

July 3, 1962

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MACHINE ADAPTABLE FOR USE IN THE MANUFACTURE OF ONE-PIECE
EXPANDABLE ENVELOPES AND OTHER BOX FORMS

3,041,944

Filed Sept. 5, 1961

3 Sheets-Sheet 1

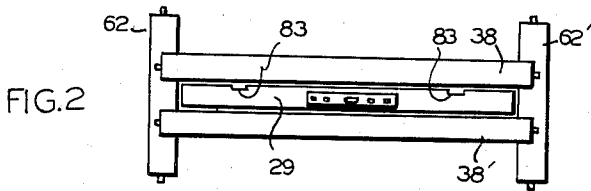


FIG. 2

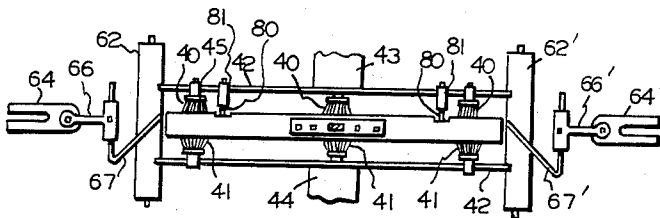


FIG. 3

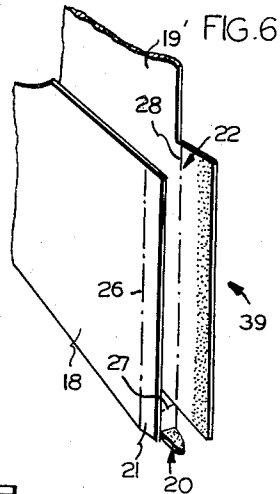


FIG. 6

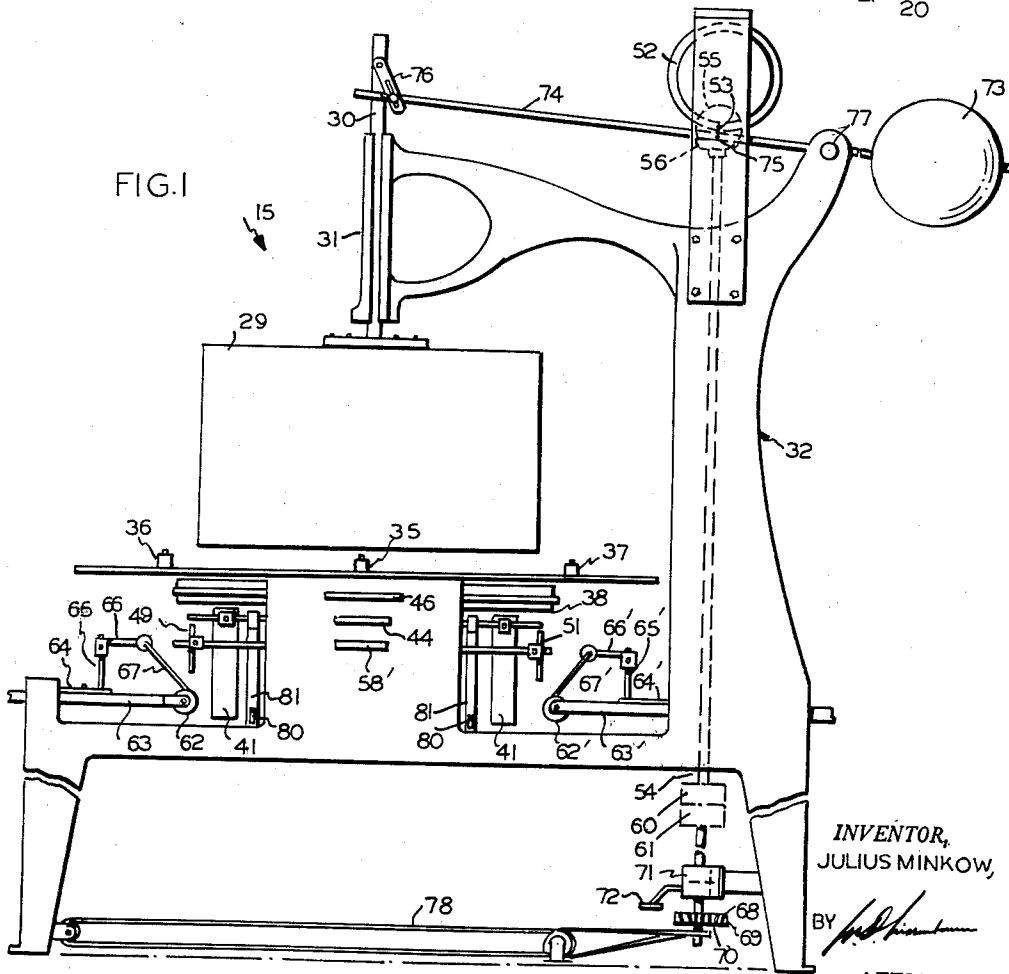


FIG. 1

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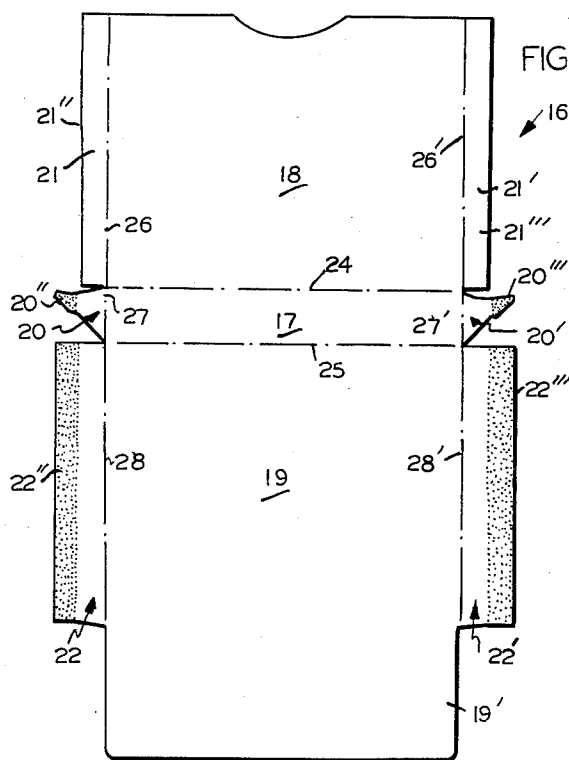


FIG. 5

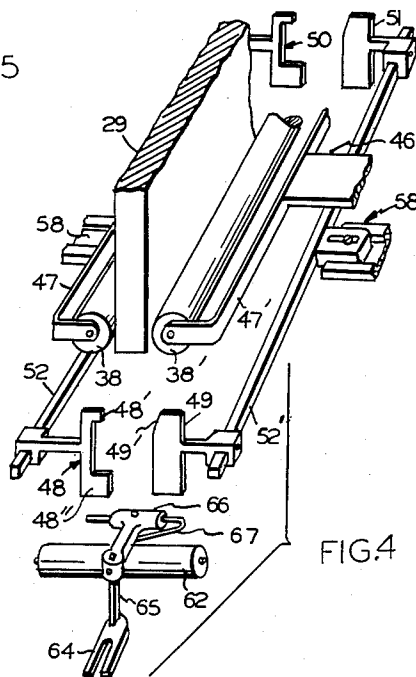


FIG. 4

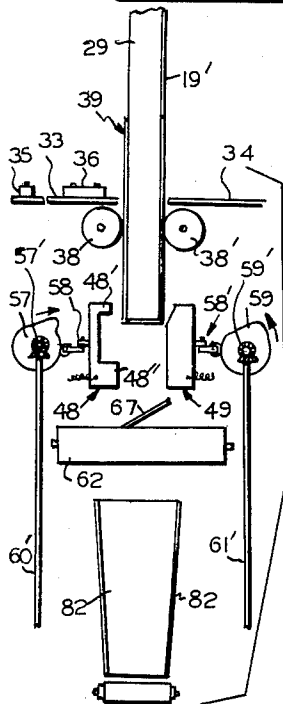


FIG. 7

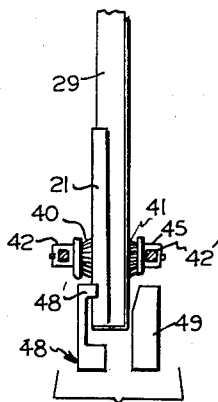


FIG. 8

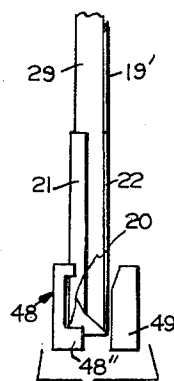


FIG. 9

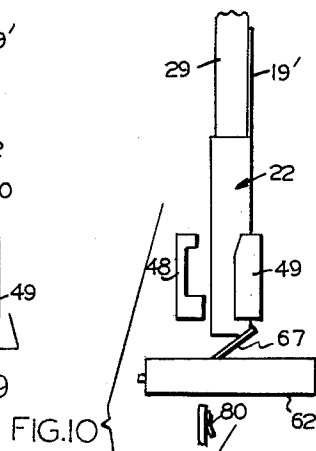


FIG. 10

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FIG. II

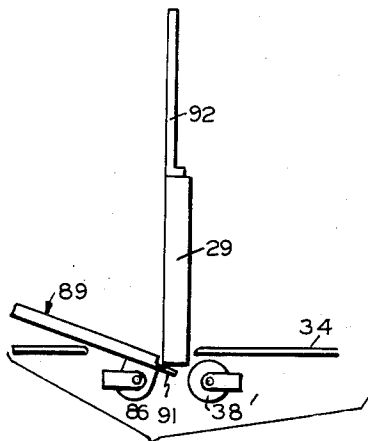
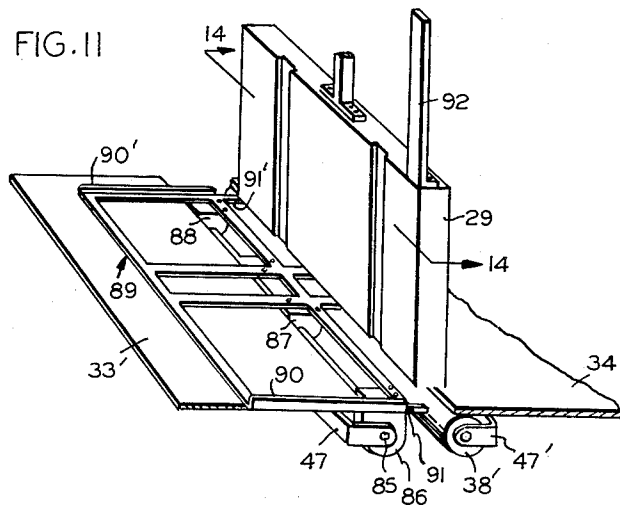


FIG. 12

FIG. 13

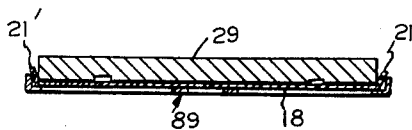
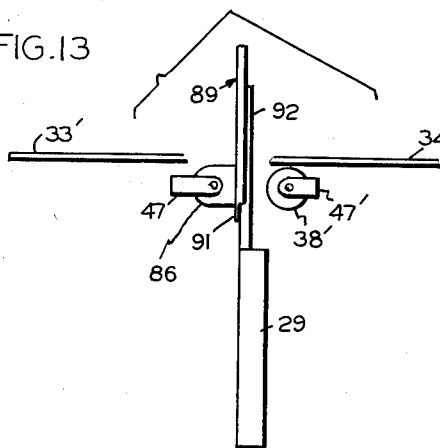


FIG. 14

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3,041,944

MACHINE ADAPTABLE FOR USE IN THE MANUFACTURE OF ONE-PIECE EXPANDABLE ENVELOPES AND OTHER BOX FORMS

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8 Claims. (Cl. 93-49)

The present invention relates to a machine adapted to fold a die-cut, scored, flat blank of fibre tag or other paper material into a one-piece expandable envelope or other box form in which pasted-together overlapping flaps constitute its side walls; each such side wall comprising a flap extending upwardly from the bottom wall, positioned intermediate a flap extending rearwardly from the front wall and a flap extending forwardly from the rear wall of said container.

An object of this invention is to provide a novel and improved folding machine of the character described, which will bend the blank to form the flaps and position them in proper sequence after folding the blank into a channel form to define the front, bottom and rear walls of the envelope or box structure.

Another object thereof is to provide a novel and improved folding machine of the type set forth, which during its cycle of operation, passes adjacent flaps against each other so that adhesive coating on the flap-forming portions of the blank, glues adjacent flaps together for permanent assembly.

A further object is to provide a novel and improved folding machine of the type mentioned, in which, though the exposed bottom edge of each outermost flap is the first to approach and meet the mechanism for pressing adjacent flaps against each other and it being the tendency for the flaps to spring back, there are means whereby said edges will be precisely directed for proper engagement for pressing action, avoiding all possibility of a bent-up corner or a tear.

Another object of this invention is to provide a novel and improved folding machine of the nature described, in which the folding blades afford action progressively along a fold line where the fold line is comparatively long. This is advantageous where the score line is not deep enough as happens when the paper stock thickness is not uniform and also allows the folding blades to be of rather small dimension and yet need no changes for different product sizes.

A further object thereof is to provide such a machine with means which will accomplish a partial fold of flaps before the final fold-over operation takes place thereon.

Another object thereof is to provide the machine with means to hold the opposite walls of said channel form flat, otherwise any buckling which might occur in the channel form during its run through the machine, would bend the flap portions and distort their fold lines, thus resulting in an imperfect product.

A further object is to provide for the machine to be adjustable so it can be set for work of different sizes within its range.

Still another object of this invention is to provide a machine of the kind set forth, having the mentioned attributes and which is simple in construction, reasonable in cost, easy to understand, manipulate, operate and maintain and which is efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

Summarizing the construction for one practice of this invention, it may include a form about which the blank is to be folded to make an upright box structure. This

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form is a vertically reciprocable plunger which upon downward movement, draws the blank between a first pair of members, preferably rollers, whereby said blank is bent into an upright channel form defined by the front, bottom and rear walls of the box form to be. Immediately below each of said rollers may be vertically positioned brush means whose bristles press the opposite walls of the channel form against the plunger to keep them flat. The flap-forming portions of the blank, some portions of which have adhesive coating, extend free away from each end of the plunger. The blank has proper score lines to determine all the fold lines.

At each side end region of the plunger on the machine frame, there are two spaced folding blades, one of which has a pair of spaced horizontal fingers extending towards the other. Similar folding blades are opposite each other and connected for simultaneous horizontal reciprocatory movement respectively. Any suitable means may be used to move the plunger and folding blades in proper timed relation. In the particular embodiment illustrated, cam means are employed.

As the plunger descends with said channel form, the fingered folding blades move partially across the plunger side ends whereupon the upper fingers will turn the flaps extending from one upright channel wall, against the plunger's side ends. Upon further downward movement of the plunger, the horizontal flaps which extend from the bottom wall of the channel form meet the top edges of the lower fingers respectively and are thereby swung upwardly to vertical position. Upon further downward plunger movement, the fingered blades move away while the other folding blades move towards them partially across the plunger's side ends whereupon the flaps extending from the other upright channel will be turned to complete the enclosure. If any of the score lines determining the lines of fold for the flaps extending from the front and rear walls of the channel form, are not deep enough to permit the entire flap to be swung all at once, then the downward movement of the plunger will effect progressive folding of said flap.

Upon further downward movement of the plunger, there are means to direct the outermost flaps of the box formed, into precise engagement with means to press all overlapped flaps together against the side ends of the plunger to assure proper sealing. Such pressing means may be offered by rollers which extend in a direction transverse that of the first mentioned rollers. Stationary spring fingers are provided to intercept the top edge of say the front wall of the box formed so that upon upward movement of the plunger, the finished item is stripped and let fall onto a conveyor belt for discharge from the machine.

In the accompanying drawings forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a front view of a machine embodying the teachings of this invention.

FIG. 2 is a top plan view showing the form plunger in relation to the rollers which bend the blank into channel form and the transverse rollers which accomplish proper sealing of the flaps.

FIG. 3 is a top plan view of the associated machine components which are below the uppermost rollers.

FIG. 4 is a fragmentary perspective view showing the pertinent components of the machine, slightly modified.

FIG. 5 is a face view of the paper blank which this machine works on to make it into a one-piece expandable envelope. Only those score lines are shown where this machine accomplishes folding.

FIG. 6 is a fragmentary perspective view showing the blank folded into channel form which is the first folding step accomplished.

FIGS. 7-10 are diagrammatic views which illustrate

successively the folding operations. These are taken, looking at an end of FIG. 1.

FIG. 11 is a fragmentary perspective view showing associated components of the machine of modified construction.

FIGS. 12 and 13 are views like 7-10, which illustrate successively the operation of the means shown in FIG. 11.

FIG. 14 is a section taken at line 14-14 in FIG. 11 when the plunger thereof is in position as that shown in FIG. 7.

To attain clarity and simplicity of illustration, framework is omitted in all views of structure except FIG. 1.

In the drawings, the numeral 15 designates generally a machine for folding a blank of the type indicated generally herein by the numeral 16. This paper blank shown is of course flat and it includes an oblong section 17 intermediate and contiguous with the substantially rectangular sections 18 and 19 which when folded, form the bottom, front and rear walls of the box form respectively. Along each side edge of each of these sections is a flap respectively. Those flaps extending from the bottom section 17 are indicated as 20, 20'. Those associated with the front wall section 18 are denoted by the numerals 21, 21' and the flaps from the rear wall section 19 are numbered 22, 22'. Each of the flaps 21, 21' is along an entire side edge of the front wall section 18 respectively and deeming such as flap length, the width of each of said flaps is a bit less than half the width of the bottom wall section 17. The length of each of the flaps 22, 22' extending from the rear wall section 19, is equal to that of the flaps 21, 21' and commence from the line of the bottom edge of the section 19 extended; the numeral 19' indicating the excess rectangular part of the rear wall section, which is intended as a fold-over closure flap for the one-piece expandable envelope said blank is eventually made into. Each of the flaps 20, 20' is along a side edge of the bottom wall section 17 respectively and is of a substantially triangular shape whose major portion is toward the front wall section.

The properly directed score lines 24, 25, 26, 26', 27, 27', 28 and 28' determine the respective junctions of said wall sections and flaps and being the only lines the work of this machine 15 is concerned with, all other score lines with which the blank 16 is provided as is well known in the art to form inward gussets of the bottom and side walls of the box structure, are omitted. Also, said blank is provided with active adhesive coatings on those portions of the flaps 20, 20', 22, 22' which are outside the confines of the lines of the edges 21'' and 21''' extended, on one face of said blank; such being indicated at 20'', 20''', 22'' and 22'''. When the blank 16 is folded, the flaps 21, 20 and 22 will overlap and form one side wall and so will the flaps 21', 20' and 22' to form the other side wall of the box structure.

In the machine 15, there is a vertically reciprocable plunger 29 which is a rectangular prismatic form about which the blank 16 is to be folded into an upright box form. To be so mounted, said plunger has an upwardly extending rod 30 from which it is detachable so that forms of different sizes may be used if the machine is to be adjustable. This rod 30 is set for movement along the vertical in a slide 31 which is on the machine frame 32. At the commencement of the cycle of operation, said plunger 29 is above a table composed of the two spaced coplanar sections 33, 34 having proper stops 35, 36, 37 to locate a blank 16 thereon, glued surface upwards, so that upon downward movement of said plunger, the blank's bottom wall section 17 will be just covered by the underside of the plunger and the blank will be drawn down through the space between the table sections and then between the pressing rollers 38, 38' whereby the blank is bent on the lines 24, 25 into a channel form indicated by the numeral 39.

In its downward movement, said channel form 39 is

pressed against the plunger 29 by the downwardly extending stationary brushes 40 which act against the front wall section 18 and by similar brushes 41 which act against the rear wall section 19. Before the channel form 39 reaches said brushes, their bristles should extend into the path taken by the plunger, so when contacted, they will flex and thereby exert good pressing action to avoid any buckling of the work piece.

All of the brushes 40 are mounted on a rod 42 which extends horizontally and is provided with a slide member 43 extending laterally thereof, slidably mounted for movement on the frame of the machine to alter the distance between the sets of brushes. Similar construction is had for the brushes 41. Means, not shown, on the frame 32, releasably secure the slides 43, 44 in any set position and some of the brushes may be on clamps as 45 which can be moved along and secured to different positions along the respective rods 42, 42'. Such possible shifting being provided to make the machine adjustable. Similar releasable and shiftable slide constructions are provided as at 46 on the holders 47, 47' of the respectively journaled rollers 38, 38', so that the distance between such rollers may be altered.

Commencing downward from a bit below the top edges of the brushes 40, 41 are a pair of folding blades indicated generally by the numerals 48 and 49 which lie in the vertical plane determined by the fold lines 26, 27 and 28, that is, their rear surfaces are in such plane. At the commencement of the cycle of operation of the machine, said blades are apart to permit the set of flanges 21, 20, 22 to come between them. A similar pair of folding blades indicated generally by the numerals 50 and 51 are positioned in like manner at the other side end of the plunger 29; the blades 48, 50 being directly opposite each other and the blades 49, 51 being directly opposite each other. Of course, said blades 49, 51 are likewise apart to permit the set of flaps 21', 20', 22' to come between them. The blades 48, 50 are on rod 52 on which they are slidable for adjustment and releasably fixed. This rod is on an extensibly adjustable laterally extending slide 58 which is slidably mounted on the machine frame 32. Similar construction is provided for the rod 52' carrying the folding blades 49, 51; the numeral 58' indicating its extensibly adjustable laterally extending slide. It is evident that the folding blades 48, 50 move together and are shiftable from their position shown in FIG. 7 to that shown in FIG. 8 and back again. Also, that the folding blades 49, 51 move together and are shiftable from their position shown in FIG. 7 to that shown in FIG. 10 and back again.

Since the blades which move together are identical, a description of 48 and 49 will suffice for the others. The blade 48 has two horizontal fingers 48', 48'' which extend towards the blade 49 and are spaced to admit the flap 20 between them; the upper finger 48' being shorter than the lower finger 48'' and the top edge of said lower finger being horizontal. The upper corner of the blade 49 which is nearest the blade 48 may be chamfered as indicated at 49'.

The reciprocating movements of the respective slides 58, 58' and the plunger 29 in proper timed relation may be accomplished by any suitable means which operate respectively in reciprocating fashion with motion controlled. In the embodiment illustrated, cam means are employed for this purpose as a matter of example. There is the rotatable cam 52 on the shaft 53 driven by the shaft 54 through the engaged mitre gears 55, 56.

The rotatable cam 57 for controlling the movement of the slide 58 carrying the folding blades 48, 50 and the rotatable cam 59 for controlling the movement of the slide 58' carrying the folding blades 49, 51, are both to be driven by the shaft 54; all cams needing one revolution per cycle of operation of the machine. The driving connections from the shaft 54 to the cam shafts 57', 59'

may be by any suitable means from the wheel means 60, 61 on the shaft 54, to the respective shafts 60', 61', which by means of mitre gears as shown in FIG. 7, drive the cam shafts 57', 59' respectively. It is essential that the cams 52, 57, 59 shall be so designed to effect the time movements of the plunger 29 and the folding blades.

Immediately below the folding blades at each end of the machine is a revolvably mounted roller. These are indicated by the numerals 62 and 62' respectively. Each is on a releasably fixed slide, indicated respectively by the numerals 63, 63' and each such slide carries a releasably fixed slide carrying a post; such latter slides being 64, 64' and their posts 65, 65'. Each post carries a slidable bracket releasably fixed thereon as indicated at 66, 66' respectively. Each bracket slidably carries the horizontal arm of a rod piece bent into the form of an acute angle, which is adapted to be fixed in any set position; such rod pieces being indicated at 67 and 67' respectively. The other arms of said bent rod pieces extend in downward convergent relation to the facing semi-peripheries of the rollers 62, 62' respectively, terminating in the plane of the rear surface of the plunger 29, also converging towards said plane and extending across the plane of the front surface of the plunger 29 in FIG. 1, so they serve to precisely guide the flaps 22, 22' to enter between said plunger and the respective rollers 62, 62'.

The numeral 68 designates a motor shaft carrying the worm 69 which is in engagement with its companion wheel 70 fixed on the shaft 54. A one-revolution clutch indicated at 71, actuated by a pedal 72, may be interposed in said shaft 54, so that upon each downward shift of the pedal, the shaft 54 is turned one revolution to accomplish one complete cycle of operation and then stop the machine 15.

The plunger 29 is urged to raised position by the action of the weight 73 on the bar 74 which is pivotally mounted to the machine frame at 77. This bar has the roller 75 as the follower for the cam 52 and is connected by the link 76 to the rod 30.

FIG. 1 shows the machine at rest. While the motor is operating, the wheel 70 revolves and the conveyor belt 78 is running so that its top flight moves towards the left in FIG. 1. To operate the machine, set a blank 16 atop the table sections 33, 34 with glued face upwards and positioned with the edges 21'', 21''' against the locating elements 36 and 37 respectively and the top edge of the section 18 against the stop 35. Now press the pedal 72 down and let it free. The cam shafts 53, 57' and 59' will be turned one revolution. The plunger 29 will descend whereupon the blank 16 will be bent into the channel form 39 by coaction of said plunger and the rollers 38, 38' and then the blank sections 18 and 19 will be pressed against the plunger 29 by the brushes 40, 41 respectively. The folding into said channel form is shown in FIG. 7. The bottom portion of said channel form will enter between the folding blades, which is also shown in FIG. 7.

Since the action of the folding blades 48, 49 on the flaps 21, 20, 22 is precisely the same as the action of the folding blades 50, 51 on the flaps 21, 20', 22', a description of the operation of one set of blades will suffice for the other.

Now, as the plunger 29 continues downward, the folding blade 48 is moved by the cam 57 so that its upper finger 48' folds over the flap 21 to lie against the side end of the plunger 29 as shown in FIG. 8. Further downward movement of said plunger, causes the flap 20 to be bent upward to overlap the flap 21 by its interception by the upper edge of the lower finger 48'' whereupon some attachment is caused between such overlapped flaps by the glue in region 20''. The bending up of the flap 20, is shown in FIG. 9.

Now, as the plunger 29 proceeds further downward, the blade 48 starts to move back towards its initial rest posi-

tion while the blade 49 is moved to fold the flap 22 to overlap the flaps 20 and 21 as shown in FIG. 10, whereupon the flaps are pasted together by the adhesive 22'', to some degree. The movement away of the blade 48 is timed that it continue in contact with the box structure without being touched by the adhesive at 22'', such contact continuing as long as possible.

The score lines 26, 28 are preferably deep enough so that the first push of a flap by the blade acting on it, shall turn the entire flap all at once. However if this does not occur, it is evident that upon downward movement of the work, the flap being acted on will be progressively shifted into folded-over position.

It is to be noted that as, or even a bit before the blade 49 starts to fold the flap 22, the bottom edge of such flap comes into contact with the rod 67 which guides it and assures true entrance of the box structure between the pressing roller 62 and the plunger 29 and avoids the possibility of said flap's lower free corner to become bent if it stood out a bit and hit the periphery of the roller 62. Of course, upon passage between the rollers 62, 62', the flaps of each set are securely sealed to each other.

The full downward stroke of the plunger 29 is completed when the cam 52 has made a half turn, at which time the top edge of the box's front wall 18 is below the stationary held downwardly directed springy stripping fingers 80 which are on the vertical members 81 carried on and extending downwardly from the horizontal bar 42. Now, during upward movement of the plunger, the finished piece of work will be stripped therefrom and let fall between the guide walls 82 and then onto the conveyor belt 78, or discharge from the machine.

Upon completion of one revolution of the shaft 54, during which all the cams 52, 57, 59 have rotated one turn, the machine 15 is again in its initial rest condition as shown in FIG. 1, ready to receive the next blank 16 to be worked on.

To set the machine 15 for a box structure of different size, mount a suitable plunger in place of 29 and adjust the slides 58, 58', 43, 44, 63 and 63' to suit such new plunger form, allowing for paper thickness, and also adjust the position of the folding blades 48, 49, 50, 51, the brushes 40 and 41, as well as the rods 67, 67' and the stripper-carrying members 81. Also adjust the position of the locating elements 36, 36, 37 and properly position the stripping fingers 80, all to suit the new-size blank. The table sections 33, 34 are also to be spread apart a proper distance. Provision for some of these adjustments have not been shown, but such are readily understandable to those versed in the machine art without further illustration. Each plunger has suitable channels as 83 along its entire height, into which the stripping fingers 80 may respectively come.

The limits of box size any machine is adapted for is, determined primarily by the lengths of the rollers 38, 38', 62, 62' and the stroke of the plunger.

In the modified construction shown in FIG. 11, the roller 38 is omitted, and instead the shaft thereof 85 has secured thereon the brackets 86, 87, 88 which carry a vane indicated generally by the numeral 89, same being a channel because of its bent-in ends 90, 90', and hence upon swinging of the vane, it will straddle the plunger 29 as shown in FIGS. 13 and 14. It is to be noted that the ends 90, 90' are spaced a bit from the plunger body so that when the vane is adjacent the plunger, the flaps 21, 21' will be but partially folded and loose against said channel ends as indicated in FIG. 14. Said vane has the fingers 91, 91' extending into the path of plunger 29, so as the plunger moves down, the said vane will be swung up as shown in FIG. 12 and then to its final position as shown in FIG. 13. Such upward motion of the vane 89 upon downward movement of the plunger 29, causes the blank to fold on line 24, and there simultaneously occurs the partial folding along the lines 26, 26' before final fold action of the upper fingers like 48' of the blades 48 and 50.

When the height of the plunger 29 is less than the stroke of said plunger, I provide the extension 92 which extends upwardly from the plunger, so that the vane 89 shall remain vertical until the plunger's bottom edge is above the fingers 91, 91', at which occurrence the vane falls down, meaning it swings downward to again lie on the table 33' of the machine, ready to receive the next blank between its flanges 90, 90'. Said vane 89 may be a panel with flanges 90, 90' or "skeletonized" as illustrated.

It is to be noted that some prefolding action is also provided for the flaps 22, 22' by the guide rods 67, 67' before final fold action thereon by the blades 49, 51.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiments shown herein shall be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

I claim:

1. In a machine for forming a box structure from a flat blank comprising a bottom wall section intermediate and contiguous with a front and a rear wall section including flap-forming parts extending from each side end of said sections with adhesive on predetermined locations thereon so that each side wall of the box structure resulting from the folding of said blank shall consist of a flap extending from the bottom wall positioned intermediate and overlapped by a flap extending from each of the other sections, a frame, a plunger serving as the form about which the blank is to be folded, reciprocatably mounted on the frame, a first pair of spaced members positioned on the frame to receive said plunger between them, means to locate the blank intermediate said plunger and said first pair of members so that the plunger in its movement towards and then between said first pair of members, will draw the blank between said first pair of members whereupon said blank will be folded into a channel form determined by said blank sections, a first pair of folding blades reciprocatably mounted on the frame for movement across the plane of one of the opposite walls of said channel whereby first the flaps extending from said one wall are folded to contact the end faces of said plunger respectively and as the plunger continues in its movement, the flaps extending from the bottom wall section are folded to overlap respectively, said flaps first folded; each of said folding blades constituting said first pair having two spaced fingers extending towards the second of said opposite channel walls; those of said fingers which are first passed by the plunger, causing the first mentioned folding of flaps and the other of said fingers causing the folding of the flaps extending from the bottom section, a second pair of folding blades reciprocatably mounted on the frame for movement across the plane of the second of said opposite walls of said channel whereby the flaps extending from said second opposite wall of the channel form are folded to overlap the end faces of the plunger respectively and constitute the outermost flaps of the now completely folded box structure, a second pair of spaced members positioned on the frame transverse said first pair of spaced members, to receive said plunger between them after the folding over of said outermost flaps, whereupon on continued movement of the plunger, all of the flaps will be pressed against the side end faces of the plunger, thereby effecting proper sealing due to the presence of said adhesive, means to control the movement of said plunger and folding blades in a predetermined timed relation, as to sequence, extents and directions respectively and means to operate said control means.

2. A machine as defined in claim 1, including means on the frame in advance of each of the members of said second pair of members respectively, to guide that edge of each of said outermost flaps which is to be adjacent the bottom section, to come and stay in a position from a time prior to the commencement of the pressing action by said second pair of members, where any bending of the body of any of said outermost flaps by said pressing members is avoided.

3. A machine as defined in claim 2, wherein said guiding means comprises a pair of rods mounted on the frame; said rods being in convergent relation towards said second pair of spaced members and each of said rods extending across the plane of the surface of the plunger which the folding blades shifting the outermost flaps pass is their movement and ending at a position the respective free corners of said outermost flaps are to assume respectively, where each such corner is to enter between the plunger and one of said second pair of spaced members for the commencement of the pressing action by said second pair of members.

4. A machine as defined in claim 1, wherein each of said pairs of spaced members constitute parallel rollers journaled on the frame.

5. A machine as defined in claim 1, wherein said control means is so arranged that while shifting the fingered blades away from the box structure while the other blades are moved to fold the last flaps to be shifted, to hold such fingered blades in contact with the box structure for as long as possible without any contact ever with said last flaps being shifted.

6. A machine as defined in claim 1, including a springy stripping finger fixed on the frame and extending in the direction the plunger moves while the blank is being folded; said stripping finger bearing against one of the opposite walls of the said channel from and such stripping finger being in such position that its free end is passed by the rim edge of the wall it bears against upon continued movement of the plunger; said plunger having a channel across its face adjacent said wall, extending in the direction said plunger moves; said stripping finger being biased towards said channel, whereby on completion of the box structure and during the return movement of the plunger to a starting position, said stripping finger will intercept the rim of the box structure and strip it off the moving plunger; the free end of said stripping finger entering in said channel before such interception.

7. A machine as defined in claim 1, wherein one of the members of the mentioned first pair of spaced members, is a vane normally in a first position where it is adapted to have a flat blank to be worked on, rested thereagainst; said vane being swingably mounted on the frame on an axis parallel to and adjacent the other of the members of said pair, for movement towards and away from the plunger; said vane having a finger element extending therefrom into the path of said plunger so that upon movement of the plunger towards the folding blades, it will cause said finger element to be shifted thereby swinging the vane to a second position where it directly faces the plunger at a predetermined distance therefrom and means on the plunger maintaining said finger element against movement until the plunger returns to the position where it first caused interception of said finger element; said vane being biased to return to said first position.

8. A machine as defined in claim 7, wherein the vane has flanges making it a channel to straddle the plunger when swung towards said plunger; each of said flanges being spaced from the plunger a predetermined distance respectively when the vane is shifted to straddle the plunger.

No references cited.