Jan. 21, 1958 E. J. PLOUGH ET AL 2,820,403

CARTON MACHINE

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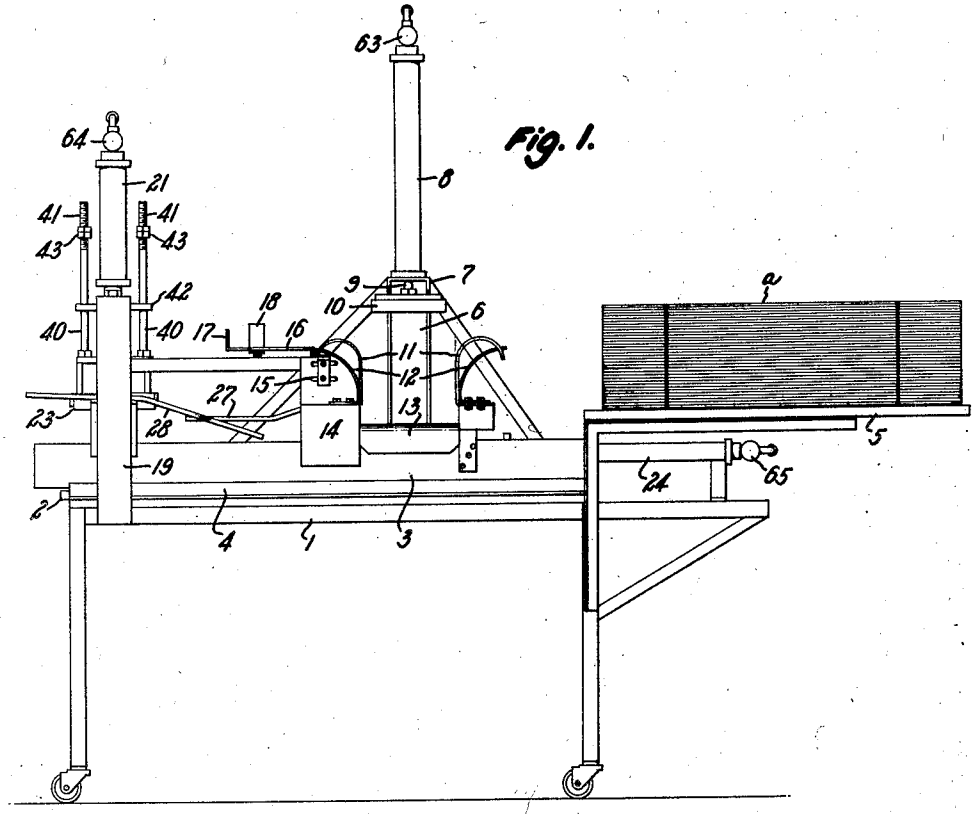


Fig. 1.

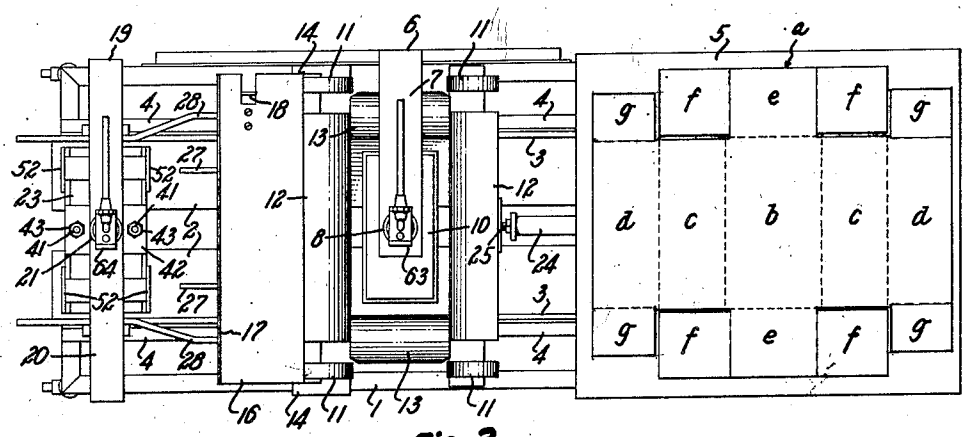


Fig. 2.

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CARTON MACHINE

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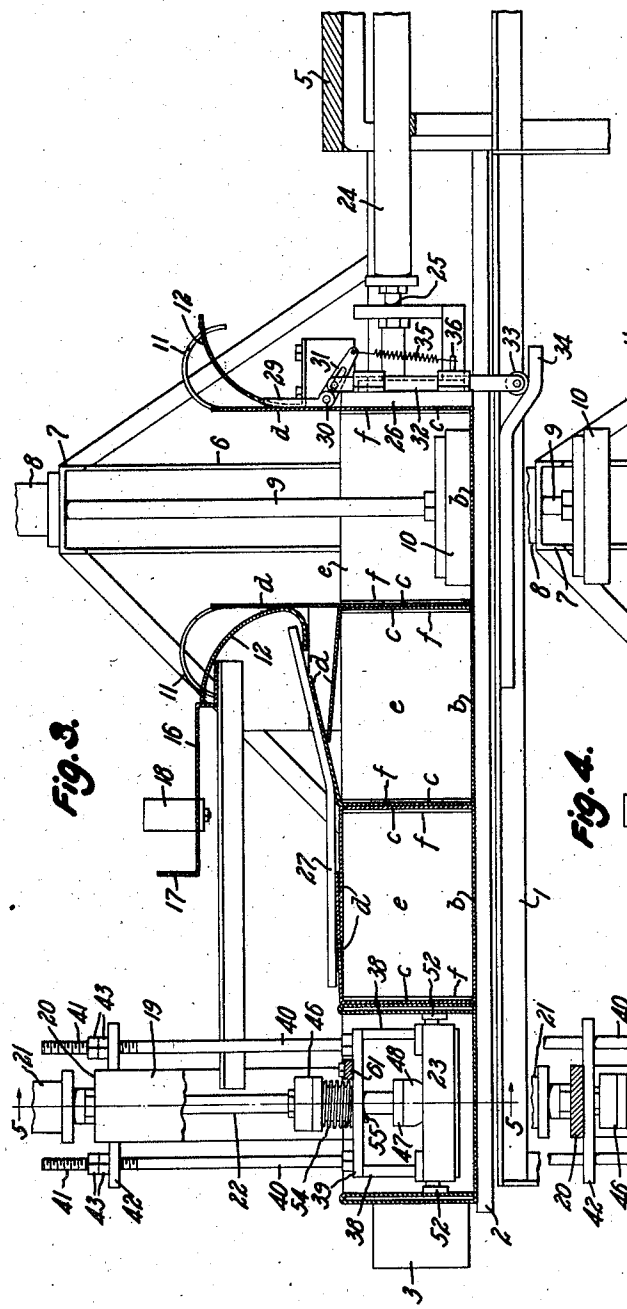


Fig. 3.

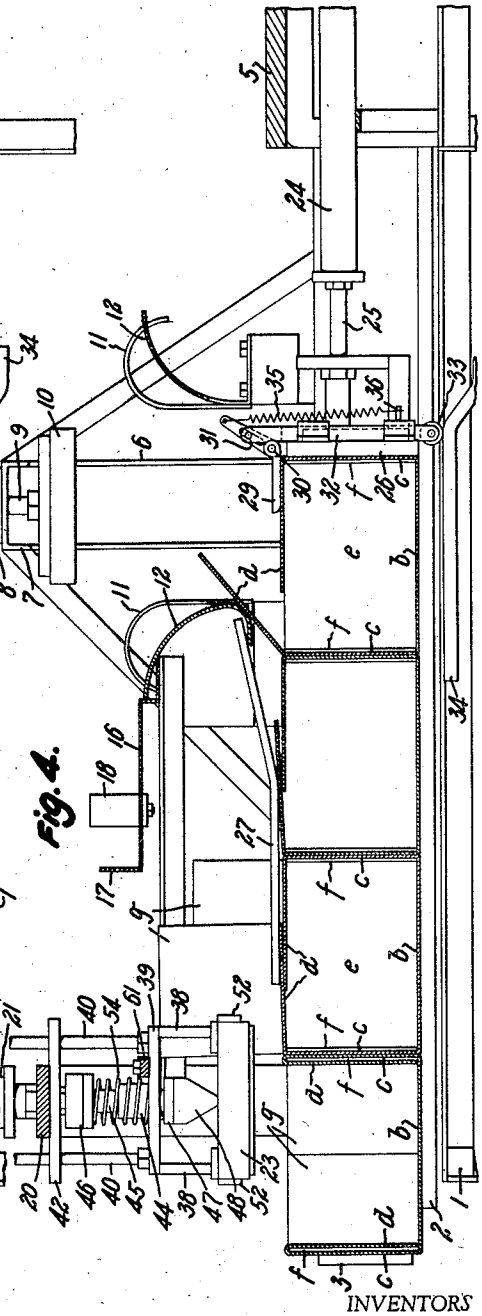


Fig. 4.

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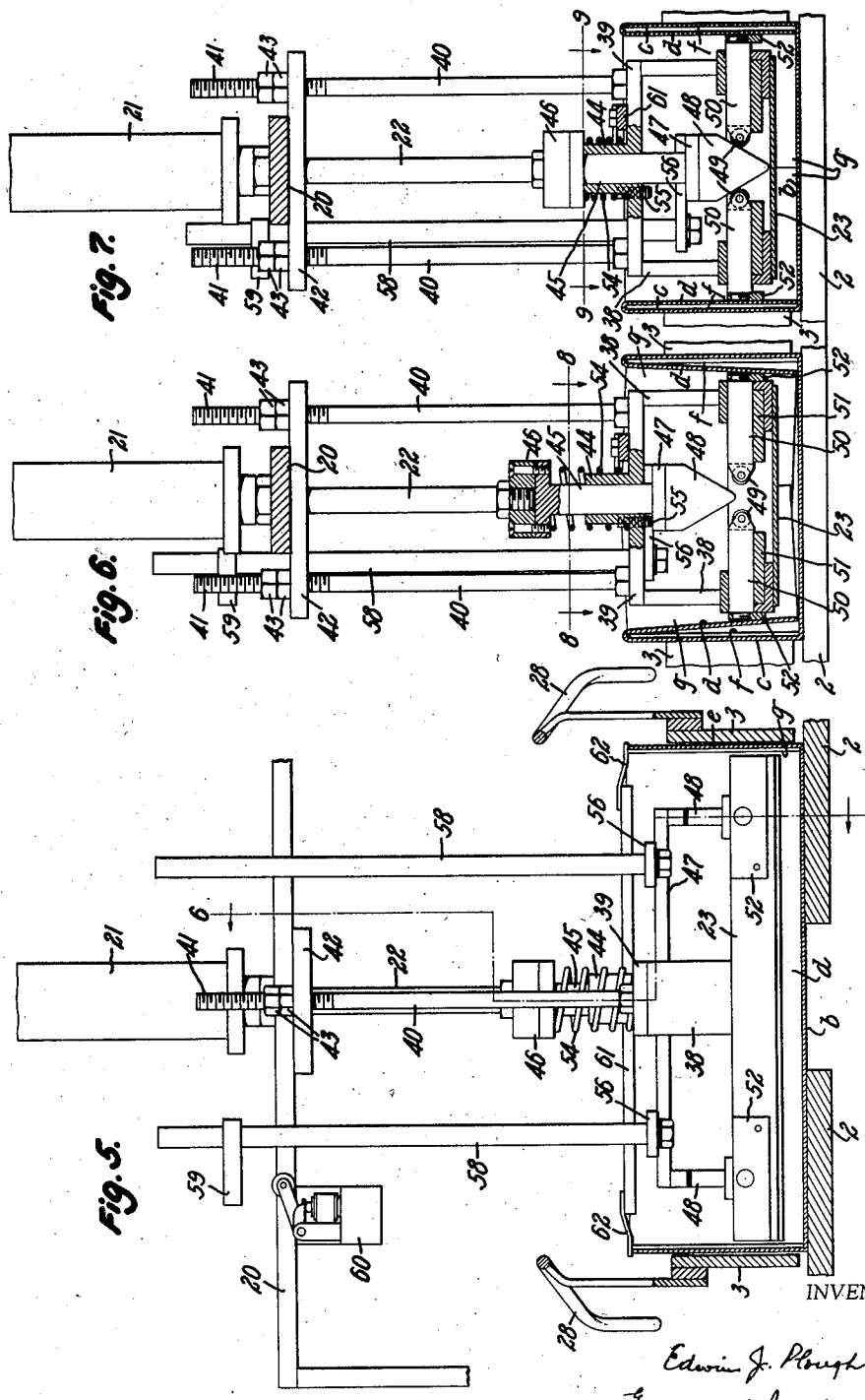


Fig. 7.

Fig. 6.

Fig. 5.

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CARTON MACHINE

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Fig. 11.

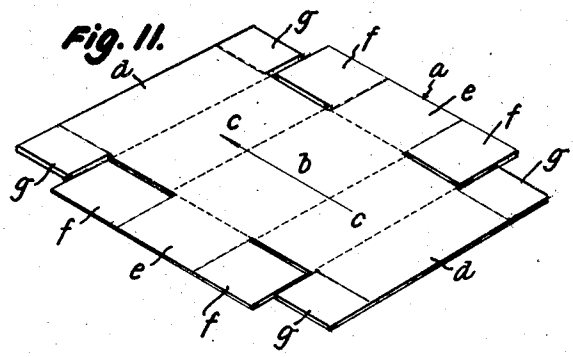


Fig. 12.

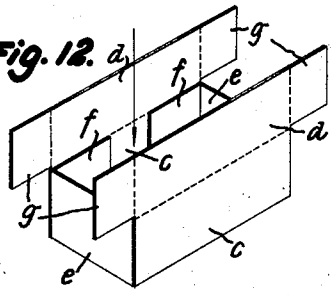


Fig. 13.

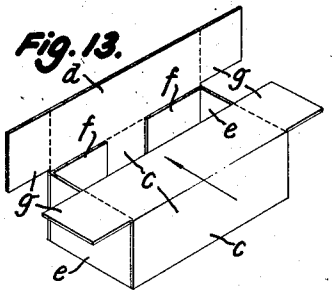


Fig. 14.

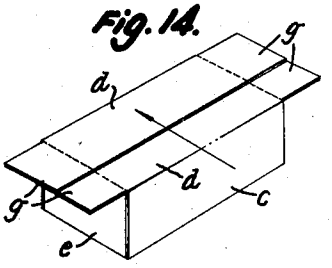
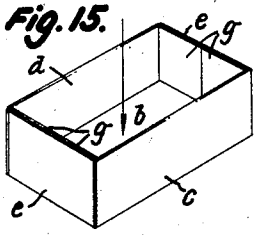


Fig. 15.



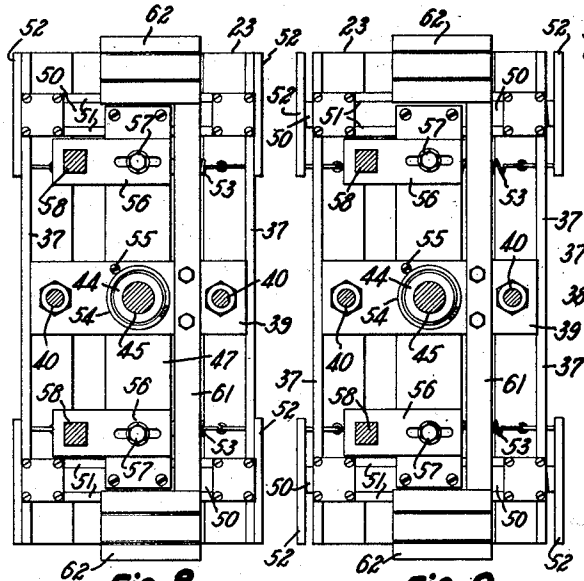


Fig. 8.

Fig. 9.

Fig. 10.

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CARTON MACHINE

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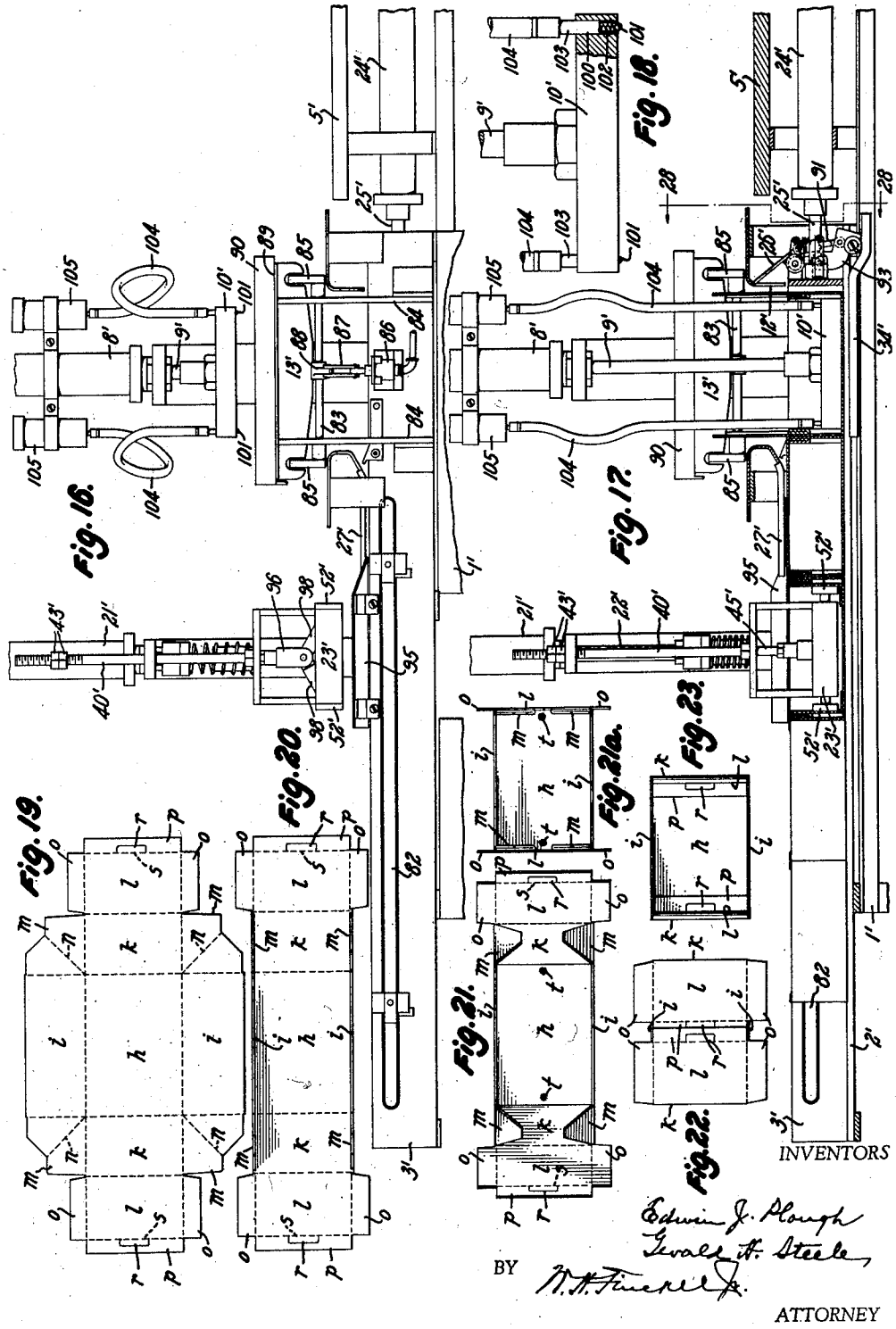


Fig. 16.

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 21a.

Fig. 22.

Fig. 23.

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Fig. 24.

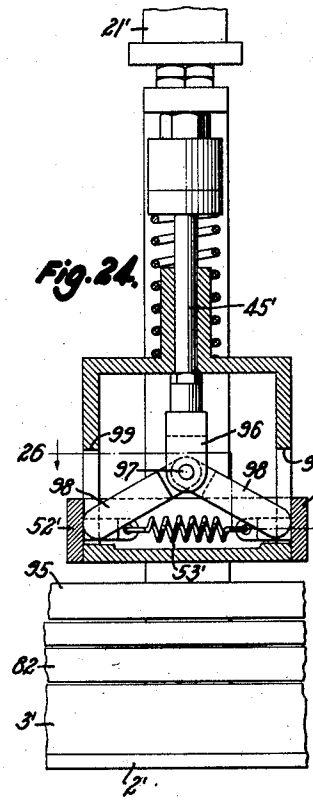


Fig. 25.

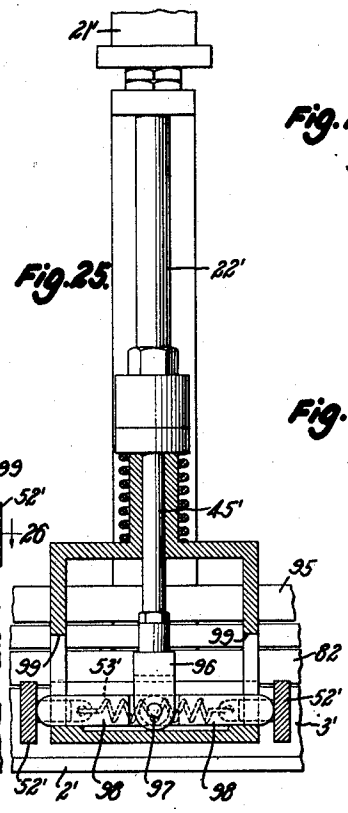


Fig. 26.

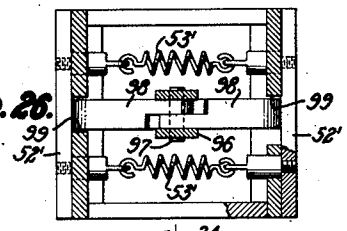


Fig. 27.

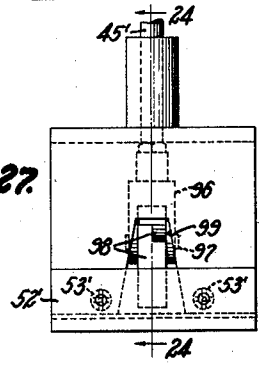


Fig. 28.

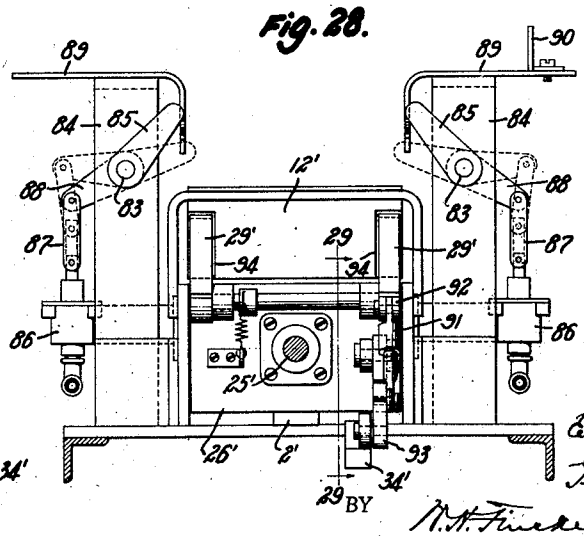
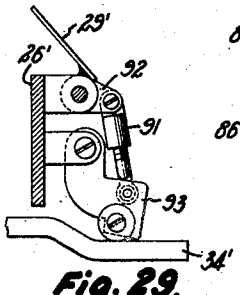


Fig. 29.



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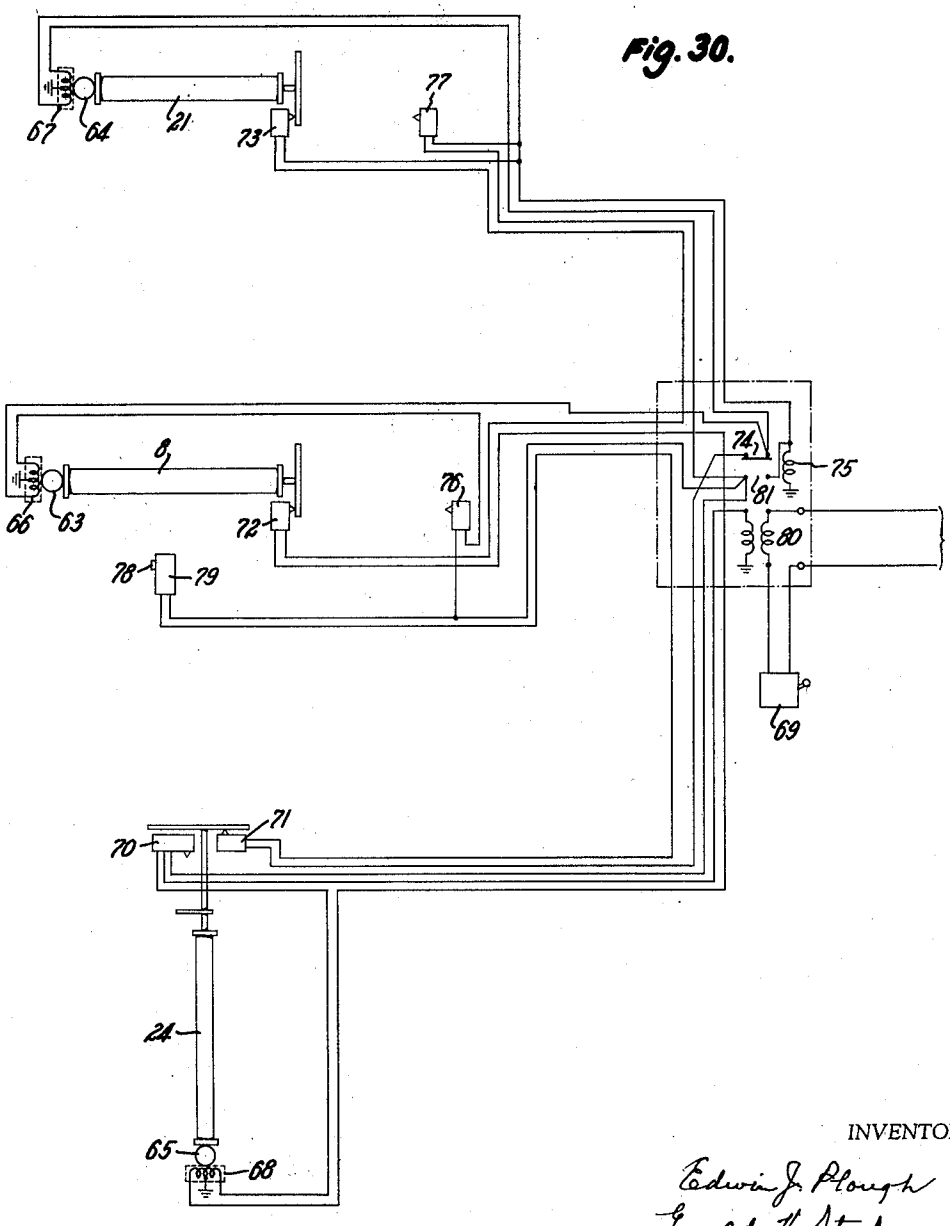
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Fig. 30.



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United States Patent Office 2,820,403 Patented Jan. 21, 1958

2,820,403

CARTON MACHINE

Edwin J. Plough, Wadsworth, and Gerald H. Steele, Leroy, Ohio, assignors to The Ohio Boxboard Company, Rittman, Ohio, a corporation of Ohio

Application April 14, 1954, Serial No. 423,066

8 Claims. (Cl. 93—51)

This invention relates to carton machines, and it has particular reference to machines for setting up cartons of the type having in-folded side and/or end wall portions, such, for example, as the cartons shown in the patent of Arnold L. Crowell, No. 2,123,771, granted July 12, 1938, or in the copending application of Robert J. Hickin for patent for Folding Carton, filed March 15, 1954, Serial No. 416,104, now Patent No. 2,742,221, granted April 17, 1956.

In accordance with generally prevailing practice, cartons of the type referred to are set up by hand, the blanks therefor being supplied by the carton manufacturer to the customer-user in flat form, and the primary object of the invention is to furnish the carton user with a relatively inexpensive machine which will perform the carton setting-up or erecting operations automatically and with greater facility, speed and accuracy than when they are manually performed, thereby making possible increased production in the packaging of the users' salable commodity, reducing the spoilage of carton blanks which often accompanies their manual erecting, and conserving man power.

As has been stated it is desirable to provide the carton customer-user with a relatively inexpensive machine, and to this end the machine of the invention as herein disclosed is of a semi-automatic type in which, although the setting-up operations are fully automatically performed by appropriately relatively timed mechanism as and after the carton blanks are initially fed to the mechanism, such initial feeding is performed manually. However, automatic, appropriately timed, initial feeding mechanism may be associated with the machine, and such feeding mechanism may be any of a variety of the types now well known to those skilled in the art, or it may be designed especially to handle the particular carton blanks for the erection of which the mechanism of the machine will be primarily designed.

A further object of the invention is, therefore, to provide a carton machine having mechanism which, after the carton blanks are successively fed, either manually or automatically will automatically, step-by-step, perform the operations required for complete erection and discharge of finished cartons in a continuous series without manipulation by the machine attendant or operator so long as initial feeding of the carton blanks is continued.

Another object of the invention is to provide a machine in which the various mechanisms designed to perform the several necessary erecting steps are designed for actuation by air cylinder means, thus eliminating gearing, electric motors and other expensive machine adjuncts and hence reducing the manufacturing and maintenance costs, all in the interest of the user.

Other objects and advantages of the machine of the invention will become apparent as the detailed description proceeds.

The invention comprises a machine for setting up or erecting a carton primarily of tray type from a flat blank having a bottom (or top) wall member, and side and

end wall members either or both of which may be provided with in-folded portions, such machine being provided with mechanism of forming-die and plunger type for erecting the side and end wall members of the blank substantially normal to its bottom (or top) wall member and with the ultimately in-folded wall portions off-standing substantially in planar alignment with their respective wall members, means for discharging the thus partially set up cartons from the forming die means, means for performing an initial in-folding of the ultimately in-folded wall portions, means for completing the in-folding of such wall portions in desired juxtaposition to their respective wall members and their interengagement or attachment to adjacent carton members, and means for guiding and supporting the partially and completely erected cartons during and subsequent to the erecting operations, all as will be explained hereinafter more fully and finally claimed.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated,

Fig. 1 is a side elevation of one embodiment of a carton machine in accordance with the invention,

Fig. 2 is a top plan view of the machine of Fig. 1,

Fig. 3 is an enlarged fragmentary longitudinal sectional elevation of operative parts of the machine of Figs. 1 and 2 showing the plungers of the two forming mechanisms at the limits of their forming strokes, with cartons in operative association,

Fig. 4 is a view similar to Fig. 3, but showing the said plungers retracted as in Fig. 1 and the cartons in progress between the two forming mechanisms,

Fig. 5 is a further enlarged sectional elevation taken on the line 5—5 of Fig. 3,

Fig. 6 is a sectional elevation taken on the line 6—6 of Fig. 5,

Fig. 7 is a view similar to Fig. 6, but with parts of the mechanism in different operative positions,

Fig. 8 is a sectional elevation taken on the line 8—8 of Fig. 6,

Fig. 9 is a sectional elevation taken on the line 9—9 of Fig. 7,

Fig. 10 is a view similar to Fig. 8, but with parts removed to more clearly disclose underlying elements of the mechanism,

Fig. 11 is a perspective view of a blank for a carton of a type capable of erection by the mechanism embodied in the machine illustrated in Figs. 1 to 10,

Figs. 12 to 15 are perspective views showing the four major steps in the carton-erecting operations of the machine,

Fig. 16 is a fragmentary side elevation of a modified form of the machine of the invention suitable for erecting another type of carton, with the opeartive plungers in retracted condition,

Fig. 17 is a longitudinal sectional elevation of the machine of Fig. 16, but with the operative plungers at the limits of their forming strokes, and with partially and fully erected cartons in place,

Fig. 18 is an enlarged side elevation of the forming plunger with parts broken away to show one of the glue depositing, or spotting, elements,

Fig. 19 is a plan view of the blank for a carton of a type capable of erection by the mechanisms of the machine of Figs. 16, 17 and 24 to 29,

Figs. 20 to 23 illustrate the several steps performed by the machine of Figs. 16, 17 and 24 to 29 in erecting cartons from the blank of Fig. 19,

Fig. 24 is an enlarged sectional elevation of the final erecting plunger taken on the line 24—24 of Fig. 27,

Fig. 25 is a view similar to Fig. 24, but showing parts

of the plunger mechanism in a different operative position,

Fig. 26 is a section taken on the line 26—26 of Fig. 24,

Fig. 27 is an end view of the plunger of Figs. 24 to 26 viewed from the right of Fig. 24,

Fig. 28 is a sectional end view of parts of the carton erecting mechanism taken on the line 28—28 of Fig. 17,

Fig. 29 is a sectional elevation taken on the line 29—29 of Fig. 28, and

Fig. 30 is a schematic view showing the electric wiring, air cylinders, and control means for the machine.

Having reference to the embodiment of the invention illustrated in Figs. 1 to 9, the setting up of the type of carton blank of Figs. 11 to 15 for which this embodiment is particularly adapted, and the wiring diagram of Fig. 30, it will be seen that the machine is preferably constructed as follows:

Upon a frame 1 are mounted platform members 2 providing a bed upon which the cartons during and after their erection may be supported and may travel. Above this bed and laterally spaced a distance to properly accommodate the length of the partially and completely erected cartons is a similar pair of confiing and guiding plates 3 suitably supported upon the frame 1 by angle strips 4, and at one end of the frame there is a table 5 for supporting within easy access of an attendant or operator a pile, or plurality, of flat carton blanks *a*.

Upon the frame 1, adjacent to the end at which the blank-supporting table 5 is located, is a stand 6 having an arm 7 which overhangs the guideway formed by the platform members 2 and guiding plates 3, and this arm 7 carries a first air cylinder 8 to the vertically reciprocating piston rod 9 of which is attached the initial forming plunger 10 which, in its reciprocation, serves to depress the succession of carton blanks *a* individually fed from the table 5 into the cavity of the forming die provided by first, second and third pairs of forming members 11, 12 and 13 appropriately interrelated and successively interacting in the order given upon the blanks as will be described more fully hereinafter. Mounted on supporting brackets 14 preferably carried by the guiding plates 3 and adjustable on such brackets by mounting members 15 is a gauging plate 16 having an integral upstanding end stop 17 and an adjustable side stop 18 which together serve to properly register the fed carton blanks *a* over the die cavity and beneath the forming plunger 10.

Adjacent to the opposite end of the frame, and suitably spaced from the forming die cavity, is another stand 19 having a bridge member 20 spanning the guideway and to which it attached a second air cylinder 21 to the vertically reciprocable piston rod 22 (Figs. 3 and 5 to 7) of which is attached the plunger 23 of the final forming means for the cartons as will be described in detail hereinafter.

A third air cylinder 24 arranged with its axis horizontal and substantially medially of the carton guideway carries upon its horizontally reciprocable piston rod 25 a pusher plate 26 which serves to push partially formed cartons along the guideway as will later be described.

Fixed flap folding and retaining members 27 overlie the guideway, and flap raising and guiding plow member 28 flanks the guideway.

Having reference particularly to Figs. 3 and 4 it will be seen that the pusher plate 26 carries folder fingers 29 pivoted upon a shaft 30 provided with an operating lever 31 oscillatable to rock the fingers 29 from vertical, inoperative, position (Fig. 3) to horizontal, operative, position (Fig. 4) under the influence of a slide bar 32 connected with it and carrying a roller 33 which rides upon a cam track 34. The fingers 29 are normally biased to inoperative position (Fig. 3) by a spring 35 having one of its ends connected to the lever 31 and its other end attached to a fixed retainer 36.

Having reference to Figs. 3 to 10, and especially to

Figs. 5 to 10, it will be seen that the final forming plunger 23 comprises side plates 37 to which are affixed the uprights 38 of a bridge member having a top plate 39 laterally spanning the plunger and to which are affixed vertically extending stop rods 40 the threaded upper ends 41 of which pass through a stop plate 42 and are provided with adjustable stop nuts 43 thereby to limit downward projection, or descent, of the forming plunger 23.

Also carried by the top plate 39 of the bridge member is a bearing boss 44 which serves as a guide for a shaft 45 having a shouldered connection 46 with the end of the piston rod 22 of the air cylinder 21. Connected with the shaft 45 at its lower end is a cross bar 47 to the ends of which are connected similar wedge cams 48 adapted, upon relative movement between the cross bar 47 and the bridge plate 39, to operatively engage and retreat from contact rollers 49 carried at the inner adjacent ends of push bars 50 slidable in ways 51 arranged transversely of the plunger 23 adjacent to its ends, and to the outer ends of these push bars 50 are affixed pressure plates 52 projectable and retractable with respect to the side plates 37 of the plunger under the influence respectively of the wedge cams 48 and return springs 53.

Between the bridge plate 39 and the shouldered connection 46 is arranged a relatively stiff spring 54 which will permit relative movement between the cross bar 47 and its wedge cams 48 and the plunger 23 proper in order to effect functioning of the wedge cams to actuate the pressure plates 52. An adjustable stop screw 55 serves to limit upward movement of the cross bar 47 with respect to the bridge plate 39 to insure that the plunger 23 will be properly raised with the piston rod 22.

Adjustably mounted upon the cross bar 47 by slotted supports 56 and bolts 57 are vertical guide bars 58 at least one of which may carry a trip member 59 for limit switches, one of which 60 is shown in Fig. 5, such switches serving to control suitable air valve means of the air cylinder 21.

Similar limit switches, switch actuators, and air valve means, for controlling operation of the other air cylinders 8 and 24 are provided as shown diagrammatically in Fig. 30 and the functioning of which will be brought out in the description of the operation of the machine.

Rigidly attached to the bridge plate 39 is a beam 61 arranged longitudinally of the plunger 23 and carrying at its opposite ends presser pads 62 adapted to overlie and, upon descent of the plunger, apply aligning pressure to the parts of the erected carton blank which ultimately form the end walls of the carton.

Having reference to the carton blank *a*, Figs. 2 and 11, and the carton erected therefrom, Figs. 12 to 15, it will be seen that the blank is provided with cuts and folding scores defining a bottom *b*, side wall members *c* provided with inwardly foldable portions *d* to form double side walls, and end wall members *e*. The end wall members have offstanding foldable corner flaps *f* which, in the erected carton, are interposed between the members *c* and *d* of the double side walls, and the side wall members *c* have end locking flaps *g* which, when the carton is erected are disposed against the end walls *e* and serve to lock the carton in erected condition by having their adjacent edges abutted against each other.

In the operation of setting up a carton blank of this form to erected condition manually, as is now the practice, the end wall members *e* and their flaps *f* are bent upwardly upon their folding scores at the bottom *b* perpendicular to the bottom and their flaps *f* are then bent inwardly substantially perpendicular to them. Thereafter, the side wall members *c* are bent upwardly perpendicular to the bottom *b* and their portions *d* are bent downwardly over the flaps *f* of the end wall members, and the locking flaps *g* are flattened against the end walls and, as the portions *d* of the side wall members *c*, and such side wall members, are drawn together into their ultimate

double wall form, with the corner flaps *f* between them, the locking flaps *g* will have their adjacent edges forced into abutting locking engagement. These setting-up steps are mechanically simulated automatically by the machine of the invention in the following manner.

First, having reference to the wiring diagram, Fig. 30, it should be noted that the air-controlling pilot valves **63**, **64** and **65** of the air cylinders **8**, **21** and **24**, respectively, are pulse operated, that is to say, a momentary electrical pulse in their respective operators **66**, **67** and **68** will shift the valves from closed to open position and vice versa, and they will remain in such position until oppositely moved by a momentary counterpulse.

When the electrical circuit of the machine is connected to a line, indicated by the bracket, Fig. 30, from a 115 v. A. C. source with the master switch **69** closed, and the cylinders **8**, **21** and **24** are connected through their pilot valves **63**, **64** and **65**, respectively, to a source of compressed air, the pistons of all of these cylinders will be moved to their retracted positions carrying with them the plungers **10** and **23** and the pusher plate **26**, respectively, as shown particularly in Figs. 1 and 4. When the parts are thus positioned the normally closed contacts of microswitch **70** are closed as are also the contacts of microswitches **71**, **72** and **73**. Also, the normally closed contacts **74** of relay **75** are closed. The contacts of microswitches **76** and **77** are open.

In order to readily understand the operative steps of the machine, it will be assumed that sufficient cartons have already been partially erected to have advanced the leading one to a position of proper register beneath the final plunger **23** due to the stroke of the pusher plate **26** acting against the trailing carton, it being noted that the distance between registering positions beneath the initial and final plungers **10** and **23**, respectively, is designed to properly accommodate a predetermined plurality of cartons as determined by the carton-advancing stroke of the pusher plate **26**, three cartons in the arrangement shown, Fig. 3.

Now, when a carton blank *a* is transferred from the table **5** to a position resting upon the forming members **11** of the die cavity of the initial plunger **10** and properly registered over this cavity by engagement of its leading edge with the end stop **17** and its side with the side stop **18**, the following sequence of operations will take place. The momentary depression of the push button **78** of a manual switch **79** permits current to flow from the ungrounded terminal of a transformer **80** through the normally closed contacts of the microswitch **70**, closed contacts of switch **79**, closed contacts of microswitch **71**, and normally closed contacts **74** of relay **75**, to the pulse operated advance solenoids in the pilot valves **63** and **64** of the air cylinders **8** and **21**, respectively, causing these pilot valves to move to the advance position and permitting air to enter the upper ends of these cylinders to depress their respective pistons, and with them their plungers **10** and **23**, upon the carton erecting stroke. A slight advance of these pistons permits the contacts of the microswitches **72** and **73** to open, and this prevents actuation of the pilot valve **65** of the air cylinder **24**.

As the plungers **10** and **23** descend, the following carton erecting operations will be performed. The initial plunger **10** will contact the bottom *b* of the blank *a* and force it into the die cavity, resulting first in upward bending of the corner flaps *f* with relation to their respective end wall members *e* by their travel over the first pairs of forming members **11**. Then the side wall members *c* carrying their inwardly foldable portions *d* will contact and travel over the second pair of forming members **12** and be brought to erected position approximately normal to the bottom *b*. Following, but substantially simultaneously with the completion of, this erection of the side wall members *c* the end wall members *e* will engage and travel over the third pair of forming members **13** and will be erected thereby, thus causing the already bent corner flaps *f* to move inwardly so as to lie in proximity to the inner faces of the side wall members *c*, and thereafter, as the plunger **10** finally forces the bottom of the thus-far erected carton (Fig. 12) to rest against the platform members **2**, the first step of erection will be accomplished.

It will be noted that, due to the location of the folding scores between the corner flaps *f* and their end walls *e* with respect to the folding scores between the side wall members *c* and the bottom *b*, and the relative arrangement of the operative faces of the forming members **11** and **12**, respectively, Figs. 1 to 4, the upwardly bent corner flaps *f* will be so positioned and held as to pass into this desired proximity to the inner faces of the side wall members *c* as erection of the end wall members *e* proceeds.

Meanwhile, the plunger **23** has completed the erection of a carton advanced and registered beneath it as will later be described.

Maximum advance of the piston of the cylinder **8** will cause the contacts of microswitch **76** to close, and current passing through the closed contacts of this microswitch will operate the solenoid of the pilot valve **63** of cylinder **8** to shift said valve to its retract position. Maximum advance of the piston of the cylinder **21** will close the contacts of microswitch **77** and energize the solenoid of the pilot valve **64** of this cylinder to shift said valve to its retract position. Closing of the contacts of the microswitch **77** also energizes the solenoid of the relay **75** to close its normally open contacts **81** and open its normally closed contacts **74**.

The piston of air cylinder **8**, on retracting slightly from its position of maximum advance permits the contacts of microswitch **76** to open, and upon reaching its maximum retracted position closes the contacts of microswitch **72**. Also, a slight retraction of the piston of air cylinder **21** from its position of maximum advance permits the contacts of microswitch **77** to close, and upon reaching its maximum retracted position closes the contacts of microswitch **73**.

This reclosing of the contacts of the microswitches **72** and **73** permits current to flow through the normally closed contacts of microswitch **70**, the now closed normally open contacts **81** of the relay **75**, and through the closed contacts of microswitches **73** and **72** to the advance solenoid of the pilot valve **65** of air cylinder **24**. A slight advance of the piston of cylinder **24** opens the contacts of microswitch **71** thereby making impossible actuation of the advance solenoids for the pilot valves **63** and **64** of the air cylinders **8** and **21**, respectively, and preventing actuation of the pistons of these cylinders until the piston of the cylinder **24** has been fully retracted. Maximum advance of the piston of cylinder **24** causes the normally closed contacts of microswitch **70** to open and its normally open contacts to close, thus energizing the solenoid of relay **75** so that its normally open contacts **81** will again be opened and its normally closed contacts **74** again closed.

Closure of the normally open contacts of microswitch **70** serves to energize the retract solenoid of the pilot valve **65** of cylinder **24** and cause the piston thereof to travel to its retracted position. When this piston is slightly retracted from its position of maximum advance, the normally open contacts of microswitch **70** will open and its normally closed contacts will close. Upon reaching its fully retracted position the piston of cylinder **24** will cause the contacts of microswitch **71** to close and the operating cycle of the machine is completed.

Having reference particularly to Figs. 3 to 10 and 12 to 15, in reference to the pusher plate **26** actuated in accordance with the just described operation of the piston and piston rod **25** of the cylinder **24**, and to the final plunger **23** actuated simultaneously with the initial plunger **10** in accordance with the operation of the piston and piston rod **22** of its cylinder **21** previously described, it will be

seen that the following carton erecting steps will be performed.

When the piston of the cylinder 24 advances, the pusher plate 26 carried by its piston rod 25 will serve to push the partially erected carton, Figs. 3 and 12, to the left, Fig. 4, along the platform members 2 and guided by the plates 3, advancing the previously further erected cartons ahead of it until the leading one of these cartons is registered beneath the final plunger 23, it being understood that the stroke of the pusher plate is properly determined for this purpose by regulation of the stroke of the piston of the cylinder 24 as controlled by the predetermined location of the microswitch 70. As the partially erected carton is thus pushed to the left from the forming die cavity by the pusher plate 26, the inwardly foldable portion *d* of its leading side wall *c* will be started on a downward fold by its wiping contact against the curled lower edge of the adjacent (left-hand) forming member 12, and the similarly foldable portion *d* of the trailing side wall *c* will be folded down to horizontal arrangement (Figs. 4 and 13) and thus retained by the action of the folder fingers 29 oscillated downwardly by the lever and bar mechanism 31, 32 as the roller 33 of the bar 32 travels upon the cam track 34. As the carton thus leaves the forming die cavity, continued contact of the portion *d* of its leading side wall *c* with the curled lower edge of the forming member 12, and its subsequent engagement with the folding and retaining members 27, will cause it to be folded down upon the already-folded similar portion *d* of the trailing side wall and thus held by the retaining members 27 (Figs. 3 and 14) when the pusher plate 26 is retracted.

As the row of the thus partially erected cartons is advanced toward a position of register of one of them beneath the final plunger 23, the locking flaps *g*, which are in coplanar arrangement with their respective foldable portions *d* and offstanding relatively to the end walls *e*, will engage the plow members 28 (Figs. 1, 2 and 5) and be raised thereby, Fig. 4, to vertical position with their then outer surfaces in substantial alignment with the inner surfaces of the carton end walls *e*. This erection of the locking flaps *g* while the foldable portions *d* are held down by the retaining members 27 will, due to the relative rigidity of the paperboard material, serve to retain the foldable portions *d* in their overlapped, flat-folded condition.

After retraction of the pusher plate 26, as hereinbefore described, and subsequent repetition of advance (descent) of the initial and final plungers 10 and 23, respectively, the mechanism embodied in the final plunger will operate upon the partially erected parts of the carton thus registered beneath it in the following manner.

As the plunger 23 descends, its bottom will engage the flat-folded foldable carton portions *d* and force them downwardly into the body of the carton, the pressure plates 52 at the sides of the plunger, and the plunger ends, respectively, serving progressively to force these foldable portions *d* and the locking flaps *g* into juxtaposition with the side and end walls *c* and *e*, respectively, of the carton (Figs. 5 and 6).

When the previously properly adjusted stop nuts 43 of the stop rods 40 abut against the upper surface of the stop plate 42 descent of the plunger proper will be arrested, but continued descent of the piston rod 22 will compress the spring 54 and, through the shaft 45, cause the cam wedges 48 carried by the bar 47 to engage the rollers 49 of the push bars 50 and push the pressure plates 52, and with them the foldable portions *d*, outwardly (Figs. 7 and 9) into close juxtaposition to the side walls *c* and interposed corner flaps *f* to thereby cause the opposed end edges of the locking flaps *g* to snap engage by their inherent resiliency in abutting relation and thus lock the carton in erected condition (Fig. 15).

Obviously, upon ascent of the plunger 23 under the influence of the retracting piston and piston rod 22 of the air cylinder 21, the wedge cams 48 will rise and permit the pressure plates 52 to retract under the influence of the spring 53, the spring 54 meanwhile expanding, and when the bar 47 strikes the stop screw 55 the plunger 23 proper will be retracted.

Referring to the modified embodiment of the machine of the invention shown in Figs. 16 to 18 and 24 to 29, and to the type of carton blank shown in Fig. 19 the erecting steps for which are illustrated in Figs. 20 to 23, it will be appreciated that, although the mechanism is essentially similar, changes are necessary to adapt it to effective operation upon the somewhat different type of carton blank.

The carton blank, Fig. 19, and the carton erected therefrom, Fig. 23, are the same as will be found disclosed in the copending application of Robert J. Hickin, Serial No. 416,104, now Patent No. 2,742,221, granted April 17, 1956, hereinbefore referred to.

The blank for this carton (Fig. 19) comprises a sheet of proper paperboard material provided with cuts and folding scores defining a bottom *h*, similar side wall members *i*, and similar end wall members *k* provided with inwardly foldable portions *l*. The side and end wall members *i* and *k* are joined by corner webs *m* intermediately flat-foldable upon diagonal folding scores *n* to form relatively rigidly erected corners for the carton when it is set up. The foldable portions *l* are provided at their lateral edges with similar foldable friction flaps *o* for frictional engagement with the side walls *i* of the erected carton, and are provided at their ends with friction flaps *p* for frictional engagement with parts of the bottom *h* of the erected carton. The end friction flaps *p* are provided with inherently displaceable glue tabs *r* cut out of the flaps *p* and hinged upon the folding scores *s* between these flaps and the foldable portions *l*. These glue tabs *r* are designed to adhere to spots *t* of glue (Figs. 21 and 21*a*) applied to the carton bottom *h* by means provided therefor in the mechanism of the machine.

In erecting this blank to carton form, first the side walls *i* and corner webs *m* are folded upwardly upon their scored connections with the bottom *h* (Fig. 20), then the end walls *k* are gradually raised, the corner webs *m* being pressed to break them upon their folding scores *n* (Figs. 21 and 21*a*), the spots *t* of glue meanwhile being applied, thereafter the foldable portion *l* are folded over upon each other (Fig. 22), then these foldable portions are forced downwardly into the body of the carton, their friction flaps *o* and *p* bending inwardly and wiping against the side walls *i* and the bottom *h*, respectively, and finally pressure is applied to these foldable portions *l* to force them outwardly into desired juxtaposition with the end walls *k* and interposed flat-folded corner webs *m* with the glue tabs *r* adhered to the spots *t* of glue.

As shown in Figs. 16 and 17, the modified machine has a stand 1' and a carton supporting and positioning guideway formed by platform means 2' and guide plates 3' somewhat similar to the comparable members of the form of the machine already described. The guide plates 3' are provided, however, with adjustable pressure bars 82 for a purpose hereinafter appearing.

At one end of the guideway is arranged a table 5' for conveniently holding a supply of the carton blanks (Fig. 19) and adjacent to the table 5' and appropriately located with respect to the guideway is the primary erecting station including a forming plunger 10' carried by and vertically reciprocable with the piston rod 9' of an air cylinder 8', and a forming die cavity including oppositely disposed pairs of longitudinal forming members 13' and transverse forming members 12' (Figs. 16, 17 and 28). Mounted upon and oscillatable with shafts 83 having their bearings in the upright members 84 of frames (Figs. 16 and 28) which support the longitudinal forming members 13', are pairs of breaker fingers 85, and oscillatory motion is simultaneously imparted to their shafts 83 by air cylinder means 86 through links 87 and levers 88.

Both of the longitudinal forming members **13'** have upper platform portions **89** for appropriately supporting fed carton blanks over the forming die cavity, and upon one of these platform portions is arranged an adjustable upstanding gauge and guide plate **90** by means of which the carton blanks may be properly successively registered over the forming die cavity.

The pusher plate **26'** of the piston rod **25'** of the horizontal air cylinder **24'**, which functions similarly to and for the same purpose as the pusher plate **26** previously described, carries oscillatable folder fingers **29'** appropriately actuated, similarly to the fingers **29** already described, by link and lever means **91, 92, 93** from a cam track **34'**. The adjacent (right-hand) transverse forming member **12'** is cut away at **94** to give operative clearance for the folder fingers **29'**.

Suitably spaced along the guideway from the forming die cavity in substantially the same manner and for the same purpose as has heretofore been described, is the final erecting station including a forming plunger **23'** carried by and reciprocable with the piston rod **22'** of an air cylinder **21'**, and flange plow members **95** attached to the guide plates **3'** are provided for a purpose similar to that of the plow member **28**. Flap folding and retaining members **27'** similar in arrangement and function to the folding and retaining members **27** are also provided.

Although the plunger **23'** is similar in general construction and function to the plunger **23**, and carries presser plates **52'** normally held against the adjacent faces of the plunger by springs **53'**, the spreading apart of these presser plates by continued descent of the shaft **45'** with the piston rod **22'** after descent of the plunger proper had been arrested by the stop nuts **43'** of the stop rods **40'** engaging the fixed stop plate **42'**, is accomplished by means differing in construction from the wedge cam means **48** already described. In this modified form the shaft **45'** carries at its end a clevis **96** to which are pivotally attached by a pin **97** the inner ends of a pair of toggle arms **98**, the outer ends of which bear, through openings **99** in the plunger frame, against the inner faces of the presser plates **52'**.

The plunger **10'** of the primary forming station (Figs. 16, 17 and 18) is provided adjacent to its ends and medially of its longitudinal axis, with glue-depositing nozzles **100** provided with depressible valve balls **101** biased to closed condition by springs **102**, and the conduits **103** of these nozzles are supplied with liquid adhesive by way of flexible hoses **104** leading from fixedly supported fountains **105**.

The operation of this modified embodiment of the invention in performing the steps of erecting the carton blanks of Fig. 19 is essentially the same as that described for the first described embodiment, there being several additional steps, however, made necessary by the structural characteristics of the blank and the added mechanism necessary to accommodate the machine to such characteristics, namely, operation of the breaker fingers **85** to insure proper inward folding of the corner webs *m* upon their scores *n*, provision of the glue spots *t* which is accomplished when the valve balls **101** are unseated upon firm contact of the bottom of the plunger **10'** with the carton bottom, and exertion by the pressure bars **82** of the guide plates **3'** upon the sides of the cartons of pressures sufficient to hold the carton parts in erected condition, particularly after they leave the final station, so that the glue joint between the bottom *h* and the glue tabs *r* will take an adequate set.

The electrical installation and controls will also be substantially the same in major respects as that shown in Fig. 30, but with the addition of valve and switch means actuated in timed relation to the reciprocation of the primary plunger **10'** for controlling operation of the air cylinders **86** which impart motion to the shafts **83** upon which the breaker fingers **85** are mounted.

Obviously, if it is desired to feed carton blanks automatically instead of manually, and thus make it possible to have the machine fully automatic, suitable feeding means may be added, and revision of the electrical system may be appropriately revised to accommodate such addition.

Various changes and modifications are considered to be within the principle of the invention and the scope of the following claims.

What is claimed is:

1. A machine for erecting a carton from a flat paperboard blank, such carton blank being provided with cuts and folding scores to define a bottom and side and end wall members, with certain of said wall members provided with inwardly foldable portions to produce a double-wall formation, said machine comprising an elongated fixed horizontally extending platform member, means providing a primary forming station and a final forming station relatively spaced longitudinally of said platform member, said primary station including carton blank engaging elements forming a die cavity fixed with respect to said platform member and for which said platform member provides a bottom, and a reciprocable plunger for forcing the carton blank into said die cavity so that its wall members will be acted upon by said blank engaging elements and its bottom will ultimately engage and be supported by said platform member, said primary forming station thus serving for erecting the side and end wall members of the blank substantially normal to said bottom, guideway means extending longitudinally of said platform member for guiding thus partially erected cartons along said platform member from said primary station to said final station, means for imparting movement to such cartons to advance the same along said platform member from said primary station to said final station while supported by said platform member between said guideway means, means operable during such movement of the cartons along said platform member for automatically initially folding the inwardly foldable portions of their said wall members toward each other and substantially normal to the respective erected said wall members, said guideway means and platform member providing at said final forming station die cavity means for which said platform member provides a bottom, and a reciprocable plunger at said final forming station for engagement with and for in-folding the thus initially folded inwardly foldable portions into substantial juxtaposition with the inner faces of their respective walls while the carton bottom is supported by said platform member.

2. A machine as claimed in claim 1, in which the plungers of said primary and final forming stations are similarly simultaneously reciprocated, and the means for imparting movement to said cartons along said platform member are provided with actuating mechanism serving to impart step-by-step movement to said cartons in timed relation to the reciprocation of said plungers.

3. A machine as claimed in claim 1, in which the means for moving cartons along said platform member include a pusher member reciprocable longitudinally of said guideway.

4. A machine as claimed in claim 3, in which said pusher member carries means for initially folding the foldable portion of the carton wall member adjacent to it during reciprocation of the pusher member toward said final forming station.

5. A machine as claimed in claim 4, in which the folding means carried by said pusher member include folder finger means mounted for oscillatory movement with respect to said pusher member, and means for imparting oscillatory motion to said finger means including a cam track stationary with respect to said guideway and means reacting between said cam track and finger

means during movement of said pusher means relatively to said guideway.

6. A machine as claimed in claim 3, in which separate means are provided for imparting reciprocation to the plunger of said primary forming station, the plunger of said final forming station, and said pusher member, respectively, including means for preventing reciprocation of said plungers during reciprocation of said pusher member, and vice versa, and all said separate reciprocation imparting means include fluid-pressure-operated cylinders to the piston rods of which said plungers and pusher member are respectively connected for reciprocative movement, each of said cylinders being provided with valve means for controlling the admission and exhaust of pressure fluid therein, and electrical means for actuating said valves comprising a circuit including switch means and means operative in response to reciprocative movement of each of said two plungers and pusher member, respectively, for actuating said switch means.

7. A machine as claimed in claim 1, adapted for operation upon carton blanks having the inwardly foldable portions of their certain wall members provided with end locking flaps, including means for raising said end locking flaps out of the planes of their respective initially flat-folded inwardly foldable portions during travel of the partially erected cartons along said guideway means.

8. A machine as claimed in claim 7, in which said raising means include plow members fixed relatively to said guideway means and extending longitudinally at opposite sides thereof.

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