E. M. HAWKINS.

CARTON BLANK FORMING MACHINE.

APPLICATION FILED JAN. 15, 1912.

1,187,144.

Patented June 13, 1916.

14 SHEETS—SHEET 1.

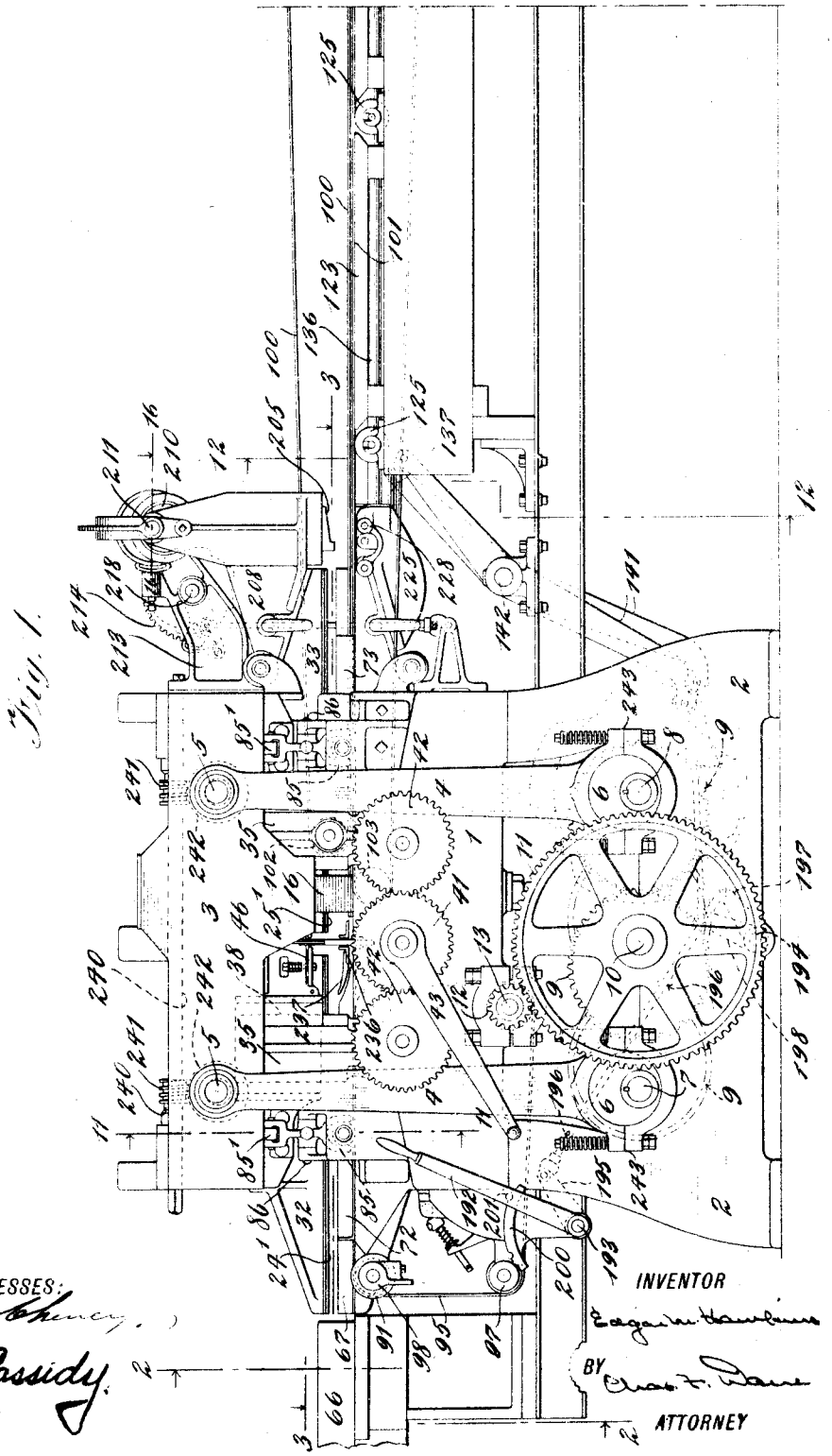

Fig. 1.

WITNESSES:

E. M. Cassidy.

INVENTOR

Edgar M. Hawkins

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14 SHEETS—SHEET 2.

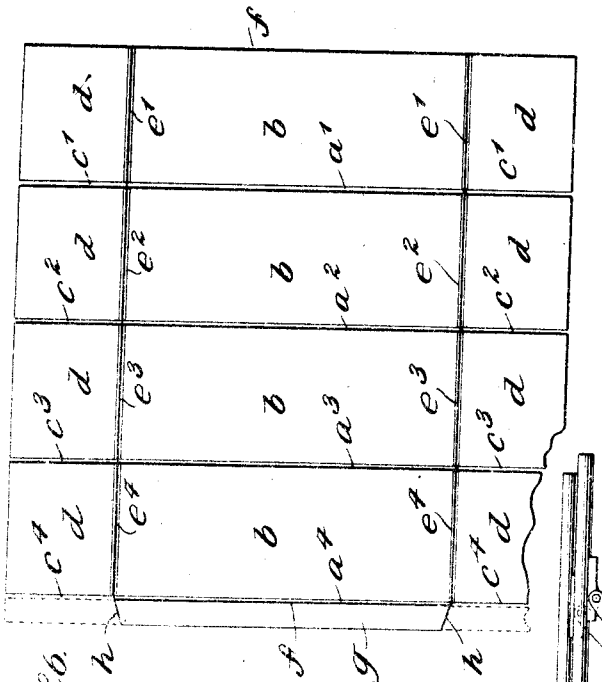

Fig. 26.

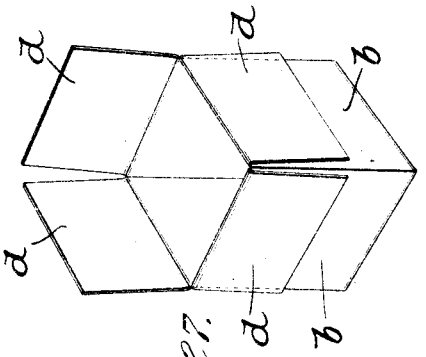

Fig. 27.

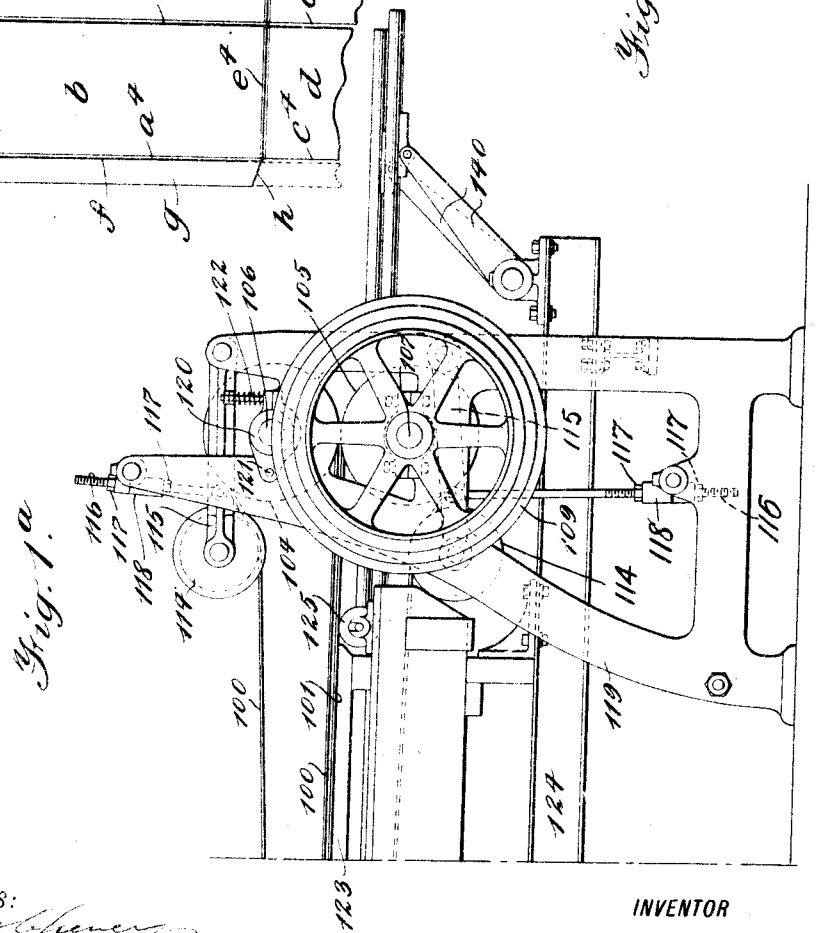

Fig. 1.a

WITNESSES:

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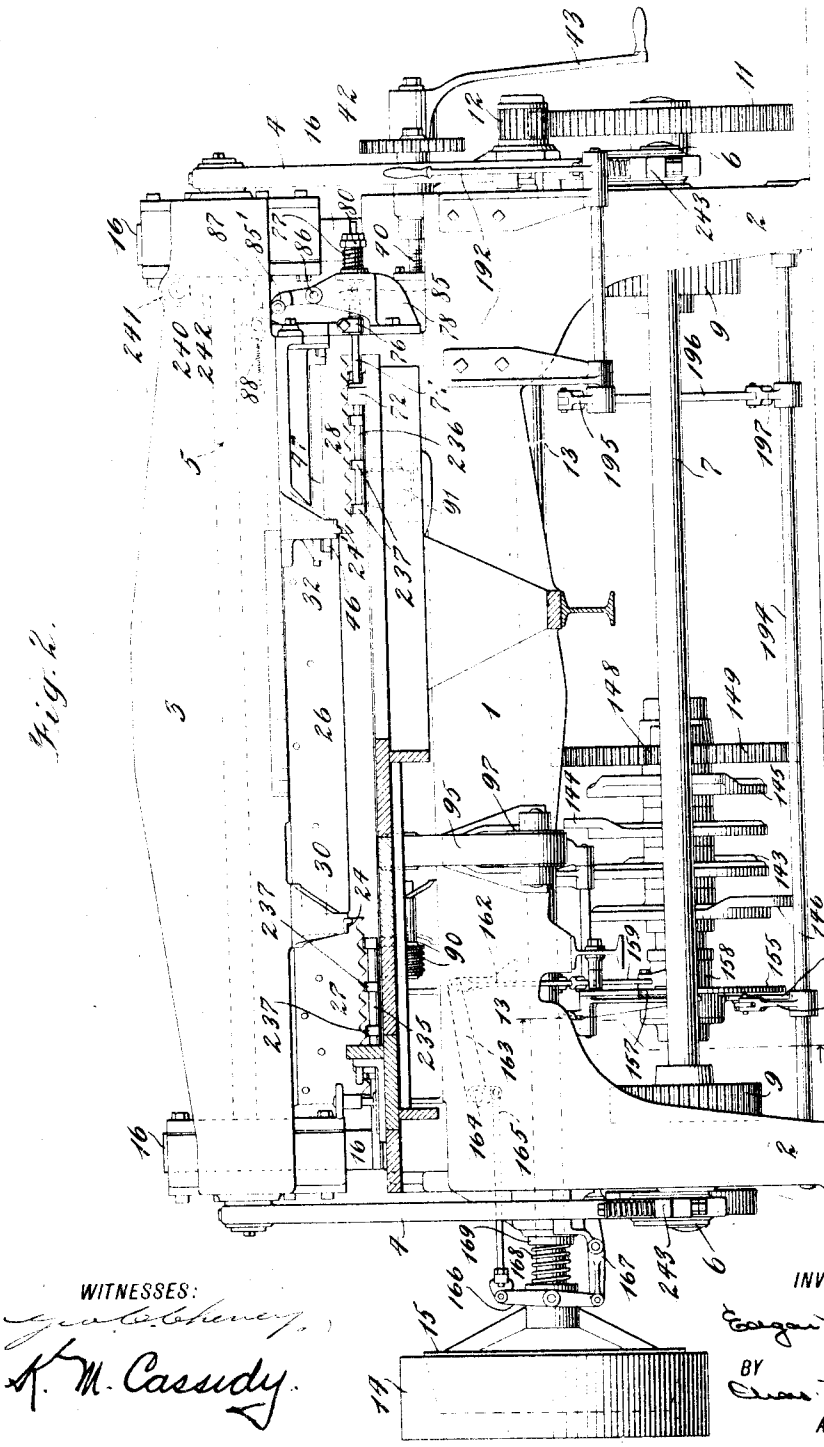
14 SHEETS SHEET 3.

Fig. 2.



WITNESSES:

K. M. Cassidy.

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CARTON BLANK FORMING MACHINE.

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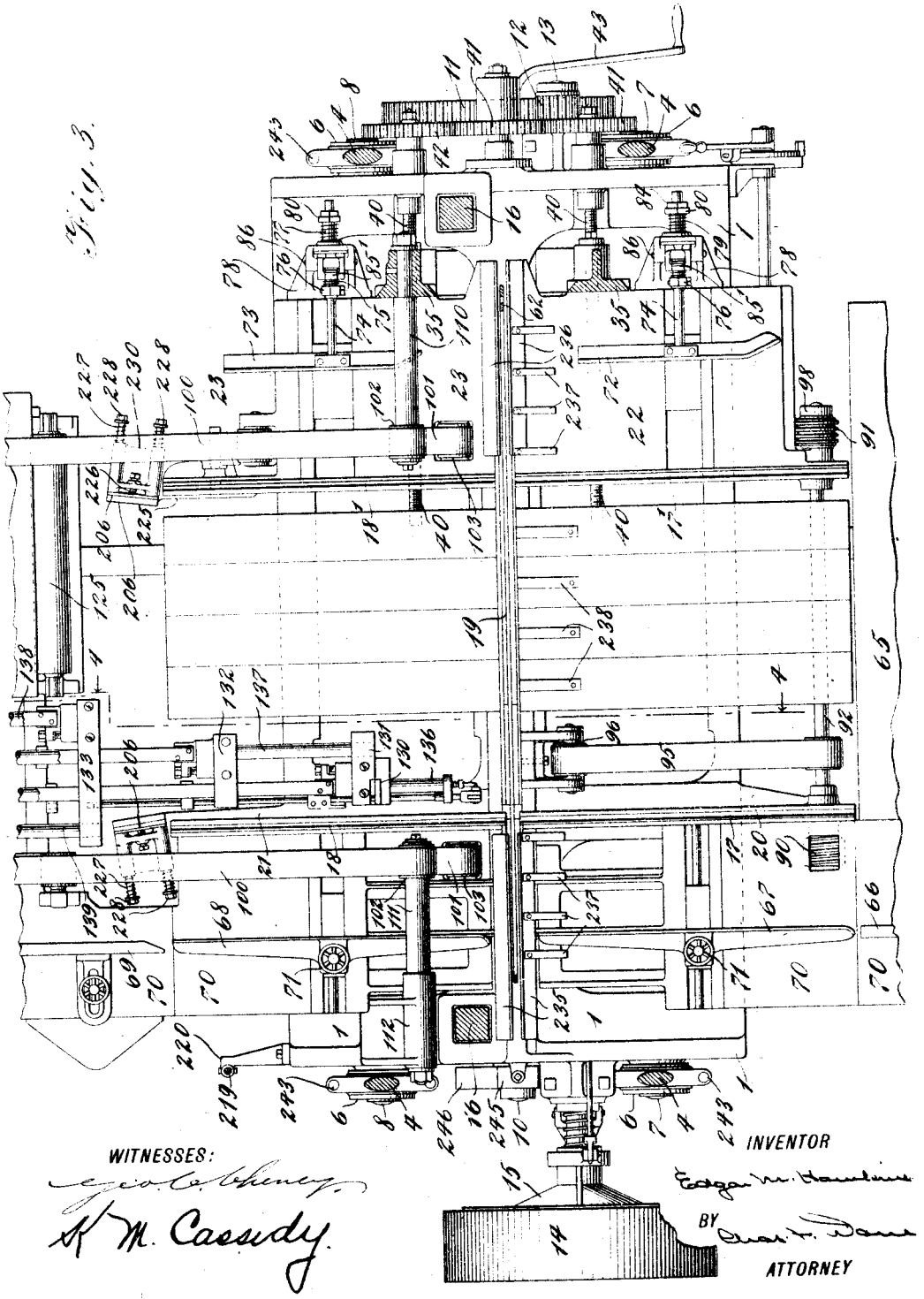

WITNESSES:

H. M. Cassidy.

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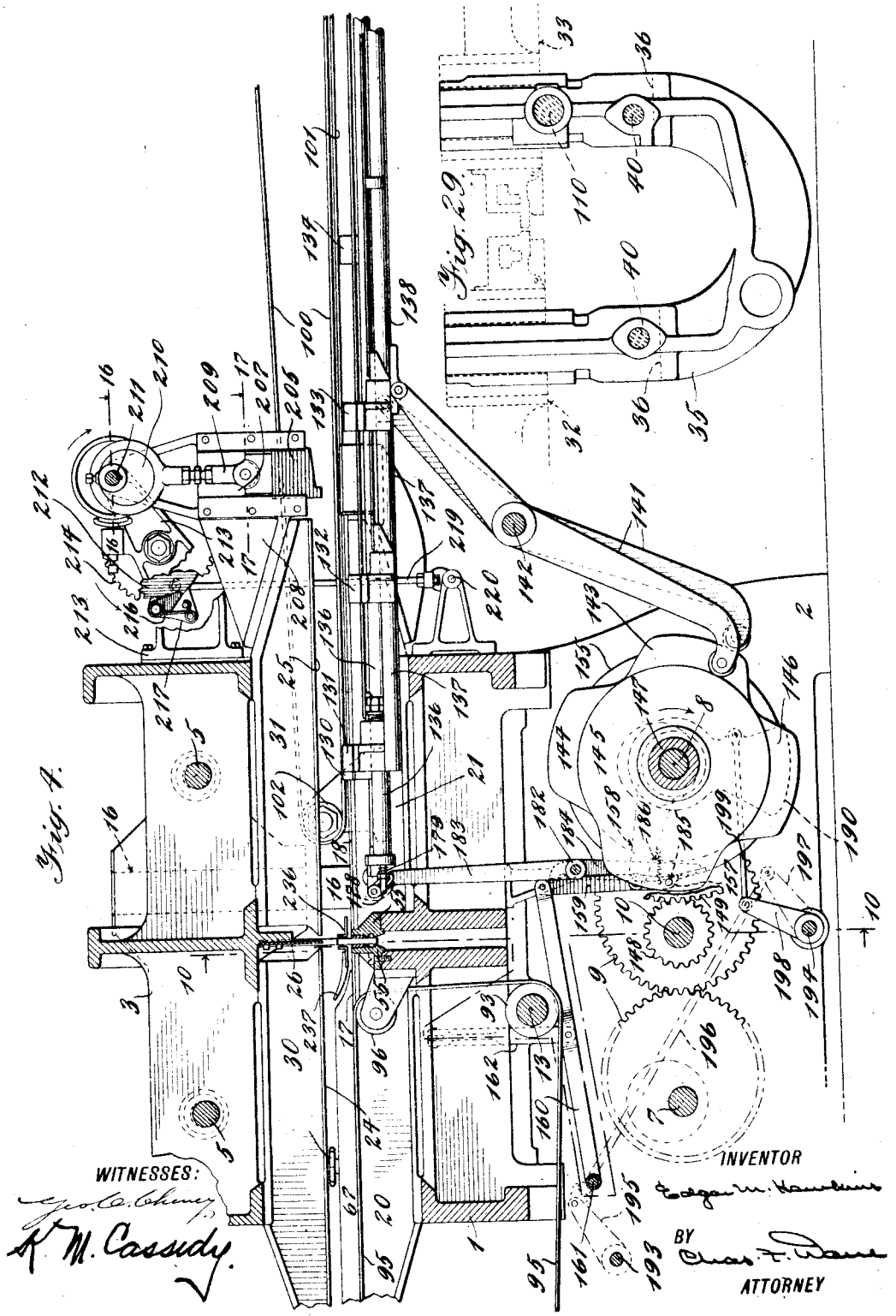

Fig. 4.

Fig. 29.

WITNESSES:

Geo. A. Cheney.

K. M. Cassidy.

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CARTON BLANK FORMING MACHINE.

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14 SHEETS—SHEET 6.

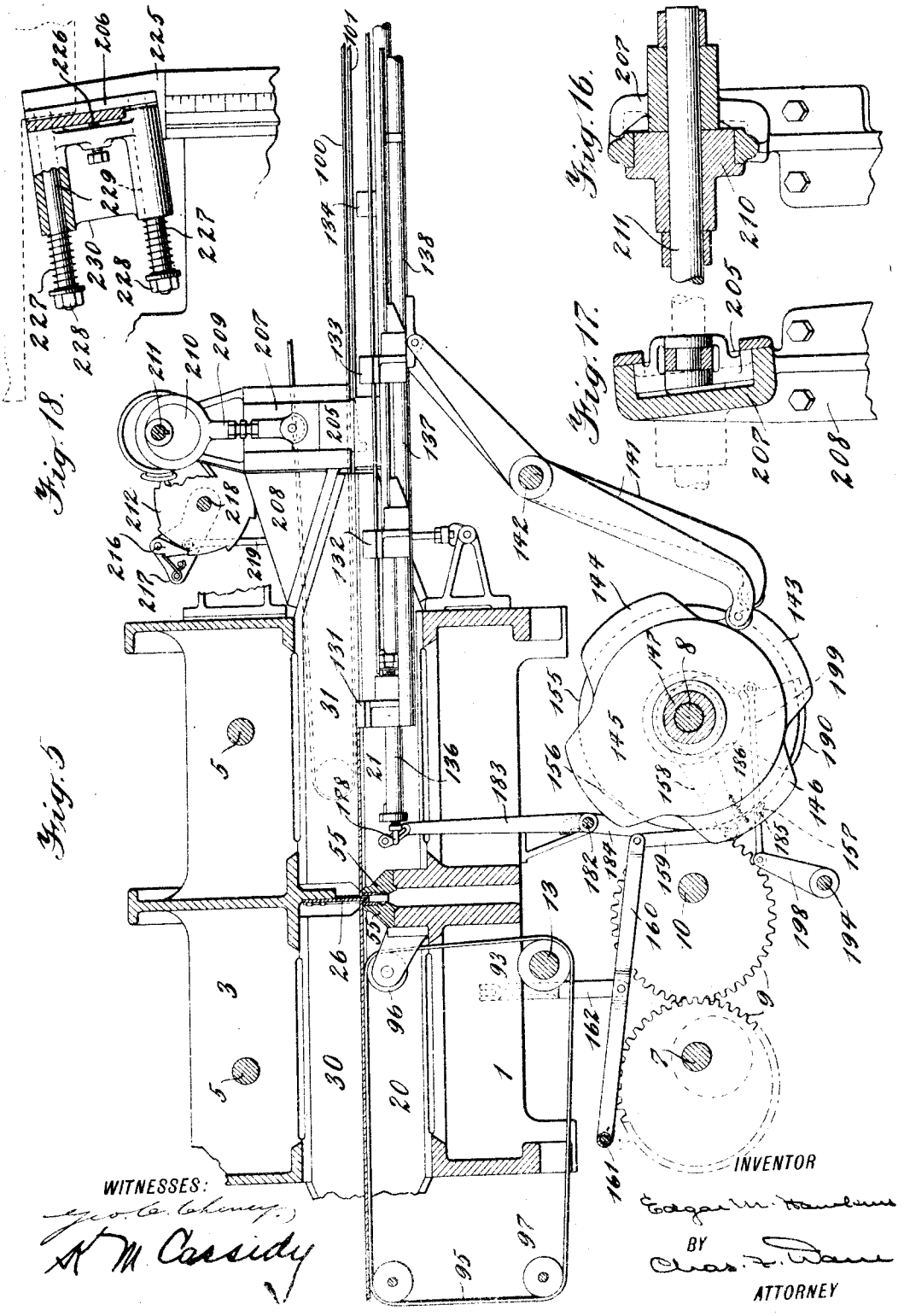

Fig. 16.

Fig. 17.

Fig. 18.

Fig. 3.

WITNESSES:

H. M. Cassidy

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CARTON BLANK FORMING MACHINE.

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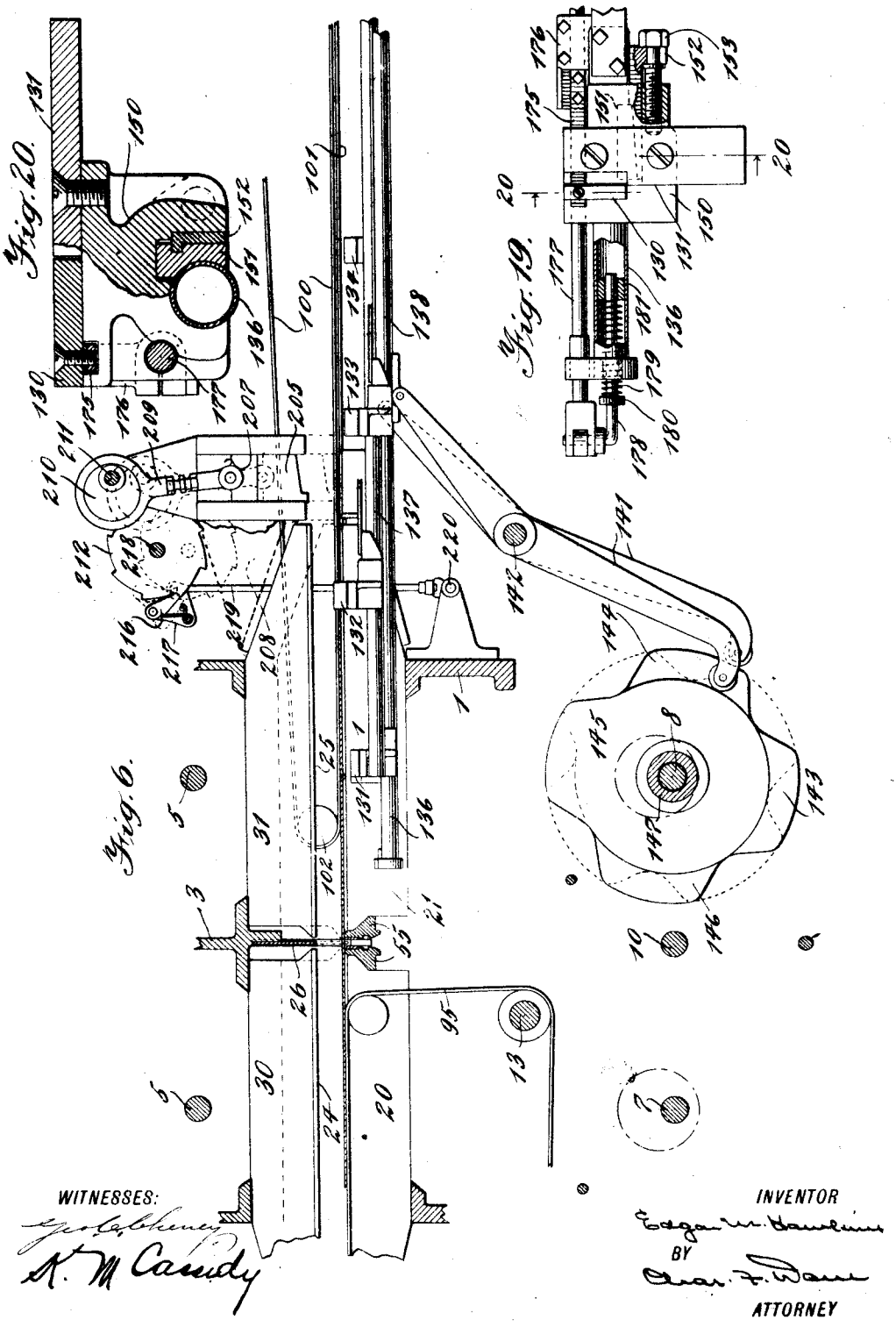
14 SHEETS—SHEET 7.



WITNESSES:

A. M. Cassidy

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CARTON BLANK FORMING MACHINE.

APPLICATION FILED JAN. 15, 1912.

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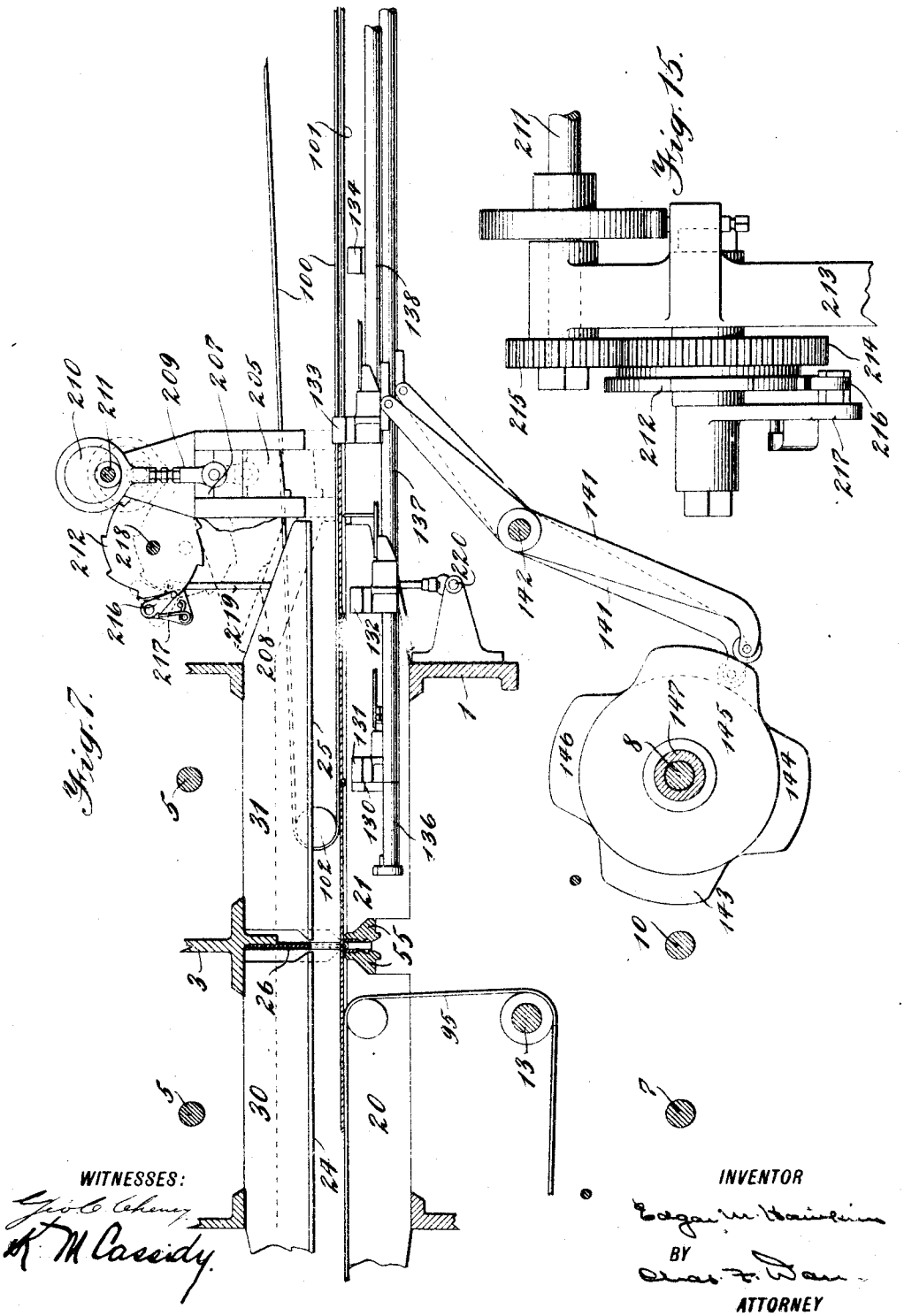
14 SHEETS—SHEET 8.



WITNESSES:

Geo. C. Cheney

H. M. Cassidy.

INVENTOR

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Chas. F. Burton

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CARTON BLANK FORMING MACHINE.

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14 SHEETS—SHEET 9.

Fig. 8.

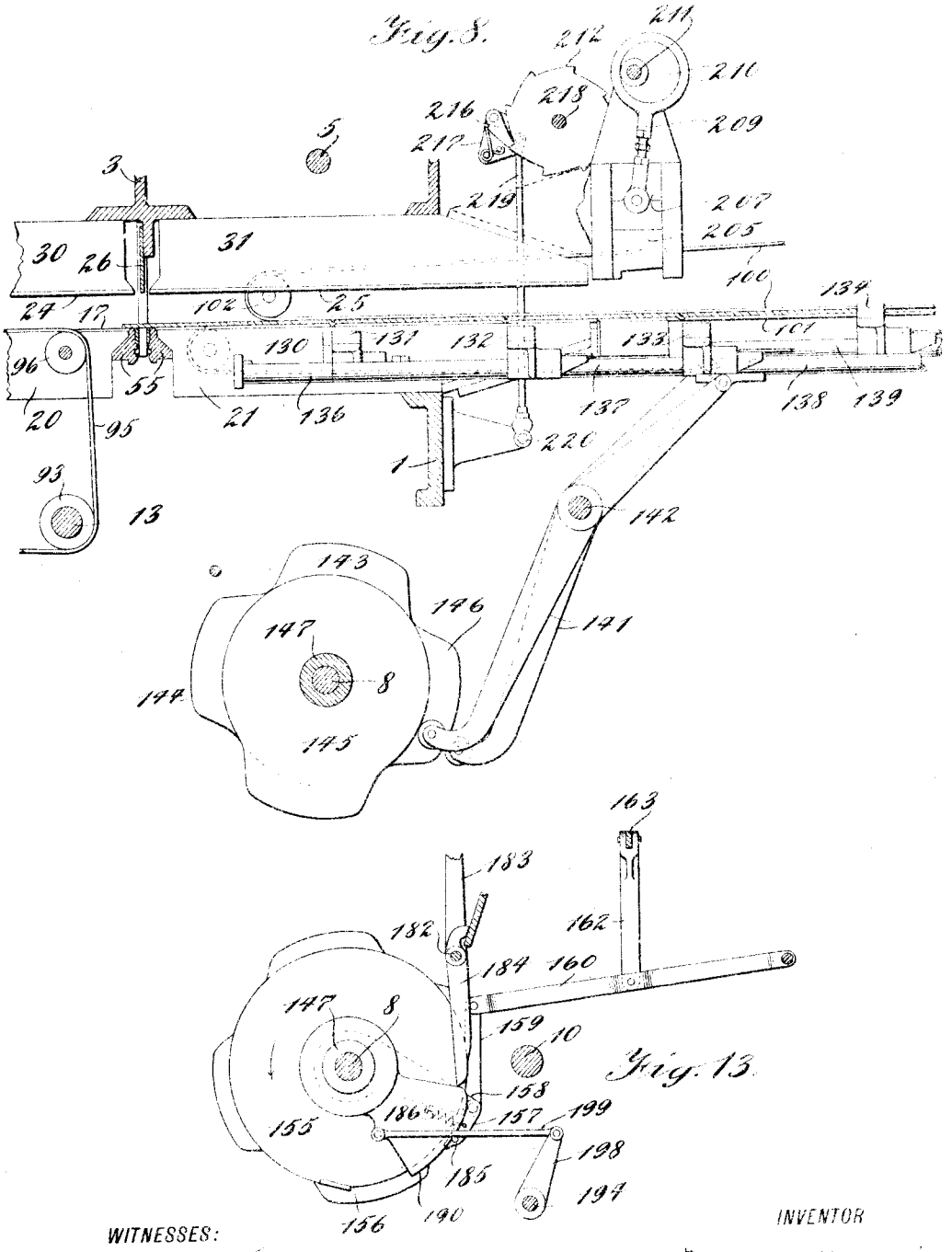

Fig. 13.

WITNESSES:

Geo. G. Cheney.

F. M. Cassidy.

INVENTOR

Eugene M. Hawkins

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Dana & Dana

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CARTON BLANK FORMING MACHINE.

APPLICATION FILED JAN. 15, 1912.

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14 SHEETS—SHEET 10.

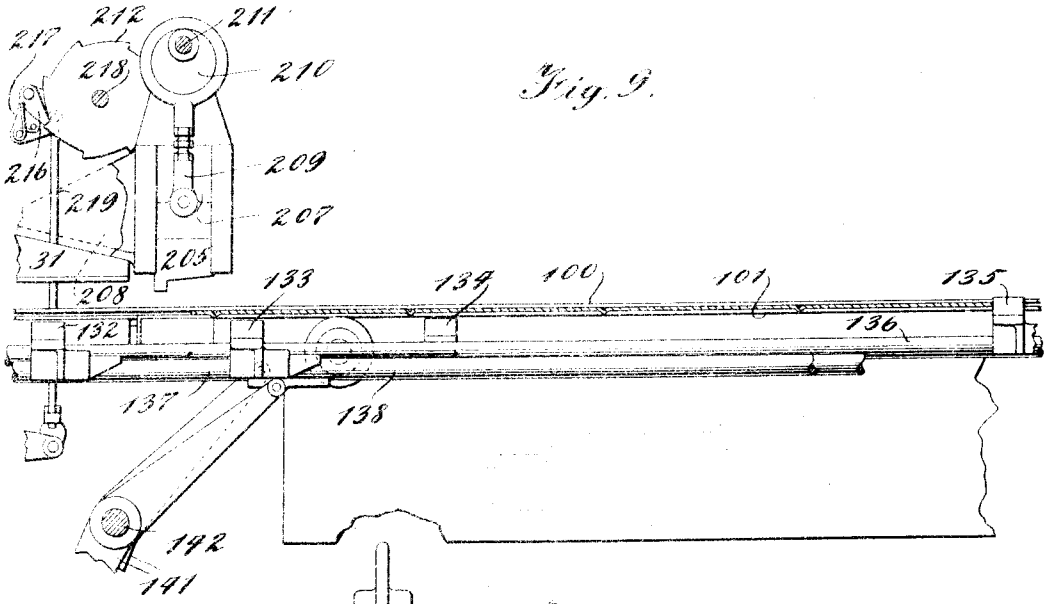

Fig. 9.

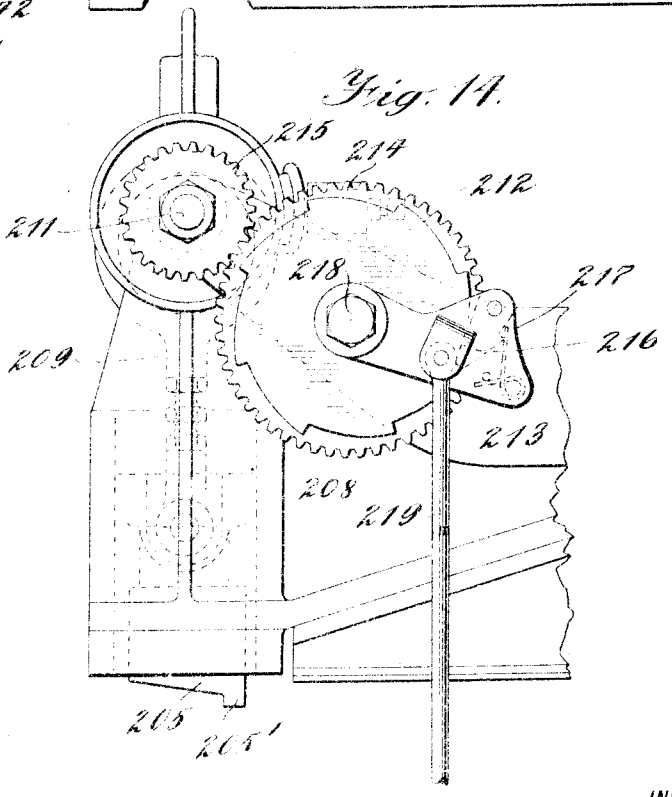

Fig. 14.

WITNESSES:

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CARTON BLANK FORMING MACHINE.

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14 SHEETS—SHEET 1.

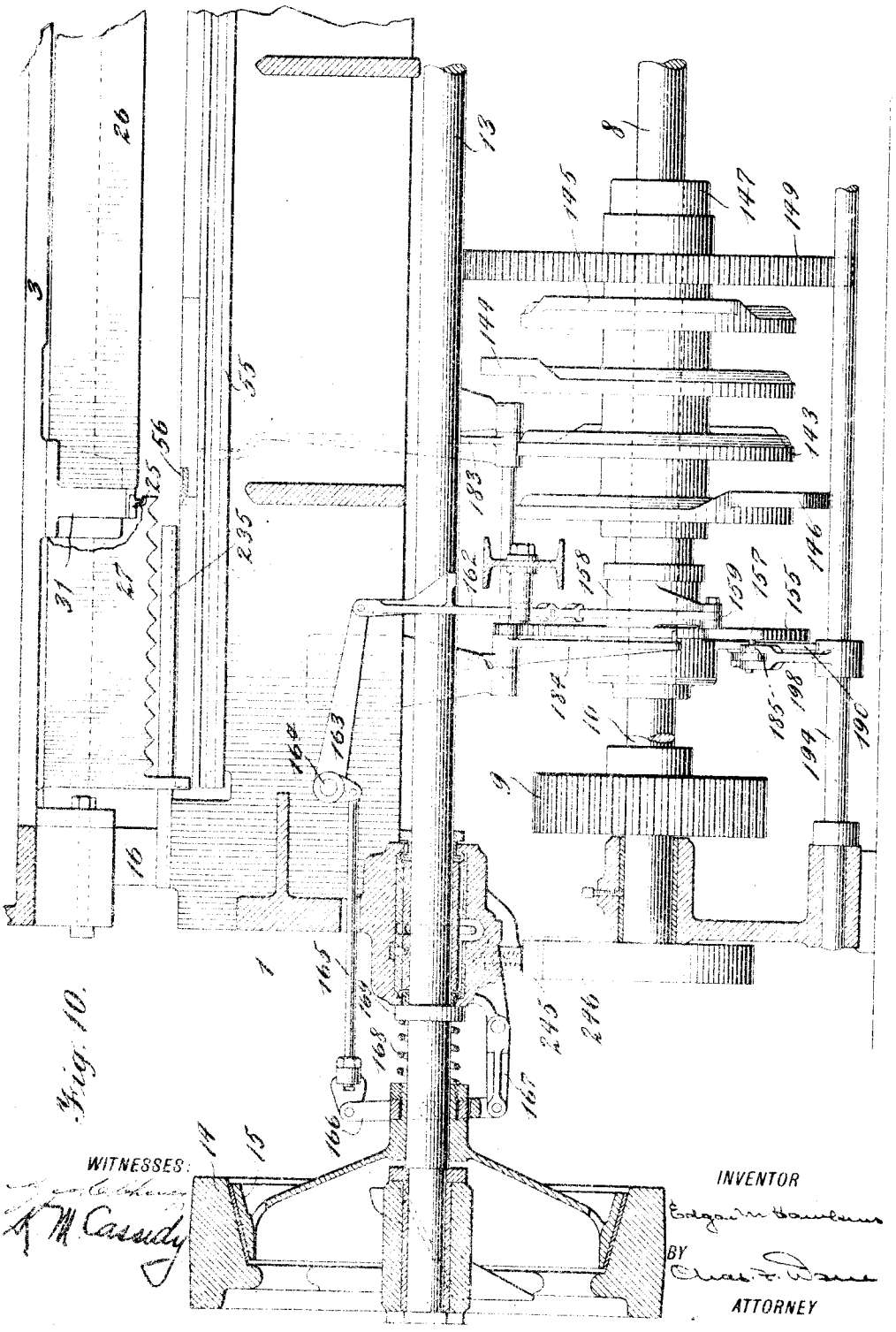

Fig. 10.

WITNESSES:

F. M. Cassidy

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14 SHEETS-SHEET 12.

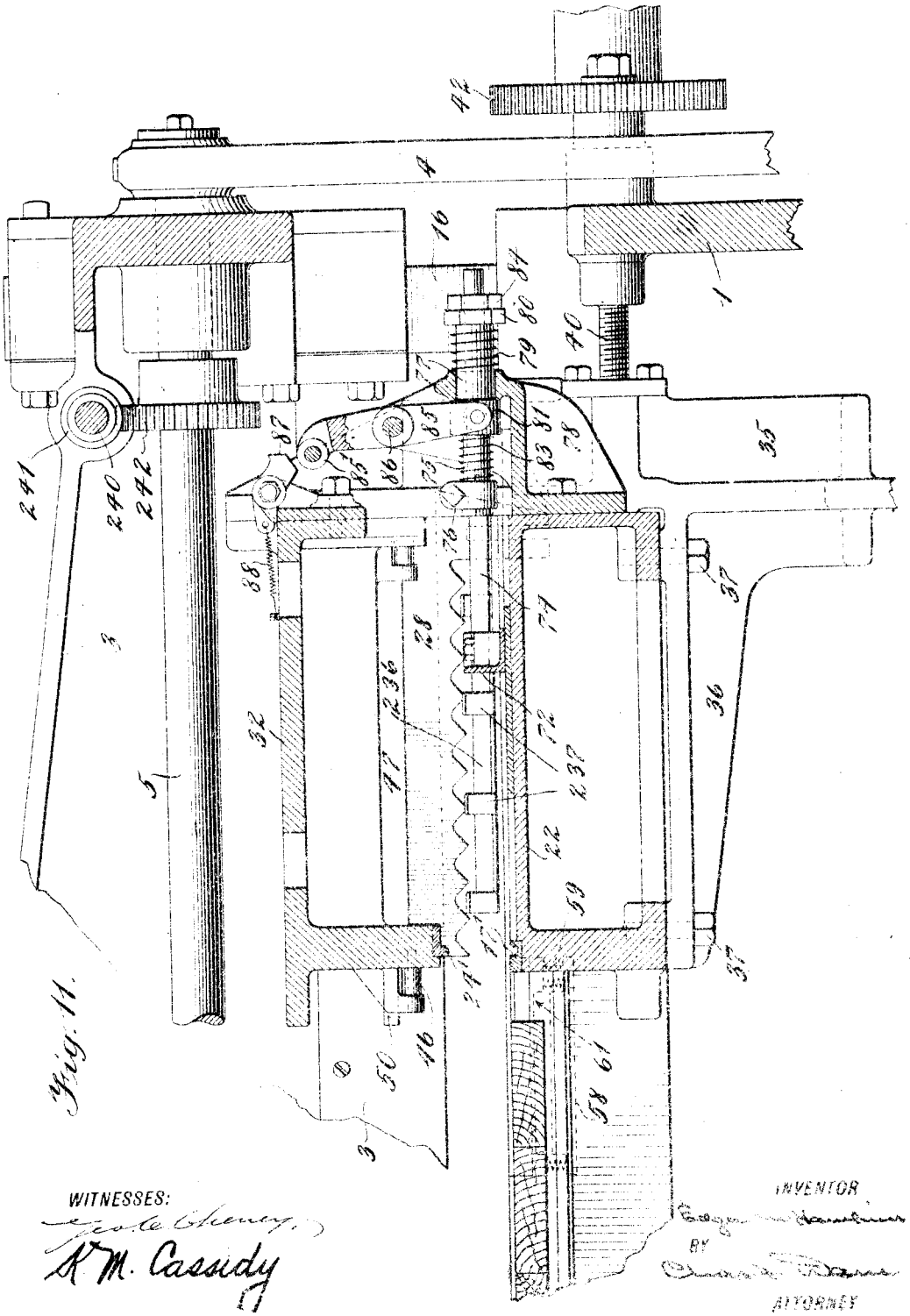

Fig. 11.

WITNESSES:

Geo. L. Cheney.

K. M. Cassidy

INVENTOR

BY

ATTORNEY

E. M. HAWKINS.

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APPLICATION FILED JAN. 15, 1912.

1,187,144.

Patented June 13, 1916.

14 SHEETS—SHEET 13.

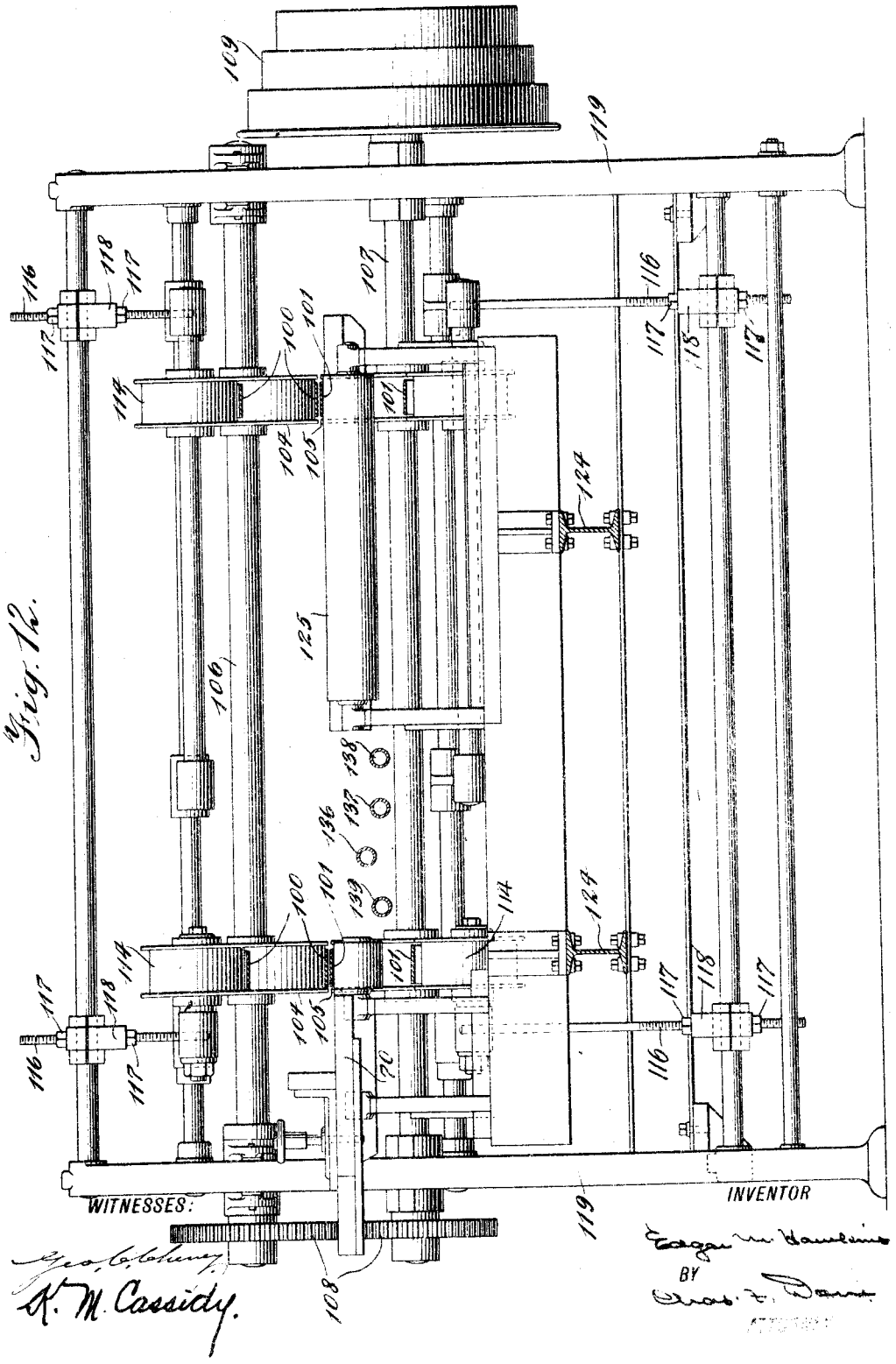

Fig. 12.

WITNESSES:

Geo. C. Cahoney.

K. M. Cassidy.

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CARTON BLANK FORMING MACHINE.

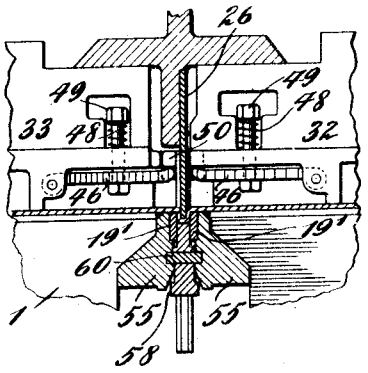
APPLICATION FILED JAN. 15, 1912.

1,187,144.

Patented June 13, 1916.

14 SHEETS—SHEET 14.

Fig. 22.



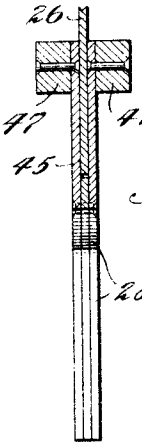


Fig. 23.

Fig. 21.

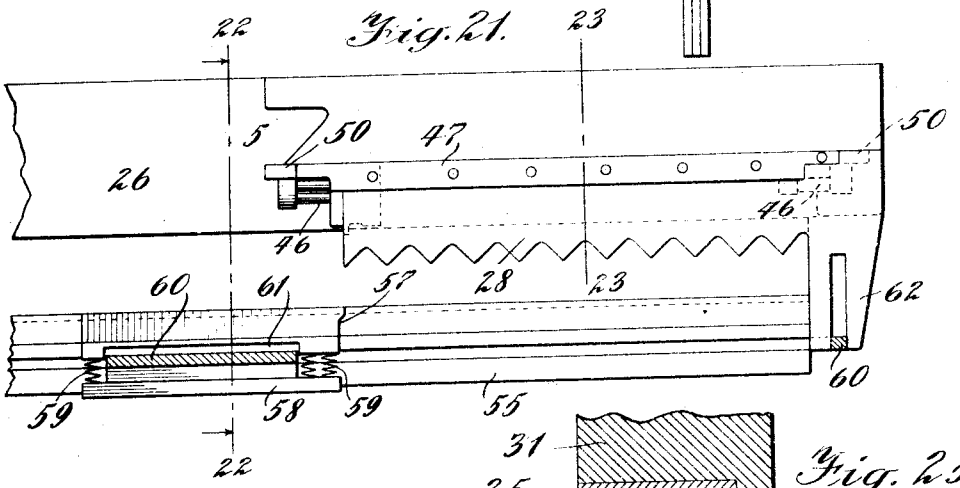


Fig. 24.

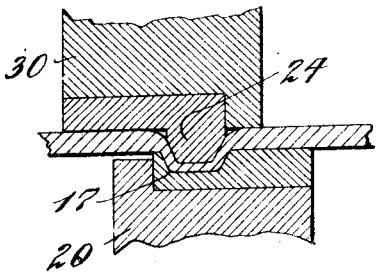


Fig. 25.

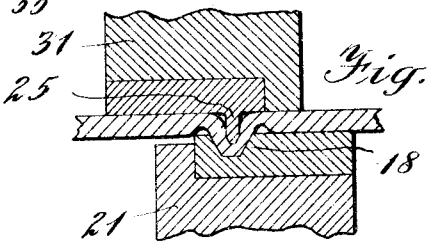
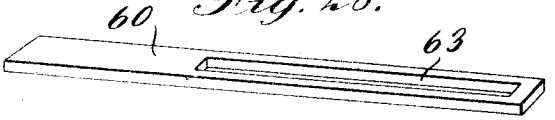


Fig. 28.



WITNESSES:

Geo. A. Ackeney.

A. M. Cassidy

INVENTOR

Edgar M. Hawkins

BY

Chas. F. Burrell

ATTORNEY

UNITED STATES PATENT OFFICE.

EDGAR M. HAWKINS, OF ROCHESTER, NEW YORK, ASSIGNOR TO M. D. KNOWLTON COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

CARTON-BLANK-FORMING MACHINE.

1,187,144. Specification of Letters Patent. **Patented June 13, 1916.**

Application filed January 15, 1912. Serial No. 671,176.

To all whom it may concern:

Be it known that I, EDGAR M. HAWKINS, citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Carton-Blank-Forming Machines, of which the following is a specification.

My invention relates to a machine for making cartons of that type in which the carton blanks are both creased and slotted on certain predetermined lines to permit of their being bent or "broken up" into complete cartons of desired form and size; the crease being made to determine the bending lines of the blanks and facilitate the blanks being bent up into carton form on those lines, and the slots being made to provide the end flaps or sections which are adapted to be folded upon each other to form the ends of the bent up or completed cartons.

The main object of my invention is to provide a simple and practical machine that will be operative to produce a complete carton blank of the type referred to, that is, a blank creased, slotted and otherwise prepared to be set up into carton or box form.

Heretofore, so far as I am aware, it has been the usual custom to crease the blanks at all of the several bending or corner lines thereof with a crease of uniform size or depth. It has been found in practice, however, that a size of crease which is sufficient to permit of the ready bending of the blanks on those lines where the blanks are to be bent only in one direction, as at the side and bottom corners of the carton, is not sufficient on those lines between the side sections and the end-flaps or sections at the filling-end of the carton to give the most satisfactory or desired results, and for this reason, viz., with only a size or depth of crease between the side sections and end-flaps that is sufficient at the bending lines between the adjoining side sections, the end-flaps have a tendency to either stand upright or else fold inwardly upon each other and so obstruct the filling-opening of the carton as to be a source of serious trouble and delay to the packer, this being particularly true in those cases where the carton is made of stiff and relatively non-flexible material, which cannot be bent or turned backward to any considerable extent without breaking or so separating the fiber of the same as to either seriously damage the carton or destroy the same. Because of these objections, resulting from the lack of flexibility of the carton material at the joint between the side and end sections, it has been a further and important object of my invention to provide an improved creasing means for the blank whereby said objections will be avoided, the creasing means employed by me for such purpose being operative to provide the blank on the bending lines between its side and end sections with larger or deeper creases than on the bending lines between its side sections; the forming of these larger or deeper creases operating to so separate and loosen up the fiber of the carton material as to furnish a sufficiently flexible joint whereby the end sections or flaps may be readily folded outwardly or inwardly as may be required without liability of breaking or otherwise injuring the carton. Preferably these creases are formed by means operative to gradually enlarge the creases by successive creasing operations so as not to materially weaken the carton material on the creased lines.

A machine embodying my invention includes blank slotting and creasing devices, the creasing devices preferably comprising two main sets, one adapted fo. forming a crease at the bending lines between the side walls of the carton, and the other adapted for forming a larger or deeper crease at the bending lines between the side walls and the movable end flaps or sections for the purpose hereinbefore referred to. These slotting and creasing devices will also each preferably comprise two members, one a stationary member and the other a movable member, the stationary members of both the slotting and creasing devices being mounted on a normally stationary support or frame and the movable members being all mounted on a reciprocatory head or frame for movement in unison to and from position for cooperation with the stationary members. In combination with these slotting and creasing devices means are also provided for feeding the blanks through the machine in operative relation to said devices to be acted upon by them, the feeding movement of the blanks preferably being intermittent whereby the blanks will be rendered stationary while being acted upon by the slotting and creasing devices.

In making cartons of different shapes and sizes the relative spacing of the slots and creases providing for their formation will of course be varied, and in order to provide for this variation in part, means are provided in connection with the blank feeding means which are operative and adjustable to automatically interrupt the feeding movement of the blanks with the latter in position to be operated upon by the slotting and creasing devices at any desired point; such interrupting or stopping means in the present case being in the form of stop-gages which are operated to project into the path of movement of an advancing blank and stop movement of the same until it has been acted upon by the slotting and creasing devices and thereafter move away from the path of movement of the blank to release the latter and permit of its continued advance through the machine.

My invention embodies in addition to these several features generally referred to, various other novel features of construction and arrangements and combinations of parts, all as hereinafter referred to in detail and more particularly pointed out in the appended claims.

In order to enable those skilled in the art to make and use my invention, I will now proceed to describe the same in detail in connection with the accompanying drawings illustrating a machine embodying my invention, wherein like reference characters in the several views indicate like parts.

In said drawings,—Figures 1 and 1ª, together, represent a side elevation of a machine embodying my invention, with a portion of a blank supporting table at the front or feeding end of the machine partly broken away. Fig. 2 is a front end elevation of the machine with the blank supporting table in section on line 2—2 of Fig. 1. Fig. 3 is a horizontal section on line 3—3 of Fig. 1, looking in the direction indicated by the arrows, said section being taken between the stationary main frame with its supported stationary members of the slotting and creasing devices, and the upper reciprocatory frame or head with its supported movable members of said slotting and creasing devices. Fig. 4 is an enlarged vertical section, on line 4—4 of Fig. 3, showing in section and elevation certain of the devices for controlling the passage of the blank through the machine, and for slotting, creasing and otherwise operating upon them during such passage to produce the desired formation of blank. In this view the parts are shown in position with the machine at rest, in which position the upper movable members of the slotting and creasing devices are raised above their coöperative stationary members on the lower or main frame. Fig. 5 is a similar view, showing the position of the parts after the machine has been started, with a blank fed to position against the first stop-gage and the upper reciprocatory head with its supported slotting and creasing members in lowered operative position. Figs. 6, 7, 8 and 9 are further detail views of parts of the machine illustrating practically the complete passage of the blank through the machine and the successive slotting and creasing operations taking place during such passage of the blank. Fig. 10 is an enlarged sectional detail at the left-hand side of the machine, taken on the line 10—10 of Fig. 4, looking in the direction indicated by the arrows. Fig. 11 is an enlarged sectional detail at the right-hand side of the machine, taken on the line 11—11 of Fig. 1, looking in the direction indicated by the arrows. Fig. 12 is an enlarged section on line 12—12 of Fig. 1, looking in the direction indicated by the arrows. Fig. 13 is an enlarged sectional detail on line 13—13 of Fig. 2, looking in the direction indicated by the arrows, showing the clutch controlling device held in position to permit continuous operation of the machine. Fig. 14 is an enlarged detail of the movable or reciprocatory knife of one of the securing-flap cutter devices and its supporting and operating means, the same being in elevation as viewed from the side of the machine opposite that shown in Fig. 1. Fig. 15 is a top plan of the parts shown in Fig. 14. Figs. 16 and 17 are enlarged sectional details, the sections being taken on line 16—16 and 17—17 respectively, of Fig. 4, showing the angular relation of the knife and its operating shaft. Fig. 18 is an enlarged detail showing in top plan the lower knife of one of the securing-flap cutter devices, and also showing in section the coöperating upper knife. Fig. 19 is an enlarged sectional plan of the stop-gage with which the blank first contacts, and the trip device associated therewith for controlling the throw-in of the clutch and thereby the starting of the machine. Fig. 20 is an enlarged section on line 20—20 of Fig. 19, looking in the direction indicated by the arrow. Fig. 21 is an enlarged detail, showing in elevation and section one of the slotting devices and a part of one of the creasing devices. Fig. 22 is a section on line 22—22 of Fig. 21, looking in the direction indicated by the arrows, showing the parts in said Fig. 21 in operative relation acting upon an interposed blank, and also showing certain additional associated parts for adjustably holding the slotting device in operative connection with the movable frame by which it is carried. Fig. 23 is an enlarged section on line 23—23 of Fig. 21, showing the construction of one of the slotting devices and its adjustable connection with the creasing device. Figs. 24 and 25 are enlarged details, showing in

cross-section the upper and lower members of two different sets of creasing devices and also showing their coöperation in successively acting upon an interposed blank to provide the same with an enlarged or deepened crease. Fig. 26 represents a slotted and creased carton blank as produced by a machine of my invention. Fig. 27 is a perspective view of a carton made up of a blank as shown in Fig. 25. Figs. 28 and 29 are detail views to be hereinafter referred to.

Before proceeding with a detailed description of the machine, I will first describe the formation of the carton or "container" blank produced by it. In the formation of these blanks, it will of course be understood, that the spacing of the slots and creases will be varied according to the size and shape of the cartons to be made. In the present case, a blank is shown in Fig. 26 properly creased and slotted for the production of a rectangular carton as shown in Fig. 27, the said blank being formed with a series of creases a^1, a^2, a^3, and a^4, at the corner or bending lines between the side wall sections or panels b; a series of slots c^1, c^2, c^3, and c^4, at its opposite longitudinal edges and in line with said creases to form the end wall sections or flaps d; and a series of creases e^1, e^2, e^3, and e^4, arranged in lines substantially intersecting the said slots at their inner ends and in position at the bending lines between the said side and end wall sections. These latter creases, as hereinbefore referred to, are preferably so formed as to provide a flexible joint between the side wall sections and the end flaps permitting of the latter being folded, first downward against the outside of the carton as shown in Fig. 27, so as to be out of the way of the packer in filling the carton, and then inwardly to close the carton, after the filling or packing operation has been completed. When the carton blank is set up, its opposite ends f—f may be secured together by any suitable means as, for instance, by an adhesively applied stay-strip of suitable material. In the present case, however, the blank is shown as being formed at one end with a short extension g, which I term the "securing flap", which is adapted to be glued or riveted to the adjoining wall section as a means of securing said sections together.

To now describe the machine, the main frame thereof, which may be of any desired form or construction suitable for the purpose, is here shown as comprising a substantially rectangular horizontally-arranged casting 1 which is of skeleton form and supported in a raised position from the floor by legs 2 (see Figs. 1 to 4 inclusive). Mounted upon this frame are the lower members of the slotting and creasing devices to be hereinafter described in detail. Above this main frame 1 is located the reciprocatory head or frame 3, which carries the movable members of the slotting and creasing devices, the same being here shown as similar in form and construction to the lower frame 1. This upper frame 3 is supported at opposite sides and vertically reciprocated, by means of eccentric rods 4 which connect at their upper ends with the opposite ends of two shafts 5, 5, mounted in said frame 3, and at their lower ends connect with eccentrics 6 on shafts 7 and 8 journaled in the lower frame. These shafts 7 and 8 each connect through a pair of gears 9, 9, with a shaft 10, which in turn connects through a gear-wheel 11 and pinion 12 with the main driving shaft 13, which latter is here shown as adapted to be driven from a drive pulley 14 through the medium of a clutch 15. The gears 9, 9, between the shafts 10 and the eccentric shafts 7 and 8 are arranged with one pair at one side of the machine and the other pair at the opposite side of the machine in order to properly distribute the strain on the parts. These gears 9, 9, are preferably of elliptical form in order to impart to the frame 3 a variable or fast and slow movement, the same being set in a manner to give said frame its slowest movement during the upper part of its stroke and its fastest movement during the lower part of its stroke; the reason for this being to provide the maximum amount of time while the frame 3 is up for the passage of the blank from one position to be operated upon to another, as hereinafter referred to. Vertically arranged posts 16, 16, fixed to the lower frame and engaging the upper frame 3 within openings adjacent its oppostie sides, as shown in Figs. 2 and 3, act to guide said upper frame in its reciprocating movement.

Mounted upon the frame 1 are the lower members of the slotting and creasing devices which include two sets of parallel longitudinally-arranged creasing dies 17—17′ and 18—18′ and a transversely arranged slotting and creasing die 19 located at about the center of the machine and intersecting said first-mentioned sets of dies at their adjacent ends, as clearly shown in Fig. 3. The die members 17—18 at the left hand side of the machine are respectively mounted on heads 20 and 21 which have a fixed connection with the frame 1, while the die members 17′—18′ at the right hand side of the machine are respectively mounted on heads 22 and 23 which have an adjustable connection with frame 1, whereby the members 17′—18′ may be adjusted laterally with respect to the members 17—18 according to the size and shape of the carton blank to be produced.

Connected to the upper reciprocatory frame 3 to be operated thereby are the movable members of the slotting and creasing devices, which include two sets of parallel

longitudinally-arranged creasing dies 24—24′ and 25—25′ for coöperation with the corresponding lower dies 17—17′ and 18—18′ to form the creases c^1, c^2, c^3, c^4, of the carton blank, a transversely-arranged creasing die 26 between said sets of dies 24—24′ and 25—25′ for coöperation with the lower die 19 at the central part thereof to form the creases a^1, a^2, a^3, a^4, of the carton blank, and two slotting knives 27 and 28 at opposite ends of the die 26 for coöperation with the lower die 19 at its opposite ends to form the slots c^1, c^2, c^3, and c^4, of the carton blank. The front and rear die members 24—25 at the left-hand side of the machine, in similar manner to the coöperative members 17—18, are mounted on heads 30 and 31 having a fixed connection with the frame 3, while the front and rear die members 24′—25′ at the right-hand side of the machine, also in similar manner to the coöperative members 17′—18′, are mounted on heads 32 and 33 which have an adjustable connection with the frame 3 whereby the members 24′—25′ may be adjusted laterally with respect to the members 24—25. In order that the lateral adjustment of the front and rear die members at the right-hand side of the machine may be effected in unison and by means of a single adjusting device, a U-shaped frame 35 is provided (see Figs. 1 and 29), to the two arms of which are connected the adjustable supporting heads of said die members, the supporting heads of the lower vertically-stationary members 17′—18′ being connected with bracket arms 36 of said frame 35 by suitable fastening means, such as bolts 37 (see Fig. 11), and the supporting heads of the upper reciprocatory members 24′—25′ being connected with said frame by means of gibs 38 (see Fig. 1), in a manner to permit of the reciprocatory movement of the heads relative to said frame 35. The latter, thus connected with the adjustable die supporting heads, is engaged by two endwise stationary screws 40, 40, mounted in the frame 1, which screws are each connected by suitable gearing 41—42 with an operating crank 43 at one side of the machine. By turning this crank in the proper direction the dies at the right-hand side of the machine may be adjusted to regulate the space between the same and those at the opposite or left-hand side of the machine.

The upper transversely arranged die or blade 26 and the slotting knife 27 at the left end thereof are both fixedly connected to the frame 3. The slotting knife 28 at the right end of the die 26, however, is connected with the frame 3 in a manner to permit of its being adjusted laterally with the die members 25′—25′. This adjustment of the knife 28 may be provided for in any suitable manner. In the present case, as most clearly shown in Figs. 21 and 23, said knife is connected to the creasing die 26 in a manner to be moved vertically therewith and at the same time be capable of a sliding adjustment in a direction lengthwise thereof; such connection being effected as here shown by providing the knife with a longitudinal groove 45 in its upper edge to receive the lower edge of the creasing die 26 and permit it to fit thereon, and holding the knife in such connection with the creasing die by means of a plurality of holding fingers 46, 46, mounted on the adjustable heads 32 and 33 and engaging at one end with the under side of bars 47, 47, attached to the opposite sides of the knife 28, as shown. These fingers 46 are supported by springs 48 engaging bolts 49 attached to the fingers, in a manner to yieldingly hold the knife 28 in operative engagement with the lower edge of the creasing die 26 and permit of its ready adjustment longitudinally of the latter. Lugs 50 on the adjustable heads 32 and 33 engaging with the ends of the bars 47, 47, on the knife 28 serve to connect the latter with said heads and cause it to be moved with them when they are shifted to adjust the position of the adjustable dies relatively to the stationary dies as hereinbefore referred to.

The groove 45 in the upper edge of the knife 28 may be provided in any suitable manner. In the present case, as most clearly shown in Fig. 23, it is provided by forming the knife of three plates riveted or otherwise secured together with the upper edge of the middle plate terminating below the upper edges of the two outer plates as shown.

The transversely-arranged slotting and creasing die 19 is shown in the present case (see Fig. 22) as comprising two parallel members 19′, 19′, supported by die holders 55, 55, fixedly connected to the lower frame 1. These die members are arranged with a space or slot therebetween to receive the creasing die or blade 26 and the slotting knives 27 and 28; the creasing die 26 being of sufficiently less width than the space between said members as to coöperate with them to merely crease the blanks, as shown in Fig. 22, and the slotting knives being of such width as to coöperate with said members to cut and slot the blank. Two cutters or cutter dies 56 and 57 are preferably located between the die members 19′, 19′, in position for coöperating with the inner transverse ends of the slotting knives 27 and 28 in cutting the blanks at the inner or closed ends of the slots, these cutters together with the coöperating transverse ends of the slotting knives constituting what I term "slot-end" cutters. The cutter 56 (see Fig. 10) which coöperates with the laterally stationary knife 27 is fixedly supported in its position, but the cutter 57 which coöperates with the laterally adjustable knife 28 is adjust-

ably supported in its position for adjustment with said knife. In the present case said cutter die 57 is yieldingly supported by a plate 58 through the medium of interposed springs 59 (see Fig. 21) in order that it may coöperate with the knife 28 upon the descent of the latter to cutting position and thereafter be moved downwardly by the creasing blade 26 and out of the way of the latter upon its passing to creasing position, as shown in Fig. 22, the arrangement of the parts being such that the slotting devices act in advance of the creasing devices. The cutter-die supporting plate 58 is connected with a slotted plate 60 (see Fig. 28) which is slidably supported by the die-holders 55 (see Figs. 21 and 22) with one end engaging the cutter die 57 within a notch 61 in its under side and thereby supporting said die against endwise movement on its supporting springs 59. The other end of said plate 60 engages a notched extension 62 of the adjustable slotting knife 28 so as to connect the cutter-die 57 with said knife whereby it will be moved with the latter upon any adjustment of the same and so be caused to maintain its operative relation thereto. The slot 63 in the plate 60 is located immediately beneath the knife 28 and is adapted to permit waste chips from the blanks to drop downwardly therethrough.

Having now described the main features of the slotting and creasing devices, I will next describe the devices for controlling the passage of the blanks through the machine to be acted upon by said slotting and creasing devices.

At the front end of the machine is located a suitable support or table—a section of which is indicated at 65—upon which the blanks or sheets to be operated upon are placed. From this table the operator feeds the sheets to the machine, through which they are fed or carried by suitable feeding devices. When being so fed through the machine the sheets are guided by suitable gages in order to be properly positioned relatively to the slotting and creasing devices when acted upon by them. These gages in the present case are formed in two sets arranged at opposite sides of the machine. The set at the left side of the machine, indicated at 66, 67, 68, and 69 (see Fig. 3), are supported in laterally adjustable position on stationary table sections 70 by suitable clamping devices, such as the hand-screws 71, whereby they may be set for any desired length of slot to be cut by the knife 27. The set of gages at the right side of the machine, indicated at 72 and 73, are supported in a laterally adjustable position on the die supporting heads 22 and 23 by means to be presently described, whereby they may be adjusted relatively to the opposing gages according to the width of the sheets to be fed therebetween. These gages 72 and 73 are preferably set a sufficient distance from the opposing gages to permit of the sheets being freely entered between them and are automatically operated upon the entry of a sheet between them to advance into engagement with the adjacent edge of the sheet and move the sheet firmly against the oppositely located stationary gages and so cause it to be accurately positioned and guided during its passage through the machine. The means here shown for so operating the gages 72 and 73 comprise two sets of separate but identical devices, one set for each gage. I will therefore describe the set employed in connection with the gage 72, the description of which will be applicable to both sets.

Referring now to Figs. 3 and 11, the gage 72, slidably mounted on the head 22, is provided with a laterally extending arm 74 adjustably connected with a sleeve 75 by a clamping collar 76, which said sleeve is slidably supported in a second sleeve 77, which in turn is slidably supported in a bracket 78 rigidly attached to the head 22 at one end thereof as shown. A spring 79 located on the sleeve 77 with its ends bearing against the bracket 78 and a collar 80 on said sleeve acts to yieldingly hold the latter in stationary position with a second collar 81 thereon in contact with the bracket 78. A second spring 83, located on the sleeve 75 with its ends bearing against the collar 76 thereon and the end of the sleeve 77, operates to effect a yielding connection of said sleeve 75 and attached gage 72 with the sleeve 77 by holding a collar 84 on the outer end of the sleeve 75 in contact with the adjacent end of the sleeve 77 or the collar 80 thereon. A lever 85, pivoted at 86 to the bracket 78 with its lower end pivotally connected to the collar 81, is operated by the engagement therewith of a cam 87 on the reciprocatory head 32 to move the sleeve 77 inwardly or toward the center of the machine and so advance the connected gage 72 into engagement with a sheet to move the same against the opposing gages in the manner hereinbefore referred to, the spring 83 serving as a cushion to permit yielding of the gage relatively to the positively moved sleeve 77 in the event of the gage being arrested by contact with the sheet or otherwise before completion of its full stroke. This advance movement of the gage 72 caused by the engagement of the cam 87 with the lever 85 upon the passing of the head 32, is timed to take place prior to the knife 28 reaching slotting position in order that the sheet will be properly positioned by engagement with the opposing gages when the slotting and creasing operations occur. At substantially the completion of the down stroke of the head 32 the cam 87 passes below the coöperating end 85′ of

the lever 85, whereupon the spring 79 operates to automatically return the gage 72 and connected parts to their normal position shown in Fig. 11. At the following or return up stroke of the head 32, it is desirable that the cam 87 should pass the lever 85 without operating the same, and to permit this the cam is pivoted to the head as shown, a spring 88 connecting therewith operating to return the cam to normal operative position following its movement above said lever, as shown in Fig. 11. The adjustable connection of the gage arm 74 with the sleeve 75 hereinbefore referred to, permits of the gage being adjusted relatively to the opposing gages according to the width of sheet to be operated on, the sleeve 75 being split adjacent its end to permit of its being firmly clamped to the gage arm by the clamping collar 76.

When the sheets are fed to the machine by the operator for passage therethrough between the side gages as described, they are engaged by a pair of feed rolls, 90 and 91, mounted on a shaft 92 which is journaled in the heads 20 and 22 of the lower frame 1 and operated from a pulley 93 on the main driving shaft 13 through a belt 95 which runs over guide rolls 96 and 97. These feed rolls are preferably formed of rubber and provided with left-hand screw threads (see Fig. 3) to aid in deflecting the sheets toward the stationary gages at the left side of the machine, for the purpose hereinbefore referred to. The roll 90 at the left side of the machine is supported in an endwise stationary position on the shaft 92, but the roll 91 at the right side of the machine is supported on said shaft for endwise adjustment with the adjustable head 22 to which it is loosely held by a keeper 98. A key and key-way connection (not shown) between the roll 91 and shaft 92 permits of such endwise adjustment of the roll on said shaft. The sheets are fed by these feed rolls 90 and 91 into the machine between the upper and lower members of the slotting and creasing devices until their advance edges reach a position beyond or at the rear of the transversely arranged dies, where they are engaged by further feeding means by which they are fed on through the machine. These last-mentioned feeding means as here shown (see Figs. 1, 1ª, 3 and 12) comprise two pairs of endless feed belts arranged adjacent the opposite sides of the machine for engaging the sheets near their opposite edges. The coöperating upper and lower belts of each pair, indicated at 100 and 101 respectively, are mounted at their front ends or those ends nearest the center of the machine, on pulleys 102 and 103 suitably supported by the frame 1, and are mounted at their opposite or rear ends on driving pulleys 104 and 105 attached to shafts 106 and 107 respectively, which shafts are journaled in an auxiliary frame 119 at the rear of the main frame and connected by gearing 108 to be driven in unison by a driving belt (not shown) connected with a cone pulley 109 on the lower shaft 107. The pulleys carrying the pair of belts at the left side of the machine are laterally non-adjustable, but the pulleys carrying the pair of belts at the right side of the machine are laterally adjustable in order that the proper relation of said belts to the other parts at that side of the machine may be maintained upon any adjustment of them. This adjustment of the belts at the right or adjustable side of the machine is provided for by mounting their driving pulleys 104 and 105 for endwise adjustment on their respective shafts, and by mounting the pulleys 102 and 103 at their front ends on the laterally adjustable head 23, the lower pulley 103 being mounted on a suitable bearing connected directly with said head 23 and the upper pulley 102 being mounted on a bearing stud 110 attached to the U-shaped frame 35 which is also connected to said head 23. The upper pulley 102 at the left side of the machine is mounted on a bearing stud 111 carried by a bracket 112 attached directly to the frame 1 (see Fig. 3). Each of the driving belts 100 and 101 is engaged by a suitable belt tightener, which is here shown (see Figs. 1ª and 12) as comprising a belt-engaging pulley 114 carried by a pivoted arm 115 having a pivotally connected screw-threaded adjusting rod 116 adjustably connected by nuts 117, 117, with a block 118, mounted on a cross-rod of the auxiliary frame 119, as shown. By adjusting the position of the pulley 114 through the medium of the rod 116 and its engaging nuts 117, the tension of the belts may be readily and accurately adjusted. In order to maintain the adjacent runs of the belts in close relation to each other, whereby liability of slippage of the sheets between them will be minimized as much as possible, the upper shaft 106 carrying the driving pulleys at the rear ends of the belts is supported at its opposite ends in the journal boxes 120 (see Figs. 1ª and 12) which are pivoted at one end on pivots 121 and at their opposite ends are engaged by springs 122 which act to bear downwardly upon the boxes and hold the upper pulleys in yielding contact with the lower ones. With this construction, the upper belts adjacent their rear ends will adapt themselves vertically under the action of the springs 122 to sheets of different thickness. The movement of the driving belts over the table 123 supported on the connecting beams 124 between the main and auxiliary frames, is facilitated by provid-

ing said table with a series of rollers 125 over which the adjacent runs of the belts will ride as shown.

Now referring again to the passage of a sheet through the machine from the front end thereof, after the sheet has been passed between the oppositely located side gages to a position with its forward end entered between the continuously moving feed belts 100 and 101, it is engaged and carried forward by said belts until its front edge strikes a clutch-controlling trip-device 130 located in the path thereof and operates the same to throw the machine into operation, immediately after which the sheet is arrested in its forward movement and brought to a stop by contact with a stop-gage 131, the feed belts in their continued operation slipping over the sheet and being inoperative to move the same until it is again released by the stop-gage. After the sheet is thus brought to a stop, the upper frame 3 descends (see Fig. 5) to bring its supported members of the slotting and creasing devices into operative relation with the stationary members of said devices on the lower frame and act upon the interposed sheet to produce the end slots c^1, the transverse single crease a^1, and the end creases e^1 and e^2. Following this operation, the frame 3 with its supported slotting and creasing members is raised and the stop-gage 131 lowered, in order to release the sheet and permit of its being again advanced by the engaging feed belts. Thereafter, the sheet is successively stopped three times in its advance movement through the machine by successively arranged stop-gages 132, 133, and 134 (see Figs. 6, 7, and 8), and at each stop the slotting and creasing operation just described is repeated; the second operation producing the slots c^2 and creases a^2 and e^3, the third operation producing the slots c^3 and creases a^3 and e^4, and the fourth operation producing the slots c^4 and crease a^4. Following this fourth operation, which has acted on the sheet adjacent its rear end, as shown, the sheet is again advanced until brought into contact with a fifth stop-gage 135 (see Fig. 9), which stops the sheet in position to be acted upon by suitable cutting devices to be hereinafter described and cut on the lines h, h, intersecting the slots c^4 (see Fig. 25) to provide the "securing flap" g. This last operation completes the blank and thereafter it passes from the machine.

In feeding a blank through the machine by means of the feed belts as described, it is desirable that the belts should operate to have a uniform pulling action on the blank which will not be so great as to cause buckling of the blank when it is held stationary against one of the stop devices, but yet which will be sufficiently strong and prompt in its action to start the blank from its state of rest instantly upon the releasing of the blank by its holding means. To obtain this desired action of the feed belts irrespective of any variation in the thickness of the belts or of the work passing between the belts, the supporting pulleys 103 for the lower belts at their front ends are located in advance of the supporting pulleys 102 for the upper belts, as clearly shown in Figs. 3, 4, and 8, whereby the lower belts have no direct support immediately beneath the upper pulleys and therefore give or yield to conform to any variation in the thickness of the belts or work as referred to.

The gages 131, 132, 133, and 134 may be supported and operated in any suitable manner to successively perform their functions as described, that is, each gage rising to position to engage a sheet, holding the same stationary during a stroke of the upper frame 3 in effecting the slotting and creasing operation, and thereafter moving below the path of movement of the sheet to release the same and permit of its further movement. The means for accomplishing the purpose as here shown comprise a series of horizontally arranged gage-supporting rods 136, 137, 138 and 139, extending in a direction lengthwise of the machine upon which are respectively mounted the gages 131, 132, 133, and 134. Each of these gage-rods is supported at its rear end by a pivoted arm 140 connected to the auxiliary frame (see Fig. 1[a]), and at its forward end is supported by a lever 141 (see Figs. 1 and 4) which is pivotally mounted on a fixed support 142 with its lower end extending into engagement with an operating cam, the lever being held in such engagement with the cam by the weight of the gage rod upon its upper end. The cams, indicated at 143, 144, 145 and 146 (see Figs. 2 and 4) for respectively operating the gage rods 136, 137, 138, and 139 through the levers 141 by raising and lowering the same successively, are all fixed on a sleeve 147 which is revolubly mounted on the shaft 8 and driven from the shaft 10 through gears 148 and 149, which gears in the present case are of a ratio to impart a one-quarter revolution to the sleeve 147 to each complete revolution of the shaft 10 and thereby cause the four cams on said sleeve to successively operate the gages 131 to 134 inclusive during four successive strokes of the frame 3 in slotting and creasing the sheet in the manner described. The gage 135, which is the fifth of the gages in their described order of operation on a sheet, is mounted on the rear end of the gage rod 136 which carries at its front end the gage 131, and is operated to engage and stop a sheet in the manner hereinbefore referred to, at the same time

that the gage 131 is raised to engage a succeeding sheet just entered into the machine. These several gages are adjustably mounted on their supporting rods for adjustment relatively to each other and to the central transverse creasing die in order to permit of the distance between the transverse creases and slots being regulated according to the size and shape of the carton to be formed. Any suitable means may be employed for securing the gages in adjustable connection with their supporting rods. In the present case, as most clearly shown in Figs. 3, 19 and 20, the gage 131 is attached by suitable fastening screws to a block 150 which is slidably fitted to the rod 136 and adjustably secured in clamped connection therewith by means comprising a wedge 151 and coöperating gib 152, interposed between a wall of the block 150 and the rod 136, and a screw 153 connecting with the gib and tapped into the said block 150, as shown. By turning said screw in the proper direction, the wedge 151 may either be loosened to permit of the gage being adjusted, or tightened to secure the gage in adjusted position. The other gages, 132 to 135 inclusive, are secured in adjustable connection with their supporting rods by means similar to that just described in connection with the gage 131.

As hereinbefore referred to, when a sheet is entered into the machine and engaged by the continuously moving feed belts, it is carried forward by said belts until its front edge strikes a clutch-controlling trip-device 130 located in the path thereof and operates the same to start the machine in operation prior to the sheet coming into contact with the gage 131. After being so started, the machine may be controlled to automatically stop at the end of one complete operation or cycle of operations, which occurs in the present case when the sheet has been operated upon four times by the slotting and creasing devices and has reached the position shown in Fig. 3. Any suitable means may be employed for controlling the action of the clutch and thereby the starting and stopping of the machine. In the present case, said clutch, which is of the friction-cone type, is adapted to be held in inoperative position away from engagement with the driving pulley by means (see Figs. 2, 3, 4, 5 and 10) comprising a disk 155 fixed to the cam sleeve 147 and provided with a peripheral shoulder 156, a pawl 157 engaged by said shoulder and carried at the free end of a swinging arm 158 loosely mounted on the cam sleeve 147, a link 159 connecting the free end of said arm 158 with a lever 160 mounted on a fixed support 161, a link 162 connecting the lever 160 with a second lever 163 mounted on a fixed support 164, and a link 165 connecting the lever 163 with the upper end of a yoke 166 which is pivoted to the hub of the clutch pulley and at its lower end connected to a pivoted link 167 attached to a stationary support, as shown. The operation of this combination of parts in moving the clutch pulley from operative engagement with the driving pulley upon the raising of the pawl 157 by the engagement therewith of the shoulder on the disk 155 will be readily understood upon reference to the drawings. To now start the machine by the entry of a sheet therein, the trip device 130 is moved a slight distance rearwardly by the engagement therewith of the sheet and operates through intermediate devices to throw the pawl 157 from its position of engagement with the shoulder on the disk 155 as shown in Fig. 4, and thereby releasing a compressed spring 168 located on the shaft 13 between a fixed collar 169 thereon and the hub of the clutch pulley and permitting it to expand and move said clutch pulley into operative engagement with the driving pulley to start the machine, as shown in Fig. 10. Thereafter the machine continues running until it has performed one complete cycle of operations, that is, until the upper frame or head 3 has made four strokes and the coöperating parts have completed their corresponding movements, at which time the disk 155 has made one complete revolution and again brought its shoulder 156 into engagement with the pawl 157 and thereby operated the clutch pulley to withdraw from engagement with the driving pulley and so stop the machine. When the machine is thus stopped, its parts are in the position shown in Fig. 4, with the upper frame or head 3 raised to permit of the passage of a sheet thereunder and the stop gage 131 raised to sheet stopping position; the parts as here shown being maintained in such position by the action of a suitable braking device such as the spring-pressed brake 245 bearing against the brake-wheel 246, carried by the shaft 8.

The trip device 130 is here shown (see Figs. 3, 4, 19 and 20) in the form of a block slidably mounted on the gage block 150 and being attached to a slide-bar 175 which is loosely fitted in a groove in said block 150 and connected at its rear end by a clamp 176 to a rod 177, which latter in turn has connection with a pin 178 extending loosely into the front end of the tubular rod 136 and having a spring 179 surrounding the same and expanding between a collar 180 thereon and a stationary block 181 to yieldingly hold the trip device in its forward operative position shown in Fig. 19, from which it is moved by the engaging edge of a sheet to a position with its front edge flush with the front edge of the adjacent stop gage 131. Upon the lowering of said stop gage from its sheet stopping position the trip device is

also lowered therewith from engagement with the sheet, whereupon it is again returned to its normal position in advance of the stop gage as shown in Fig. 19. The means through which the trip device operates to disengage the pawl 157 from the shoulder of the disk 155 as hereinbefore referred to, comprises a shaft 182 mounted in suitable bearings on the lower frame and having two lever arms 183 and 184 affixed thereto, the arm 183 having a loose connection with the rod 177 to be moved thereby, and the arm 184 being arranged, upon movement being imparted thereto by the rearward movement of the trip device, to engage a pin 185 on said pawl and move the latter from its engagement with the disk shoulder. A spring 186 engaging with the pawl 157 operates to normally hold the latter in contact with the periphery of the said disk 155.

Instead of having the machine automatically stopped at the end of each complete operation in the manner described, it may be desirable in some instances to have it run continuously. Provision for this is made by the following means: A sector 190, mounted to turn on the hub of the disk 155, is movable to and from an operative position beneath the lower end of the lever arm 184, as shown in Fig. 13, where it will engage a pin 185 on the pawl 157 upon the release of the latter from engagement with the disk shoulder 156 through the operation of the trip device 130, and hold said pawl in a position away from the path of movement of said disk shoulder, whereby the machine will continue running until the pawl is released by the sector and again returned to its operative position of contact with the periphery of the disk 155 under the action of the spring 186. The sector 190 may be operated to move from its inoperative position as shown in Figs. 1 and 4, to its operative position shown in Fig. 13, or vice versa, by any suitable means. In the present case it is connected with an operating lever 192 at the front side of the machine by means comprising two rock shafts 193 and 194, the shaft 193 having the operating lever 192 attached thereto and also having an arm 195 connected by a link 196 with an arm 197 of the shaft 194, and the shaft 194 having a second arm 198 connected by a link 199 with the sector 190. A notched bracket 200 coöperating with a pin 201 on the lever 192 serves to hold the latter in either of its two positions.

As hereinbefore referred to, after a sheet has been creased and slotted, it is adapted to be again brought to a stop by contact with the stop gage 135 as shown in Fig. 9, and then cut by suitable cutting devices on the lines *h*—*h* (see Fig. 25) to provide the securing flap *g* by cutting off the end portions thereof, shown by dotted lines. These cutting devices may be of any suitable kind. In the present case they comprise two pairs, one pair being supported by the laterally stationary die-supporting heads at one side of the machine and the other pair being supported by the laterally adjustable die-supporting heads at the opposite side of the machine, whereby the cutting devices will be maintained in the same operative relation to the creasing dies at whatever adjusted position of the latter. Each of these pairs of cutting devices comprises an upper reciprocating cutter 205 mounted on the upper frame 3 and a lower non-reciprocating cutter 206 mounted on the lower frame 1. The upper cutter 205 is attached to a vertically reciprocating slide 207 which is fitted to a guide on a bracket 208 carried by the upper frame and operated through an eccentric rod 209 from an eccentric 210 fixed to a shaft 211 journaled in the upper end of the bracket 208. As these end-flap cutters are adapted to act on the sheet only once during the passage of the sheet through the machine, the upper cutters 205 are operated to make but one complete working stroke at each fourth stroke of the upper frame 3. This is accomplished by the following means: A ratchet disk 212 supported by a bracket 213 on the upper frame 3 and having operative connection with the eccentric shaft 211 through gearing 214—215 (see Fig. 14), is engaged by a pawl 216 carried by an arm 217 which is loosely mounted on the disk supporting shaft 218 and connected through a pivoted link 219 with a bracket 220 fixedly attached to the lower frame 1. With this combination and arrangement of parts, the ratchet disk 212 will be engaged by the pawl 216 at each upward stroke of the frame 3 and caused to receive a partial turn which will act through the described intermediate connections to locate the cutter 205 at the lowest point of its stroke relatively to the bracket 208 and in position for coöperation with the lower cutter 206 at a predetermined down stroke of the upper frame 3, as shown in Figs. 5 and 14, and during the succeeding three strokes of the frame 3 raise and lower the cutter relatively to the bracket 208 in a path above its said operative cutting position whereby it will be prevented from acting upon a sheet passing through the machine. The movement of the cutter 205 to and from its operative cutting position during the successive strokes of the frame 3 and the action of its operating means in effecting such movement are clearly shown in Figs. 5 to 9 inclusive.

The lower cutters 206 (see Figs. 3 and 18) are each supported by a bracket 225 connected with the lower frame and yieldingly held in contact with an adjustable stop 226 by means of springs 227 acting against nuts

228 on the outer ends of pins 229 which are connected with the cutter and slidably supported in a horizontally arranged extension 230 of the bracket 225 as shown. This laterally yielding support of the lower cutter is for the purpose of holding the same in close contact with the upper cutter during their coöperation and so assure a clean shear cut being made, the upper cutter being provided with a beveled tang 205′ for engaging the lower cutter in advance of the upper cutter and positioning the same for coöperation with the latter.

Located at opposite sides of the machine are strippers 235 and 236 (see Figs. 3 and 4) which are arranged in position to permit of the passage of the sheets thereunder and adapted to strip the sheets from the upper slotting knives upon the rising of the latter from the lower coöperating dies. The strippers 235 at the left side of the machine are mounted on the frame 1 and the strippers 236 at the right side of the machine are mounted on the laterally adjustable die-supporting heads. Attached to the strippers at the front side of the slotting dies are upwardly curved fingers 237 adapted for deflecting the sheets beneath the strippers. Located between the two sets of strippers 235 and 236 in a position adjacent the lower transversely arranged creasing die is a series of springs 238 adapted to lift the sheet from said die following the creasing operation.

The general operation of the machine, in brief, is as follows: Assuming the machine to be stopped with the upper frame 3 in raised position, a sheet is pushed into the machine along the stationary gages at the left side of the machine until its front edge enters between the adjacent runs of the continuously moving feed belts, by which it is engaged and carried forward until it strikes and operates the trip device 130 to release the clutch and set the machine in operation, and then come to a stop against the stop gage 131. Thereupon the upper frame 3 starts its descent, first operating through the connections shown in Fig. 11 to advance the movable gages 72—73 laterally into contact with the sheet and move the same firmly against the opposing stationary gages, and then operating on its continued descent to bring the supported members of the slotting and creasing devices into operative relation with the stationary members of said devices on the lower frame and act upon the interposed sheet to slot and crease the same in the manner described. Upon the starting of the machine as referred to, the feed rolls 90 and 91 are also set in operation and these act both to feed the sheets into the machine, and also, by reason of their left-hand screw-threads, coöperate with the gages 72—73 in deflecting the sheets toward the stationary gages at the left side of the machine. Following the engagement of the sheet by the slotting knives, the movable gages 72—73 are automatically moved backward from their position of contact with the edge of the sheet to permit of the free advance of the sheet by the feed belts when again released by the engaging stop gage. One slotting and creasing operation now having been completed, the frame 3 rises and the stop gage 131 lowers, whereupon the now released sheet is again advanced by the feed belts. Thereafter, the sheet is successively stopped three times in its advance movement by the successively arranged stop gages 132, 133, and 134, as shown in Figs. 6, 7 and 8, and at each stop the several operations just described are repeated. This completes the slotting and creasing of the sheet, which has now been performed in the manner shown in Fig. 25. Following the last slotting and creasing operation, the sheet is again advanced until brought into contact with the fifth stop gage 135 which is mounted on the same rod with the stop gage 131 and has been raised with the latter. The operator now enters the next sheet into the machine which will then start on another series of four strokes of the upper head or frame 3. Upon the first stroke of this new series the end flap cutters will act on the first sheet to provide the flap g, after which said first sheet will pass from the machine in completed condition.

In the general operation of the machine as just described, the creasing of the sheets may be effected by creasing devices of any suitable or desired character. Preferably, however, and as hereinbefore referred to, devices are employed of a character which will crease the blank in a manner to make a more flexible joint at the bending lines between the side and end sections than between the adjoining side sections. This is accomplished in the present case by adapting the longitudinally arranged creasing dies to make a larger and deeper crease than that made by the transverse dies, and preferably to make such larger and deeper crease gradually and by a plurality of successive creasing operations, whereby liability of unduly separating or breaking the fiber of the board on such creased lines will be avoided. In the embodiment of my invention here shown the set of die members 17—17′ and 24—24′ at the front side of the transverse dies are formed to make a relatively wide crease, as shown in Fig. 24, and the die members 18—18′ and 25—25′ at the rear side of said transverse dies are made narrower and adapted to enlarge and deepen the crease formed by said first set, as shown in Fig. 25. In the operation of the machine provided with these dies, a sheet or blank being fed through the machine is provided with a

preliminary crease on the lines between the side and end sections by the action of the first set of dies, and is subsequently—in its continued passage through the machine—further creased on the same creasing lines by the action of the second set of dies; the successive creasing operations serving to provide the desired flexibility of joint between the side and end sections without causing substantial injury to the carton material.

As the clutch-releasing trip device 130 is located some distance to the rear of the transverse creasing and slotting devices, it is obvious that if the machine is at rest and a blank is inserted to position with its forward edge in contact with said trip device to thereby start the machine, that the forward panel of the blank will receive only one creasing impression on the lines e'—e', and that the one given by the narrow or second set of dies. Therefore, in order to effect the double creasing of the blank on said lines e'—e', the operator will preferably insert the first blank to a position with its front edge substantially in line with the transverse creasing and slotting dies and then trip the machine by hand and allow the front panel of the blank to receive an initial crease on the lines e'—e' by the front or relatively wide set of dies. Thereafter, the blank will be advanced into contact with the trip device and trip the machine off for its predetermined cycle of operations to complete the creasing and slotting of the blank. In the subsequent feeding of blanks to the machine, the operator will usually and preferably enter each succeeding blank into the machine to have the front panel thereof receive its initial creasing impression at the fourth or last creasing operation of the cycle that completes the previous blank; in this way assuring a maximum output of the machine.

As a means for varying the depth of crease made in the sheets, according to the thickness of the sheets or otherwise, the shafts 5 on the upper frame 3 have an eccentric connection with the eccentric rods 4 in order to permit of a slight vertical adjustment of the upper frame 3 relatively to the lower frame 1, which may be conveniently and accurately accomplished by means of an adjusting shaft 240 mounted on the frame 3 (see Figs. 1 and 2) and having connection with the eccentric shafts 5 through worms 241 and worm gears 242, the said shaft 240 being adapted to be operated by an applied key or crank. As the length of stroke of the frame 3 is constant the connection of the eccentric rods 4 with the lower operating eccentric 6 is made yielding by means of split spring-connected eccentric straps 243, this connection permitting of the frame 3 and its supported creasing members yielding in the event of a sheet being passed through the machine of greater thickness than the machine is adjusted for and so compensating for the difference in thickness.

While I have shown and described one particular embodiment of my invention, it will be obvious that many more or less substantial changes may be made within the skill of the mechanician without departing from my invention, and as all such mechanical departures are within the purview of my invention, I do not limit myself to any of the details of construction herein illustrated and described for the purpose of disclosing the invention, except so far as I may be limited by the prior art to which this invention belongs.

I claim—

1. In a machine for making box-blanks, the combination of blank-feeding means, a transverse creasing device, means to operate the same to cause it to act a plurality of times upon a single blank to form a series of transverse creases therein, and a pair of longitudinal creasing devices disposed at either side of said transverse creasing device and operable simultaneously with the transverse creasing device to form a pair of continuous longitudinal creases in the blank.

2. In a machine for making box-blanks, the combination of blank feeding means, a transverse creasing device, longitudinal creasing devices capable of operating simultaneously with the transverse creasing device upon a single blank and designed to form continuous longitudinal creases in the blank, means to operate all of said creasing devices to cause the same to act a plurality of times on a single blank whereby the transverse creasing device forms a series of transverse creases in the blank intersecting the longitudinal creases formed by the longitudinal creasing devices.

3. In a machine for making box-blanks, the combination of blank-feeding means, a transverse creasing device, a transverse slotting device, means to operate said devices to cause them to act a plurality of times upon a single blank to form a series of transverse creases and slots therein, and a pair of longitudinal creasing devices disposed at either side of said transverse creasing device and operable simultaneously with the transverse creasing and slotting devices to form a pair of continuous longitudinal creases in the blank.

4. In a machine for making box-blanks, the combination of blank-feeding means, a transverse creasing device, a transverse slotting device, longitudinal creasing devices capable of operating simultaneously with the transverse creasing and slotting devices upon a single blank and designed to form continuous longitudinal creases in the blank, and means to operate all of said devices to

cause the same to act a plurality of times on a single blank whereby the transverse creasing and slotting devices form a series of transverse creases and slots in the blank intersecting the longitudinal creases formed by the longitudinal creasing devices.

5. In a machine for making box-blanks, the combination of blank-feeding means, a transverse creasing device, a pair of transverse slotting devices disposed at either end of said transverse creasing device and in line therewith, longitudinal creasing devices capable of operating simultaneously with the transverse creasing and slotting devices upon a single blank and designed to form continuous longitudinal creases in the blank, and means to operate all of said devices to cause the same to act a plurality of times on a single blank whereby the transverse creasing and slotting devices form a series of transverse creases and slots in the blank intersecting the longitudinal creases formed by the longitudinal creasing devices.

6. In a machine for making box-blanks, the combination of two sets of longitudinal creasing devices arranged end to end, the creasing devices of the second set being adapted to form a deeper crease in the blank than the creasing devices of the first set, and means to feed the blank with a step by step motion through the machine so that the second set of creasing devices will serve to deepen the creases formed by the creasing devices of the first set at which time the creasing devices of the first set will be providing new creases along the same lines of the same blank.

7. In a machine for making box-blanks, the combination of longitudinal creasing devices, a transverse creasing device arranged intermediate the ends of the longitudinal creasing devices, and means to feed a blank through the machine with a step by step motion so that in the first position of the blank the forward extremities of the longitudinal creasing devices will serve to crease the blank, and in subsequent positions of the blank the rear portion of the longitudinal creasing devices will serve to deepen the creases made by the forward portion of the longitudinal creasing devices while the latter are operating upon a portion of the same blank to extend or continue the longitudinal creases, the transverse creasing device being operative during this time to provide the same blank with a series of transverse creases intersecting the longitudinal creases.

8. In a machine for making box-blanks, the combination of longitudinal creasing devices and a transverse creasing device arranged to form transverse creases in the blank intersecting the longitudinal creases formed by the longitudinal creasing devices, means tending to move the blank continuously through the machine, and a plurality of stop devices to interrupt movement of the blank and permit it to be successively acted upon by said creasing devices.

9. In a machine for making box-blanks, the combination of longitudinal creasing devices and transverse creasing and slotting devices arranged to form transverse creases and slots in the blank intersecting the longitudinal creases formed by the longitudinal creasing devices, means tending to move the blank continuously through the machine, and a plurality of stop devices to interrupt movement of the blank and permit it to be successively acted upon by said creasing and slotting devices.

10. In a machine of the character described, the combination of a creasing device, slotting devices at opposite ends of said creasing device and arranged substantially in line therewith, a pair of creasing devices at right angles to said first-mentioned creasing device, one of said slotting devices and one of said pair of creasing devices being adjustable relatively to the opposite slotting and creasing devices, and operating means for said devices.

11. In a machine for making cartons of paper board or like material, having swinging sections or flaps at their filling ends, means for creasing the carton blanks on the several bending or corner lines thereof comprising a stationary member, a reciprocating member, longitudinal creasing devices associated with said members, a transverse creasing device also associated with said members and arranged intermediate the ends of said longitudinal creasing devices, the devices for creasing the blanks on the bending lines between the side and filling end sections being operative to make a greater crease than those devices for creasing the blanks on the bending lines between the side sections, and operating means for said devices.

12. In a machine for making cartons of paper board or like material, having swinging sections or flaps at their filling ends, means for creasing the carton blanks on the several bending or corner lines thereof comprising a stationary member, a reciprocating member, longitudinal creasing devices associated with said members, a transverse creasing device also associated with said members and arranged intermediate the ends of said longitudinal creasing devices, the devices for creasing the blanks on the bending lines between the side and filling end sections being operative to make a deeper crease than those devices for creasing the blanks on the bending lines between the side sections, and operating means for said devices.

13. In a machine of the character described and in combination, a stationary member, and a reciprocating member, two sets of longitudinal creasing devices asso-

ciated with each of said members, one set being arranged at the rear of the other and being operative to act subsequently to said other on the same creasing line and further crease the work on that line, a transverse creasing device also associated with said members and arranged intermediate the ends of said longitudinal creasing devices, means for feeding the work relatively to said devices whereby it may be successively acted on by them, and operating means for said devices.

14. In a machine of the character described and in combination, a stationary member, and a reciprocating member, two sets of longitudinal creasing devices associated with each of said members, one set being arranged at the rear of the other and being operative to act subsequently to said other on the same creasing line and deepen the crease in the work on that line, a transverse creasing device also associated with said members and arranged intermediate the ends of said longitudinal creasing devices, means for feeding the work relatively to said devices whereby it may be successively acted on by them, and operating means for said devices.

15. In a machine of the character described and in combination, blank feeding means, a creasing device arranged transversely to the direction of feed of the blank, slotting devices arranged at opposite ends of said creasing device and in line therewith, two sets of creasing devices arranged parallel with the direction of feed of the blank and at opposite sides of said transverse creasing device, the set of creasing devices at the rear of the transverse device being operative to enlarge the crease made by the first or front set, and operating means for said devices.

16. In a machine of the character described and in combination, blank feeding means, a creasing device arranged transversely to the direction of feed of the blank, slotting devices arranged at opposite ends of said creasing device and in line therewith, two sets of creasing devices arranged parallel with the direction of feed of the blank and at opposite sides of said transverse creasing device, one of said sets being operative to act subsequently to the other on the same creasing line, and operating means for said devices.

17. In a machine of the character described and in combination, means for slotting and creasing a carton blank, means for feeding a blank relatively to said slotting and creasing means, a stop-gage for interrupting movement of the blank at a predetermined time in its feeding movement to permit of its being acted on by said slotting and creasing means, a horizontally-arranged vertically-movable rod or support on which the stop-gage is adjustably mounted for horizontal adjustment, and means for operating said rod or support to project the supported stop-gage into the path of movement of the blank at a predetermined time.

18. In a machine of the character described and in combination, means for slotting and creasing a carton blank, means for feeding a blank relatively to said slotting and creasing means, a stop-gage for interrupting movement of the blank at a predetermined time in its feeding movement to permit of its being acted on by said slotting and creasing means, a horizontally-arranged pivotally-supported rod or support on which the stop-gage is adjustably mounted for horizontal adjustment, and means for operating said rod or support to project the supported stop-gage into the path of movement of the blank at a predetermined time.

19. In a machine of the character described and in combination, means for slotting and creasing a carton blank, means for feeding a blank relatively to said slotting and creasing means, a series of stop-gages for successively interrupting movement of the blank at different predetermined times in its feeding movement to permit of its being successively acted on by said slotting and creasing means, a plurality of vertically-movable horizontally-arranged rods or supports on which stop-gages are mounted, and means for operating said rods or supports to successively project the supported stop-gages into the path of movement of the blank at predetermined times.

20. In a machine of the character described and in combination, means for slotting and creasing a carton blank, means for feeding a blank relatively to said slotting and creasing means, a series of stop-gages for successively interrupting movement of the blank at different predetermined times in its feeding movement to permit of its being successively acted on by said slotting and creasing means, a plurality of vertically-movable horizontally-arranged rods or supports on which the stop-gages are adjustably mounted for adjustment relatively to each other and to the slotting and creasing means, and means for operating said rods or supports to successively project the supported stop-gages into the path of movement of the blank at predetermined times.

21. In a machine of the character described and in combination, carton blank slotting and creasing means, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on a blank subsequent to the action of said slotting and creasing means thereon.

22. In a machine of the character de-

scribed and in combination, carton blank slotting and creasing means, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, the slotting means being arranged to act in advance of the creasing means, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on a blank subsequent to the action of said slotting and creasing means thereon.

23. In a machine of the character described and in combination, carton blank feeding means, carton blank slotting and creasing means, the slotting means being arranged and operative to act in advance of the creasing means, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on the blank subsequent to the action of said slotting and creasing means thereon.

24. In a machine of the character described and in combination, carton blank feeding means, carton blank slotting and creasing means, end-flap cutting means, and means for successively interrupting the feeding movement of the blank to permit of its being successively acted on by said slotting and creasing means and end-flap cutting means.

25. In a machine of the character described and in combination, carton blank feeding means including a continuously moving blank-engaging member, carton blank slotting and creasing means, end-flap cutting means, and means for successively interrupting the feeding movement of the blank to permit of its being successively acted on by said slotting and creasing means and end-flap cutting means.

26. In a machine of the character described and in combination, carton blank feeding means including a continuously moving blank-engaging member, carton blank slotting and creasing means, end-flap cutting means, a series of stop-gages, and means for operating said stop-gages to successively project the same across the path of movement of the blank at predetermined times and interrupt the feeding movement of the same to permit of its being successively acted on by the said slotting and creasing means and end-flap cutting means.

27. In a machine of the character described and in combination, carton blank feeding means, carton blank slotting and creasing means, end-flap cutting means, and means successively interrupting the feeding movement of the blank relatively to the slotting and creasing means to permit of its being successively acted on by the latter at different predetermined points and thereafter again interrupting its feeding movement relatively to the end-flap cutting means to permit its being acted on thereby.

28. In a machine of the character described and in combination, carton blank feeding means including a continuously moving blank-engaging member, carton blank slotting and creasing means, end-flap cutting means, and a series of stop-gages and actuating means therefor operative to successively interrupt the feeding movement of the blank relatively to the slotting and creasing means to permit of its being successively acted on by the latter at different predetermined points and to thereafter again interrupt its feeding movement relatively to the end-flap cutting means to permit its being acted on thereby.

29. In a machine of the character described and in combination, carton blank slotting and creasing means, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on the blank to cut the blank subsequent to the slotting thereof on a line at an angle to and intersecting a slot therein formed by said slotting means.

30. In a machine of the character described and in combination, carton blank slotting and creasing means, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on the blank to cut the end of the blank subsequent to the slotting thereof on a line at an angle to and intersecting a slot therein formed by said slotting means.

31. In a machine of the character described and in combination, carton blank slotting and creasing means, the slotting means being operative to slot the blank at opposite edges thereof, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will be caused to act only once on the blank to cut the end of the blank subsequent to the slotting thereof on lines at an angle to and intersecting opposite slots therein formed by said slotting means.

32. In a machine of the character described and in combination, carton blank slotting means constructed and operative to slot the blank at opposite edges thereof, means to cause several operations of said slotting and creasing means on a single blank passing through the machine, end-flap cutting means and means to actuate said end flap cutting means so that the same will

be caused to act only once on the blank to cut the end of the blank on lines at an angle to and intersecting opposite slots therein formed by said slotting means.

33. In a machine of the character described and in combination, carton blank slotting and creasing means, end-flap cutting means, and operating means imparting a plurality of working operations to the slotting and creasing means to each working operation of the end-flap cutting means.

34. In a machine of the character described and in combination, carton blank slotting means, carton blank creasing means, and end-flap cutting means, each embodying a movable member, and operating means imparting a plurality of working strokes to the movable members of the slotting and creasing means to each working stroke of the end-flap cutting means.

35. In a machine of the character described and in combination, carton blank slotting, creasing, and end-flap cutting devices, a reciprocatory head carrying said devices, and means imparting differential movements to the slotting and creasing devices and end-flap cutting device respectively.

36. In a machine of the character described and in combination, carton blank slotting, creasing, and end-flap cutting devices, a reciprocatory head carrying said devices, and means imparting a plurality of working strokes to the slotting and creasing devices to each working stroke of the end-flap cutting device.

37. In a machine of the character described and in combination, carton blank slotting, creasing, and end-flap cutting devices, a reciprocatory head carrying said devices and having the end-flap cutting device movably mounted thereon, and means imparting a plurality of working strokes to the slotting and creasing devices to each working stroke of the end-flap cutting device.

38. In a machine of the character described and in combination, carton blank slotting, creasing, and end-flap cutting devices, a reciprocatory head having said slotting and creasing devices attached thereto for movement in unison therewith and having said end-flap cutting device slidably mounted thereon, and means for imparting a plurality of working strokes to the slotting and creasing devices to each working stroke of the end-flap cutting device.

39. In a machine of the character described and in combination, carton blank creasing, slotting and end-flap cutting devices, a reciprocatory head carrying said devices and having the end-flap cutting device movably mounted thereon, means for reciprocating said head, and means controlling the position of the end-flap cutting device relatively to the head whereby it will be rendered inoperative to act on the blank during certain strokes of said head.

40. In a machine of the character described and in combination, carton blank forming means embodying two coöperating members one of which is slotted, means for feeding a blank relatively to said forming means and past the slotted member thereof, means for interrupting the feeding movement of the blank to permit of its being acted on by said forming means at a predetermined point, and means for disengaging a blank from said slotted member subsequent to its being acted on by the forming means.

41. In a machine of the character described and in combination, carton blank creasing means embodying two coöperating members one of which is slotted, means for feeding a blank relatively to said creasing means and past the slotted member thereof, means for interrupting the feeding movement of the blank to permit of its being acted on by said creasing means at a predetermined point, and means for disengaging the blank from said slotted member subsequent to its being acted on by the creasing means.

42. In a machine of the character described and in combination, carton blank forming means, means for feeding a blank relatively to said forming means to be acted on thereby, a series of stop-gages for successively interrupting the feeding movement of the blank to permit of its being successively operated on by said forming means, a clutch-controlled operating mechanism for said blank forming and feeding means and for said stop-gages, and means for operating the clutch to throw said mechanism into operation including a trip device arranged in the path of movement of the blank to be operated thereby, said trip device being supported in position in advance of the first stop-gage of the series.

43. In a machine for making box-blanks, the combination of blank-forming means embodying two coöperating members, one of which has an elongated slot, and a series of springs disposed along the length of said slotted member for automatically disengaging the blank therefrom subsequent to its being acted upon by the forming means.

44. In a machine for making box-blanks, the combination of means tending to move a blank continuously through the machine, a plurality of longitudinal gage rods, each of which carries a stop gage, said stop gages being set to stop the blank in different positions, and means to raise and lower said gage rods bodily and in timed relation to render said stop gages effective and ineffective for operating upon the blank.

45. In a machine for making box-blanks,

the combination of means tending to feed the blank continuously through the machine, a plurality of longitudinal gage rods, each of which carries a stop gage for arresting movement of the blank in a predetermined position thereof, and means to impart a vertical lifting movement to each gage rod at a predetermined time to bring its stop gage into the path of movement of the blank and thereby arrest the motion of the same.

46. In a machine for making box-blanks, the combination of means tending to feed the blank continuously through the machine, a plurality of longitudinal gage rods, each of which carries a stop gage for arresting movement of the blank in a predetermined position thereof, and means to impart a vertical lifting movement to each gage rod at a predetermined time to bring its stop gage into the path of movement of the blank and thereby arrest the motion of the same, said means being operable to subsequently lower the lifted gage rod to withdraw its stop gage from the path of movement of the blank.

47. In a machine for making box-blanks, the combination of a transverse creasing device, a pair of longitudinal creasing devices disposed at either side of said transverse creasing device, and means to simultaneously adjust the corresponding longitudinal creasing device of each pair toward and away from the opposite longitudinal creasing devices.

48. In a machine of the class described, the combination of carton blank forming means, clutch-controlled operating means therefor, means for moving the carton blank through the machine, a plurality of stop gages to interrupt movement of the blank in different positions thereof to permit it to be operated upon by the forming means, and trip mechanism associated with the first of said gages to render the clutch of the operating means operative.

49. In a machine of the class described, the combination of carton blank forming means, clutch controlled operating means therefor, means for moving the carton blank through the machine, a plurality of stop gages to interrupt movement of the blank in different positions thereof to permit it to be operated upon by the forming means, trip mechanism associated with the first of said gages to render the clutch of the operating means operative, and means capable of automatically rendering said clutch inoperative after all of said gages have operated to intermittently arrest movement of the blank.

Signed at Rochester, in the county of Monroe, and State of New York, this 10th day of January, A. D. 1912.

EDGAR M. HAWKINS.

Witnesses:

ROBERT J. GARRISON,

LOUISE ELLIS.