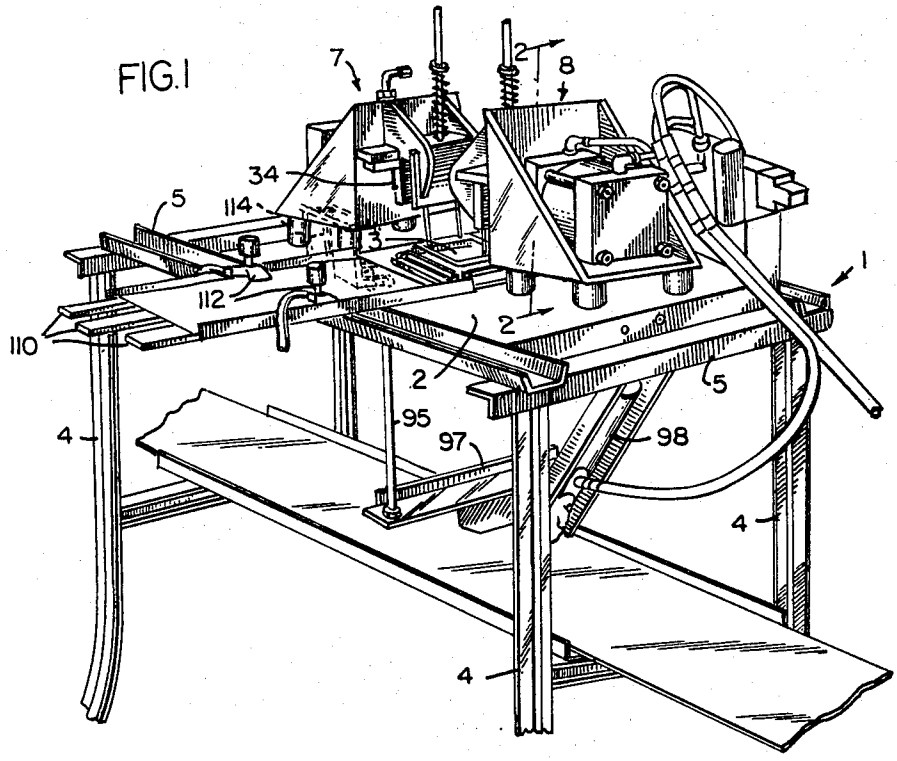
June 4, 1968 H. G. HALE, JR 3,386,349

BOX MAKING MACHINE

Original Filed Nov. 12, 1964 4 Sheets-Sheet 1

FIG. 1



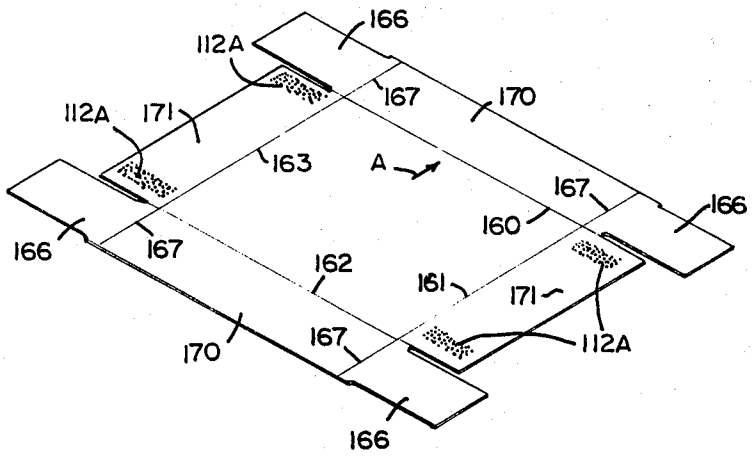


FIG. 8

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BOX MAKING MACHINE

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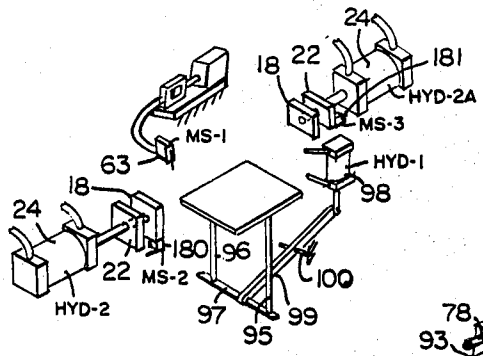


FIG. 5

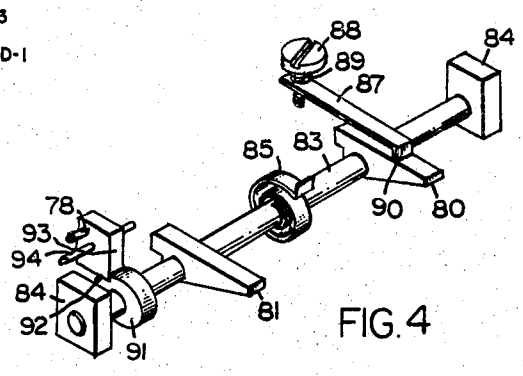


FIG. 4

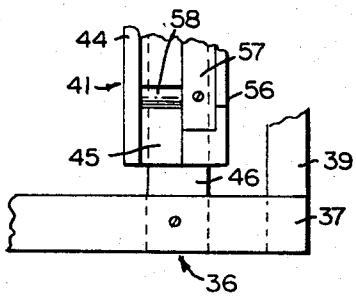


FIG. 9

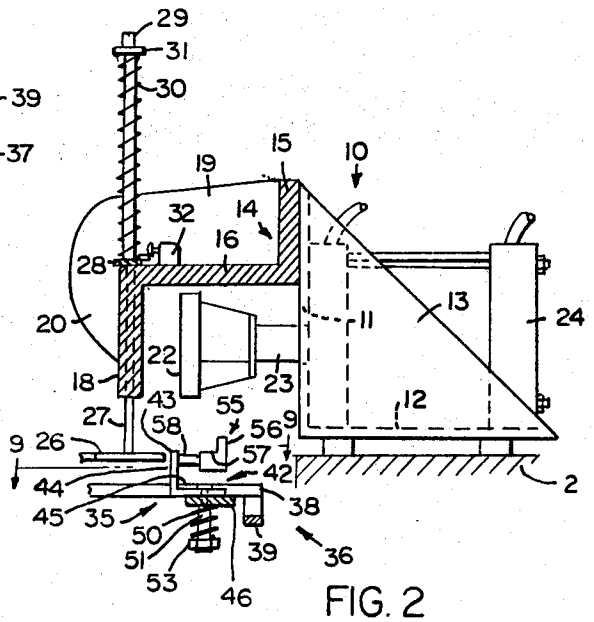


FIG. 2

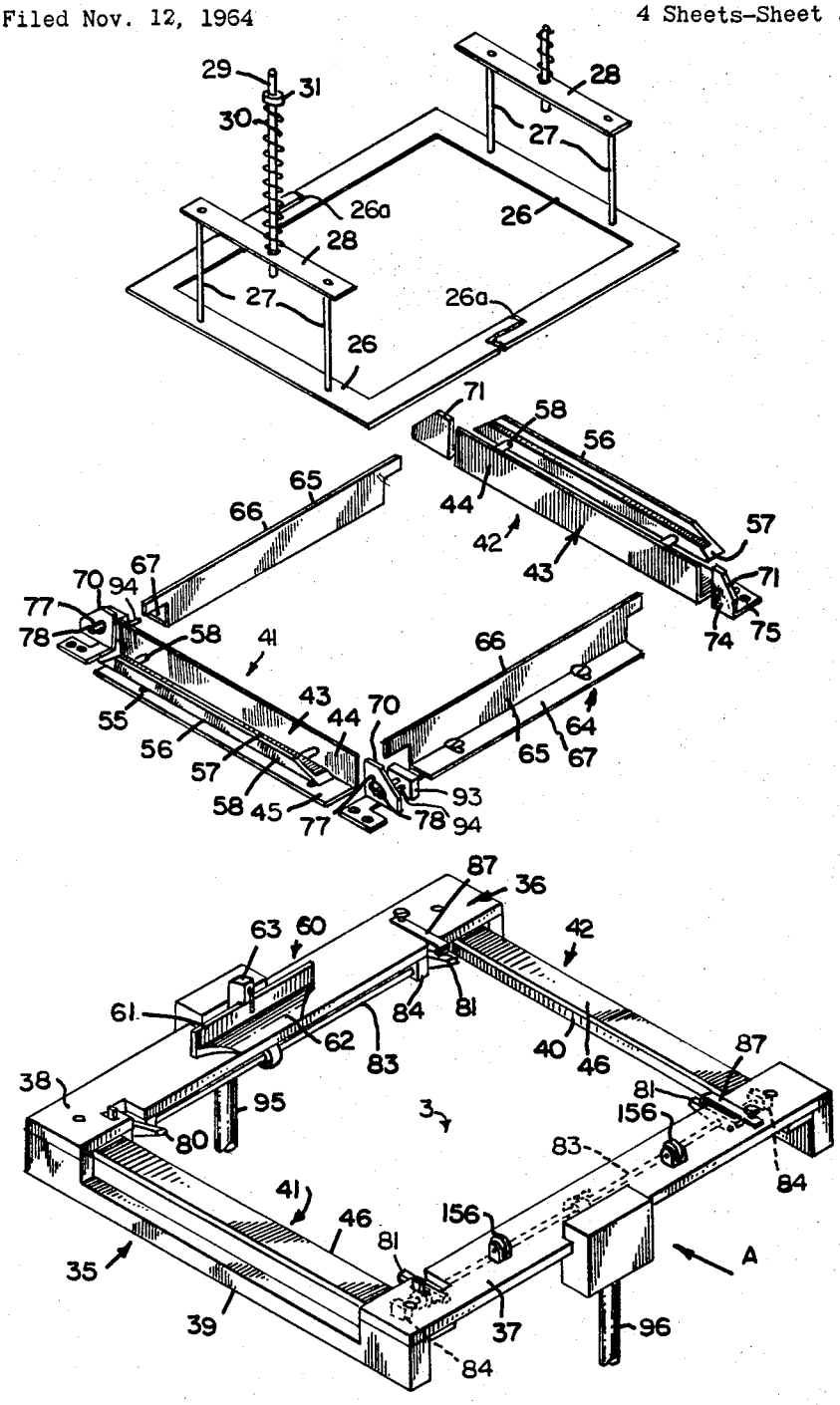
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BOX MAKING MACHINE

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FIG. 3



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BOX MAKING MACHINE

Original Filed Nov. 12, 1964 4 Sheets-Sheet 4

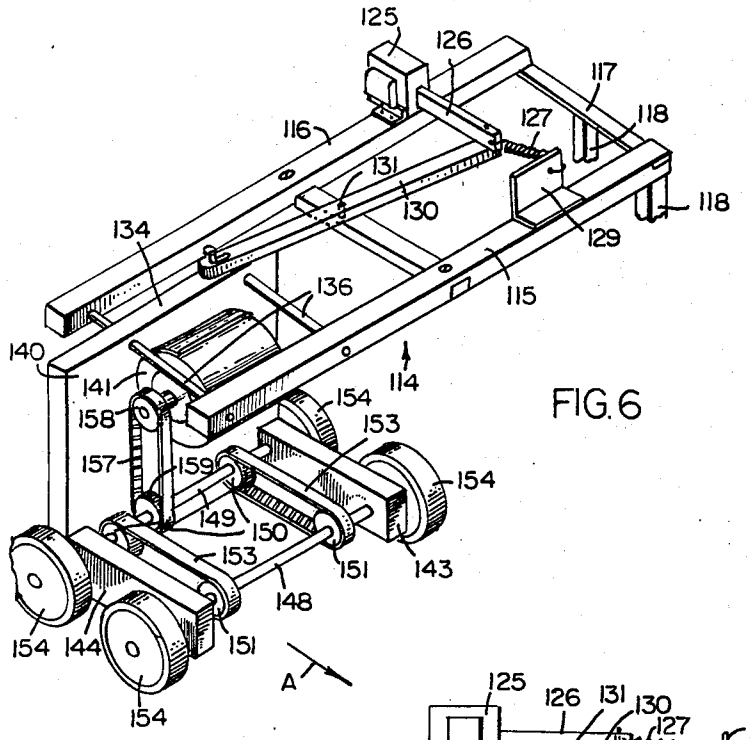


FIG. 6

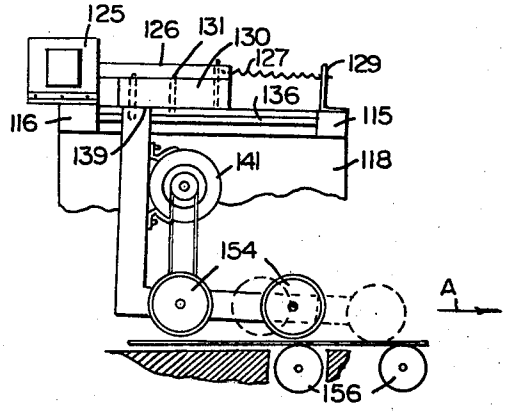


FIG. 7

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3,386,349

BOX MAKING MACHINE

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Continuation of application Ser. No. 410,609, Nov. 12, 1964. This application May 3, 1967, Ser. No. 635,927
12 Claims. (Cl. 93—49)

This application is a continuation of application Ser. No. 410,609, filed Nov. 12, 1964.

The present invention relates to a machine for manufacturing boxes.

There has been a consistent demand for box manufacturing machines that are more efficient to operate and are less expensive to manufacture. The present invention is designed to provide such a machine. Therefore, it is an object of the present invention to provide a box manufacturing machine which is capable of fabricating boxes from successively fed paperboard blanks at a rate of at least approximately one box per second.

A further object of this invention is to provide a relatively light, compact box manufacturing machine capable of folding box blanks into boxes and adhesively sealing side walls of the blanks into permanent engagement under pressures in excess of 3,000 to 4,000 p.s.i. In this connection, it is also an object of the present invention to provide a box manufacturing machine design that is capable of exerting clamping pressures of 3,000 to 4,000 pounds without the requirements of a machine having a heavy press frame.

A further object of this invention is to provide a light compact box manufacturing machine of inexpensive design that is adapted to be adjusted to fabricate boxes of a variety of sizes.

A further object of this invention is to provide a box manufacturing machine in which box blanks are folded into a box configuration by relative movement of the box blank and clamping elements in a direction perpendicular to the bottom of the box blank. A further object of this invention is to provide an improved feed mechanism for positively and successively feeding box blanks into a box forming machine at rapid rates. A further object of this invention is to provide a light compact box manufacturing machine that is inexpensive to manufacture, maintain, move from location to location and which is not likely to break down even under continuous use.

In the present invention there is provided a box making machine having means for feeding box blanks successively to a first position. Means are provided for folding the side walls and tabs of the box blank angular to its bottom into generally a box configuration at this first position. Means move this box configuration to a second position between a pair of clamps. Each of these clamps has a pair of clamping plates for engaging opposite side walls of the box configuration at this second position. These clamping plates are constructed and arranged to engage opposite side walls of the box configuration and adjacent tabs for sealing the tabs and side walls together. Means eject the formed box with a positive force, preferably in a downward direction, through the means for forming the box configuration.

These and other objects and advantages of the present invention will be core clearly understood when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a preferred embodiment of this invention;

FIG. 2 is a fragmentary vertical cross sections elevation of one half of the clamping and forming mechanism, taken along a line generally indicated at 2—2 of FIG. 1;

FIG. 3 is a perspective exploded fragmentary view of folding or forming elements;

FIG. 4 is a perspective detail of the holding fingers assembly;

FIG. 5 is a schematic perspective view of some of the actuating elements;

FIG. 6 is a perspective fragmentary detail of the feed mechanism;

FIG. 7 is a side elevation of the feed mechanism;

FIG. 8 is a perspective view of a box blank formed by this invention, and

FIG. 9 is a cross sectional detail taken along the lines 9—9 of FIG. 2.

The machine components are mounted on a suitable frame 1 having a supporting bed 2 with a centrally located aperture 3. The frame 1 may include legs 4 suitably formed of angle members, and a plurality of horizontal beams 5 interconnecting the legs 4 and supporting the bed 2. A pair of hydraulically operated clamps generally indicated at 7 and 8 are supported on the bed 2 on opposite sides of the aperture 3. These clamps are better illustrated in FIG. 2 which shows one of the pair of similar clamps. Each of these clamps are formed with a frame 10 having a forward wall 11 and bottom wall 12 integrally connected together with bottom wall 12 bolted or otherwise suitably secured to the bed 2. Sidewalls 13 are provided to strengthen frame 10 and have edges welded respectively to the side edges of the walls 11 and 12. An L-shaped member 14 having one leg 15 and a second leg 16 is secured to the frame 10 with a leg 15 being welded in facing relation to the upper portion of wall 11. Extending downwardly from leg 16 at the free end thereof is the clamping plate 18. This clamping plate is also partially supported and secured to the L-shaped member 14 by parallel sidewalls 19 that are integrally joined to opposite ends of the legs of the L-shaped member. The sidewalls 19 also have downwardly extending portions 20 welded to the inner portion of the clamping plate 18. Each clamping plate 18 is a stationary clamping plate. Positioned in spaced facing relationship with clamping plate 18 is a movable clamping plate 22. This movable clamping plate 22 is supported on a piston 23 which extends through the wall 10 and is actuated for reciprocal movement by the hydraulic cylinder 24. Also secured and supported on the hydraulically operated clamps is a pair of hold-down members 26, (FIG. 3). Each of these members comprises flat aligned C-shaped members split from one another at 26A. These members 26 are independently supported and adapted to cooperate to engage the center portion of a box blank. These members each are supported on a pair of rods 27. Each pair of rods 27 extend upwardly through a clamping plate 18 of the clamps 7 and 8. The upper ends of each pair of rods 27 are secured to a cross member 28 that is positioned over the upper surface of clamping plate 18. Clamping plate 18 thus in part form a journal for a pair of rods 27 which move up and down and carry a hold-down member 26. A guide pin 29 extends upwardly through cross member 28 with its lower end rigidly secured to the upper surface of clamp plate 18. A helical spring 30 coaxially mounted on guide pin 29 has its lower end engaging cross member 28 and its upper end engaging stop member 31 which in turn is secured to the guide pin 29. This helical spring 30 normally exerts a force on the cross member 28 and consequently on the hold down member 26. Spring detents 32 (FIG. 2) are mounted on each leg 16 and are adapted to engage each cross member 28 to hold them down against forces within selected limits. Above such limits the detents 32 release allowing the hold-down members 26 to be moved upwardly against the spring tension of helical spring 30. Also secured to and positioned on the frame 10 of supporting hydraulic clamp 7 is a pair of downwardly extending pawls 34 (FIG. 1). These pawls 34 are positioned on opposite side edges of the legs 16 and extend downwardly to engage a dog 78

on the forming mechanism generally illustrated at 35 (FIG. 3).

This forming mechanism 35, best illustrated in FIG. 3 is adapted to be moved up and down through the aperture 3 to first shape blanks into a box configuration, then move the box configuration into engagement with the clamping mechanisms.

The forming mechanism 35 includes a base frame 36. This frame includes side members 37 and 38 interconnected by side members 39 and 40. Side members 37 and 38 are coplanar and side members 39 and 40 are also coplanar but on a level lower than side members 37 and 38. Extending parallel to side members 39 and 40 and supported on side members 37 and 38 are the side guide-forms 41 and 42. These side guide-forms are each similar in construction and each includes an elongated angle member 43 having one leg 44 extending upwardly and aligned with the space between the clamping plates 18 and 22. The other leg 45 is suitably secured by screws or otherwise to a supporting plate 46. This support plate 46 extends across and below side members 37 and 38. The support plate 46 is secured against the lower sides of the side members 37 and 38 by the spring tension of helical springs 50 (FIG. 2). These springs 50 are coaxially mounted on pins 51 in turn rigidly secured to and extending downwardly from the lower surfaces of the side members 37 and 38. A stop member 53 at the lower end of the pins 51 engages the lower ends of the springs 50. The legs 44 act in part as a former as will be understood from the subsequent description of the operation. Secured to the legs 44 of each of the side guide formers 41 and 42 are guide members 55. These guide members 55 are formed of elongated angular members having legs 56 and 57. The guide members are rigidly secured to the legs 44 by a plurality of pins 58 which have one end secured to the outer surface of leg 44 and the other end secured to the horizontal leg 57 of the guide members 55. The pins 58 are vertically aligned with the lower surface of clamp plate 22 so as to engage this clamp plate on upward movement of the base frame. Engagement of the pins 58 with the clamping plate 22 limit the upward movement of side guide-formers 41 and 42 and hold them down in this position of upper limit against the spring tension of spring 50.

Supported on side 38 is an end guide member 60. This end guide member 60 has an upwardly extending wall 61 integral with downwardly angularly aligned wal 62 that is adapted to engage a box blank as it is moved over the aperture 3 and guide the blank to a proper position over the forming mechanism 35. A microswitch 63 is positioned on wall 61 and is adapted to engage the edge of a box blank when it is moved into position over the aperture 3.

Side formers 64 and 65 are positioned respectively on side members 37 and 38. Each of these side members is formed of an elongated angle member having legs 66 and 67. Legs 66 extend upwardly and are adapted to engage the box blank during the forming process. Legs 67 are longitudinally secured to the upper surfaces of side members 37 and 38. Also secured to the side members 37 and 38 are four dogs 70 and 71. These dogs are secured to the side members 37 and 38 with one dog 70 on one side of each leg 66 and another dog 71 on the other side of each leg 66. The dogs 70 differ slightly in construction from the dogs 71. The dogs 71 are simple angle members having upwardly extending legs 74 and horizontally extending legs 75. Legs 75 are secured to the members 37 and 38 while legs 74 lie in planes extending generally inwardly toward the corners of hold down members 26. Dogs 70 are generally of a similar construction except that they have an aperture 77 formed in the upwardly extending leg through which aperture a dog 78 projects (see FIG. 4). This dog 78 is aligned with and is adapted to be engaged by the previous described pawl 34 (FIG. 1) on upward movement of the forming mechanism 35. The dog 78 is tripped by pawl 34 on downward movement of the forming mechanism 35.

The dogs 78 are each operatively interengaged with a set of fingers 80, 81 secured to side members 37 and 38 (FIG. 4). This arrangement is the same on both side members 37 and 38, therefore, only one will be described. The fingers 80 and 81 are secured to a shaft 83 positioned below an extending longitudinally of side member 37. The shaft 83 is rotatably supported in journals 84, in turn secured to opposite ends of the lower surface of side member 37. The helical spring 85 coaxially mounted on the shaft 83 has one end secured to side member 37 and the other to the shaft 83 so as to spring tension the shaft and consequently the fingers 80 and 81 into a preselected position in which these fingers 80 and 81 project inwardly beyond the upwardly extending legs 66 of the side formers 64 and 65. Each finger 80 and 81 is restrained against movement beyond a selected point under the tension of spring 85 by stops 87. Only one of these stops is shown in FIG. 4. These stops 87 are resiliently supported on the side members 37 by a headed screw 88 loosely extending through the stop 87. A helical spring 89 is coaxially mounted on the screw 88, with one end engaging the head of the screw and the other the top surface of the stop 87. The stop 87 has a depending lip 90 which extends down into engagement with the upper surface of one of the fingers 80 and 81. Thus, the fingers 80 and 81 may be pivoted downwardly against the spring tension of spring 85 or pivoted upwardly beyond a normal rest position against the spring tension of spring 89. Also mounted on shaft 83 is a cam 91. This cam has a shoulder 92 which normally engages the lower end of lever 93. Lever 93 is mounted on a pin 94, in turn secured to a suitable journal supported on the side member 37. The upper end of lever 93 terminates in the dog 78, which as previously indicated, projects through the aperture 77 in the dog 70. This dog is adapted to be engaged, as previously indicated, by pawl 34 to disengage the lever from the shoulder 92, thereby allowing downward pivoting of the fingers 80 and 81 to a selected position in which they are no longer below the hold down members 26.

The base frame 36 is mounted for vertical movement on a pair of vertically extending shafts 95 and 96 connected at their upper ends to side members 37 and 38. They are suitably journaled on the frame 10 for vertical movement. The lower ends of these shafts are interconnected by a cross beam 97 (FIG. 1) so that they may be raised and lowered simultaneously and uniformly. A hydraulic cylinder 98 is suitably mounted on the frame and has a shaft connected to its piston that extends downwardly. The piston shaft is connected to link 99 schematically illustrated in FIG. 5. Link 99, in turn, is supported intermediate its ends by a suitable frame member 100. The other end of link 99 engages the cross beam 97 and is adapted to transmit vertical movement of the hydraulic cylinder piston to the cross beam.

The feed mechanism, as shown in FIGS. 1, 6 and 7, is designed to horizontally feed individual blanks one at a time and center these blanks over the aperture 3 within the area defined by the side guide formers 41 and 42 and side formers 64 and 65. In this arrangement, a plurality of rails 110 extend outwardly from the bed from the apparatus 3 on the side that the side member 37 is located. Straddling the rails on either side are a pair of glue spreaders 112 which may be conventional design and which are adapted to apply glue spots at the tab locations in a conventional fashion.

Straddling the rails 110 in a location illustrated in dotted lines in FIG. 1 is a support 114 for the feed mechanism. This support includes forward and a rear cross members 115 and 116 respectively. These cross members are secured together by cross braces 117 at each end, in turn supported on vertical standards 118 which have their lower end suitably secured to the bed 2. The cross members

115 and 116 are coplanar, but lie in a plane inclined downwardly at a slight angle to the horizontal. Supported on these cross members 115 and 116 is a solenoid 125. This solenoid 125 has an arm 126 that is engaged by spring 127 in turn secured to a bracket 129. The bracket is mounted on cross member 115. The solenoid arm 126 also engages the lever 130 and is adapted to pivot this lever about the pin 131 on actuation of the solenoid. The other end of the lever 130 engages carriage 134 supported on the rails 136. The carriage, in turn, supports a frame 140 on which is secured a motor 141. Also supported on the frame 140 are two forwardly directed parallel legs 143 and 144 at the lower end of the frame 140. Journalled in these legs 143 and 144 are shafts 148 and 149. Shaft 149 extends through both legs 143 and 144 and has a pair of pulleys 150 supported on it. A pair of pulleys 151 are suported on shafts 148. The two pairs of pulleys 150 and 151 in turn support and functionally engage the endless rubber belts 153. Also supported on shafts 149 and 148 outside of legs 143 and 144 are roller bearings 154. These roller bearings 154 are adapted to ride over rails 110 and in selected forward positions are adapted to move to wheels 156 which are mounted on bed 2 with one aligned with each bearing 154.

In the operation of this device, successively fed blanks of the size and shape illustrated in FIG. 8 are fed forwardly along the rails 110, either by hand or by conveyor system, not a part of this invention. As the blank is moved forwardly localized glue spots may be applied to the spots 112A on the upper surfaces of the blank by conventional glue spreaders 112. The solenoid 125, when actuated, will cause a reciprocating movement of the carriage 134 through the lever 130. The motor driven belts 153 continuously rotate roller bearings 154 which will then gradually engage the top surface of the foremost box blank and carry it forward on the rails 110. (A belt and pulleys 157 connect the motor shaft 158 with shaft 149). The blank first moves between and is then engaged on opposite sides by the outermost bearings 154 and wheels 156. The positive motion of bearings 154 accelerate the blank forward and between the forwardmost converging bearings 154 and wheels from which the blank is rapidly moved forward in the direction of arrow A. It is carried over the rails 110 base frame 36, including side members 37 to 40 inclusively, and the side guideformers 41 and 42. As is it carried over these elements, it is carried below the hold-down members 26. The blank moves forward until it strikes and actuates microswitch 63. When actuated, microswitch 63 causes a solenoid (not shown) to actuate hydraulic cylinder 98. This in turn causes the base frame 36 to move upwardly. As the base frame 36 moves upwardly, the hold down members 26 engage the top surface of the box blank within the crease lines 160, 161, 162 and 163 (FIG. 8). As the base frame 36 continues to move upwardly dogs 70 and 71 first engage the tabs 166 of the box blanks. This causes these tabs to bend upwardly on the crease lines 167. Immediately thereafter the upper edges of legs 66, which are not quite as high as dogs 70 and 71, engage sides 170 of the box blank outside of crease lines 160 and 162. This causes these sides 170 to simultaneously fold upwardly. The already partially creased tabs 166 will then move inwardly above side walls 171 of the box blanks as the base frame 36 continues to move relative to the hold down members 26. As the base frame 36 continues to move upwardly, the hold down members 26 remain in their initial fixed position until the walls 170 and 171 have been folded to a vertical position with the tabs 166 on the inside of walls 171. When these walls 170 and 171 have been vertically positioned, continued upward movement of the base frame overcomes the tension of detents 32 (FIG. 2) and thereby disengages cross member 28 from the detent and permits the hold down members 26 to move upwardly with the base frame 36, against the tension of springs 30. In this position as the base frame 36 moves upwardly the fingers 80 and 81 securely engage a lower surface of the box blank at opposite sides thereof. The base frame 36 moves upwardly until the now-vertically positioned walls 171 and tabs 166 have moved between the clam plates 18 and 22. At the same time dogs 78 pass pawls 34 without being actuated and are positioned above these pawls so that on downward movement of the base frame 36 the dogs 78 may be tripped and actuated by the pawls 34. The upward movement of the angle members 43 and guide members 55 is limited by the engagement of pins 58 with the lower surface of the clamp plate 22. This engagement prevents legs 44 from moving between the plates 18 and 22 but allows the walls 171 and tabs 166 projecting beyond legs 44 to move between the clamping plates. As the box blank reaches the desired position with the walls 171 between the clamp plates, a second microswitch 180 suitably positioned to be engaged by the blank wall 171 as it moves to its desired position is tripped (FIG. 5). This microswitch actuates the hydraulic cylinders 24 and causes them to close the clamp plates 22 against the clamp plates 18 and return the clamp plates 22 to their original position. Suitable adjustments may be made to effect a desired pressure sufficient to set the adhesive on the walls 171, thereby forming the box blank into its final set shape. As clamp plate 22 returns to its initial position it trips a third microswitch 181 which in turn energizes the solenoid controlling hydraulic cylinder 98. This permits the base frame 36 to move downwardly under the weight of gravity. As the base frame starts to move downwardly, dogs 78 engage and are tripped by the pawls 34. When the dogs 78 are engaged the cam 91 is freed from the lever 93 and fingers 80 and 81 are released. At that point the fingers 80 and 81 are held in position only by the upward spring tension of springs 85. However, the now compressed springs 30, which are of greater size than springs 85 and therefore have greater force, impel the hold-down members 26 downwardly at a substantially greater speed than the downward movement under gravity of the base frame 36. This causes the hold-down members 26 to force the formed box downwardly through aperture 3 in the base frame 36 and past fingers 80 and 81 which are pivoted out of the path of the box, as the box bottom pivots the fingers downwardly against the tension of springs 85. The box is forced past the frame 36 downwardly onto a moving conveyor means, or other suitable means for removing the box blank. As the base frame 36 continues to move downwardly after discharge of the box, it will pass the hold down members 26 which has now returned to its normal position shown in FIG. 2 in which the spring 30 is not under compression. As the frame 36 moves past the hold down members 26 the now inwardly projecting fingers 80 and 81 may be forced upwardly out of the path of the base frame 36 beyond their normal position against the tension of spring 89 as the hold down members move past them. Once the hold down members 26 have cleared the fingers 80 and 81 they return to their normal position under tension of spring 89. The machine is then ready for a subsequent cycling.

Having now described my invention, I claim:

1. A machine for forming boxes from blanks having sidewalls and tabs defined by score lines with said tabs adapted to be engaged with said sidewalls under pressure to form a box comprising, a frame with an aperture formed therein over which said blanks are moved to a first position, means for successively feeding said box blanks to said first position, means for folding said tabs and sidewalls along said score lines, defining them to shape said blank into a box configuration, means for moving said box configuration in a direction normal to the plane within which the bottom of said box configuraiton lies to engage the sidewalls and tabs with a clamping means, said means for moving said box configuration including members adapted to move upwardly through said aperture

carrying said box configuration into engagement with said clamping means and a folding mechanism having hold-down members for engaging the upper surface of the bottom of said blank and forming members for engaging the sidewalls and tabs to hold them while said blank is engaged by said hold-down members, with said hold-down members and forming members adapted to be moved vertically as said box configuration is carried into engagement with said clamping means, said clamping means having elements for engaging said tabs and sidewalls and applying pressure thereto seal said tabs and sidewalls in fixed interengagement to form said box, and means for ejecting said box from said machine.

2. A machine as set forth in claim 1 wherein said forming members include

a base frame having side members forming a continuous support,

a plurality of upwardly extending dogs on said frame adapted to engage said tabs and fold them upwardly when said box blank s in said first position, and

a plurality of side guide formers having upwardly extending legs attached to said frame for engaging and upwardly folding opposite sidewalls of said box blank.

3. A machine as set forth in claim 2 where in said hold down members includes laterally extending elements positioned to engage the upper surface of said box blank,

rod means supporting said laterally extending elements for vertical movement,

means normally tensioning said rod means for downward movement toward a selected position, and

means for maintaining said rod means in said selected position against limited upward forces.

4. A machine as set forth in claim 3 wherein each of said clamps has one moveable and one fixed clamp plate with said moveable clamp plate adapted to be moved into clamping engagement with said fixed clamp plate.

5. A machine as set forth in claim 4 having means journalling said rod means for vertical reciprocal movement, a vertically extending pin secured to each clamp with a helical spring coaxial therewith having one end in engagement with said rod means for downwardly tensioning hold down members.

6. A machine as set forth in claim 2 including a plurality of guide members for guiding said box blank into said first position.

7. A machine as set forth in claim 6 wherein said guide members are secured to opposite side members of said base frame, and include elongated upwardly extending legs parallel to and spaced outwardly of said upwardly extending legs of said side guide formers, and

support means securing said upwardly extending legs of said side guide formers and said guide members to said base frame for limited vertical movement relative thereto.

8. A machine as set forth in claim 7 having means carried by said support means, engageable with said clamping means to limit the vertical movement of said guide formers and guide members in relation to said base frame as said blank in said box configuration is carried upwardly to said clamping means.

9. A machine as set forth in claim 7 having a plurality of fingers supported on said base frame and projecting inwardly therefrom to engage and support the bottom of said box blank and

means for retracting said fingers from engagement with said blank when said tabs and sidewalls have been sealed by said clamping means.

10. A machine as set forth in claim 9 having spring means for normally tensioning said hold down means to move in a downward direction with said hold down means adapted to be carried upwardly against said tension as said box configuration is moved upwardly, and

means for releasing said spring means on sealing said tabs and sidewalls, whereby said box will be projected downward through said base frame on retraction of said fingers.

11. A machine for forming boxes from blanks having sidewalls and tabs defined by score lines with said tabs adapted to be engaged with said sidewalls under pressure to form a box comprising, means for successively feeding said box blanks to a first position including a plurality of rails over which successive blanks may be carried, a first plurality of rollers successively positioned along said rails with surface portions thereof positioned to engage blanks carried over the rails, a second plurality of rollers for angular movement in respect to said rails toward engagement with said first set of rollers, and means rotating said second set of rollers whereby a box blank may be moved into engagement with said first and second set of rollers on opposite sides thereof and be projected into said first position by the rotation of said second set of rollers, means for folding said tabs and sidewalls along said score lines to shape said blank generally into a box configuration, means for moving said box configuration in a direction normal to the plane within which the bottom of said box configuration lies to engage the sidewalls and tabs with a clamping means, said clamping means having elements for engaging said tabs and sidewalls and applying pressure thereto to seal said tabs and sidewalls into fixed interengagement to form said box, and means for ejecting said box from said machine.

12. A machine for forming boxes from blanks having sidewalls and tabs defined by score lines with said tabs adapted to be engaged with said sidewalls under pressure to form a box comprising,

a frame with an aperture formed therein over which said blanks are moved to a first position,

means for successively feeding said box blanks to said first position,

means for folding said tabs and sidewalls along said score lines defining them to shape said blank into a box configuration,

a clamping means,

means for moving said clamping means and said box configuration relative to one another in a direction normal to the plane within which the bottom of said box configuration lies to engage the sidewalls and tabs with said clamping means,

said means for moving including members adapted to move through said aperture carrying the moving element of said clamping means and box configuration into said engaging position,

a folding mechanism having hold-down members for engaging the upper surface of the bottom of said blank and forming members for engaging the sidewalls and tabs to hold them while said blank is engaged by said hold-down members, with said hold-down members and forming members adapted to be moved in said normal direction during said relative movement of said clamping means and box configuration,

said clamping means having elements for engaging said tabs and sidewalls and applying pressure thereto to seal said tabs and sidewalls in fixed interengagement to form said box,

and means for ejecting said box from said machine.

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