April 23, 1940. C. R. SWAFFORD 2,198,094

METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

Filed March 9, 1939 5 Sheets-Sheet 1

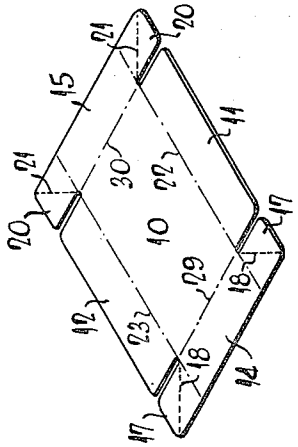


Fig. 1

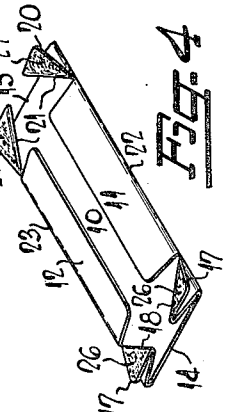


Fig. 4

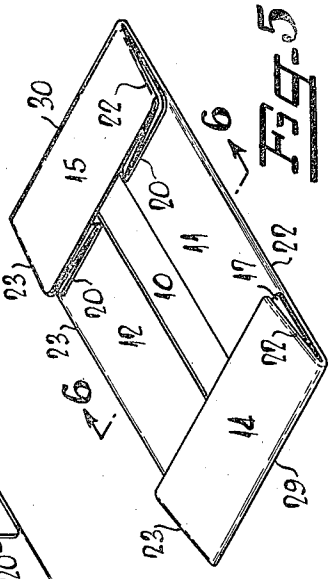


Fig. 5

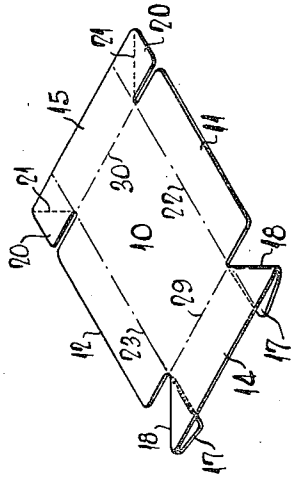


Fig. 2

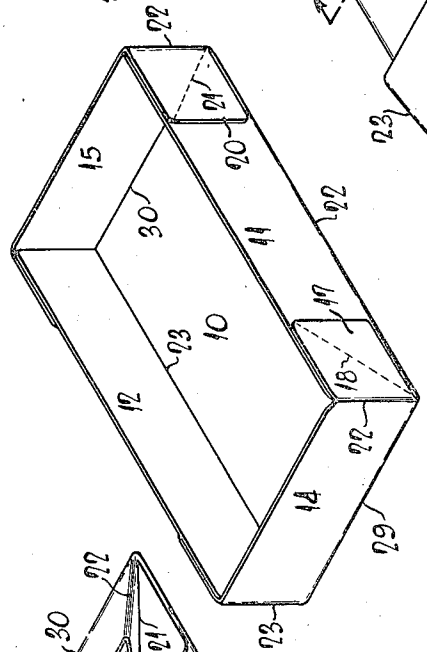


Fig. 7

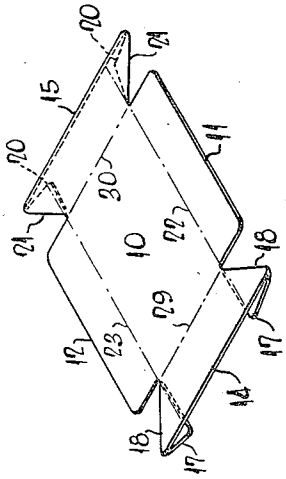


Fig. 3

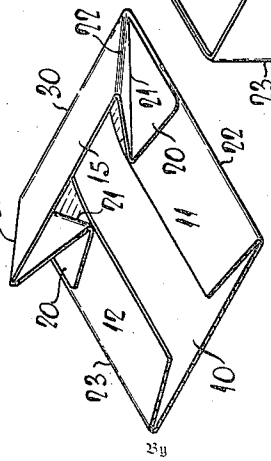


Fig. 6

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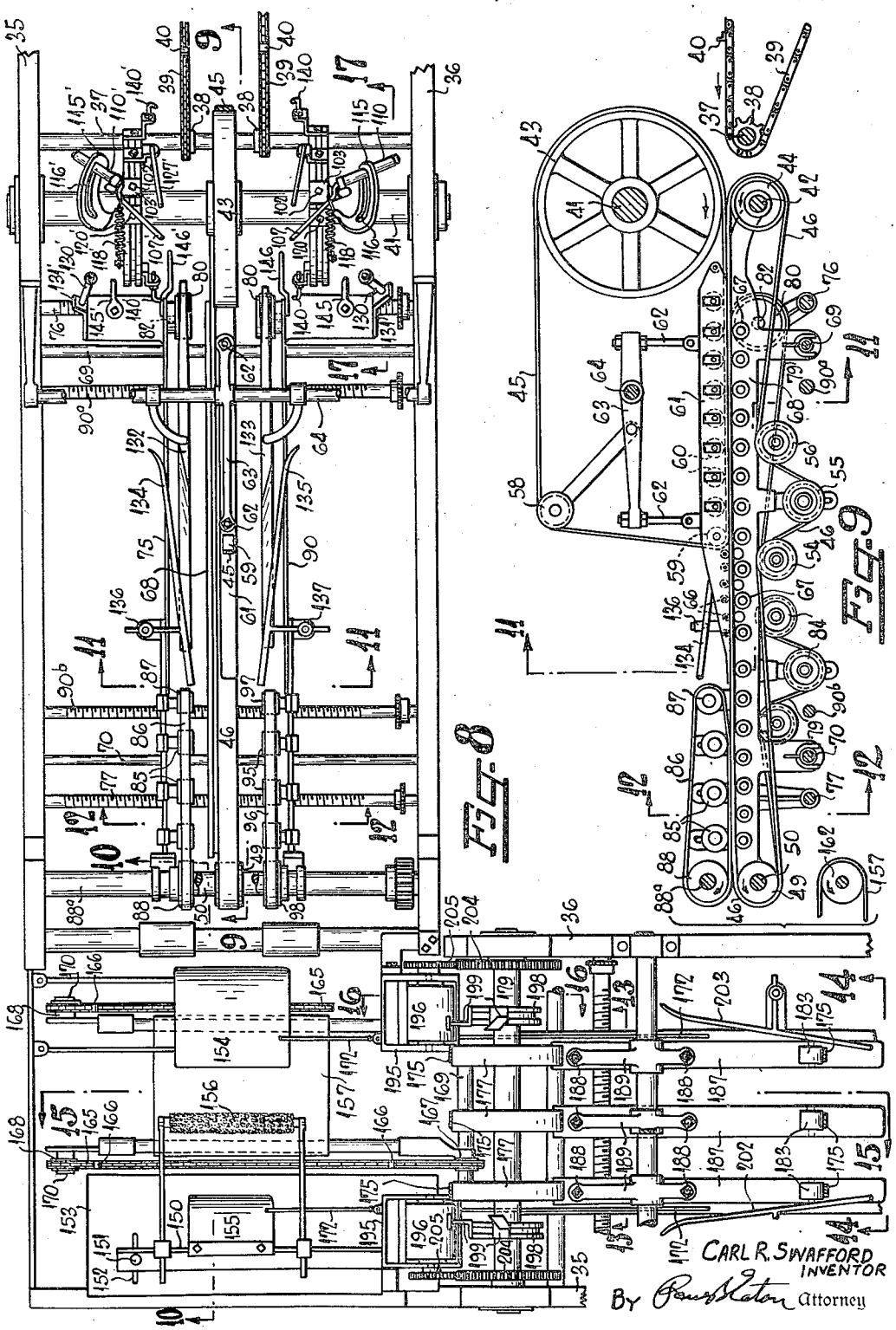
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METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

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METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

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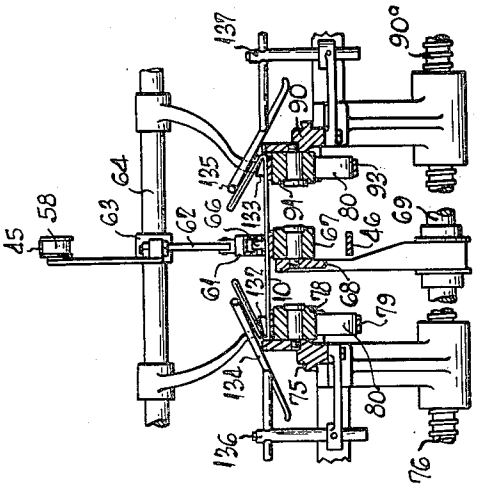


Fig. 11

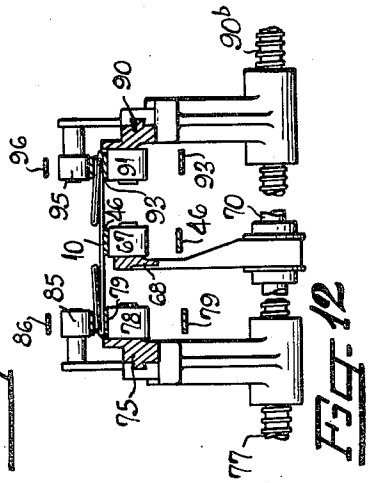


Fig. 12

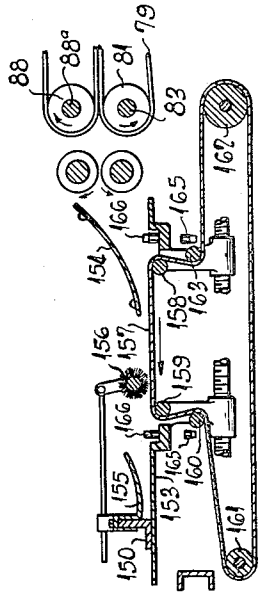


Fig. 10

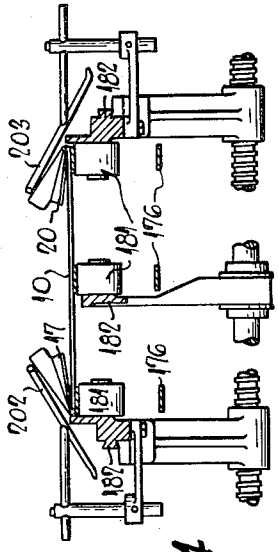


Fig. 14

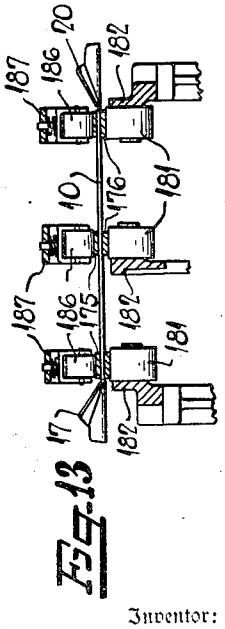


Fig. 13

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METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

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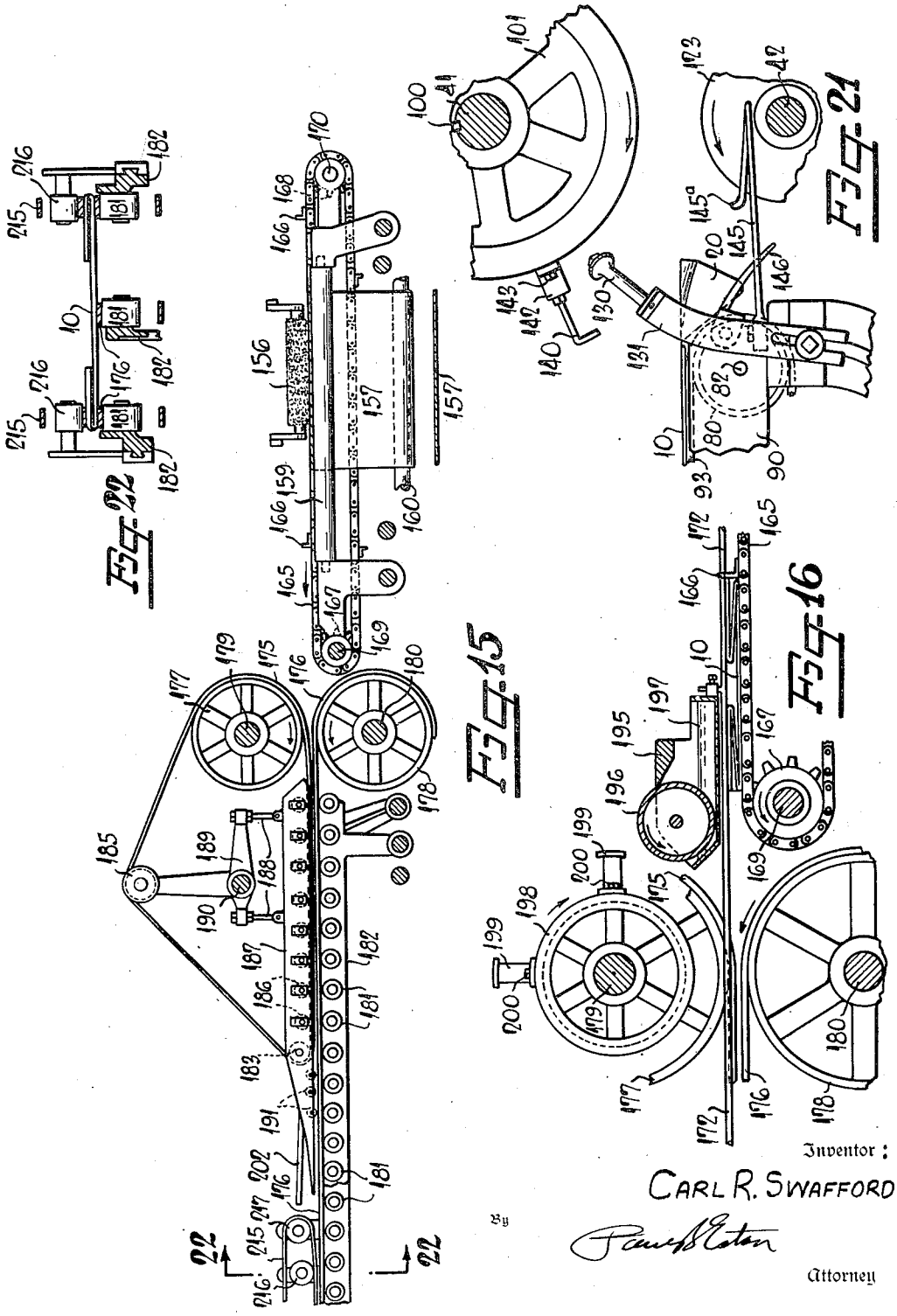


Fig. 22

Fig. 15

Fig. 16

Fig. 21

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METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

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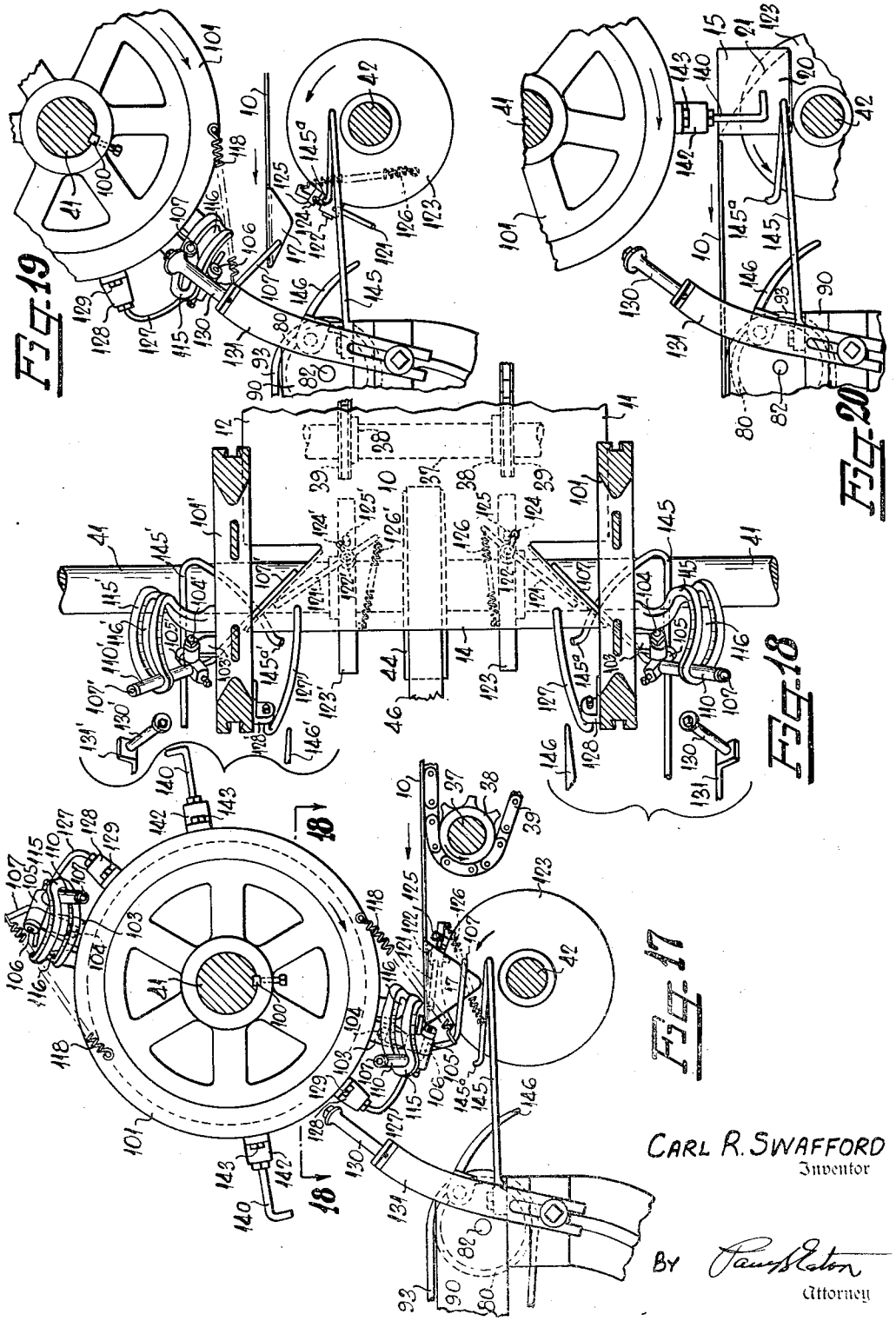


Fig. 19

Fig. 20

Fig. 18

Fig. 17

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Patented Apr. 23, 1940 2,198,094

UNITED STATES PATENT OFFICE

2,198,094

METHOD AND APPARATUS FOR MAKING COLLAPSIBLE BOXES

Carl R. Swafford, Charlotte, N. C., assignor to Old Dominion Box Company, Lynchburg, Va., a corporation of Virginia

Application March 9, 1939, Serial No. 260,794

16 Claims. (Cl. 93—49)

This invention relates to a method and means for making collapsible boxes whose side walls and end walls can be folded inwardly in planes substantially parallel to the bottom thereof, so that the boxes will occupy a minimum amount of space. More specifically, it relates to a method and means for making boxes of this type with great rapidity. The box comprises a bottom and a pair of parallel side walls and a pair of parallel end walls, the end walls having over-lapping tabs secured to the exterior of the side walls, each end of said tabs also having an oblique crease therein to allow said walls to simultaneously collapse inwardly to a folded position. The novel apparatus comprises means for quickly folding these end tabs along this oblique crease line during the formation of the box, from a stamped body blank.

It is, therefore, an object of this invention to provide a method of manufacture of a box which comprises moving a stamped body blank longitudinally of its center line through a machine, folding end wall tabs upon themselves along diagonal crease lines, folding said side walls inwardly then moving the box transversely, applying spots of glue to the exterior of said tabs, then folding the ends walls and the creased tabs upon the side walls to thereby form a collapsed box.

It is another object of this invention to provide a mechanism which will quickly and efficiently fold the end wall tabs of a box along diagonal creases or perforations in such a manner that these tabs may be adhesively or otherwise secured to the exterior of the side walls when the box is subsequently formed. Heretofore, it has been impossible to manufacture boxes of this type with great rapidity, due to the inability of machines to quickly and properly crease these end tabs. The present invention comprises a creasing means which will perform this task efficiently and rapidly and thereby enable the manufacturer to produce the box in great quantities. A box made in accordance with this pattern contains a minimum amount of material per unit volume.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

Figure 1 is an isometric view of a pre-cut body blank for use in the apparatus and upon which the method is adapted to be carried out;

Figure 2 is an isometric view of this same blank showing the first operation performed in making of the box;

Figure 3 is a view showing this blank after a second operation has been carried out, where it will be noted that all of the end tabs have all been folded upon themselves;

Figure 4 is an isometric view showing this body blank after the third and fourth operations, in which the side walls and the ends of the end walls have been folded inwardly, and glue spots have been applied to the tabs;

Figure 5 is an isometric view showing the box after the fifth operation has been performed in which the box is shown constructed in a collapsed position;

Figure 6 is a sectional isometric view taken along the line 6—6 in Figure 5 but showing the box in a partially opened position;

Figure 7 is an isometric view of the box fully opened;

Figure 8 is a plan view with parts in section of a machine upon which the box shown in Figures 1 and 7 may be manufactured;

Figure 9 is a longitudinal sectional view taken along the line 9—9 in Figure 8;

Figure 10 is a longitudinal sectional view taken along the line 10—10 in Figure 8;

Figure 11 is a transverse vertical sectional view taken along the lines 11—11 in Figures 8 and 9, with portions of shafts 69, 76 and 90*a* broken away;

Figure 12 is a transverse sectional view taken along line 12—12 in Figures 8 and 9, with portions of shafts 70, 77 and 90*b* being broken away;

Figure 13 is a vertical sectional view taken along the line 13—13 in Figure 8;

Figure 14 is a vertical sectional view taken along the line 14—14 in Figure 8;

Figure 15 is a vertical sectional view taken along the line 15—15 in Figure 8;

Figure 16 is an enlarged vertical sectional view taken along the line 16—16 in Figure 8 showing the glue applying means;

Figure 17 is an enlarged vertical sectional view taken along the line 17—17 in Figure 8, showing the apparatus for creasing the leading end of the tabs along their oblique crease lines;

Figure 18 is an enlarged sectional plan view taken along the line 18—18 in Figure 17;

Figure 19 is a view similar to Figure 17 but showing the parts in a slightly more advanced position during the creasing of the leading end wall tabs;

Figure 20 is a view similar to Figure 19 but

showing the parts in a still farther advanced position with the trailing end tabs being creased;

Figure 21 is a sectional view showing the parts in a still farther advanced position than shown in Figure 20, at which time the final creasing operation is being performed on the trailing end tabs;

Figure 22 is a sectional view taken along line 22—22 in Figure 15 showing the final operation during the formation of the box in which the end walls and glued tabs are held in folded and compressed position.

Referring more particularly to the drawings, the numeral 10 denotes a stamped body blank made of any suitable material such as cardboard or the like upon which the novel apparatus is adapted to operate, and upon which the novel method is carried out. This blank has side portions which later become side walls 11 and 12 and also has other portions which later become end walls 14 and 15. The forward portion 14 has tabs 17 integral with each end thereof, these tabs being joined to the ends of the foremost end walls along perforated oblique lines 18. Likewise, the trailing portion 15 has tabs 20 secured thereto along oblique perforated lines 21. In order to fully understand the invention, the method of forming this box will be first described.

Operation No. 1

By referring to Figure 2 it is seen that the foremost end tabs 17 are first creased along the diagonal perforated lines 18 by a suitable apparatus which will be presently described. This blank is moved along a line passing through its longitudinal center line and suitable fingers are moved downwardly to crease these tabs. As the blank is moved to the left the tabs finally assume the folded position shown in Figure 2.

Operation No. 2

The blank 10 is then again moved along a line passing through its longitudinal center line. When the trailing end tabs 20 reach a predetermined point, they are pushed downwardly by a suitable apparatus which eventually folds them along the perforated crease lines 21 until they assume the position shown in Figure 3. It will be noted that the leading tabs 17 are folded in the same direction in which the blank is travelling; whereas the trailing tabs 20 are folded in an opposite direction from the direction which the blank travels.

Operation No. 3

As the blank 10 continues to be moved sidewise the portions 11 and 12 and the ends of each of the end portions 14 and 15 are folded inwardly along lines 22 and 23, forming side walls 11 and 12. These bend lines are dot-dash in Figures 1, 2 and 3. The tabs 17 and 20 are then disposed with the contact faces upwardly. With the box thus folded it is held in a compressed position with practically all of its layers in substantially parallel planes.

Operation No. 4

Operations 1, 2 and 3 are carried out while the blank 10 moves longitudinally to the left. After the creasing along the lines 22 and 23 has been effected, the longitudinal movement of the blank 10 ends. At this time certain apparatus is brought into play to move the box substantially at right angles to its longitudinal axis. Operations 4 and 5 are carried out while the blank is moving transversely of a line passing through the longitudinal axis or toward the observer in the lower left hand corner of Figure 8. The fourth operation comprises the application of glue spots 26 and 27 to the exposed faces of tabs 17 and 20. These tabs with the glue applied, are now ready to be folded against the exterior of the side walls 11 and 12.

Operation No. 5

After the glue spots have been properly applied, the box continues its travel along a line passing through its transverse axis. Then suitable mechanism is brought into play whereby the portions 14 and 15 together with the tabs 17 and 20 will be folded inwardly along dot-dash lines 29 and 30 to form the end walls at which time the glued tabs will be pressed against and thereby secured to the exterior of the side walls 11 and 12. With the completion of operation 5, the box is completed in a collapsed position. It is only necessary to open the collapsed side walls to bring the box to the partially opened position shown in Figure 6 and then to a completely opened position as shown in Figure 7.

The mechanism employed in carrying out the method which has been enumerated in operations 1 to 5 inclusive, constitutes an improvement over the patent to Staude, No. 1,104,013 of July 21, 1914. The creasing of the side walls, that is operation 3, can be carried out by the structure disclosed in this patent. However, since it is necessary to entirely remodel the machine in order to perform the operations 1, 2 and 4 and 5, a complete description will be made.

The numerals 35 and 36 designate the side frames which support the machinery for creasing the end tabs and folding the side walls. Between these frames is mounted a shaft 37 upon which sprockets 38 are secured, said sprockets being adapted to carry chains 39 which have projections 40 secured thereon at spaced intervals (Figures 8, 9 and 17). The top portions of the chains 39 move to the left in Figures 8 and 9 to cause the projections 40 to deliver blanks 10 in timed relation to the operation of the creasing and folding machinery. The chains 39 and 40 are also mounted on the sprocket wheels, not shown, to form a suitable feeding mechanism for the blanks 10.

Disposed also between the side frames 35 and 36 are super-posed shafts 41 and 42, which have secured to the central portion thereof superposed wheels 43 and 44 respectively (Figures 8 and 9). Wheel 43 rotates in a clockwise direction and wheel 44 rotates in a counter-clockwise direction, as viewed in Figure 9. The peripheries of these wheels are separated sufficiently to provide space for belts 45 and 46 to be disposed therebetween, and also to provide space for the blanks 10.

By referring to Figure 9, it will be seen that a belt 45 is mounted on wheel 43 and a belt 46 is mounted on the wheel 44. The lower layer of belt 45 moves directly above the upper layer of belt 46. It is between these belts that the blanks 10 are conveyed.

The lower belt 46 also is mounted upon a pulley 49 which is disposed upon transverse shaft 50, said shaft having its ends journaled in the side frames 35 and 36 (Figures 8 and 9). The lower layer of the belt 46 also is adapted to pass over intermediate tightener pulleys 54, 55 and 56.

The upper belt 45 which cooperates with the

lower center belt 46 in conveying the blanks 10 also passes over a tightener pulley 58 and a roller 59. The lower periphery of the roller 59 is so disposed that it will hold the lower left-hand side of the belt 45 in close proximity to the top of the upper layer of belt 46, thereby affording a considerable length in which the belts will clamp the body blank 10, therebetween along its longitudinal center line and cause it to move to the left in Figure 9 as the proximate portions of these belts move in the same direction. The lower layer of belt 45 supports, between the wheel 43 and the roller 59, intermediate rollers 60 which rollers are disposed in slots in a bar 61 which, in turn, is suspended by means of hanger rods 62. These hanger rods are secured to the ends of a lever 63 which is pivotally supported by a transverse shaft 64. The bar 61 has a plurality of smaller rollers 66 in the extreme left-hand end thereof which are slightly removed from the upper part of the bottom belt 46. The rollers 66 serve to hold the blank 10 downwardly against belt 46.

Likewise, the upper portion of the bottom belt 46 is supported in its proper position by a plurality of rollers 67 which are secured to center rail 69. This rail is supported by transverse shafts 69 and 70, which, in turn, are disposed between the side frames 35 and 36, (Figures 1, 9, 11 and 12).

The lower side track on the far side in Figure 8, is designated by the reference character 75. The ends of this track are supported by threaded shafts 76 and 77 which, in turn, are mounted between the side frames 35 and 36, (Figures 11 and 12).

The inner surface of track 75 has rollers 78 secured thereto which support the intermediate portion of the upper layer of side belt 79, said side belt having its right-hand end mounted around a pulley 80 (Figures 8 and 9), and its right-hand end mounted around a pulley 81 (Figure 10). The pulley 80 is rotatably secured as at 82 to the right-hand end of track 75, whereas the pulley 81 is fixedly secured to a transverse shaft 83.

Disposed over the left-hand end of the belt 79 (Figures 9, 10 and 12) is a plurality of rollers 85 which rest on the upper surface of the lower layer of a belt 86, said belt being also mounted around pulleys 87 and 88, the pulley 88 being fixed on shaft 88*a*, (Figure 9). Although the belt 86 appears to be directly above the center belt 46 in Figure 9, this is not the case, but the belt is disposed farther over as will be seen in Figure 8 and at a point directly above the belt 79 on the far track 75. The purpose in providing the additional belt 86 is to have means for assisting the lower left-hand end of side belt 79 in moving the folded box to the left after it passes out from beneath the center belt 45.

A track 90 is disposed on the near side of the center track 68 which is substantially of the same construction as the track 75 previously described and is supported by shafts 90*a* and 90*b*. This track has a plurality of rollers 91 secured thereto (Figures 11 and 12) over which is adapted to pass the top layer of a belt 93. This belt 93 is also adapted to pass over suitable pulleys such as 80 and 83 previously described, and which are disposed at the extremities of the belt. The pulley 80 is rotatably mounted on the right hand end of the track 90 whereas the pulley 83, which supports the left-hand extremity of the belt 93, is disposed upon the shaft 81 in a similar manner to that shown in Figure 10.

Cooperating with the left-hand portion of the belt 93 are suitable rollers 95 which press against the top side of the lower layer of a belt 96, said belt 96 being also mounted around end rollers 97 and 98 (Figures 8, 9 and 12). Therefore, it is seen that the belts 86 and 96 are mounted substantially in the same manner and are adapted to cooperate with belts 79 and 93, respectively, disposed therebelow. These belts provide clamping surfaces between which the side edges of the box blank are adapted to pass.

The shaft 41 has adjustably secured thereto by means of keyway 100, suitable wheels 101 and 101'. These wheels 101 and 101' have means associated therewith for creasing the leading tabs 17 and the trailing tabs 20 of blank 10. The structure on wheel 101' is identical to that shown on wheel 101 except that it is opposite hand; consequently only a description of the parts associated with wheel 101 will be made and similar parts associated with wheel 101' will be given like reference characters with the prime notation added. Secured to the periphery of this wheel 101 as at 102 is a bracket 103 (Figures 17 and 18). Pivoted to the bracket 103 as at 104 is another bracket 105. Pivot 104 is substantially radial with respect to the wheel 101 and the bracket 105 has limited rotative movement about this point. The bracket 105 has a transverse bore therein which is substantially at right angles to the longitudinal axis of bolt 104. Through this transverse bore, a bolt 106 extends which bolt supports the intermediate portion of a finger 107. The upper end of the finger 107 has a sleeve 110 mounted thereon, whereas the lower end of the finger extends downwardly and then diagonally toward the center line of the machine in the manner shown in Figures 17 and 18. A closed cam bracket 115 is secured to wheel 101 as at 120 and is provided with a slot 116 therein for encircling the center of sleeve 110 on the upwardly extending portion of finger 107 and holding it in the position shown in the lower portion of Figures 17 and 18. This gives a universal mounting to finger 107. This sleeve and its associated portion of finger 107 is normally held in the left-hand extremity of the slot 116 by means of a tension spring 118, said tension spring having one end secured to the intermediate portion of the finger 107 and its other end secured to a wheel 101.

As the wheel 101 rotates in a clockwise manner in Figure 17, the blank 10 is advanced by means of chains 39 and projections 40 so that the leading end of the blank will pass directly beneath the wheel 101. Of course, as the wheel moves to the position shown in Figures 17 and 18 the lower end of the finger 107 will move downwardly to cause the leading tab 17 to be creased along the perforated line 18. This is what constitutes previously described operation No. 1.

It is also necessary for the leading end of the blank 10 to be supported on the lower side along a line adjacent the crease line while the finger 107 is moving downwardly to perform its function. Therefore, a finger 121 has been provided which is pivoted as at 122 to the periphery of wheel 123 on shaft 42. A screw 124 and a projecting pin 125 are provided to limit the counterclockwise movement of this finger in Figure 18 due to the tension exerted by tension spring 126. Since the wheel 123 and its associated shaft 42 are driven in timed relation to the shaft 41 and the wheel 101, the supporting finger 121 will be in the proper position for supporting the lower portion of the box while the finger 107 moves

downwardly to crease the tab 17 along the crease line 18.

In order to prevent the leading end wall 14 from being forced upwardly a greater amount than necessary on account of the rapid rotation of wheel 123 and finger 121, a suitable prong 127 is provided, said prong being secured to the periphery of wheel 101 by means of a bracket 128 and a bolt 129 (Figure 18). As the wheel 101 rotates finger 107 to the creasing position, the finger 127 moves downwardly against the top side of the end wall 14 at a point close to the fold or bend line 18 and holds the upper portion of the end wall steady.

As the box 10 is moved to the left in Figures 17, 18 and 19, the finger 107 continues to fold the tab 17 inwardly. A short interval of time prior to the lower end of the finger 107 leaving the tab however, the sleeve 110 contacts a sleeve 138. This contact causes the lower end of finger to move forwardly at a faster rate than the body blank and in the same direction that the blank is traveling, to thereby effect a quick release of the finger 107 from the folded end tab. In other words, the finger 107 is rotated in a counter-clockwise direction about point 104 (Figure 18) to cause the lower end of the finger to complete the fold of the end tab and at the same time clear the path of travel of the blank. Due to the shape of slot 116 the lower end of the finger 107 is also moved downwardly to the left to keep the lower end of the finger traveling substantially horizontally. The sleeve 130 is secured to bracket 131 which extends upwardly from the rail 90.

After the leading tab 17 has been creased in the manner shown in Figure 19 it is then directed on top of the side rails 75 and 90 and the central portion of the box is directed between the upper and lower center belts 45 and 46. The portions of the box which rest upon the side belts 79 and 93 are also drawn beneath swords 132 and 133 which, in turn, are disposed over belts 79 and 93, respectively (see Figures 1 and 11). These swords are supported by the transverse shaft 64 (Figure 8). Secured to and disposed above side rails 75 and 90 are folding arms 134 and 135 respectively, said folding arms being secured as at 136 and 137 to the side rails. The right-hand ends of these arms in Figure 8 are inclined downwardly and outwardly so that when the leading end of the blank 10 reaches these folding arms the outer portions 11 and 12 and the tabs 17 will ride along the top edges of these arms. Since the intermediate portion of the blank is disposed beneath the swords 132 and 133, it stands to reason that the side walls 11 and 12 and end walls 14 and 15 will be bent upwardly and inwardly along lines 22 and 23 to occupy a position beneath the folding arms 134 and 135 as shown in Figure 11. As they continue to advance, the sidewalls will be folded to a substantially parallel position to the bottom of the box in the manner shown in Figures 4 and 12. This folding operation constitutes operation number 3 previously described.

In order to effect operation number 2 which takes place immediately after operation number 1, that is to crease the trailing end tabs 20 along their perforated crease lines 21, a suitable projection 140 is provided on wheel 101 (Figures 8, 17 and 20), the other end of which is disposed upon a circumference which passes through the same path traveled by the lower portion of crimping finger 107. This member is secured to a Z-shaped bracket 142 which is secured to periphery of wheel 101 by means of bolts 143. The leading tab 17 is crimped and the trailing end wall 15 and its associated tab 20 is then passed beneath the wheel 101. The projecting member 140 is so positioned that it will contact this tab 20 and bend it downwardly as shown in Figure 20 along line 22 when the blank is in proper position. In this figure, it will be noted that not only is the tab 20 bent downwardly but also a portion of the end wall 15. As the blank 10 continues to move to the left from the position shown in Figure 20, a suitable inwardly directed bar 145 engages the leading edge of tab 20 and serves to bend it along the crease line 21. The hooked end 145a is provided to exert the proper bending pressure along the crease line 21. Since this crease line is perforated, the bending will take place along this line. As the tab continues to move to the left, it is subsequently engaged by a guide 146 which directs the tab farther inwardly to the position shown in Figure 21. It also prevents the tab 20 from opening before the blank reaches the belt. Incidentally guide 146 also serves to complete the folding of tab 17 and to guide it onto the side rail 90 where it is held in folded position as shown in Figures 2 and 3. The tab then passes on top of the side rail 90 and the blank bottom passes beneath the sword 133.

With both the leading tabs 17 and the trailing tabs 20 folded to the position shown in Figure 3 and with the side walls and the ends of the end walls folded inwardly in the position shown in Figure 4, the box continues its longitudinal movement until the leading end wall 14 contacts stop 150 (Figures 8 and 10). This stop is adjustably secured to the top of the machine by means of bolts 151 and slots 152 in plate 153 (Figure 8). Before the collapsed box, as shown in Figure 4 reaches this stop 150, it passes beneath curved plates 154 and 155 (see Figures 8 and 10) and beneath brush 156. While passing beneath members 155 and 156 it passes over the top of a moving belt 157 disposed beneath these members. Belt 157 is mounted for travel on rollers 158 and 159, 160, 161, 162 and 163.

By referring to Figures 8 and 15, it is seen that sprocket chains 165 are provided with lugs 166. These sprocket chains are mounted on sprockets 167 and 168 which, in turn, are rotatably mounted on shaft 169 and studs 170, respectively. These chains 165 and the lugs 166 are so positioned that the lugs will contact the side walls of the box and move the box transversely from the position assumed when the end strikes the stop 150. The lugs 166 engage the box in the manner shown in Figure 16, after which the box is delivered sidewise between a pair of belts 175 and 176 which are mounted upon wheels 177 and 178, respectively, said wheels being rotatably mounted upon transversely disposed shafts 179 and 180. These wheels, as shown in Figure 15 are positioned along the center line of the box. In other words, they constitute a portion of the center track. Notwithstanding this fact, the side tracks are identical in all respects to the center track shown and like reference characters will be given like parts. All of the tracks are shown in the lower portion of Figure 1. The wheels upon which the left-hand end of belts 176 are mounted are not shown, but this structure is identical to the structure shown in the lower left-hand portion of Figure 9 which has been previously described. The belts 176 ride on top of suitable rollers 181 which are supported by tracks 182 (see Figures 13, 14 and 15).

The upper belts 175 each pass beneath a roller 183 and then upwardly over a roller 185. The lower layer of each belt 175 is also supported by suitable spaced tension rollers 186 which are disposed in bar 187, said bar 187 being supported by links 188 on lever 189. The lever 189 has its intermediate portion secured around shaft 190. The bar 187 also has smaller rollers 191 in the left-hand end thereof for holding the box in contact with the belt after it passes out from beneath the lower layer of the upper belt 175.

Suitable glue pots 195 (Figures 8 and 16) are disposed along the courses which are traveled by the ends of the box. Each of these glue pots has a roller 196 therein, the lower periphery of which is adapted to pass through an adhesive solution 197. Also secured on the shaft 179 is a wheel 198, and this wheel has glue spot applicators 199 secured to the periphery thereof as at 200. As the chains 165 and lugs 166 move the box to the left in Figure 16, it is passed beneath the glue pots and between the belts 175 and 176. While it passes between these belts the glue applicator 199 is adapted to contact the periphery of the glue roll 196 from which is obtained a quantity of adhesive. Then just at the time that the folded sidewalls pass between the shafts 179 and 180, these glue applicators apply glue spots 26 and 27 to the tabs (see Figure 4). Of course one end of the box as shown in Figure 4 will pass beneath the other glue pot. It is seen in Figure 8 that the glue roll 196 is driven in timed relation to shaft 179 through gears 204 and 205. With the glue applied to the tabs 17 and 20, the fourth operation is completed.

After the glue spots are applied to the tabs, the belts carry the box toward the observer in Figure 8. Suitable folding bars 202 and 203 are provided which are similar to the folding bars 134 and 135 employed in carrying out the third operation. These bars are directed downwardly and outwardly so that when the box reaches these bars, the lower end of the bars will be disposed beneath the ends 14 and 15 of the box to cause the same to be folded inwardly and to cause the tabs 17 and 20 to adhere to the exterior of the box.

I have therefore provided an apparatus which is capable of bending the end tabs 17 and 20 along perforated lines 18, folding the side walls, applying glue spots, folding the end walls and securing the end tabs to the exterior of the sidewalls to form a completed box. I have also disclosed a method of making a collapsible box which comprises folding the leading tabs 17, folding the trailing tabs 20, creasing the side walls along lines 22 and 23, moving the box transversely, applying glue spots 26 and 27 to the tabs and then folding the end walls to cause the tabs 17 and 20 to be secured to the exterior of the side walls.

After the end walls of box 10 have been folded by arms 202 and 203, these walls move beneath belts 215 (Figure 22) and while going beneath these belts the end walls are held firmly against the intermediate portions of the box to thereby cause the glued surface of the tabs 17 and 20 to be compressed against the exterior of side walls 11 and 12. The belts 215 are supported by rollers 216 and 217 in a manner similar to the supporting of belts 86 and 96 shown and described in connection with Figures 9 and 12.

In the drawings and specification, there has been set forth a preferred embodiment of the invention and although specific terms are employed, they are used in a generic and descriptive sense only and not for the purposes of limitation, the scope of the invention being set forth in the appended claims:

I claim:

1. That method of forming a collapsible box from a stamped blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent of the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, the steps of which comprise moving the blank longitudinally, folding said extensions on the leading end portions inwardly and forwardly upon themselves, along crease lines oblique to the longitudinal center line of the box, folding said extensions on the trailing end portion inwardly and rearwardly upon themselves along oblique crease lines, folding the side walls and said folded extensions inwardly toward the longitudinal center line, moving said blank transversely of its longitudinal center line, applying an adhesive to said folded extension and then folding the end walls and said folded extension inwardly along lines at right angles to the longitudinal center line to cause the extensions to adhere to the exterior of said side walls.

2. In the art of making a collapsible box from a rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, moving such a prefabricated sheet endwise of itself, bending the trailing portion of the tabs on the leading end of the sheet beneath the other portions of said leading tabs, bending the leading portion of the tabs on the trailing end of the sheet and folding them beneath the other portions of said tabs, then folding the folded tabs and the side portions of the blank upwardly along a line passing through the bases of said slots and pressing said tabs and side portions against the central portion of the blank, then moving the partially folded blank sidewise, while applying an adhesive to selected portions of the upper surface of the folded portions of the blank, then moving the blank sidewise and folding the ends of the blank upwardly and onto the top surface of the folded side edges to cause adhesion between the first folded portion of the tabs and the exterior of the side walls, whereby when the side walls and end walls are unfolded, the tabs will be unfolded and the tabs being secured to the side walls will limit outward movement of said walls.

3. In the art of making a collapsible box from a rectangular blank having slots in each side edge penetrating the blank to a depth equivalent to the depth of the completed box and said slots being parallel to the end edges and spaced from the end edges a distance equivalent to the depth of the completed box to form tabs on each corner of the blank, the tabs being perforated diagonally at an angle of approximately 45 degrees extending from the corners of the blank, the method of making a box from such a blank which comprises moving the box endwise of itself, then folding the trailing portions of the leading tabs along their perforated lines and folding the same be-

neath the other half of their other portions, and bending the leading half of the trailing tabs downwardly and beneath the other half of the tabs, then folding the previously folded tabs and the side edges of the blank upwardly and over against the central portion of the blank, then applying an adhesive to portions of the top surfaces of the folded portions, then moving the blank along a line parallel to its end edges and folding the ends of the blank and the tabs upwardly and over against the upper surfaces of the folded side walls to cause the upper surfaces of the folded tabs to adhere to the side walls.

4. In the art of making a collapsible box from a rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, moving such a prefabricated sheet endwise of itself, bending the trailing portion of the tabs on the leading end of the sheet beneath the other portions of said leading tabs, bending the leading portion of the tabs on the trailing end of the sheet and folding them beneath the other portions of the said tabs, then folding the folded tabs and the side portions of the blank upwardly along a line passing through the bases of said slots and pressing said tabs and side portions against the central portion of the blank, then moving the partially folded blank and folding the ends of the blank and the folded tabs upwardly and against the upper surfaces of the folded side edges and securing the first folded portions of the tabs to the side walls to complete the box.

5. Apparatus for forming a box from a unitary rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, comprising means for moving the blank endwise, means for folding the trailing portion of the extensions on the leading end of the blank downwardly and forwardly along an oblique line bisecting the forward extensions, means for folding the leading portion of the extensions on the trailing end of the blank rearwardly and downwardly along oblique lines bisecting the trailing extensions, means for folding the extensions and the side portions of the blank upwardly and over against the central portion of the blank, means for then moving the blank sidewise, means for folding the end portions and the folded extensions upwardly and over against the folded side portions, and means for securing the first folded portions of said extensions to the upper surface of the folded side portions to complete the box.

6. Apparatus for forming a box from a unitary rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank, a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, comprising means for moving the blank endwise, means for folding the trailing portion of the extensions on the leading end of the blank downwardly and forwardly, along an oblique line entirely bisecting the forward extensions, means for folding the leading portion of the extensions on the trailing end of the blank rearwardly and downwardly along oblique lines entirely bisecting the trailing extensions, means for folding the extensions and the side portions of the blank upwardly and over against the central portion of the blank, means for then moving the blank sidewise, means for folding the end portions and the folded extensions upwardly and over against the folded side portions, and means for rendering the upper surface of the first folded portions of the extensions adhesive before they are folded onto the side walls to cause said extensions to adhere to the side walls.

7. Apparatus for forming a box from a unitary rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank, a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, comprising means for moving the blank endwise, means for folding the trailing portion of the extensions on the leading end of the blank downwardly and forwardly along an oblique line entirely bisecting the forward extensions, means for folding the leading portion of the extensions on the trailing end of the blank rearwardly and downwardly along oblique lines entirely bisecting the trailing extensions, means for folding the extensions and the side portions of the blank upwardly and over against the central portion of the blank, means for then moving the blank sidewise, means for folding the end portions and the folded extensions upwardly and over against the folded side portions, and means for applying an adhesive to the top surface of the first folded extensions before the last folding operation is completed.

8. Apparatus for making a box from a rectangular blank having slots defining the ends of the side walls and forming extensions on the ends of the end walls, comprising means for moving the blank endwise, means for folding the trailing end of the leading extensions inwardly, downwardly and forwardly along an oblique line entirely bisecting the extension, means for folding the leading portion of the trailing extensions inwardly, rearwardly and downwardly along an oblique line entirely bisecting the extensions, means for folding the folded extensions and the side portions of the blank inwardly and over the central portion of the blank, means for moving the blank laterally, means for folding the ends and their associated folded extensions upwardly and over against the top surfaces of the folded side portions, and means for securing the upper portion of each folded extension to the exterior surface of the side portions.

9. Apparatus for making a box from a rectangular blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, comprising means for moving the blank endwise, means for folding the trailing end of the leading extensions inwardly, downwardly and forwardly along an oblique line

entirely bisecting the extensions, means for folding the leading portion of the trailing extensions inwardly, rearwardly and downwardly along an oblique line entirely bisecting the extensions, means for folding the folded extensions and the side portions of the blank upwardly and over against the central portion of the blank, means for moving the blank laterally, means for folding the ends and their associated folded extensions upwardly and over against the top surfaces of the folded side portions, and means for rendering the uppermost fold of the extensions adhesive before they contact said side walls.

10. Apparatus for making a box from a rectangular blank having slots defining the ends of the side walls and forming extensions on the ends of the end walls, comprising means for moving the blank endwise, means for folding the trailing end of the leading extensions inwardly, downwardly and forwardly along an oblique line entirely bisecting the extensions, means for folding the leading portion of the trailing extensions inwardly, rearwardly and downwardly along an oblique line entirely bisecting the extensions, means for folding the folded extensions and the side portions of the blank upwardly and over against the central portion of the blank, means for moving the blank laterally, means for folding the ends and their associated folded extensions upwardly and over against the top surfaces of the folded side portions, and means for depositing an adhesive on the upper portion of the folded extensions before they are pressed into contact with the exterior surface of the side walls.

11. Apparatus for forming a box from a unitary rectangular blank having slots in its side edges which are parallel to the end edges and spaced from the end edges a distance equal to the depth of the completed box, and forming extensions on the end portions defined by said slots, comprising a plurality of belts for conveying the blanks endwise through the apparatus, a rotatable shaft, a pair of spaced wheels on said shaft, fingers on the wheels for engaging the trailing ends of the leading extensions and folding them along an oblique line downwardly and forwardly, supporting means movable in timed relation to the movement of the blank for moving into the path of the leading extensions for supporting the same along said oblique line while the folding operation is performed, means on said wheels for later engaging the trailing extensions and bending them downwardly, means for engaging the leading edge of the trailing extensions and folding the leading half of the trailing extensions inwardly and rearwardly along an oblique line bisecting the same, a pair of fixed fingers for engaging the lower surfaces of the extensions and the lower surfaces of the side portions of the blank for folding them upwardly and onto the upper surfaces of the body portion of the blank as the blank is moved through the apparatus, means for moving the blank sidewise, means for applying an adhesive to selected portions of the upper exposed portions of the blank, means for engaging the lower surfaces of the end portions and folding them upwardly and over against the upper surfaces of the side walls of the box as the box continues to be moved sidewise to cause adhesion between the uppermost portion of the folded extensions and the sidewalls of the box.

12. Apparatus for folding a box from a unitary blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, comprising means for moving the blank endwise, a pair of rotatable means for engaging the rear portions of the extensions on the leading end of the blank and folding them along an oblique line entirely bisecting the extensions to a position where the trailing half of the extensions occupy a position beneath the leading half of the extensions, a pair of spaced means for engaging the leading portion of the extensions on the rear end of the blank and folding them along an oblique line entirely bisecting the latter extensions to where the leading portions of the latter extensions occupy a position beneath the trailing portions of said latter extensions, means for further moving the blank endwise, a pair of outwardly and downwardly extending fingers engageable by the lower surface of the outer portions of the blank for folding the folded extensions and the side portions of the blank upwardly and onto the central portion of the blank to form side walls for the box, means for moving the blank sidewise, means for applying an adhesive to selected spots on the upper surfaces of the folded portions, means for engaging the lower surfaces of the ends of the blank and folding them upwardly and over against the top surfaces of the side walls as the blank is moved sidewise, and means for holding the folded ends in position against the top surfaces of the side walls while adhesion takes place between the upper folded portion of each tension and the side walls to complete the box.

13. In a machine for making a collapsible box from a rectangular unitary blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, a pair of rotatable shafts having superposed pulleys thereon, a plurality of belts mounted on said pulleys and being spaced from each other to receive box blanks therebetween and to move the same through the machine, means for feeding the blanks into the space between the belts, a pair of spaced wheels mounted on the upper one of the superposed shafts, folding fingers mounted on each of said wheels, fixed means for engaging one end of said fingers and moving the other end into the path of an advancing blank to fold the trailing half of the leading extensions downwardly and forwardly along an oblique line bisecting the extensions, means for supporting the extensions along their fold lines while said folding operation is being carried out, other means on said wheels for engaging the trailing extensions and bending them downward along a line defining the corners of the box, means for engaging the leading edges of the trailing extensions and folding them inwardly and rearwardly along a line bisecting the latter extensions, means for engaging the lower surfaces of the folded extensions and the outer portions of the blank for folding them upwardly and over against the upper surface of the blank to form the sidewalls of the box, means for arresting the endwise movement of the blank, means for engaging the blank and moving the same sidewise, means for engaging the lower surfaces of the end portions and

folding them upwardly and over against the folded side walls, and means for securing the uppermost folded extension portion to the exterior of the side walls.

14. In a machine for making a collapsible box from a rectangular unitary blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portion of the blank, a pair of superposed rotatable shafts having superposed pulleys thereon, a plurality of belts mounted on said pulleys and being spaced from each other to receive box blanks therebetween and to move the same through the machine, means for feeding the blanks into the space between the belts, a pair of spaced wheels mounted on the upper one of the superposed shafts, folding fingers mounted on each of said wheels, fixed means for engaging one end of said fingers and moving the other end into the path of an advancing blank to fold the trailing half of the leading extensions downwardly and forwardly along an oblique line bisecting the extensions, means for supporting the extensions along their fold lines while said folding operation is being carried out, other means on said wheels for engaging the trailing extensions and bending them downward along a line defining the corners of the box, means for engaging the leading edges of the trailing extensions and folding them inwardly and rearwardly along a line bisecting the latter extensions, means for engaging the lower surfaces of the folded extensions and the outer portions of the blank for folding them upwardly and over against the upper surface of the blank to form the side walls of the box, means for arresting the endwise movement of the blank, means for engaging the blank and moving the same sidewise, means for engaging the lower surfaces of the end portions and folding them upwardly and over against the folded side walls, and means for rendering the upper surface of the folded extensions adhesive before they are pressed against the upper surfaces of the folded side walls.

15. In a machine for making a collapsible box from a rectangular unitary blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, a pair of superposed rotatable shafts having superposed pulleys thereon, a plurality of belts mounted on said pulleys and being spaced from each other to receive box blanks therebetween and to move the same through the machine, means for feeding the blanks into the space between the belts, a pair of spaced wheels mounted on the upper one of the superposed shafts, folding fingers mounted on each of said wheels, fixed means for engaging one end of said fingers and moving the other end into the path of the advancing blank to fold the trailing half of the leading extensions downwardly and forwardly along an oblique line bisecting the extensions, means for supporting the extensions along their fold lines while said folding operation is being carried out, other means on said wheels for engaging the trailing extensions and bending them downward along a line defining the corners of the box, means for engaging the leading edges of the trailing extensions and folding them inwardly and rearwardly along a line bisecting the latter extensions, means for engaging the lower surfaces of the folded extensions and the outer portions of the blank for folding them upwardly and over against the upper surface of the blank to form the side walls of the box, means for arresting the endwise movement of the blank, means for engaging the blank and moving the same sidewise, means for engaging the lower surfaces of the end portions and folding them upwardly and over against the folded side walls, and means for causing adhesion between the upper fold of the extensions and the exterior surface of the side walls.

16. In a machine for making a collapsible box from a rectangular unitary blank, the blank having the characteristic of being provided with a pair of slots in each side extending to a depth equivalent to the depth of the completed box and being disposed in spaced relation to the ends of the blank a distance which is equivalent to the depth of the completed box, thus forming extensions on the ends of the end portions of the blank, a pair of superposed rotatable shafts having pulleys thereon, a plurality of belts mounted on said pulleys and being spaced from each other to receive box blanks therebetween and to move the same through the machine, means for feeding the blanks into the space between the belts, a pair of spaced wheels mounted on the upper one of the superposed shafts, folding fingers mounted on each of said wheels, fixed means for engaging one end of said fingers and moving the other end into the path of an advancing blank to fold the trailing half of the leading extensions downwardly and forwardly along an oblique line bisecting the extensions, means for supporting the extensions along their fold lines while said folding operation is being carried out, other means on said wheels for engaging the trailing extensions and bending them downward along a line defining the corners of the box, means for engaging the leading edges of the trailing extensions and folding them inwardly and rearwardly along a line bisecting the latter extensions, means for engaging the lower surfaces of the folded extensions and the outer portions of the blank for folding them upwardly and over against the upper surface of the blank to form the side walls of the box, means for arresting the endwise movement of the blank, means for engaging the blank and moving the same sidewise, means for engaging the lower surfaces of the end portions and folding them upwardly and over against the folded side walls, and means for applying an adhesive to the upper surface of the folded extensions before the last folding operation is completed.

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