March 19, 1929. H. BRIDGMAN 1,705,748

METHOD OF MAKING BOXES

Filed Dec. 30, 1926 2 Sheets-Sheet 1

Fig. 1.

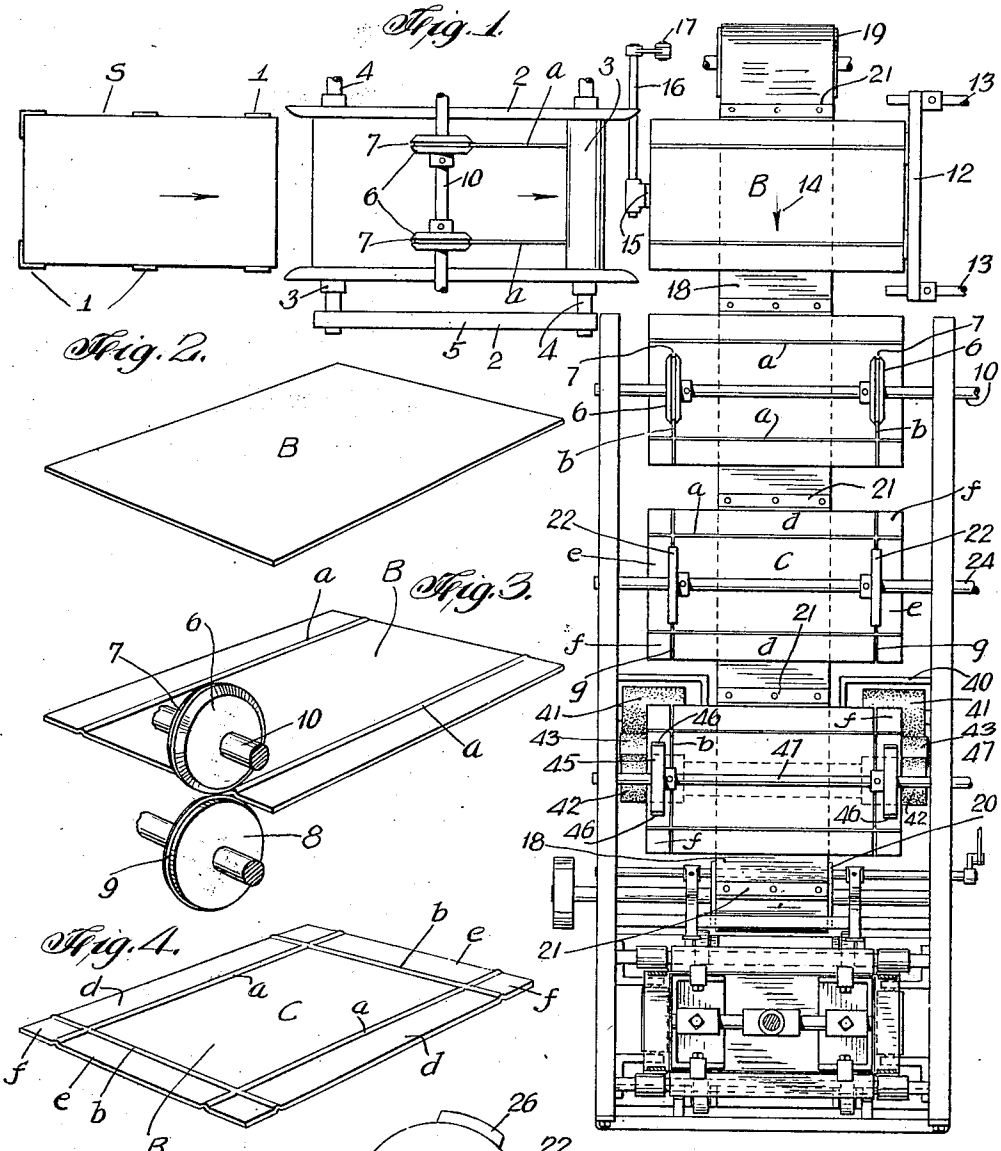


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

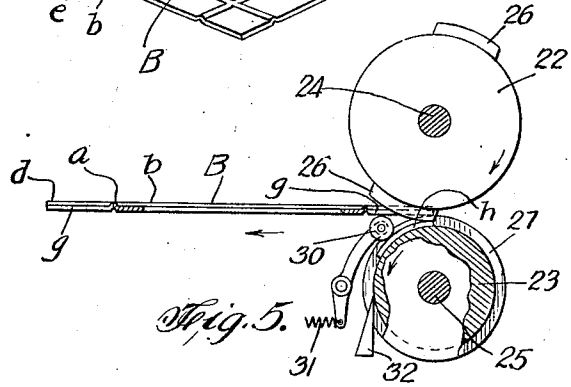
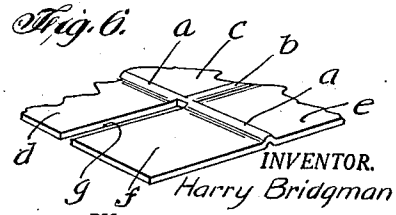


Fig. 6.



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Fig. 7.

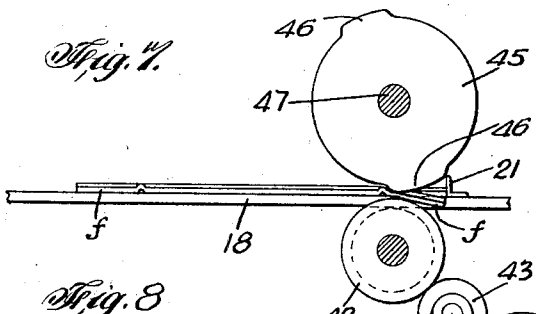
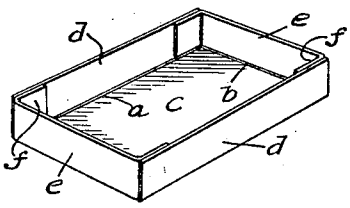


Fig. 12.



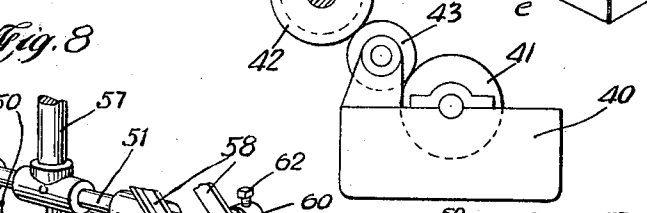


Fig. 8

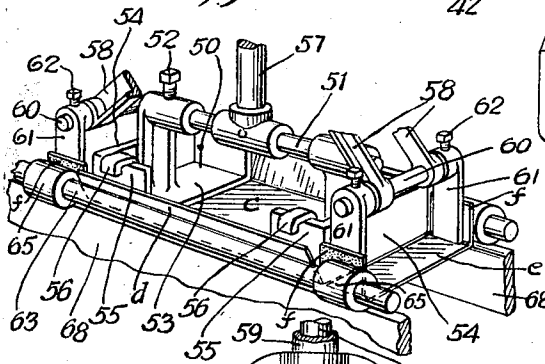
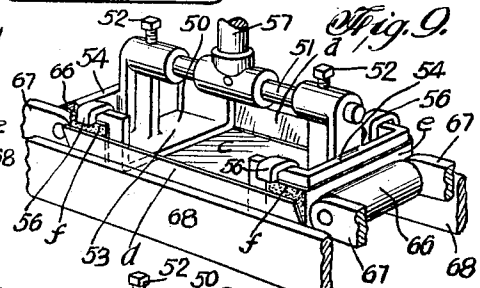
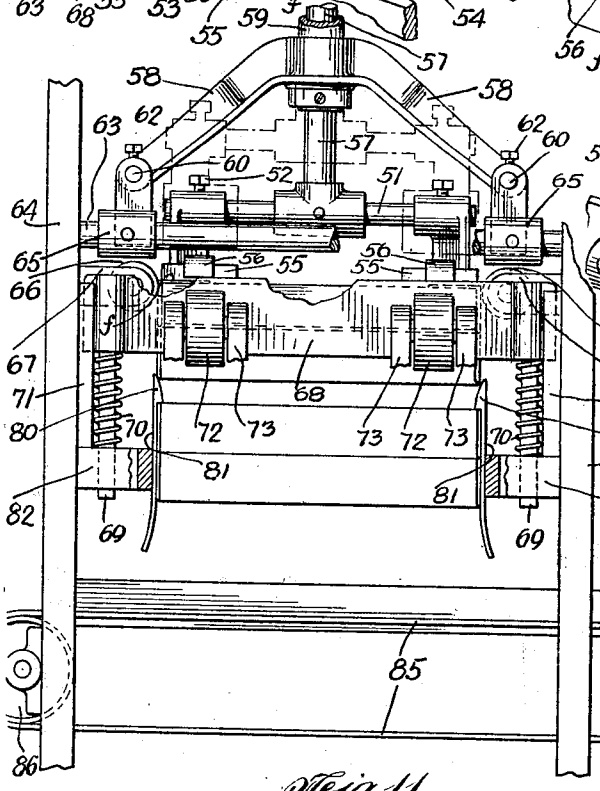


Fig. 9.





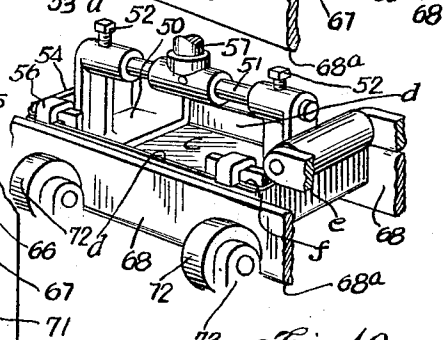


Fig. 10.

Fig. 11.

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Patented Mar. 19, 1929. 1,705,748

UNITED STATES PATENT OFFICE.

HARRY BRIDGMAN, OF NEW YORK, N. Y.

METHOD OF MAKING BOXES.

Application filed December 30, 1926. Serial No. 158,021.

The invention relates to methods of making boxes and especially uncovered box parts suitable for use in that condition or for covering by subsequent stripping and topping operations.

An important object is to provide a method of making boxes which is capable of being carried out by relatively simple and cheap machines which can easily be adjusted for the desired box dimensions either for short or long runs. Although such a machine does not form a part of the present invention, one suitable mechanism for the purpose is illustrated in rudimentary or diagrammatic form and hereafter described sufficiently to enable the method to be understood, as performed in connection with such a machine or otherwise.

Another object is to provide, regardless of mechanism or implements employed, a method of producing complete box parts from originally plain, rectangular blanks, by advancing the blanks practically continuously or through a continuous course of operations, and meantime producing upon them parallel fold formations in one direction of the blank and then other parallel fold formations at right angles to the first ones, cutting the blanks to provide for corner lap separation, gluing selected portions of the blanks, and then folding the blanks to box form in a particular manner which has regard to a preferred corner lap arrangement, pressing the corner formations to insure adhesion of the glued surfaces, and finally disposing of the completed box parts, without interruption of the generally continuous course or advance of the blanks from start to finish, and without requiring any hand operations when the process is carried out with an automatic machine, such as that here shown and described.

The creasing operations involve advancing the blank in two different directions to produce the two differently-directed pairs of parallel creases; the cutting operation includes, preferably, excising narrow strips of the material to effect corner lap separation and provide sufficient clearance to facilitate folding; the gluing operation includes deforming or depressing selected portions of the blank to bring them in contact with gluing elements while application of glue to other blank surfaces is prevented or avoided; and the folding and pressing operations include the bending of the corner laps, side wings and end wings in a particular manner or sequence and then applying heavy and properly equalized pressure to corner formations, and especially to glued blank areas near the corners, this pressure preferably being applied while the folded blanks are being moved toward a discharge point in the general course of movement of the blank from the beginning to the end of the folding and securing stages of the process.

The accompanying drawing shows the blank in its original and successive stages or conditions to explain the performance of the process in one way, and also shows sufficient parts of a representative machine to enable the performance of the process by automatic machine operations to be understood. After considering these examples, skilled persons will understand that variations may be made within the scope of the invention, as sufficiently indicated by the appended claims.

In the drawings:

Fig. 1 is a plan view in diagrammatic form of one suitable automatic machine for carrying out the invention process.

Fig. 2 is a perspective view of a plain blank, that is, one of the rectangular box blanks in its original form.

Fig. 3 shows the blank after parallel fold formations or creases have been produced in one direction thereon, and also shows diagrammatically suitable creasing rolls.

Fig. 4 shows the blank after the other pair of parallel creases have been produced therein.

Fig. 5 shows the blank in transverse section and in relation to slotting devices for effecting corner lap separation.

Fig. 6 shows one corner, enlarged, of the blank after the slotting operation.

Fig. 7 is a fragmentary side elevation, explanatory of the gluing operation.

Fig. 8 shows the movable folding and associated parts of the folding mechanism in an early stage of the folding operations.

Fig. 9 shows these and other parts of the folding and pressing mechanism at a subsequent stage of operations.

Fig. 10 shows parts of the mechanism and the blank after folding is completed and with pressing operation in progress.

Fig. 11 shows the folding and pressing mechanism with the parts in the position which they occupy just after the com-

pleted box has been delivered with drawing or ejecting devices, and while the form and other parts are returning toward the upper or blank receiving position.

Fig. 12 is a perspective view of a completed box part.

An important feature of the invention is its adaptation to the use of plain rectangular blanks, which may easily be arranged in stacks and fed singly therefrom without difficulties ordinarily encountered in properly stacking and feeding cornered or other specially formed blanks, in which the wing or lap formations frequently interlock and interfere with proper feeding.

Fig. 2 shows a suitable rectangular blank B, and Fig. 1 shows at the left, the top of a stack S of such blanks, the stack holder being sufficiently represented by the uprights 1. Suitable individual blank feeding mechanism (not shown) is to be provided. The blank selected for illustration is oblong, and it is first advanced in one direction for the production of two parallel fold formations, and this direction of advance is conveniently that of the longer dimension of the blank, as indicated by the arrows at the top of Fig. 1. In subsequent description the statements in regard to blank dimensions or movements will relate to an oblong blank which is originally advanced lengthwise or in the direction of its greatest dimension, and then is moved at a right angle thereto or sidewise; but evidently these dimensional or directional terms are interchangeable since in some cases the blank may first be moved sidewise and then lengthwise, or if the blank is square, the only significant thing is movement of the blank first in one direction and then at a right angle thereto.

An oblong blank, as shown in Fig. 1, is therefore first advanced lengthwise, as indicated by arrows, between parallel edge guides 2, which may be readily adjusted for different blank widths. Blank advance may be effected by rolls 3 on shafts 4 connected by pulleys in the belt 5, or by a feed belt running on the pulleys 3. During this movement the blank passes between pairs of creasing rolls, each pair including an upper roll 6 having a peripheral groove 7, and a lower roll 8 having a peripheral flange or bead 9 to cooperate with groove 7. The upper rolls 6 are carried by a shaft 10, and the lower rolls 8 by a shaft 11, these shafts being driven in any suitable way to produce the parallel longitudinal bead creases *a*, Figs. 1 and 3. The forward end of the blank after leaving the creasers is brought against a positioning stop bar 12 laterally adjustable on rods 13 to initially position the blank for movement in a new direction, indicated by the arrow at 14, Fig. 1. The proper positioning of the blank is facilitated by an oscillating arm or finger 15 on a shaft 16 provided with a suitable operating linkage 17. After passage of the blank the finger rises and swings horizontally to definitely locate the blank against the stop bar.

As so positioned the blank is located above the upper stretch of a feed belt 18 which runs on pulleys 19 and 20. The belt has pushers 21 spaced apart sufficiently to accommodate blanks of the greatest width contemplated, the blank width now referring to the blank axis parallel to the blank dimension indicated by the arrow 14. Just after the blank is positioned in the manner described, one of the pushers 21 engages its rear edge and the blank is advanced between the second set of creasing rolls, similar to those previously described, the upper rolls only being shown and being identified by the same numerals as in Fig. 3, and in the upper part of Fig. 1. The second set of creasers produce the second pair of bead creases *b*, Figs. 1 and 4. The completely creased blank, as shown in Fig. 4, includes the main or body portion *c*, side wings *d*, defined by creases *a*, end wings *e*, defined by creases *b*, and corners *f*, defined by end portions of two of the crease formations. The blank is next advanced between pairs of slotting rolls, each pair including an upper roll 22, Fig. 5, and a lower roll 23. The upper rolls 22 are carried by a shaft 24, Figs. 1 and 5, and the lower rolls 23 are carried by a shaft 25. The upper rolls have oppositely located slotting segments or cutters 26 which co-operate intermittently with a channel 27 in the corresponding lower roll 23. The upper rolls are positioned and the cutters 26 thereon are dimensioned and arranged in accordance with blank dimensions so that as the blank is advanced between the rolls the cutters 26 co-operate with the channels 27 to produce the slots *g*, Figs. 1 and 6. The slots are produced by excision of narrows strips *h*, Fig. 5, these consisting substantially of end portions of the crease formations *b* extending from the creases *a* to the outer edges of the blank and thus converting the blank corners *f* into corner laps *f* extending from the end wings and separate from the side wings. To insure removal of the slot strips *h* from the blank, rolls 30 may be provided, running in the lower roll channels 27 and acted upon by springs 31. These rolls co-operate with the lower cutter rolls 23 to grasp the leading end of each excised strip and pull it away from the blank as the strip is progressively severed. Ejector blades 32 may also be provided, running in the grooves 27, to discharge the severed strips therefrom.

The blank is now passed over gluing mechanism, which includes, for each end of the blank, a glue pot 40, Figs. 1 and 7, a dip-

per roll 41 therein, and a glue applying roll 42, which may be in contact with the dipper roll, or another or transfer roll 43 may be interposed. As the blank passes over the glue rolls 42 it is in practically flat condition and its lower face is maintained by the upper stretch of the feed belt 18 in a plane substantially, say approximately 1/8" (more or less), above the upper faces of the glue rolls. In this way portions of the blank which project laterally beyond the feed belt and over the glue rolls are prevented from coming in contact with the glue rolls, except selected portions, which, in the present example, are the under faces of the corner laps *f*. To provide contact of these corner lap faces with the glue rolls, a cam roll 45 is provided for each end portion of the blank. Each cam roll has cams or lobes 46 oppositely located, and the roll is of proper diameter and the lobes of proper arcuate length to agree with the blank and corner lap dimensions. The cam rolls are carried by a shaft 47 which is driven at such a speed that, as the blank passes, the lobes 46 depress the corner laps and bring their under faces in contact with the glue rolls which apply glue thereto. Thus, in Fig. 7, if the blank is moving to the left, the upper lobe 46 has already depressed and glued the left hand corner lap *f*, and the lower lobe has come in contact with the right hand or rearward corner lap and has depressed the lap, which easily bends at its fold formation. The lobe continues to hold the lap in depressed condition, in contact with the glue roll, until the lap is entirely glued, and then the lobe passes away from contact with the blank and the lap springs back entirely or approximately to normal position. Intermediate blank portions, that is, the end wings, are not depressed and do not come in contact with the glue rolls.

All of the creasing and slotting devices may readily be adjusted for different blank dimensions and crease or slot positions. Thus the creasing rolls 6 and 8 have hubs provided with set screws, as shown for the upper rolls 6, in Fig. 1, and in this way the rolls may easily be moved lengthwise of their shafts and secured by setting up the screws. Similar provision is made for the slotting rolls and the cam rolls.

The completed and glued blank is now advanced by the feed belt to its initial position in the folding mechanism, most parts of which are shown in plan at the lower end of Figs. 1, and 8 to 11 inclusive, inner box end forms 50 mounted on a horizontal bar 51 and secured in adjusted positions thereon by set screws 52. Each form has a bottom wall 53, an end wall 54 and side walls 55 with lugs 56 projecting from upper portions thereof. The forms are supported and moved vertically by a plunger 57 connected to the center of bar 51. A framework 58 has a central sleeve 59 through which form plunger 57 passes, and this sleeve is vertically movable to position the framework, the end portions or arms of which supports bars 60, on which corner lap folding blades 61 are adjustably mounted by means of set screws 62 engaging the bars. To act as turning or folding members for the blank side wings, bars 63 are supported in the main frame of the folding mechanism, which includes uprights 64, Fig. 11, these bars being parallel to the side walls 55 of the forms and spaced somewhat outward therefrom, as best shown in Fig. 8. Adjustably mounted on these bars are corner lap turning or folding rolls 65. Below the bars 63, end wing turning or folding rolls 66 are located parallel to the form end walls 54, and spaced slightly therefrom, these rolls being supported by lugs or brackets 67. Pressing plates 68 are arranged for vertical movement parallel to the former side walls 55. These plates are guided by ways 71 on vertical frame members 64 and are yieldingly supported by springs 70 placed about plungers 69, which are guided by holes in a horizontal frame member 82. The ways 71 provide enough clearance for slight lateral movement of the plates. In their upward positions the upper edges of the plates are close to bars 63. When the plates move down in co-operation with the forms and a box blank thereon, they co-operate with pressing rolls 72, which are supported by brackets 73 to apply pressure to the box corner laps and the overlying side wings, as more fully explained below. The lower edges of the plates are tapered, as at 68^a to facilitate their entry between the rolls and the forms as the plates move down along with the form, and the rolls are set so that when the plates come in contact with their inner faces and pass downward, heavy pressure is applied by the rolls through the plates to the underlying box parts supported by the form side walls 55. The rolls are adjustable axially to suit different box dimensions. At a certain point in the descent of the forms under the control of plunger 57, lugs 56 above identified, strike the upper faces of the pressure plates 68 and move the plates down along with the box and forms. Below the level of the pressing plates any suitable box-engaging devices are provided to eject or strip the completed box parts from the forms. Such means is sufficiently represented by hooks 80 carried by spring blades 81 secured to frame members, such as 82. After the box is folded and pressed, it is moved down between the hooks 80, the supporting blades spring outward to permit box entry, and then the hooks spring back to engage the upper wall edges of the box and strip it from the form as plunger 57 rises. If the blades are arranged as shown, of suffi-

cient depth to contain more than one box, each successive box will move the preceding one farther down, and finally the lowermost box will drop upon a transversely running carryoff belt 85, Fig. 11, this belt being supported by pulleys 86 and driven in any convenient way.

As each blank leaves the gluing position, it is brought below the bottom walls 53 of the forms 50 while the latter and their plunger 57 are in an upper position, somewhat higher than that indicated in Fig. 8. The plunger and forms are then moved downward and simultaneously frame 58, with its corner lap folders 61, is moved downward so that the bottom form surfaces engage the central portion or body of the blank near its ends, and the lower ends of the folding blades engage the corner lap creases. The plunger 57 and frame 58 then descend without change of their relative positions, to the position of Fig. 8. Just before reaching this position the horizontally projecting corner laps encounter the upper faces of rolls 65 and the horizontally projecting side wings *d* encounter the turning bars 63. Then as the forms and folding blades move to the position of Fig. 8, the corner laps are turned up vertically, being properly bent at the fold lines under the control of the folding blades, and are pressed against the vertical faces of the folding blades, while the side wings are turned up to an angular position, which may be nearly, but not quite, vertical. The angularity is sufficient to provide clearance for the entry of the corner laps between the side wings and the outer faces 55 of the forms. The forms are then moved farther downward while frame 58, with the corner lap folding blades 61 is kept stationary or moved upward. The horizontally projecting end wings *e* then engage the upper faces of rolls 66, which fold these wings upward to vertical position and at the same time cause the folded corner laps to move in an arcuate path between the end portions of the side wings and the side walls 55 of the forms. The final positions of the end wings and corner laps are shown in Fig. 9. At this time the lower portions of the side wings have been brought somewhat within the upper inward faces of the pressing plates 68, and in further downward movement toward the position of Fig. 10, the side wings are moved slightly farther inward to vertical position in contact with the glued faces of the corner laps. The forms and blank continue to move downward in relation to the pressing plates until the entire areas of the blank side walls are located opposite inner faces of the plates, and just after this lugs 56, as above mentioned, strike the upper faces of the pressing plates and the forms, box and plates are thus caused to move down together with heavy pressure provided by the pressing rolls 72 applied through the plates to the end portions of the side wings and the underlying corner laps. This pressure causes the fibers of the respective box parts to be pressed tightly together, and the glue is forced into the fibers to provide very effective adhesive connection during the downward movement of the forms and box, and without any delay which would otherwise be required to maintain the forms in stationary position while pressure could be applied by such mechanism as toggles. In some cases the roll faces may be applied directly to the box side wings, but in other cases it is preferred, as shown, to apply the roll pressure indirectly through plates, such as 68. In this way, instead of a mere line pressure upon the descending box walls, pressure is mantained over the entire wall areas during passage between the rolls. Also, at the same time the plates provide substantially equalized pressure on the respective box end structures, and the central portions of the plates overlying the central portions of the box walls prevent any bulging of such walls which might otherwise be produced by the greater pressure applied to the ends thereof.

The plunger 57 with its forms, is then moved downward clear of the pressing plates, and the box is ejected or removed by the hooks 80, in the manner previously described. The plunger is then raised, returning the forms to original position while the pressing plates are elevated by their springs 70. These operations are repeated automatically and indefinitely as the glued banks are supplied at the initial position in the folding mechanism.

The completed boxes or box shells are thus rapidly and automatically produced, ready for use, or for covering by stripping and topping or other operations, and without the necessity for corner staying.

I claim:

1. A method of making set-up box shells from initially plain, rectangular uncornered shell blanks, comprising advancing successive blanks in one direction and during such advance producing parallel fold formations therein defining side wings, then moving the blanks successively in another direction and during such movement producing other parallel fold formations defining end wings and corner portions, slitting the blanks along the lines of certain of the fold formations to convert the corners into corner laps foldably connected to the end wings and separated from the side wings, moving the blanks adjacent glue appliers and depressing certain portions of the blanks to cause application of glue thereto, the glued areas providing for connection of the corner laps to faces of the side wings, the blanks being

meantime controlled to avoid glue application to other blank areas, folding the corner laps substantially at right angles to the end wings and central blank portion and folding the side wings and locating them in nearly vertical positions suitable for movement of the corner laps to positions confronting inner faces of the side wings, folding the end wings to vertical position and simultaneously moving the corner laps to positions confronting end portions of the side wings, and pressing end portions of the side wings in contact with the corner laps to secure the blank in box form by adhesion of the glued areas.

2. A method of making set-up box shells from initially plain, rectangular uncornered shell blanks, comprising advancing successive blanks in one direction and during such advance producing parallel fold formations therein defining side wings, then moving the blanks successively in another direction and during such movement producing other parallel fold formations defining end wings and corner portions, cutting the blanks along the lines of certain of the fold formations to convert the corners into corner laps foldably connected to the end wings and separated from the side wings, moving the blanks adjacent glue appliers and depressing certain portions of the advancing blanks to cause application of glue thereto, the glued areas providing for connection of the corner laps to faces of the side wings, the blanks being meantime controlled to avoid glue application to other blank areas, folding the corner laps substantially at right angles to the end wings and central blank portion and folding the side wings and locating them in nearly vertical positions suitable for movement of the corner laps to positions confronting inner faces of the side wings, folding the end wings to vertical position and simultaneously moving the corner laps to positions confronting end portions of the side wings, and applying pressure to entire end areas of the side wings to secure the corner laps and superposed wing areas together.

3. A method of making set-up box shells from initially plain, rectangular uncornered shell blanks, comprising advancing successive blanks in one direction and during such advance producing parallel fold formations therein defining side wings, then moving the blanks successively in another direction and during such movement producing other parallel fold formations defining end wings and corner portions, slitting the blanks along the lines of certain of the fold formations to convert the corners into corner laps foldably connected to the end wings and separated from the side wings, moving the blanks to cause application of glue to the corner laps, the glued areas providing for connection of the corner laps to faces of the side wings, the advancing blanks being meantime controlled to avoid glue application to other blank areas, folding the corner laps substantially at right angles to the end wings and central blank portion and folding the side wings and locating them in nearly vertical positions suitable for movement of the corner laps to positions confronting inner faces of the side wings, folding the end wings to vertical position and simultaneously moving the corner laps to positions confronting end portions of the side wings, and applying equalized pressure over the entire areas of the side wings underlaid by the corner laps during movement of the blank to secure the corner laps and side wings together.

4. A method of making set-up box-trays from initially plain, rectangular uncornered blanks, comprising advancing successive blanks in one direction, and during such advance producing parallel fold formations therein defining side wings, then moving the blanks successively in another direction and during such movement producing other parallel fold formations defining end wings and corner portions, cutting the blanks along the lines of certain of the fold formations to convert the corners into corner laps foldably connected to the end wings and separated from the side wings, advancing the blanks to cause application of glue to the corner laps, the glued areas providing for appropriate connection of the corner laps to inner faces of the side wings, the advancing blanks being meantime controlled to avoid glue application to other blank areas, and then folding the thus formed blanks each into the form of set-up box-trays.

5. A continuous method of making a set-up box tray from a rectangular uncornered blank, which consists in advancing the blank and forming therein longitudinal and transverse fold formations and slitting certain of such formations to provide the blank with integral side and end wings, two of which have a corner lap at each end, partially bending the opposed wings at an angle to the blank body to cause the outer faces of the corner-laps to lie opposite the inner faces of the previously partially bent wings, then supporting the outer faces of the last-named wings and finally bodily moving the thus folded and supported blank and imparting a squeezing pressure to the wings and the overlapping corner-laps during such movement to set the blank into the form of a box tray.

6. A continuous method of making a set-up box tray from a rectangular uncornered blank, which consists in advancing the blank and forming therein longitudinal and transverse fold formations to provide the

blank with integral side and end wings two of which have a corner lap at each end, partially bending two opposed wings at an angle to the blank body, then bending the corner-laps at right angles to their wings, moving the wings with their corner-laps at right angles to the blank body to cause the outer faces of the corner-laps to lie opposite the inner faces of the previously partially bent wings, then confining the inturned corner-laps and their associated wings between rigid supporting members and bodily moving the thus confined blank portions together with their supporting members and imparting sustained lateral pressure thereto during such movement to set the blank into the form of a box tray.

Signed at New York city, in the county of New York and State of New York, this 24th day of December A. D., 1926.

HARRY BRIDGMAN.