset intermediate portion permitting the box-rim to intervene between the pintles, and means for rotating the folder to fold the extremity of an end-portion of the blank down within the box, the intermediate portion following the extremity in an arc approximately concentric with the arc of travel of the extremity in folding over the rim-line.

4. In a box-making machine, in combination, means for folding up the sides and end-portions of a box-blank into box shape including a form, and a folder swinging about a shiftable axis having a portion offset from such axis to swing inwardly and downwardly over the rim-line of the box and thus to fold an extremity of an end-portion upstanding above the rim-line down within the box, the folder being thrust outwardly, to press against the fold-line being formed in the extremity, by engagement with the form and with attendant shift of the folder's axis.

5. In a box-making machine, in combination, means for folding up the sides of a box-blank including a vertically reciprocating form, means for folding up the end-portions of the blank including bending-rails disposed transversely of and adjacent to the path of the ends of the form, folders for the extremities of the end-portions retracted outwardly of the box out of the path of the descending form to positions beneath such bending-rails and thence rotating on axes parallel to such bending-rails inwardly and downwardly within the box to bend the extremities of the end-portions inwardly and downwardly, means moving the folders outwardly in the course of their downward movement within the box, means acting to support the box-ends adjacent the fold-lines of the extremities during such outward movement, and pressers subsequently brought into engagement with the box-ends to set the folds thus made.

6. In a paper-box-making machine, in combination, a presser, a vertically reciprocating form, and a box-end-shaping member having spaced pintles rotating on an axis at a fixed level substantially in the plane of the rim of the box, with the material of the member cut away between the pintles, and an intermediate portion connecting the pintles and offset from such axis to enter between the presser and the form by swinging over the rim of the box.

7. In a paper-box-making machine, in combination, a presser, a reciprocating form, a box-end-shaping member periodically reaching into the box between its end-wall and the form, shiftable bearings outside the path of the form mounting such member for rotation into and out of the path of the form, and driving means rotating such member in timed relation to the reciprocations of the form and permitting shift of the bearings through engagement of the member with the form while maintaining driving connection with such member.

8. In a paper-box-making machine, in combination, a vertically reciprocating form, and a rotatable member swinging inward over the rim of the box and down within the box between the latter and the form about an axis outside the latter's path to turn down the extremity of a box-end standing up above the box-rim, such member being yieldably mounted to allow its horizontal displacement upon engagement with the form.

CLAYTON STRAW.
CHARLES H. GEORGE.