C. HORTON.

MACHINE FOR MAKING PAPER BOXES.

APPLICATION FILED SEPT. 26, 1918.

1,430,232.

Patented Sept. 26, 1922.

4 SHEETS—SHEET 1.

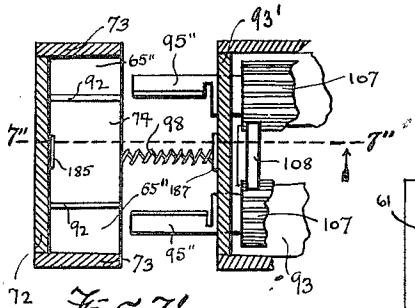


Fig. 7'

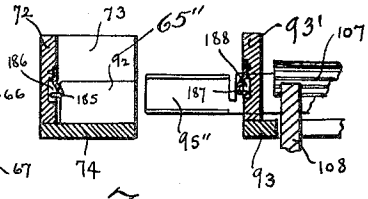


Fig. 7"

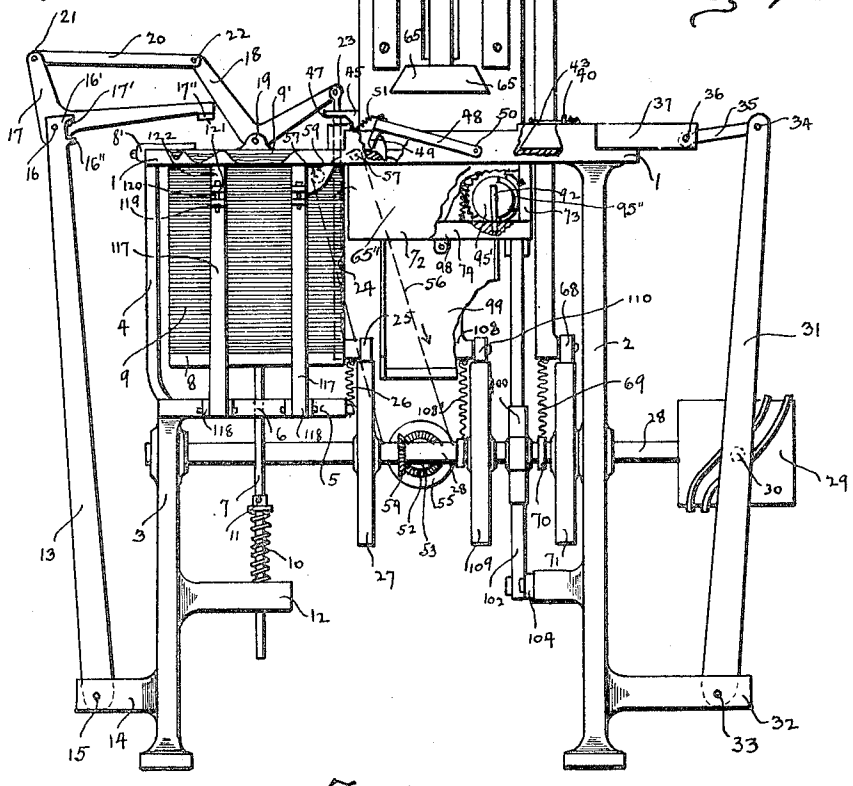


Fig. 1.

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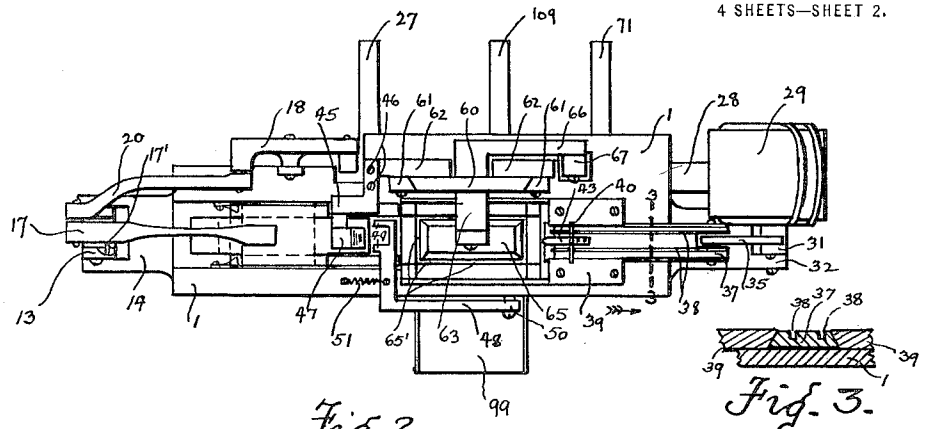


Fig. 2.

Fig. 3.

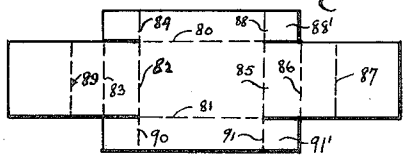


Fig. 8.

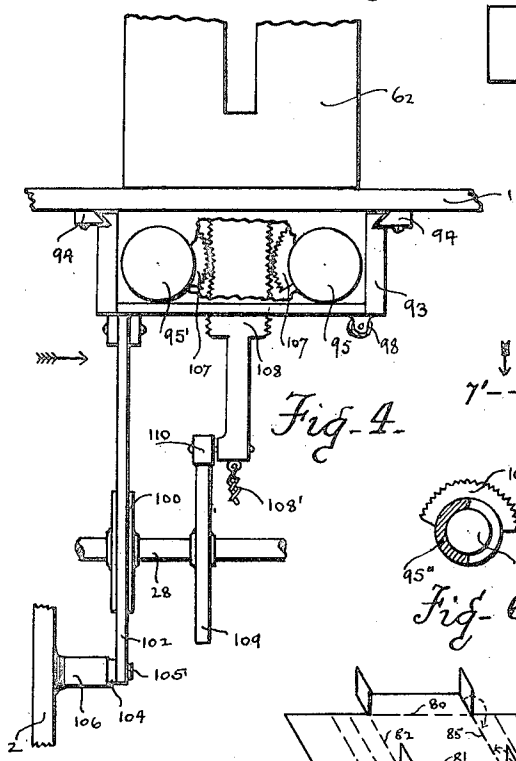


Fig. 4.

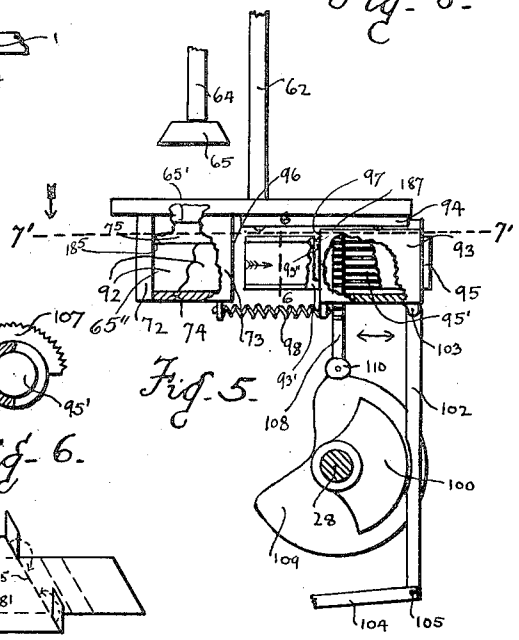


Fig. 5.

Fig. 6.

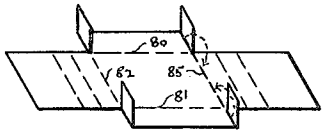


Fig. 9.

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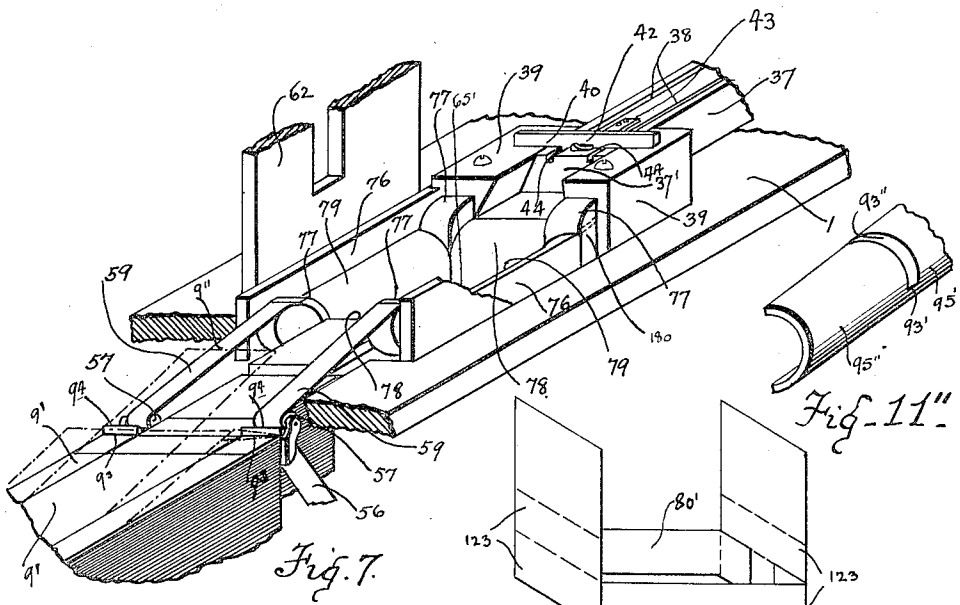


Fig. 7.

Fig. 11".

Fig. 10.

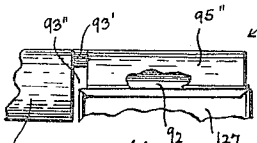


Fig. 11'.

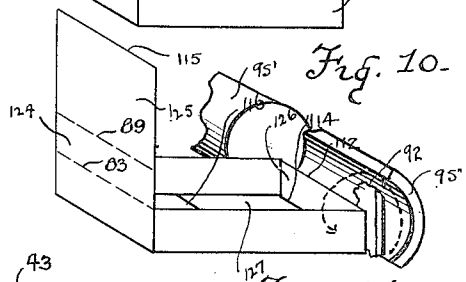


Fig. 11.

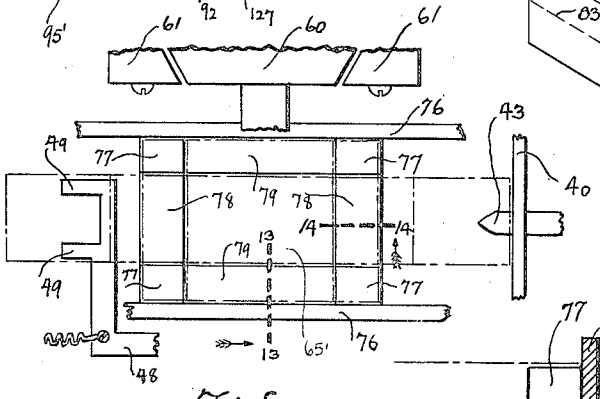


Fig. 12.

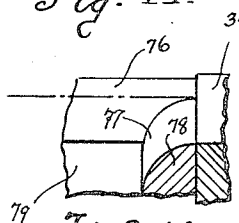


Fig. 14.

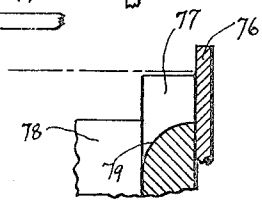


Fig. 13.

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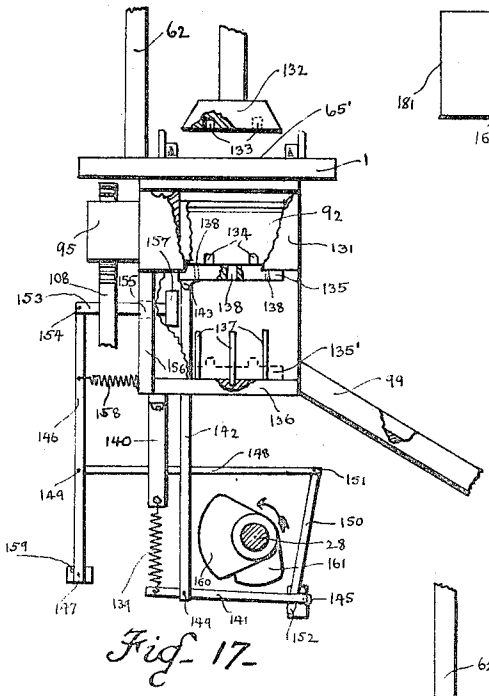


Fig. 17.

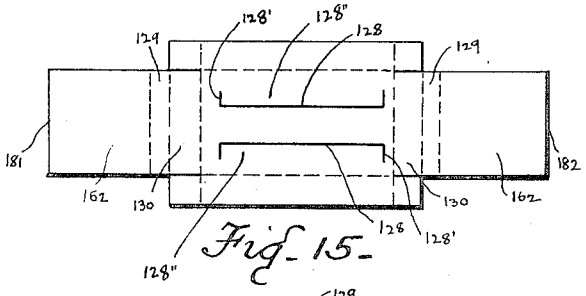


Fig. 15.

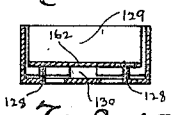


Fig. 16.

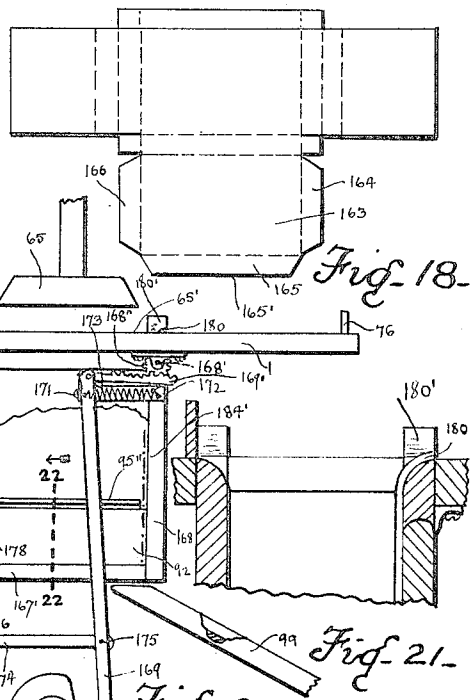


Fig. 18.

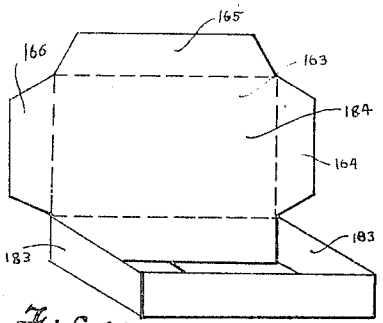


Fig. 19.

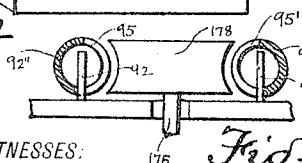


Fig. 22.

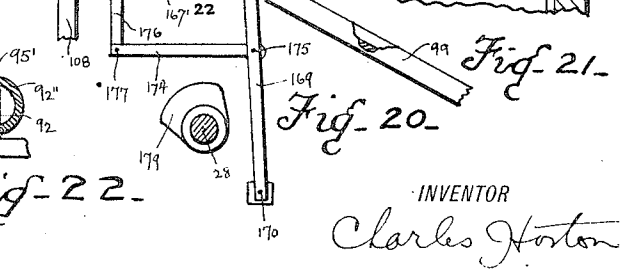


Fig. 20.

Fig. 21.

WITNESSES:

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A. L. Mellen

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Patented Sept. 26, 1922. 1,430,232

UNITED STATES PATENT OFFICE.

CHARLES HORTON, OF BROOKLYN, NEW YORK, ASSIGNOR TO PERCY E. GINN, OF BOSTON, MASSACHUSETTS.

MACHINE FOR MAKING PAPER BOXES.

Application filed September 26, 1918. Serial No. 255,744.

To all whom it may concern:

Be it known that I, CHARLES HORTON, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Machines for Making Paper Boxes, of which the following is a specification.

This invention relates to apparatus for folding or conforming blanks of flexible material into containers or the like, and aims primarily to provide in connection therewith improved feeding mechanisms for carrying the blank from a removed point to within range of the conforming instrumentalities, improved instrumentalities for giving such blank such conformations, and improved means for ejecting the conformed blank.

One of the objects of this invention is to provide a general structure for the conforming instrumentalities of a simple, compact and positive nature, and one that will be readily amenable to substantially slight constructional differences in order to accommodate blanks of different sizes and characteristics; and the better to indicate the extent to which this invention satisfies the just-recited object, a plurality of embodiments of the same, each capacitated for the conformation of a distinctly dissimilar type of blank, are disclosed below.

Another object is to illustratively disclose a type of feeding mechanism which does not necessarily depend, for its engagement with a blank, upon adhesive relations, or edge or mutilation engagements therewith, but preferably actuates said blank, through frictional engagement, to travel for a portion or the entirety of the length of "feed."

Other objects and aims of the invention will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the various combinations of the different mechanisms, and in the modes of operation of the same, as well as in the combination of all of them in one apparatus, and also in the features of construction, arrangements of parts and modes of operation of the parts making up the several mechanisms individually considered; all as will hereafter be set forth and indicated in the appended claims.

Referring now to the accompanying drawings, wherein is shown one of the various possible embodiments of this invention.

Fig. 1 is a front elevation, partly in section, showing a structure embodying the same;

Fig. 2 is a top plan view of the parts illustrated in Fig. 1;

Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 2, and looking in the direction of the arrow, showing more clearly a detail of construction;

Fig. 4 is an enlarged view, showing in rear elevation certain of the parts illustrated in Figs. 1 and 2;

Fig. 5 is a side elevation of the parts illustrated in Fig. 4, looking in the direction of the arrow;

Fig. 6 is a detail sectional view, taken on the line 6—6 of Fig. 5 and looking in the direction of the arrow;

Fig. 7 is a perspective view, showing more clearly certain of the parts attendant as folding instrumentalities;

Fig. 7′ is an enlarged sectional view taken on the line 7′—7′ of Fig. 5, looking in the direction of the arrow;

Fig. 7″ is a similar view taken on the line 7″—7″ of Fig. 7′ and looking in the direction of the arrow;

Fig. 8 is a top plan view, enlarged, showing a form of blank adapted for use in this embodiment of the invention, the dotted lines indicating the location of scorings to aid in the folding;

Fig. 9 is a perspective view of the same blank, showing the first result of the folding operation;

Fig. 10 is a similar view of the same blank, showing the next result of the said operation;

Fig. 11 is a similar view of the same blank, showing in part (i. e. only with reference to the right-hand end) the next result of the said operation, as well as two of the hereinafter-described folding elements, to wit, plate 92 and revoluble member 95′;

Fig. 11′ is a top plan view, partly broken away, of certain of the parts shown in Fig. 11;

Fig. 11″ is a perspective view, looking in the direction of the arrow of Fig. 11′, of a portion of said revoluble member 95′;

Fig. 12 is a top plan view, showing certain of the parts illustrated respectively in Figs. 1 and 2 and in Fig. 7, and in connection therewith a dotted-line representation of a blank which has been fed ready to be folded;

Fig. 13 is an enlarged sectional view, taken on the line 13—13 of Fig. 12, and looking in the direction of the arrow;

Fig. 14 is a similar view, taken on the line 14—14 of Fig. 12, and looking in the direction of the arrow;

Fig. 15 is a top plan view of another type of blank for possible utilization in a variation of this embodiment of the invention;

Fig. 16 is a transverse sectional view therethrough after the folding operation is completed;

Fig. 17 is a side elevation, partly in section showing certain parts of the apparatus illustrated in Figs. 1 and 2 and disclosing certain modifications in the structure thereof to allow of the utilization within the same of a blank similar to the one illustrated in Figs. 15 and 16;

Fig. 18 is a top plan view of another type of blank for possible utilization in a further variation of this embodiment of the invention;

Fig. 19 is a perspective view of the same blank, folded, and ready for ejection from the apparatus as hereinafter described;

Fig. 20 is a side elevation, partly in section, of certain parts of the apparatus illustrated in Figs. 1 and 2, showing certain modifications in the structure thereof to allow of the utilization within the same of a blank similar to the one illustrated in Figs. 18 and 19;

Fig. 21 is an enlarged sectional view taken transversely of the parts disposed beneath the plunger 65 and looking in the direction in which Fig. 20 is assumed to be viewed; and

Fig. 22 is a sectional view, taken on the line 22—22 of Fig. 20 and looking in the direction of the arrow.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Referring now particularly to Figs. 1 and 2, 1 represents a table supported upon leg-supports 2, 3 and 4. Leg-support 3 carries as shown a feed-table 5 for the blanks and is provided with a central squared aperture 6, through which is adapted to reciprocate a presser-rod 7 to force upward the column of blanks 9, through the engagement of the head 8 with the lowermost blank in said column, so that the top blank in said column will always be presented substantially in the relation to the table level and to the stop 8′, all as illustrated in Fig. 1; said presser-rod being normally urged upward as shown by means of the expansile spring 10 positioned upon said rod between the collar 11, carried on said rod, and the bracket 12, formed on support 3.

A composite means for controlling the feed towards the central part of the machine and properly beneath the plunger 65 is in part comprised of the lever 13, pivoted as at 15 to the bifurcated extension 14 formed on support 3, and pivotally connected as at 16 to the bell-crank lever 17, which latter is in turn, by means of a link 20 pivoted as shown at 21 and 22, operatively connected to a second bell-crank lever 18, lever 18 being pivoted as at 19. Pivotally connected to bell-crank lever 18 as at 23 is a member 24 carrying as shown an idler 25; said idler being spring-pressed, as by means of the retractile spring 26 supported as shown, to travel upon the periphery of a cam 27, keyed upon the main shaft 28. Said shaft 28 is supported for rotation in leg-supports 2 and 3 as shown. Bell-crank lever 17 is provided with a pin 17′, normally restrained against finger 16′ carried upon the lever 13. Another finger 16″ is carried upon said lever 13 for the purposes explained hereinafter. Bell-crank lever 17 carries as shown a portion 17″ equipped with the blank-engaging point or points indicated.

Constituting a concomitant portion of the aforesaid composite means for controlling the feeding of blanks as aforesaid, there is shown mounted upon the shaft 28 a rotative cam 29, the guiding parts of which during revolution co-act with a stud 30 carried by the lever 31. Lever 31 is pivotally supported at its lower end as at 33, within the bifurcated extension 32 of support 2, and is pivotally connected at its upper end as at 34 to a link 35, which link is pivotally connected as at 36 to the bifurcated right-hand end of carriage 37. Carriage 37 is beveled in cross-section as shown clearly in Figs. 2, 3 and 7, carrying two surface grooves 38, and is guided for reciprocation between the inner undercut walls of guide blocks 39. Guide blocks 39 are bridged (as illustrated most clearly in Fig. 7) by a bridging member 40, provided with a transverse channel 42 which is adapted to permit of the uninterrupted travel transversely therethrough of a leaf-spring 43 carried upon said carriage. Said bridging member 40 is formed in addition with two depending fingers 44 each adapted to extend into and ride within a groove 38 during the aforesaid horizontal reciprocation of said carriage 37.

As still an additional device here present as a part of the feeding means, there is disclosed a bracket 45 (Figs. 1 and 2) mounted upon table 1 as at 46 (Fig. 2). Bracket 45 carries a stop 47, in the line of the leftward advance of carriage 37.

As an agent preferably present as a further part of said feeding means, there is disclosed a member 48, carrying two depending fingers 49 and pivotally mounted upon table 1 as at 50. A retractile spring 51 normally tends to maintain fingers 49 downpressed upon a portion (such portion

being shown in section in Fig. 1) of one of the folding conformations which will be later described.

A bevel-gear 52, keyed upon a second shaft 53, is shown in mesh with bevel-gear 54, keyed upon shaft 28. Gear 52 carries with it for revolution a drum 55, which is adapted to feed a pair of belts 56 in the direction of the arrow. Each belt 56 as shown passes over its idlers 57 and the portion 59 of each is thus made to feed in the direction of the feed of a blank to be folded; the relation of the gear-meshing being preferably such that the speed of travel of belts 56 is in advance of the speed of the blank-feeding, to prevent as far as possible a premature bending or twisting of either or both of the small flaps 88′ and 91′ shown in Fig. 8.

Still referring particularly to Figs. 1 and 2, there is shown a beveled cross-head 60, mounted for reciprocation with reference to cross-head guides 61 carried upon standard 62, said standard being here formed upon table 1 as shown. Cross-head 60 carries a frontwardly extending portion 63 (Fig. 2) from which depends (Fig. 1) a rod 64, carrying at its lower end a punch-plunger 65. At proper intervals during the actuation of the apparatus, cross-head 60 is given vertical reciprocation, by means of its rigid connection with bars 66 and 67, bar 67 carrying at its lower end an idler 68 which is spring-tended to ride upon the periphery of cam 71, through the impulse of the retractile spring 69 connected at one end thereto and at its other end to a collar 70 loosely carried upon the shaft 28.

Directly beneath the top of the plunger 65 and subtending an opening 65′ in table 1 beneath said plunger, the variously formed walls of which opening will be hereinafter described and which constitute the "folding conformations" above mentioned, is a compartment 65″ (best illustrated in Figs. 1 and 5) formed of the walls 72, 73, 74 and 75.

Referring now to Fig. 7, the side walls of said opening beneath the plunger are seen to constitute in effect a female die-member comprised of the walls 76, the four small convex surfaces 77, the two transverse convex surfaces 78 therebelow, and the longitudinally-extending convex surfaces 79. The functions of these "rolls" may be briefly explained following a preliminary reference to Fig. 8, which shows one of the blanks with the usual scorings, to wit, those indicated at 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90 and 91. The blank disclosed in Fig. 8, when properly fed according to the description of the operation of this apparatus hereinafter contained, will lie over the opening bounded by the aforementioned variously shaped side walls, as diagrammatically shown in dot-and-dash lines in Fig. 12. Upon the actuation of the plunger which forms the male folding element to force the blank down into compartment 65″, the die-shaped walls of such opening will fold the blank according to the following steps: First, the blank illustrated in Fig. 8 will take the form disclosed in Fig. 9, the flat blank being primarily forced down upon the convex surfaces 77, thereby making the folds upon the scored lines 84, 88, 90 and 91. The further travel of plunger 65 will next force the blank simultaneously against convex surfaces 78 and 79 in such a manner that the blank will thereupon be folded simultaneously upon the scored lines 80 and 81 (as indicated by the curved arrows in Fig. 9) and upon the scored lines 82 and 85, the blank assuming as a result the conformation shown in perspective in Fig. 10. The blank as so folded is now so far within compartment 65″ that its bottom is resting upon the upper surface of bottom wall 74 of said compartment (Fig. 5), and said blank's end walls are resting between and being supported by the inner vertical surfaces of two parallelly-extending transverse plates 92, one of which plates is shown in Figs. 1, 5, 11, 11′ and 11″.

Attention is now directed to Fig. 4, wherein is disclosed a rear elevation of certain of the means illustrated in Figs. 1 and 2. Beneath cross-head-supporting standard 62 and on the underside of table 1 is shown a movable compartment 93, adapted to reciprocate within the guides 94 in the direction of the arrow (Fig. 5), and is adapted to carry therein a pair of oscillatory members 95 and 95′. One of said members, to wit, member 95, is shown in Fig. 5 as being broken away. A sectional view of member 95′ is shown in Fig. 6, taken on the line 6—6 of Fig. 5. Member 95′ is provided (member 95 being similarly provided) with a half-tubular front extension 95″, so joined to the main body by means of an integral neck portion 93′ that there is created a slot 93″, as illustrated in Figs. 5, 11, 11′ and 11″. This structure is such that were compartment 93 to be in its normal position and not in the position illustrated in Fig. 5, that is, with the rear surface 96 of the fixed front compartment 65″ flush against the front surface 97 of movable compartment 93, the aforesaid half-tubular extensions carried by member 95 and member 95′ would lie alongside the end walls of the forced-home blank shown in Fig. 10, but so disposed that the plates 92 lying as aforesaid against the said end walls of the said blank will separate therefrom the semi-tubular portions of members 95 and 95′.

Compartment 93 is normally maintained forward, flush against the compartment 65″, by means of the retractile spring 98, and at the proper intervals (namely, to withdraw the completely folded blank rearwardly off

the floor of compartment 65″, so that said blank may fall into the chute 99 for ejection) compartment 93 is moved towards the rear to the position disclosed in Fig. 5, thereby clearing members 95 and 95′ and the folded blank free of the fixed front compartment, which members have been previously actuated to whirl over the tops of plates 92 and into the semifolded blank, thereby completing the folding of the same, the manner and means of which last actuation will be next taken up. The forward and backward shifting of compartment 93 is controlled at the proper intervals by means of co-action of cam 100, keyed upon the shaft 28, with the link 102. Link 102 is pivotally connected to compartment 93 as at 103, and to a second link 104 as at 105; said link 104 being pivotally mounted as shown upon the bracket 106 carried upon the support 2 (Fig. 4).

Referring to Figs. 4 and 6 it will be seen that members 95 and 95′ carry offset concentric segments 107. These segments are provided with teeth as shown in Figs. 4 and 6, which teeth extend longitudinally in the nature of parallel corrugations as shown in Fig. 5. Figs. 4 and 5 disclose a double rack 108 adapted always to mesh with the corrugations carried on members 95 and 95′, whatever the position of compartment 93, and at the proper intervals to simultaneously rotate members 95 and 95′ when compartment 93 is in the position illustrated in Fig. 5, in such a manner that upon the downward actuation of said rack 108, due to the proper yield of the periphery of cam 109 to the spring-pulled idler 110, mounted upon the lower end of said rack in a continuous contact with said periphery, caused by the stress of retractile spring 105′, the direction of rotation of such members 95 and 95′ will cause their half-tubular front extensions, normally isolated from the folded blank shown in Fig. 10 by the plates 92, to make the semi-revolution shown diagrammatically by the two arrows in Fig. 11. One of said arrows indicates the relative position of a half-tubular extension before actuation, and the other of said arrows indicates the relative position of such half-tubular extension when the actuation is completed.

In Fig. 11 a partially folded box is shown, on the assumption that but one end-flap has been folded within the box, and it should be clear that with both end-flaps simultaneously folded, as they in practice would be, scoring 83 will fold as at 112, the scoring 89 will fold as at 114, and edge 115 will tightly lock in the bottom of the box against edge 116.

As a convenient means for feeding new blanks upon cap-plate 8, I have shown in Fig. 1 a pair of restraining members 117, hinged at their lower ends to said table 5 as at 118 and carrying at their upper ends an apertured rib 119, in such a manner that the pin 120, when dropped through a similarly apertured rib 121 carried upon a depending bracket 122, will engage within the aperture of the rib 119, to lock member 117 in place.

Having thus described this first variation of this embodiment of my invention, a description of the operation thereof is now in order.

The first step to be performed, the feeding to a proper position beneath plunger 65 of the topmost blank 9′ in the column 9 (Fig. 1), is accomplished by two sets of mechanisms, the first driven at proper intervals by cam 27 through rod 24, and the second driven at proper intervals by cam 29 through lever 31. Upon cam 27 allowing retractile spring 26 to actuate rod 24, bell-crank lever 18 is rocked on its pivot 19, thereby through link 20 causing bell-crank lever 17 to also rock on its pivot, in such a way that the point-carrying head 17″ of said lever 17 is thrust downward into engagement with topmost blank 9′. With head 17″ thus in engagement with said blank, pin 17′, carried upon said lever 17, will abut against finger 16″, formed upon lever 13, and thereupon cause lever 17 and lever 13 temporarily to become a single rigid member, so that head 17″, carrying with it topmost blank 9′ will be given substantially horizontal travel towards the center of the machine. During such horizontal travel, the forward edge 9^3 of the blank will abut against the abutments 9^4 (Fig. 7), and cause it to buckle up into the position illustrated in dot-and-dash lines in Fig. 7. Carriage 37, carrying the lipped leaf-spring 43, driven by cam 29 through lever 31 and link 35, has been simultaneously moving towards the center of the machine to meet the approaching blank 9′; and said carriage continues its travel until it abuts against stop 47, the inclined face of which thereupon raises the lipped portion of leaf-spring 43 sufficiently to permit of the forcing of the adjacent portion of blank 9′ between said leaf-spring and the top floor of said carriage. Carriage 37 preferably has been actuated to its said halted position, with its leaf-spring 43 properly engaged by stop 47, before said blank 9′ has been actuated to the position illustrated in dot-and-dash lines in Fig. 7; so that, with said carriage so halted, the blank 9′ is approaching said carriage in its halted position, whereby the forward edge 9″ (Fig. 1) of said blank is guided up the transversely-bevelled nose 37′ of said carriage and thus well under leaf-spring 43. Cam 29, through the connected elements, now causes carriage 37 to return toward normal position (i. e. slightly be-

yond the position shown in Figs. 1, 2 and 3), first, sufficiently to permit leaf-spring 43 to snap free from stop 47 and grip blank 9′ upon said carriage, and, next, to carry with it said blank up to the point where the forward edge of the blank will abut against the bridge 40; carriage 37 thereupon continuing its travel to normal position after pulling free from the blank to allow it to remain properly beneath plunger 65. The fingers 49 of the member 48, held down by the comparatively weak spring 51 (Figs. 1 and 2), tend to maintain blank 9′ in this position. Cam 27 has in the meantime allowed the parts controlled by it to assume the normal position disclosed in Figs. 1 and 2. The function of the rapidly travelling belts 56 (Figs. 1, 2 and 7) has been already explained, to wit, to aid in the feeding of the blank and prevent twisting and bending of any of the subdivisions thereof, particularly in view of the bending-under of certain of these in the first feeding step, as illustrated in Fig. 1.

Cam 71 now allows spring 69 to become effective to force plunger 65, carrying with it the blank 9′, into the compartment subtending opening 65′, and thereby will take place the folding operations hereinbefore referred to, caused by the forcing of the plunger-carried blank successively against the various surfaces 76, 77, 78 and 79 whereupon plunger 65 will return to the normal position illustrated in Fig. 1. Blank 9′, reposing in said compartment with its ends supported against plates 92, will be folded as illustrated in Fig. 10.

Before taking up the next operation, it should be noted that compartment 93 (Fig. 5) is now disposed in its normal relation to the front fixed compartment, that is, it is held in abutment thereagainst by retractile spring 98; and that therefore the half-tubular extensions carried by members 95 and 95′ are respectively opposite the side portions 123 (Fig. 10) of blank 9′ but separated therefrom by the plates 92 (Figs. 1, 5, 11 and 11′). With the said parts so disposed, cam 109 now allows spring 108′ to cause the double rack 108 to be pulled down, thereby whirling the said half-tubular extensions each over the top of its adjacent plate 92 and into the partially folded blank (see the arrow Fig. 1), completing the folding thereof in such a manner that, with reference to the blank illustrated in Fig. 11 its flaps 124 and 125 will be folded within the box simultaneously with the folding therein of the flaps so illustrated at 126 and 127, and so that edge 116 will form a lock to maintain the blank in its said completely folded condition.

Referring now particularly to Figs. 4 and 5, it being remembered that the half-tubular extensions as aforesaid are still within the folded blank and therefore will remove the said folded blank rearwardly with them, attention is now directed to cam 100. Cam 100 now forces link 102, against the tension of spring 98, to carry compartment 93 to the rear of the machine. The folded blank 9′ thereupon drops upon chute 99, and gravity causes its ejection therefrom. At the proper time cam 109 allows rack 108 to return to normal position, thereby to return members 95 and 95′ likewise to normal position.

During the withdrawal to the rear of compartment 93 (Fig. 5), cams 27 and 29 (Fig. 1) are being brought into effective relation with their operative parts to commence the feeding of another blank.

Referring now particularly to Figs. 15, 16 and 17, whereof as aforesaid Fig. 15 is a top plan view of another type of blank for possible utilization in a variation of this embodiment of this invention, Fig. 16 is a transverse sectional view therethrough after the folding operation is completed, and Fig. 17 is a side elevation, partly in section, showing certain parts of the apparatus illustrated in Figs. 1 and 2, to wit, the table 1, the standard 62, the rack 108, the oscillatory member 95, one of the plates 92, and the chute 99, and disclosing in addition certain modifications in the structure, attention is called to the blank illustrated in Fig. 15 (unfolded) and in Fig. 16 (folded), which as will be noted is similar to the one illustrated in Fig. 8, the former being shown with interior substantially-U-shaped cuts 128. These cuts need not preliminarily be provided in the blank, and the lips 128″ may instead be punched directly out of the stiff body of said blank by the simple coaction of the channels 133 and the members 134; which latter method, indeed, I have found in practice to be preferable. The functions of said lips 128″ are to be bent up as shown in Fig. 16, thereby to aid in the formation of a box of the so-called "false bottom" type. The portions 129 of said blank, as indicated, are preferably as much smaller in width than the portions 130 as the length of each arm 128′ of each cut 128.

Referring now to Fig. 17, it will be seen that there is disclosed beneath the opening 65′ (which opening has side-wall conformations similar to those of the apparatus disclosed in Figs. 1 and 2) a compartment 131, and that there is positioned above said such opening 65′ a plunger 132 adapted at the proper time for actuation therethrough and into compartment 131. Said plunger 132 is similar to the plunger 65 illustrated in Figs. 1 and 2, except that it is provided with under-cut channels 133, adapted upon the actuation of said plunger fully into compartment 131 to coact with

corresponding die-members 134, formed upon floor-plate 135, thereby to bend up the cuts 128 (Figs. 15 and 16). Channels 133 and die-members 134 are shown merely in end elevation in Fig. 17, but are of the proper length to perform their above-designated function. Floor-plate 135 is normally in the position shown in full lines in Fig. 17, and at other times in the position shown in dotted lines in said figure. When in the dotted-line position it will be seen that floor-plate 135 is resting upon the fixed bottom wall 136 of said compartment, and in order to be enabled to assume such position, notwithstanding the vertically extending pin 137 carried by wall 136, said floor-plate is provided with a plurality of vertical slots 138 adapted to register with and for the reciprocation therethrough of said pins 137. Floor-plate 135 is normally maintained in the position illustrated in full lines by the tension of the retractile spring 139 mounted as shown, which tension is transmitted as shown through the lever 141 and the link 142, the latter being pivoted to said floor-plate as at 143 and to lever 141 as at 144, lever 141 being fixedly pivoted as at 145.

Another lever system is also shown in connection with the structure disclosed in Fig. 17, which is comprised of lever 146 pivoted as at 147, link 148 pivoted to lever 146 as at 149, and lever 150 pivoted to said link as at 151 fixedly pivoted as at 152. Lever 146 is pivoted to rod 153 as at 154, said rod being guided within aperture 155 in wall 156, for reciprocation therethrough and carrying an ejector head 157. Said lever system is normally maintained as shown by means of expansile spring 158 and stop 159.

Cam 160 is carried by shaft 28, which here has revolution in the direction of the arrow. Another cam 161 is also carried by said shaft. Cam 160 is adapted to enter into engagement with lever 141 and cam 161 into engagement with lever 150, these engagements being preferably in such manner and at such intervals that lever 141 will be actuated slightly in advance of and partially during the actuation of lever 150. In this connection, it will be observed from Fig. 17 that lever 150 is arranged for pivotal actuation not within the same transverse plane as is lever 141, and also that cam 161 is likewise not arranged for revolution within the same transverse plane as is cam 160; but it should be noted that cam 160 is arranged in the appropriate plane properly to actuate lever 141, and that cam 161 is arranged in the appropriate plane properly to actuate lever 150.

Having thus described this variation of this embodiment of this invention, the operation which should largely be obvious may now be understood. An appropriate blank having been fed beneath plunger 132, said plunger forces the same over the side-wall conformations aforesaid into compartment 131, and folds it as illustrated in Fig. 10; in addition upturning the cuts 128 due to the coaction of the channels 133 with the die-members 134; whereupon rack 108 is actuated, rotating the members 95 and 95′ to whirl their aforesaid half-tubular front extensions over the tops of plates 92 to fold into the blank, as illustrated in Fig. 16, the portions 129 and 162, and thereby locking together in the bottom of the now-folded box the edges 181 and 182. Cam 160 now actuates lever 141, against the tension of spring 139 and through the agency of link 142, to lower floor-plate 135 (and with it the folded blank) to the position illustrated in dotted lines at 135′, the pins 137 arresting complete descent of the box with said floor-plate so that the said box may be supported on their upper ends to permit of the clearance therebelow of die-members 134. Cam 161 now actuates lever 150, link 148, lever 146 and rod 153, all against the tension of spring 158, thereby to drive forward ejector head 157 and sweep said box forwardly off the upper ends of pins 137 and into chute 99.

At this point, it should be noted that the embodiment of this invention illustrated in Figs. 20, 21 and 22 could advantageously be utilized for the type of blank illustrated in Fig. 8 as well as the type of blank illustrated in Fig. 18; and could thus obviate the necessity of providing at all the particular embodiment illustrated in Figs. 1, 2, 3, 4, 5, 6 and 7 were it desired to construct a single embodiment capable of so utilizing as variously desired the diverse types of blanks above-mentioned.

Referring now particularly to Figs. 18, 19, 20, 21 and 22, whereof Fig. 18 is a top plan view of another type of blank for possible utilization in a further variation of this embodiment of this invention, Fig. 19 is a perspective of the same blank, folded, and ready for ejection from the apparatus, Fig. 20 is a side elevation, partly in section, of certain parts of the apparatus illustrated in Figs. 1 and 2, to wit, the table 1 the standard 62, the plunger 65, the opening therebelow 65′, the rack 108, the member 95 with its front half-tubular extension 95″, the plate 92 and the chute 99, showing certain modifications in the structure thereof to allow of the utilization within the same of a blank similar to the one illustrated in Figs. 18 and 19. Fig. 21 is an enlarged sectional view taken transversely of the parts exposed beneath the plunger 65 and looking in the direction in which Fig. 20 is assumed to be viewed, and Fig. 22 is a sectional view, taken on the line 22—22 of Fig. 20 and looking in the direction of the arrow, it will first be

noted, with particular reference to Figs. 18 and 19 that the form of blank illustrated is similar to the one shown in Fig. 8, except for the addition of the portions 163, 164, 165 and 166, the latter constituting means for folding a cover portion within the box after ejection from the machine.

Referring now to Figs. 20, 21 and 22, there is shown disposed beneath opening 65′ a compartment 167, provided with a front wall 168. Said wall 168 is mounted for outward swinging upon a shaft 168′, upon which shaft is keyed a pinion 168″. A lever 169, fixedly pivoted as at 170, is normally urged against the stop 171 by the expansile spring 172 carried by the bracket 173. Lever 169 is pivotally connected with a link 174 as at 175, and link 174 is pivotally connected with a link 176 as at 177, link 176 carrying an ejector head 178. Lever 169 carries as shown a rack-bar 169′, adapted to mesh with pinion 168′ as shown. A cam 179 is carried upon shaft 28 and at proper intervals actuates lever 169. Compartment 167 is provided with a floor 167′. The side wall conformations within openings 65′ are similar to those illustrated in Figs. 1, 2, 7, 12, 13 and 14, except that the wall 76 is in this embodiment positioned as shown in Fig. 20, thereby to guide the edge 165′ of the blank illustrated in Fig. 18, and except that at each of the two opposite ends of the portions 180′ a guiding channel 180 is provided. Channel 180 is provided of such a conformation that the portions 164 and 166 of the blank illustrated in Fig. 18 may, immediately following the completion of the first folding operation (illustrated with reference to another type of blank in Fig. 9), pass into said channels beneath the convex surfaces 77 illustrated in Fig. 7 for uninjured emergence from said channels into compartment 167 without becoming torn, mutilated or completely stripped off.

Having thus described this variation of this embodiment of this invention, the operation thereof which should be largely obvious, may now be understood. An appropriate blank, such as the one shown in Fig. 18, having been fed beneath plunger 65 so that the edge 165′ of such blank will lie against wall 76, said plunger forces the blank into compartment 167 and over the various convex surfaces aforesaid and allows the latter to perform their successive folding functions, channels 180 as aforesaid protecting portions 164 and 166 of the blank from mutilation meanwhile. The blank is now folded as shown in Fig. 19, and so folded is lying within compartment 167, with each side wall 183 (Fig. 19) adjacent a plate 92, with the half-tubular extensions 95″ whirled home within the box, and with cover portion 184 (Fig. 19) in the position diagrammatically located by the dot-and-dash line at 184′ (Fig. 20). Rack 108 now rotates members 95 and 95′ to normal positions, and thereby clears away from engagement within said box the half-tubular front extensions 95″ of said members. Shaft 28 thereupon, against the tension of spring 172, causes cam 179 to actuate lever 169, through the rack 169′ and the pinion 169″, to swing forward and open the wall 168, and, through links 174 and 176, to drive forward ejector head 178 and sweep said box forwardly into chute 99.

It will be thus seen that I have provided an apparatus capable of utilization or ready adaptation in connection with blanks of various characteristics and sizes, and one that is adapted to perform its various functions through novel and simple means and mechanisms; comprising in each complete cycle of related operations a comparatively small plurality of actuations and elements.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all the generic and specific features of the invention herein described and all statements of the scope of the invention, which as a matter of language, might be said to fall therebetween.

It should be understood that wherever the terms "friction," or any word or expression derivative therefrom, or equivalent thereto is used herein, particularly with reference to the "feeding means," it is intended to express the idea of any contact-engagement between a blank and a portion of the apparatus, whether such portion be elastic, spring-pressed, abraded, peculiarly conformed, or provided with antennae, or bristles, or be of other characteristic, whereby any blank not absolutely smooth and inelastic may be "fed" through such contact-engagement. By the term "contact-engagement" is meant any engagement between such portion and a substantially horizontal surface of a blank, which does not depend for its "feeding" effectiveness upon an extraneous adhesive or a previous mutilation in the blank itself. And by the term "previous mutilation" is meant any mutilation in the blank existent therein preliminarily to the commencement of a "feeding" operation with reference thereto.

I desire it to be noted, also, that with reference to the location of the stop 8′ (Fig. 1) in relation to the spring-pressed column of blanks 9 thereagainst, I have found in

practice that the compression thereunder of the subtended portions of said blanks gives to the latter a tendency to spread fan-like therefrom thereby tending to aid in the successive feeding of the blanks.

1. In apparatus of the class described, in combination, folding instrumentalities adapted partially to fold a blank, means including an oscillatory member to act on said blank when so partially folded, a device carried by said oscillatory member normally removed from the blank, and means adapted to actuate said oscillatory member whereby said device will further fold said blank.

2. In apparatus of the class described, in combination, folding instrumentalities adapted partially to fold a blank, means adapted to act on said blank when so partially folded including a fixed member adjacent to said partially-folded blank, an oscillatory member, a device carried by said oscillatory member normally removed from said blank, means adapted to actuate said oscillatory member whereby said device will be carried over the edge of said fixed member into said blank thereby further to fold the same.

3. In apparatus of the class described, in combination folding instrumentalities adapted partially to fold a blank, and a fixed supporting member adapted to accommodate said blank when so partially folded, a movable supporting member, a folding device carried by said movable supporting member, the latter being normally maintained in such relation to said fixed supporting member that said folding device is adjacent to said blank, means adapted to actuate said folding device whereby the same will further fold said blank and remain engaged therewith, and means adapted to actuate said movable supporting member whereby said blank will be withdrawn from said first-mentioned supporting member.

4. In apparatus of the class described, the combination with a single die member having a plurality of meeting walls which are immovable relative to each other and which enclose all sides of a closed space, the upper portion of each wall being curved outwardly from one end to the other thereof and the outwardly-curved portions all being at the same elevation, said die member having at each end of each of two opposite sides convexly-curved folding surfaces situated above the outwardly-curved portions of the walls and entirely outside of the opening, the inside edge of each convexly-curved portion merging into one corner of the die, of a punch member, and means to cause said punch member to move into said opening thereby to fold a blank.

5. In apparatus of the class described, the combination with a single die member having a plurality of walls immovable relative to each other and surrounding an opening, the upper portion of each wall being curved outwardly, said die member also having convexly-curved folding surfaces situated above the outwardly-curved portions of the walls and entirely outside of said opening, of a punch member, means to cause said punch member to move into said opening thereby to fold a blank to form a compartment by a plurality of successive folds, and means to act on oppositely-situated portions of said blank and fold them into said compartment.

6. In apparatus of the class described, the combination with a single die member having a plurality of walls immovable relative to each other and surrounding an opening, the upper portion of each wall being curved outwardly, said die member also having convexly-curved folding surfaces situated above the outwardly-curved portions of the walls and entirely outside of said opening, of a punch member, means to cause said punch member to move into said opening thereby to fold a blank to form a compartment and then to be withdrawn from said opening, and rotatable means acting on oppositely-situated portions of the blank to fold them into said compartment.

7. In apparatus of the class described, in combination, a male and female instrumentality adapted to fold a blank into a plurality of non-parallel sets of folds each set of which is composed of a plurality of substantially parallel folds whereby said blank is folded to constitute a partially opened chamber, and movable means adapted to traverse an arcuate path bodily to enter said chamber and thereupon to give said blank additional folds.

8. In apparatus of the class described, in combination, co-acting folding instrumentalities comprising a male member and a female member, one of which members is adapted to be actuated for reciprocation with respect to the other, thereby to fold a blank into a plurality of non-parallel folds whereby said blank is folded to constitute a partially opened chamber, and movable means adapted to traverse an arcuate path bodily to enter said chamber and thereupon to complete the folding thereof.

9. In apparatus of the class described, in combination, co-acting folding instrumentalities comprising a single male member and a female member, one of which members is adapted to be actuated for reciprocation with respect to the other and said female member including a plurality of walls immovable with relation to each other during the entire performance of said reciprocation thereby to fold a blank into a plurality of non-parallel folds, and movable means adapted to complete the folding thereof and to cause said folds to interlock against unfolding.

10. In an apparatus of the class described, in combination, two co-acting folding instrumentalities, one of which is provided with a plurality of curved walls, immovable relative to each other and surrounding all sides of a space and the other of which constitutes a plunger adapted to have a single movement into said space thereby to fold a blank into a plurality of successively-formed non-parallel folds, said first named instrumentality being provided with oscillatory means to give the blank additional folds.

11. In apparatus of the class described, in combination, a supporting member adapted to accommodate a partially-folded blank, a revoluble member, a substantially semi-tubular device carried thereby normally removed from said blank, and means adapted to actuate said revoluble member whereby said device will further fold said blank.

12. In apparatus of the class described, in combination, a supporting member adapted to accommodate a partially-folded blank, a revoluble member, a curved blade carried thereby and normally removed from the blank, means to move said revoluble member to bring the curved blade into operative position relative to the blank, and means to rotate said revoluble member thereby to further fold said blank.

13. In apparatus of the class described, in combination, a first supporting member adapted to accommodate a partially-folded blank, a second supporting member, a folding device carried thereby, said supporting members being normally maintained in such relation to each other that said folding device is adjacent said blank, means adapted to actuate said folding device whereby the same will further fold said blank and remain engaged therewith, and means adapted to actuate one of said supporting members relatively to the other whereby said blank will be withdrawn from said first supporting member.

14. In apparatus of the class described, in combination, a first supporting member adapted to accommodate a partially-folded blank, a second supporting member, a folding device carried thereby, said supporting members being normally maintained in such relation to each other that said folding device is adjacent said blank, means adapted to actuate said folding device whereby the same will further fold said blank and remain engaged therewith, said means being adapted to maintain positive connection with said folding device irrespective of the relative dispositions of said supporting members, and means adapted to actuate one of said supporting members relatively to the other whereby said blank will be withdrawn from said first supporting member.

Signed at Brooklyn, in the county of Kings and State of New York, this 6th day of July A. D. 1918.

CHARLES HORTON.