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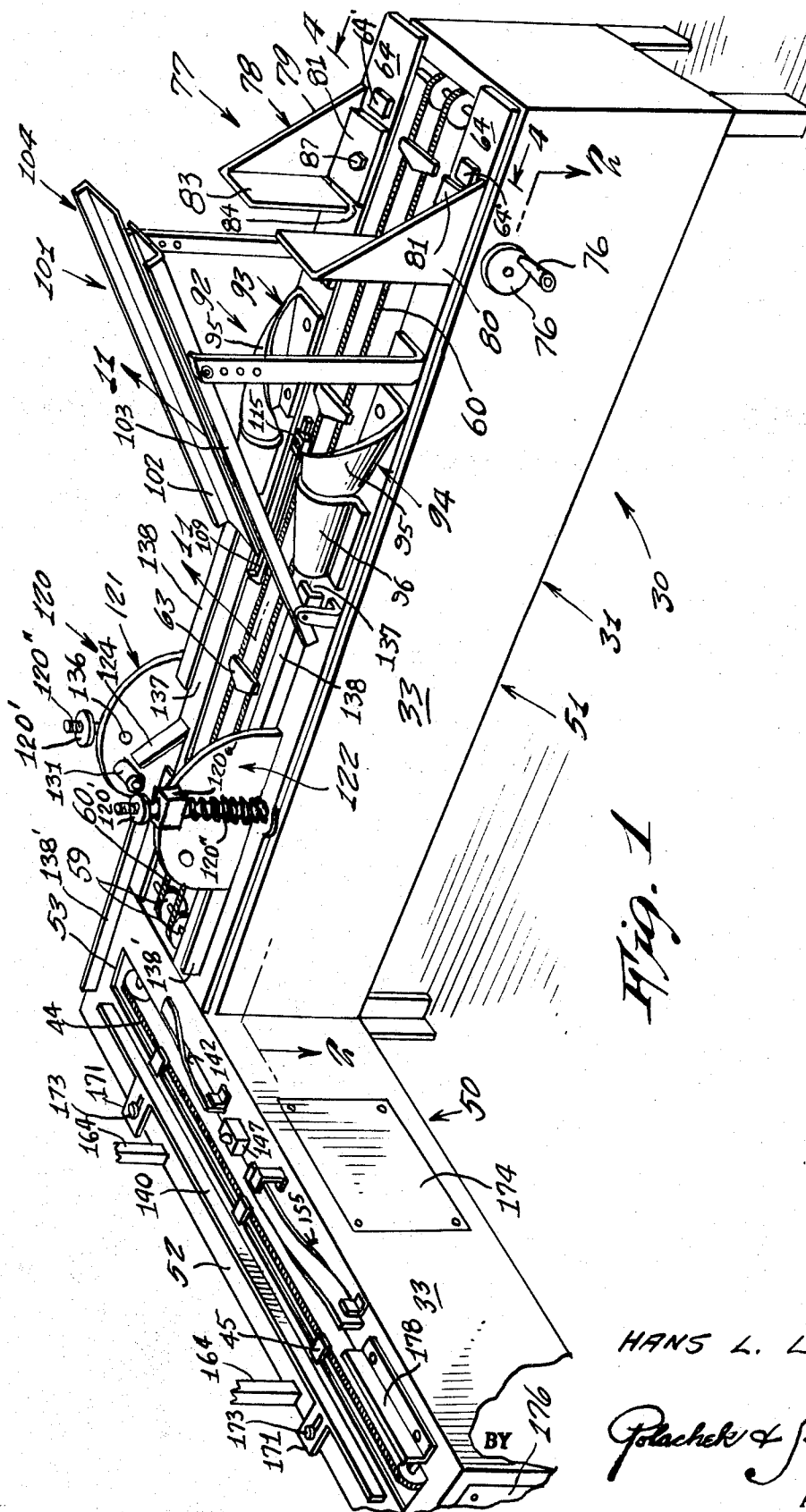
H. L. LEVI

3,530,643

APPARATUS FOR PACKAGING BOOKS

Filed May 23, 1968

9 Sheets-Sheet 1



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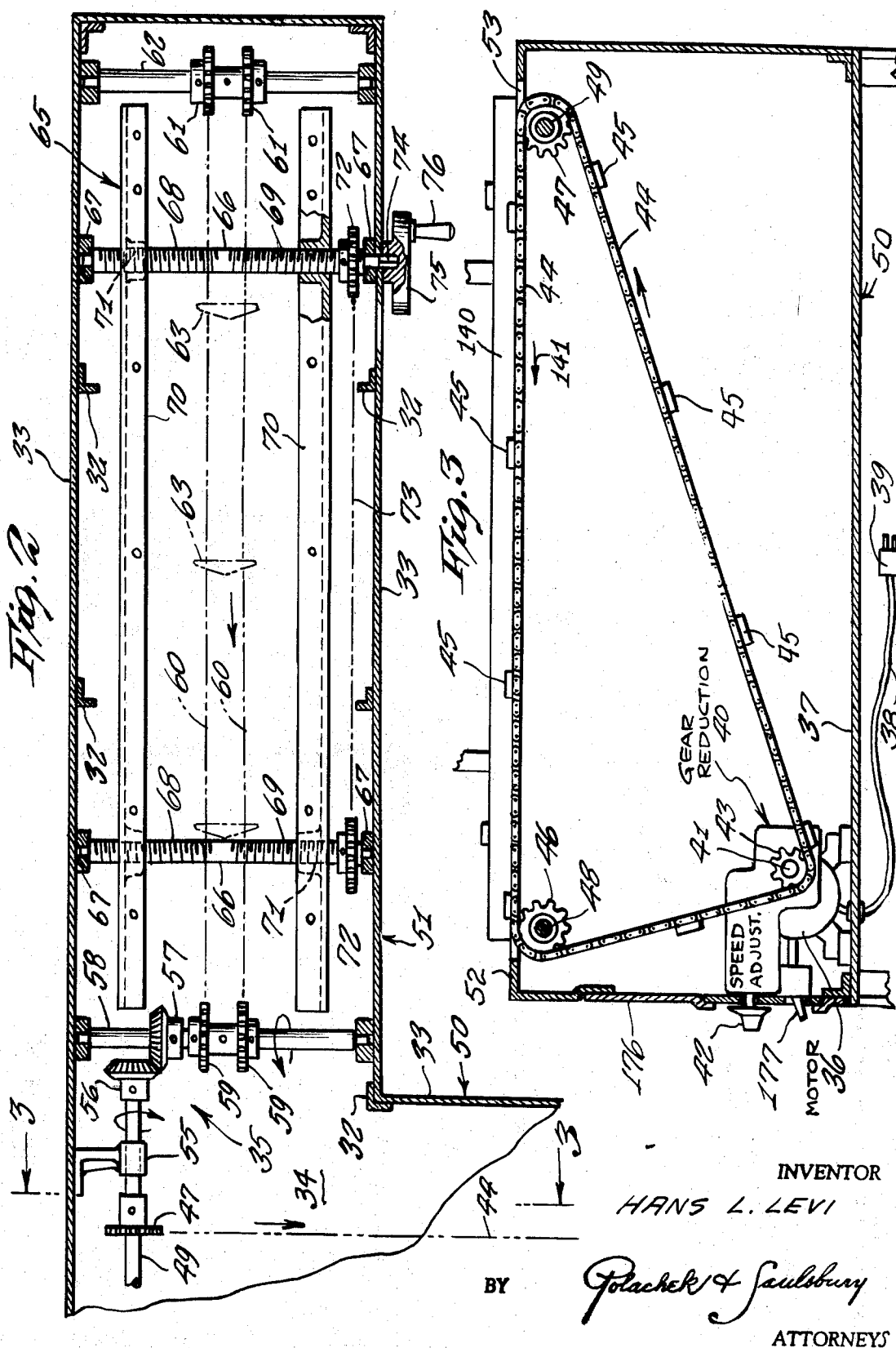
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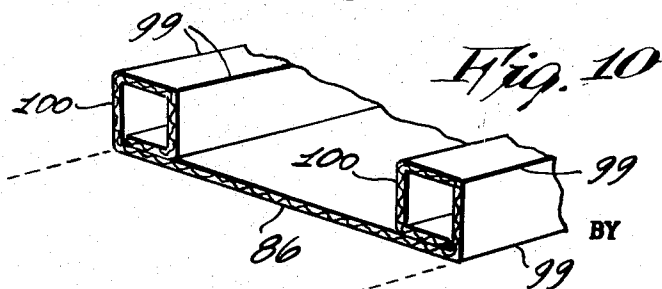
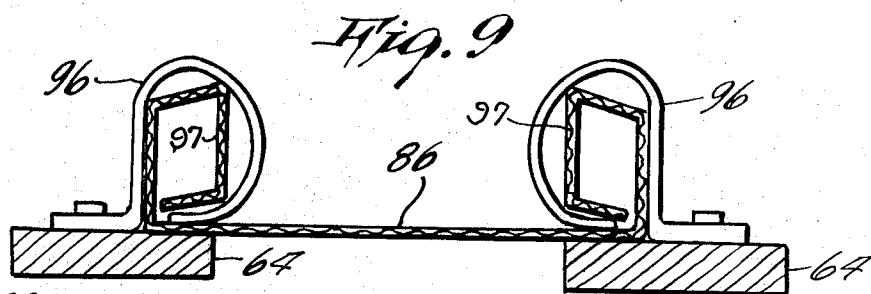
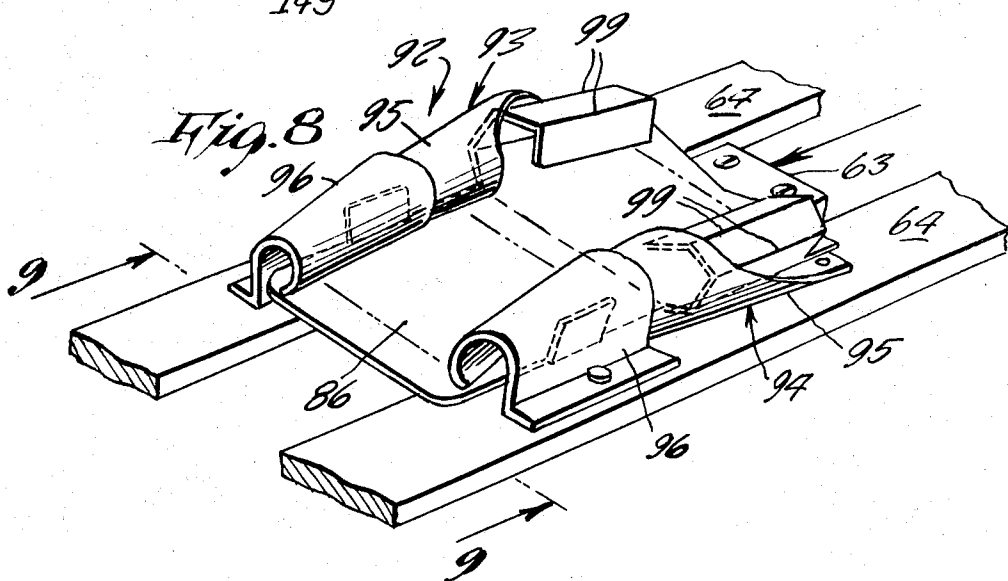
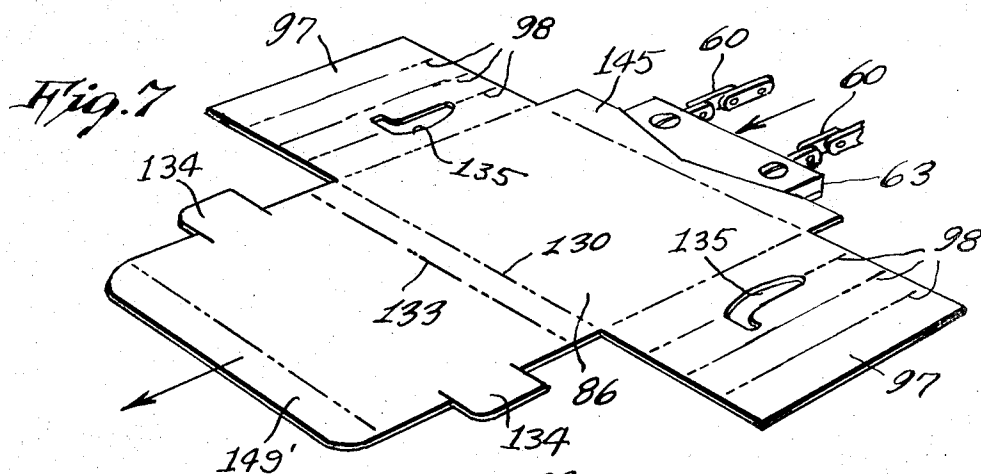
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9 Sheets-Sheet 4



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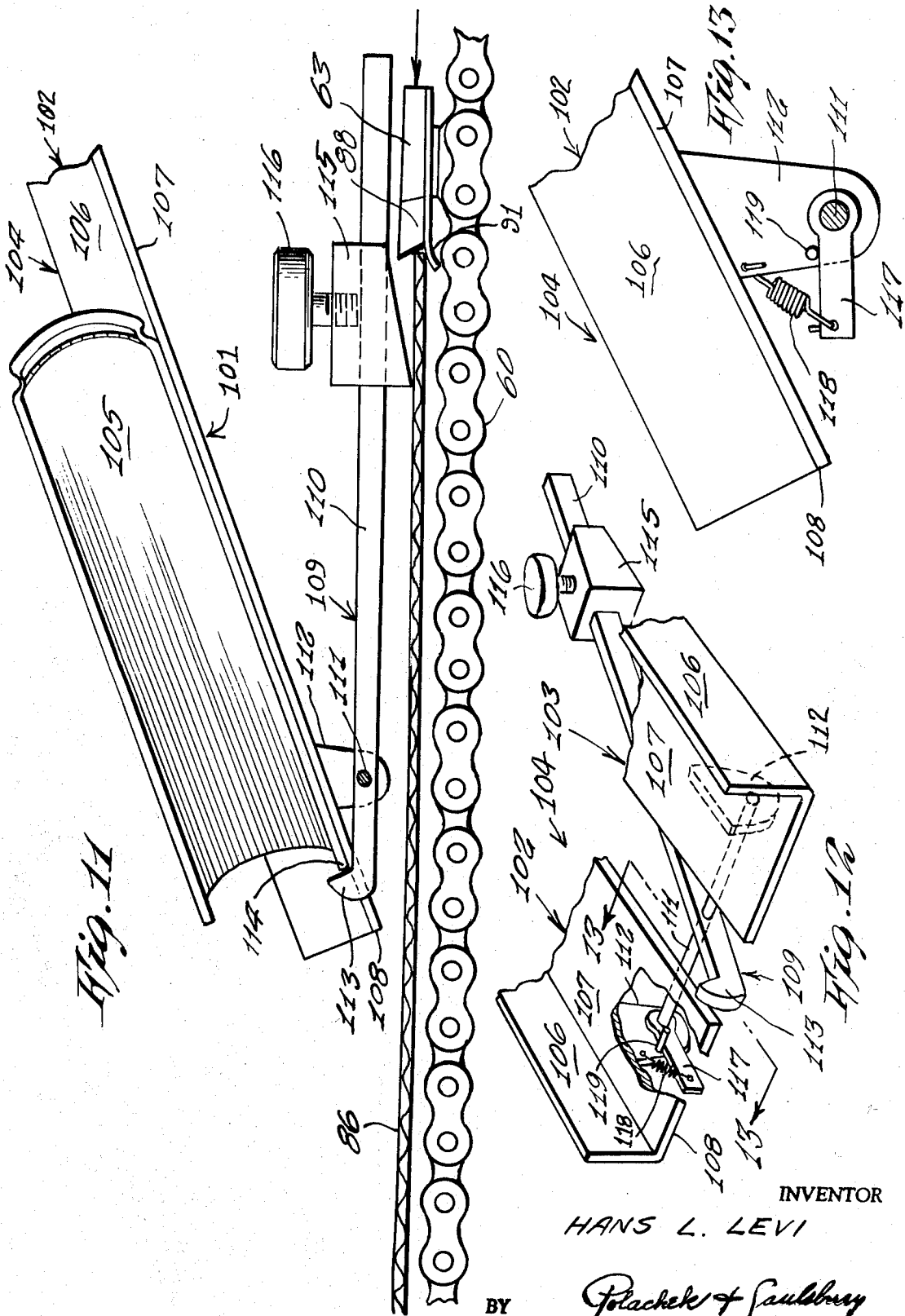
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9 Sheets-Sheet 5



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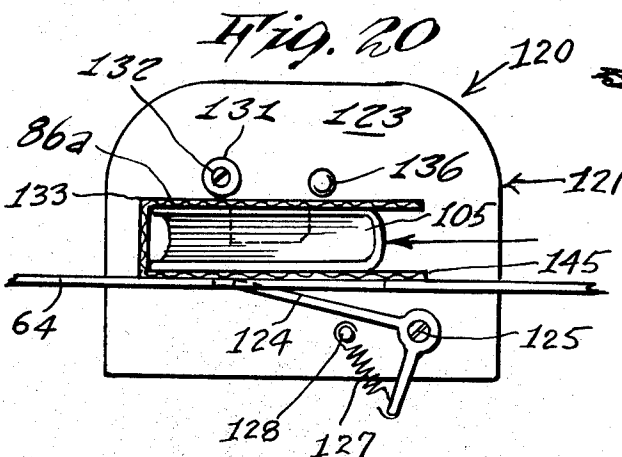
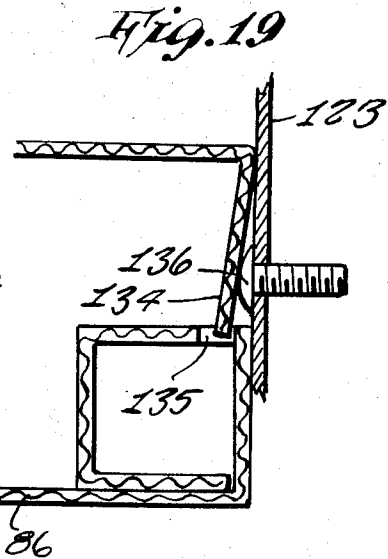
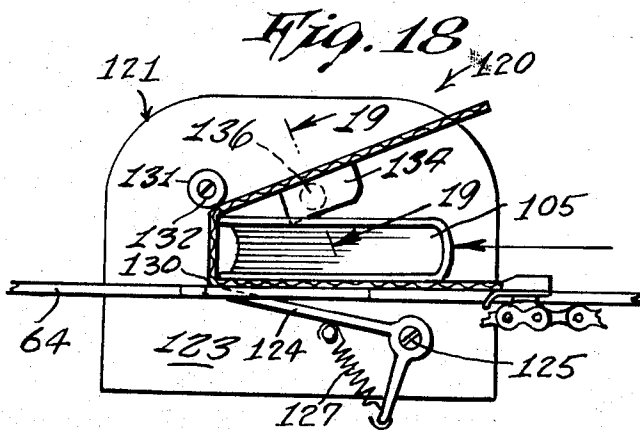
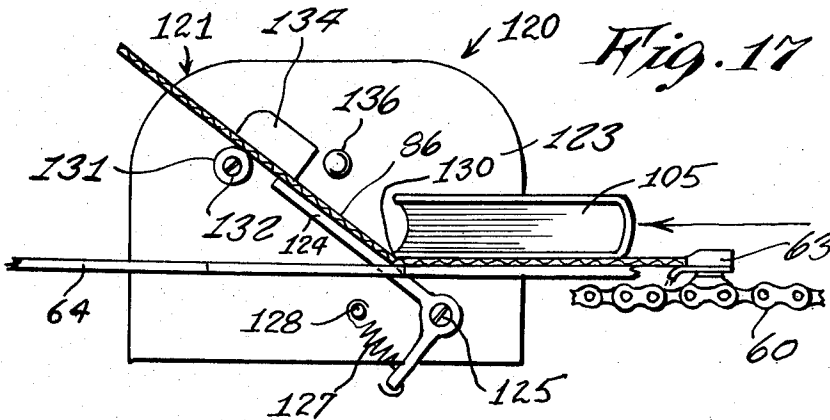
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9 Sheets-Sheet 7



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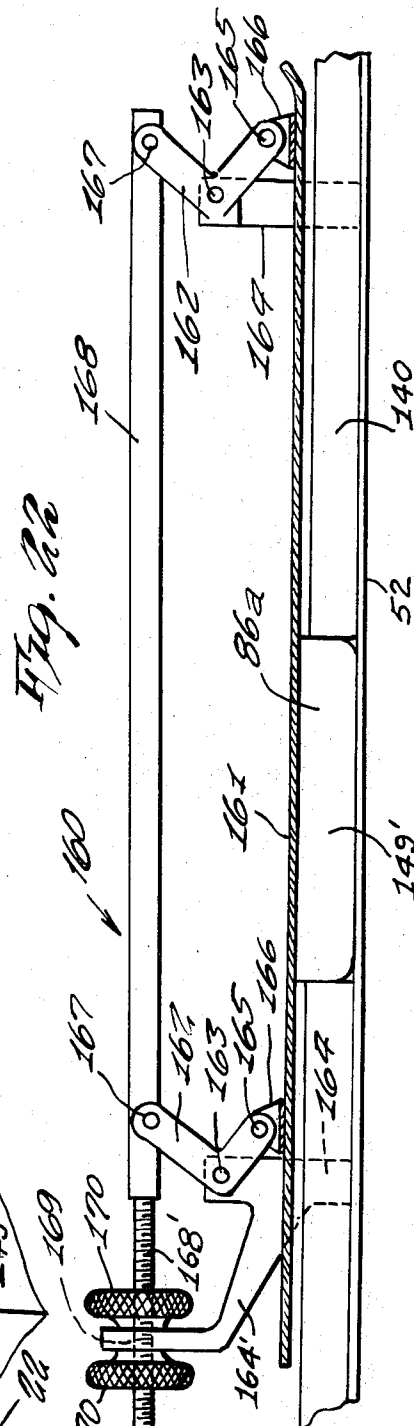
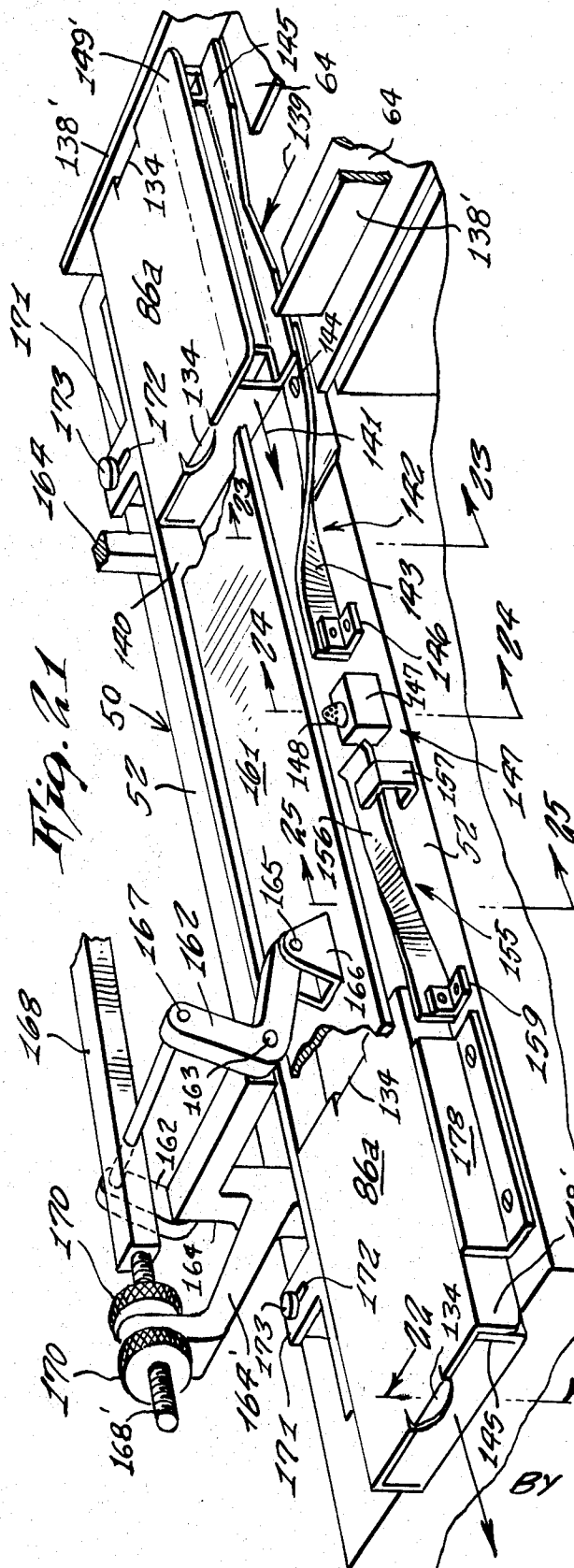
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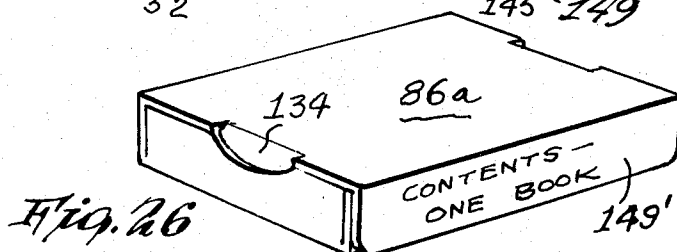
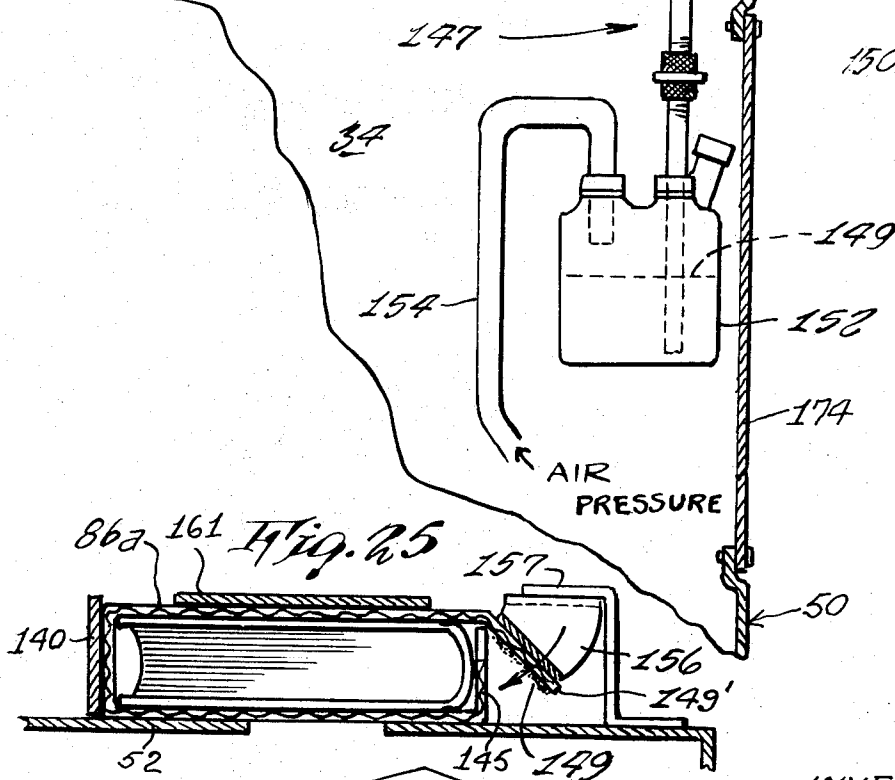
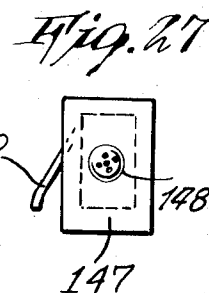
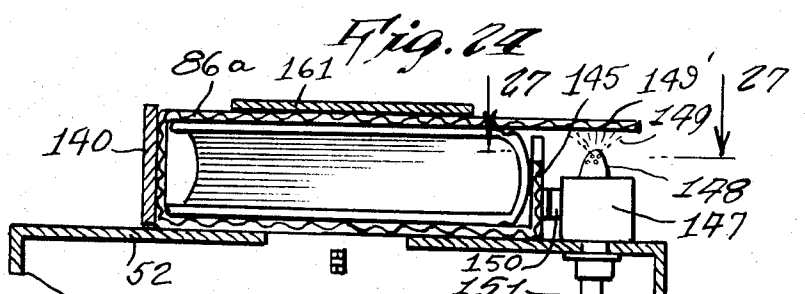
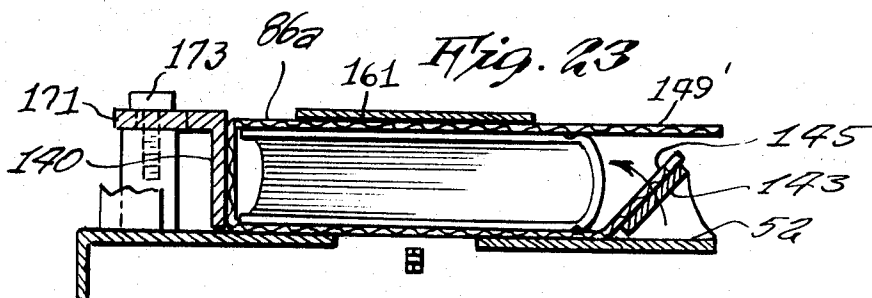
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9 Sheets-Sheet 9



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APPARATUS FOR PACKAGING BOOKS

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12 Claims

ABSTRACT OF THE DISCLOSURE

A machine for enclosing books and similarly shaped articles within mailing cartons by high-speed mass production methods, the machine including a magazine from which unfolded cartons are automatically fed. Subsequently the books are automatically or hand fed one at a time upon each of the unfolded cartons, and then the carton is folded around the book and sealed by adhesive or tuck flap; the enclosed book thus being completely packaged and ready for mailing.

This invention relates generally to automatic wrapping or packaging machines. More specifically it relates to book packaging machinery, and comprises an automatic machine for individually enclosing books within the specific mailing carton that is described in applicant's U.S. Pat. No. 3,368,735.

A principal object of the present invention is to provide an automatic machine for enclosing books within individual mailing cartons wherein the operation is accomplished by high-speed, mass production methods.

Another object of the present invention is to provide a book packaging machine that is designed to specifically use the improved mailing carton described in applicant's earlier patent which was developed to protect particularly the corners and ends of the book against rough handling during shipment.

Another object is to provide a book packaging machine that is readily adjustable so as to accommodate books of various dimensions in any direction.

Yet another object is to provide a book packaging machine wherein there is a hopper or magazine for the carton blanks and wherein a feeding mechanism allows the blanks to be stripped therefrom one at a time with subsequent drop of blanks so to obtain a better grip thereof.

Yet another object is to provide a book packaging machine wherein there is a feeding bar of flattened arrow shape which abuts with a corresponding configured edge on the blank so as to provide improved guidance by the bar to the blank.

Yet a further object is to provide a book packaging machine wherein the arrow configured edge of the blank will result in increased strength by cutting across the flutes of the corrugated material.

Yet a further object is to provide a book packaging machine which includes forming devices to permit continuous forming of the blank within a short space so as to form rolled-in cushions at each side of the blank; the forming devices each being comprised of a funnel shaped form consisting of two sections, the final section of which is interchangeable for size adjustment.

Yet a further object is to provide a book packaging machine which incorporates a carton closing mechanism

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which includes a spring loaded lever that turns over a portion of the blank so to fold the same around a book, and wherein the lever retracts out of the way after having thus performed its turning service.

Yet a further object is to provide a book packaging machine which incorporates a pair of conveyor chains in transverse directions to each other and along which the carton travels.

Yet a further object is to provide a book packaging machine which incorporates an upper and lower flap closing mechanism.

Yet a further object is to provide a book packaging machine incorporating a hold-down device which is adjustable to conform to the thickness of a book and its carton.

Other objects are to provide a book packaging machine which is simple in design, inexpensive to manufacture, rugged in construction, easy to use and efficient in operation.

These and other objects will be readily evident upon a study of the following specification and the accompanying drawings wherein:

FIG. 1 is a perspective view of the present invention.

FIG. 2 is a cross sectional view taken on line 2—2 of FIG. 1, showing a part of the drive mechanism.

FIG. 3 is a cross sectional view taken on line 3—3 of FIG. 2 showing the remainder of the drive mechanism.

FIG. 4 is a cross sectional view taken on line 4—4 of FIG. 1 showing the adjustable mechanism.

FIG. 5 is a cross sectional view taken on line 5—5 of FIG. 4 showing an initial step in the operation of the machine.

FIG. 6 is a perspective view of a carton blank shown in alignment for being engaged by a pusher bar.

FIG. 7 is a similar view thereof showing the pusher bar engaging the blank and pushing the same.

FIG. 8 is a perspective view of the forming mechanism shown rolling up a cushion at each side of the blank.

FIG. 9 is a view in the direction of line 9—9 of FIG. 8, shown with the carton blank in a further advanced position.

FIG. 10 is a fragmentary perspective view of the blank after having passed through the forming mechanism.

FIG. 11 is a cross sectional view taken on line 11—11 of FIG. 1 showing the book feeding mechanism.

FIG. 12 is a fragmentary perspective view thereof shown partly broken away to show the hidden structure.

FIG. 13 is an enlarged cross sectional view taken on line 13—13 of FIG. 12.

FIG. 14 is a perspective view of one of the units of the carton closing mechanism.

FIG. 15 is a rear perspective view thereof.

FIG. 16 is a perspective view of the carton shown partly formed and with a book in position thereupon; the carton having arrived at the carton closing mechanism.

FIG. 17 is a cross sectional view taken on line 17—17 of FIG. 16.

FIG. 18 is a view similar to FIG. 17 showing a subsequent step in the carton forming operation.

FIG. 19 is a cross-sectional view taken on line 19—19 of FIG. 18 showing the carton tab deflecting mechanism.

FIG. 20 is a view similar to FIG. 18 showing a subsequent step on the cycle of operation.

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FIG. 21 is a perspective view of the carton lower and upper flap closing mechanisms.

FIG. 22 is a cross-sectional view taken on line 22—22 of FIG. 21 showing the hold down mechanism.

FIG. 23 is a cross-sectional view taken on line 23—23 of FIG. 21 showing the lower flap closing mechanism in operative use.

FIG. 24 is a cross-sectional view taken on line 24—24 of FIG. 21 showing the adhesive applying mechanism in operative use.

FIG. 25 is a cross-sectional view taken on line 25—25 of FIG. 21 showing the upper flap closing mechanism in operative use.

FIG. 26 is a perspective view of the carton shown fully closed and containing a single book therewithin, and

FIG. 27 is a detail view of the spray valve opening mechanism.

Referring now to the drawings in detail, and more particularly to FIGS. 1 to 4, the reference numeral 30 represents an automatic machine for enclosing books within individual mailing cartons according to the present invention wherein there is an L-shaped housing 31 comprised of a framework 32 upon the outer side of which, a number of enclosing panels 33 are secured to form an enclosure for a central compartment 34 therewithin for containing a drive mechanism 35 for driving the machine.

THE DRIVE MECHANISM

The drive mechanism 35, shown in FIGS. 2 and 3, includes an electric motor 36 mounted upon a platform 37, the motor being connected by an electric extension cord 38 to a plug 39 receivable within an electric outlet receptacle for delivering power to the motor. The motor drives through a gear reduction 40 having an output shaft 41, the rotational speed of which is selectively controlled by a speed adjustment control knob 42 externally positioned of the housing.

The output shaft 41 has a sprocket 43 secured thereto, the sprocket 43 driving an endless chain 44 having a plurality of equally spaced apart pushers 45 secured thereto. The chain 44 extends around a pair of sprockets 46 and 47 mounted upon shafts 48 and 49 respectively, supported transversely at opposite ends of the housing section 50 which together with the housing section 51 comprise the L-shaped housing 31.

The housing section 50 has a top wall 52 having a longitudinal central opening 53 between opposite ends, and a horizontal portion 54 of the chain 44 extending between the sprockets 46 and 47 is fitted within the opening 53 so that the pushers 45 thereof extend above the level of the top wall 52 while traveling between sprockets 46 and 47. While the sprocket 46 may be mounted rotatably free on the shaft 48, the sprocket 47 is rigidly affixed to shaft 49, the shaft 49 being rotatably supported within bearings 55.

A bevel gear 56 secured to shaft 49, engages a bevel 57 affixed on a shaft 58 thus extending the drive mechanism from section 50 to the section 51 of the L-shaped housing.

A pair of sprockets 59 secured on shaft 58 are connected by endless chains 60 to a pair of sprockets 61 on a shaft 62 at the opposite end of housing section 51, the chains carrying a plurality of equally spaced apart pushers 63 secured therebetween the two chains. The above chains 44 and 50 drive all the mechanisms described here below which package the books within the mailing cartons.

THE CARTON LENGTH ADJUSTMENT MECHANISM

In view of the fact that books are made in various sizes, the present machine is designed to accommodate the packaging thereof regardless of book size in length, width and thickness. The book length and the resultant carton length require that all the mechanisms on the housing section 51 be sideward adjustable. This is accomplished by mounting the mechanisms upon a pair of longitudinally-extend-

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ing, parallel platforms 64 which are adjustable apart by a mechanism 65 shown in FIG. 2. This mechanism includes parallel, spaced apart, transverse screws 66 journaled at their opposite ends within bearings 67 secured on the housing. Each screw is provided with a left hand thread 68 at one end, and a right hand thread 69 at its opposite end. Each platform 64 is mounted upon a longitudinal channel 70 having a pair of threaded openings 71 engages with one of the threads on each screw 66. A sprocket 72 is fastened on each screw 66 and an endless chain 73 extends around the two sprockets 66. One of the screws has a cross sectionally square terminal end 74 that protrudes outwardly of the housing and is attached to a hand crank 75 having eccentric handle 76. Manual rotation of handle 76 will move the platforms adjustably apart or together, thus the distance between separated parts of various parts of various mechanisms mounted on the platform 64.

THE CARTON BLANK FEEDING STATION

At one end of the housing sections 51, a carton blank feeding station 77 includes a hopper 78 comprised of right and left hopper or magazine sections 79 and 80. Each hopper section is comprised of a bottom wall 81, side wall 82 secured along its lower edge to the bottom wall, and a front wall 83 secured to the side wall, there being a narrow slot 84 provided between the lower edge 85 of the front wall and the bottom wall so to allow a lower most of a stack of carton blanks 86 placed upon the hopper to feed forwardly therethrough. The hopper sections are secured upon the platforms 64 by means of bolts 87.

As shown in FIGS. 5 and 6, the pusher 63 includes a V-shaped undercut forward edge 88 that is receivable within a V-shaped notch 89 of the carton blank rear edge. The V-shaped edge 88 of the pusher has a thickness that is greater than the thickness of the carton blank. It is to be noted that the edge 88 is downwardly rearwardly inclined so to force the carton blank into a lower corner 90 formed between edge 88 and a forwardly extending lip 91 on the pusher, the lip being downwardly arched at its forward edge so as to guide the blank into the corner. Until the pusher 63 engages the blank 86, the stack of blanks are supported upon spaced pads 64' upon the platforms 64 and thereby raised to permit the lowermost carton to be started without interference with the carton thereabove and then lets it drop to get full grip.

FORMING MECHANISM

Adjacent the blank feeding station, a forming mechanism 92, comprised of right and left units 93 and 94 is mounted upon the respective platforms 64. Each unit is composed of a preforming bracket 95 of scroll configuration and a funnel 96, as shown in FIG. 8, this funnel 96 comprising a final forming element for the blank and being interchangeable with other funnels for different sizes of the finished form of the blank. The carton blank 86, as illustrated in FIG. 7 has laterally extending wings 97 each having parallel score lines 98 which become bends 99 while passing through the forming mechanisms, as shown in FIG. 8, so as to form rectangular tubular cushions 100 between which a book may be placed for protection, as shown in FIG. 10.

BOOK FEEDING MECHANISM

Adjacent the forming mechanism, there is a book feeding mechanism 101 comprised of right and left units 102 and 103 to form a chute 104 down which books 105 may slide. As shown in FIGS. 11 to 13, each book feeding unit includes a side wall 106 and an inclined bottom wall 107 having lower end 108 from which books are discharged upon the carton blank as it passes therebelow. A stop mechanism 109 momentarily halts the lower most book on the chute 104 until the carton blank is properly positioned therebelow. The stop mechanism 109 comprises a lever

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110 centrally pivotable about a pivot shaft 111 supported on a bracket 112 on the underside of the chute units 102 and 103, the lever having a hook 113 at one end for engaging the leading edge 114 of the lower most book, and the opposite end of the lever carrying a slidably adjustable cam 115 selectively securable on the lever by a set screw 116, the cam comprising a block that is upwardly lifted by the pusher as it passes therebelow, thus causing the opposite end of the lever to be lowered and thereby disengaging the hook from the leading edge 114 of the book and allowing the book to drop upon the blank 86. After the pusher 63 passes the cam, the hook returns to stop the next book from discharging off the chute 104. The shaft 111 has an integral sideward arm 117 to the end of which one end of a tension spring 118 is secured, the spring being connected at its other end to the bracket 112 thus aiding the return of the hook 113 upwardly. The arm 117 is limited in upward travel by a stop pin 119 secured on the bracket 112, as shown in FIG. 13. This mechanical actuation of the book release may be effected by electric means, such as the application of a solenoid or similar means.

CARTON CLOSING MECHANISM

A carton closing mechanism 120, shown in FIGS. 14 through 20 is located adjacent the book feeding mechanism, the mechanism 120 comprising the final mechanism upon the housing section 51. The carton closing mechanism comprises right and left units 121 and 122 secured upon the platforms, 64, each unit including an upstanding wall 123, extending through the platform. A lever 124 is pivoted at one end on a pin 125 secured to a portion of the wall below the platform 64, the lever extending normally upwardly through an opening 126 in the platform so that the upper end of the lever intercepts the carton blank 86 as it is moved along the platform. A tension spring 127 secured at one end to a pin 128 mounted on the wall 123 is secured at its other end on a spur 129 integrally formed on the lever so to cause the lever to be normally urged upward.

As the blank 86 enters the closing mechanism, the front portion thereof not being weighted by the book, accordingly is bent along score line 130, the front portion moving upwardly upon the levers 124, as shown in FIGS. 16 and 17. Further travel of the platform causes the upwardly bent forward portion of the blank to engage rollers 212 mounted upon pins 132 secured in the walls 123. As shown in FIG. 18, this causes the upward bent portion of the blank to bend along a score line 133, thus bending the blank about the leading edge of the book. As the blank is continued to be advanced, the portion thereof carrying the book is moved over the depressed lever 124, which due to the pressure of rollers 131 retract downwardly below the level of the platform as shown in FIG. 18. As the blank is further advanced, the remainder of the upward portion thereof is drawn under the rollers which push it adjacent the upper side of the book, as shown in FIG. 20. However, before this last movement is accomplished, the tab 134 on each side must be positioned so to properly enter the slots 135, as indicated in FIG. 16. This is accomplished by a button 136 on the side of wall 123, the tab coming alongside the button just at the moment when a corner of the tab is ready to enter the slot. As shown in FIG. 19, the button 136 deflects the tab sidewardly so to be perfectly aligned with the slot. As the carton blank, now generally forming a carton 86a, advances further under the rollers, the rollers force the tabs into the slots, as shown in FIG. 20. The complete carton closing mechanisms 120 are adjustable in height by hand nut 120' and screws 120'' extending between the platforms 64 and internally threaded side tabs 120a.

The carton is now urged by the pusher 63 off the housing section 51 and upon the section 50 which extends in a direction transversely to the section 51.

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It is to be noted that the blank 86 with its rolled side wing cushions was guided toward the carton closing mechanism 120 by passing within a channel 137 formed between each platform 64 and a hold down bar 138 thereabove. On leaving the mechanism 120, the carton 86a is retained in a closed position by the tabs 134, and between guides 138' and no longer requiring hold down bars to maintain the cushions.

FLAP CLOSING AND SEALING MECHANISMS

After carton 86a, containing the book, leaves the section 51 it slides, as indicated by arrow 139, upon the platform 52 of the section 50, the leading end of the carton abutting against adjustable backstop 140. In this position, it is located above the feed chain 44, as shown in FIG. 21 and is ready for being pushed in a lateral direction by a pusher 45 on the chain 44, as indicated by arrow 141.

The carton thus first arrives at a lower flap closing station 142 wherein there is a spiral-configured, bottom-flap closing bar 143 which comprises an elongated flat bar that is twisted 90° between opposite ends so that the leading end is secured in horizontal position by a screw 144 secured to the platform 52, thus allowing the horizontal lower closing flap 145 of the carton to move thereupon. As the carton continues to advance due to pusher 45, the flap 145 is gradually pivoted by the twisted bar 143 toward a vertical or closed position, as shown in FIG. 23. The opposite, vertical end of the bar 143 is secured to a bracket 146 fastened upon the platform.

The lower flap thus closed, the carton is moved alongside an adhesive applying mechanism 147 shown in FIGS. 21 and 24. It comprises a spray jet 148 which directs a spray of adhesive 149 to the underside of sidewardly extending upper closing flap 149', as shown in FIG. 24. The jet may be automatically opened by the carton 86a as it passes by. One suggested automatic device for this shown in FIG. 27 wherein an arm 150 extending into the path of the carton is actuated thereby so to open a valve in a pipe 151 communicating with an adhesive reservoir 152 within the compartment 34. Compressed air is delivered through a pipe 154 to reservoir 152 so to force the adhesive out of the spray jet. This is only a suggested one of any type automatic adhesive spray mechanisms which would be here adaptable. Instead of the adhesive system, a tuck-flap mechanism can be used to lock the upper flap in place.

After passing the adhesive applying mechanism 147, the carton 86a then arrives at an upper flap closing station 155 wherein there is a spiral configuration, upper flap closing bar 156 which comprises an elongated flat bar that is twisted 90° between opposite ends so that the leading end is secured in horizontal position on a bracket 157 fastened upon the platform, thus allowing the horizontal upper closing flap 158 of the carton to move beneath the horizontal end. As the carton continues to advance, the flap 159' is gradually pivoted by the twisted bar 156 upwardly toward a vertical or closed position as shown in FIG. 25. The adhesive 149 is thus brought against the flap 145, thereby securing the two flaps together in a locked position. Thus, the trailing end of the bar 156 is vertical and is secured to a bracket 159 fixed upon the platform 52.

As shown in FIGS. 21 and 22, a hold down device 160 is employed for the purpose of maintaining the carton in a compact unit while the adhesive is setting, the hold down device comprising a flat horizontal panel 161 that bears against the upper side of the carton. The panel is vertically adjustable so to accommodate various thicknesses of books and their enclosing cartons. This adjustment is accomplished by means of a pair of L-shaped levers 162 centrally pivotable about pins 163 secured on posts 164 stationarily mounted on the platform. One end of the levers is attached pivotally free on pins 165 supported on brackets 166 mounted upon the panel 161, while the opposite end of the levers is attached pivotally

free on pins 167 supported on a horizontal bar 168. One end of the bar 168 has a threaded extension 168' received through a clearance opening 169 in an extension 164' upon one of the posts 164 a threaded nut 170 engaging the threaded extension on each side of the opening 169, thus locking the panel at a selected elevation.

The backstop 140 extends across the entire length of the housing section 50 and is sidewardly adjustable to accommodate cartons with different sizes of books. A lug 171 at each end of the backstop 140 has a slot 172 receiving a screw 173 secured in the platform 52 to provide for sideward adjustment of the backstop 140.

Thus, structure has been shown to accommodate book cartons varied in length, width and height..

It is to be further noted that a door 174 may be provided on the section 50 to gain access to the adhesive reservoir 152 for refilling purposes. Another door 176 on the end of section 50 permits access to service the motor 36 and its associate member.

OPERATION

In operative use, the machine after being first adjusted for carton size in width, length and thickness, is then made ready by loading mailing carton blanks upon the hopper 78, placing a quantity of books upon the feeding mechanism 101, and filling the reservoir 152 with adhesive. A motor switch 177 is then turned on causing the drive whains in each section to travel. The lowermost blank is withdrawn from the hopper and pushed through the forming mechanism so to form cushions at each side. The blank then advances below the book feeding station when a book is deposited thereupon. The blank and the book advance to the carton closing mechanism 120 where the carton is folded over the top of the book and side tabs 134 are engaged within side slots 135. The carton thus closed advances to the lower flap closing bar 143 where the lower flap 145 is folded over then adhesive 149 is applied to the lower side of the upper flap 149' which is then folded down against the folded lower flap thus sealing them together and completing the book packaging operation. The finished package is discharged from the machine by being moved between adjustable backstop 140 and a stationary bracket 178.

While various changes may be made in the detail construction, it shall be understood that such changes will be within the spirit and scope of the present invention as is defined by the appended claims.

What is claimed is:

1. An automatic packaging machine for enclosing a flat book or similarly shaped article in a carton, comprising in combination, a horizontal support, a series of stations on said support for forming a flat carton blank into a carton, a drive mechanism in said support arranged to move a carton blank past said stations in succession, a first one of said stations comprising a hopper for supporting a stack of flat carton blanks and for feeding one carton blank at a time from said stack, each of said carton blanks being generally rectangular in form with a first flap portion at one end, a pair of oppositely extending lateral wing formed with tab receiving slots and parallel core line, a cover portion having laterally extending tabs, and a second flap portion at the other end of the carton blank; a second one of said stations disposed to receive a flat carton blank fed from the first station, said second station comprising cushion forming means including a pair of brackets of scroll configuration for partially folding both wings of the carton blank on said score lines, and a pair of funnels for finally forming the partially folded wings respectively into two cushions of rectangular tabular form, a third one of said stations comprising means for depositing an article to be enclosed in a carton upon a carton blank between the tubular cushions, a fourth one of said stations comprising means for folding down said cover portion of the carton blank over the cushions to partially enclose said article,

a fifth one of said stations comprising means for turning up the first flap portion under the folded down cover portion, a sixth one of said stations comprising means for turning down the second flap portion adjacent to the turned up first flap portion, and a seventh one of said stations comprising means for holding the folded carton blank in compressed position enclosing said article while the two folded flap portions are adhered to each other.

2. An automatic packaging machine as defined in claim 1, further comprising means disposed between the fifth and sixth stations for applying an adhesive to the underside of said second flap portion.

3. An automatic packaging machine as defined in claim 2, wherein said fourth station further includes means for folding said tabs and inserting same in said slots in the folded wings.

4. An automatic packaging machine as defined in claim 1, wherein said drive mechanism comprises a pair of endless chain drives powered by a common electric motor, each chain drive carrying a series of spaced apart pushers, each chain drive being mounted around spaced sprockets within said support, said support having openings through which said pushers extend for engaging and moving a carton blank along said series of stations.

5. An automatic packaging machine as defined in claim 4, wherein said pushers are flat arrow-shaped members with undercut leading edges for engaging a carton blank and moving the same along said series of stations.

6. An automatic packaging machine as defined in claim 1, wherein said support comprises a pair of horizontal parallel platforms, and wherein the hopper, cushion forming means, means for depositing said article on the carton blank, and means for folding down the cover portion each comprise a pair of adjustable, separate units each of which is mounted on one of the platforms, and means engaging the platforms for adjustably spacing the platforms apart to accommodate carton blanks of different sizes.

7. An automatic packaging machine as defined in claim 1, wherein said hopper comprises two opposite halves each having an upstanding side wall and front wall, said side wall having a lower edge secured to a base on said support, said front wall having an opening between a lower edge thereof and said base to allow passage therethrough of a lowermost carton blank of said stack.

8. An automatic packaging machine as defined in claim 1, wherein the means for depositing said article on the carton blank comprises two feeding mechanisms each including a side wall adjacent to an inclined bottom wall, said bottom wall having a lower end for discharging therefrom an article placed on said mechanisms; and an arresting mechanism disposed for momentarily halting the discharge of said article until a carton blank is in proper alignment below said feeding mechanisms.

9. An automatic packaging mechanism as defined in claim 1, wherein the means for folding down the cover portion of the carton blank comprises two opposing units, each unit comprising a vertical wall having a lever pivoted at one end on a pin mounted on said wall, a free end of said lever extending upwardly against spring bias to intercept a travel path of a certain blank, and a sidewardly projecting roller mounted on a pin in said wall for folding backward and downward said cover portion of the blank.

10. An automatic packaging mechanism as defined in claim 9, further comprising a button on said wall for engaging and deflecting a tab on said blank to engage in a slot in one of the folded wings.

11. An automatic packaging mechanism as defined in claim 1, wherein the means for turning up the first flap portion comprises an elongated bar twisted ninety degrees along its length so that a horizontal end thereof engages said first flap portion while it is in horizontal position and pivots the same to vertical closed position while the carton blank is moved alongside said bar.

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12. An automatic packaging mechanism as defined in claim 1, wherein the means for turning down the second flap portion comprises an elongated bar twisted ninety degrees along its length to engage said second flap portion while it is in horizontal position to pivot the same to vertical position adjacent to the turned up first flap portion.

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