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B. LIEBERMAN

3,285,145

CARTON SETTING UP MACHINE

Filed Nov. 18, 1963

4 Sheets-Sheet 1

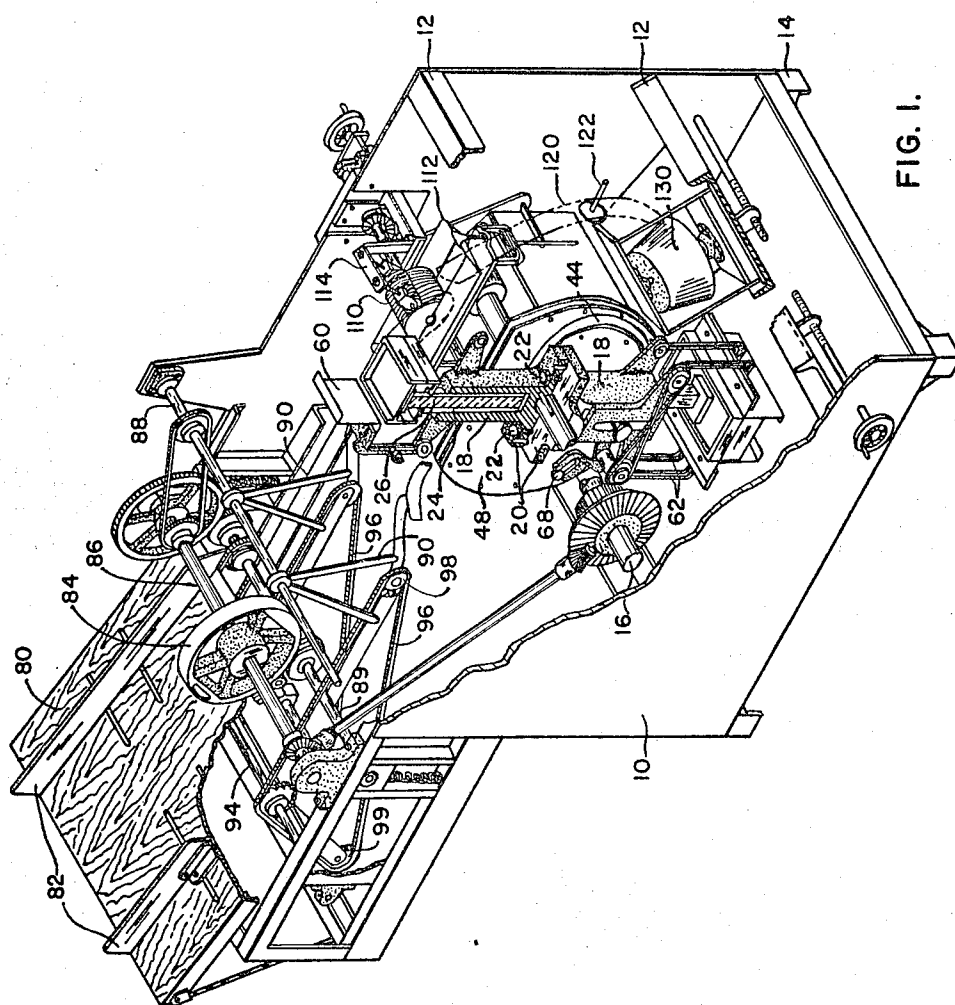


FIG. 1.

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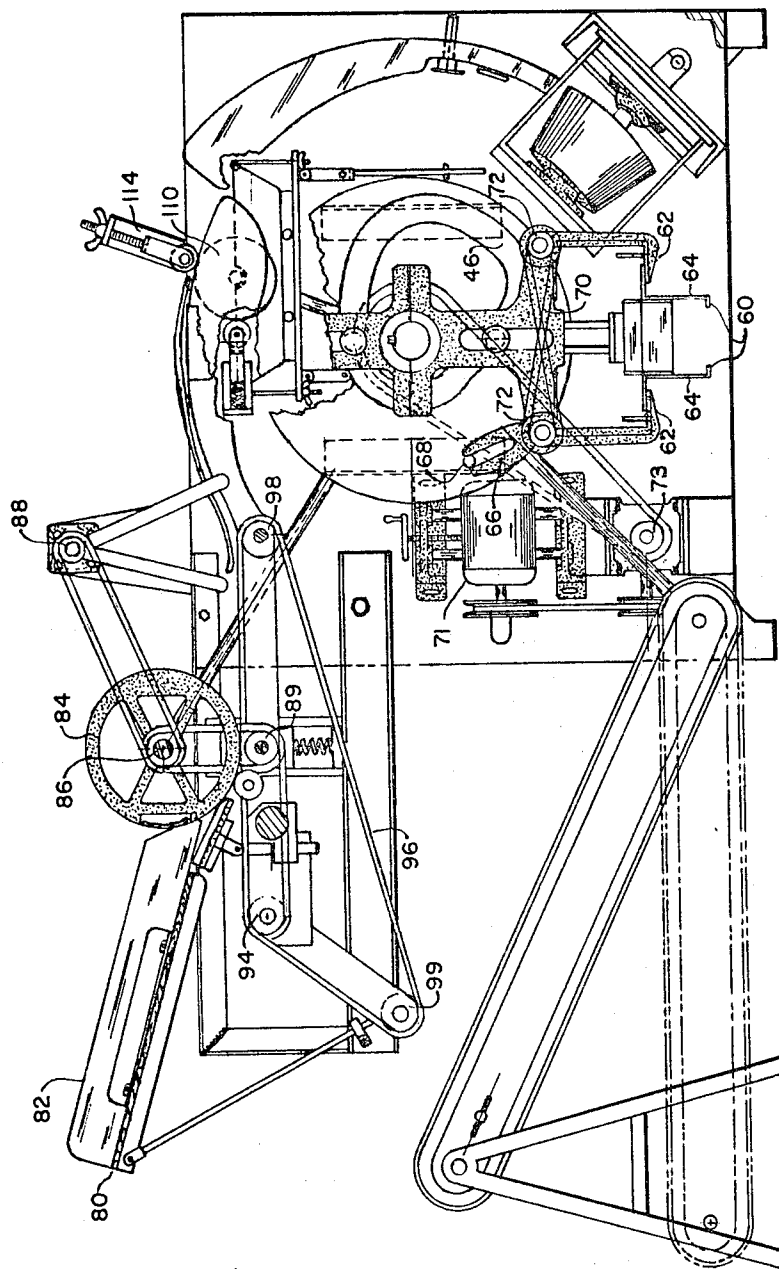


FIG. 2.

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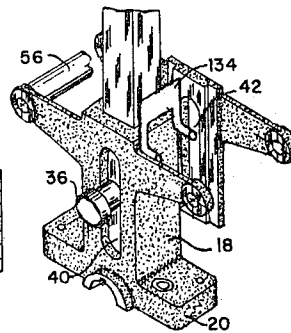
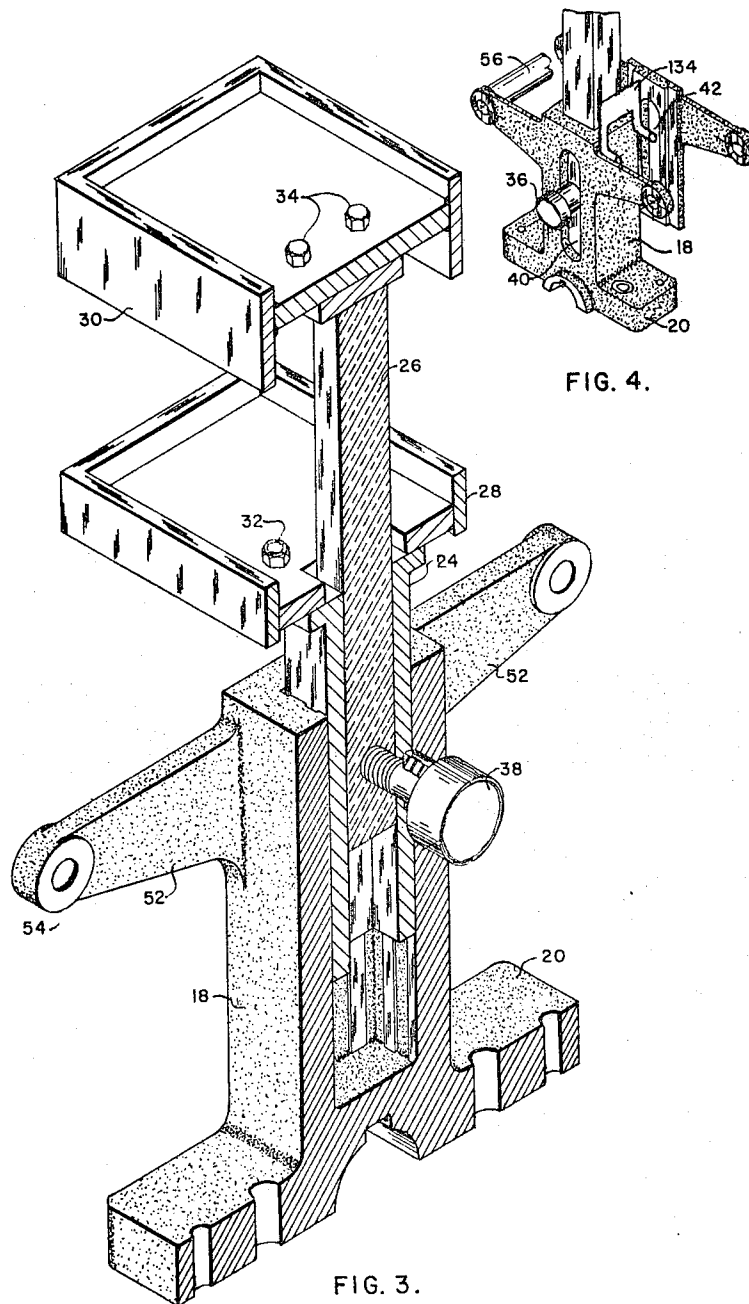
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4 Sheets-Sheet 3



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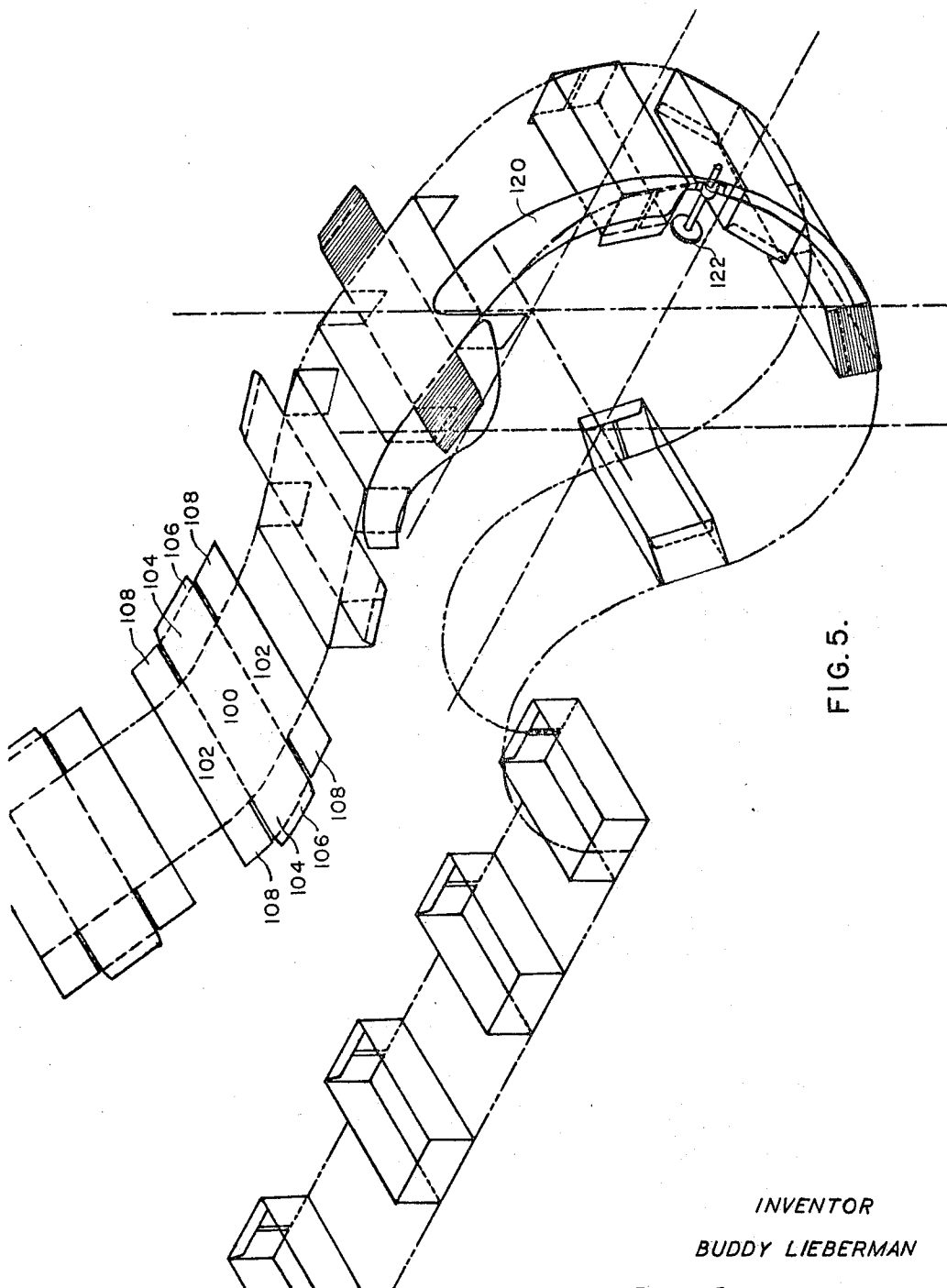


FIG. 5.

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CARTON SETTING UP MACHINE

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4 Claims. (Cl. 93-51)

This invention relates to the manufacture of boxes, and is particularly concerned with a machine for forming paperboard boxes of the type which are commonly known as shoe boxes.

The machine in accord with the invention forms boxes from precut blanks and is designed for continuous operation. It is particularly adapted to the manufacture of shoe boxes which are characterized by end walls formed of overlapped extensions of the bottom and side walls, wherein the end walls include a lock flap folded over the side wall extensions and glued to their inside surfaces. However, while the machine is particularly adapted to the manufacture of shoe boxes, it is to be understood that it is capable of manufacturing boxes of any size, and for any intended use, which are characterized in the construction briefly described and particularly characterized by a lock flap of the type mentioned.

The machine in accord with the invention is an improvement on those machines previously available in its simplicity of construction, and in its high speed and trouble-free continuous operation. These improvements are largely achieved through the use of die assemblies of particular construction. These die assemblies effect certain folding operations on the carton blanks by pressing the blanks into female dies with male dies and are characterized by female dies which are comprised of die forming elements normally separated from one another and brought together to form the female dies only following delivery of carton blanks to the faces of the male dies.

By this arrangement it is possible to achieve a particularly smooth continuous operation as the female die forming elements may be attached to the male dies so that the combined die assemblies may be caused to move cyclically past various work stations. This advantage is gained, as previously indicated, by the principle of providing the apparatus in accord with the invention with female die forming elements which are brought together to form the female dies only after delivery (at one of the work stations) of the blanks to the faces of the male dies. As distinct from this arrangement, those prior machines employing die assemblies have used permanently formed female dies. These have required maintenance of the die assemblies in fixed positions and movement of the carton blanks to and from the die assemblies merely for the performance of the operation carried out by the die assemblies. Accordingly, complicated equipment has been required to effect movement of the blanks, whereas, in accord with this invention, such equipment is not required because the die assemblies themselves can be used to transport the blanks to and from the various work stations. In accord with a preferred embodiment of the invention, these work stations are arranged in a circular path with the die assemblies carried at the outer ends of rotating arms. By this ar-

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range, a particularly compact and efficient carton forming machine is provided.

The invention will be more thoroughly understood from the following description of this preferred embodiment thereof as read in conjunction with the accompanying drawings.

In the drawings,

FIGURE 1 is a perspective view of a box making machine in accord with this preferred embodiment of the invention, with the view being broken away and showing certain parts in cross-section.

FIGURE 2 is an elevation view taken in cross-section through the longitudinal center line of the machine shown in FIGURE 1.

FIGURE 3 is an enlarged perspective and partly cross-sectional view of one of the elements of the machine shown in FIGURES 1 and 2.

FIGURE 4 is a view showing the outer appearance of the lower part of the member shown in FIGURE 3; and

FIGURE 5 is a sequence view of the path taken by a carton blank as it moves through the machine in accord with this preferred embodiment of the invention, and shows the various folding operations effected by the machine from the time the carton blank is received to delivery of a formed box.

Referring to FIGURE 1, the machine in accord with this embodiment of the invention is contained within an outer frame 10. This frame essentially consists of sheet metal side walls supported by a plurality of internal reinforcing cross members 12. As the machine is designed to rest on the floor, it is conveniently provided with a plurality of feet 14, as is common in this type of machinery.

Carried within bearings (not shown) in the side walls of the frame, there is a transverse central rotatable shaft 16. Keyed to this shaft at its center are a pair of arm members 18, one of which is shown in cross-section in FIGURE 1. These arm members are shown in greater detail in FIGURES 3 and 4. They consist of castings having radially inward flanges 20, which are bolted together by bolts 22 and keyed to shaft 16, as to rotate therewith. Both of the arms 18 are hollow members and are internally machined to provide slideways for a pair of first male die members 24. The latter, in turn, are also hollow as to provide slideways for a pair of second male die members 26 (see FIGURE 3). Both die members are provided with outer replaceable die faces 28 and 30 respectively. These are fixed to the die members by appropriate bolts 32 and 34. Both the inner and outer die members also carry cam followers 36 and 38, which project outwardly of the arms 18 through slots 40 and 42. These cam followers are adapted to engage cam forms 44 and 46, which are fixed to the inside faces of plates 48 and 50. As only plate 48 is shown in the drawings, only cam form 44 can be seen, but it will be understood that a similar cam form 46 is engaged by the other cam follower. In any case, it will be appreciated that the cam followers cooperate with the cam forms to cause the die members 24 and 26 to reciprocate radially as the arms 18 rotate with shaft 16. The purpose of this reciprocating action is explained hereinafter.

Arms 18 also carry integrally cast or welded wing elements 52. Supported in bearing 54 in the outer ends of these wing elements 52, are a pair of rotatable shafts 56. One of these can be seen in FIGURE 4. Fixed to shafts 56 for rotation therewith are a pair of female die forming members 60. More accurately stated, the female die forming members 60 each consist of a pair of L-shaped arms extending outwardly from shaft 56 and a pair of die elements 64, which form a female die between them when they are brought into the position shown in FIGURE 2. They are brought into this position by the fork 66, which is attached to one of the shafts 56 and which engages the stud 68 fixed to the plate 48. As the arms 18 rotate, in order to effect rotation of both shafts 56 through the operation of fork 66, the shafts are connected by a chain 70 engaged over a pair of sprocket wheels 72 carried by the shafts. It can be seen, therefore, that as arms 18 rotate, the female die forming members 60 alternately open and close. This is an important feature of the apparatus in accord with this invention, as the alternate opening and closing of the female die is the feature most responsible for the simplicity with which the machine achieves a continuous and fast operation.

As a brief introduction to this continuous operation, it is pointed out, that as the arms 18 are caused to continuously rotate, the carton blanks are continuously fed to the faces of the male die members while the female die members are open, and upon closing of the female die members, the male die members are caused to radially reciprocate as to push the carton blanks into the formed female dies to achieve certain folding operations on the carton blanks. Other folding operations are effected by fixed members spaced around the path of the moving die assemblies. In addition to the fixed folding mechanisms, glue applying and setting devices are also located adjacent the path followed by the die assemblies.

Any suitable means may be employed for rotating the central shaft 16, and in the illustrated embodiment, this means consists of a motor 70, a speed reducer 72, and a sprocket carried by shaft 16, all of which are connected together through appropriate belting or chains.

As stated above, carton blanks are fed onto the face of the male die members as the latter move past the blank feeding means. The latter may consist of any suitable carton blank feeding device, as are generally well known in this type of manufacture. In the illustrated embodiment of the invention, the carton blanks are arranged in an overlapping array on the inclined platform 80, which is provided with a pair of upstanding guide rails 82, which are capable of being moved sideways as to adjust the spacing between them. Arranged adjacent the lower end of the inclined platform 80 is a friction wheel 84, carried on a transverse shaft 86, which is rotated by means of a power takeoff from the central shaft 16 through appropriate chain and sprocket mechanisms. Shaft 86 is also used to rotate the other transverse shafts 88 and 89. Shaft 88 carries a pair of V-shaped side wall extension folding members whose function is explained in detail hereinafter. Shaft 89 through additional chain and sprocket mechanisms is used to rotate the additional transverse shaft 94, which in turn drives the traveling rail members 96, which may comprise lug chains engaged over the idler sprockets 98 and 99.

In operation, the feeding mechanism successively picks carton blanks from the overlapped array on platform 80 by means of the friction wheel 84 with the blanks being delivered by the friction wheel to the travelling rails 96, which in turn deliver the blanks to the face of the male dies as the latter move past the ends of the rails 96.

As is explained hereinafter, the carton blanks are delivered to the face of the male die member so that the bottom wall forming portion of the carton blank substantially mates the male die member. The carton blanks are shown in FIGURE 5. Each blank comprises a bottom wall forming portion 100, two side wall forming por-

tions 102, two bottom wall extensions 104 carrying outer lock flaps 106 and four side wall extensions 108. The end walls of the completed carton are formed of the bottom wall extensions 104 and the side wall extensions 108, with the lock flap 106 bent over the top edges of the side wall extensions 108 and glued to the inside surfaces thereof. Preferably, the inside surface of the bottom wall extensions 104 are also coated with glue as to bond with the outside surfaces of the side wall extensions 108.

It is to be understood that the above description of a carton blank refers to the bottom member of a carton, so that a portion 100 is referred to as a bottom wall forming portion. However, the apparatus in accord with this invention is equally capable of forming lids for such cartons, and these take essentially the same form as the carton blanks themselves, except that the depth of the side and end wall portions will be considerably reduced. In the case of the lid, the portions 100 more properly are called top wall forming portions, and the members 104 are called top wall extensions. Nevertheless, the lid blank is also characterized by the lock flaps 106.

In the interests of clarity, the following specifications and claims refer to the manufacture of cartons themselves rather than lids, but it is to be understood, that where references to bottom wall forming portions and bottom wall extensions are made, these terms are to be taken as including top wall forming portions and top wall extensions.

As can be seen in FIGURE 5, the sequence of folding the illustrated carton blank consists of first folding of the side wall extensions 108, followed by downward folding of the side wall forming portions 102, folding of the bottom wall extensions 104 and finally folding of the lock tabs 106. The first folding operation of side wall extensions 108 is carried out by the V-shaped members 90, and this folding takes place immediately following feeding of the carton blank onto the face of the male die. The relative rotational positions of members 90 with respect to the position of the male dies is so selected that the two arms of the members 90 press downwardly the side wall extensions 108, immediately following the receipt of the carton blank on the face of the male die members. Shortly thereafter, the female die forming members 60 are brought into female die forming positions adjacent the male die members through the action of the fork member 66.

The carton blank is then carried on the face of the male die member over the rotating surface of the glue applying drum 110. More accurately stated, it is the bottom wall extensions 110 and the lock flaps 106 which pass over drum 110. The latter rotates in a glue bath 112 as to continually pick up glue for application to the under surfaces of bottom wall extensions 104 and lock flaps 106. The pressure roller device 114 insures that the latter carton elements 104 and 106 will be pressed firmly against the surface of the drum 110.

Subsequent to the glue applying operation, the carton blank is carried between the under edges of the cam rails 120, which fold the bottom wall extensions 104 inwardly and downwardly. Simultaneously, or just slightly before this latter folding operation, the male die members are advanced radially outward into the formed female die as to fold the side walls 102 inwardly and downwardly. The two final folding steps are accomplished by the fixed rotatable wheels 122 and by the die faces 28 of the first male die members 24. Following the folding of the side walls 102 and the bottom wall extensions 104, the carton blank is carried by the die assembly past the wheels 122, so that the lock flaps 106 are folded inwardly. Subsequently, the first die member 24 is caused to move radially outward as to fold the lock flaps 106 within the inside of a formed carton against the inner faces of the side wall extensions 108.

To set the glue in the formed end walls, the carton is caused to move between a pair of pressure rollers 130,

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which press the end walls tightly against the side faces of the male die members. Finally, the formed carton or lid, as the case may be, is rejected from the die assembly by first removing the female die forming members 60 away from their position adjacent the male die members and then by withdrawing radially the male die members from the formed carton, whereby the cartons are caused to drop off the male die members by the fixed stops 134.

What I claim as my invention is:

1. An apparatus for forming cartons from paperboard or the like blanks, said blanks having bottom, side and end wall forming portions, the end wall forming portions consisting of extensions of said bottom and side wall forming portions, the two bottom wall extensions further including additional extensions forming lock flaps which are folded over and fixed to the inside surfaces of the side wall extensions in the finished cartons, said apparatus comprising a pair of rotatable arms, means for rotating said arms about a common centre, a die forming assembly carried at the outer end of each of said rotatable arms, each of said die assemblies consisting of a male die member and a pair of female die forming members, means for feeding carton blanks in succession on to said male die member with the bottom wall forming portions positioned on the face of the male die member, means for folding said side wall extensions into mutually parallel positions at right angles to said side wall forming portions, means for moving said female die forming members into female die forming position adjacent said male die member following each delivery of a carton blank to said male die member, means for advancing said male die member into said formed female die as to fold said end wall forming portions into mutually parallel positions at right angles to the bottom wall forming portions, means for applying adhesive to the undersides of said bottom wall extensions including the undersides of said lock flaps, means for folding said bottom wall extensions into mutually parallel positions at right angles to both said bottom wall forming portions and said side wall forming portions, means for folding said lock flaps into positions parallel with said bottom wall forming portions, means carried by said male die member for folding said lock flaps against the inside surfaces of the formed end walls and means for pressing said lock flaps and the formed end walls together as to set the adhesive carried by said bottom wall extensions and said lock flaps, means for moving said female die forming members away to their positions adjacent said male die member, means for ejecting the formed cartons from said male die member, said means for folding said side wall extensions, for applying said adhesive, for folding said bottom wall extensions and for folding said lock flaps into position parallel with said bottom wall all being positioned adjacent the path followed by the outer ends of said arms as they are caused to rotate.

2. An apparatus for forming cartons from paperboard or the like blanks, said blanks having bottom, side and end wall forming portions, the end wall forming portions consisting of extensions of said bottom and side wall forming portions, the two bottom wall extensions further including additional extensions forming lock flaps which are folded over and fixed to the inside surfaces of the side wall extensions in the finished cartons, said apparatus comprising at least one traveling die forming assembly consisting of a male die member and a pair of female die forming members, means for moving said die assembly through its path of travel, means for feeding carton blanks in succession on to said male die member with the bottom wall forming portions positioned on the face of the male die member, means for folding said side wall extensions into mutually parallel positions at right angles to said side wall forming portions, means for moving said female die forming members into female die forming position adjacent said male die member following

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each delivery of a carton blank to said male die member, means for advancing said male die member into said formed female die as to fold said end wall forming portions into mutually parallel positions at right angles to the bottom wall forming portions, means for applying adhesive to the undersides of said bottom wall extensions including the undersides of said lock flaps, means for folding said bottom wall extensions into mutually parallel positions at right angles to both said bottom wall forming portions and said side wall forming portions, means for folding said lock flaps into positions parallel with said bottom wall forming portions, means carried by said male die member for folding said lock flaps against the inside surfaces of the formed end walls and means for pressing said lock flaps and the formed end walls together as to set the adhesive carried by said bottom wall extensions and said lock flaps, means for moving said female die forming members away to their positions adjacent said male die member, means for ejecting the formed cartons from said male die member, said means for folding said side wall extensions, for applying said adhesive, for folding said end wall extensions and for folding said lock flaps into position parallel with said bottom wall, all being arranged at successive work stations past which said travelling die assembly is caused to move.

3. An apparatus as claimed in claim 2, in which said travelling die assembly is carried at the outer end of a rotatable arm, including means for rotating said arm, said work stations being positioned adjacent the circular path traced by the outer end of said arm.

4. An apparatus for forming cartons from paperboard or the like blanks, said blanks having bottom, side and end wall forming portions, consisting of extensions of said bottom and side wall forming portions, the two bottom wall extensions further including additional extensions forming lock flaps which are folded over and fixed to the inside surfaces of the side wall extensions in the finished cartons, said apparatus comprising a frame, a central horizontal shaft mounted for rotation within bearings carried by said frame, a pair of die assemblies carried at the outer ends of opposed arms keyed to said shaft for rotation therewith, each of said die assemblies consisting of a first male die element carried in a slideway within its associated arm, a second male die element carried in a slideway within the first die element, and a pair of female die forming elements fixed to the outer ends of opposed wing members carried at the outer end of said arm; said female die forming elements each consisting of a wall-like form carried by a generally L-shaped element fixed to a rotatable shaft carried at the outer end of one of said wing members; said die assemblies further comprising means for rotating said L-shaped elements as to move said female die forming elements to and from female die forming positions; means for feeding carton blanks in succession to the face of said male die elements as the latter move past a first work station, means for folding said side wall extensions into mutually parallel positions at right angles to said side wall forming portions following delivery of the carton blanks to said male die elements; means for applying glue to the undersides of said bottom wall extensions and said lock flaps following first folding of said side wall extensions; a first cam form carried within said frame, a first cam follower carried by said second male die element and projecting laterally outwardly through a slot in said first male die element for engagement with said first cam form, said first cam form being shaped to cause said second and first male die elements to reciprocate radially within said rotatable arms whereby said male die elements are advanced outwardly into said female die to fold said side wall forming portions following application of the glue to said bottom wall extensions and lock flaps, rotatable wheel means for inwardly folding

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said lock flaps to positions parallel with said bottom wall forming portion, a second cam form carried by said frame and second cam followers carried by said first male die elements, which are mutually cooperable to advance radially outward said first male die elements to fold said lock flaps downwardly and inwardly against the inside surfaces of said folded side wall extensions, fixed pressure roller means for setting the glue in the formed end walls of the cartons and stop means carried by the die assemblies for removing the formed cartons from the male die elements as the latter are retracted radially

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inwardly by said cam forms and cam followers, and means for receiving the finished cartons and delivering them from the apparatus.

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