Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 1

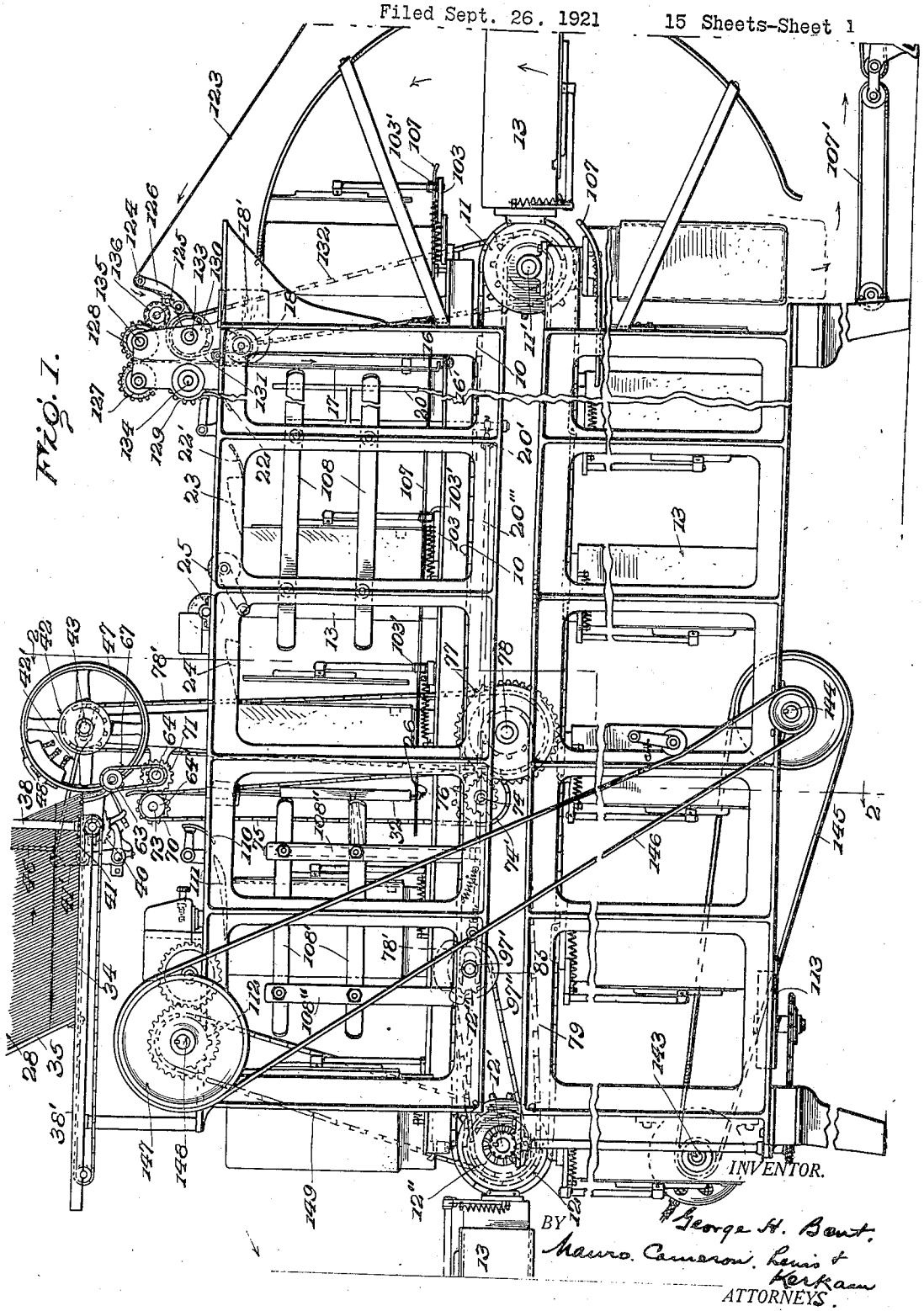


Fig. 1.

INVENTOR.
George H. Bent.
BY
Mauro, Cameron, Lewis & Kerkam
ATTORNEYS.

Jan. 8, 1924.

1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 2

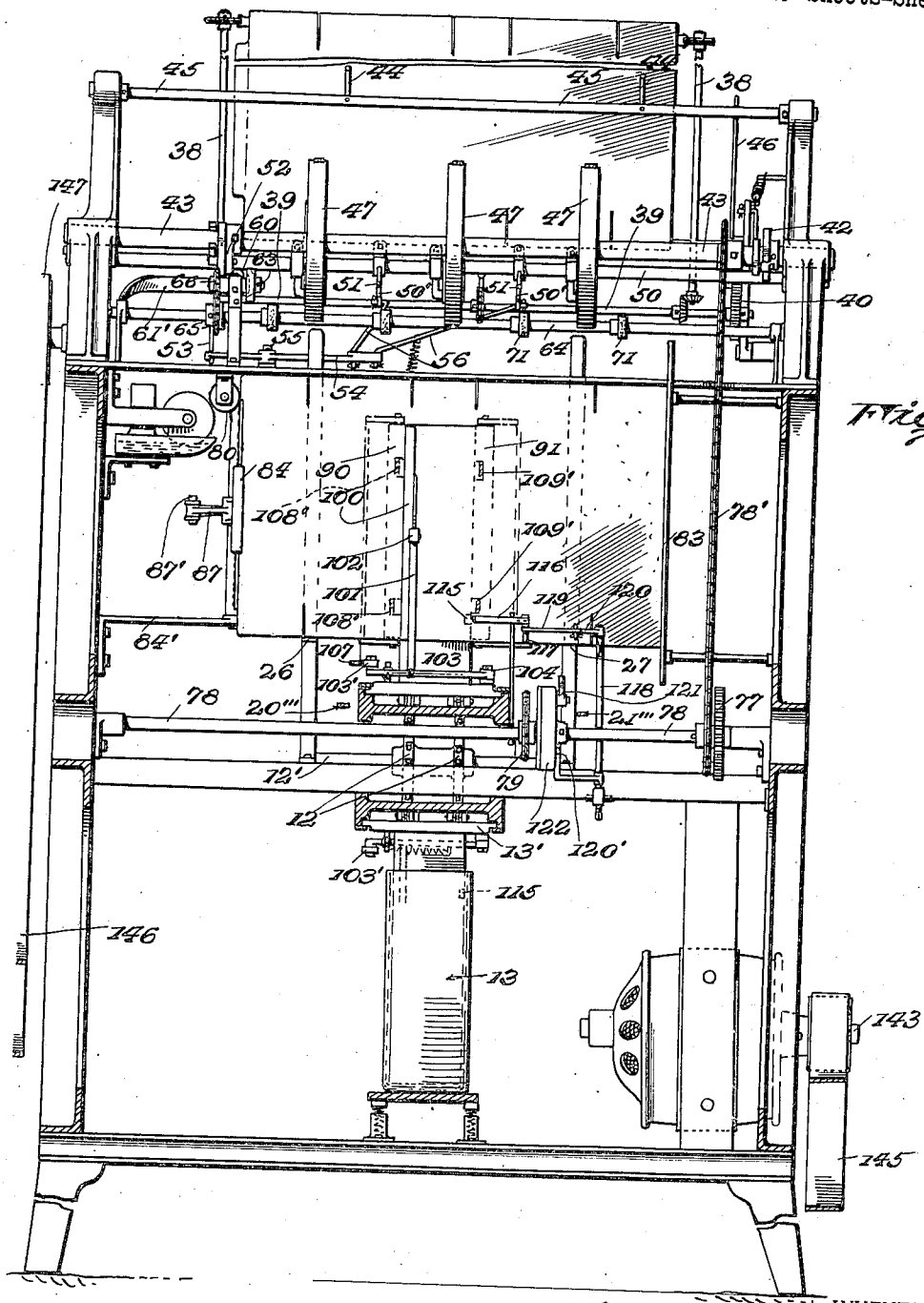


Fig. 2.

INVENTOR.

George H. Bent

BY

Mauro, Cameron, Heins & Kerkam

ATTORNEYS.

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 3

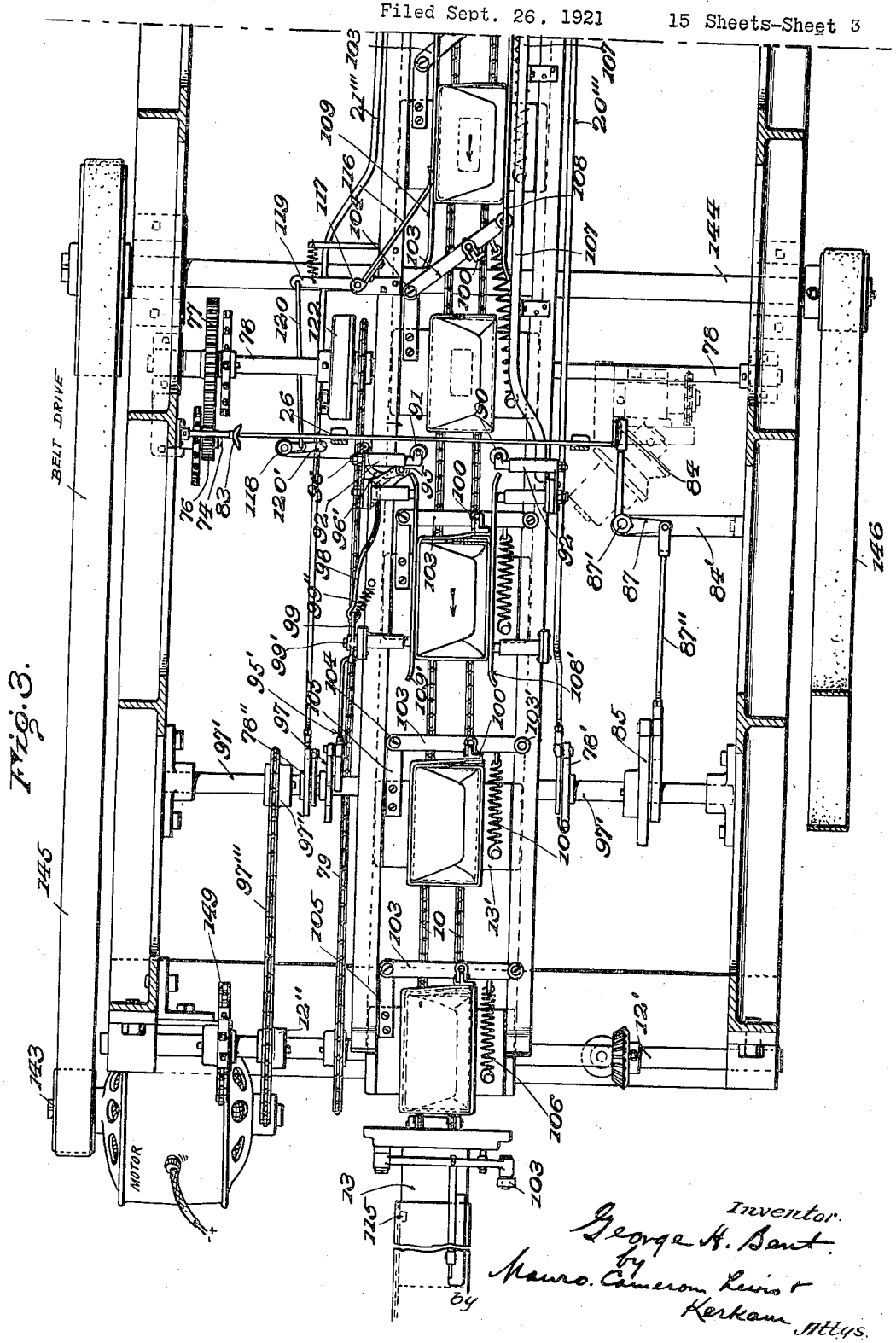


Fig. 3.

Inventor.
George H. Bent.
By
Mauro, Cameron, Lewis & Kerkam
Attys.

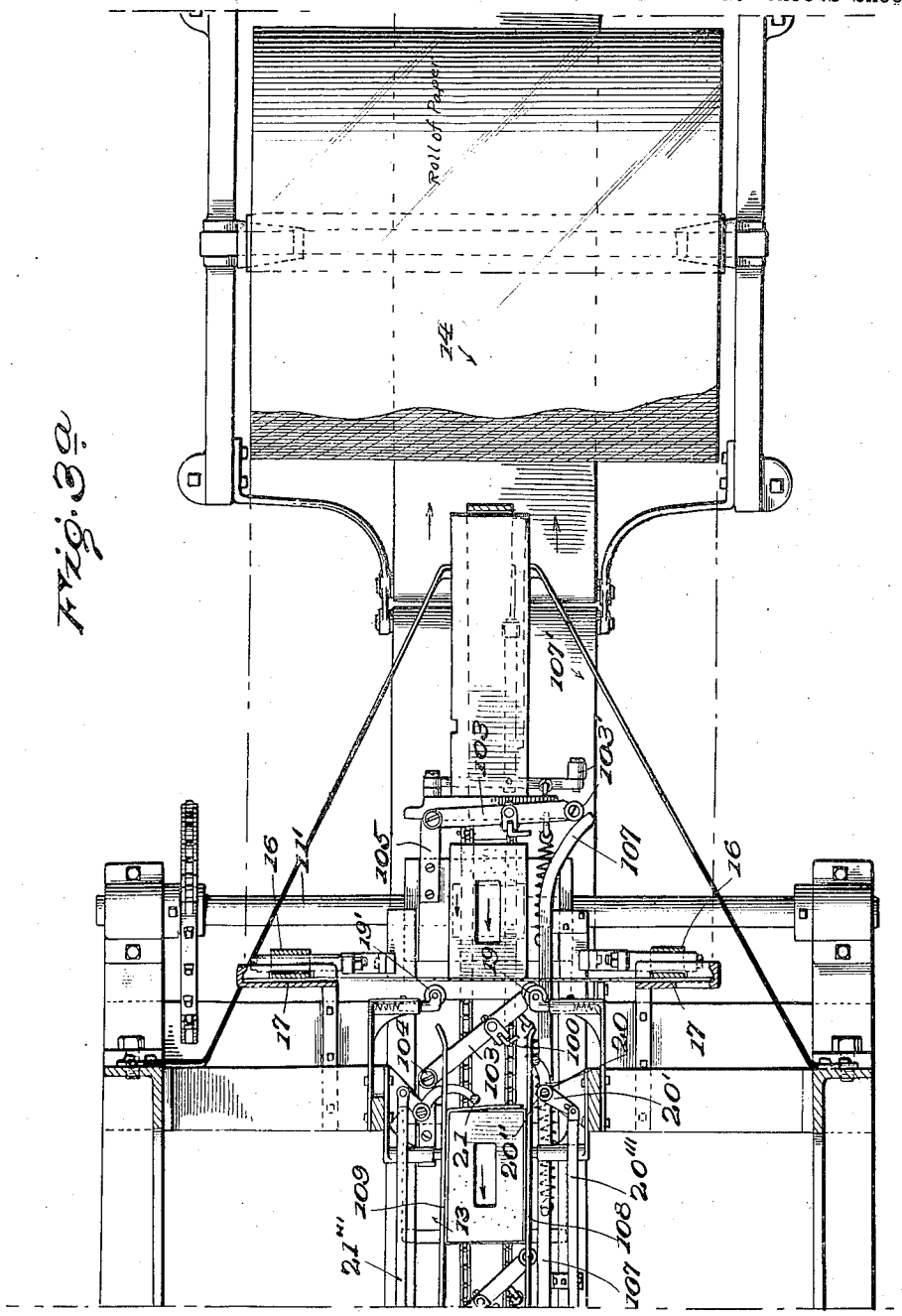
Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 4

Fig. 32a.



Inventor

George H. Bent.

By Munn, Cameron, Lewis & Parkman.

Attorneys

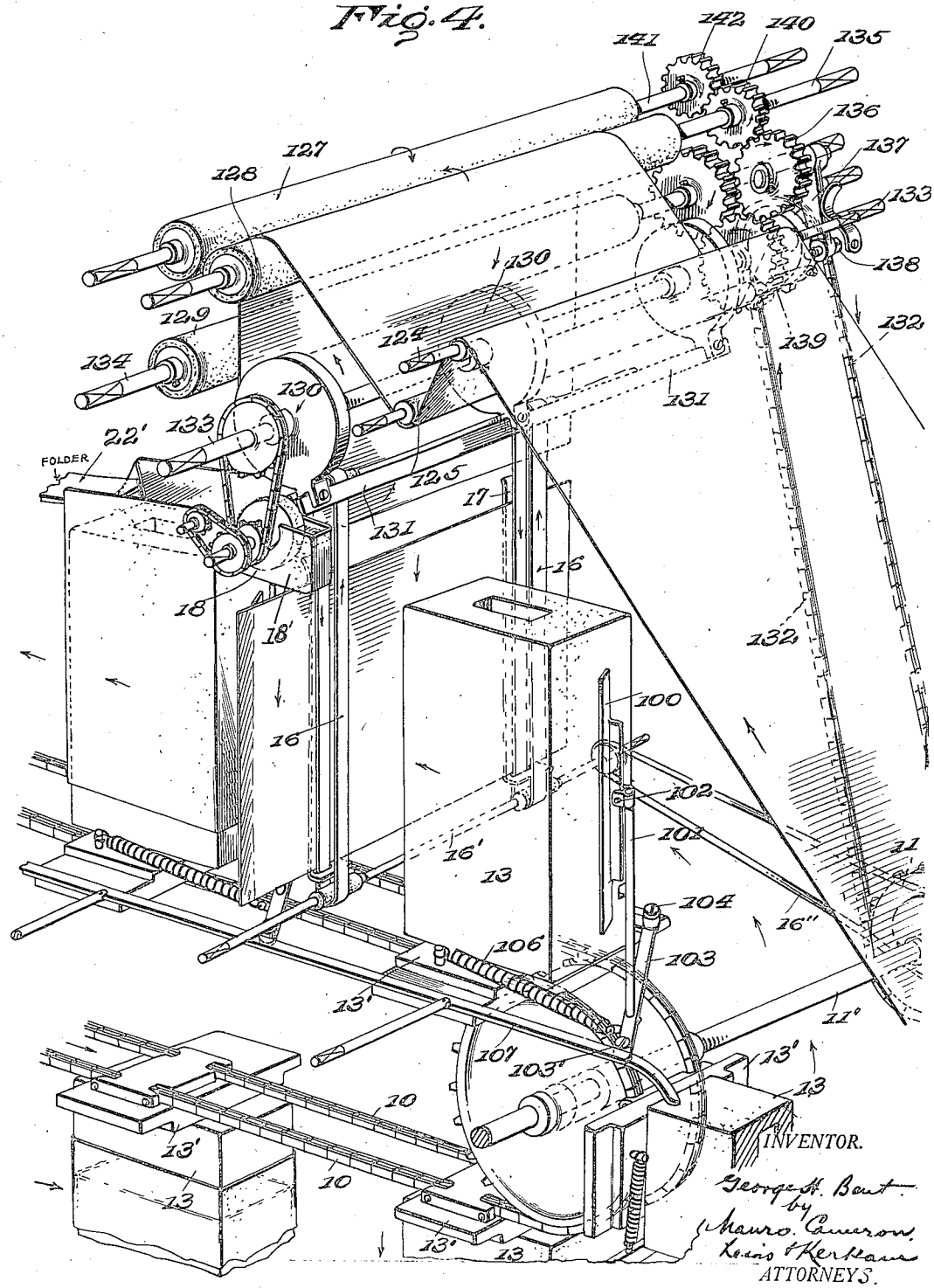
Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 5

Fig. 4.



Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 6

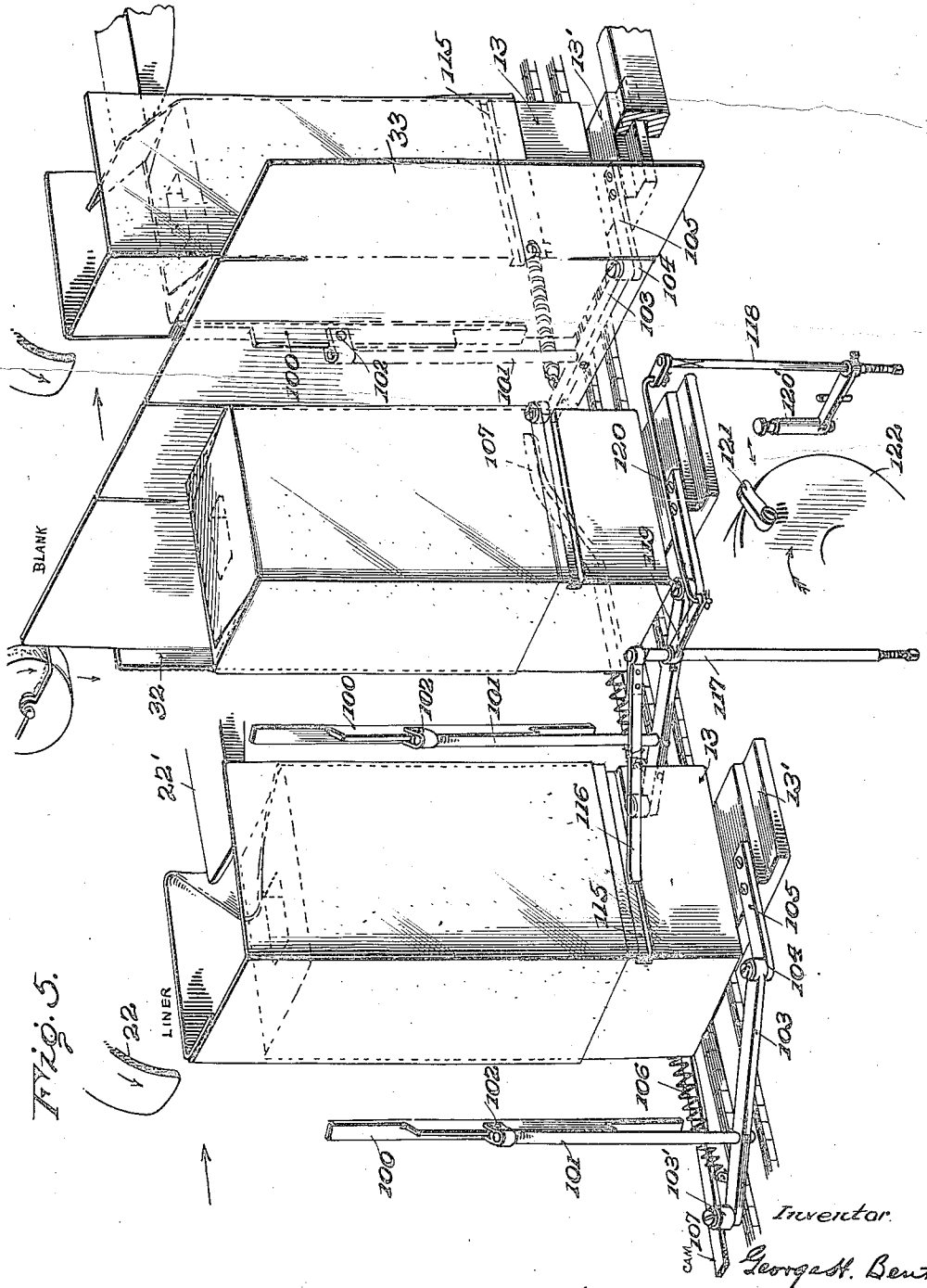


Fig. 5.

Inventor.
George H. Bent
by Mauro, Cameron, Leis & Kerkam
Attys.

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 7

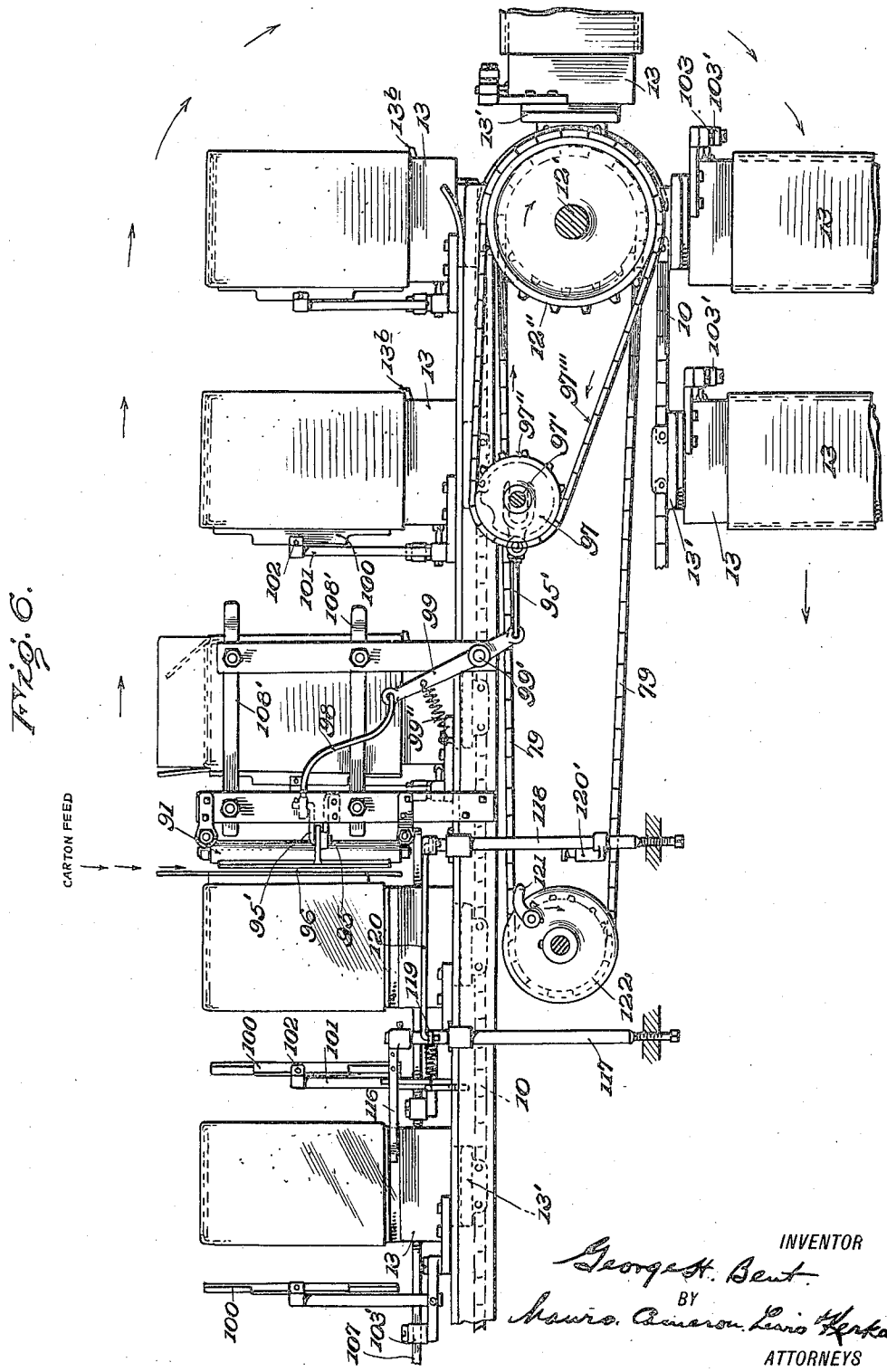


Fig. 6.

INVENTOR
George H. Bent
BY
Mauro, Cameron, Lewis & Herkam
ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26. 1921 15 Sheets-Sheet 8

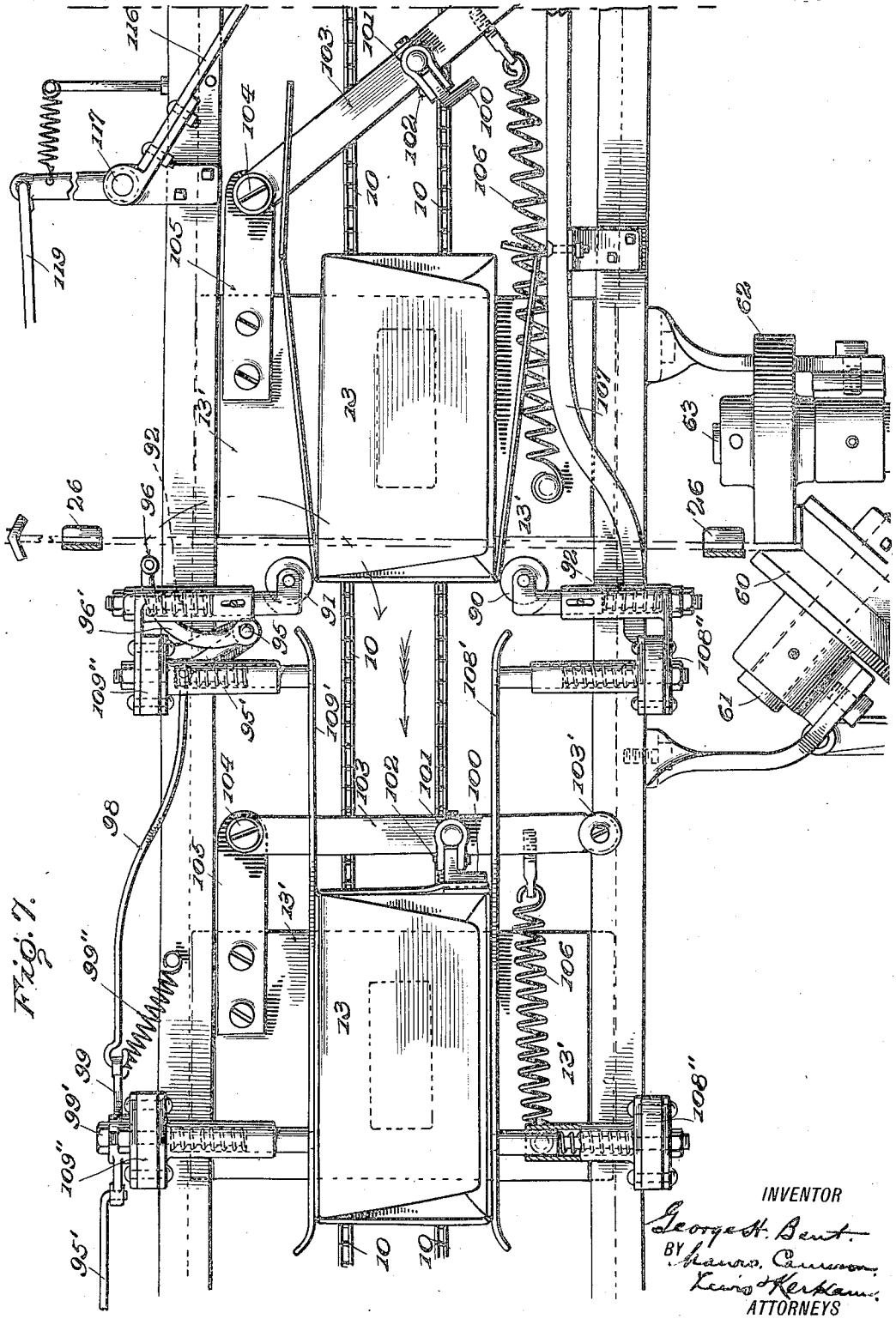


Fig. 1.

INVENTOR
George H. Bent.
BY Mason, Cameron, Lewis & Kerkam.
ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 9

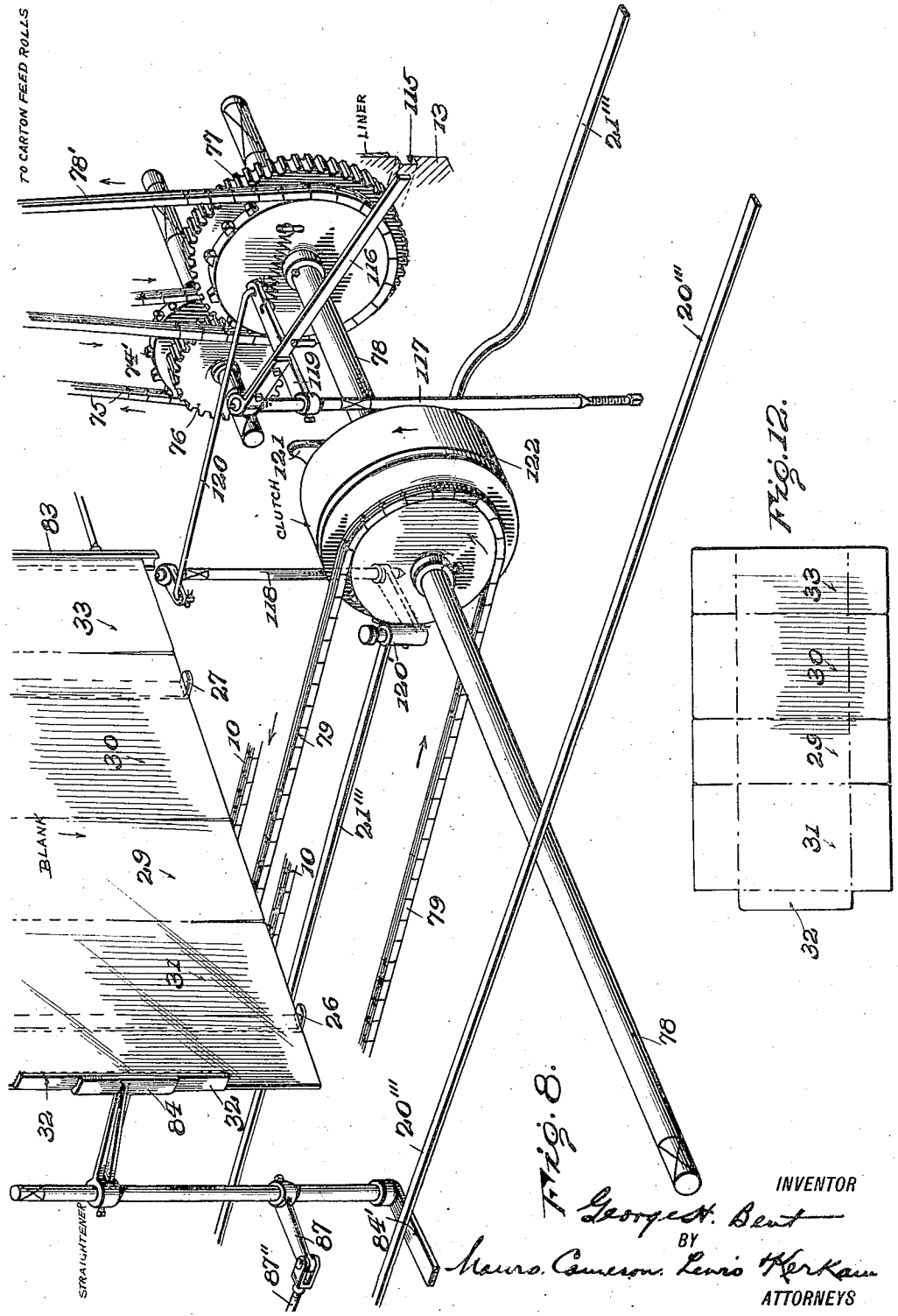


Fig. 8.

Fig. 12.

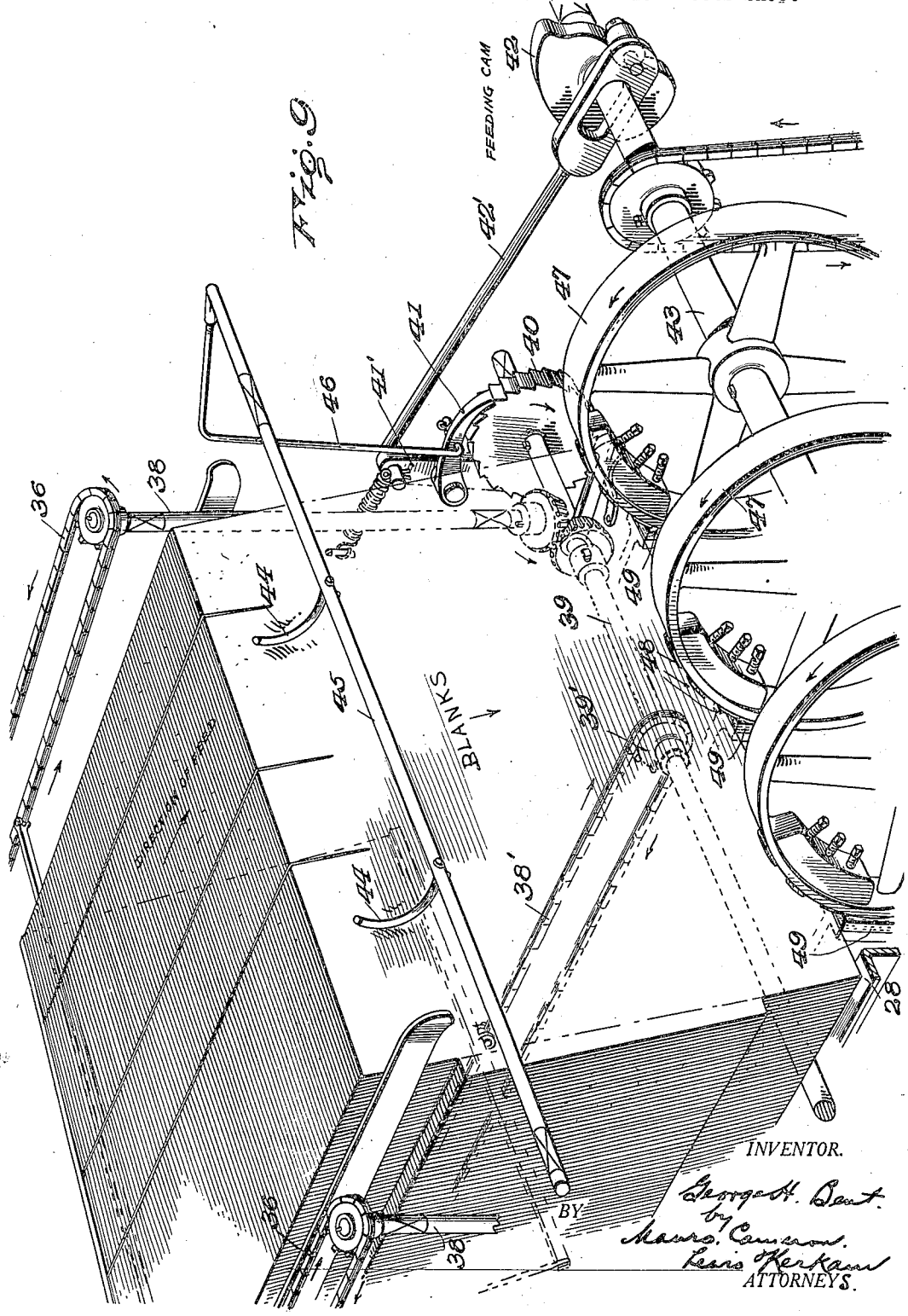
INVENTOR
George H. Bent
BY
Mauro, Cameron, Lewis & Kerkam
ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 10



Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 11

Fig. 10.

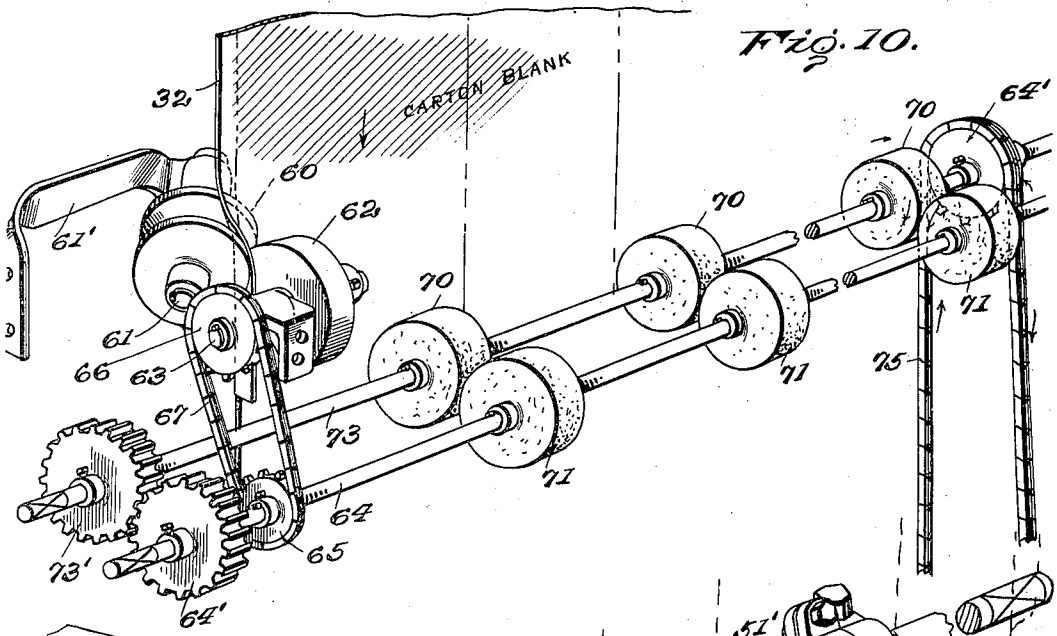
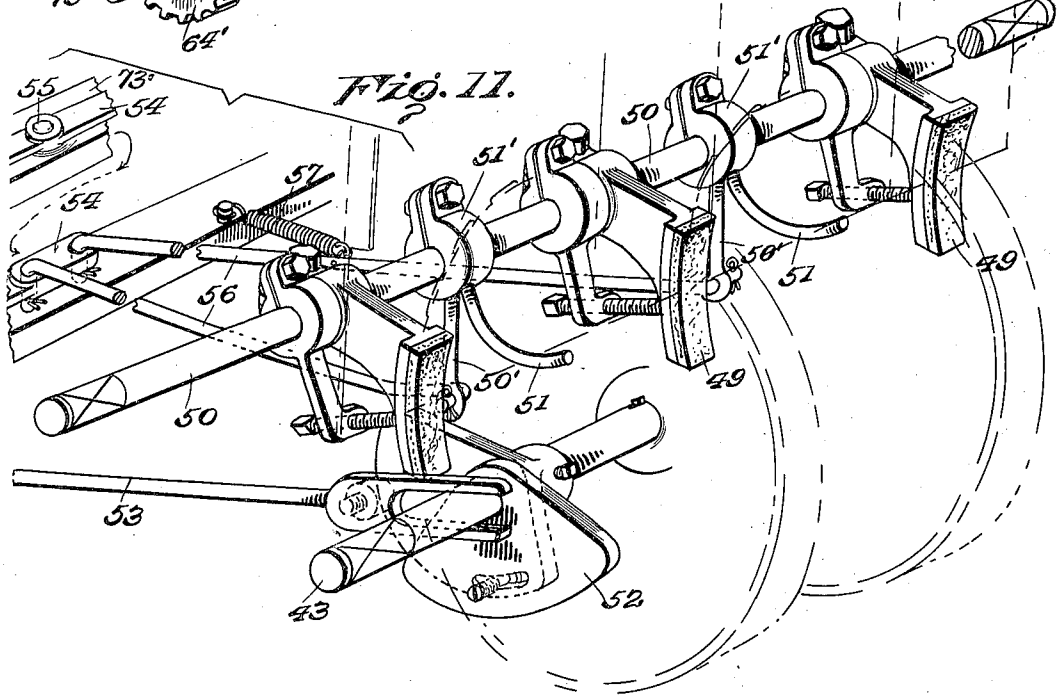


Fig. 11.



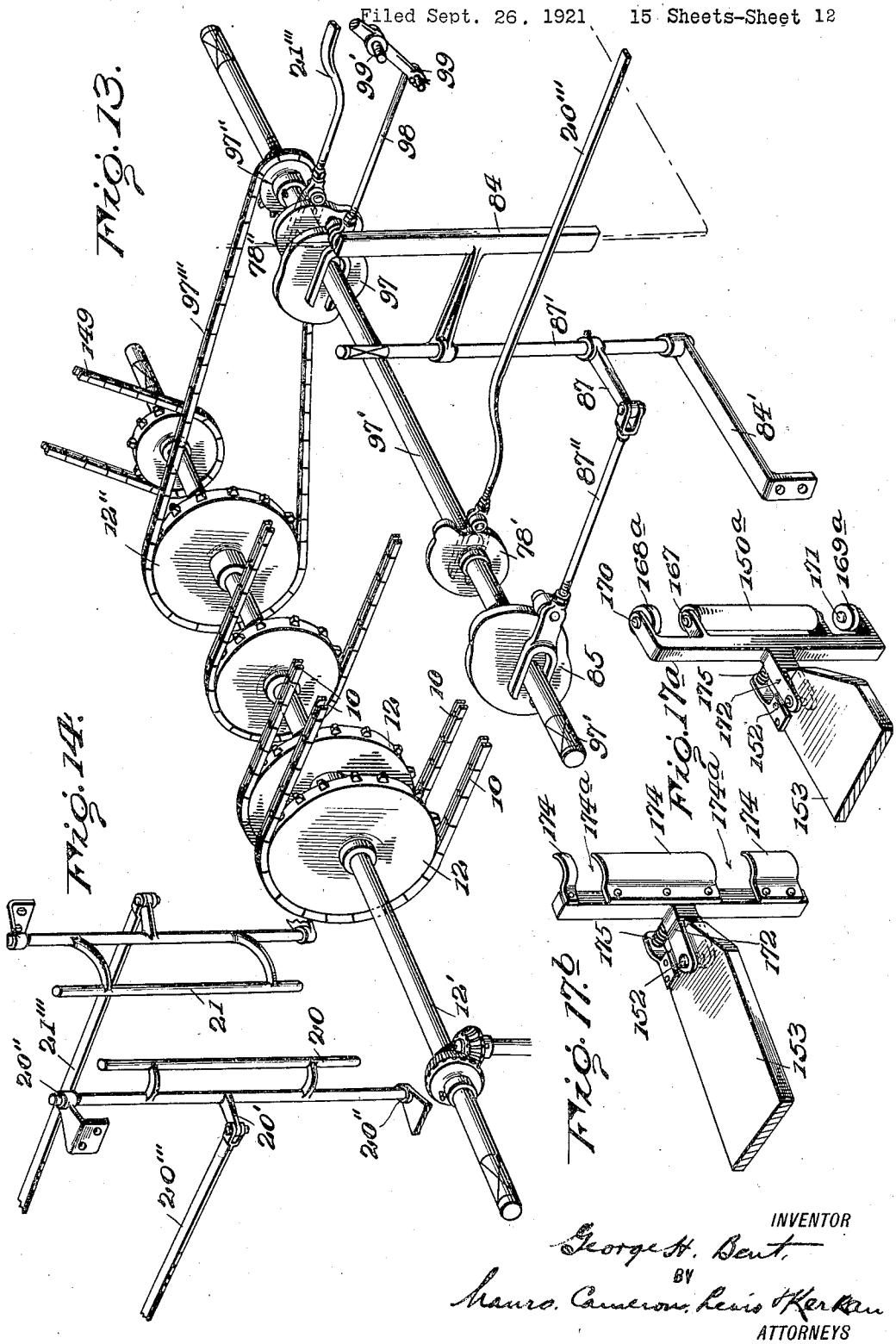
INVENTOR.
George H. Bent
BY
Mauro, Cameron, Lewis & Kerkam
ATTORNEYS.

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 12



INVENTOR
George H. Bent.
BY
Mauro, Cameron, Lewis & Kerkam
ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 13

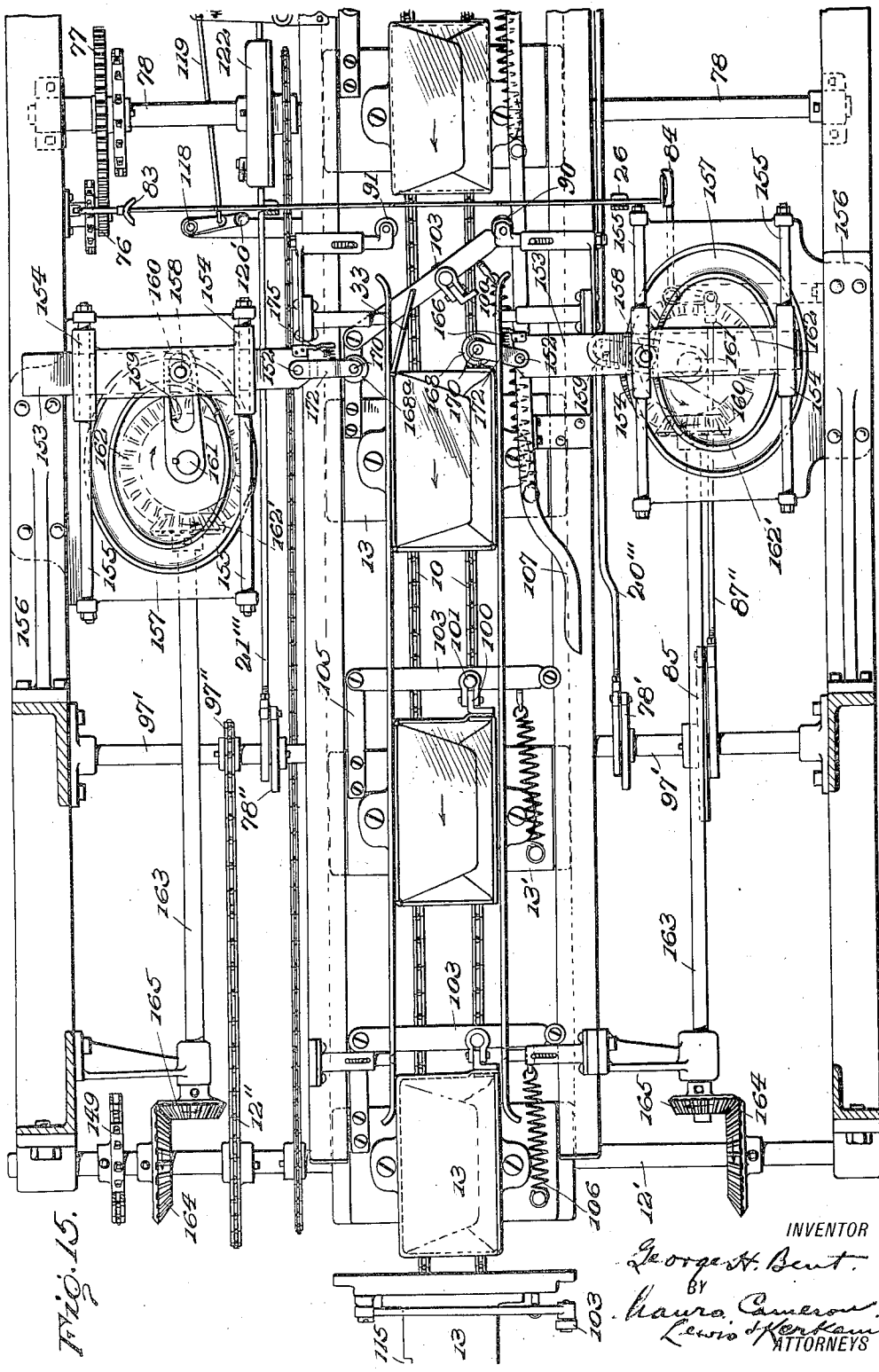


Fig. 15.

INVENTOR
George H. Bent.
BY
Laura Cameron.
Lewis & Kenkam.
ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 14

Fig. 16.

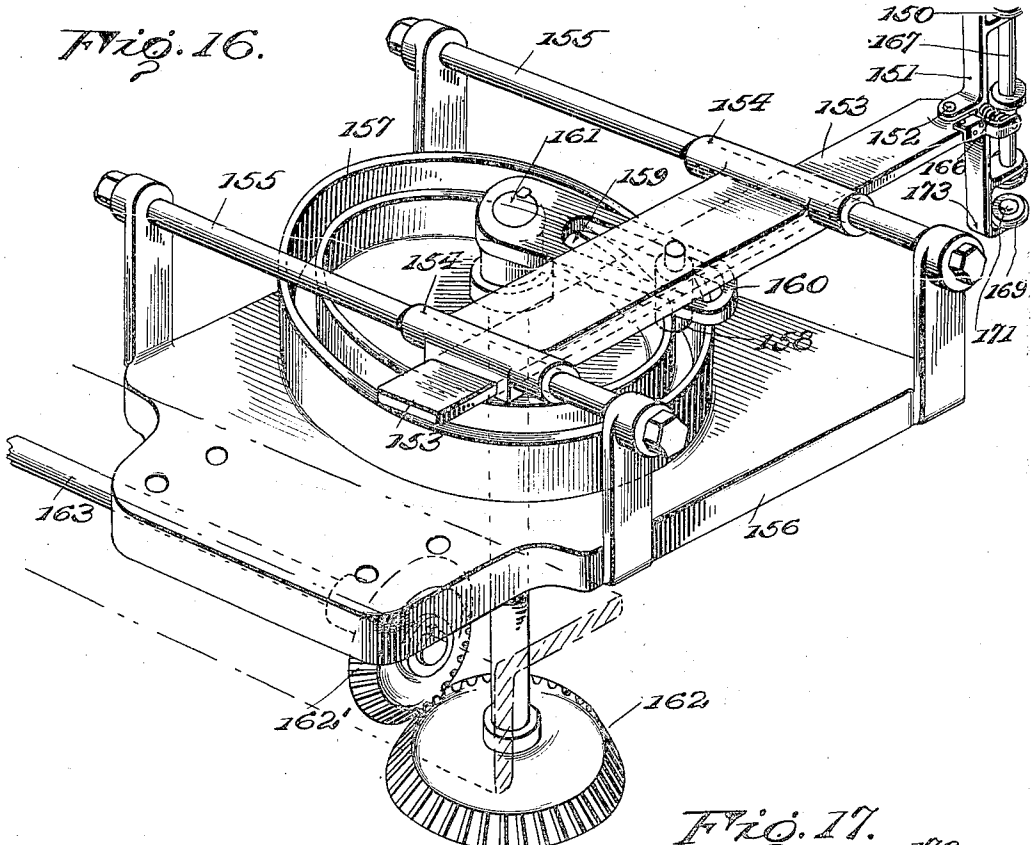


Fig. 17.

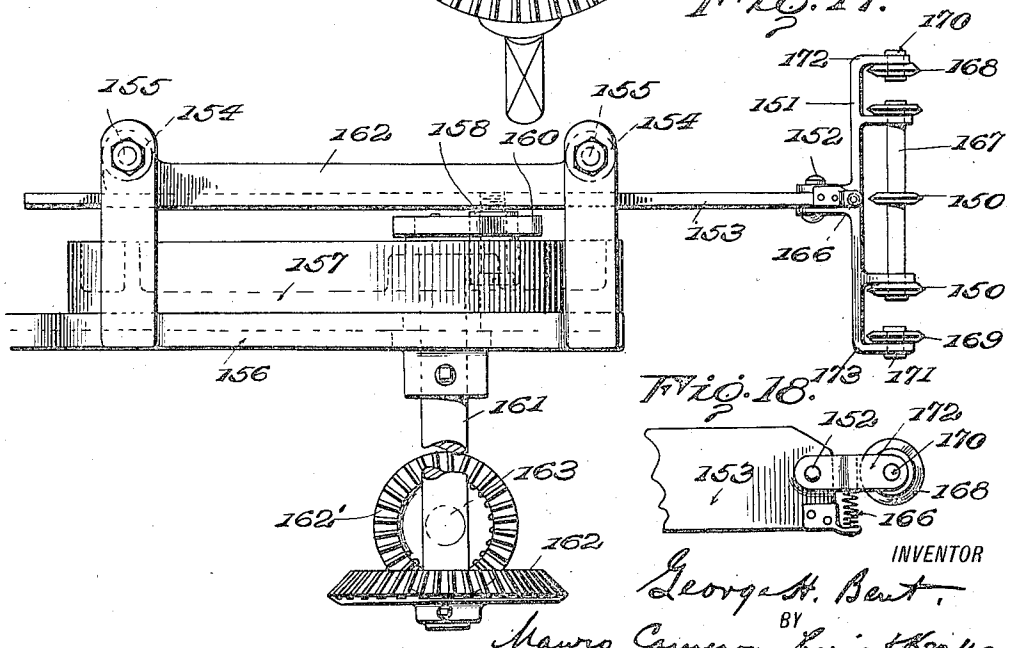


Fig. 18.

INVENTOR

George H. Bent.

BY

Mauro, Cameron, Davis & Perkins

ATTORNEYS

Jan. 8, 1924. 1,480,143

G. H. BENT

CARTON AND LINER FORMING MACHINE

Filed Sept. 26, 1921 15 Sheets-Sheet 15

Fig. 19.

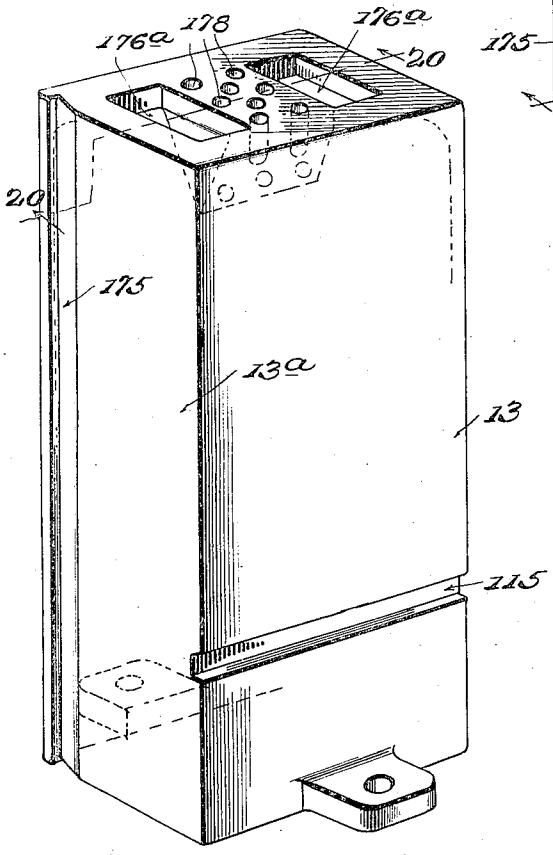


Fig. 21.

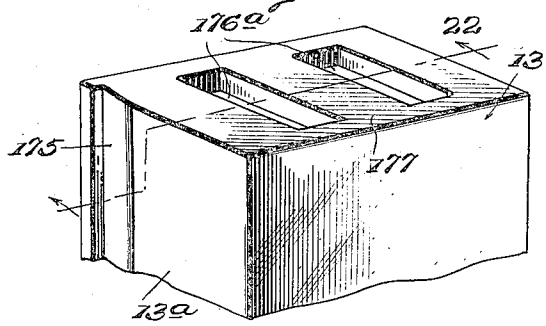


Fig. 22.

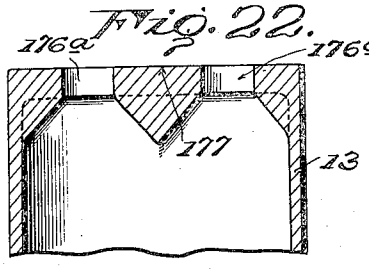


Fig. 20.

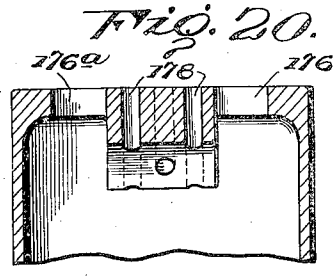


Fig. 23.

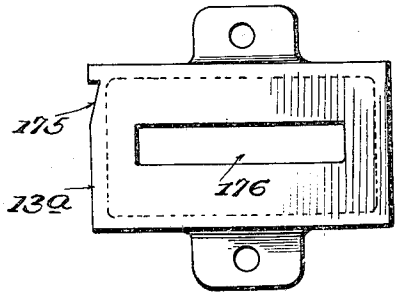
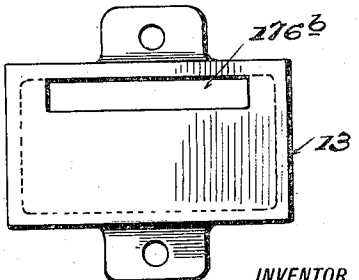


Fig. 24.



INVENTOR

George H. Bent.

BY

Mauro, Cameron, Lewis & Herkom

ATTORNEYS

Patented Jan. 8, 1924. 1,480,143

UNITED STATES PATENT OFFICE.

GEORGE H. BENT, OF BATTLE CREEK, MICHIGAN.

CARTON AND LINER FORMING MACHINE.

Application filed September 26, 1921. Serial No. 503,194.

To all whom it may concern:

Be it known that I, GEORGE H. BENT, a citizen of the United States of America, and a resident of Battle Creek, Michigan, have invented new and useful Improvements in Carton and Liner Forming Machines, which invention is fully set forth in the following specification.

The present invention is an improvement in carton-forming machines and particularly is a device for automatically wrapping or folding a carton blank about a continuously moving form. The invention in a further aspect is an improved device for automatically forming liners for cartons on a continuously moving form which may be used in combination with the carton-forming mechanism or separately, as may be desired.

One of the objects of the invention is to provide improved means (either with or without the liner-forming mechanism) for automatically wrapping a carton blank about a continuously moving form in such manner and by such means that the side panels of the blank will be sharply bent with respect to the front panel, and the two marginal panels sharply bent with respect to the side panels, thus responding to the exacting requirements of the art for perfect and sightly cartons.

In the preferred embodiment of the inventive idea, this is effected by mechanism that folds and yieldingly holds the side panels of the blank against the form, and oppositely operating folding members that engage the lateral marginal panels of the blank and fold the same into engagement with the rear face of the form. These folding members in said embodiment have a lateral and forward movement and are yielding in the line of movement of the form, and engage the marginal panels adjacent their junction with the side panels, so that the said marginal panels are sharply bent or folded against the rear face of the form. Adhesive is applied to one of these marginal panels as it is fed into the path of movement of the form, and this panel is first folded against the rear face of the form. Thereafter, the other marginal panel is folded into engagement with said glued panel. Means are provided for clamping said marginal panels against each other and the rear face of the form, and holding them so clamped until they are firmly secured together. In addition, I prefer to form a vertical channel or groove in the rear face of each form adjacent the line of engagement of the glued panel with the other marginal panel so that, if any adhesive is squeezed out, it will enter said channel or groove and not adhere to the smooth rear face of the form.

The invention further resides in means for forming on each of a series of continuously moving forms a carton liner and a superposed carton by first wrapping a liner about a continuously moving former, then sealing the bottom of said liner, then wrapping the carton about said liner, sealing the marginal panels against the rear face of the form, and then sealing the bottom of said carton. Thereafter, if desired, the lined carton may be filled with any desired material and the other end or top sealed by any desired means. In this aspect, the invention more particularly resides in a continuous source of paper supply with means for continuously severing appropriate lengths for each liner which is wrapped about the moving form, in combination with a source of carton blanks from which successive carton blanks are fed and formed about said liners, whereby lined cartons are continuously and expeditiously formed with a large saving in cost of production and all the economics that flow from automatic and continuous operations as opposed to manual and intermittent operations as heretofore employed. The feed of the liner sheets and the carton blanks are synchronized to the travel of the continuously moving formers about which they are to be wrapped.

In addition to providing means for continuously forming lined cartons on a series of continuously moving forms, means are provided for insuring that only one carton blank at a time shall be fed from the hopper containing the blanks, and also means that automatically and periodically move forward against the rear of the carton being withdrawn so that, should a second blank start down, said means will support the same and prevent its downward movement until the first blank has been wrapped about its former. Also that, should a lined carton not be removed from a form as the latter approaches the point

where a carton blank is normally fed to the same, the feed of said blank will be automatically prevented.

In addition, the invention in one aspect resides in providing rotary means for bending one marginal panel of the carton blank to which glue is to be applied, to eliminate friction and to prevent any retardation of movement of that edge of the carton blank as the latter is fed downward to the form. Further, the invention resides in means for exactly registering or positioning the carton blank in the path of the continuously moving former.

The invention will be better understood by reference to the accompanying drawings, illustrating one expression of the inventive idea, and wherein—

Fig. 1 is a side elevation of the improved machine;

Fig. 2 is a vertical cross-section on the line 2—2 of Fig. 1;

Figs. 3 and 3ª are a horizontal plan view, partly in section;

Fig. 4 is a perspective view showing part of the feed for the liner paper, and associated mechanism;

Fig. 5 is a detail showing particularly the mounting of the carton detector mechanism;

Fig. 6 is a side elevation showing particularly the mounting and operation of the blank folder;

Fig. 7 is a plan view at the point where the carton blank is fed in front of the moving form;

Fig. 8 is a perspective view showing the carton detector mechanism, and a blank in position to be engaged by a form;

Fig. 9 is a perspective view of the hopper and associated mechanism;

Fig. 10 is a perspective detail showing the rollers for bending one of the marginal panels of the blank;

Fig. 11 is a detail showing the means for preventing more than a single blank at one time from being fed into the path of the moving form;

Fig. 12 illustrates a well-known form of carton blank;

Fig. 13 is a detail perspective showing the cam-shaft on which are mounted the cams for folding the marginal panels of the liner around the rear face of the form, the cam for registering device for the carton blank, and the cam for folding one of the marginal panels of the carton blank;

Fig. 14 is a detail perspective showing the folding members for the marginal panels of the liner;

Fig. 15 is a plan view of the machine with a preferred form of folding members for the marginal panels of the blank;

Fig. 16 is a perspective view of one of said folding members;

Fig. 17 is an elevation corresponding to Fig. 16;

Fig. 17ª is a perspective view of the folder member for the marginal panel of the carton blank that is folded into engagement with the glued panel; and Fig. 17ᵇ is a similar view of a different embodiment;

Fig. 18 is a detail of the folding rollers for the glued marginal panel of the carton blank;

Fig. 19 is a perspective view of a carton form provided with a vertical channel on its rear face, and with its top so formed that the end flaps of the liner may be readily sealed thereagainst;

Fig. 20 is a section in elevation corresponding to Fig. 19;

Fig. 21 is a perspective view showing a modified construction of carton form;

Fig. 22 is a sectional view corresponding to Fig. 21;

Figs. 23 and 24 are plan views of further modifications of the forms.

Referring to said drawings, wherein like reference numerals indicate like parts, 10 is the usual continuously driven conveyor passing around sprockets 11 and 12 on shafts 11′ and 12′, respectively, mounted as desired in the machine frame, and carrying a plurality of suitably spaced forms 13 to which the liners and carton blanks are fed and about which they are wrapped and from which the lined cartons are removed in any suitable or usual manner. An air-blast through said forms, as disclosed in Johnson Patent No. 1,052,667 dated Feb. 11, 1913, may, if desired, be employed.

A roll 14 of liner paper is supported in any suitable manner, the proper length for each separate liner being cut off by any suitable severing means and fed downward between belts 16 and plates 17. Said belts pass around pulleys on shaft 16′ (Fig. 4) which latter is suitably driven, as from shaft 11′ by belts 16″ (Fig. 4). The liner is fed past a gluing wheel 18, associated with a glue box 18′, which applies a thin film of glue to the edge of the liner, and then in front of one of the continuously moving forms 13 which passes between a pair of vertically disposed rollers 19 and 19′ (Fig. 3ª) and spring-pressed guide rails 108 and 109, said rollers and rails being suitably mounted in the machine frame. Thus the side portions of the liner are folded against the form. Thereupon folder member 20 (Fig. 3ª) operates to fold the glued flap against the form and immediately thereafter folder member 21 acts on the other end flap to press it against said glued flap. The construction and operation of said folder members are preferably the same as the folder member for the carton blank hereinafter described. Preferably, folder 20 is carried by a lever 20′ pivoted at 20″ to the machine

frame and is operated by cam 78′ on shaft 97′ through link 20‴ (Figs. 3ª, 8, 13 and 14). Folder 21 is similarly mounted and is operated by cam 78″ through link 21‴.

The front and rear top flaps of the liner are closed by the flap folders 22 and 22′ (Figs. 1 and 5), and the side flaps are closed thereon by any usual flap folders, as stationary flap folders 23 and 24. Glue may be applied either to one or both of the top side flaps of the liner, preferably to only one, by the glue mechanism 25. The top flap folder 23 first operates, then the glue is applied, this being immediately followed by the operation of the top flap folder 24; whereupon the liner, sealed along a rear longitudinal line and with bottom closed, approaches the carton blank resting on supports 26 and 27 (Figs. 1 and 8), carried by the machine frame, where it has been deposited by the blank feed mechanism after being withdrawn from the hopper 28.

In Fig. 12 is illustrated one form of blank for a well-known carton, 29 indicating the panel that is engaged by the front of the form 30, and 31 the panels that are pressed back against the sides of the form, 32 the panel to which glue is applied, and 33 the panel that is secured to the glued flap 32.

The hopper 28 and the means for feeding the blanks in front of the forms to which liners have been applied will now be described.

As illustrated, in Figs. 1 and 9, a large number of blanks arranged on edge are supported by the base 34 of the hopper. This arrangement simplifies and renders easier the feed of the foremost blank and enables the supply of blanks in the hopper to be replenished without stopping the machine. The supply of blanks in the hopper is constantly fed forward by a follower 35 carried by a plurality of chains 36 passing over sprockets mounted on shafts 38, which latter are bevel-geared to shaft 39, and a bottom chain 38′ passing around a sprocket 39′ on shaft 39 (Fig. 9). On the latter shaft is mounted a ratchet 40 which is rotated to revolve said shaft by means of a pawl 41 carried by a pivoted arm 41′, periodically operated through link 42′ into feeding engagement with said ratchet by a cam 42 mounted on shaft 43. Fingers 44 carried by shaft 45, suitably mounted in the machine frame, press against the front of the supply of blanks and, if undue feeding pressure is exerted against the pile, said fingers are moved, thereby rotating shaft 45 and, through connections 46, elevating said pawl 41 out of engagement with its ratchet.

The downward movement of the foremost blank of the supply is effected by the feed wheels 47 mounted on shaft 43 provided in their peripheries with rubber inserts 48, said wheels cooperating with rubber-faced blocks 49 mounted on rod 50. This mechanism may be, and preferably is, the same as that shown in Johnson Patent No. 1,096,918 dated May 19, 1914, and need not be further described.

As the foremost blank is fed downward, a plurality of curved supporting fingers 51 (Fig. 11) each carried by a sleeve 51′ on said rod 50, are swung forward into engagement with the rear of said blank, and are thus in position to catch a second blank if it should be withdrawn from the hopper with the first. Said supporting fingers are preferably operated by an adjustable two-part cam 52 on shaft 43 operating through link 53 to rock on arm 54 pivoted at 55 to the frame. Links 56 extend forward from one end of said arm, each being connected to the lower end of an arm 50′ projecting downward from its associated sleeve 51′. Spring 57, one end of which is connected to a link 56 and the other anchored to the frame, normally holds said fingers in their rearward position.

As the blank is fed downward, the flap 32 may be engaged by means for bending the same forward so that, first, the glue may be readily applied thereto and, second so that the panel 33 may be readily turned down thereon. It is quite desirable, not to say necessary, that the operation of the bending means should not retard the movement of that edge of the blank and hence there is provided a channelled or grooved roller 60 (Fig. 10) mounted on a pin 61 carried by a bracket 61′ secured to the frame of the machine, the groove of which is preferably V-shaped in cross-section. With this roller 60 there cooperates a roller 62 which engages in said groove. This roller 62 is mounted on a shaft 63 and is driven from shaft 64 through sprockets 65 and 66 and sprocket chain 67. The flap 32 passes between said rollers, being pressed into said groove and bent at an angle to the main body of the blank.

Thereupon the blank is fed between two sets of rubber-covered rollers 70 and 71, the former being mounted on shaft 73 and the latter on shaft 64. Shaft 64 is driven from shaft 73, a gear 64′ on the former meshing with a gear 73′ on the latter. Shaft 73 is driven from shaft 74 (Figs. 1 and 10) through chain 75. These shafts are rotated at high speed to accelerate the downward feed of the blank. When it is considered that the machine is run normally at the rate of 60 cartons per minute, it will be appreciated that this acceleration in the downward feed of the blanks is quite desirable in order that a blank may be properly positioned in front of each rapidly moving form. Shafts 64 and 73 are geared together and are driven from shaft 74 (as stated) through a sprocket chain 75 passing around sprockets 64 and 74′ on shafts 73

and 74, respectively. A pinion 76 carried by shaft 74 meshes with a gear 77 carried by shaft 78. There is preferably a 2 to 1 ratio between sprockets 64′ and 74′, and preferably a 5 to 1 ratio between gear 77 and pinion 76, hence the accelerated speed of rotation of the rollers 70 and 71. Shaft 78 is driven from shaft 12′ by chain 79 and shaft 43 is driven from shaft 78 by chain 78′.

As the blank is fed downwardly, the panel 32 engages a glue roll 80 (Fig. 2) so that a thin film of adhesive is applied thereto, and the blank is then deposited on supports 26 and 27 (Figs. 1, 3 and 8) arranged on either side of the path of the moving forms. If desired, each form may be provided with a support 13ᵇ (Fig. 6) to position the blank thereon, tho the spring-pressed rails (hereinafter described) will in most instances prevent the blank from slipping down on the form.

A vertical guide 83 is arranged adjacent one edge of the blank and, as soon as the same engages said supports, a laterally-moving aliner or registering device 84 engages the other edge of the blank and shifts the same into engagement with said guide, whereby the blank is exactly positioned in front of the approaching form. This aliner is operated by a cam 85, mounted on shaft 97′, through bell-crank lever 87 pivoted at 87′ to a bracket 84′, and link 87″.

As the front of the liner-covered form engages the panel 29 of the positioned blank, it forces said blank between two vertically-disposed rolls 90 and 91 (Figs. 3, 6, 7 and 15) which may yield laterally by reason of the provision of springs 92, and thus forces panels 30 and 31 backward against the sides of the form. The bent glued panel 32 is by the same means moved behind the form so that it is only necessary to fold the panel 33 thereon. This may be effected by a folder member pivoted at 95, which folder member consists of a vertically disposed roller or strip 96 carried by a sharply bent arm 96′. The roller or strip is moved quickly inwardly across the path of the form just as the latter passes, and thus wipes or folds the panel 33 downwardly onto the glued flap 32, and is at once withdrawn. Said roller or strip is operated by a cam 97 (Figs. 6 and 13) on shaft 97′ through arm 95′, link 98, and arm 99 pivoted at 99′ to the machine frame. Said shaft 97′ is driven from shaft 12′ (Figs. 1, 3, 6 and 13) through sprocket chain 97‴ passing over sprockets 12″ and 97″ on shafts 12′ and 97′, respectively. A spring 99″ connected at one end to the pivoted arm 99 and anchored at its other end to the machine frame tends to force said roller 96 into engagement with the panel 33 of the blank. The cam 97 acts to remove said roller.

As soon as the panel 33 has been moved into contact with the glued panel 32, a clamp 100 (Figs. 5 and 7), preferably carried by and moving with each form, engages the carton along the glued line and holds it clamped against the form until the carton is to be removed. The carton is thus securely glued and held until the adhesive has set. The clamp 100 is mounted on an upright 101 being pivoted at 102 with a slight play. The upright is carried by an arm 103 pivoted at 104 to an abutment 105 mounted on the block 13′ that carries the form 13. A spring 106, one end of which is secured to the arm 103 and the other anchored to the block 13′, normally holds the clamp against the carton. The clamp is released to permit removal of the carton, and the folding of a blank about a form, by a stationary cam rail 107. The spring 106 acts to effect the clamping as soon as panel 33 is folded onto panel 32, at which point the cam rail ends; and the release is effected when the roller 103′ mounted on the free end of the arm 103 engages said cam rail 107 when the cartons are delivered onto the off-bearing conveyor 107′ (Fig. 1). Instead of such a spring-actuated clamp, I may employ a rubber-faced clamp operated by a cam-actuated toggle, said toggle being cam controlled both in its opening and closing.

After the blanks pass the vertically disposed rollers 90 and 91, the panels 30 and 31 of the blanks are engaged by spring-pressed guide rails 108′ and 109′ suitably mounted on brackets 108″ and 109″, two rails being preferably disposed on each side of the path of the moving form. These rails hold the panels of the blank closely against the form so that all chance of displacement is avoided.

After the blank has been wrapped around the form and clamped by the device 100, the front and rear top flaps are closed by the usual flap closers 110 and 111, the latter acting also to spread the side top flaps which then pass under the glue rolls 112 and are finally closed by any suitable or usual flap closers 113 (see bottom of Fig. 1). Any suitable devices for these purposes, such as those disclosed in Johnson Patent No. 1,052,667 may be employed, and hence need not be more particularly described.

It sometimes happens that the carton when it reaches the point of removal from the form is not removed and passes through the machine a second time; and, if a blank were fed down in front of a form which carried a carton, the machine would become jammed. I have accordingly provided means for preventing the feed of a blank under these conditions. As illustrated (see Figs. 5, 6 and 8), each form is provided with a groove 115 along one side through which

a feeler 116 normally passes. This feeler is pivoted on upright 117 and, if said finger is moved outwardly by the presence of a carton on the form, a second upright pivoted member 118 will be rotated through arm 119 and link 120, thus moving a stop 120′ into the path of a pivoted finger 121 carried by one member of a clutch 122 on shaft 78, so that said clutch will be opened when the finger 121 is rocked by engagement with said stop 120′, and all the carton feed wheels associated with the hopper, which are driven from shaft 78, will be stopped in their rotation, thus preventing the feeding of the blank.

The paper-feed mechanism may be driven in any suitable manner so long as the feed of the paper is accurately timed with respect to the travel of the continuously moving forms 13. As clearly illustrated in Figs. 1, 3ª and 4, the paper web 123 passes from the roll 14 around rollers 124 and 125, suitably mounted in a bracket 126, and thence downwardly between rolls 127 and 128 also suitably mounted in bracket 126. Below these two rollers is mounted the paper severing mechanism, preferably in the form of a pair of rolls 129 and 130, the latter carrying the knife 131 that severs the paper. The four rolls last mentioned are geared together and are driven from shaft 11′ by means of a sprocket chain 132 passing around a sprocket on shaft 133, on which latter the severing roll 130 is mounted. A gear on shaft 133 meshes with a gear on shaft 134 on which roll 129 is mounted. Shaft 135 on which roll 128 is mounted is driven from shaft 133 through a movable gear 136. The latter is preferably mounted on an arm 137 pivoted at 138 (Fig. 4) so that it may be moved into and out of engagement with the gears on shafts 133 and 135. The gear on shaft 133 is shown at 139 and the gear on shaft 135 is numbered 140. The roll 127 is mounted on a shaft 141 that carries a gear 142 meshing with gear 140 on shaft 135.

It will be understood that any desired length of paper may be automatically severed by changing the size of the gears and rolls employed.

The driving connections of the machine are so devised as to provide the most accurate timing of the various parts in order to insure the delivery of the severed liner sheets and the carton blanks in front of the continuously moving forms at the precise moment that they are needed. This is of great importance in view of the fact that the machine is a continuously operating one and is devised to wrap the liners or carton blanks or both about the continuously moving forms at the rate of approximately 60 per minute. It is therefore pointed out that the devices for feeding the cartons from the hopper in front of the moving form are driven from the shaft 12′ about which the main conveyor 10 passes, and that the paper-feed mechanism is driven from the shaft 11′ about which the main conveyor also passes. The operation of the carton feed and the paper feed is thus coordinated and synchronized with the movement of the forms carried by the main conveyor 10.

Referring to Fig. 1, it is pointed out that 143 is the motor shaft which drives counter shaft 144 through belt 145. A belt 146 passes around a pulley on shaft 144 and also around a pulley 147 on shaft 148. From shaft 148 the power is transmitted to the shaft 12′ through sprocket chain 149. Shaft 97′ is driven from shaft 12′ through sprocket chain 97″; shaft 78 is driven from shaft 12′ through sprocket chain 79; shaft 43 is driven from shaft 78 through sprocket chain 78′; and shaft 133 of the paper-feed mechanism is driven from shaft 11′ through sprocket chain 132.

In Figs. 15 to 18 is shown a preferred form of folding mechanism for bending and closing the panels 32 and 33 against the rear face of the form. When this construction of folding mechanism is employed, the rollers 60 and 62 for bending the panel 32 may be dispensed with if desired. This device may, however, be employed either separately or in conjunction with the folding members heretofore described.

As illustrated, a folding member employing a plurality of knife-edge rollers 150, 168 and 169 (Figs. 16, 17 and 18) act to fold the panel 32 around the rear of the former. These rollers are mounted in a carrier 151 pivoted at 152 to a slide 153. Said slide is mounted on and movable with a carriage 154 slidable longitudinally of the machine on rods 155. In addition, said slide is movable transversely of said carriage across the rear of the form. The movements of the carriage and slide are effected by a stationary cam mounted on a bracket 156 carried by the machine frame. Said cam has a groove 157 into which projects a pin 158 fixedly secured to the under face of slide 153. Said pin also passes through an elongated slot 159 in arm 160 keyed on an upright shaft 161 eccentrically mounted with respect to cam groove 157. This shaft carries a bevel gear meshing with a bevel gear 162′ carried by a shaft 163 which latter also carries a bevel gear 165 that meshes with a bevel gear 164 on shaft 12′ from which said folders are accordingly driven.

Through these connections said folder will engage the glued flap 32 preferably at its junction with the side panel 31, bend it sharply around the form and travel with it an appreciable distance.

In order to secure a sharp bend of the panel, the folder is pressed by spring 166 so

that it may yieldingly engage the side of the carton and then suddenly wipe around the rear of the same.

The folder rollers 150, 168 and 169 are mounted to revolve freely and are made with a knife edge so that they will not pick up the glue on the flap 32. In addition, they are mounted on the carrier 151 so that a space is left between each end pair and hence this folder device may span the side rails 108'. The three intermediate rollers 150 are carried by a pin 167 and the end rollers 168 and 169 are carried by studs 170 and 171 on arms 172 and 173 of said carrier.

The folder for the panel 33 is positioned on the other side of the conveyor and is arranged to act immediately after the folder for panel 32. It is similarly constructed and operated, except that, in place of knife-edge rollers, I preferably employ rollers 150^a, 168^a, and 169^a, such as illustrated in Figs. 15 and 17^a. If desired, I may employ a blade or bar 174 (Fig. 17^b) that is slightly curved at its engaging end and is also provided with a spring 175 so that it will yieldingly engage the side panel 30 of the blank. Said bar is cut away at two places 174^a so that it will span the spring-pressed guide rails. This folder operates on panel 33 immediately after the panel 32 has been folded, said folder yieldingly engaging the side panel 30, and then wiping sharply around the rear face of the form, whereby the panel 33 is perfectly folded with relation to panel 32.

The provision of folding members arranged on each side of the conveyor and oppositely operating to fold the marginal panels into engagement against the rear face of the form insures the formation of cartons that respond to the exacting requirement of the art with respect to excellence and sightliness.

In Figs. 19 to 24 inclusive I have illustrated several modified constructions of the form 13. In Figs. 19, 21 and 23 there is shown a vertical channel or groove 175 formed in the rear face 13^a of the form. This channel or groove is particularly desirable when unlined cartons are being made on the forms as it sometimes happens that when the marginal panel 33 of the blank is folded and clamped against the glued panel 32 some of the adhesive will be squeezed out. The channel 175 receives this squeezed out adhesive which, except for the presence of said channel, would be smeared on the face 13^a and the carton.

In Fig. 23 is shown the air-discharge opening 176 positioned centrally of the form 13 as usual. In certain instances, when the machine is forming liners on the forms, this positioning of the air-discharge opening is objectionable as there would be no support for the end flaps when they were pressed down to glue the same together. Accordingly, I have provided and illustrated several constructions which, while permitting sufficient air to be discharged through the form to remove the liner or the lined carton, at the same time provides a surface against which the end flaps may be pressed to securely glue the same together.

In Figs. 21 and 22 I have provided two air-discharge passages 176^a with an intermediate imperforate support 177 against which the flaps are pressed. In Figs. 19 and 20 I have modified this construction by providing perforations 178 in the surface 177 so that more air may be discharged. In Fig. 24 I have positioned the air-discharge 176^b along one side of the form so that the center of the top of the same remains imperforate.

While it is preferred to employ in combination the liner-forming and carton-forming devices, it is to be understood that in certain cases it will be desired to form only the cartons without a liner, and in certain other cases to utilize the liner-forming mechanism without the carton-forming mechanism, the cartons (already formed), if desired, being placed on the liner-covered formers by hand. Further, it may sometimes be desired to feed the blanks to the moving forms by hand, and to apply the adhesive to the blank before it is so fed. In addition, wax paper will sometimes be employed as liners, in which event it will be unnecessary to apply adhesive thereto, the sealing of the liners being effected by heat and pressure in the usual manner.

While, for the purpose of illustration, various expressions of the inventive idea have been herein shown and described in considerable detail, it is to be understood that the invention is not to be limited to the particular construction shown but that the inventive idea is susceptible of embodiment in various mechanical expressions within the limits of the appended claims.

What is claimed is:—

1. In combination, a movable conveyor, a continuously moving form carried thereby and about which a paper blank is adapted to be wrapped, yielding guide rails between which said form passes and which act to force the blank into engagement with the sides of the form and hold it in said relation, and means positioned on either side of said conveyor and operating transversely of said rails and closing the paper blank against the rear face of said form.

2. In combination, a movable conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, yielding guide rails between which said form passes and which act to force the blank into engagement with the sides of the form and hold it in said relation, and means

traveling transversely of said rails and also in the direction of movement of said form and closing the carton against the rear face of said form.

3. In combination, a movable conveyor, a continuously moving form carried thereby and about which a paper blank is adapted to be wrapped, means feeding a blank into the path of movement of said form, yielding guide rails between which said form passes and which act to force the blank into engagement with the sides of the form and hold it in said relation, and means positioned on either side of said conveyor and operating transversely of said rails and closing the blank against the rear face of said form.

4. In a machine of the character described, the combination of a continuously moving form about which a carton blank is adapted to be wrapped, means applying adhesive to one marginal panel of said blank, means automatically wrapping said blank about said form, and means pressing the other marginal panel against said glued panel on the rear face of said form.

5. In a machine of the character described, the combination of a continuously moving form about which a carton blank is adapted to be wrapped, means automatically wrapping said blank about said form, and means forcing the lateral marginal panels of said blank into engagement against the rear face of said form.

6. In a machine of the character described, the combination of a continuously moving form about which a carton blank is adapted to be wrapped, means for feeding a carton blank into the path of movement of said form, means applying adhesive to one marginal panel of said blank as it is so fed, means automatically wrapping said blank about said form, and means pressing the other marginal panel against said glued panel on the rear face of said form.

7. In a machine of the character described, the combination of a conveyor, a continuously moving form carried thereby, means for feeding a paper blank into the path of movement of said form, means folding and holding the side panels of said blank against said form, means engaging one lateral marginal panel of said blank and folding it against the rear face of said form, and independent means engaging the other lateral marginal panel and folding it against said first mentioned marginal panel.

8. In a machine of the character described, the combination of a conveyor, a form carried thereby, means for feeding a carton blank into the path of movement of said form, means folding and holding the side panels of said blank against said form, means engaging one lateral marginal panel of said blank and folding it against the rear face of said form, independent means engaging the other lateral marginal panel and folding it against said first-mentioned marginal panel, and means pressing said engaged marginal panels against the rear face of said form.

9. In a machine of the character described, the combination of a conveyor, a form carried thereby about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, a folder member having a lateral and forward movement engaging one marginal panel of said blank and folding the same against the rear face of said form, and a second folder having a lateral and forward movement engaging the other marginal panel of said blank and folding the same against the rear face of said form.

10. In a machine of the character described, the combination of a conveyor, a form carried thereby about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, a folder member having a lateral and forward movement engaging one marginal panel of said blank and folding the same against the rear face of said form, a second folder having a lateral and forward movement engaging the other marginal panel of said blank and folding the same against the rear face of said form, and means pressing said marginal panels against each other and the rear face of said form.

11. In a machine of the character described, the combination of a conveyor, a form carried thereby about which a carton blank is adapted to be wrapped, means for feeding a carton blank into the path of movement of said form, means folding the side panels of said blank against said form, a yielding folder member having a lateral and forward movement engaging one marginal panel of said blank and folding the same against the rear face of said form, and a second yielding folder having a lateral and forward movement engaging the other marginal panel of said blank and folding the same against the rear face of said form.

12. In a machine of the character described, the combination of a conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, a pair of yielding folder members one arranged on each side of said conveyor, means for moving said members laterally and forwardly in timed relation with respect to each other and said form whereby the marginal panels of said blank are folded against the rear face of said form.

13. In a machine of the character described, the combination of a conveyor, a form carried thereby and about which a

carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, means applying adhesive to one of the marginal panels of said blank, a folder member having a lateral and forward movement with respect to said form and yielding in the line of movement thereof, means engaging said member with said blank at the junction of one side panel and said glued panel whereby said glued panel is sharply folded against the rear face of said form, a second folder member having a lateral and forward movement with respect to said form and yielding in the line of movement thereof, and means engaging said second member with said blank at the junction of the other side panel and the other marginal panel whereby said last-mentioned panel is sharply folded against the rear face of said form and into engagement with said glued panel.

14. In a machine of the character described, the combination of a conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means for feeding a carton blank into the path of movement of said form, means folding the side panels of said blank against said form and yieldingly pressing the same thereagainst, a pair of yielding folder members one arranged on each side of said conveyor, means for moving said members laterally and forwardly in timed relation with respect to each other and said form whereby the marginal panels of said blank are folded against the rear face of said form.

15. In a machine of the character described, a movable conveyor, a continuously moving form carried thereby and about which a paper blank is adapted to be wrapped, means folding the side panels of said blank against said form, and means engaging the marginal panels of said blank and oppositely operating across said form whereby said marginal panels are pressed against the rear face of said form.

16. In a machine of the character described, a continuously movable conveyor, a continuously moving form carried thereby and about which a paper blank is adapted to be wrapped, means for feeding a paper blank into the path of movement of said form, means folding the side panels of said blank against said form, and yielding means engaging the marginal panels of said blank and oppositely operating across said form whereby said marginal panels are pressed against each other and the rear face of said form.

17. In a machine of the character described, a movable conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, and yielding means arranged on either side of said conveyor having a lateral and forward movement engaging the marginal panels of said blank and oppositely operating across said form whereby said marginal panels are pressed against each other and the rear face of said form.

18. In a machine of the character described, a movable conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, means applying adhesive to one of the marginal panels of said blank, means arranged on either side of said conveyor having a lateral and forward movement and engaging the marginal panels of said blank and oppositely operating across said form, the said means engaging the glued panel first operating and the means engaging the other marginal panel thereafter operating whereby the last-mentioned panel is pressed against said glued panel.

19. In a machine of the character described, a movable conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, means applying adhesive to one of the marginal panels of said blank, yielding means arranged on either side of said conveyor having a lateral and forward movement and engaging the marginal panels of said blank and oppositely operating across said form, the said means engaging the glued panel first operating and the means engaging the other marginal panel thereafter operating whereby the last-mentioned panel is pressed against said glued panel.

20. In a machine of the character described, a movable conveyor, a form carried thereby and about which a carton blank is adapted to be wrapped, means folding the side panels of said blank against said form, means applying adhesive to one of the marginal panels of said blank, a folding member for said glued panel including a plurality of knife-edge rollers, and a folder member for the other marginal panel operating oppositely to said first-mentioned member and forcing its panel against said glued panel and the rear face of said form.

21. In a machine of the character described, the combination of a continuously moving conveyor the upper reach of which moves forward in a straight line, a form carried thereby, means for feeding liner sheets into the path of movement of said form and wrapping the same thereabout, and means for feeding carton blanks into the path of movement of said form and wrapping the same around said liner, and means for synchronizing the feed of said liner sheets and blanks with the movement of said form.

22. In a machine of the character de-

scribed, the combination of a continuously moving conveyor the upper reach of which moves forward in a straight line, a form carried thereby, means for feeding liner sheets downwardly into the path of movement of said form and wrapping the same thereabout, and means for feeding carton blanks downwardly into the path of movement of said form and wrapping the same around said liner, and means for synchronizing the feed of said liner sheets and blanks with the movement of said form.

23. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the seame about said form and closing the end thereof, and automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same.

24. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for timing the feed of the paper with the movement of said form.

25. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for timing the feed of the blanks with the movement of said form.

26. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for timing the feed of the paper and blanks with the movement of said form.

27. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for sealing the marginal panels of said blank against the rear face of said form.

28. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for sealing the marginal panels of said blank against the rear face of said form.

29. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for sealing the marginal panels of said blank against the rear face of said form.

30. In a device of the character described, a continuously moving form, a source of liner paper supply, automatic means for feeding a liner sheet to said moving form, wrapping the same about said form and closing the end thereof, automatic means for feeding a carton blank to said form, closing the same about said liner and sealing one end of the same, and means for sealing the marginal panels of said blank against the rear face of said form.

31. In a device of the character described, a moving form about which carton blanks are wrapped, a hopper for said blanks, means for feeding a blank to said form, means for synchronizing said feeding means with said moving form, and automatically operating means engaging the rear of said blank as it is being fed and preventing the feed of a second blank.

32. In a device of the character described, a moving form about which carton blanks are wrapped, a hopper for said blanks, means for feeding a blank to said form, means for synchronizing said feeding means with said moving form, and oscillating means engaging the rear of said blank as it is being fed and preventing the feed of a second blank.

33. In a device of the character described, a moving form about which carton blanks are wrapped, a hopper for said blanks, means for feeding a blank to said form, means for synchronizing said feeding means with said moving form, and pivoted cam-operated means engaging the rear of said blank as it is being fed and preventing the feed of a second blank.

34. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in the path of the moving form, means for synchronizing said feeding means with said

moving form, a guide on one side of the path, and automatically operated means for registering said blank with said guide.

35. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in the path of the moving form, means for synchronizing said feeding means with said moving form, and a registering device shifting said blank laterally to exactly position the same relatively to said form.

36. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in the path of the moving form, means for synchronizing said feeding means with said moving form, and an automatically operating registering device engaging one edge of said blank and exactly positioning the same relatively to said form.

37. In a device of the character described, a moving form about which carton blanks are wrapped, means for applying glue to one panel of the blank as it is being fed in front of said form, and means for clamping the blank against said form after it has been wrapped around the same.

38. In a device of the character described, a moving form about which carton blanks are wrapped, means for applying glue to one panel of the blank as it is being fed in front of said form, and means for clamping the blank against said form along the glued line after it has been wrapped around the same.

39. In a device of the character described, a moving form about which carton blanks are automatically wrapped, and automatically operated means clamping said blank against said form after it has been wrapped about the same.

40. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, and automatically-operating means clamping said blank against said form after it has been wrapped about the same.

41. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, and means moving with said form and clamping said blank against said form after it has been wrapped about the same.

42. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, means moving with said form and clamping said blank against said form after it has been wrapped about the same, and a stationary cam removing said clamp from engagement with said form.

43. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, automatically-operating means clamping said blank against said form after it has been wrapped about the same, and a cam rail removing said clamp from engagement with said form.

44. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, and spring-pressed means moving with said form and clamping said blank against said form after it has been wrapped about the same.

45. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, spring-pressed means moving with said form and clamping said blank against said form after it has been wrapped about the same, and means removing said clamp from engagement with said form.

46. In a device of the character described, a moving form, means for feeding a blank into the path of said form, means for wrapping the blank about said form, means moving with said form and clamping said blank against said form after it has been wrapped about the same, and means removing said clamp from engagement with said form.

47. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in front of said form, and movable means engaging one of the marginal panels of said blank as it is being fed to said form and bending said panel at an angle to the main body of the blank.

48. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in front of said form, rotary means engaging one of the marginal panels of said blank as it is being fed to said form and bending said panel at an angle to the main body of the blank, and means for applying glue to said bent panel.

49. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in front of said form, and cooperating rollers engaging one of the marginal panels of said blank as it is being fed to said form and bending the same at an angle to the main body of the blank.

50. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a blank in front of said form, cooperating rollers engaging one of the marginal panels of said blank as it is being fed to said form and bending the same at an angle to the main body of the blank, and means for applying glue to said bent panel.

51. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a carton blank in front of said form, a grooved roller engaging one of the marginal panels of said blank and bending the same at an angle to the main body of the blank, and means for folding the other marginal panel over said bent panel.

52. In a device of the character described, a moving form about which carton blanks are wrapped, means for feeding a carton blank in front of said form, a grooved roller engaging one of the marginal panels of said blank and bending the same at an angle to the main body of the blank, means for applying glue to said bent panel and means for folding the other marginal panel over said bent panel.

53. In a device of the character described, a continuously moving form about which a carton blank is to be wrapped, a source of carton blank supply, and accelerated feed rollers for moving said carton blank into the path of movement of said moving form.

54. In a machine of the character described, the combination of a conveyor, a form carried thereby and provided in one face with a vertical channel, means applying adhesive to one marginal panel of a blank adapted to be wrapped about said form, means for folding the side panels of said blank against the sides of said form, and means folding said glued panel and the other marginal panel into engagement, said vertical channel being positioned adjacent the line of overlap of said panels to receive any excess adhesive.

55. In a machine of the character described, the combination of a conveyor, a form carried thereby and provided in its rear face with a vertical channel, means applying adhesive to one marginal panel of a blank adapted to be wrapped about said form, means folding the side panels of said blank against the sides of said form, means folding said glued panel and the other marginal panel into engagement and against the rear face of said form, and means for clamping said marginal panels until the adhesive has set, said vertical channel being positioned adjacent the line of overlap of said panels to receive any excess adhesive.

56. In a device of the character described, a form about which carton blanks are adapted to be wrapped and provided on one face with a vertical groove, means for applying glue to one of the marginal panels of said blank, and means for folding the other marginal panel into engagement with said glued panel, said groove being positioned to receive any excess adhesive from said glued panel.

57. In a device of the character described, a form about which carton blanks are adapted to be wrapped and provided on its rear face with a vertical groove, means for applying glue to one of the marginal panels of said blank, and means for folding the other marginal panel into engagement with said glued panel against the rear face of said form, said groove being positioned to receive any excess adhesive from said glued panel.

58. In a device of the character described, a form about which a liner is adapted to be wrapped and provided in its upper end with an air-discharge opening offset from the center of said end, means for applying adhesive to one of the end flaps of said liner, and means for pressing said flaps against said end at a point removed from said discharge opening.

59. In a device of the character described, the combination of a carton blank hopper in which the blanks are supported on edge, means for moving the blanks forward in said hopper, means for feeding said blanks one at a time from said hopper, controlling means engaging the foremost blank and disconnecting said moving means when undue pressure is exerted by said moving means, moving forms to which said blanks are fed, and means synchronizing said feeding means with said moving forms.

60. In a device of the character described, the combination of a carton blank hopper in which the blanks are supported on edge, means for moving the blanks forward in said hopper, means for feeding said blanks one at a time from said hopper, pivoted fingers engaging the face of the foremost blank and movable to disconnect said moving means when undue pressure is exerted by said moving means, moving forms to which said blanks are fed, and means synchronizing said feeding means with said moving forms.

61. In a machine of the character described, the combination of a conveyor, a continuously moving form carried thereby about which a paper blank is adapted to be wrapped, means for folding the side panels of said blank against said form, and means positioned on both sides of said conveyor and oppositely operating to fold the marginal panels of said blank against said form.

62. In a machine of the character described, the combination of a conveyor, a form carried thereby about which a carton blank is adapted to be wrapped, means for folding the side panels of said blank against said form, and means positioned on both sides of said conveyor and having lateral and forward movements and operating to fold the marginal panels of said blank against said form.

63. In a machine of the character described, the combination of a conveyor, a

form carried thereby about which a paper blank is adapted to be wrapped, means for folding the side panels of said blank against said form, and means positioned on both sides of said conveyor and having lateral and forward movements and operating to fold the marginal panels of said blank against said form.

64. In a machine of the character described, the combination of a continuously moving conveyor, a form carried thereby, means for feeding liner sheets into the path of movement of said form and wrapping the same thereabout, means for feeding carton blanks into the path of movement of said form and wrapping the same around said liner, and means for synchronizing the feed of said liner sheets and blanks with the movement of said form.

65. In combination, a source of blanks, means for feeding successive blanks therefrom, moving forms about which said blanks are wrapped, means for removing blanks so wrapped from said forms, and detector mechanism controlling the feed of blanks from said source and operating to interrupt the same should a blank inadvertently remain on its form.

In testimony whereof I have signed this specification.

GEORGE H. BENT.