May 24, 1955 L. PERILLI 2,708,862

BOX BLANK SETTING UP MACHINE

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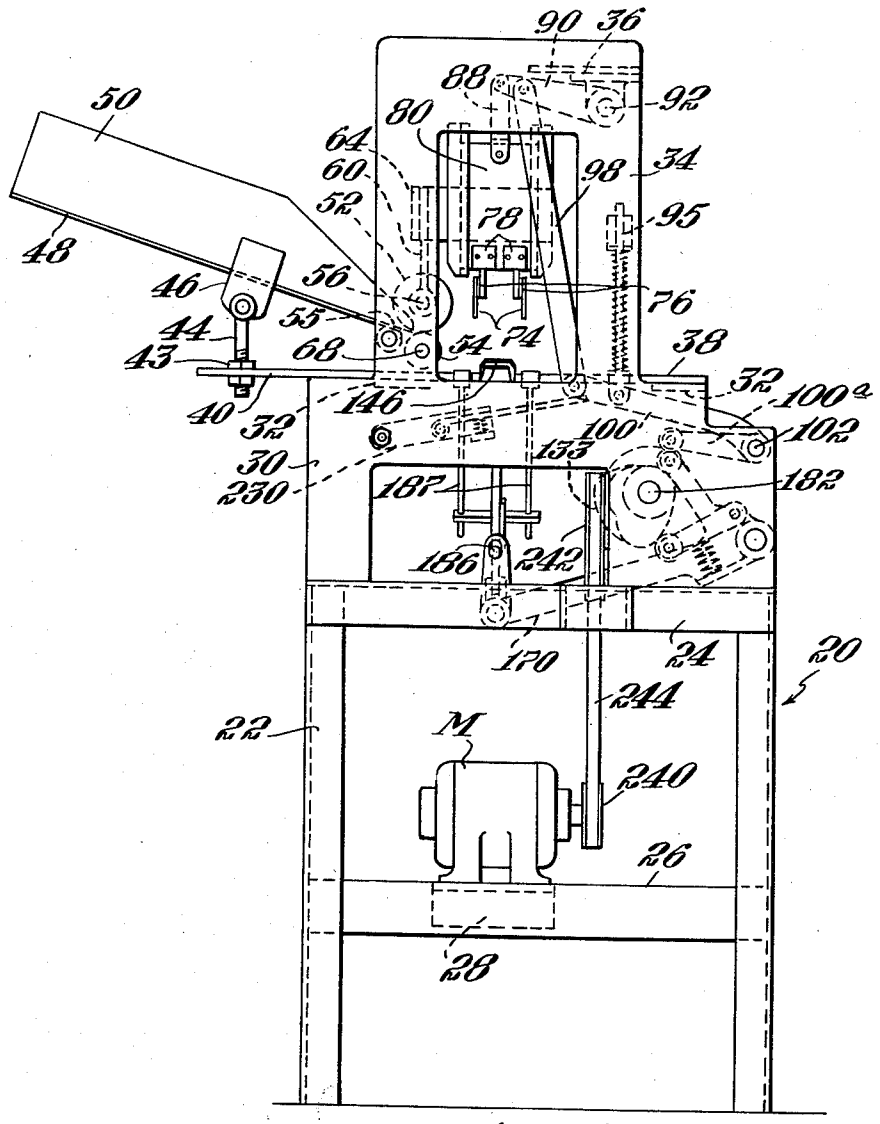



Fig. 1

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BOX BLANK SETTING UP MACHINE

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6 Sheets-Sheet 2

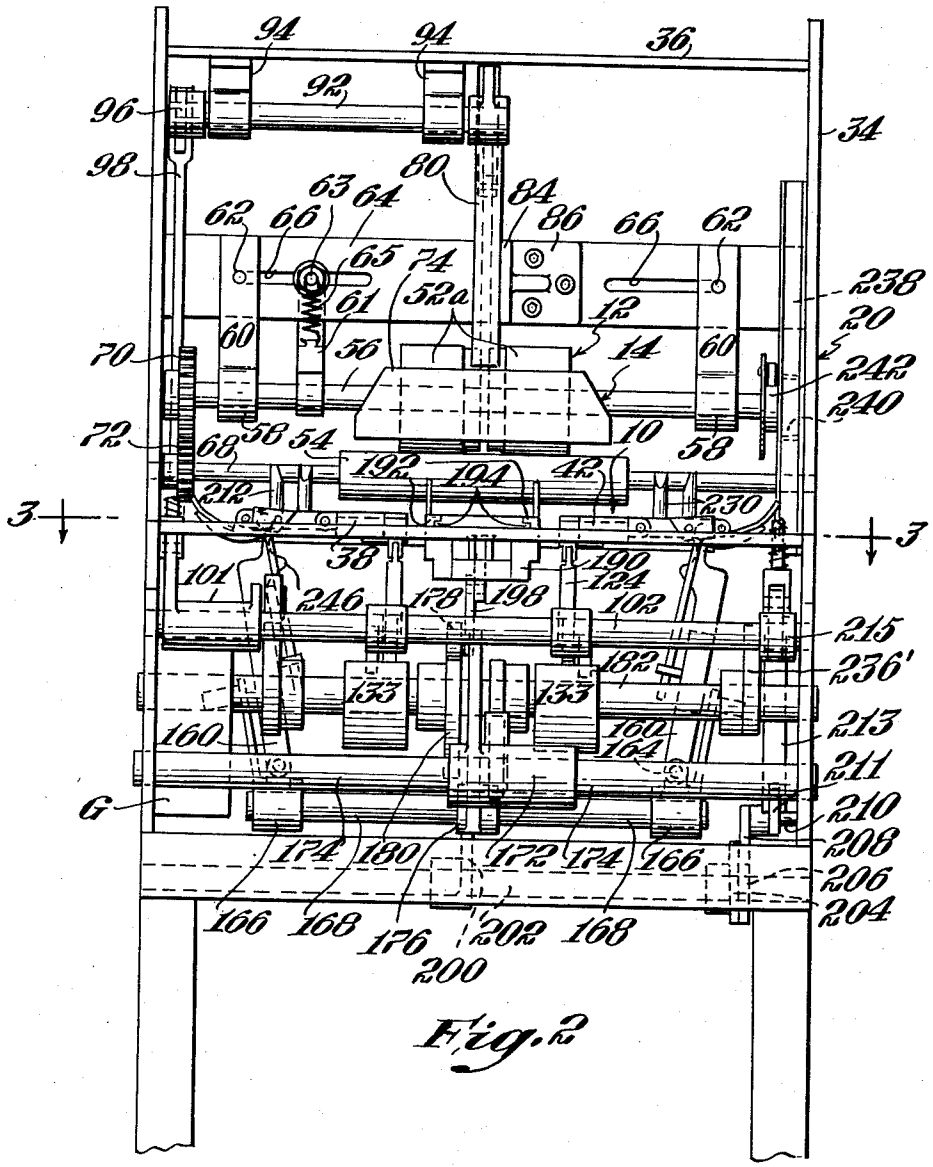



Fig. 2

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BOX BLANK SETTING UP MACHINE

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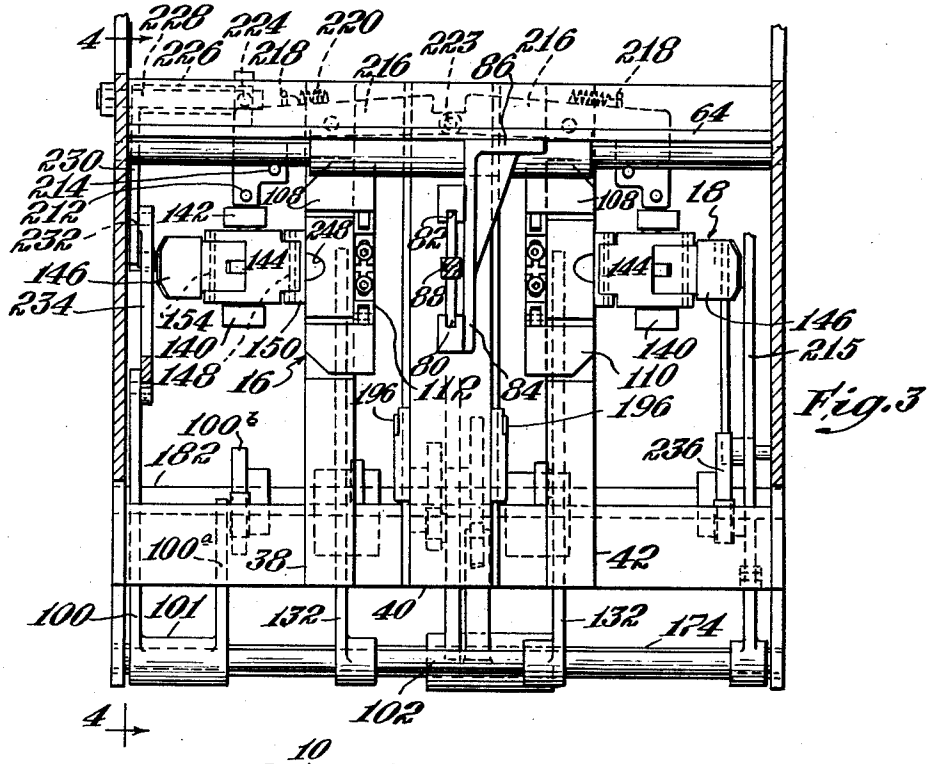



Fig. 3

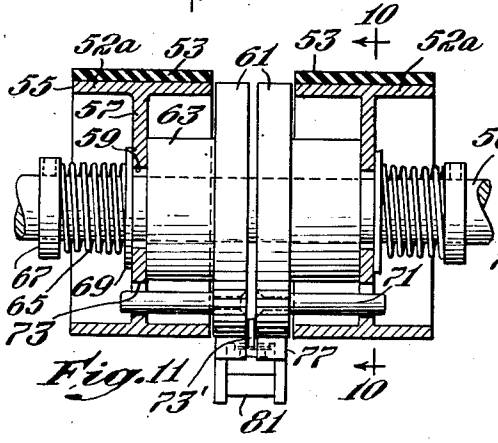



Fig. 11

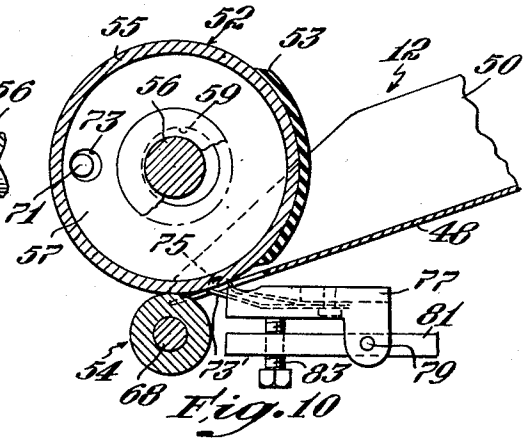



Fig. 10

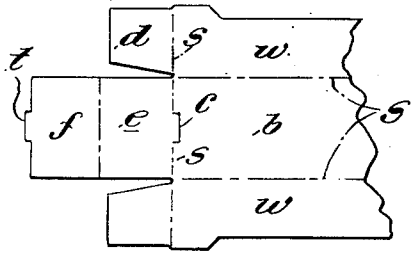



Fig. 3a

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BOX BLANK SETTING UP MACHINE

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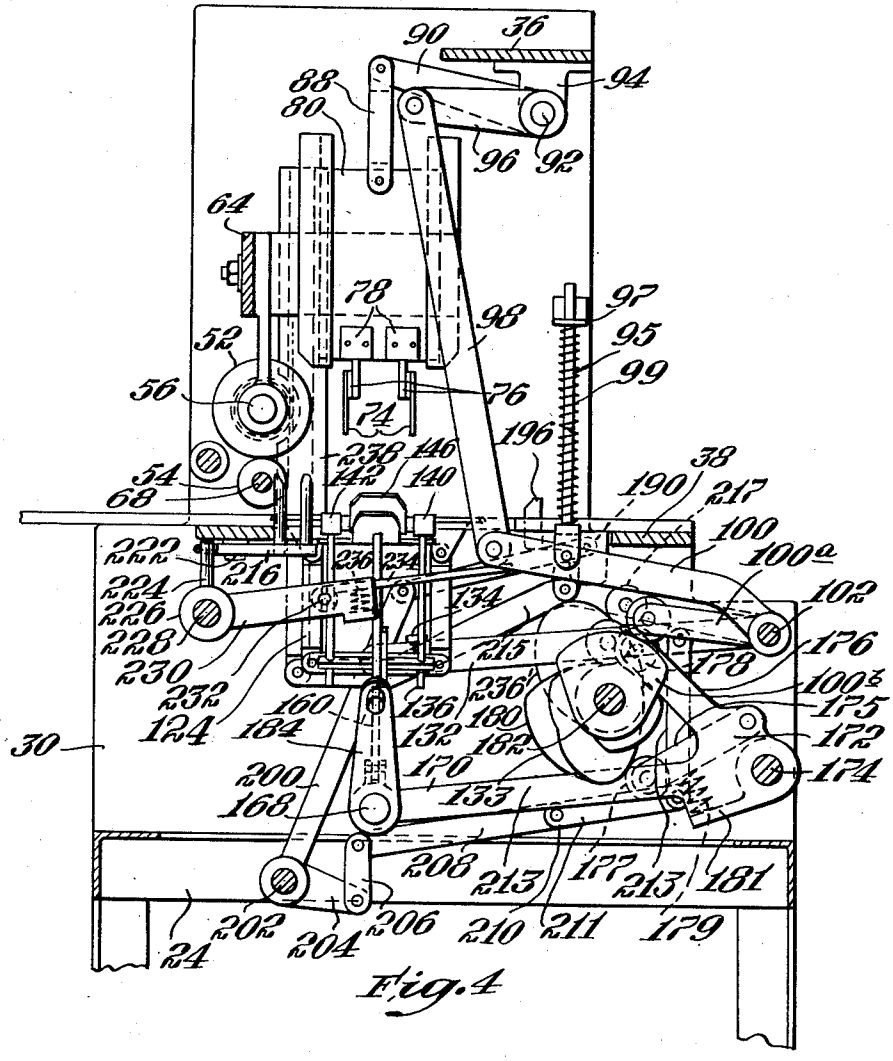



Fig. 4

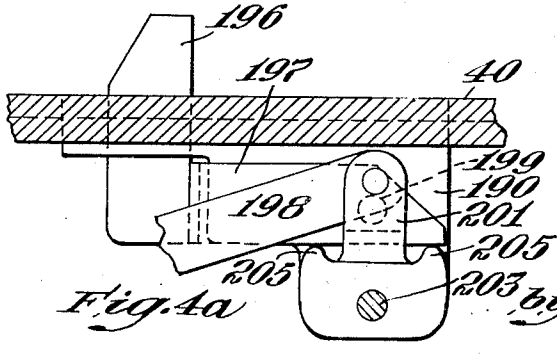



Fig. 4a

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BOX BLANK SETTING UP MACHINE

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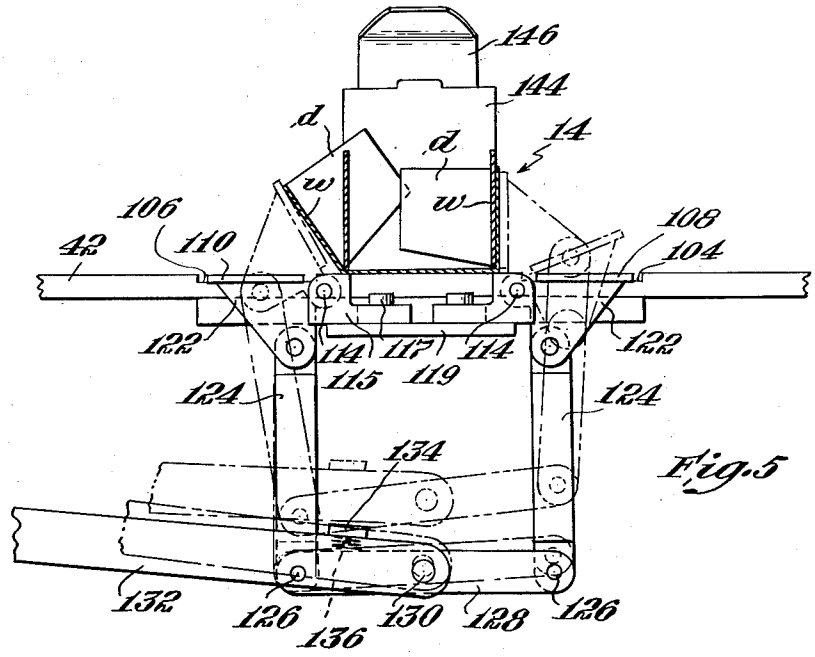



Fig. 5

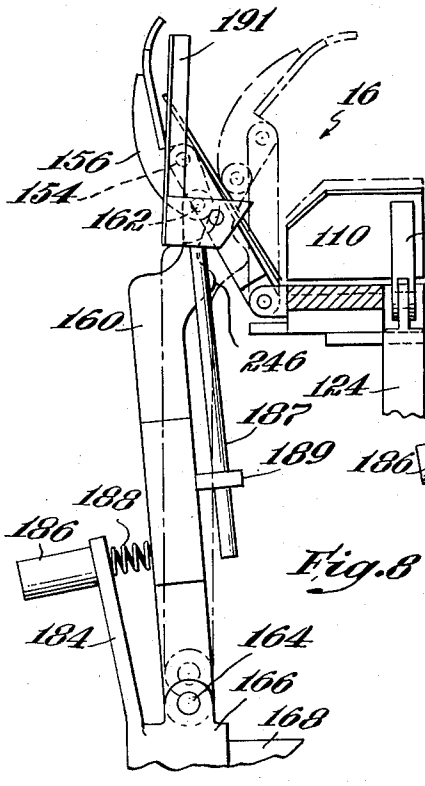



Fig. 8

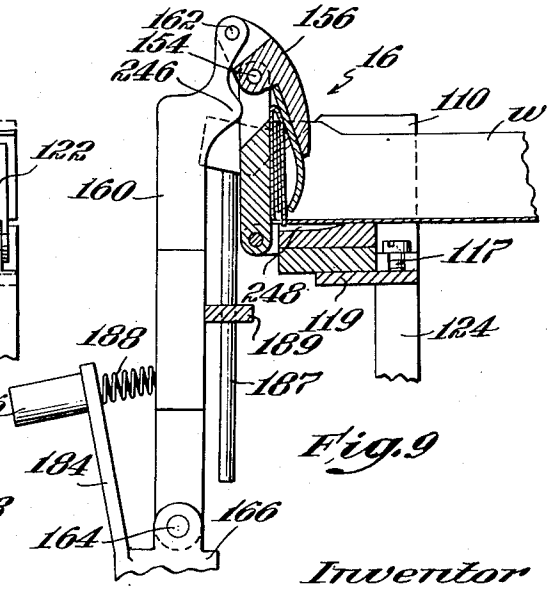



Fig. 9

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BOX BLANK SETTING UP MACHINE

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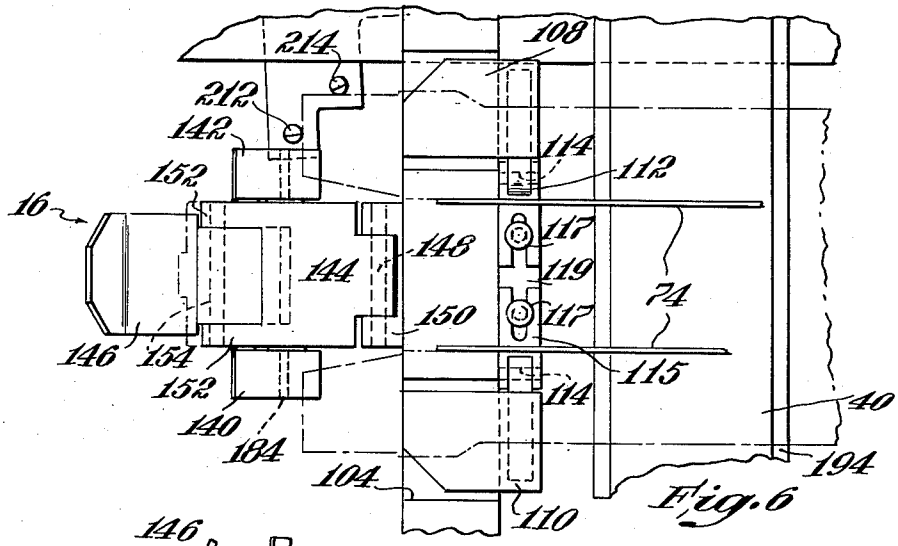



Fig. 6

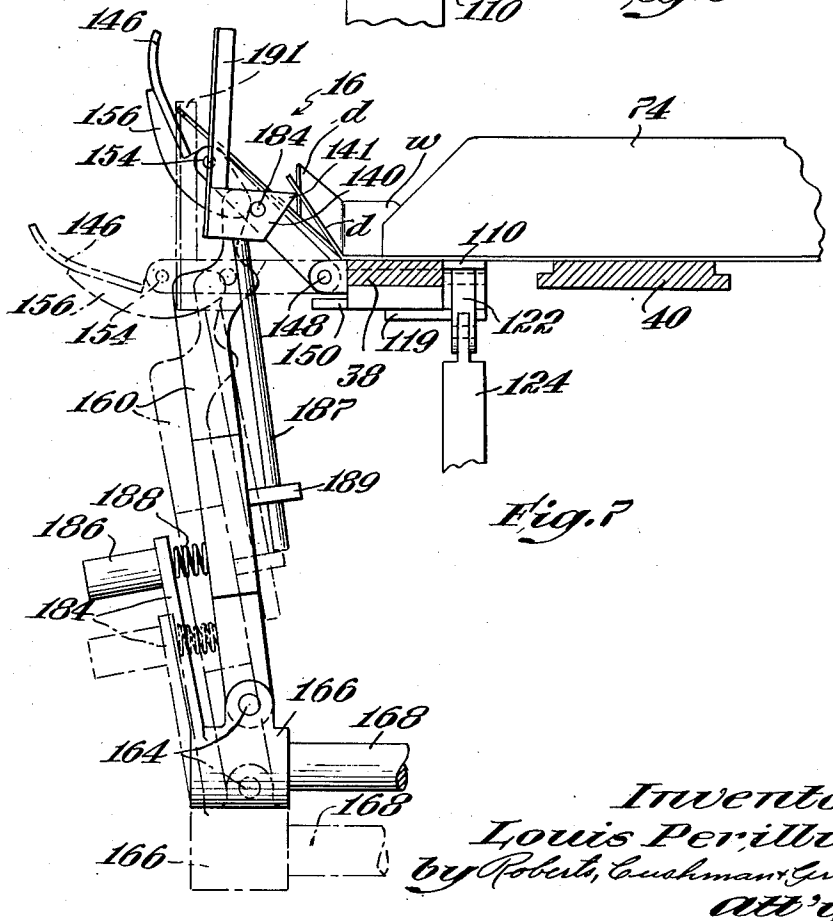



Fig. 7

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United States Patent Office 2,708,862 Patented May 24, 1955



2,708,862

# BOX BLANK SETTING UP MACHINE

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Application January 11, 1951, Serial No. 205,484

6 Claims. (Cl. 93—49)

This invention relates to apparatus for setting up boxes and more especially to a machine for operating on flat blanks, the foldable parts of which initially lie in a common plane.

In my application for setting up box blanks, Ser. No. 78,375, filed February 25, 1949, now U. S. Patent No. 2,582,393, there is illustrated a machine for setting up box blanks which have been partially prefolded, that is the side walls have been folded over into engagement with the bottom and the ends connected thereto. This type of prefolded box blank is much more expensive to make than a perfectly flat die-cut blank, in which all the parts are in a common plane. The principal objects of this invention are to provide a machine which will erect the side and end walls of flat blanks, to vertical positions, fold the end wall flaps into engagement inside the end walls, and the locking tongue over the edge of the end flaps, and then insert the locking tongue through the slots in the bottom, thus to set up the entire blank from a perfectly flat condition, and hence to eliminate costly prefolding or special treatment of the blank before setting up. Further objects are to provide a machine which is of comparatively simple construction, rapid and efficient in its operation, and durable. Other objects are to provide a machine in which there is improved feeding means to insure delivery of but one blank at a time to the folding instrumentalities, improved locating means for bringing the blank into exact registry with the operating instrumentalities, and improved folding means which will erect one wall ahead of the other so that the end flaps will not catch edge on edge.

As herein illustrated, and in accordance with the foregoing objects, the machine has a support upon which flat box blanks may be placed for setting up, and a plurality of operating instrumentalities for setting up the blanks to form a box, which include a hold-down member movable into engagement with the bottom of the blank for holding it against the support, end wall elevators including tuck flap elevators for raising the end walls and tuck flaps, and side wall elevators for raising the side walls. As constructed there is mechanism for raising the end wall elevators partially from prone positions subjacent to the blank through angles of approximately 45° to lift the end walls through approximately 45° to inclined positions. At the same time, the tuck flap elevator means lift the tuck flaps ahead of the end walls so that they precede them and project a little way inwardly against the inside surfaces of the end walls. Next, while the end walls rest at approximately 45° of elevation, the side wall elevating means rise, lifting the side walls in such a manner that one precedes the other to its vertical position, thus permitting the tuck flaps of the wall raised to its upright position first to move inwardly of the end walls ahead of the tuck flaps of the other wall, and hence behind them. Following complete elevation of the side walls, the end wall elevators resume movement to erect the end walls to their vertical positions, whereupon locking flap members carried by the end wall elevator members, fold the locking flaps inwardly and downwardly into engagement with the inside surfaces of the tuck flaps within the box, and force the locking tongues into the slots at the bottom of the box. The flat blanks are delivered to the support by feeding means which include a feed roll having an arcuate traction member on it which, at each rotation of the roll, will draw a blank from a pile of blanks resting on a hopper at the rear side of the feed rolls forwardly and deliver it to the place of setting up. The feed roll is constructed automatically to compensate for wear of the traction member and to yield as a blank passes beneath it. There is also a yieldable finger located close to the bottom side of the feed roll to hold back all of the blanks except the one directly engaged with the traction member.



To register the blank with the operating instrumentalities, there are associated with the support gauge fingers between which the blanks are deposited by the feed roll, and these are thereafter movable to shift the blank both longitudinally and laterally of the support prior to movement of the hold-down into operative position. The forward ones of the guide fingers are arranged to be drawn below the support, moved rearwardly of the blank while the latter is being set up, raised behind the blank and then to be moved forwardly after the blank is set up and the operating instrumentalities have been retracted to eject the completed blank from the machine.

The invention will now be described in greater detail with reference to the accompanying drawings, wherein:

Fig. 1 is a side elevation of the machine;

Fig. 2 is a front elevation of the machine;

Fig. 3 is a plan view of the machine looking down at the top;

Fig. 3*a* is a plan view of approximately half of a flat box blank;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3;

Fig. 4*a* is a detail of the combined stop fingers and discharge means;

Fig. 5 is a vertical section to larger scale of the operating instrumentalities for raising the side walls of the blank;

Fig. 6 is a plan view to larger scale showing a box blank in phantom superimposed on the operating instrumentalities for raising both its sides and ends;

Fig. 7 is a vertical section to larger scale showing one of the operating instrumentalities for raising the end walls in its initial and an intermediate position;

Fig. 8 is a similar view showing the end wall operating instrumentalities in an intermediate position and fully raised position;

Fig. 9 is a still further view showing the tongue folding instrumentalities lowered inside of the box so as to fold the locking flap into engagement with the inside and force the locking tongue into the slot in the bottom;

Fig. 10 is a transverse vertical section through the main feeding means; and

Fig. 11 is a longitudinal vertical section through the main feeding means.

The instant machine is for the purpose of operating upon box blanks in such manner as to raise their sides and ends to substantially vertical positions, and to lock the parts thereof so as to provide a permanently set up box.

The box blanks as shown in Fig. 3*a* are die cut from paper stock, scored and slotted, and are supplied flat to the customer for setting up and use. As herein illustrated, the blank has a substantially rectangular bottom *b* along opposite edges of which are sides *w*—*w* divided from the bottom by score lines *s*—*s*. At opposite ends of the bottom are end walls *e*—*e* divided from the bottom by score lines *s*—*s*, and these have at their extremities

locking flaps *f*—*f* of corresponding area, which terminate in locking tongues *t*—*t*. Cuts *c*—*c* are formed near the ends of the bottom close to the junction of the end walls with the bottom for receiving the tongues *t*—*t* as will appear hereinafter. At the ends of each side wall there are tuck flaps *d*—*d* divided therefrom by score lines *s*. The machine receives blanks such as just described perfectly flat and then operates upon them first to raise the end walls *e*—*e* through about 45° inclination and the tuck flaps a corresponding amount, then to fold the side walls *w*—*w* in such manner that one precedes the other to its vertical position, and simultaneously to further fold the tuck flaps *d*—*d* inwardly, then to further fold the end walls *e*—*e* upwardly against the tuck flaps *d*—*d*, then to fold the end locking flaps *f*—*f* over the upper edges of the tuck flaps, and downwardly on the inside, and finally to insert the locking tongues *t*—*t* into the cuts *c*—*c* so as to lock the parts together. In practice, the walls *w*—*w* are not raised simultaneously, but one is erected ahead of the other so as to bring its tuck flaps *d*—*d* inside of the tuck flaps *d*—*d* of the opposite wall without catching one on the other.

The machine for operating on the blanks so as to set them up, as will be seen by reference to Fig. 2, includes a place of setting up or support **10**, to which the flat blanks are fed for setting up by feeding means **12**. Upon delivery to the place of setting up, hold-down means **14** engages the bottom of the blank and holds it in place while side wall and end wall erecting instrumentalities **16** and **18** (Fig. 3) operate upon the sides and ends. The foregoing parts are mounted in cooperating relation with each other together with suitable mechanism for effecting their operation in a frame **20** (Fig. 1).

As illustrated in Fig. 1, the frame **20** consists of a base having four legs **22** rigidly joined at their upper ends to horizontal rectangularly arranged angle bars **24**, and near their lower ends by forwardly and rearwardly extending braces **26** between which there extends a cross brace **28** which serves as a support for a motor M. Rising from the top of the base are spaced, parallel frame plates **30**, joined near the front and rear edges by transversely extending, horizontally disposed plates **32**. The plates **30** have integral, upwardly extending portions of narrower width **34** rising from the cross braces **32** which are joined near their upper ends by a cross brace **36**.

The support **10** for receiving the flat blanks in a position to be operated upon is constituted by spaced forwardly and rearwardly extending plates **38**, **40** and **42** (Fig. 3) resting on and secured to the transversely extending braces **32**—**32**. The supporting plate **40** extends rearwardly of the frame as shown in Fig. 1 and has standing upright therefrom, a vertical post **44** to the upper end of which is pivotally fastened a bracket **46**. A hopper consisting of a bottom wall **48** and vertical side walls **50** is fastened to the bracket **46** and may be adjusted to incline its bottom **48** toward cooperating feed rolls **52** and **54**. The forward end of the hopper rests on a bar **55** extending transversely of the machine in a horizontal position, its ends being fixed in the wall plates **34**—**34**. Adjustment of the inclination of the hopper is effected by rotation of a nut **43** mounted on the lower end of the post **44** which is screw threaded.

The upper feed roll **52** is divided into two sections **52***a*—**52***a* (Fig. 11) and is mounted on a horizontal shaft **56** which is journaled in bearings **58** (Fig. 2) suspended by hangers **60** which are fastened by bolts **62** to a horizontal, transversely extending bar **64**, the opposite ends of which are fixed to the wall plates **34**—**34**. The bolts **62** extend through horizontal slots **66** in the bar **64** so that lateral adjustment of the bearings may be had if desired. A brake band **61** embraces the shaft **56**, one end being attached by a bolt **63** passing through the slot in the bar **64**, and the other end being yieldably connected to the bolt by a spring **65**. This prevents overrun of the shaft due to momentum.



The feed roll sections **52***a*—**52***a* have on an arcuate portion of their external surfaces a strip of rubber which is somewhat tacky and which serves to pull the blanks forwardly from beneath the stack resting on the hopper. As the rubber strip wears, it is desirable that the roll automatically adjust itself so that it will be effective regardless of the thickness of the strip and so that the roll will yield as the blank passes between it and the bottom roll. To this end (Figs. 10 and 11) each roll comprises a drum **55** having a diametral web **57** in which there is an enlarged hole **59** through which the shaft **56** passes. Also mounted on the shaft are two discs **61**, each of which has a hub **63** at its outside which extends into the inside of the drum **55** into contact with the diametral web **57**. On the shaft **56** at opposite sides of each web there is a compression spring **65** held between the web and a collar **67** fast to the shaft under compression. A washer **69** placed between the end of the spring and the web provides a bearing surface. The springs are so arranged that they normally tend to exert a clockwise force on the rolls, as indicated in Fig. 10, so as always to hold the surface of the roll in contact with the lower roll **54**. Fixed to and projecting outwardly from each web is a pin **71**, the extremity of which passes through an enlarged hole **73** in the web **57**. The hole **73** is large enough so that the drums **55** can shift relative to the shaft **56** by the thickness of the rubber strips **53**. When the strips are new and of full thickness, the discs will yield to permit the strip to pass over the roll **54** without binding. As the strip becomes thinner, the springs **65** bias the drums in directions to keep the rubber strips in contact with the lower feed roll until they are completely worn away, and at the same time permit the drums to yield as the blanks pass between the rolls.

In order to prevent more than one blank at a time from being dragged between the rolls, a stop is provided. The stop consists of a resilient finger **73'** (Fig. 10) made of flat or round wire bent double and arranged with its bent end **75** projecting upwardly into the space between the discs **61** close to their under sides. The rear ends of the finger are fastened to a bracket **77** pivoted on a pin **79** which is fast to a support **81**. A height adjusting screw **83** threaded through the support **81** so that its end bears against the under side of the bracket, provides means for adjusting the heightwise position of the stop.

The lower feed roll **54** is of smaller diameter than the upper feed roll and approximately as long as the blank to be fed. The feed roll **54** is mounted on a horizontal shaft **68**, the ends of which are journaled in the walls **34**—**34**, and gears **70** and **72** are mounted respectively on the shafts **66** and **68** to effect rotation of these rolls in directions to feed blanks from the hopper inwardly to a position above the support **10**.

The hold-down **14** for holding the blank in place on the support consists of a pair of spaced, vertically disposed parallel plates **74**—**74** (Fig. 2), the lower edges of which are parallel with the upper surface of the support. The plates **74**—**74** are arranged for vertical movement to and from the support, and to this end are fastened to the lower ends of flanges **76** (Fig. 1) extending downwardly from anchor plates **78**, the latter being fastened to a vertically arranged slide plate **80** extending forwardly and rearwardly of the machine, and having its opposite edges slidably engaged with spaced vertically disposed ways **82** formed in a bracket **84** (Fig. 3) which has at its rear end a flange **86** by which it is bolted to the bar **64** (Fig. 2). A link **88** is pivotally fastened to the top of the slide plate **80** and has its upper end pivotally fastened to an arm **90**. The arm **90** is fixed to a horizontally arranged shaft **92** suspended from the cross brace **36** in a pair of spaced bearing straps **94**—**94** (Fig. 2). An arm **96** is fast to the shaft **92** and has pivotally secured to its free end a link **98** (Figs. 2 and 4) which extends downwardly along the inside of the wall **34** to a point just below the cross

beams 32—32 and has connected to its lower end one end of an arm 100, the opposite end of which is journaled on a horizontally arranged shaft 102 which itself is fixed at its opposite ends between the plates 30—30. A laterally extending hub 101 (Figs. 2 and 3) integral with the arm 100 has a forwardly extending arm 100*a* to which there is secured a cam follower, the cam follower engaging a cam 100*b* (Fig. 3) mounted on a cam shaft 182. To eliminate sloppy movement in the aforesaid linkage, a rod 95 forked at its lower end, is pivoted to the arm 100, extends upwardly therefrom through an ear 97 fast to the wall 34, and has on it a compression spring 99.

The side wall erecting means 14 are mounted in recesses 104 and 106 cut in the upper surfaces of the supports 38 and 42 (Fig. 5) so as to be flush with the upper surfaces thereof, and consists of four plates (Fig. 3), a pair of rear spaced plates 108, and a pair of forward spaced plates 110 pivoted for movement from the horizontal plane of the support upwardly to substantially vertical positions. Each plate has at its inner edge and near one end, as shown in Fig. 3, an ear 112 pivotally mounted on a horizontal pin 114 mounted in a block 115 which in turn is fastened by a bolt 117 to a strip 119 welded or otherwise secured to the under side of the support 38 or 42 as the case may be. Slots in the blocks 115 permit adjustment of their spacing. On the under side of each of the plates 108 and 110, there is fixed an arm 122, the lower end of which is pivotally secured to the upper end of a link 124. The lower ends of the links 124 are joined by pivot pins 126 to the opposite ends of links 128. A pivot pin 130 connects one end of each link 132 to the center of each of the links 128. A block 134 fast to each link 132 overlies the link 128 as seen at the left in Fig. 5, and a spring 136 is interposed between the block and the link 128. As thus constructed, when the link 132 is raised, the right end of the link 128 will rise ahead of the left side, due to the depressing effect of the spring 136. Accordingly, the rear wall elevating plates 108—108 will rise ahead of the front wall elevating plates 110 and as seen in Fig. 5, when the rear wall elevating plates 108 are completely elevated, the front wall elevating plates are only partially elevated.

The end wall elevating means 16 consists of the tuck flap folding means 140 and 142, end wall elevating means 144 and locking flap folding means 146 (Fig. 6). The end elevating means 144 are in the form of plates which are hinged on pins 148 journaled in spaced ears 150 formed integral with the supports 38 and 42 for movement from a horizontal plane as shown in Fig. 7 upwardly as shown in Figs. 8 and 9, to vertical positions. The outer end of each plate 144 is provided with a pair of spaced arms 152 between which is fixed a pin 154 on which is journaled the locking flap folding means 146. A link 160 is pivotally connected at its upper end by a pin 162 to the inner end of the folding plate 146 and extends downwardly therefrom and is pivotally connected at 164 to a sleeve boss 166 fast on a shaft 163. Fast on the shaft 168 is an arm 170 which extends forwardly of the machine and is connected to a block 172 freely mounted on a shaft 174 extending transversely of the machine between the frame walls 30—30. Integral with and extending upwardly from the block 172 is an arm 176 having a follower 178 at its end which engages a cam 180 fast on a cam shaft 182. To hold the follower 178 in accurate contact with the cam, an arm 175 is pivotally mounted on the block 172 and has a follower 177 thereon engaged with the under side of the cam 180 and yieldably held in engagement therewith by a spring 179 interposed between the arm 175 and a web 181 on the block. An upright 184 is formed integral with each boss 166 so as to extend upwardly behind each link 160, and has at its upper end a pocket 186 in which there is placed a spring 188, the outer end of which projects from the pocket into engagement with the rear side of the link. This takes up any slack in the movement of the parts.



The tuck flaps at the ends of the side walls are folded upwardly and inwardly by the members 140—142, which are pivotally mounted on pins 184 at the sides of the plate 144, and have forwardly projecting angular noses 141 which lie just beneath the extremities of the flaps (Fig. 6). Each block is fast to the upper end of a rod 187 (Fig. 7) which extends downwardly therefrom through a guide plate 189 welded or otherwise attached to the links 160.

On each of the front blocks 140 there is a vertical post 191 which rises from its rear outer corner sufficiently high to intercept the forward edge of a blank as it is delivered onto the support, in the event that it floats forward out of control, for example by reason of an air cushion trapped beneath it.

On the center support 40 (Figs. 2 and 4) there is hung a carriage 190 which has spaced inwardly projecting lips 192 arranged slidably to engage tracks 194 along the opposite edges of the support 40. The carriage has at opposite sides thereof upright fingers 196—196 which serve both to limit the forward movement of the box blank as it is fed into the position to be operated upon, and to discharge the completely folded box from the machine. To this end the lower side of the carriage (Fig. 4*a*) has pivotally connected thereto one end of a link 198, the opopsite end of which is connected to a link 200 which extends downwardly through the base and is pivotally fastened to a transversely extending shaft 202 fixed between the angles 24. Extending from a hub at the lower end of the link 200 is an arm 204 connected by a link 206 to a link 208. The forward end of the link 208 is connected to a horizontal shaft 210 to which there is also connected an arm 211, and this in turn is connected by a link 213 to the link 132. The fingers 196 project upright from arms 197 pivotally mounted by pins 199 on posts 201, which in turn are pivoted on pins 203 to the carriage 190. The link 198 is pivotally fastened to the post 201 and at each side of the post is a toe 205. As thus constructed, forward movement of the link 198 causes the post 201 to tilt on the pin 203 and thus raise the fingers 196. Reverse movement of the link tilts the post 201 in the opposite direction and lowers the fingers 196. The fingers 196 are initially in a position to be engaged by the forward or leading edge of the box blank as it is deposited at the place of support, thus serving as a stop, and then while the blank is held and folded, it is drawn downwardly below the support, rearwardly and then raised behind the box, whereupon it is moved forwardly to push the completed box from the machine.

As the blanks are delivered by the feed rolls to the place of support it is necessary to guide them so that they will be properly located when the presser or holddown descends into engagement therewith. The guide fingers 196 as heretofore described, limit the forward movement of the blanks, however means must be provided for causing the blanks to move forward into engagement with these guides, and also to insure proper positioning of the blanks lengthwise, that is transversely of the machine. This is provided for by a pair of pins 212 and 214 (Figs. 3 and 6) at each side of the support, and at the rear side thereof, the pins 212 being so positioned as to engage the end extremities of the tuck flaps, and the pins 214 to engage the rear edges of the tuck flaps. The pins 212 and 214 are fixed vertically to flat plates 216 mounted on the under side of the support on pins 222 (Figs. 3 and 4) the latter being connected at their inner ends by a pivot pin 223. Extending rearwardly from the rear edges of the plates 216 are a pair of ears 218 between which is stretched a tension spring 220 which normally tends to cause the plates to turn rearwardly in opposite directions about the pin 223. Near the left end of the left-hand plate 216 (Figs. 3 and 4) there is a pin 224 which engages its rear edge. The

pin **224** is fixed to a boss formed on a sleeve **226** rotatably mounted on a short shaft **228** fixed to the frame wall **30**. Extending forwardly from the sleeve **226** is an arm **230** and in the forward end of the arm there is pivotally mounted at **232** an arm **234** which is held in alignment with the arm **230** by a spring **236**. The forward end of the arm **234** extends beneath the link **98** and is engaged by a boss extending from the lower end thereof. As thus constructed, when the hold-down is moved downwardly to clamp a box blank, the link **98** moves the arm **234** downwardly and through the aforesaid mechanism, causes the plates **216** to turn forwardly about their pivot **223** so as to move the pins **212** and **214** forwardly and inwardly to shift the box blank if it is slightly out of line, both laterally and longitudinally into proper position with its forward edge against the guides **196** and ready for clamping by the hold-down plates **74**.

The cam shaft **182** provides the means for effecting operation of the various links and levers in their proper sequence, and is directly driven from gears contained in a gear box G (Fig. 2), the latter deriving their motion from the motor M (Fig. 1), which has on it a pulley **240** on which there is entrained a belt **244**, the opposite end of which is entrained on a pulley **242** fixed on a shaft entering the gear box. Rotation of the cam shaft **182** effects movement of an arm **215** by way of a follower **217** and elliptical cam **236'** fast on the cam shaft. The end of the arm **215** is connected to the lower end of a vertically reciprocable rack bar **238** (Fig. 2) slidably mounted on the inside of one of the frame plates **34**. Engaged with the rack bar is a rack gear **240** which drives a one revolution clutch **242** mounted on the shaft **56**. During each cycle of operation of the machine, the shaft **56** is turned sufficiently to feed a box blank to the place of setting up, and through the gears **70** and **72** to cause the feed roll **54** to rotate simultaneously with the feed rolls **52***a*—**52***a*. Following feeding of the blanks into position on the support, the cam **180** transmits motion through the arms **100***a* and **100** to the hold-down, which begins to descend into engagement with the support. When the hold-down is about half way between its elevated and depressed positions, the lower end of the link **98** depresses the arm **234** and hence the arm **230**, so as to move the positioning pins **212** and **214** inwardly and forwardly to shift the blank both transversely and longitudinally into engagement with the stop pins **196**. Following completion of the downward movement of the hold-down, thec am **180** rocks the arm **176** and hence the arm **170** in a clockwise direction (Fig. 4) to elevate the links **160** and hence to lift the end wall erecting plates **144**. The plates **144** are elevated through an angle of approximately 45° from their horizontal position, whereupon they come to rest due to a dimple in the cam. At this point the side wall elevating plates **108**—**110** begin to rise. The links **132** through which motion is imparted to the side wall elevating plates are operated by the cam **133**. Due to the connection of the links **132** with the links **128**, the rear elevating plate **108** rises ahead of the front elevating plate **106**. As thus constructed, the partial elevation of the end elevating plates **144** through approximately 45° lifts the end walls *e*—*e* to the positions shown in Fig. 7 in which the end walls *e*—*e* and lock flaps *f*—*f* are inclined at about 45° from the horizontal. At the same time, the corner tuck flaps *d*—*d* are partially raised by the blocks **140**—**142**, the noses **141** of which underlie the tuck flaps so that they are raised through a somewhat greater angle than the end walls and lie in positions to be folded inwardly inside of the end walls as shown in Fig. 7. As the rear wall elevating plate begins to fold the rear wall upwardly, the tuck flaps *d*—*d* connected to the rear wall begin to move inwardly along the inside surfaces of the walls *e*—*e* ahead of the tuck flaps *d*—*d* which are integral with the ends of the front wall. The rear wall elevating plates precede the front wall elevating plate through their vertical position as illustrated in Fig. 5, so that the tuck flaps *d*—*d* of the front wall will always slide inwardly inside of the tuck flaps of the rear wall. As the side wall elevating plates reach vertical positions, the cam **180** then effects renewed elevation of the end wall elevating plates so as to move them to vertical positions (Figs. 8 and 9). As the links **160** approach their upper limit of movement, shoulders **246** on the links move into engagement with the rear sides of the plates **144** and hold them vertical, while the final movement of the links pivots the locking flap plates **156** about their pivots **154** so as to fold the locking flaps *f*—*f* inwardly and downwardly into engagement with the inside of the tuck flaps *d*—*d*. The terminal ends of the members **156** are concave so that as they move inwardly and downwardly at the insides of the ends of the box, they force the locking tongues *t*—*t* into the slots *c*—*c*. To permit free passage of the tongues *t*—*t* through the slots *c*—*c*, the supports **38** and **42** are provided with shallow recesses **248** (Fig. 9) subjacent to the slots. Following completion of the box, the folding instrumentalities retract, the hold-down is elevated, and the stop fingers **196** move forwardly to eject the box from the machine.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a substantially flat surface upon which may be placed a flat blank, a hold-down mounted for movement to and from the place of setting up, means for effecting movement of the hold-down from an out-of-the-way position into engagement with the blank at the place of setting up, side and end wall elevators arranged circumferentially of the place of setting up substantially in the plane of the support, subjacent to the blank on the support, said elevators being movable relative to the support from said common plane to positions to fold the side and end walls to substantially right angular positions with respect to the bottom, and means to effect movement of said elevators to cause the end elevators to rise to positions intermediate their prone and vertical positions, said means including a spring biased linkage common to both side wall elevators for raising the same from their prone positions to vertical positions in succession so that one precedes the other to its vertical position, and means thereafter to renew movement of the end wall elevators to complete their upward movement to vertical positions.

2. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a flat support upon which may be placed a flat blank, a hold-down mounted for movement to and from the place of setting up, means for effecting movement of the hold-down from an out-of-the-way position into engagement with a blank at the place of setting up, side wall and end wall elevators arranged circumferentially of the place of setting up substantially in the plane of the support, subjacent to the blank on the support, said elevators being movable relative to the support from said common plane to positions to fold the side and end walls to substantially right angular positions with respect to the bottom, mechanism for effecting movement of said end wall elevators from prone positions to vertical positions with a pause in said upward movement part way between their prone and vertical positions, mechanism for effecting movement of the side wall elevators from prone positions

to vertical positions during the pause in the elevation of the end walls, and means in said last-named mechanism operating to delay elevation of one of said side wall elevators so that the other precedes it to its vertical position.

3. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a substantially flat support, upon which may be placed a flat box blank, a hold-down mounted for movement to and from the place of setting up, means for effecting movement of the hold-down from an out-of-the-way position into engagement with a blank at the place of setting up, said side and end wall elevators being arranged circumferentially of the support, tuck flap elevators intermediate the side and end wall elevators, said elevators being arranged in a substantially common plane subjacent to the blank on the support, said elevators being movable from said common plane to positions to move the side and end wall flaps to vertical positions with respect to the bottom, and to fold the tuck flaps inwardly into contact with the inside of the end walls, mechanism for effecting movement of said elevators to vertical position so that the end walls and tuck flap elevators rise from their initial positions to intermediate positions and pause, said mechanism including a rocker arm connected at its ends to the respective side wall elevators and spring means for biasing the rocker so that as it is raised to impart movement to the elevators one end precedes the other, and means for thereafter causing the end wall elevators to resume upward movement to their final position.

4. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a substantially flat support, upon which may be placed a flat blank, hold-down means mounted for movement to and from the place of setting up, means for effecting movement of the hold-down from an out-of-the-way position into engagement with a blank at the place of setting up, side and end wall elevators arranged circumferentially of the support, tuck flap elevators intermediate the side and end wall elevators, said elevators being arranged in a substantially common plane subjacent to the blank on the support, mechanism for effecting movement of said end wall and tuck flap elevators simultaneously from their initial position in the plane of the support, upwardly to raise the end walls and tuck flaps to inclined positions with respect to the bottom of the box to be formed, means in said mechanism to bring the end wall and tuck flap elevators to rest with the end walls inclined upwardly and the side wall flaps bent inwardly into engagement with the insides of the end walls, mechanism for raising the side wall elevators to bend said side walls upwardly from prone positions to vertical positions while the end walls remain partially erected, means in said last-named mechanism for effecting movement of one of said end wall elevators ahead of the other so as to advance the tuck flaps of that wall inwardly along the inside of the end walls at a sharper angle than the tuck flaps at the ends of the other side wall, thereby to insure disposal of the tuck flaps at the ends of the wall erected first behind the tuck flaps of the other wall, said first-named mechanism being operable after the lagging one of the side walls has reached its vertical position to renew elevation of the end wall elevators to vertical positions.

5. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a substantially flat support, upon which may be placed a flat blank, a hold-down mounted for movement to and from the place of setting up, means for effecting movement of the hold-down from an out-of-the-way position into engagement with a blank at the place of setting up, operating instrumentalities for erecting the end and side walls and tuck flaps of the blank and for thereafter folding the locking flaps into engagement with the inside end portions of the box, said instrumentalities including articulate members at opposite sides of the support subjacent to the end walls and locking flaps, spaced side members fore and aft of the support subjacent to the end portions of the side walls, and corner members located at the four corners of the support between the articulated members and the spaced side wall members subjacent to the tuck flaps, each articulate member consisting of two sections hinged to the support for movement in a common plane from a prone position to a vertical position, and hinged together for movement of one section relative to the other, mechanism for elevating the articulate members bodily with its sections in a common plane to vertical positions, thereby to lift the end walls and locking flaps to vertical positions, means in said mechanism to cause the articulate members to dwell for a predetermined length of time in its upward movement so that the end walls and locking flaps are inclined, said corner members being movable with the articulate members to lift the tuck flaps upwardly and having portions thereon which press the articulate members for causing the tuck flaps to precede the end walls, mechanism for raising the side wall members about their hinges from their prone positions to vertical positions to raise the side walls to positions at right angles to the bottom during the predetermined delay of the end wall elevators, a delay motion in said last-named mechanism for effecting erection of one pair of side wall elevating members ahead of the other pair so that one side wall reaches its vertical position ahead of the other, said means for effecting the dwell being designed to restore upward movement to the articulate members following erection of the side walls to vertical positions, and means for thereafter effecting relative movement of the sections of said articulate means to fold the locking tongues inwardly and downwardly into engagement with the insides of the end walls and to tuck the locking tongues into the slots in the bottom.

6. In a machine for setting up flat box blanks of the kind having a bottom, sides and ends adapted to be folded upwardly therefrom, tuck flaps and locking tongues foldable over the ends and tuck flaps and engageable within slots at the junctions of the ends with the bottom, a place of setting up including a substantially flat support upon which may be placed flat blanks, a hold-down mounted for movement to and from the place of setting up, setting up instrumentalities arranged peripherally of the support subjacent to the end and side walls of a blank resting on the support, said setting up instrumentalities being movable to erect the end and side walls while the bottom of the blank is held against the support by the hold-down, positioning members arranged about the support including fore and aft members, said forward members being initially fixed and said rear members being movable from extended positions greater than the dimensions of the blank forwardly and laterally to shift a blank resting on the support into engagement with the forward members and into transverse registration with the setting up instrumentalities, said fixed members being arranged to be retracted to a position below the support, moved rearwardly while retracted below the support and then elevated to positions above the support behind the blank for forward movement to their initial position, feeding means for delivering blanks one at a time to the support within the positioning means, and means for effecting operation of the foregoing component parts of the machine in sequence to feed a blank to the support, effect movement of the positioning members to register the blank with the setting up instrumentalities, lower the hold-down into contact with the bot-

tom portion of the blank, effect actuation of the setting up instrumentalities, simultaneously lower the front positioning members, move them rearwardly, and then restore them to a position above the support behind the blank, retract the operating instrumentalities and move the forward positioning members forwardly to their initial position to discharge the completed box.



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