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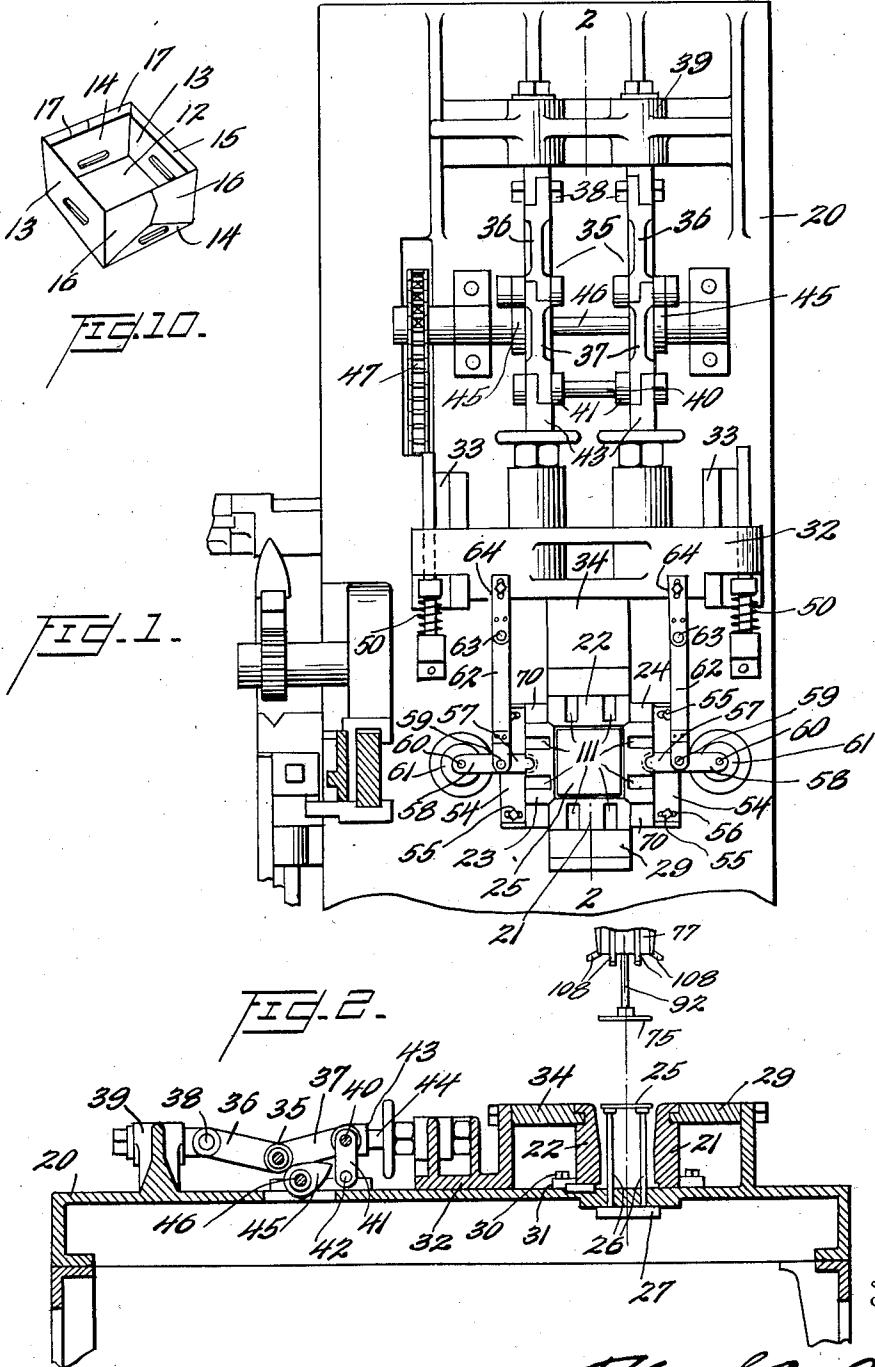
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2,014,046

BOX FOLDING MECHANISM

Filed April 5, 1935

3 Sheets-Sheet 1



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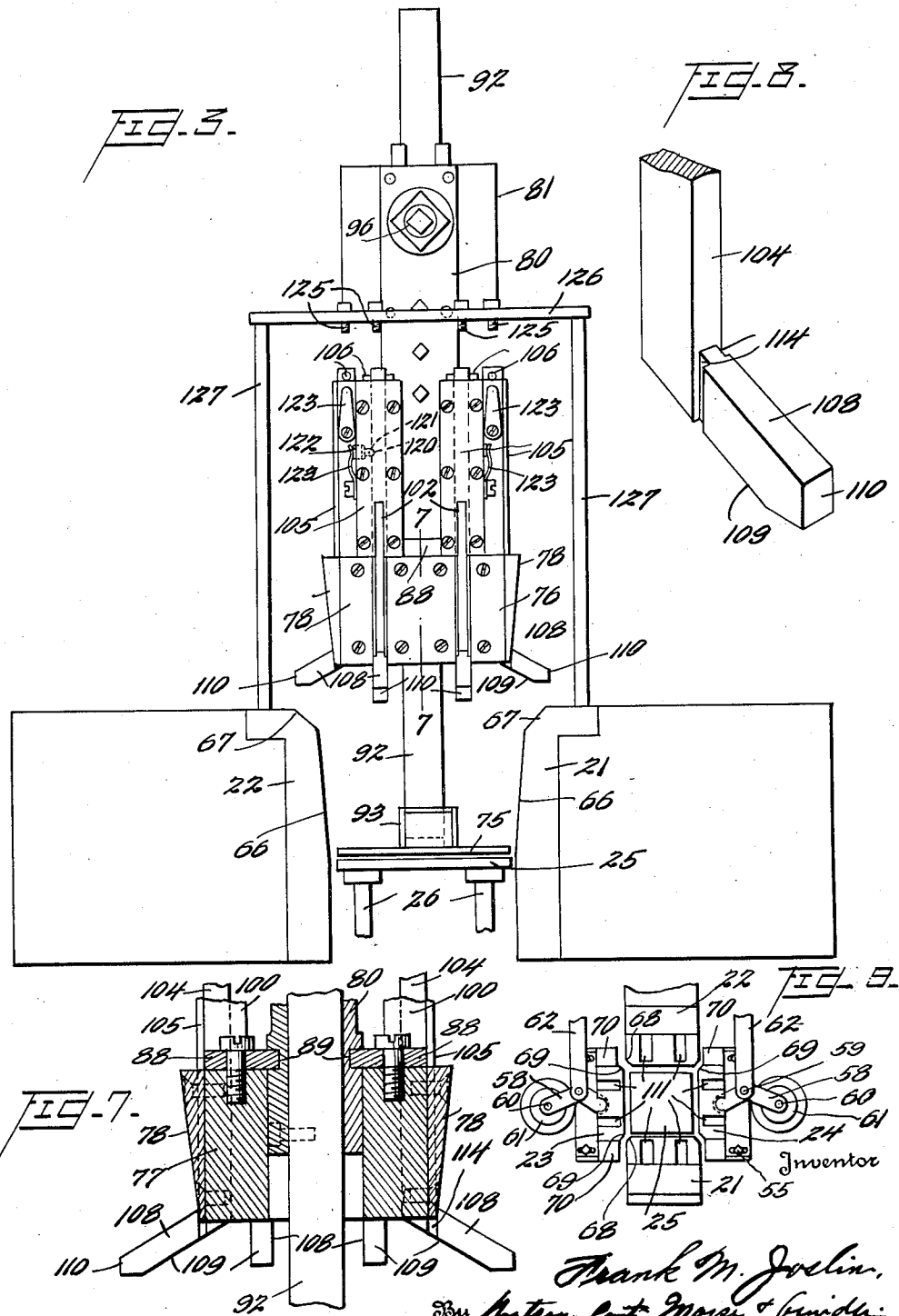
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BOX FOLDING MECHANISM

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3 Sheets-Sheet 2



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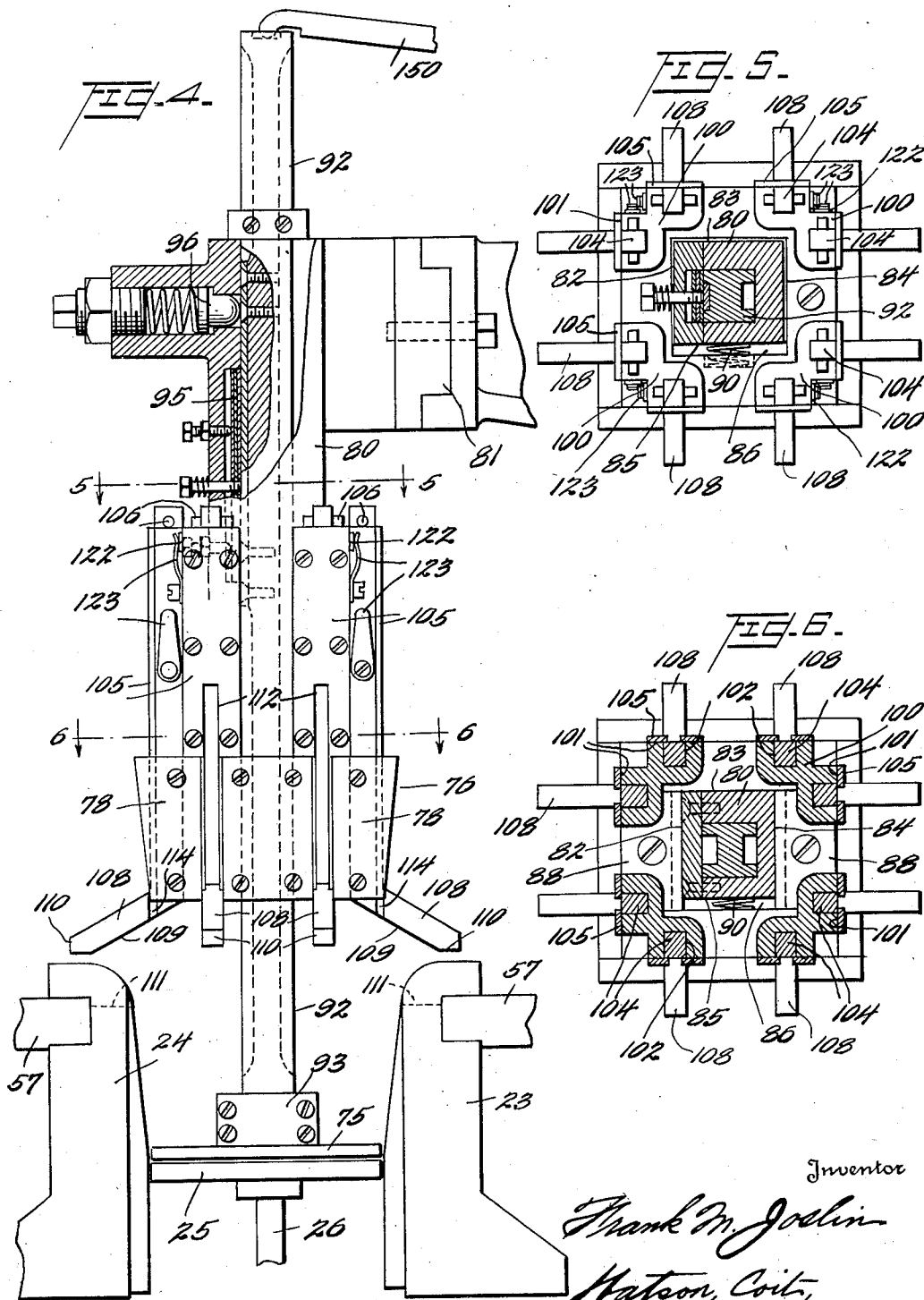
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BOX FOLDING MECHANISM

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3 Sheets-Sheet 3



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2,014,046

BOX FOLDING MECHANISM

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Application April 5, 1935, Serial No. 14,907

14 Claims. (Cl. 93—51)

This invention relates to box making machinery and particularly to machinery for folding and forming boxes or baskets from blanks of flexible, fibrous, sheet material such, for instance, as the so-called berry or fruit boxes or baskets of a size holding approximately one quart.

This invention is particularly directed to the portions of the machine which perform the folding and clamping operations upon a blank of material which has been previously cut to shape, scored and had adhesive applied thereto.

It is therefore the general object of the present invention to provide novel and improved plunger and die mechanism for box making machinery.

An important object of the present invention consists in the provision of plunger and die mechanism for box making machines, equipped with means to fold inwardly the upper edges of all four sides of a partially formed blank so as to provide a reinforcement or cuff about the upper edge of the box, which is used without a cover.

Another important feature of the invention resides in the construction of the plunger mechanism for cooperation with the die for forming a blank into a box and particularly to the construction of the plunger body which provides improved means for mounting the folders, a plurality of which is carried by each side thereof.

A further feature of the invention resides in the novel construction and arrangement of the die mechanism whereby movement is imparted to one wall thereof by power mechanism to give a final pressure to set the shape of the box and to properly adhere the wings which are folded over the ends of the box from the two sides and at the same time and from the same operating means to move both of the laterally disposed sides of the die to give a final pressure to the cuff flaps so that they are properly adhered to their basket walls.

A still further feature of the invention resides in the novel manner of mounting the plunger body on the plunger rod and in the construction of both of these parts.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specification wherein is disclosed a single exemplary embodiment of the invention with the understanding, however, that various changes, additions and subtractions may be made thereto such as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Figure 1 is a plan view of a machine embodying the present invention, certain parts being removed for clearness of illustration;

Figure 2 is a vertical section taken on line 2—2 of Figure 1;

Figure 3 is an elevation, on an enlarged scale, of the plunger and die, with one side of the die removed;

Figure 4 is a view similar to Figure 3 but taken at right angles thereto;

Figure 5 is a horizontal section on line 5—5 of Figure 4;

Figure 6 is a horizontal section on line 6—6 of Figure 4;

Figure 7 is a central vertical section through the plunger taken on line 7—7 of Figure 3;

Figure 8 is a perspective view of the lower portion of a folder;

Figure 9 is a fragmentary plan view of the die showing the parts thereof in their separated positions; and

Figure 10 is a perspective view of a berry box of the type adapted to be formed on the present machine.

In my previous Patent No. 1,814,043, granted July 14, 1931 for Machine for making boxes, I have shown a complete machine for removing previously cut box blanks from a pile, feeding them one at a time to creasing or scoring mechanism, then to adhesive applying means, and finally to a position on a die where they are folded by plunger mechanism which is equipped with pivoted folders for turning in flaps on two ends on the box blank so that they are positioned in the path of the plunger for final folding.

In my Patent No. 1,935,032, granted November 14, 1933 for Box machine, I have shown die and plunger mechanism, with particular improvements in the folding means whereby the pivoted folders are eliminated and their places taken by sliding folders moving in advance of and with the plunger to engage the upper edges of flaps on two ends of the box blank and fold them into the path of the plunger.

In these and other patents granted to me and to others, folding of flaps upon the upper edges of the box has been limited to two oppositely disposed ends of the box. In accordance with the present invention, equipment is provided which simultaneously folds the flaps upon four sides of the box, thus producing in a single stroke of the plunger a completed box having a reinforcing band or cuff around all of its upper edges. This is a distinct improvement over prior devices

for when a fully reinforced box was required, they only provided it by the previous folding and gluing of two of the cuff flaps before the feeding of the blank to the plunger mechanism.

5 Not only does the present machine fold all four cuff flaps in one operation, but it provides a final forming and gluing pressure to all of these flaps as well as to the wings which secure the sides and ends of the box together.

10 All of the above is accomplished by an extremely simple construction of both the plunger and die mechanism and in which at least three sides of the die are simultaneously moved through the action of a single power driven slide member.

15 For a better understanding of the invention reference should now be had to the accompanying drawings in which the same reference numerals are applied to the same parts throughout all the figures.

20 Figure 10 of the drawings shows, in perspective, the type of box intended to be manufactured on the machine of the present invention. It is a so-called fruit or berry box or basket of open top type having a rectangular and preferably square bottom 12 and four flaring walls 13, 13, 14, 14. The walls 13, 13 which may be called the sides of the box are integral extensions of the bottom, folded upwardly therefrom slightly less than 90° to provide the flare and are of single thickness except for the upper edges which are each reinforced by an intumed flap 15 folded over to an angle of 130° and secured down against the inner face of the side by suitable adhesive. The ends 14, 14 not only comprise portions integral with the bottom and similar to the sides but have overlapped on the outer faces thereof the wings 16, 16 formed as extensions of the side walls 13, 13 and bent around the corners of the box and secured down by adhesive. These wings 16, 16 are each provided with a flap-like portion 17, 17 which is folded over the upper edge of their end 14 and secured by adhesive against the inner face thereof.

In the operation of the machine, previously cut and scored blanks are fed, by suitable apparatus such as that shown in one of my previously mentioned patents, through adhesive applying mechanism and are finally positioned one at a time on top of the die mechanism. The plunger then descends, forces the flat blank down into the die and forms it into the shape of the finished box. In doing so the sides and ends are automatically turned up around the bottom by engagement with the upper edges of the die parts and the wings turned into position over the ends. All of this original forming is caused by a separate lower member on the plunger which is only a thin plate of substantially the shape of the bottom of the box. The plunger proper then moves downwardly and folders carried thereby and projecting below the lower surface thereof engage the now upstanding flaps 15, 15, 17, 17 and turn them inwardly until they are in the path of the main body of the plunger. These folders are stopped then in their downward movement by engagement with the die, but movement of the plunger continues, the under-surface thereof engaging the partially intumed flaps and carrying them downward and outward against the inner faces of their corresponding walls. When the plunger has reached the limit of its downward movement, movable walls of the die are forced inwardly to firmly press the material of the box into its final shape and to ensure close adherence of the parts, to which adhesive has been applied, against their cooper-

ating parts. This pressure is essential to ensure adequate sticking of the adhesive so that the box can be quickly removed from the die and plunger and a subsequent and similar operation performed on another blank.

The feeding, creasing and adhesive applying may be performed by any suitable mechanism such, for instance, as that shown in my previously mentioned Patent No. 1,814,043. The present invention contemplates mainly improvements in the die and plunger mechanism of that and other patents whereby flaps to reinforce all four upper edges of the box are turned in and glued in a single operation and all four sides of the box are pressed. Only so much of the cooperating machine as is necessary for the understanding of the operation of the plunger and die has been shown for the sake of simplicity.

Figure 1 shows the machine in plan with the plunger mechanism removed so that the die parts can be more readily observed. The machine is built on a flat bed plate 20 mounted on suitable standards and beneath which are carried the various power shafts and the like for applying power and movement to the different parts. Mounted on the bed are four die parts or sides 21, 22, 23 and 24, all surrounding the movable bottom plate 25 of the die which is mounted on rods 26 connected to cross head 27 driven by a suitable mechanism, not shown, in timed relationship to movement of other parts of the machine as will be later described. The die side 21 is stationary and is permanently secured to bed 20 as seen in Figure 2 and has secured in alignment with its upper face the extension 29 to provide a flat surface on which to support a portion of the blank when it is first fed to the die. The opposite die member 22, of similar shape, is slidably mounted on the bed plate and positioned by bolts 30 secured to the bed plate and fitting through elongated slots in extension 31 so that this side can be moved toward and from the side 21.

A slide 32 is adapted for movement along the upper surface of bed plate 20 and is guided by tracks 33. This slide is attached by means of plate 34 to the die side 22 which not only provides the means for operating the die side from the slide but the flat surface corresponding to part 29 for the reception of box blanks. Movement is imparted to slide 32 by means of a pair of toggles 35 each consisting of two links 36 and 37 pivoted to each other and with the link 36 pivoted at 38 to an abutment 39 integral with or secured to the bed plate. Each link 37 is pivoted at 40 to a link 41 pivoted at 42 to the bed of the machine. The pivot 40 also attaches link 37 to the head 43 of a rod 44 which is adjustably secured in the slide 32 by the mechanism shown.

The link 37 of each toggle is directly positioned above a cam 45 mounted on shaft 46 driven by sprocket and chain 47 from a suitable power shaft beneath the machine. It will be seen that when the lobe of the cam engages beneath link 37 that the toggle will be straightened from the position shown in Figure 2 and the slide and its attached die part will be moved to the right as shown in that figure. The final position of the die part is determined by the adjustment of the mechanism connecting the rods 44 to the slide.

Return movement of the slide upon recession of the cam lobes is effected by means of coil springs 50 surrounding guide rods 51 and bearing between fixed standards 52 and the slide.

The remaining pair of sides 23 and 24 of the die are identical, but oppositely disposed, and

each is mounted for sliding movement along the surface of bed plate 20 by having bottom flanges 54 resting on that surface and guided by bolts 55 operating in slots 56 in these flanges. Each of these die sides is attached by a toggle, comprising links 57 and 58 pivoted together at 59, to the pivot 60 of an abutment 61 secured to the bed of the machine.

When these toggles are straight as shown, the ends of links 57, which are received in recesses in the side walls of the die parts, hold these parts in their position of nearest approach to each other, but when the toggles are "broken" by moving pivots 59 upwardly as viewed in Figure 1, the die parts are drawn apart slightly to facilitate the entrance of the blank and plunger between them. This drawing apart by "breaking" the toggles is effected by means of links 62, each pivoted at 59 to the junction of the two links of the toggle and at 63 to members 64 attached to the slide 32. It will thus be seen that movement of the single slide not only imparts movement in the same direction to die part 22 but movement at right angles thereof and simultaneously to die parts 23 and 24.

As seen in Figure 3, fixed die side 21 and its partner 22 have sloping faces 66 set at the same angle in respect to movable bottom plate 25 as are the sides of the finished box to its bottom. Suitable chamfered corners 67 facilitate the entrance of the blank into the die and assist in turning up the sides and ends. Any additional folder guides necessary to turn the wings about the ends can be used such as might be necessary to facilitate this operation. Die parts 21 and 22, as seen in Figure 9, which shows all of the parts in their separated positions, are not much greater in horizontal length than the width of the box and have relieved corners 68, but die parts 23 and 24 not only have relieved corners 69 to co-operate with corners 68 to close the die, but have extensions 70 which bear against the ends of die parts 21 and 22 when they are all clamped together as in Figure 1.

The plunger is mounted for reciprocation into and out of the die and includes two main parts independently and jointly movable. The one part comprises a thin plate 75 of substantially the same shape as movable bottom 25 of the die and which is adapted to first engage the blank and press it into the die. The second or main plunger part 76 is arranged to be moved independently of the plate 75 on a part of the downstroke but the two move together on the upstroke.

The main plunger 76 has a body 77 in the form of a casting, substantially square in horizontal section, and to which are attached wedge-like side plates 78 to give the plunger the configuration of the inside of a finished box. The casting has a central opening therein with four sides each parallel to one of the walls of the casting. This opening receives the lower end or head of plunger rod 80, the upper end of which is attached by means of bracket 81 to the vertically reciprocated cross head of the machine for imparting to the plunger the desired motion.

The head of this plunger rod has three faces 82, 83 and 84 which closely engage the corresponding walls of the opening in the plunger casting, but fourth wall 85 has considerable clearance 86 from its corresponding opening wall. The plunger and its rod are mounted for movement in unison and are connected together by keys 88 each bolted to the top of the casting as seen in Figures 6 and 7 and having their inner

edges closely fitting in grooves 89 in the faces 82 and 84. These keys permit relative lateral movement, to the extent of clearance 86, between the rod and plunger head which is in the same direction as the movement of the die part 22. This permits displacement of the plunger head caused by movement of die part 22 to clamp the folded wings on both ends of the box between the die parts and the plunger. If this clearance and relative movement were not provided, lateral strain would be applied to the plunger rod. The plunger is held in proper position in relation to the head of its rod by means of the helical spring 90 housed in an opening in the casting and bearing against the face 85 of the rod head.

The rod 80 is hollow to receive and guide secondary rod 92 which has its lower or head end secured by means of suitable quick detachable mechanism 93 to the plate 75. Friction brake means 95 and a detent mechanism 96 serve to connect the main and secondary rods for simultaneous movement, with plate 75 in advance of the main plunger head to the extent shown in Figures 3 and 4, when power is applied to the main rod. When the plate 75 is stopped by the bottom plate 25 of the die reaching its lowest position, further application of power to the main rod causes the release of detent mechanism 96, which is fully described in my previously mentioned Patent No. 1,935,032, and permits the main plunger to follow down into the die.

The plunger casting has extending upwardly from each corner an integral extension 100 best shown in Figures 5 and 6. These extensions are of irregular cross section, but each has two faces 101 each coincident with one of the faces of the main portion of the casting to which the wedge blocks 78 are secured. Each of these faces is grooved as at 102 and these grooves are extended on down through the full length of the faces of the main body to provide a guide and receptacle for the straight stem portion 104 of a folder. This stem portion 104 is preferably rectangular in cross section and just fills the groove 102. Most of the upper portion of each groove is completely closed by a plate 105 attached to the extension by screws as shown in Figures 3 and 4 and these plates thus hold the folder stems in their grooves. Downward movement of the folders is limited by engagement of the pins 106 which extend through the upper ends of the stems with the top surfaces of the extensions 100.

Each folder has splayed portion 103 at the bottom thereof, the undersurface 109 of which is adapted to engage the upstanding flaps on the folded blank, after the plate 75 has reached its bottom position in the die, and to turn these flaps inwardly into the path of the body of the plunger. In order to afford proper clearance of one set of flaps in respect to the other, the folders on the two sides of the plunger which cooperate with the die parts 23 and 24 are positioned somewhat in advance or lower down than those on the other two sides of the plunger and in this manner the full length flaps 15, 15 are folded in slightly ahead of the half length flaps 17, 17.

The normal position of the folders when the plunger is advancing toward the die is shown in Figures 3 and 4, with pins 106 down against the tops of extensions 100 and splayed ends 103 projecting below the bottom of the plunger. As the plunger moves downwardly, and after the flaps have been folded in a sufficient distance to be in the path of the main body of the plunger, the flat ends 110 on the folders abut the bottoms of

recesses 111 in the upper edges of their corresponding die sides and their further downward movement thereof is stopped but the plunger continues to move downwardly. To provide for this movement not only are the wedge plates 78 grooved to accommodate the splayed portions of the folders, but these grooves extend on upwardly into the plates 105 as seen at 112.

The grooves in the plates 105 are not as wide as the width of portions 108 of the folders, for otherwise no support against lateral spreading of the folders would be provided. Grooves 114 are therefore provided in the sides of the parts 103 just adjacent their junction with stems of the folder and thus permit movement of the folder ends up through grooves 106. The wedge plates 78 are grooved to the full width of splayed ends 108 for a part of their depth, but the innermost portion, of the same thickness as the plates 105, has the same width slots as these plates, thus providing adequate support for the folder stems throughout the full length of their movement and yet permitting the splayed portions to assume a position above the body of the plunger when it is housed in the die.

The stem portion 104 of each folder has a shallow recess 120 in one of its edges which is engaged by the end 121 of pin 122 guided in an aperture in extension 100 and having a leaf spring 123 bearing on its head. When this pin end 121 is fitted into recess 120 it holds the folder in the position shown in Figures 3 and 4, or in other words, in its folding position, and sufficient resistance is offered by this device to fold the flap, but when the end of the folder engages the bottom of the recess in the top of the die, the pin connection is broken and the plunger is permitted to move on down over the folder. When the plunger is withdrawn from the die the folders are held in their uppermost positions by friction and in order to return them to their proper position for folding on the next stroke, there is positioned above each folder an adjustable resetting screw 125 suitably carried on a frame 126 supported by rods 127. These screws are so positioned vertically that they engage the ends of stems 104 of the folders during the upward movement of the plunger and stop their movement while the plunger continues to rise until pin ends 121 drop into recesses 120 and lock the folders in position in respect to the plunger.

In operation, the device starts with the dies set as shown in Figure 9, with a blank positioned, by suitable mechanism, with its bottom portion over the opening in the die and resting on the raised plate 25. The plunger with its parts 75 and 76 separated to the extent shown in Figures 3 and 4 then starts on its downward movement. The plate 75 engages the blank portion which forms the bottom of the finished basket and clamps it against movable bottom 25 of the die. Thereafter parts 75 and 25 move together with this bottom clamped between them. The die sides are engaged by the parts which form the sides and ends of the box and fold them upwardly into substantially their final positions by the time plate 25 reaches the bottom of its permitted stroke when it is stopped by suitable mechanism. This causes detent 96, which connects secondary rod 92 on which plate 75 is carried to main rod 89, to release and the main rod and its plunger continue the downward movement alone.

The inwardly inclined lower edges of the folders now engage the upper edges of the flaps of the box, which stick up above the edges of the

die, and as the plunger moves downwardly, they fold these flaps inwardly until they lie substantially along faces 109 of the folders, at which time the edges of the flaps are beneath the bottom of the main portion of the plunger. The flat ends of the folders now come into engagement with the bottoms of recesses 111 in the tops of the die parts. Further movement of the plunger continues, and detent pins 121 are pressed out of the recesses 120 in the folder stems so that the folders remain stationary. Continued movement of the main plunger presses the flaps downwardly and outwardly until their total folding movement is about 180°. As soon as the plunger bottom reaches the top of plate 75, movement of its drive mechanism is stopped and movement of slide 32 begins.

This movement of the slide presses die member 22 to the right as seen in Figure 2 to tightly press the wings engaged by this die member against the end of the box. The corresponding flaps are also pressed against their box end. This imparts a slight lateral movement to the plunger, permitted by the connection previously described, and tightly clamps the other wings and flaps 25 to their box end by cooperation of the plunger and stationary die side. Since lateral movement of the plunger is desirable in one direction only for obvious reasons, the remaining two sides of the die are moved simultaneously throughout the exact same distance and their movement starts with the movement of the single movable side of the die but is not so rapid, so the plunger is not so tightly clamped that movement thereof by die side 22 is prevented. The pair of movable sides in coming together tightly clamps the flaps at the tops of their cooperating box sides and ensures proper adhesion of their inner surfaces to the inner faces of the box sides.

When the plunger is withdrawn, it moves more rapidly than the bottom plate 25 of the die and is out of the way by the time this plate reaches the top surface of the die sides so that the box can readily be pushed aside to make room for the next blank. During the lifting operation of the plunger both parts thereof move together until member 150, which is lowered by mechanism operated in synchronism with the other parts of the machine, is engaged by secondary rod 92. This arrests upward movement of that rod during continued movement of the main rod until the detent 96 again engages rod 92 and again locks plate 75 in its desired position ahead of the main plunger.

By the mechanism just described, the four sided box can be completely formed at a single stroke of the plunger, a reinforcing flap or cuff can be folded in on all four sides and a final pressure given to all four sides to ensure the adequate shaping of the box by clamping the folds tightly. Final pressure is also imparted to ensure adequate adhesion of the parts.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a machine of the type described, in combination, a four sided die, a plunger movable into and out of the die, an individual folder slidably and independently carried by each of the four sides of the plunger and normally positioned in advance of the same as it moves toward the die, said folders being arranged to contact with the edges of a blank in the die and bend the same inwardly into the path of the plunger for final

folding, means arranged in the paths of the folders to be engaged by them to arrest their forward movement prior to the entrance of the plunger into the die, the folders on one pair of oppositely disposed sides of the plunger being normally in advance of those on the other pair of sides whereby they fold their flaps first and stop moving downward before those on the other pair of sides.

2. A plunger for a machine of the type described and adapted for cooperation with a die to form a box having flaring sides, including in combination, a casting having a central aperture to receive a plunger rod adapted to reciprocate on a vertical axis, four side faces on said casting each in a plane parallel to said axis, an integral vertical extension at each corner of said casting, a groove extending vertically through each face and one of said extensions, a folder slidably mounted in said groove and a wedge shaped plate secured to each casting face and retaining said folder in said groove.

3. A plunger for a machine of the type described and adapted for cooperation with a die to form a box having flaring sides, including in combination, a casting having a central aperture to receive a plunger rod adapted to reciprocate on a vertical axis, four side faces on said casting each in a plane parallel to said axis, an integral vertical extension at each corner of said casting, a groove extending vertically through each face and one of said extensions, a folder carried by said plunger for each face thereof and having a portion adapted to fit in said groove and a foot flaring downwardly and outwardly to engage the upper edge of a blank in the die and bend the same inwardly into the path of the plunger, said foot engaging said die and being stopped thereby while the plunger continues to move downwardly, a wedge shaped plate covering each face of the plunger and holding the upper portion of the folder in its groove, said plate being slotted for the passage of said foot.

4. In a machine for making berry boxes having four flaring sides with an intumed cuff on each side, in combination, a die having a fixed side, a movable side opposite thereto, a plunger for cooperation with said die to form a blank into a box, means to move said plunger into said die, means to positively advance said movable die side toward the fixed one when the plunger and blank are in the die, a pair of oppositely disposed movable die sides at right angles to the fixed side, positive connections between said pair of sides and the means for moving the first mentioned movable side whereby the three movable sides are advanced toward the plunger substantially simultaneously and independent of the varying resistance of the blank parts.

5. In a machine of the kind described, the combination of a die and plunger for cooperating therewith, said plunger having a body provided with four forming sides, a four sided opening through said plunger with each side of the opening parallel to the line of intersection of a forming side with a plane at right angles to the axis of reciprocation of the plunger, a plunger rod having an end received in said opening, three faces of said end closely engaging the corresponding sides of the opening for centering the plunger on the rod while the fourth face is remote from its opening side, means attaching the rod and plunger for movement together but permitting relative lateral movement in a direction normal to said fourth face, and resilient means housed

in said plunger body and bearing on said fourth face to hold the plunger centered on the rod.

6. In a machine of the kind described, the combination of a die and a plunger for cooperating therewith, said plunger having a body provided with four forming sides, a four sided opening through said plunger with each side of the opening parallel to the line of intersection of a forming side with a plane at right angles to the axis of reciprocation of the plunger, a plunger rod having an end received in said opening, three faces of said end closely engaging the corresponding sides of the opening while the fourth face is remote from its opening side, means attaching the rod and plunger for movement together but permitting relative lateral movement in a direction normal to said fourth face, resilient means housed in said plunger body and bearing on said fourth face to hold the plunger centered on the rod, said die having a movable side cooperating with the side of the plunger nearest the fourth face of the rod, an oppositely disposed fixed side and a pair of intermediate movable sides, means to move said first mentioned movable side and connections from said means to said pair of movable sides to move them simultaneously.

7. A die for cooperation with a plunger to form a blank into a rectangular box having lapped ends, plain sides and full peripheral reinforcements, which lapped ends and reinforcements are secured against the other box parts by an adhesive, in combination, a fixed die side, an opposing side movable through a short range to give a final pressure to the box ends, a pair of opposed die sides to cooperate with the box sides, a slide having direct connection to said movable die side, power means to move said side toward the fixed side when the plunger has forced a blank into the die, means mounting said pair of sides for movement toward and from each other, a set of toggle links connecting each side of said pair to a fixed pivot and a link connecting each toggle to said slide and arranged to extend it upon movement of the slide toward the plunger whereby the reinforcements are clamped to squeeze the adhesive.

8. In a machine of the kind described, in combination, a die having a fixed side and an opposing side movable toward and from the fixed side, a pair of sides movable toward and from each other on a path at right angles to the path of the single movable side, a plunger adapted to cooperate with said die to fold a blank and force it into the die, a rod adapted to reciprocate said plunger into and out of said die, means mounting said plunger on said rod for relative movement thereon only in the direction of movement of the first mentioned movable side, means to actuate said rod to move said plunger into the space enclosed by said die sides, means to then move said first mentioned movable side toward the plunger, said last mentioned means being connected to move said pair of sides simultaneously toward the plunger.

9. In a machine of the type described, a plunger mechanism including, in combination, a hollow main plunger rod, a secondary plunger rod slidably mounted and closely guided in the main rod, a plate removably secured to the lower end of the secondary rod and solely guided thereby, a main plunger body having an aperture therethrough, a head on said main rod arranged in said aperture, cooperating faces on said head and aperture walls to fix their relative lateral positions in all but one direction, means housed in

the plunger body to resiliently restrain against relative movement in that direction, and means connecting the main rod and plunger head for movement in unison in the direction of length of the rods.

10. In a machine of the type described, in combination, a die having a fixed side and a cooperating side movable toward and from the fixed side, a pair of sides movable toward and from each other on a path at right angles to the path of the single movable side, a slide having direct connection to the movable die side which cooperates with the fixed side, power means to move said slide and indirect connections between said slide and pair of sides to move them simultaneously toward each other.

11. In a machine of the type described, in combination, a die having a fixed side and a cooperating side movable toward and from the fixed side, a pair of sides movable toward and from each other on a path at right angles to the path of the single movable side, a slide having direct connection to the movable die side which cooperates with the fixed side, power means to move said slide, and indirect connections between said slide and pair of sides to move them simultaneously toward each other, the direct and indirect connections to said slide being such that movement of all three movable die sides is in unison.

12. A die for cooperation with a plunger to form in a single operation a blank into a rectangular box having lapped ends, plain sides and full peripheral reinforcements, which lapped parts and reinforcements are secured against their respective sides and ends by an adhesive, in combination, a pair of die sides relatively movable through a short range to give a final pressure to the box ends, a second pair of die sides relatively movable through a short range and on a path at right angles to the path of the first pair to give a final pressure to the box sides, and power

means to positively impart converging movement to said pairs of sides substantially in unison, said means being so connected to said sides as to provide positive separation thereof on reverse movement.

13. A die for cooperation with a plunger to form in a single operation a blank into a rectangular box having lapped ends, plain sides and full peripheral reinforcements, which lapped parts and reinforcements are secured against their respective sides and ends by an adhesive, in combination, a pair of die sides relatively movable through a short range to give a final pressure to the box ends and to then release them, a second pair of die sides relatively movable through a short range and on a path at right angles to the path of the first pair to give a final pressure to the box sides and then release them, and single means, power actuated, to impart positive movement in each direction to each pair of sides substantially in unison but at different rates of speed.

14. A die for cooperation with a plunger to form in a single operation a blank into a rectangular box having lapped ends, plain sides and full peripheral reinforcements, which lapped parts and reinforcements are secured against their respective sides and ends by an adhesive, in combination, a pair of die sides relatively movable through a short range to give a final pressure to the box ends, a second pair of die sides relatively movable through a short range and on a path at right angles to the path of the first pair to give a final pressure to the box sides, a slide reciprocable along an extension of one of said paths, power means to move said slide, and means to positively connect said slide to one side of each pair to move them in unison toward and from their cooperating sides.

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