March 6, 1945. H. W. GREGOIRE 2,371,046

MACHINE FOR SETTING UP BOX BLANKS

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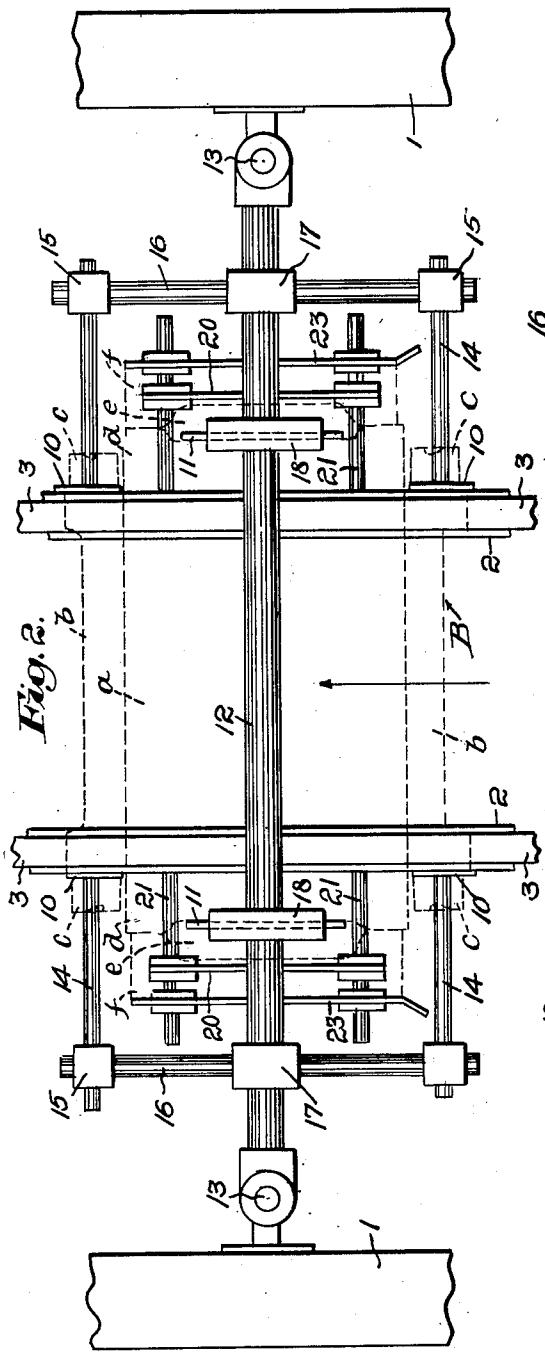

Fig. 2.

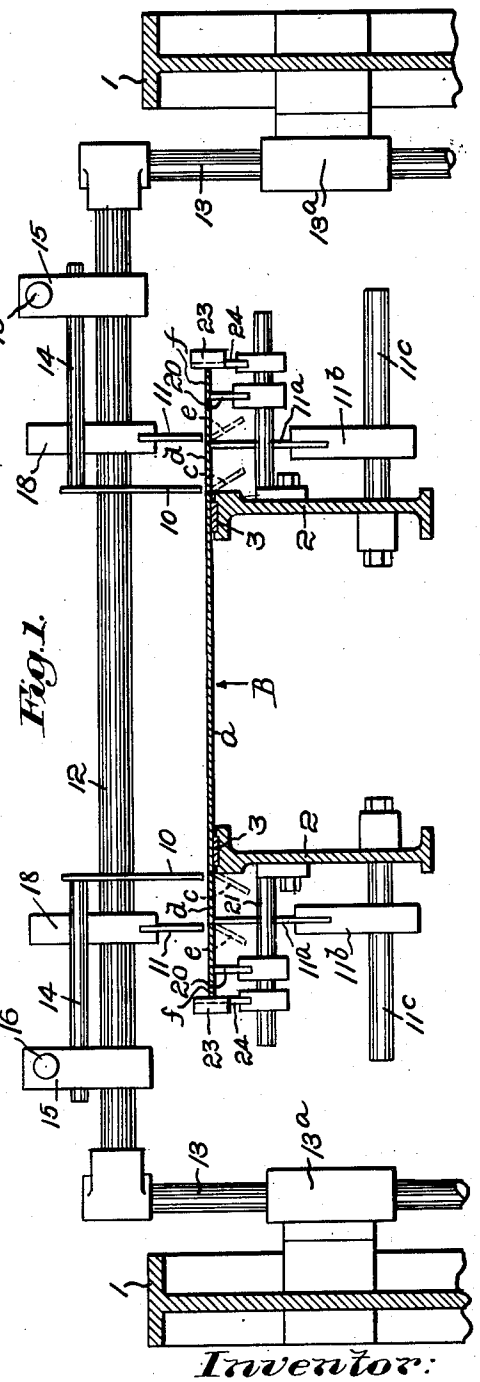

Fig. 1.

Inventor:
Horace W. Gregoire.
by Emery, Booth, Townsend, Miller & Widmer
Attys.

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Fig. 3

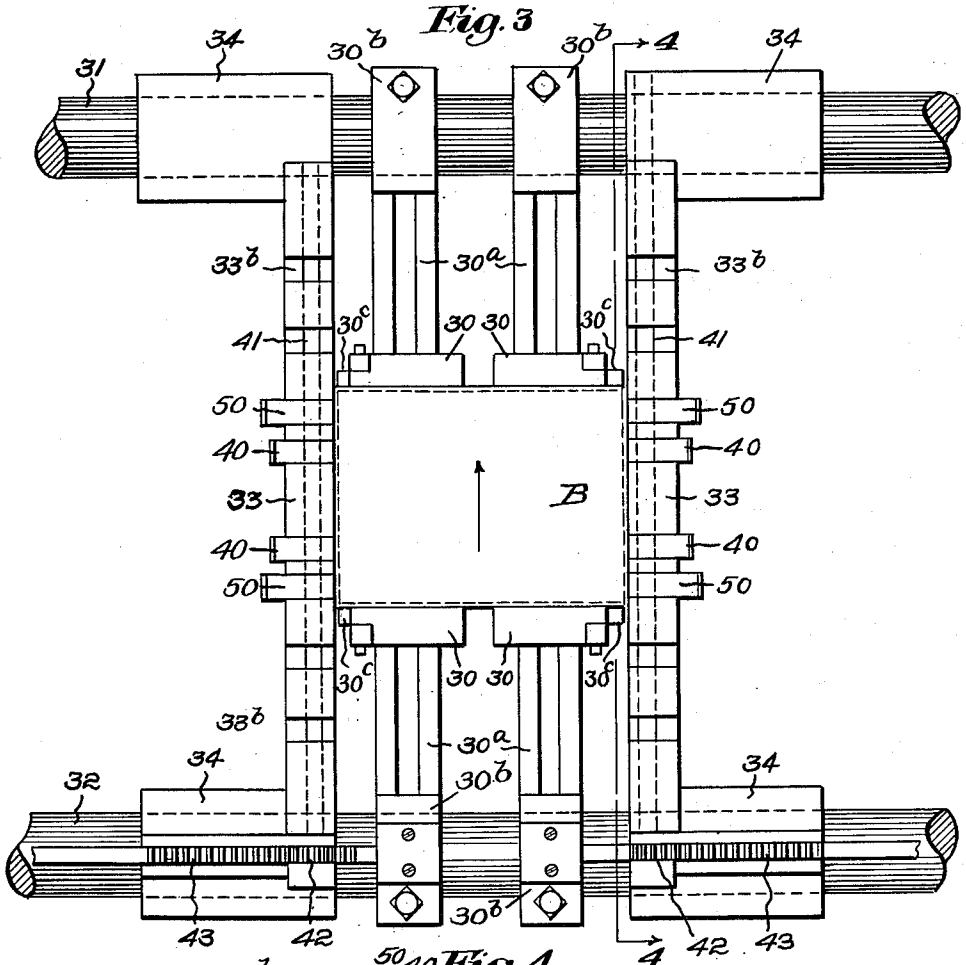
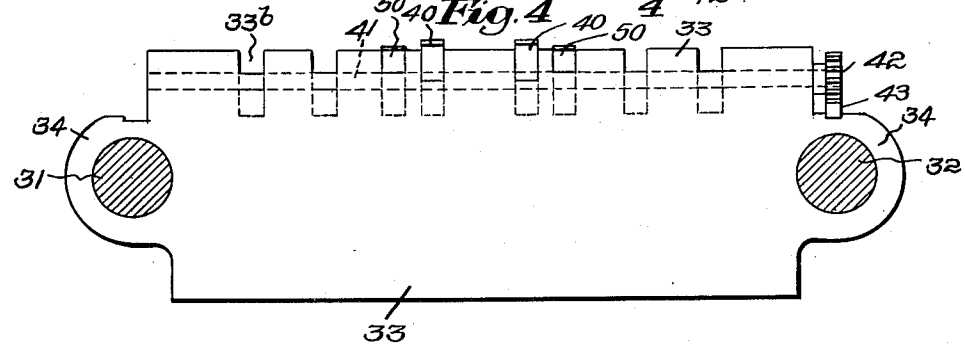


Fig. 4



Inventor:
Horace W. Gregoire,
by Emery, Booth, Townsend, Miller & Weidner
Attys.

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MACHINE FOR SETTING UP BOX BLANKS

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Fig. 8.

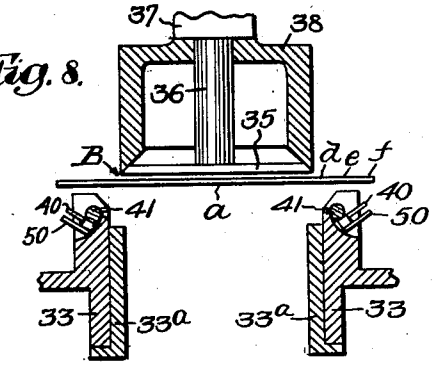


Fig. 9.

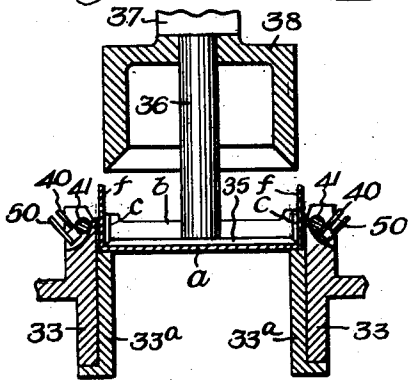


Fig. 10.

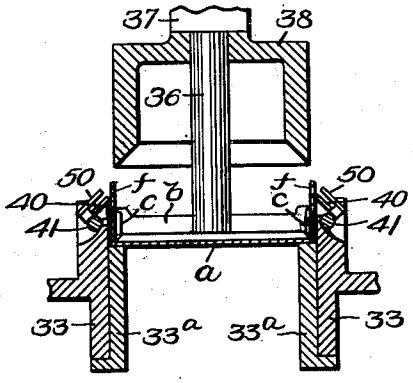


Fig. 11

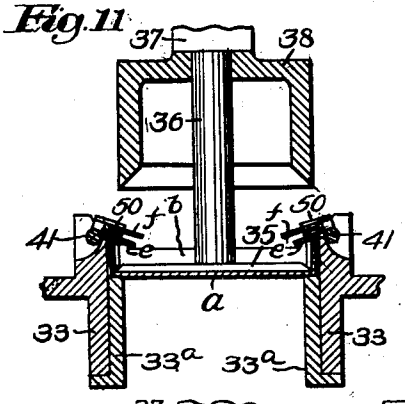


Fig. 5

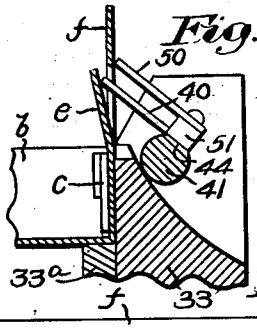


Fig. 6.

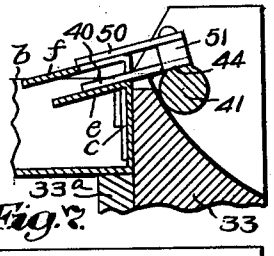


Fig. 12.

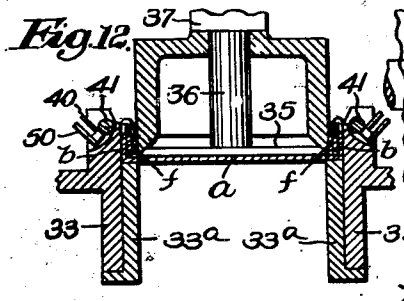
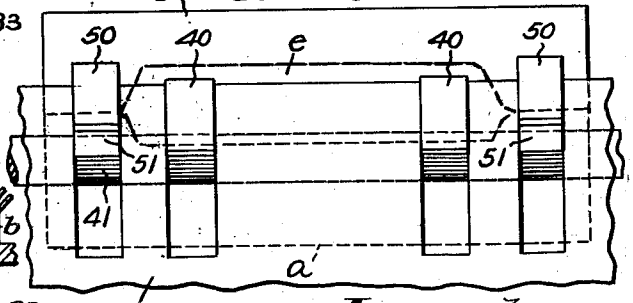


Fig. 7.



Inventor:
Horace W. Gregoire,
by Emery, Booth, Townsend, Miller & Wallace
Attys

March 6, 1945. H. W. GREGOIRE 2,371,046

MACHINE FOR SETTING UP BOX BLANKS

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Fig. 13.

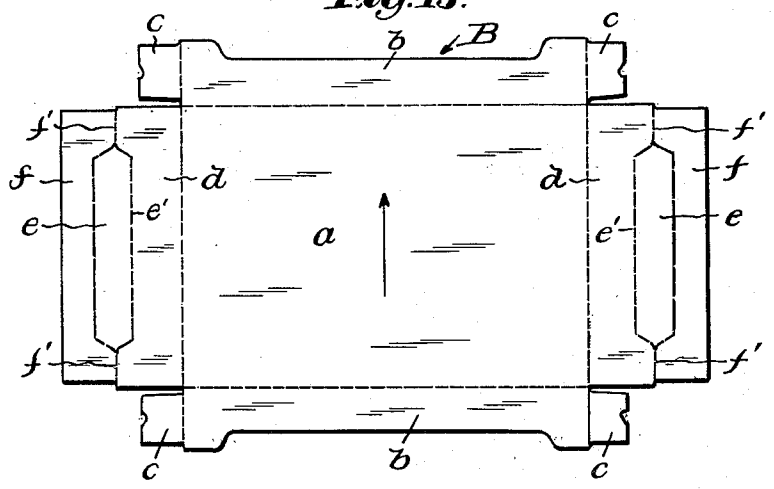


Fig. 14.

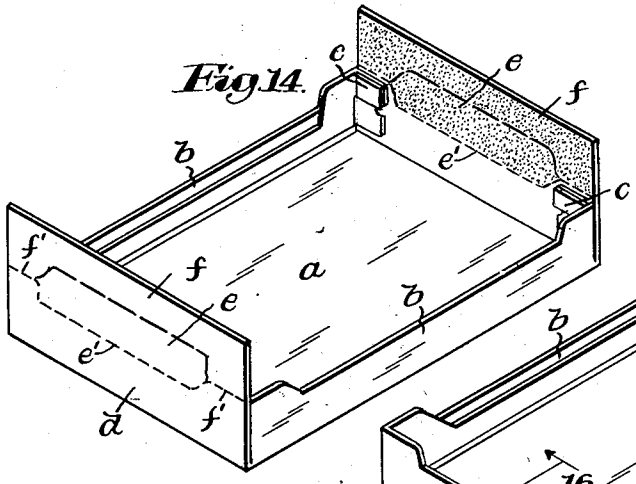


Fig. 15.

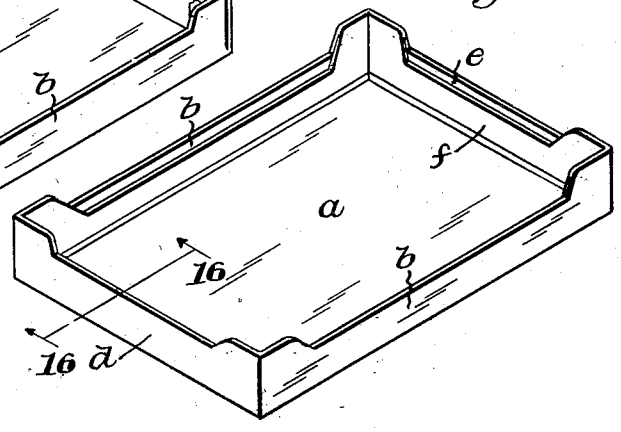
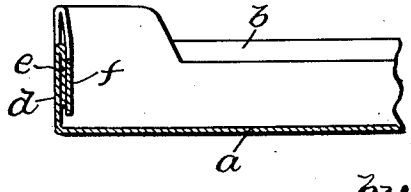


Fig. 16.



Inventor:
Horace W. Gregoire,
by Emery, Booth, Townsend, Miller & Weidner
Attys.

Patented Mar. 6, 1945 2,371,046

UNITED STATES PATENT OFFICE

2,371,046

MACHINE FOR SETTING UP BOX BLANKS

Horace W. Gregoire, Boston, Mass., assignor to Oskar W. Wikstrom, Newton, Mass.

Application June 5, 1942, Serial No. 445,887

5 Claims. (Cl. 93—51)

My present invention relates to paper box machines, such for example as commonly referred to as the Brightwood type, for making the set-up or tray form of container, including especially boxes of the folded end type, examples of which and of machines of the general class concerned appear in U. S. Patent No. 1,281,982 and in my prior Patent No. 2,120,214, dated June 7, 1938.

In various respects the present invention supplements and improves upon paper box apparatus as disclosed and claimed in my said patent.

In the drawings illustrating by way of example one embodiment of the invention:

Fig. 1 is a vertical cross sectional view at the blank-receiving and breaker portion of the machine, including mechanism for initially flexing or bending parts of the box blanks;

Fig. 2 is a top plan of the mechanism of Fig. 1;

Fig. 3 is a top view of the forming throat of the machine, including certain novel tucker mechanism;

Fig. 4 is a vertical sectional view as on the line 4—4 of Fig. 3 looking toward the right in said figure, the section being taken lengthwise the machine, that is, in the direction of travel of the blanks through it;

Figs. 5 and 6 are enlarged sectional details crosswise the machine illustrating two succeeding intermediate positions of said novel tucker devices;

Fig. 7 is a fragmental elevation, on a similar scale as Figs. 5 and 6 of the mechanism of Figs. 5 and 6 as if looking from the right in said figures;

Figs. 8 to 12 inclusive are partial diagrammatic cross-sectional views of the forming and tucker mechanism in various succeeding stages of operation;

Fig. 13 represents a typical blank for a box or tray such as adapted for handling by the means of the invention;

Figs. 14 and 15 show the box or tray resulting from the blank of Fig. 13, in partially formed and completed conditions respectively; and

Fig. 16 is a longitudinal section through one end portion of the container of Fig. 15, upon a larger scale, as for example on the line 16—16.

Referring to the drawings in detail I have herein shown sufficient of the organized apparatus as a whole for the purposes of the present disclosure. The invention is applicable to various machines of the general class above referred to but with a view to simplifying the description and illustrations of the novel means and combinations of elements concerned in the invention are represented in connection with a machine such as that of my prior Patent 2,120,214 above identified and to which reference may be had for further illustration of the machine as a whole. Accordingly, unless otherwise stated, parts which are not described or illustrated in detail in the present application may be such for example as represented in my said patent.

Turning now to Fig. 1, in connection with which reference may be had to Fig. 11 of said Patent 2,120,214, a portion of the main frame, at the left side of the machine looking in the direction of travel of the blanks, is indicated at 1.

The blanks, one of which is indicated generally at B, are conveyed along spaced carrier frames seen in section at 2, 2, these preferably being laterally adjustable on the main frame as appropriate for the particular size of blank. The blanks B are moved along from the infeeding end of the machine, not shown, through the creasing or breaker mechanism with which Figs. 1 and 2 are mainly concerned. The blanks are temporarily halted at this creasing or breaker station, substantially in the position as indicated by the dotted outline of the blank B in Fig. 2.

A typical blank B in its flat condition as fed to the machine is illustrated in Fig. 13. It comprises a main wall *a*, to form the bottom for the set-up box or tray or the top for a container cover. The arrow on Fig. 13 indicates the direction of travel of the blank in the machine. The blank further comprises side walls *b*, at two opposite edges of the main wall *a*, having corner flaps *c* at their opposite ends. At the other two opposite edges of the wall *a* are intermediate or end elements herein of a triple character, each including an end wall proper *d*, an intermediate turn-in piece or tuck *e*, and a further terminal turn-in piece or overlap tuck *f*.

It will be understood that the term "side" and "end" as applied to the walls *b* and *d* respectively are merely for convenience in description and without implication as to the relative dimensions of the walls concerned or any special front, rear or transverse position thereof in the finished article. And it will be observed that the vertical walls which in this example happen to be the longer pair, herein termed the "side" walls *b* extend crosswise of the machine and of the path of the blanks along it, the "end" wall members *d—e—f*, which happen to be the shorter pair, being parallel with said path and with the sides of the machine.

The manner of folding and setting up the several parts of the blank will later be referred to in more detail, it being here briefly noted, with reference particularly to Figs. 14 to 16, that in the course of the machine operation the blanks B are to have their side walls *b* erected, their side wall flaps *c* turned in at right angles, see Fig. 14, end walls *d* erected, and the end tucks *e* and *f* individually tucked or turned in, with first the intermediate tucks *e* folded flatwise against the then inner face of the corresponding end walls *d* and then the wider tucks *f* lapped down over tucks *e* and over the inturned side wall flaps *c*.

The result is a finished folded edge along the full extent of the end walls, including both their lower intermediate portions and their higher corner portions seen in Fig. 15. It will be particularly noted that the resulting end walls of the box or tray are of triple thickness throughout their major areas. An intermediate thickness or layer of the paper or other fibrous material of the blank is provided by each intermediate flap *e* and the adjacent inturned side flaps *c* these parts being inserted between and held by the in-turned terminal flaps *f*. The side walls *b* and their flaps *c* may themselves be of plural thickness, the blank in such case initially having a laterally extended area seen infolded in Figs. 14–16, which lateral areas are assumed to have been folded over onto and secured against the side walls *b* and flaps *c* (beneath them in the Fig. 13 outerface-up position) by appropriate folding and gluing. Any such single or double infolding of the side walls *b* and of their end flaps *c* is here assumed to have already taken place, the blank being in the flat condition as represented in Fig. 13 as it is conveyed to the breaker mechanism of Figs. 1 and 2 by means of the travelling belts 3, 3.

Referring again to Figs. 1 and 2, the mechanism there shown serves to "break" or flex the corner flaps *c* along their line of hinge connection with the side walls *b*, and similarly also to break or bend the intermediate end tucks *e* along their line of foldable connection *e'* (Fig. 13) with the respective end wall members *d*, preliminary to the gluing, folding and securing of these parts.

This breaker mechanism comprises, for each side of the machine, two bars or plates 10, 10 for acting on the respective pairs of corner flaps *c* and a single longer plate or breaker 11, operable to break or flex the adjacent intermediate end tucks *e*.

These several flexing elements or breakers 10 and 11 are commonly mounted on a vertically movable cross bar 12 carried by plungers 13, these parts providing a breaker head or assembly guided as at 13*a* for vertical movement on the machine frame. This breaker assembly is actuated in timed relation to the other elements of the machine, as by cam means such as that of said Patent 2,120,214, the blanks B being successively halted in proper position at this breaker station, also as in said patent by way of example. The corner-flap breakers 10 are disposed on transverse arms 14 adjustable in blocks 15 in turn adjustably positioned on longitudinal bars 16 held in collars 17 for variable positioning along the main cross member 12 of the assembly. Similarly, the breakers 11 for the intermediate end tucks *e* are adjustably supported by blocks 18 on said cross bar 12.

As seen in Figs. 1 and 2, the corner-flap breakers 10 are located above and substantially in vertical alignment with the outer edges of the track-supported carrier belts 3, on which the blanks B are disposed with the fold lines of their corner flaps *c* also in line with said belt edges. Thus the adjacent portions of the side walls *b* which carry the corner flaps *c* are supported from below along the corner-flap fold lines, while the corner flaps themselves project laterally without under support. Hence as the breakers 10 descend they act to break down these corner flaps *c* along their fold lines, into a position such as shown dotted in Fig. 1.

The breakers 11, one at each side of the machine, are adjusted to stand vertically over the fold line *e'* between the corresponding intermediate tucks *e* and their end wall members *d*. The latter are supported, at the breaker station of Figs. 1 and 2, as by means of underlying plates or bars 11*a* held in blocks 11*b* adjustable along studs 11*c* projecting from the adjacent belt carrier frames 2. The intermediate tucks *e* however have no directly underlying support. Hence in the same descending operation of the breaker assembly the breakers 11 engage and flex these intermediate tucks *e* downwardly, into substantially their dotted line position indicated in Fig. 1.

As evident in Fig. 13, the outer or terminal tucks *f* enclose the outer portions of the intermediate tucks *e*. The latter are in effect formed in part from what would be portions of the tucks *f* if the latter were rectangular, of uniform extent straight across the blank; and in remaining part these intermediate tucks *e* are taken from what would be material of the end wall members *d*, if these latter also were rectangular, straight across the blank, instead of being wider or higher at their opposite extremities, as shown. In other words, the fold lines *e'* and *f'* of adjoining tucks *e* and *f* (Fig. 13) are offset relatively to each other, and the outer transverse cut edge of a tuck *e* is spaced further out from the main wall *a* than is the fold line *f'* of its associated tuck *f*. This causes the two tucks to have an overlapping relation when both are subsequently folded down flatwise against the inner face of the erected end wall member *d* by which they are carried: see Figs. 14 to 16.

In the preliminary flexing operation at the breaker station of Figs. 1 and 2 only the intermediate tucks *e* are "broken" or bent down, in addition to the corner flaps *c*. The outer tucks *f*, also the end wall members *d*, are kept in their initial flat position, in the plane of the blank as a whole, so as to insure clean separation of the intermediate tucks *e* fully along their cut edges.

To that end, and to avoid breaking the outer crease, that is, the line of folding connection F' between the tucks *f* and the end wall members *d*, I herein provide special supporting means at the breaker station. As illustrated in Figs. 1 and 2, such means comprises, at each side of the machine, a supporting bar or plate 20 adjustably positioned on brackets 21, 21 projecting from the respective adjacent belt carrier frames 2. These supporting plates 20 are adjusted to stand directly below the terminal tucks *f*, and out of vertical line with the intermediate tucks *e*. Said supporting means 20 accordingly prevents the outer tucks *f* from being carried down with the breakers 11 as the latter bend the intermediate tucks *e*, even if the line of separation between them has not been completely cut through.

In cooperation with the described supporting and breaker mechanism as a whole I desirably provide additional guiding and aligning means whereby the blanks B are accurately located, in the direction across the machine, for and dur-

ing the breaking operation. Such means as illustrated in Figs. 1 and 2, comprises, at each side of the machine, a longitudinal abutment or guide in the form of a strip or bar 23 carried by upright arms 24 adjustably fixed on the extended outer portions of the brackets 21 already described. These guides 23 are adjusted in position, substantially as shown, to receive the blanks B between them, with the outer edges of the terminal tucks *f* adjacent the inner vertical faces of the guides. Thus the blanks are centered and held against displacement transversely of the machine in the course of the described breaking operation.

From the breaker station of Figs. 1 and 2, the blanks resume their travel with the conveyer belts 3, passing to and past suitable gluing mechanism and if desired through glue-tempering means, none of which mechanism is necessary to be further illustrated or described herein and which may be such as fully explained in my said prior Patent 2,120,214. The gluing means desirably is such as to apply the glue to appropriate selected areas of the blanks, herein for example the areas represented by the stippling in Fig. 14, one example of such gluing means being found in U. S. Patent No. 2,230,963, to Macdonald, dated February 4, 1941. The blanks B having the glue applied to the appropriate areas are delivered in timed succession to the forming throat, at the setting-up station of the machine, such as represented in Figs. 3 and 4, together with Figs. 5 to 12 inclusive. The blanks are presented at this station with their inner faces uppermost, that is, inversely from the Fig. 13 position, for cooperation with downwardly-acting forming means whereby the blank side and end walls are erected upwardly, the resulting box or tray as formed being positioned upright as in Figs. 14–16.

The forming throat comprises the herein rectangular enclosure or passage in which the side members of the boxes are erected and secured. The main elements defining the throat, and which in general may be of similar construction as in said Patent 2,120,214, are illustrated sufficiently for present purposes in Figs. 3 and 4 and the others above mentioned.

Referring to said figures, such elements comprise opposed fold plates, abutments or wall members 30 disposed crosswise the machine, to act on the walls or sides *b* of the present blanks. As in said patent, these members are formed as individual plates at the inner ends of slides 30*a* adjustably disposed in collars 30*b* on parallel cross bars 31, 32 supported on the main framing 1 of the machine. The other walls of the forming throat, extending lengthwise the machine and adapted to act on the end walls *d* of the boxes, are presented by presser plates 33, one at each side of the machine, having bearing sleeves 34 at their respective ends supporting them for horizontal movement transversely of the machine, toward and from each other, on the cross bars 31, 32.

The setting up of the blanks into their completed box form of Fig. 15 is accomplished by a double plunger element which is brought down into the forming throat, in cooperation with the fixed and movable elements of the latter. This plunger device may be generally similar as in my said Patent 2,120,214, and is herein illustrated sufficiently for the disclosure of the present invention in Figs. 8 to 12 which are vertical sectional views through the forming throat, taken crosswise of the machine.

Said plunger means comprises a horizontal forming plate 35 removably attached at the foot of an inner or central vertically movable slide-bar 36 which is in turn guided in a relatively movable outer slide 37. These elements 36 and 37 at times move together substantially as a unit and at other times move relatively to each other, as is evident in said Figs. 8 to 12. The box-like former 38 is replaceably secured to the lower end of said outer slide 37. The forming plate 35 and said former 38 together comprise a double-plunger forming element actuated and timed as by means of cam and associated mechanism such as that of the patent mentioned.

From the foregoing description taken in connection with the drawings it will be apparent that the present invention makes provision for a triple tucking action in association with the "end" walls *d* of the blanks. Such tucking operation includes the inturning of the corner flaps *c*, and the infolding or tucking of the two separated tucks *e* and *f* with which said double-tuck end walls *d* of the blanks B are provided. This triple operation further is such that both the corner flaps *c* and the intermediate end tucks *e* are set behind and are overlapped by the terminal or main end tucks *f*.

The triple tucking action mentioned takes place at the forming throat through the conjoint operation of the abutment plates 30, the presser plates 33 and the double-plunger device together with the tucker mechanism to be described. It will be understood that the blanks B as presented in succession at the forming throat are positioned with their inner faces up, in the case of a downwardly acting forming mechanism such as here illustrated, the blanks, if otherwise positioned at some earlier point in their travel through the machine, as for example at the breaker station, being inverted before or in the course of their presentation to the forming throat, by suitable means such for example as in my prior Patent 2,120,214 above mentioned.

First, as to the infolding or tucking of the corner flaps *c*, this is accomplished by means of folder points or cam-like turning devices 30*c*, Fig. 3. These are disposed at the outer corner portions of the abutment plates 30, extending above them and having inwardly inclined surfaces presented below and behind said corner flaps *c*. By reference to Fig. 8 in which a blank B is shown in position above the forming throat, and comparison thereof with Fig. 9, it will be understood that the forming plate 35 is brought down onto the main wall *a* of the blank, thrusting the latter down into the throat and simultaneously erecting the side walls *b* and the other side or end walls *d*. In the course of this step, from the position of Fig. 8 to that of Fig. 9, said folder points 30*c* engage and turn the corner flaps *c* on the walls *b* inwardly to a position perpendicular to said walls *b*, so as to stand parallel to and flatwise against the inner face of the now erected end walls *d*. As seen in Fig. 9 the pairs of end wall tucks *e* and *f* at this stage project in substantially upright position above the erected end walls *d*.

The presser plates 33 are provided at their inner and lower portions with interrupted flange portions 33*a* disposed in the throat and acting as bottom stops for the blanks as the latter are carried down into the throat by the forming plate 35. These bottom stops 33*a* are adjustable or interchangeable, for location on the presser plates 33 at a level appropriate to the particular

size and design of box. It will be understood that the presser plates 33 together with the stops mentioned are laterally movable, inwardly toward each other for the application of pressure against the folded parts, and outwardly sufficiently to allow the boxes to be shed downwardly past the stops 33a and out of the forming throat, following the final step of the setting operation such as represented in Fig. 12. This operation of the presser plates 33 may be effected, in the proper timed relation with the plunger element, by mechanism such as that of my prior patent mentioned.

Following the operating step of Fig. 9, the double end tucks *e* and *f* are turned inwardly and downwardly, individually and into the desired overlapping relation of the end tuck *f* with respect to the corner flaps *c* and the intermediate tuck *e*. Two successive stages in the course of the in-tucking of the tucks *e* and *f* are represented in Figs. 10 and 11, and upon a larger scale in Figs. 5 and 6, which are partial views corresponding respectively to portions of said Figs. 10 and 11. The resulting triple-thickness end walls, including the outer wall members *d*, the then inside flaps *f* providing the inner faces for the wall and the enclosed corner flaps *c* and intermediate tucks *e* are completed by the application of pressure to set them in adhesively secured position, as represented in Fig. 12, see also Figs. 15 and 16.

The infolding of the tucks *e* and *f* is effected by means of plural tucking elements or tucking fingers herein comprising a plurality or set of such tuckers 40 for each intermediate tuck *e* and a further plurality or set of tuckers or tucking fingers 50, for each of the terminal tucks *f*. These tucking elements are mounted on and along the upper portions of the presser plates 33, in oppositely facing relation at the opposite sides of the feed throat. They are disposed in recesses 33b provided for the purpose at the top edges of said presser plates 33, a series of some eight such recesses being shown in Figs. 3 and 4, only four of which are occupied by tucking fingers in the set up of the machine for the particular size and form of box herein illustrated by way of example. It will be understood that a greater or less number of tuckers and different arrangements thereof may be utilized for different sizes of blanks and boxes.

The tuckers for each side of the throat are adjustably fixed on a rock shaft 41, one journaled for rotation in one and the reverse directions upon its own axis in each of the presser plates 33 and each having at one end a pinion 42 meshing with reciprocating racks 43, Fig. 3, adapted for operation in timed relation to the other parts by driving mechanism such for example as in my prior patent already identified.

The tucking fingers 40 for the tucks *e*, as best seen in Figs. 5 and 6, have their lower ends fixed on the corresponding rock shaft 41, as in seats 44 formed therein, these fingers 40 thus having their bases at or closely adjacent the shaft axis, the fingers standing in substantially true radial relation to it. The other sets of fingers 50 also are mounted on the same rock shafts 41 but are adjustably fixed on blocks or finger bases 51 in turn removably secured to and extending laterally from the shaft sides. The two finger sets 40 and 50 at the given side of the forming throat are set in general parallelism axially of the shafts. But by reason of the angular or bell-crank form of the outer finger elements 50, for cooperation with the terminal tucks *f*, they are offset behind the shaft axes and away from the throat, in the initial or upright position of the fingers corresponding to Figs. 3, 4, 8 and 9. Hence as the shafts 41 are rocked inwardly, that is turned upon their axes, the sets of tucking fingers 40 arrive at and cross the vertical plane of the erected end walls *d* in advance of the overlap tuckers 50. Accordingly the intermediate tucks *e* are turned in an instant ahead of the terminal tucks *f*; see Fig. 5. This insures the independent folding and tucking of these blank members in the further action of the plural finger sets. As evident in Fig. 6, the intermediate tucks *e* are carried down into flatwise position against the inner faces of the set-up end wall members *d*, while attendantly the terminal or enclosing tucks F are folded down into the desired overlapping relation with respect both to said intermediate tucks *e* and the already inturned corner flaps *c*.

By varying the relative spacing of the two sets of tucking fingers 40 and 50 and by adjusting their angular relation to the axis of the corresponding rock shaft, and to each other, their action may be controlled and predeterminedly set to infold a plurality of individually separate tucks along a given wall, so as to place one or more of the tucks for such wall in a following or superposed relation to another or others. Within the capacity of this successive plural tucking mechanism of the invention, the relative sizes and shapes of the several tucks may vary within a considerable range, for containers of different volume, shape and design.

It will be understood that in the operation of the machine the racks 43 in geared relation to the rock shafts 41 are subjected to rapid lengthwise reciprocation, just after or as the erecting of the main side walls of the blank is effected, whereby the sets of fingers, one predeterminedly following another, are swung in across the vertical plane of the walls and down into the throat to fold the respective flaps down toward the inner vertical faces of the corresponding walls, in the appropriate order and positional relation. The several fingers are immediately reversely withdrawn, clearing the throat for entrance of the former element 38; see Figs. 9 to 12. The descending former 38 supplements the action of the tucking fingers, bringing the inturned flaps tightly against the inner face of the corresponding upright wall of the box and against each other where the flaps are overlapped. While the former 38 is in its position within the erected box, Fig. 12, the movable presser plates 33 are forced in toward each other, thereby insuring adhesive securement of the appropriate contacting glued areas of the blank parts.

My invention is not limited to the particular embodiment as herein illustrated and described, its scope being pointed out in my claims as follows.

I claim:

1. In a paper-box machine for setting up blanks having triple flaps for one or more of the resulting box walls, in combination, wall and presser plates in mutually opposed relation defining a forming throat, plunger means cooperable with said plates to erect the vertical wall portions of the blanks, and tucker means operatively carried by a presser plate for acting on individual flaps of the corresponding blank wall portion, said means including a rock shaft journalled on the presser plate, an inner tucking

finger fixed substantially radially on the shaft to engage and inturn a given flap, and an outer tucking finger carried by the shaft with its free extremity offset angularly behind that of the inner finger to fold another of said flaps into overlapping relation to said given flap.

2. In a machine for setting up box blanks having plural flaps to be infolded at one or more vertical walls of a box, in combination, blank presenting means, wall and presser plates defining a forming throat across which the blanks are successively presented, at least one of the throat plates disposed for erecting engagement with a plural-flap wall of the blanks, a shaft mounted on said throat plate to rock toward and from the throat, and a plurality of tucker fingers spaced along and projecting laterally from the rock shaft, one of said fingers adapted to turn a given flap of the plurality down into the throat, and another of the fingers constructed and arranged to infold another flap of said plurality down onto said given flap.

3. Mechanism for acting on blanks of which one or more walls have plural inturning flaps foldable along spaced lines paralleling the wall base, said mechanism adapted for association with opposed plates defining a forming throat, said mechanism comprising a plurality of tucking fingers along the upper portion of one of such throat plates, an actuating shaft for mounting along such plate for rocking motion toward and from the throat, and means attaching the fingers in laterally projecting positions on the shaft, for movement of one finger angularly in advance of another respectively to engage and inturn in succession different flaps of the same blank wall.

4. In a paper-box machine for setting up blanks of which one or more walls have plural inturning flaps foldable along spaced lines paralleling the wall base, opposed plates defining a forming throat, plunger mechanism movable into and reversely out of the throat to set up the walls of a blank presented across it, said plunger mechanism comprising two independently movable forming elements at times adapted to enter the throat sequentially one or more of the throat plates respectively having each one or more pairs of tucker fingers adapted for rocking motion into and out from the throat, and means for mounting and rocking the fingers of each pair to inturn and retract them for sequential tucking operation of the respective fingers of the pairs and both of them in the interval between throat-entering movement of one of said independently movable forming elements of the plunger mechanism and the sequentially attendant like movement of the other of said forming elements.

5. In a paper-box machine for setting up blanks having triple flaps for one or more of the resulting box walls, including a corner flap and intermediate and outer end flaps, in combination, wall and presser plates in mutually opposed relation defining a forming throat, cam-like folder points adjacent outer corner portions of an oppositely disposed pair of said plates for infolding of corresponding corner flaps, plunger means cooperable with said plates and folder points to erect the vertical wall portions of the blanks and to infold the corresponding corner flaps, and tucker means operatively carried by a presser plate for acting on individual flaps of the corresponding blank wall portion, said means including a rock shaft journalled on the presser plate, an inner tucking finger fixed substantially radially on the shaft to engage and inturn an intermediate end flap, and an outer tucking finger carried by the shaft with its free extremity offset angularly behind that of the inner finger to fold an outer end flap into overlapping relation both to infolded corner flaps and to said inturned intermediate flap.

HORACE W. GREGOIRE.