Jan. 5, 1937. E. CONTI 2,066,769

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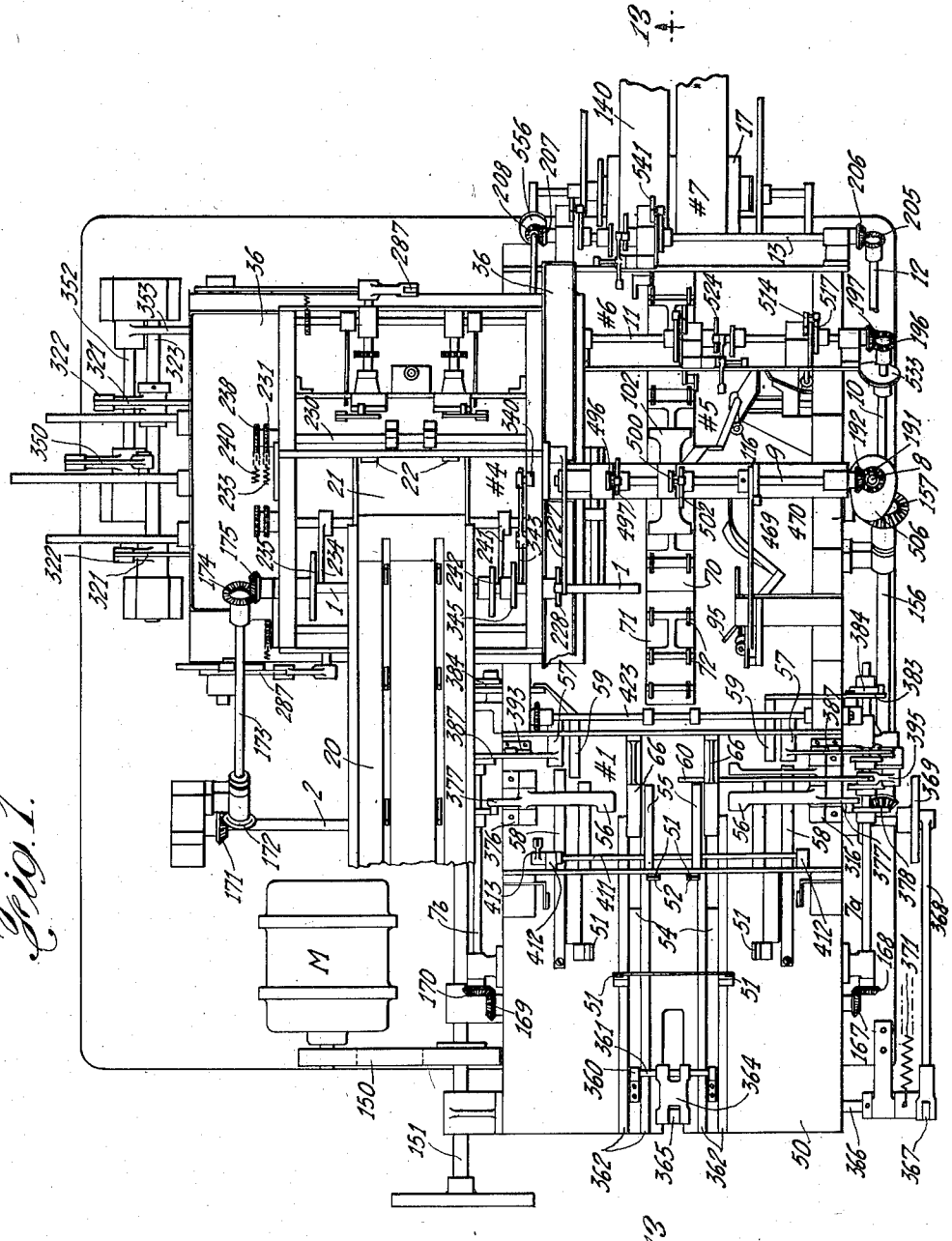


Fig. 1.

INVENTOR
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

APPARATUS FOR PACKAGING ARTICLES

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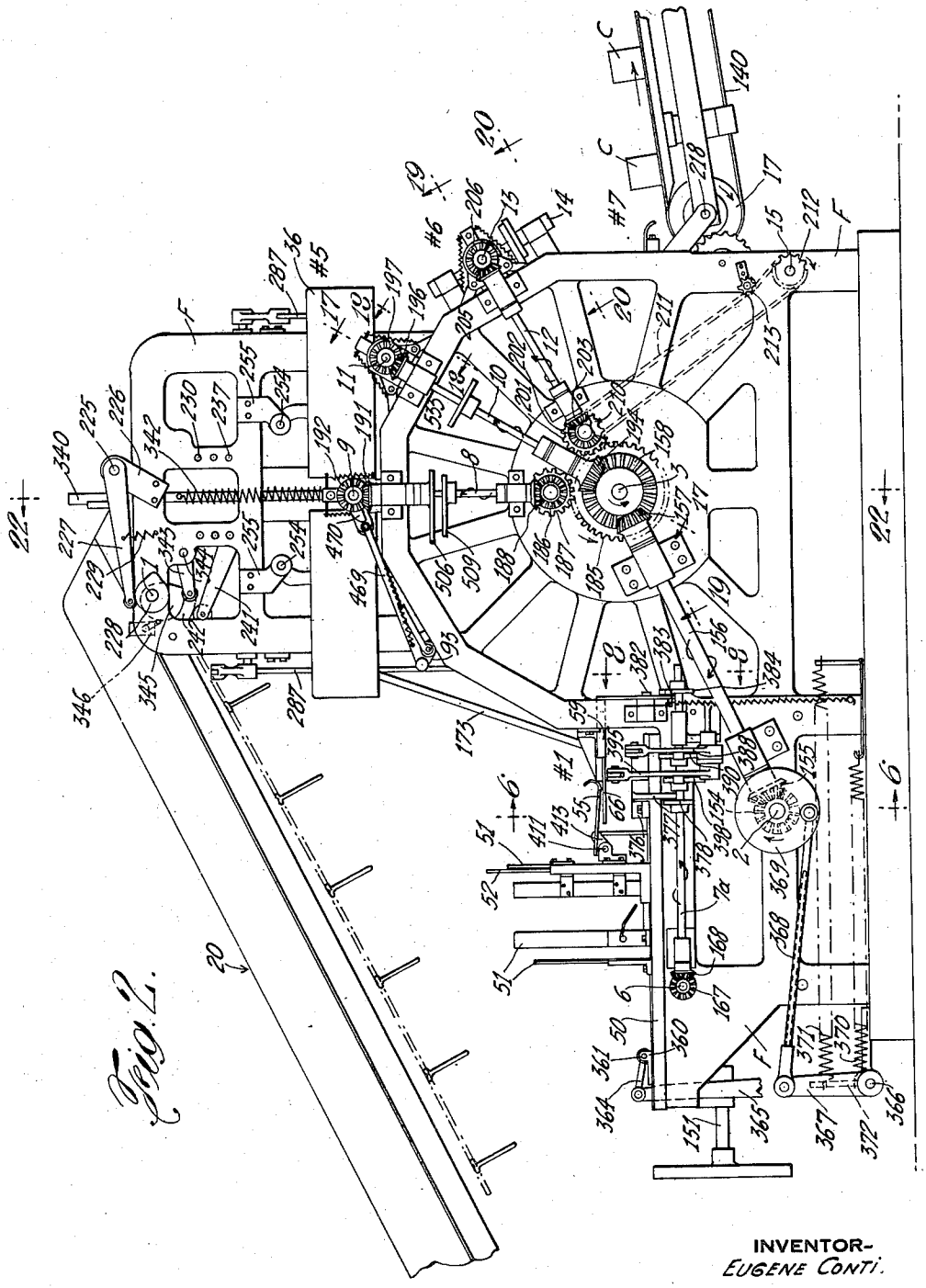


Fig. 2.

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

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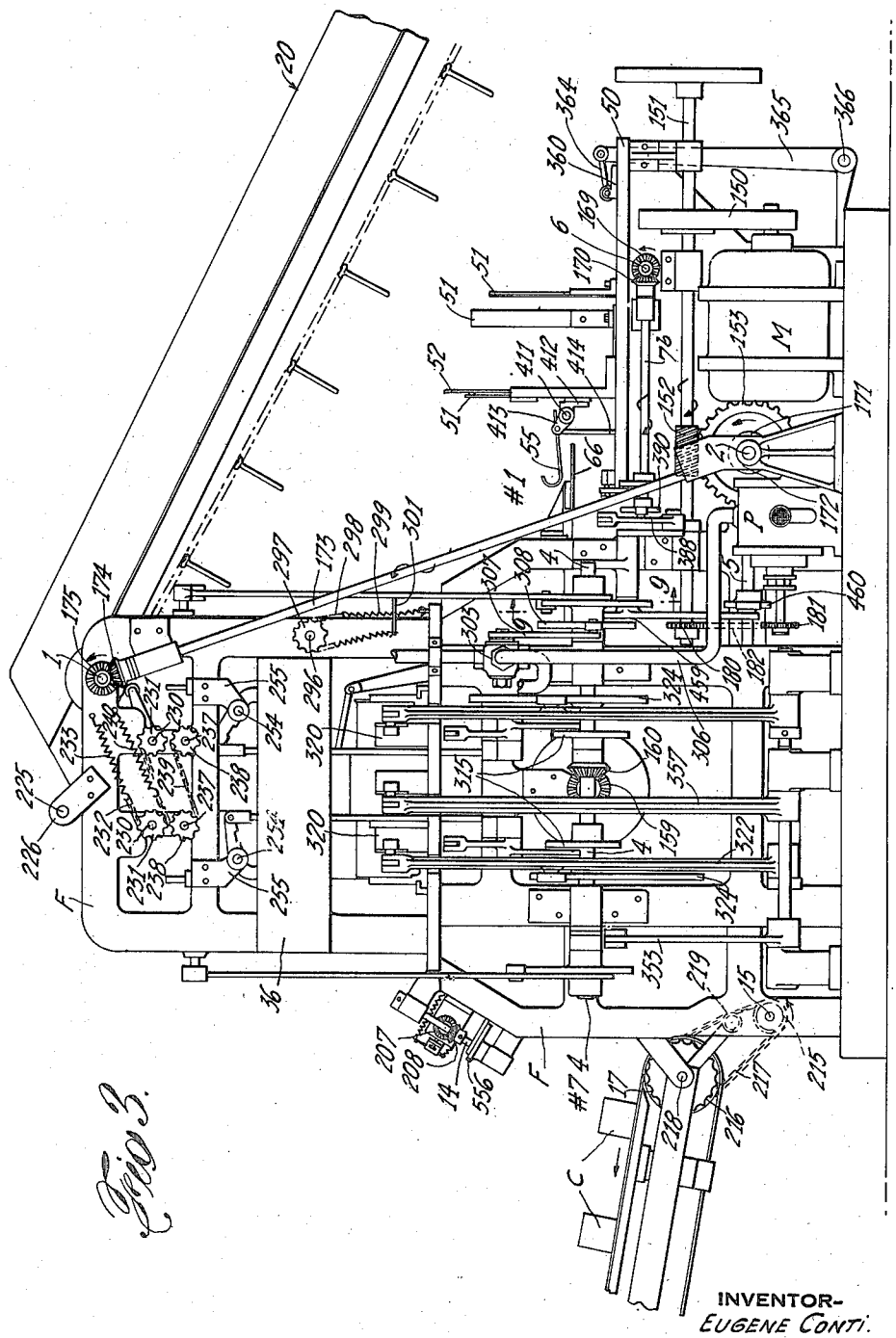


Fig. 3.

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

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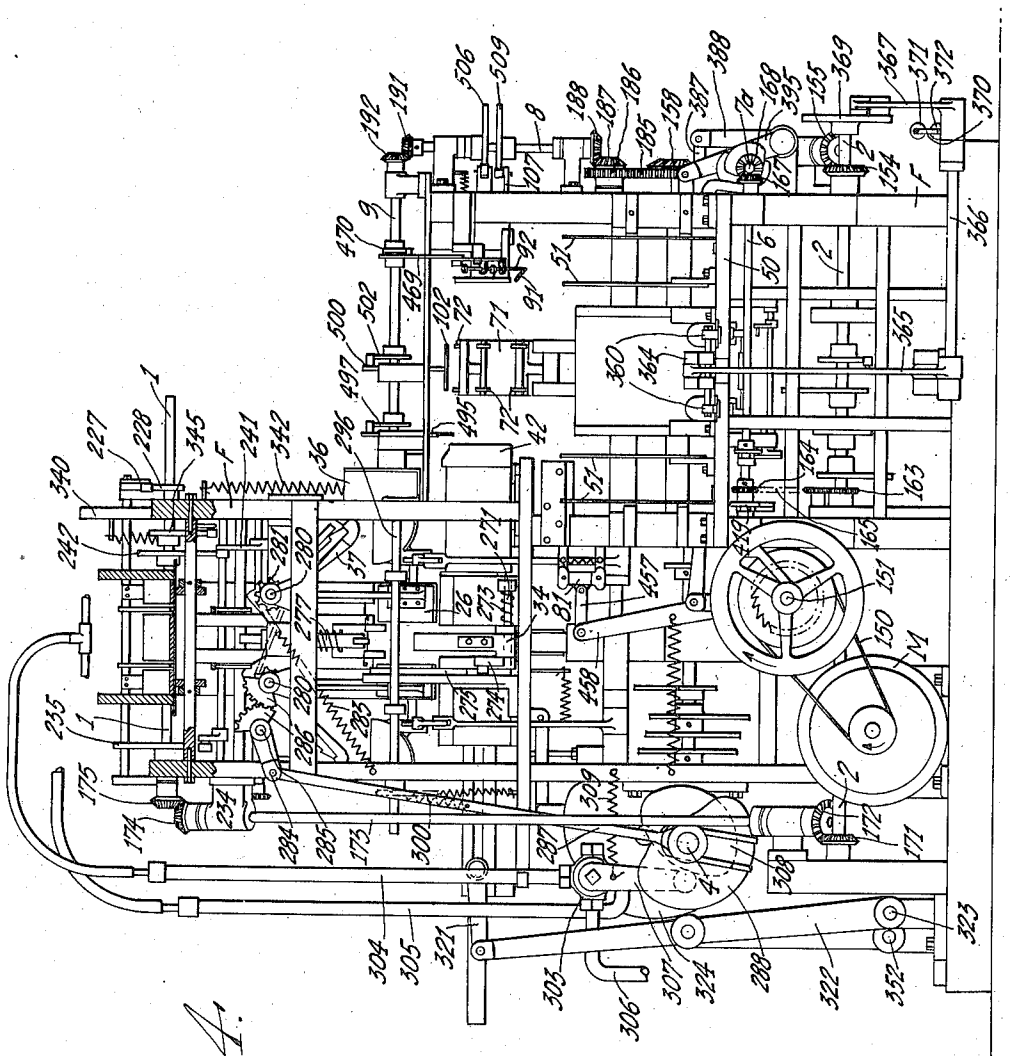


Fig. 4.

INVENTOR-
EUGENE CONTI.
BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

APPARATUS FOR PACKAGING ARTICLES

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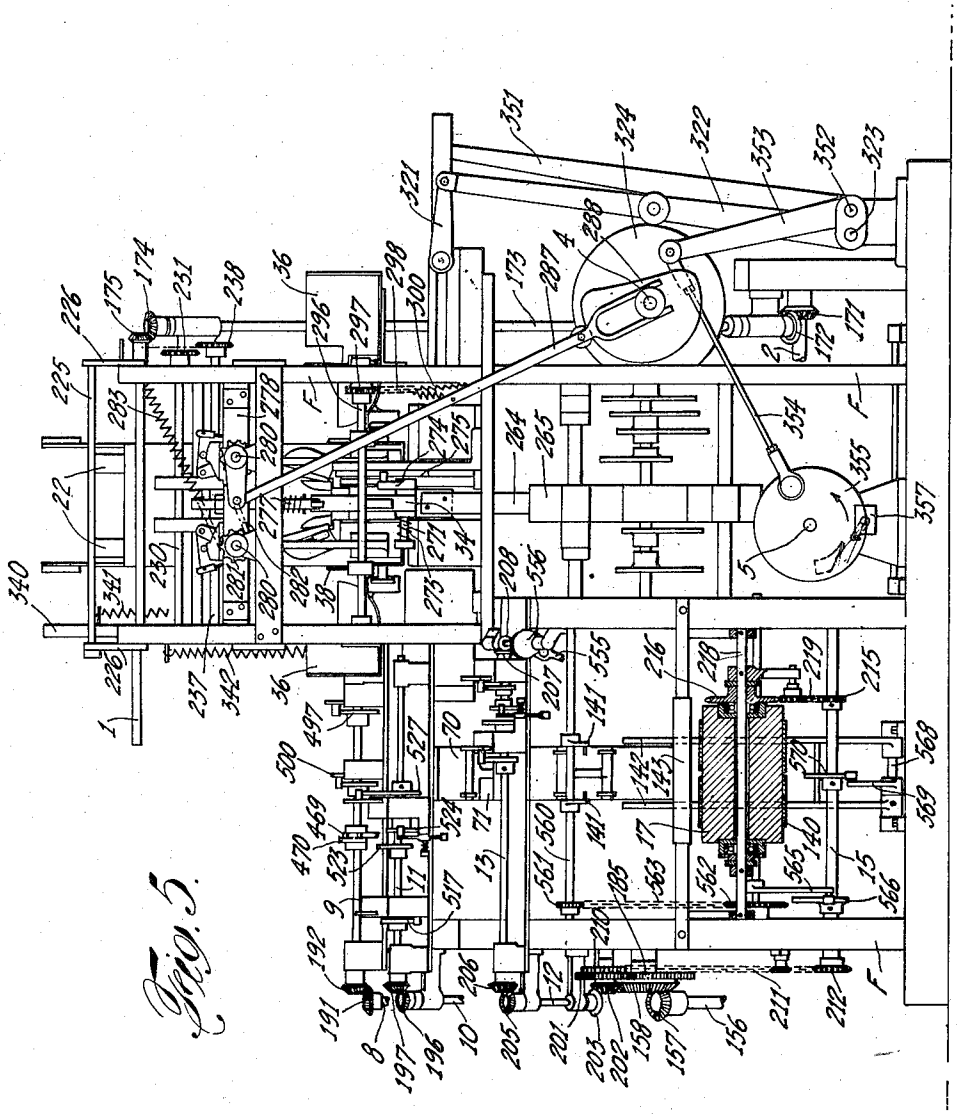


Fig. 5.

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

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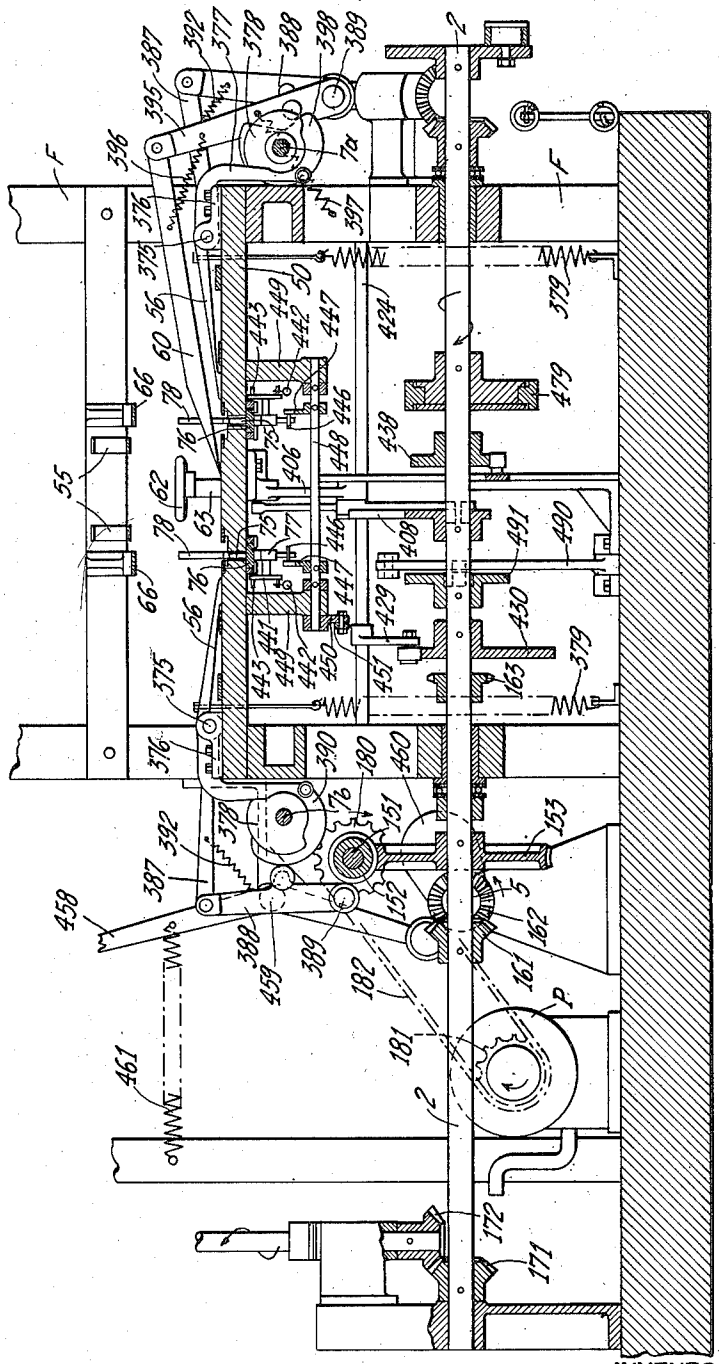


Fig. 6.
(On Fig. 2.)

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

APPARATUS FOR PACKAGING ARTICLES

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Fig. 7. (on Fig. 13.)

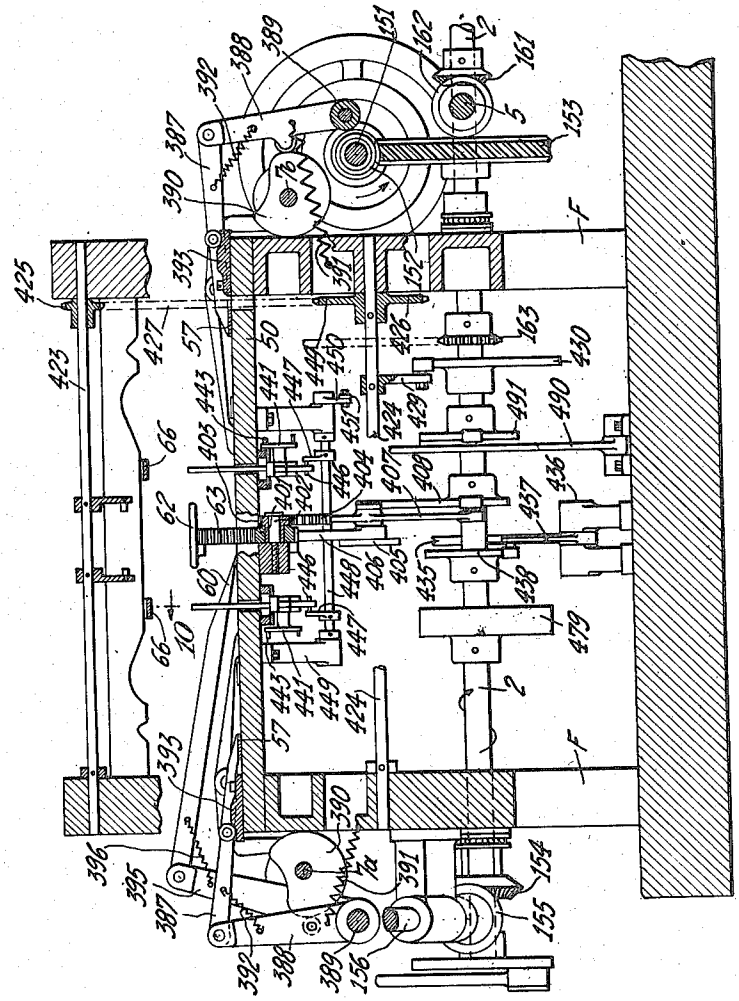


Fig. 8. (on Fig. 2.)

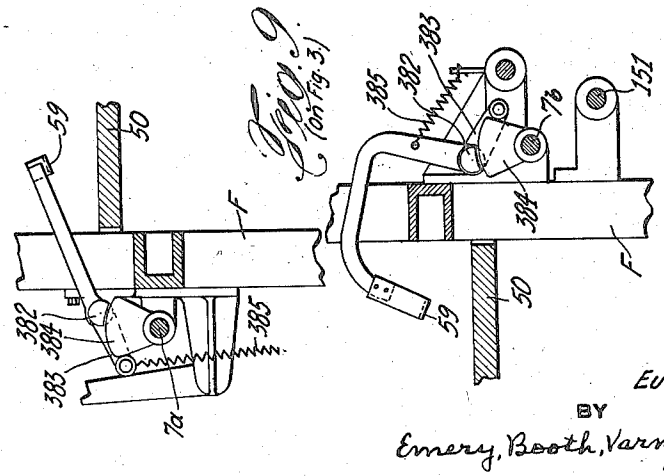


Fig. 9. (on Fig. 3.)

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Jan. 5, 1937. E. CONTI 2,066,769

APPARATUS FOR PACKAGING ARTICLES

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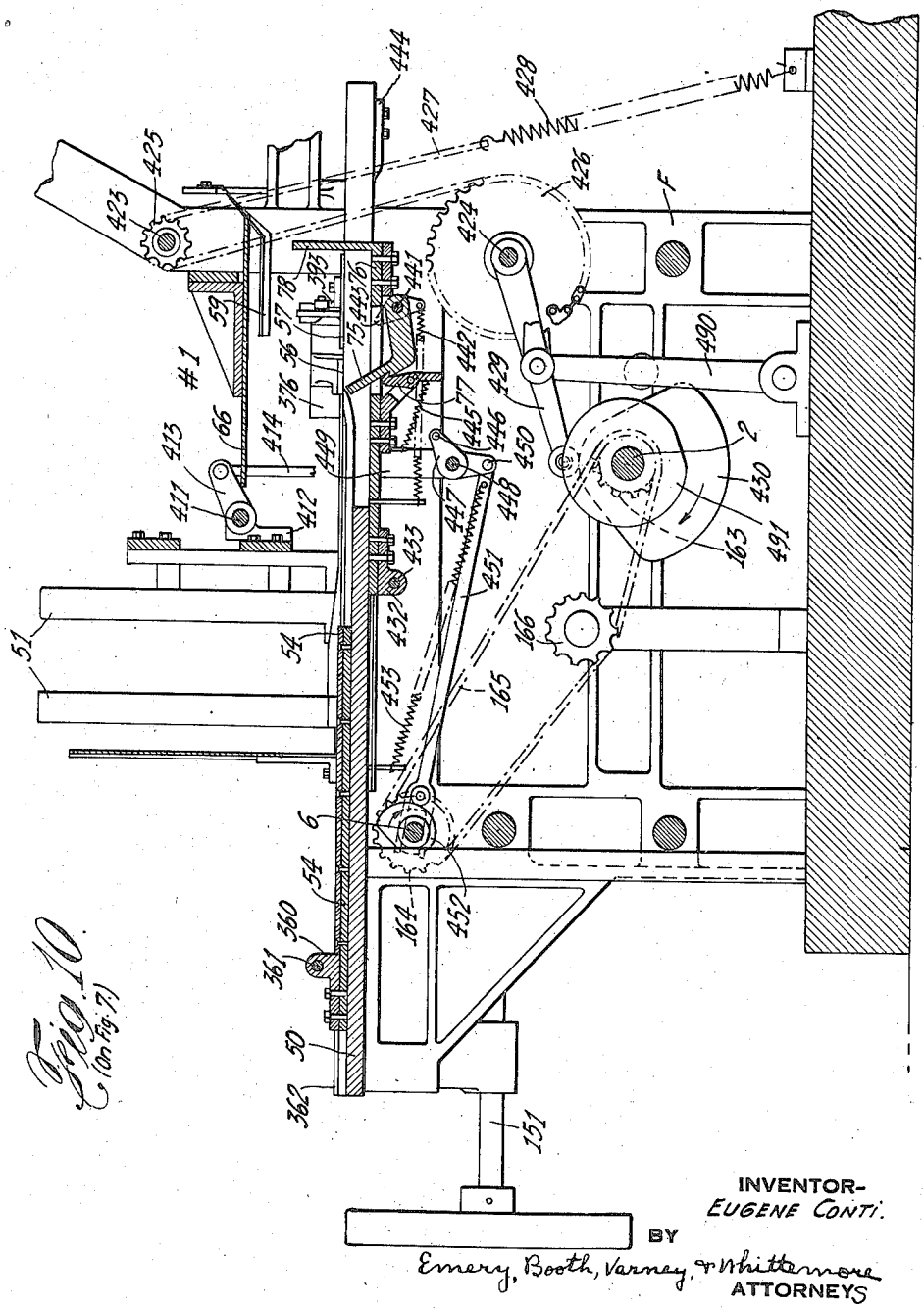


Fig. 10.
(On Fig. 7.)

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

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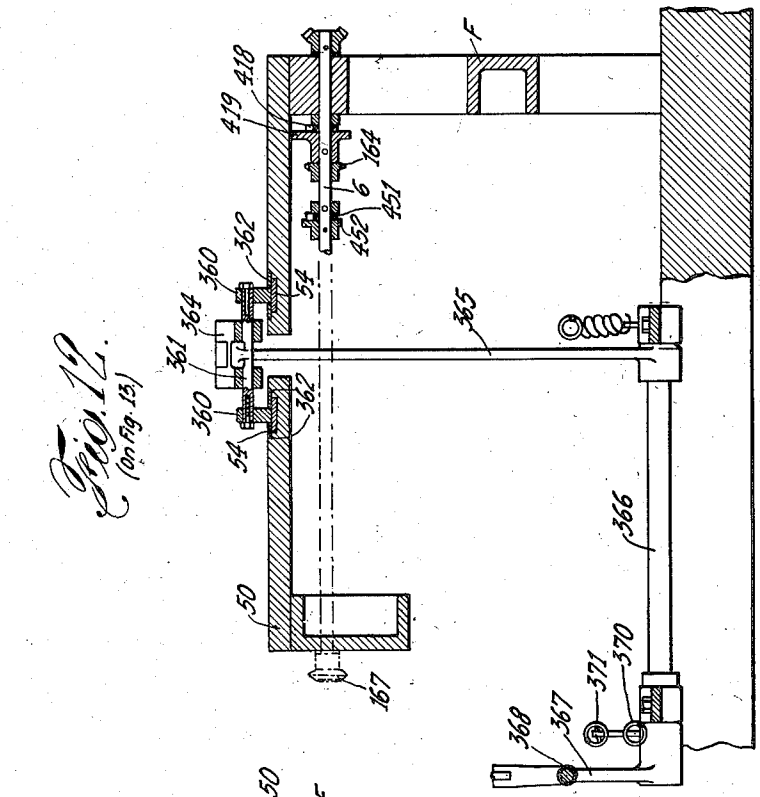


Fig. 12. (On Fig. 13)

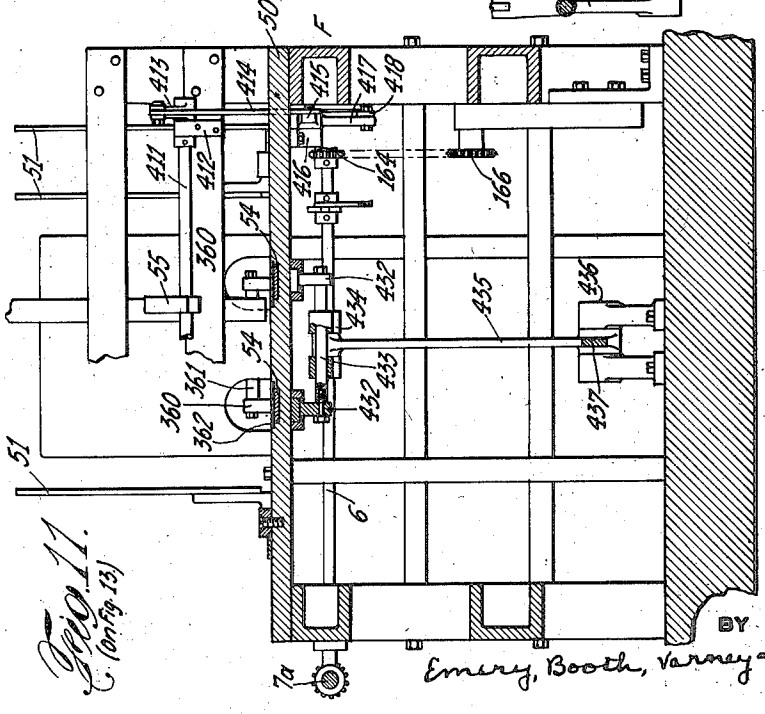


Fig. 11. (On Fig. 13)

INVENTOR-
EUGENE CONTI.
BY
Emery, Booth, Varney & Whittemore
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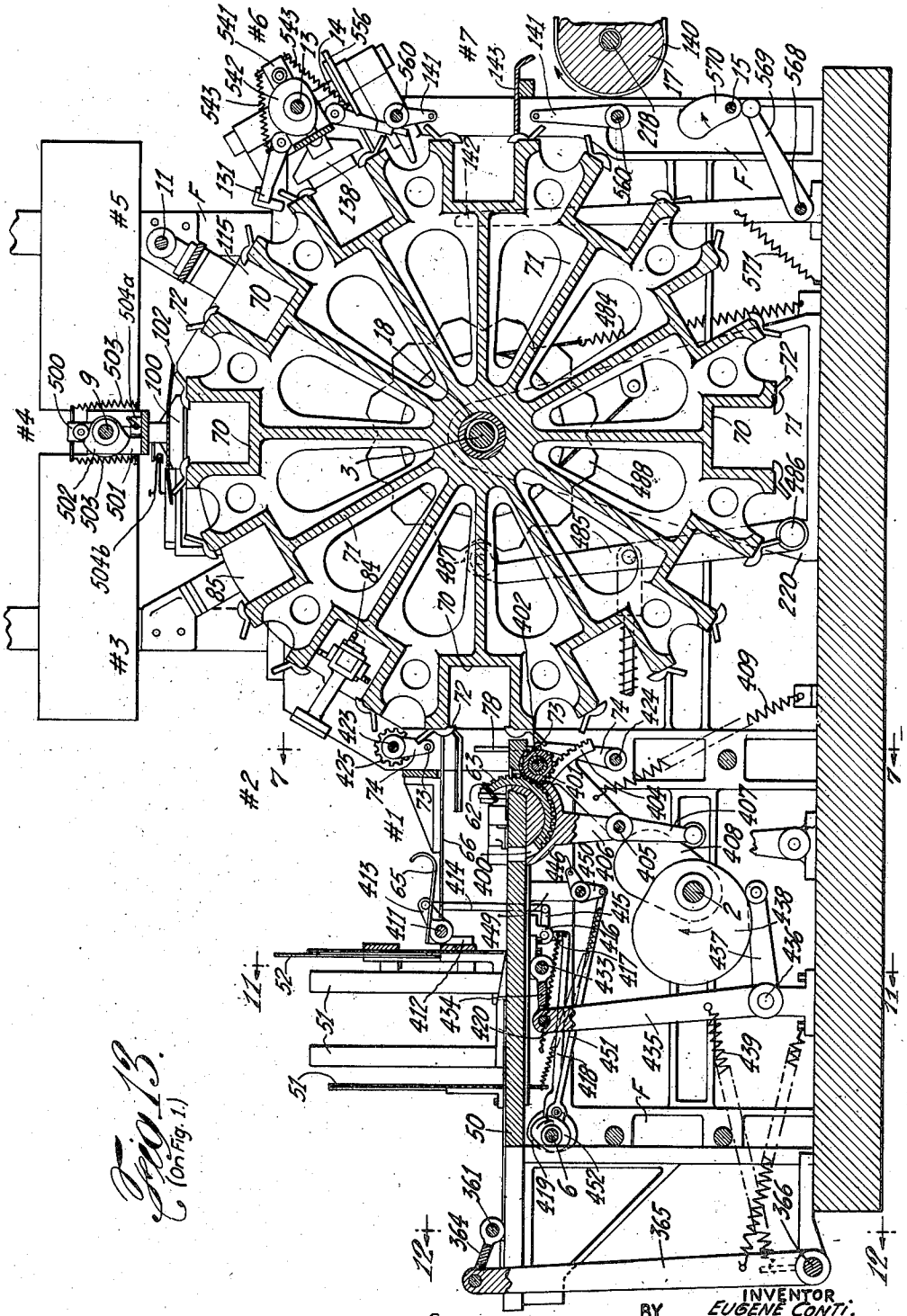


Fig. 13.
(On Fig. 1.)

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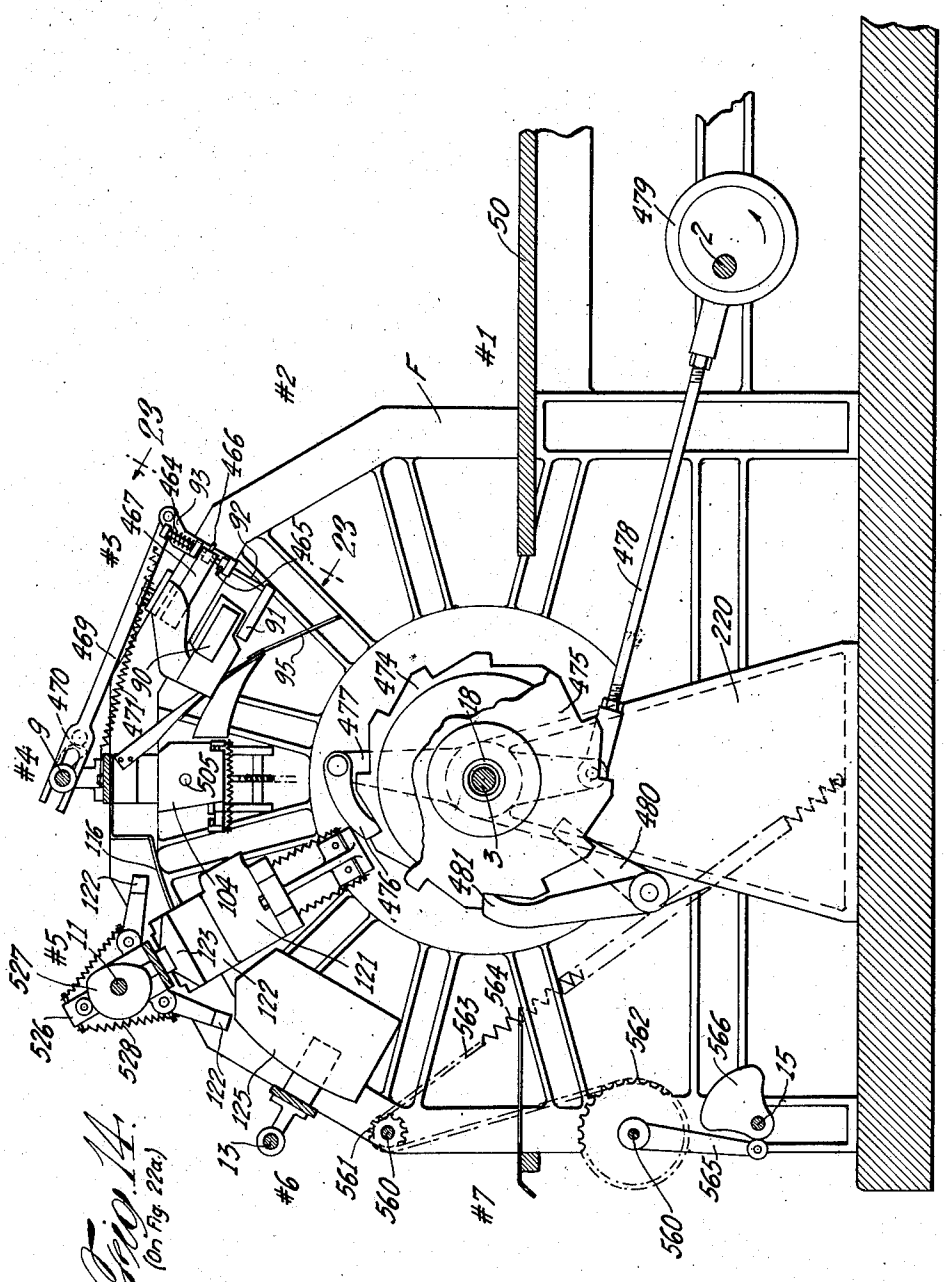


Fig. 14.
(On Fig 22a)

INVENTOR-
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

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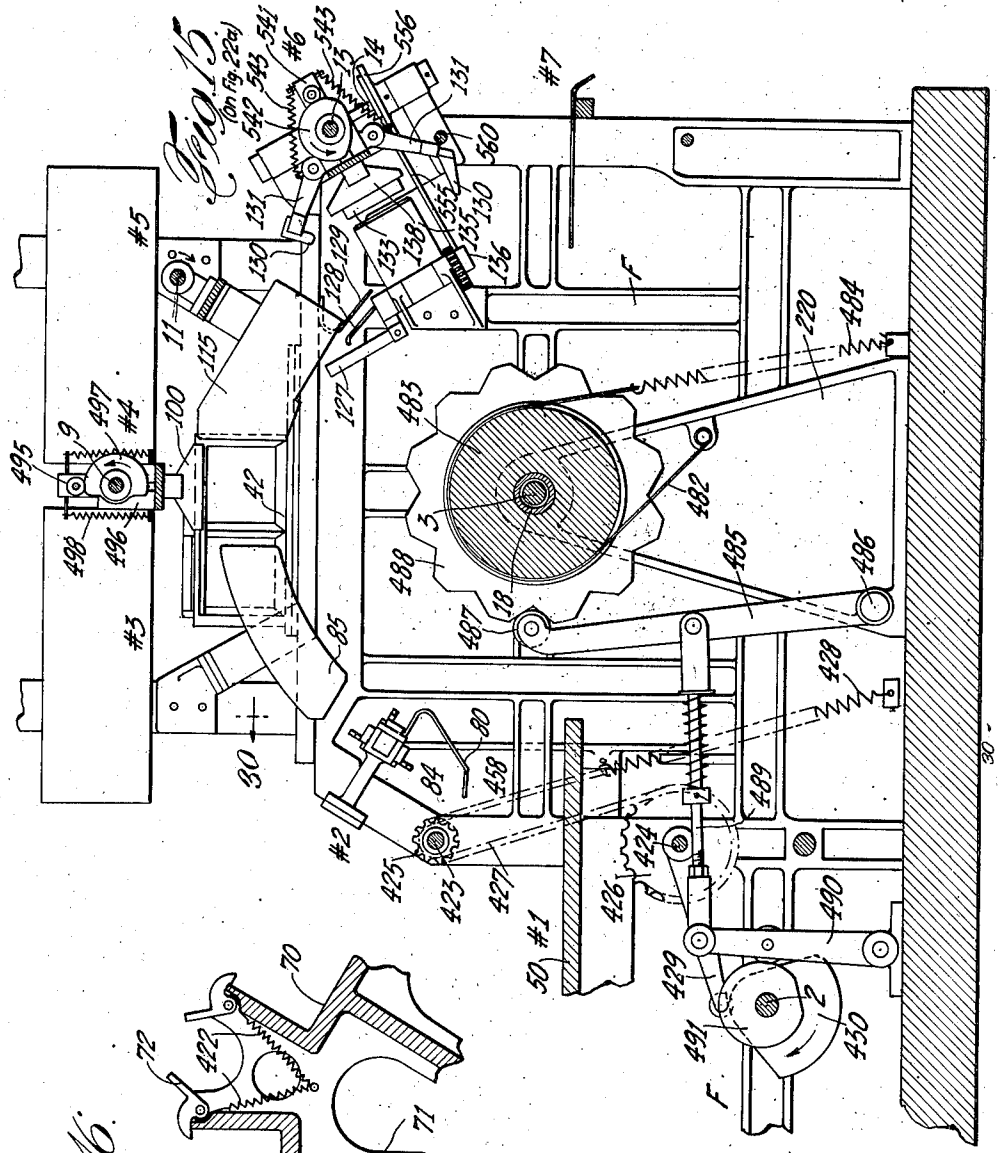


Fig. 15. (On Fig. 22a)

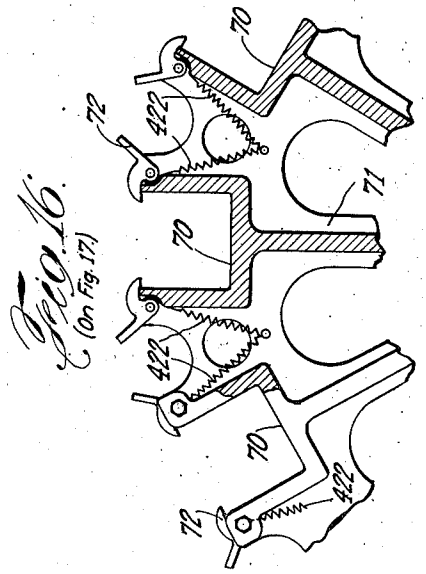


Fig. 16. (On Fig. 17)

INVENTOR-
EUGENE CONTI.
BY
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APPARATUS FOR PACKAGING ARTICLES

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Fig. 17.
(On Fig. 2)

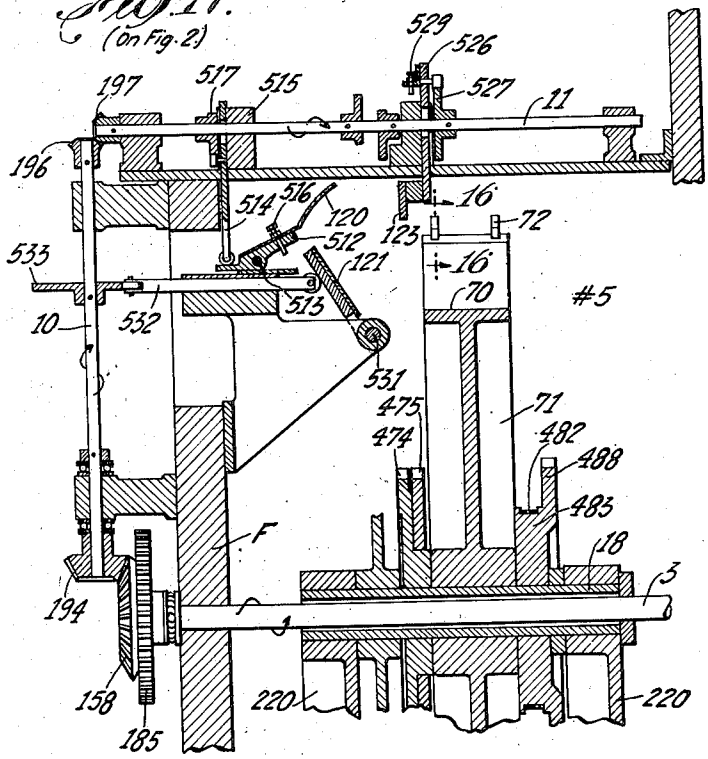
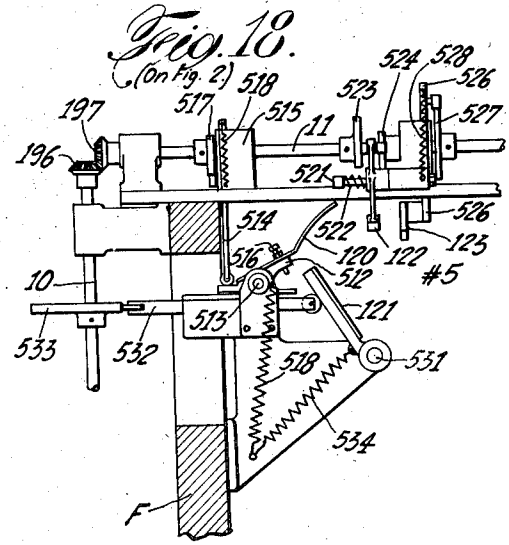


Fig. 18.
(On Fig. 2)



INVENTOR-
EUGENE CONTI.

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Fig. 19.
(on Fig. 2)

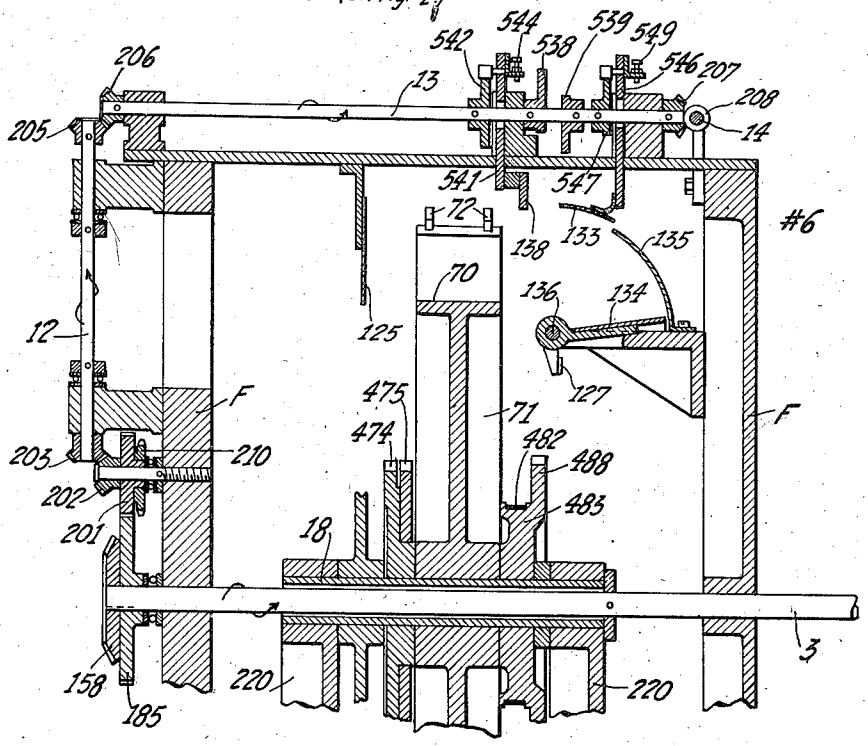
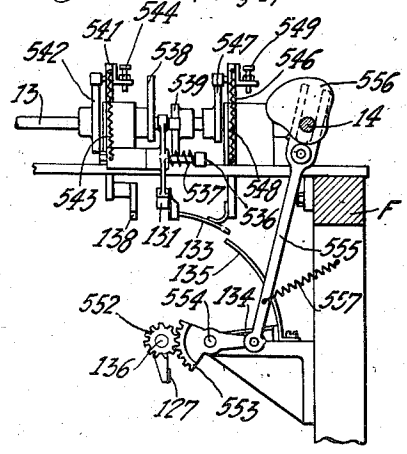


Fig. 20.
(on Fig. 2)



INVENTOR-
EUGENE CONTI.

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Fig. 21.
(on Fig. 22a.)

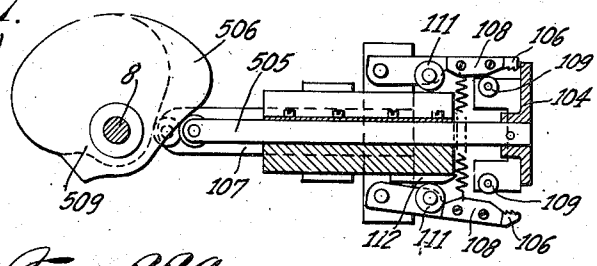


Fig. 22a
(on Fig. 2.)

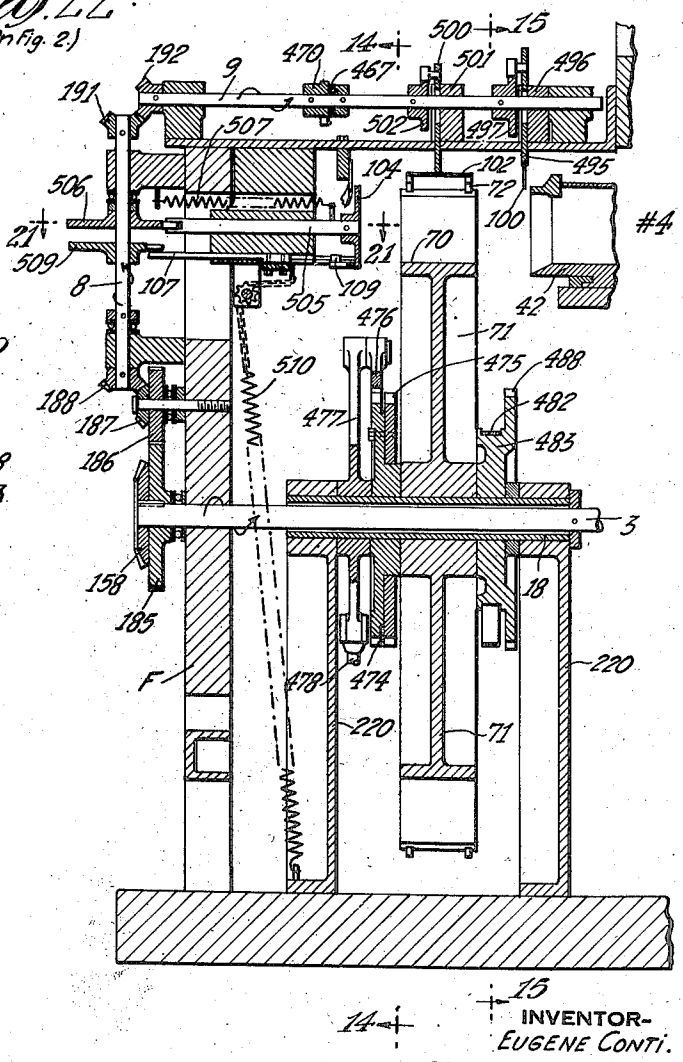
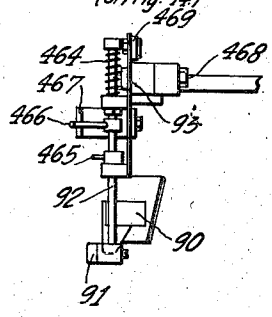


Fig. 23.
(on Fig. 14.)



INVENTOR-
EUGENE CONTI.

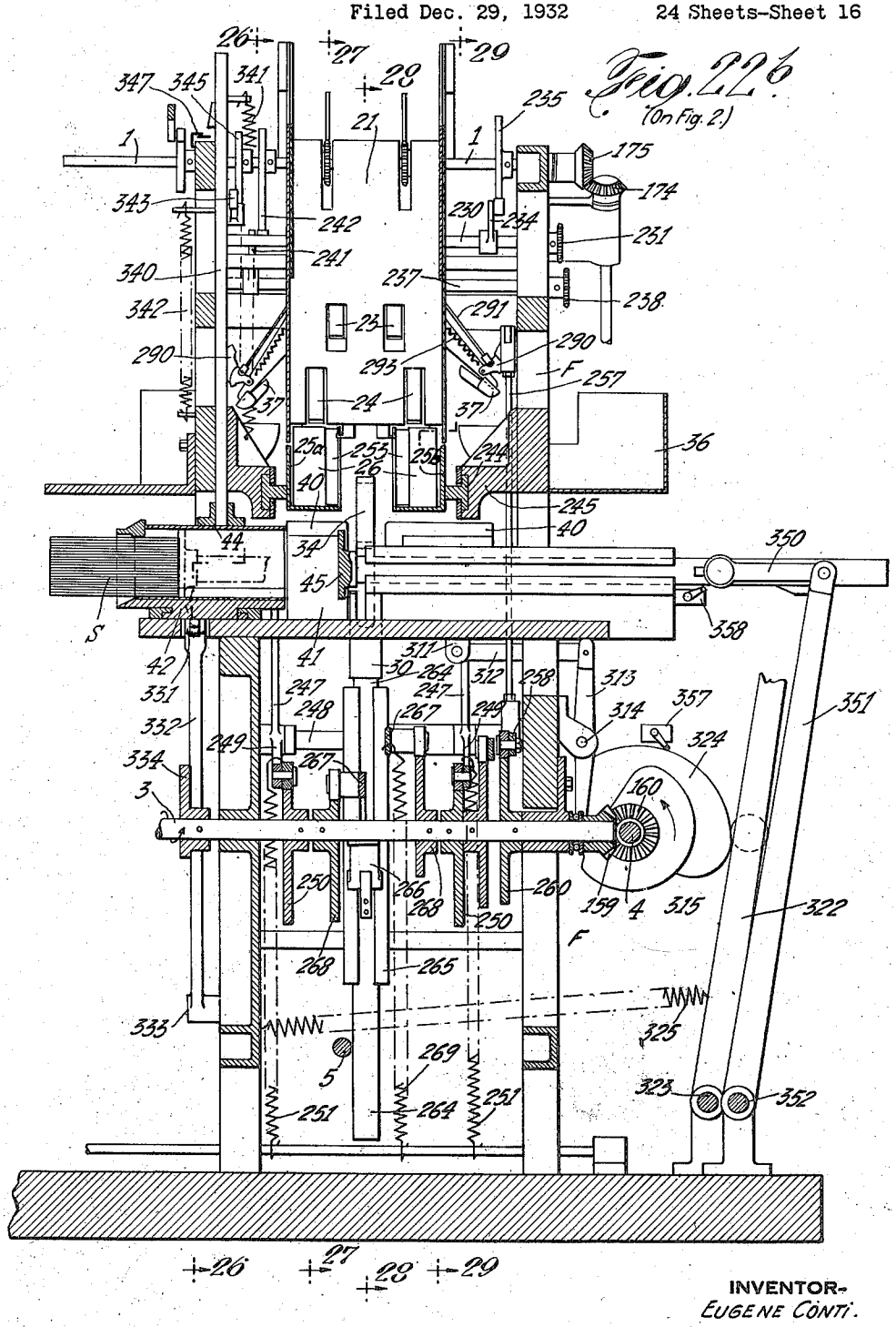
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INVENTOR-
EUGENE CONTI.

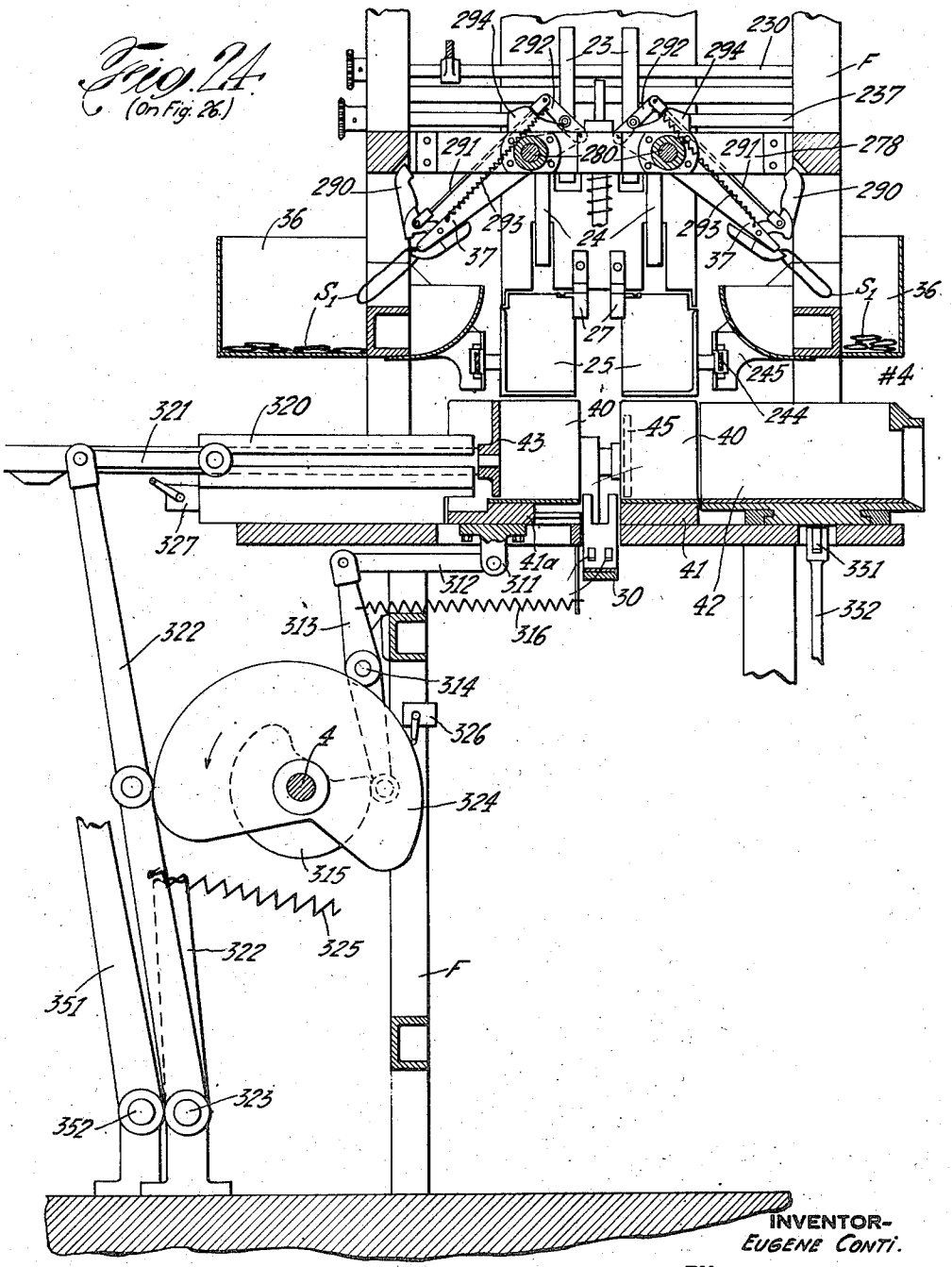
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APPARATUS FOR PACKAGING ARTICLES

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Fig. 24.
(On Fig. 26.)



INVENTOR-
EUGENE CONTI.

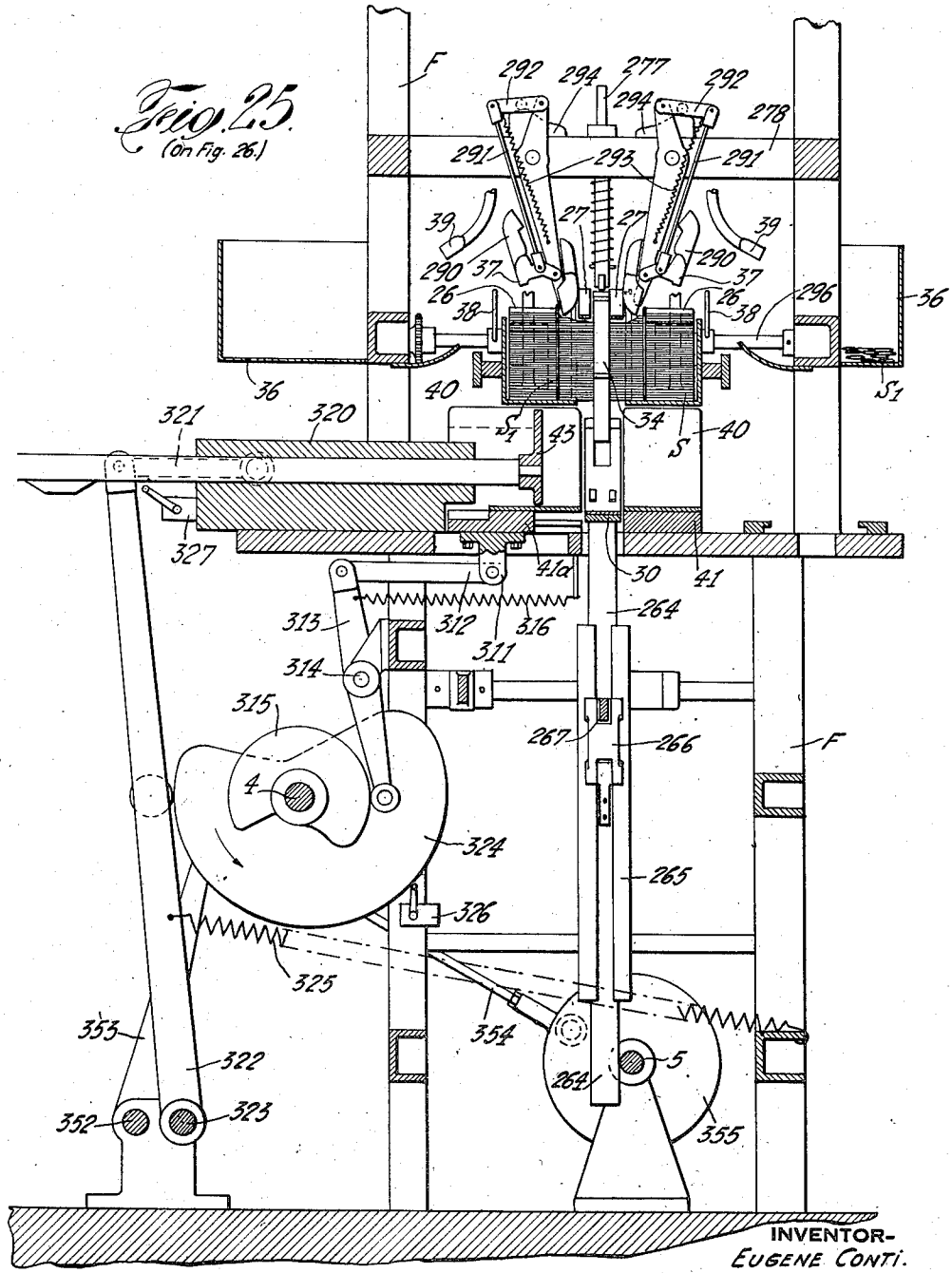
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Fig. 25.
(On Fig. 26.)



INVENTOR-
EUGENE CONTI.

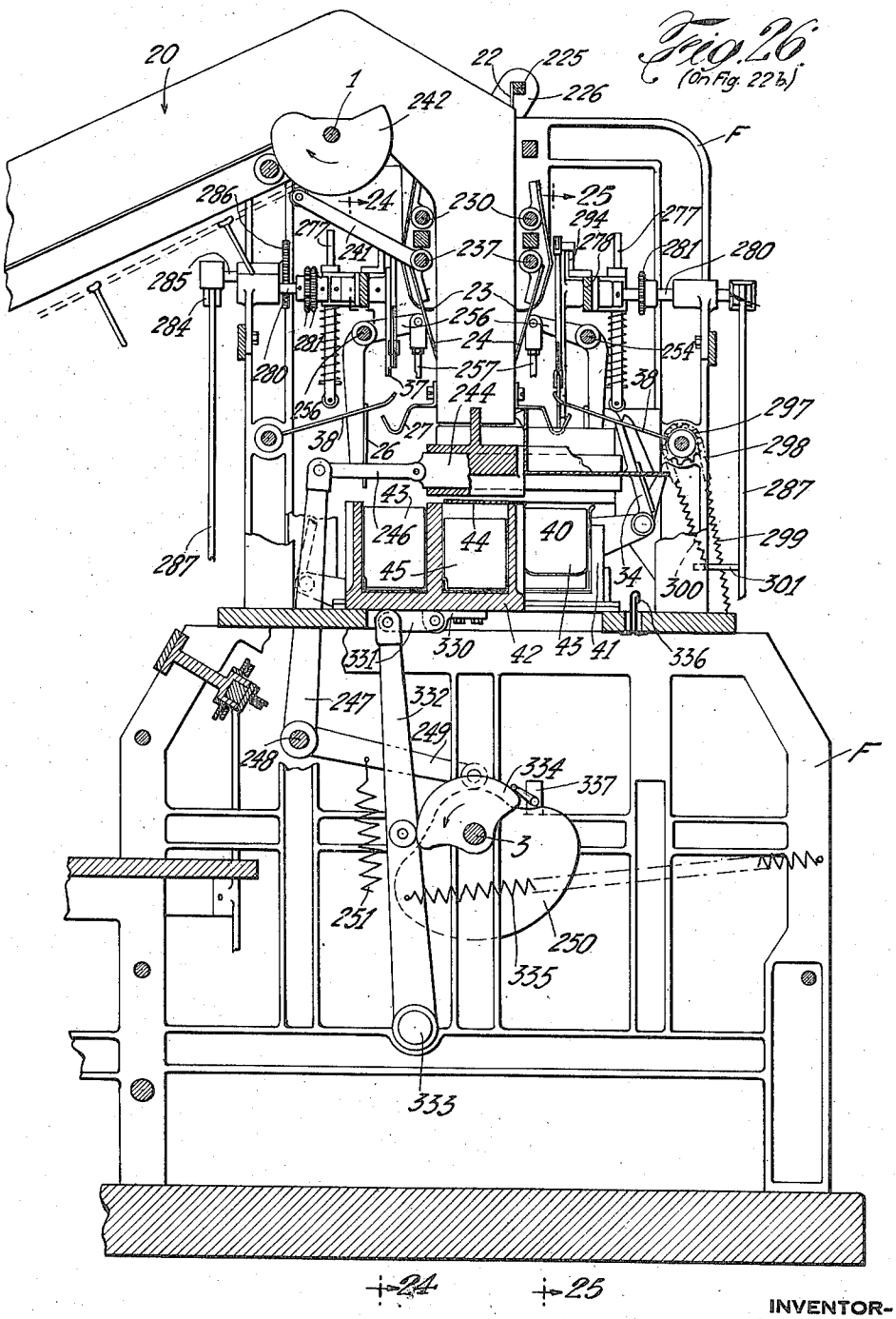
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Fig. 26
(On Fig. 22b)



INVENTOR-
EUGENE CONTI.

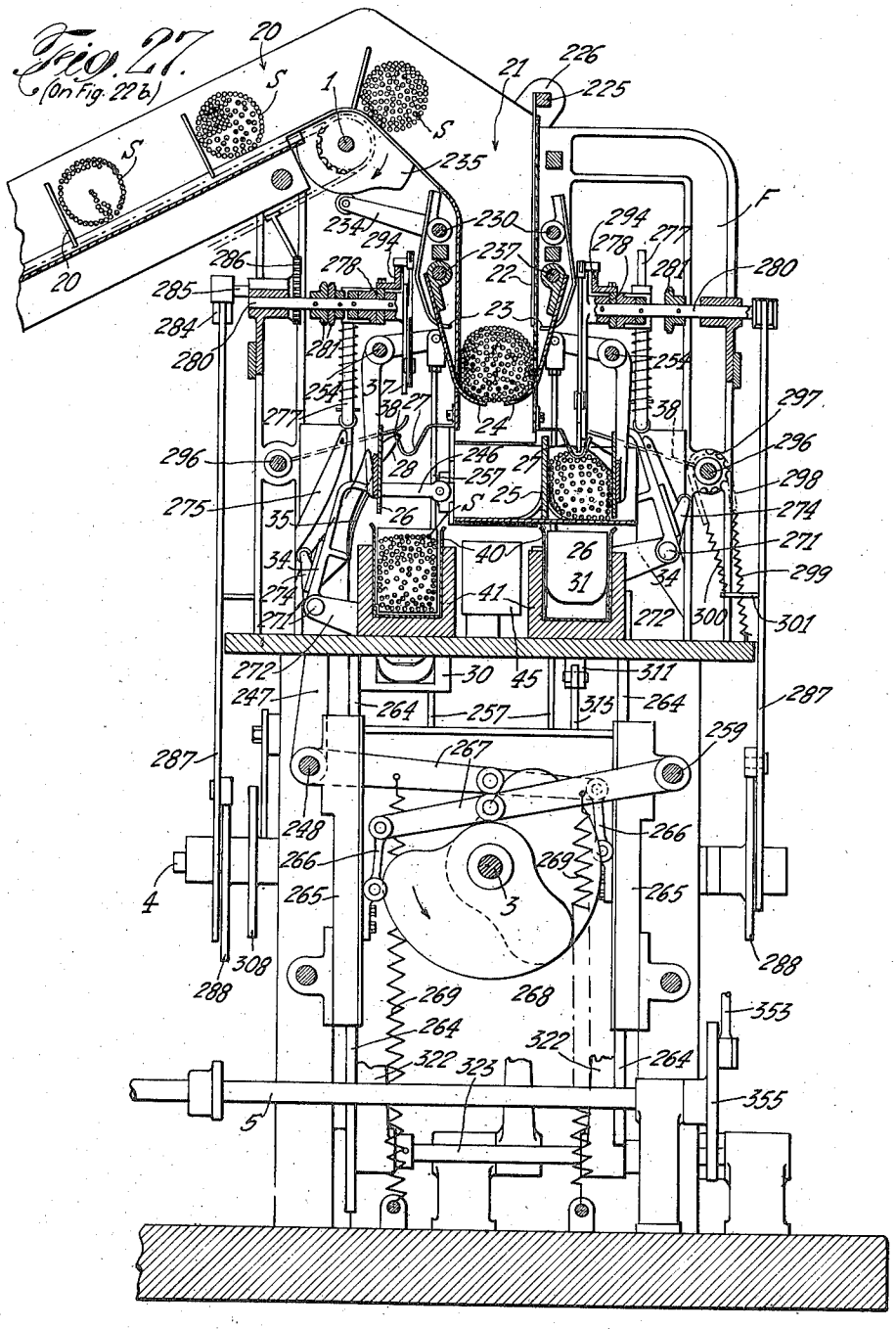
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Fig. 27.
(On Fig. 22b)



INVENTOR-
EUGENE CONTI.

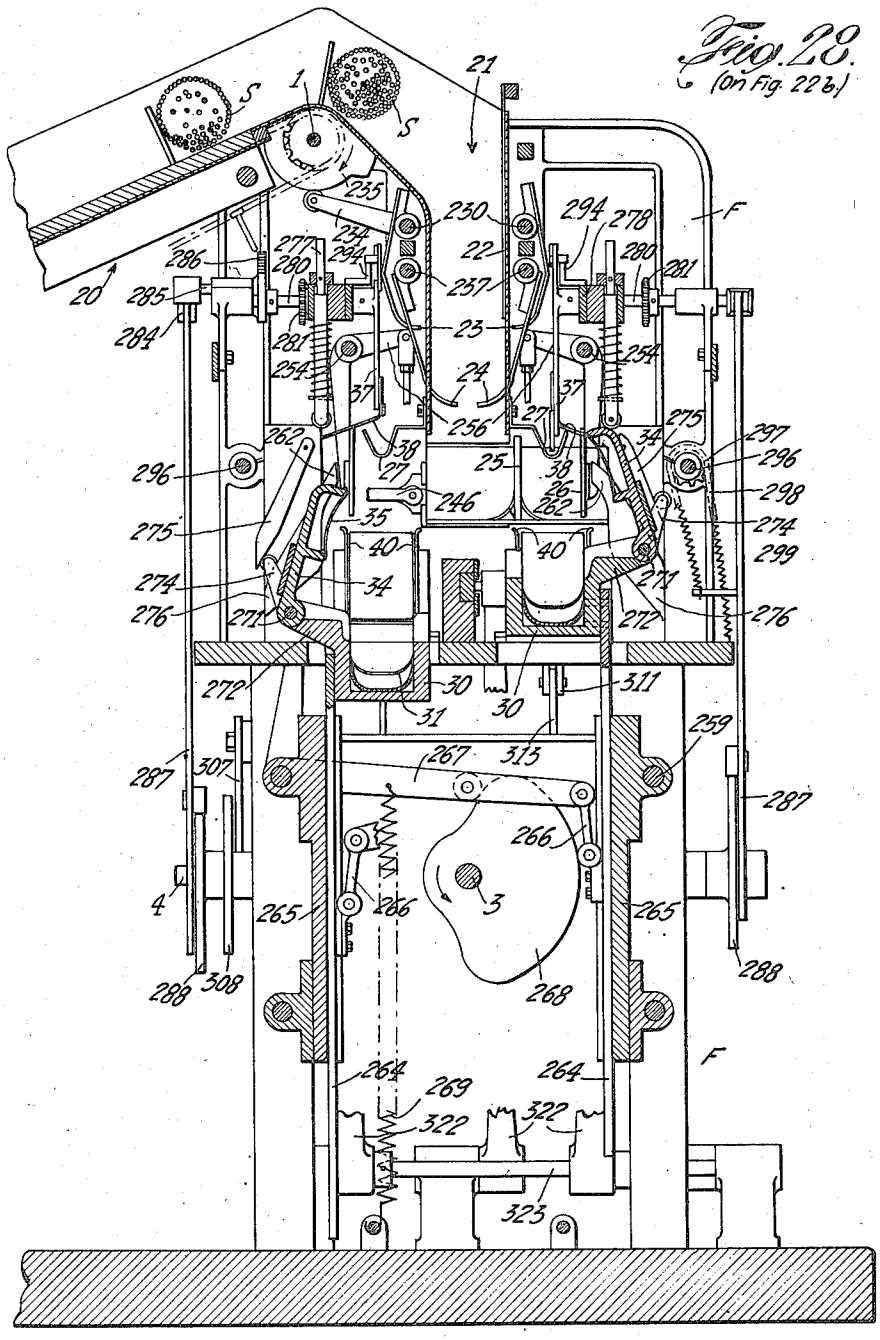
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Fig. 28.
(on Fig. 22b)



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EUGENE CONTI.

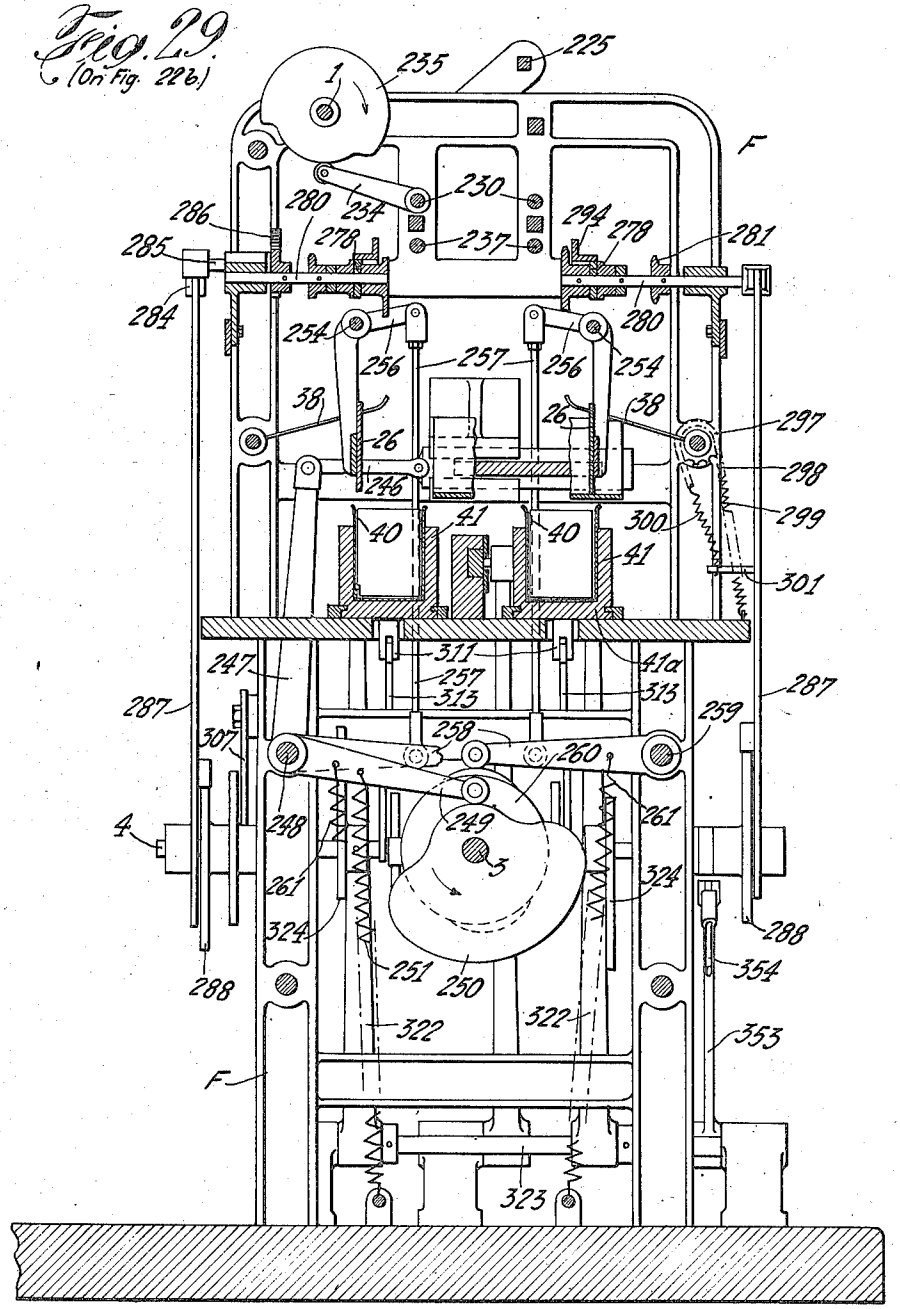
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Fig. 29.
(On Fig. 22b)



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EUGENE CONTI.

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Fig. 30
(On Fig. 15)

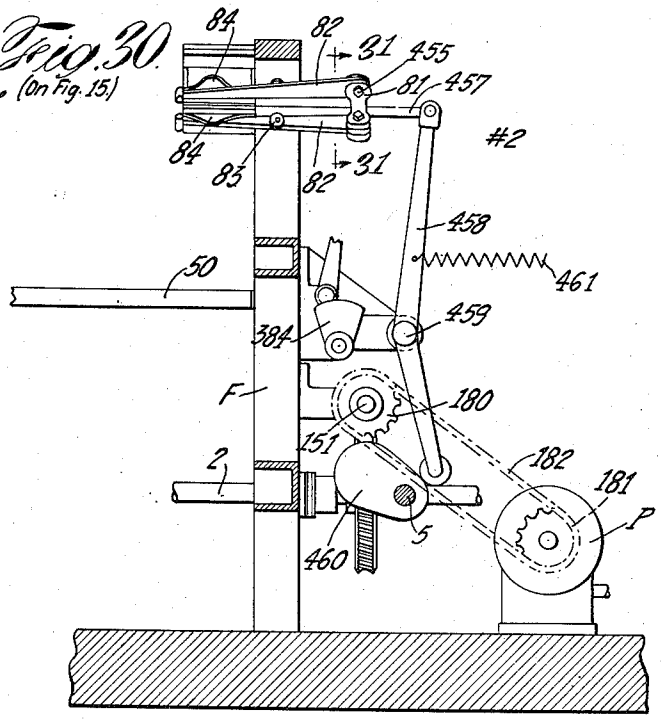


Fig. 31.
(On Fig. 30)

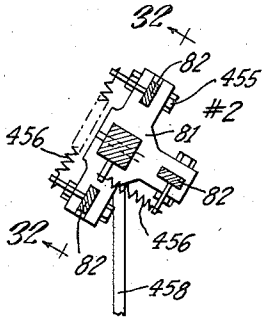
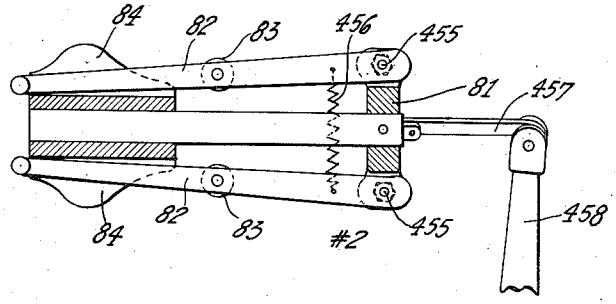


Fig. 32.
(On Fig. 31)



INVENTOR
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

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Fig. 34.

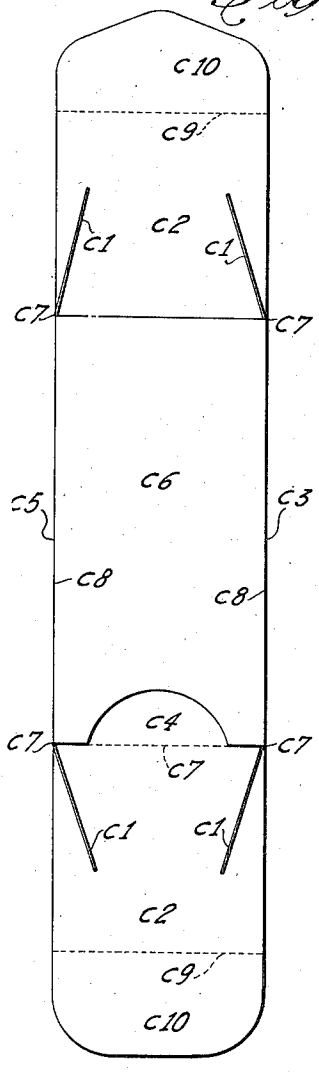
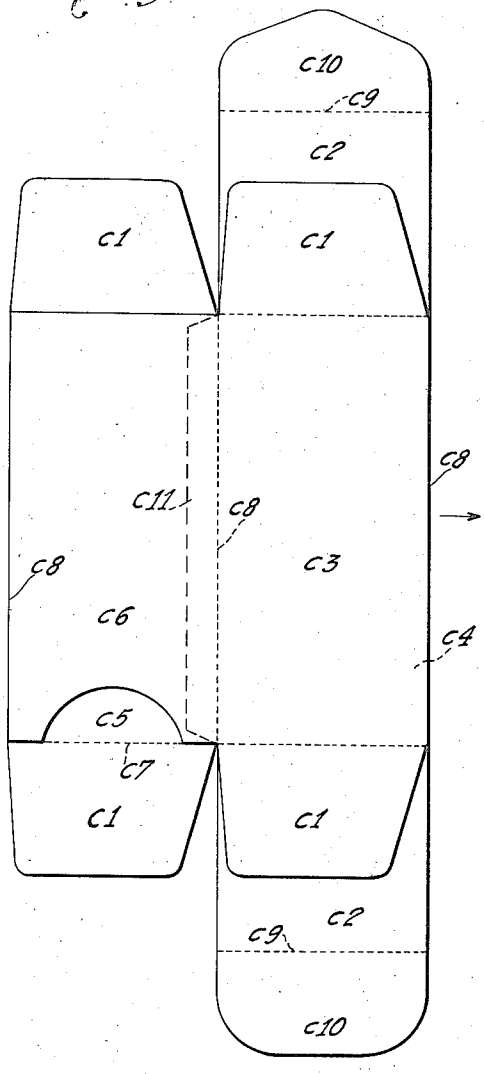


Fig. 33.



INVENTOR
EUGENE CONTI.

BY
Emery, Booth, Varney & Whittemore
ATTORNEYS

Patented Jan. 5, 1937 2,066,769

UNITED STATES PATENT OFFICE

2,066,769

APPARATUS FOR PACKAGING ARTICLES

Eugene Conti, Mount Vernon, N. Y., assignor to Alexander Herz, New Rochelle, N. Y.

Application December 29, 1932, Serial No. 649,276

35 Claims. (Cl. 93—6)

This invention relates to packaging apparatus and has for its object the provision of improvements in this art. The invention has been developed in connection with the packaging of drinking straws in foldable cardboard cartons so this embodiment will be referred to for concrete illustration, though without any intention of limiting the invention thereby.

Drinking straws are usually made of paper impregnated with paraffin. They are fragile and easily broken so that it has been the custom to place them in cartons by hand. The present apparatus has been operated successfully for this purpose, so it will be described to illustrate the principles of the invention to enable those skilled in the art to understand and practice the invention.

In the accompanying drawings which are annexed to and form a part of this specification:

Fig. 1 is a plan view of the exemplary embodiment of apparatus constructed according to the invention;

Fig. 2 is a right side elevation;

Fig. 3 is a left side elevation;

Fig. 4 is a front end elevation, a few parts near the top being shown in section;

Fig. 5 is a rear end elevation, a few parts at the left near the bottom being shown in section;

Fig. 6 is a transverse vertical section taken on the line 6—6 of Fig. 2;

Fig. 7 is a transverse vertical section taken on the line 7—7 of Fig. 13;

Fig. 8 is a partial transverse vertical section taken on the line 8—8 of Fig. 2;

Fig. 9 is a partial transverse vertical section taken on the line 9—9 of Fig. 3;

Fig. 10 is a longitudinal vertical section taken on the line 10—10 of Fig. 7;

Fig. 11 is a transverse vertical section taken on the line 11—11 of Fig. 13;

Fig. 12 is a transverse vertical section taken on the line 12—12 of Fig. 13;

Fig. 13 is a longitudinal vertical section taken on the line 13—13 of Fig. 1;

Fig. 14 is a longitudinal vertical section taken on the line 14—14 of Fig. 22*a*;

Fig. 15 is a longitudinal vertical section taken on the line 15—15 of Fig. 22*a*;

Fig. 16 is a partial enlarged longitudinal section taken on the line 16—16 of Fig. 17;

Fig. 17 is a transverse inclined section taken on the line 17—17 of Fig. 2;

Fig. 18 is a transverse inclined section taken on the line 18—18 of Fig. 2;

Fig. 19 is a transverse inclined section taken on the line 19—19 of Fig. 2;

Fig. 20 is a partial transverse inclined section taken on the line 20—20 of Fig. 2;

Fig. 21 is a partial transverse vertical section taken on the line 21—21 of Fig. 22*a*;

Fig. 22 (including the parts 22*a* and 22*b*) is a transverse vertical section taken on the line 22—22 of Fig. 2;

Fig. 23 is a partial transverse inclined section taken on the line 23—23 of Fig. 14;

Fig. 24 is a transverse vertical section taken on the line 24—24 of Fig. 26;

Fig. 25 is a transverse vertical section taken on the line 25—25 of Fig. 26;

Fig. 26 is a longitudinal vertical section taken on the line 26—26 of Fig. 22*b*;

Fig. 27 is a longitudinal vertical section taken on the line 27—27 of Fig. 22*b*;

Fig. 28 is a longitudinal vertical section taken on the line 28—28 of Fig. 22*b*;

Fig. 29 is a longitudinal vertical section taken on the line 29—29 of Fig. 22*b*;

Fig. 30 is a transverse vertical section taken on the line 30—30 of Fig. 15;

Fig. 31 is a section taken on the line 31—31 of Fig. 30;

Fig. 32 is a section taken on the line 32—32 of Fig. 31;

Fig. 33 is a top plan view of a carton as placed in the machine, the arrow indicating the direction of movement of the carton from the stack of cartons to the operating parts of the machine;

Fig. 34 is a side elevation of the carton as viewed from the front of the machine after it has been opened ready for introduction to the carton carrier wheel.

In the present specific embodiment of the invention the apparatus is designed, as noted hereinabove, for placing bundles of drinking straws S (Fig. 27) in tubular cardboard cartons C (Figs. 33 and 34) and closing the flaps at the ends of the cartons to confine the straws. The bundles of straws are prepared for packaging by gathering approximately the desired number of straws together and confining them by elastic bands S1 (Fig. 25) which are placed near each end. This is a convenient way of presenting the straws to the machine. The elastic bands may be left permanently on the bundles or may be removed in the packaging operation. It has been found more economical to remove them, so the present apparatus comprises means for accomplishing this. The bands are saved and used again.

The cartons

The tubular cardboard cartons C, as shown in Fig. 33, are received in flat condition with the short and long end flaps *c1*, *c2* respectively extended in the planes of the sides *c3*, *c4*, *c5*. There are creases *c7* at the hinge lines between the flaps and the sides, and also creases *c8* along the joining edges of adjacent sides to promote proper opening from flat tubular to the square tubular shape. At each end there are three flaps—two short ones *c1* and one long one *c2*. One side *c6* is without flaps at both its ends. The short flaps are creased only where they join the sides at *c7* but the long flaps which are to be folded over the short flaps are creased both where they join the sides at *c7* and also near their free ends *c9* where the tips *c10* are to be bent to enter the opposite side of the carton. Obviously, the cartons might be supplied by hand or otherwise to the machine in opened condition; or different kind of cartons might be used; but the kind illustrated is that which has been adopted as most desirable and the one for which the machine has been especially designed.

General outline of operations

Having noted that the nature of the articles to be packaged and the characteristics of the cartons for enclosing them, it may be of assistance to consider briefly the general nature of the operations to be performed before entering upon a detailed account of the operations and the apparatus for performing them.

The bundles of straw are elevated; dropped down a chute to mechanism which removes the elastic bands; and transferred into receptacles ready to be pushed endwise into cartons carried on a conveyor wheel. The cartons before being placed on the wheel have the creases, or at least some of them, broken and the cartons are opened from flat to rectangular open shape. On the conveyor the cartons are grasped and held at their body portions by spring pressed retaining dogs, the ends and flaps being free. At the first position past the feed-in position for the cartons the flaps at the end of the carton into which the straws are to be introduced (the left end) are pushed outward and their creases broken so that they will stay out. At the next position the short flaps at the other (right) end are folded inward, the leading one over the trailing one, so that the latter will be held down as the former rides forward beneath a confining guide. At this position the flaps at the left end are held open by a flat arcuate plate which on its forward end is inclined to cause the flaps to move therebeneath. As it moves forward from this position the long flap at the right end is turned up over the infolded short flaps by a suitable guide. At the next position, which is the top one, the cartons are released from the retaining dogs on the wheel and are pushed endwise toward the straws so as to enter a tubular guide, and the straws are pushed endwise through the guide into the carton. Grip arms pull the carton back and it is again secured on the wheel by the retaining dogs. As the filled cartons approach the next position the left end flaps are kept open against another flat arcuate plate, a shiftable plate having guided them past filling position, though being withdrawn while the filling operation was in progress, and the tip of the long flap at the right end is trained downward so as to enter the carton. At the next position the tip of the long flap at the right end is pushed into the carton, the sides of the carton being squeezed in momentarily to bow the upper side up in the center to permit the flap to start in between the straws and the upper side; and the top side being pressed down thereafter to permit the flap to enter the full length so that the end is completely closed. At the next station the flaps at the left end are closed, the mechanism for accomplishing this being similar to that at the previous station for the other end, except that means are provided for folding in the short flaps. And at the next station the retaining dogs are released and the carton is discharged upon a belt conveyor.

More specific outline of operations

Considering the various operations and the immediate mechanisms for effecting them, the following schedule is followed.

Bundles of straws elevated

(1) The bundles of straws S confined by the rubber bands S1 are elevated by a belt conveyor **20** (Fig. 27) and are dropped into the upper end of a chute **21**.

Bundles pressed flat in the chute

(2) During passage down the chute the bundles are pressed flat by straight swinging arms **22** mounted vertically at the rear side of the chute.

Upper feed fingers

(3) The bundle is caught by an upper set of curved fingers **23**.

Lower feed fingers

(4) After a previous bundle has been fed forward ahead, the bundle on fingers **23** is released and is caught by a lower set of curved fingers **24**. This arrangement of arms and fingers serves as an escapement for feeding the bundles smoothly without injuring them.

Shifting the bundles for band removal

(5) A partitioned receptacle **25** reciprocates below the lower end of the chute. When an empty compartment is presented beneath the chute the fingers **24** release a bundle, allowing it to fall into the compartment.

Bundle compressed

(6) The receptacle is shifted to one side, front or rear according to phase. The bundle is compressed by aligned flat vertical plates **26** which are swung inward. Upward movement of straws is prevented by curved brackets **27** and elastic bands **28** which are stretched between the brackets and the plates.

Bundle engaged by lowering frame

(7) The bundle is pushed upward by a vertically reciprocating lowering frame **30** (Fig. 28). Here it is to be noted that the receptacle **25** is discontinuous in the center to allow movement of the frame **30**. In fact, the receptacle is formed as paired end members which are reciprocated in unison. Elastic bands **31** suspended above the bottom of the frame **30** cause the engagement of the bundle to be resilient so as not to crush the straws. The upward push on the bundle causes a longitudinal groove to be formed in the top thereof by the brackets **27**, allowing the end bands S1 to be easily grasped for removal.

Bundle grasped by swinging arm

(8) A swinging arm **34** which is pivotally mounted on the frame **30** swings over and grasps the bundle when the frame reaches the top of its stroke. An elastic band **35** stretched across depending prongs on the arm is the part which actually engages the bundle to avoid crushing the straws.

Bands removed from bundle

(9) While the bundle is thus secured, two swinging grippers **37** (see also Fig. 25) move inward along the groove, one from each end, grasp the elastic bands at the ends of the bundle and swing back outward to remove them. Near the end of the outswing (the position shown in Fig. 24) fingers **38** (Fig. 25) strike the rubber bands which at this time are stretched between the grippers and the bottom of the bundle, to snap them free from the latter. At the end of the outswing after the grippers have opened, jets of air from pipes **39** blow the bands off the grippers into suitable receptacles **36**.

Bundle lowered

(10) The bundle is lowered by the frame **30**, the arm **34** maintaining its holding position and guides **40** confining the bundle on the sides until it is deposited in aligned boxes **41**. These boxes support the guides **40**. The frame continues downward until it is out of the way, as shown at the left in Fig. 28, whereupon one of the aligned portions **41***a* of the divided boxes (see Figs. 24 and 29) is shifted endwise so as to contact with the end of the mating fixed part of the box so as to constitute a continuous smooth guideway for the bundle.

Bundle shifted endwise into shiftable receptacle

(11) Referring to Figs. 22*b* and 26, a double compartment receptacle **42** is mounted to reciprocate past the ends of the fixed boxes **41** in such manner that one of the compartments of the receptacle registers with one of the boxes and the other compartment registers with the other box in alternation. The compartments when not in registry with a box occupy a central position. Plungers **43** (Fig. 25) push the bundles of straws endwise from the boxes into the registering compartments of the receptacle **42**.

Bundle shifted back into central position

(12) The receptacle **42** is shifted to carry the bundle of straws to the central position beneath a vertical plunger **44**, (Fig. 22*b*) whereupon the latter descends to compress the bundle so that it may be pushed into a carton.

Bundle shifted into carton

(13) A central plunger **45** now moves over and pushes the bundle of straws into a carton which has previously been prepared and placed in position. The plunger **45** makes two strokes for each stroke of the plungers **44**, the former being required to move as many bundles as both of the latter together. The primary reason for dividing the work into two parts between the chute **21** and the central plunger **45** is to increase the time for action of the band removing grippers **37**. Otherwise the bundles might be dropped directly from the chute into the path of the plunger **45**, the mechanism being changed accordingly.

Carton stack

(14) Meanwhile the cartons have been prepared and advanced to the position in which the bundles of straws are inserted in them. Referring to Figs. 1 and 2 the cartons are stacked upon a table **50** between upstanding vertical guides **51** with the long flaps *c***4** downward and forward. The front guides (front with respect to the direction of movement of the cartons) terminate above the surface of the table so as to permit a carton to be fed forward from the bottom of the stack along the table. Referring to Fig. 33, the lower sides *c***4**, *c***5** of the cartons are joined by an extension *c***11** of the side *c***4** which overlaps and is glued interiorly upon the side *c***5**, hence the stack is thicker in the center than at either the front or rear edges. In order to keep the rear edge of the lowermost carton down upon the table where it can be engaged by feeding mechanism, the stack is tilted to rest on the rear edges. This is accomplished (Fig. 13) by placing auxiliary guides **52** inside (behind) the front guides **51**. These guides extend downward some distance and cause the upper cartons to be tilted downward toward the rear edges but permit approximately twenty-five of the lower cartons to lie freely in the main guides **51**. The inclined upper cartons press downward upon the rear edges of all the lower cartons and cause the rear edge of the lowermost one to engage the surface of the table.

Carton fed from stack

(15) The bottom carton of the stack is fed forward (Figs. 1 and 10) by a pair of pusher slides **54**. Spring guides **55** hold the advancing carton down until it stops and is held down by other means.

Carton clamped to table

(16) Referring to Figs. 1 and 6, the carton blank when fed forward is held down by swinging clamp fingers **56** which at this time are released from hold-off cams and are pulled down by springs upon the rearmost short flaps *c***1** of the carton.

Tips of long flaps broken

(17) The carton is now ready for opening. In this operation it is necessary to "break" the creases so that the carton will remain open. First, the tips *c***10** of the long flaps are bent up. The tips in this position overlie tip-folding blades **57** (Figs. 1 and 7). They have ridden forward upon straps **58** fixed upon the table in line with the blades **57** so as not to catch upon the edges of the blades. Clamp blades **59** (Figs. 1, 8, and 9) which are beveled at their outer top edges, are moved down upon the flaps just inside the creases and beyond the tip folding blades **57**. The folding blades **57** are now lifted and pushed inwardly above the beveled edges of the clamp blades **59** so as to raise the tips and fold them over and thus break the creases.

Opening of carton started

(18) The carton is still held down by the clamp fingers **56** which engage the short flaps *c***1** at the rearward bottom part of the carton. This leaves the top of the carton free as soon as the tip breaking blades **57** and **59** have withdrawn. A beveled and inclined finger **60** moves to the left (Fig. 6) beneath the rear upper side *c***6** of the carton which is without flaps and begins to lift the free upper portion. As shown in Fig. 33, the side *c***6** has an arcuate indentation at one end to assist the insertion of the finger beneath the side.

Carton opened further

(19) A plate **62** (Figs. 7 and 13) mounted on an arcuate rack **63** and which previously has lain in a recess below the surface of the table now moves upward and rearward (with reference to the direction of the travel of the carton) beneath the front part of the carton, i. e., under the side *c4*, and opens the carton further until it is slightly past the square condition.

Side joints of carton broken

(20) A pair of curved arms **65** (Fig. 13) then comes down upon the top side of the carton and pushes it downward and rearward until all of the four joints along the creases *c8* between the sides are broken. The carton is now released and will remain in approximately square condition. It is held down by upper guides **66**.

Retaining dogs opened

(21) The carton is to be transferred to a socket **70** (Fig. 13) of a large conveyor wheel **71**. The wheel is thinner axially than the length of the sides of the carton exclusive of the flaps, thus permitting operations to be performed on the carton while it is held on the wheel. Before the carton is placed in the socket certain retaining dogs **72**, four in number for each socket, are swung clear by pins **73** on oscillating arms **74**.

#1 position—Carton fed in on wheel

(22) All parts having moved clear, the carton is now pushed into the socket **70** on the conveyor wheel by pusher fingers **75** pivoted to slides **76** (Fig. 10). The table is extended on each side of the wheel beyond the front edge thereof to furnish support for the ends of the carton as it is fed into the socket. On their forward movement the fingers are protruded above the surface of the table **50** but on their rearward movement they are held down to clear the next carton by latch pawls **77**. At the front end of the same slide there are secured upstanding fixed studs **78** which limit the forward movement of the carton when it is fed forward from the stack. The slides are spaced further apart than the thickness of the conveyor wheel so that they will clear the wheel in their movements.

#2 position—Flap hinges at L. E. broken

(23) The retaining dogs having been returned to position to grip the carton, the conveyor wheel is moved one step to take the carton from the feed-in-position—which will be referred to as the #1 position—to a second or #2 position. As the carton approaches the #2 position the long flap at the left end rides under a guide **80** (Fig. 15) so that the flap is pushed open. This insures that this flap will not overlie the two short flaps when the #2 position is reached. Furthermore, it provides that the tip of the long flap which has already been bent outward with reference to the axis of the conveyor wheel will not cause the flap to come on the wrong side of a flap bending device which is located at this position. All three flaps at the left end are pushed open and their hinge creases *c7* broken at the #2 position. This is accomplished by the advance of an umbrella plunger **81** (Fig. 30) which carries three arms **82**. The arms in this advance movement are pushed within the flaps and then are opened by the engagement of their rollers **83** with fixed cams **84**. The arms swing outwardly before their ends reach the ends of the sides of the carton so as to pass outside of the carton; then upon further forward movement, the ends of the arms approach the sides of the carton to set the flaps in broken position. The flaps, of course, tend to return gradually toward a mid position but before they have come back as far as perpendicular to the sides of the carton the conveyor wheel has advanced to place this end of the carton against a flat arcuate guide **85** (Fig. 15) so that the flaps will be held open.

#3 position—Short flaps at R. E. folded

(24) At the next or #3 position the short flaps *c1* at the right end of the carton are folded inward. It is to be noted that the hinge creases of these two flaps as well as of the long flap at this end are not at any time broken by bending beyond normal positions. Referring to Fig. 14, the forward short flap is bent down by riding against a fixed guide **90** as the carton comes into #3 position. The trailing end of this flap, however, insofar as it will be overlain by the end of the other short flap, is not covered by the guide **90** when the carton halts here. This is necessary in order to cause the rear flap to ride under this guide. The rear flap is pushed down after the carton stops (Figs. 14 and 23) by a swinging arm **91** mounted upon a rock shaft **92** which is itself mounted upon a swinging frame **93**. The swinging frame is utilized for placing the swinging arm in the plane of the movement of the flap when it is closing and incidentally to avoid obstruction to the travel of the flaps as the carton advances into #3 position. The long flap at this end is started up into closing position (Fig. 14) as the carton approaches #3 position by a fixed guide **95** and the closing movement continues until the carton reaches the next or #4 position.

#4 position—L. E. flap guided past feed opening

(25) After the next rotational movement the carton arrives at the straw feeding or #4 position, the top central position of the wheel, which brings the narration of events back to the point where it digressed to take up the preparation of the cartons.

There must be a clearance space between the open end of the carton and the shiftable receptacle **42** from which the straws are fed. The arcuate guide **85** which holds the flaps open, obviously cannot extend across this space. For the purpose of guiding the forward flap across the opening a vertically reciprocating guide segment **100** (Figs. 15 and 22*a*) is employed. This is lowered as the carton moves into position and is raised before the straws are fed.

#4 position—Carton released from dogs

(26) The feed receptacle **42** and the carton must be placed directly together if the feeding in of straws is to be most satisfactory. For this purpose one of them must be moved endwise. Herein the carton is moved toward the box. But first the carton must be released from the spring pressed retaining dogs. This is accomplished (Fig. 22*a*) by a curved plate **102** which pushes down against the heels of the dogs to open them.

#4 position—Carton moved to left for feeding straws

(27) The carton is now pushed to the left (Fig. 22*a*) by a pusher plunger **104** until the end

of the carton enters the socket end of the receptacle 42. As already explained the central plunger 45 pushes the bundle of straws into the carton.

#4 position—Carton returned to right after feeding

(28) Means are provided for returning the carton to its original position on the conveyor wheel after the straws have been inserted. Herein (Fig. 21) this comprises grippers 106 which are mounted upon a plunger 107 which moves co-axially with the pusher plunger 104. The gripper arms carry cam pieces 108 which cooperate with cam rollers 109 mounted upon the pusher plunger to cause the grippers to open when pushed forward, then to grip, thereafter to remain in gripping position until the carton is returned, and then to release it. The grippers engage the carton near the back, i. e., the hinge side of the long flap, so that enough resistance will be furnished to the grippers to cause them to hold the carton. The grippers thereafter withdraw still further so as to clear the end of the carton. In this retreat the forward gripper arm (in the direction of wheel travel) is moved outward more than the other so as to clear the carton as it begins to move forward. This is accomplished by the interaction of a roller 111 on the gripper and a fixed cam 112. The dogs 72 are permitted to re-grip the carton to the wheel before the wheel moves.

#5 position—R. E. flaps closed

(29) At the next or #5 position the left end of the carton with its flaps still open is found riding against another arcuate guide 115 (Fig. 15). At the right end of the carton the flaps are finally closed at #5 position. It will be remembered that at the filling or #4 position the flaps at this end had already been folded up but the tip of the long flap had not been entered in the carton. The flaps are maintained in this condition between the #4 position and the #5 position by an arcuate guide bar 116 (Fig. 14) which engages the tip of the long flap and pushes it down radially toward the axis of the conveyor wheel.

At the #5 position the tip of the long flap is pressed down into position to enter the carton (Fig. 17) by a swinging curved plate 120 while the body of the flap is pushed inward by a swinging flat plate 121. As the tip begins to enter the carton the top side c6 of the carton is bowed up in the center by squeezers 122 (Fig. 14) but after the tip has started in the squeezers are released and the side is pressed flat by a vertically reciprocating plate 123. During this closing operation the arcuate plate 115 at the left end furnishes a backing for the carton. After leaving the #5 position the right end of the carton, which is now closed, rides against an arcuate end plate 125, which furnishes a backing while the flaps at the left end are closed at the next or #6 position.

#5 position—Long flap at L. E. swung up

(30) at #5 position the long flap at the left end will have been pushed up to a horizontal position (Fig. 15) if it does not have enough residual resiliency to return so far—by a swinging blade 127 which is operated by mechanism which at the time is also closing a carton at the #6 position. The flap when pushed up will be held in position by spaced end guides 128, 129 which receive the flap between them. The upper one 129 prevents the flap from closing too far, it being noted that the side flaps have not yet been closed.

#6 position—L. E. flaps closed

(31) At #6 position (Fig.15) the side flaps are closed by blades 130 which are secured to the swinging squeezer arms 131 which are employed like the similar ones at station #5 to bow up the upper side of the carton. The forward blade is longer than the other to cause the forward short flap to be closed before the rearward one. The tip of the long flap is pushed down into entering position (Fig. 19) by a vertically reciprocating curved plate 133. The long flap is swung up by an oscillating flat plate 134, the tip being held down during this movement by a fixed curved guide plate 135. The blade 127 which, as noted, moved the flap up at #5 position is secured to the operating shaft 136 of the plate 134, though being located on the opposite side of the axis. During the final stage of the closing operation the squeezers release the carton and a vertically reciprocating blade 138 (Fig. 19) presses the top side of the carton flat again.

#7 position—Dogs released—Package discharged

(32) At #7 position the filled and closed package is discharged (Fig. 13) upon a belt conveyor 140. Swinging arms 141 release the retaining dogs and long swinging arms 142 eject the packages along guide supports 143 upon the belt.

Power operating mechanism—The system of rotary shafts

The preceding description furnishes a general survey of the direct operations of the machine upon the straws and cartons. To those skilled in the art suitable power means for causing these ultimate direct operations will readily occur. They may be of various sorts. Those which are found in the illustrated embodiment will be described to make the entire embodiment fully understood. First, a skeleton view of the operating shafts will be given so these parts may be kept in mind since they will be referred to frequently throughout the further description of power operating parts.

Referring to Fig. 3, the motive power for the entire machine is supplied by a motor M. Through a belt 150 it drives a power take-off shaft 151 extending longitudinally of the machine, i. e., from front to back. The shaft is supported in suitable bearings bolted to the frame F. Throughout the description no mention will be made of the shape of the frame or the details of the supports for the various operating elements thereon except where special features are involved.

The power take-off shaft 151 through a worm 152 and a pinion 153 drives a front transverse shaft 2. Referring to Fig. 2, this shaft 2 through suitable bevel gears 154, 155 drives an inclined shaft 156 which in turn through other bevel gears 157, 158 drives a main transverse cam shaft 3. The drive ratio from shaft 2 to shaft 3 is 1 to 2; that is, shaft 2 is a full speed shaft making one revolution for each bundle of straws or each carton which is fed in, while shaft 3 is a half speed shaft making one half a revolution for each bundle or each carton.

Referring to Fig. 3, the main cam shaft 3 at its left end, through a pair of bevel gears 159, 160, drives a plunger cam shaft 4. Shaft 4, like shaft 3 operates at half speed.

Referring to Fig. 6, the shaft 2 through bevel

gears 161, 162 drives a full speed plunger operating shaft 5.

Referring to Figs. 4 and 10, the shaft 2 through sprockets 163, 164 and a sprocket chain 165 therefor drives a short front transverse shaft 6. An adjustable idler sprocket 166 keeps the chain regulated. Shaft 6 is a full speed shaft. It drives a right hand longitudinal cam shaft 7a (Fig. 2) through bevel gears 167, 168; and a mating left hand cam shaft 7b (Fig. 3) through bevel gears 169, 170. Shafts 7a, 7b operate at full speed.

Referring to Figs. 3 and 4, the shaft 2, through bevel gears 171, 172, an inclined shaft 173, and this through bevel gears 174, 175, drives a top cam shaft 1 at full speed.

In the same figures it may be seen that the shaft 151 through sprockets 180, 181 and a sprocket chain 182 drives an air pump P.

Referring to Fig. 2, the main shaft 3 through a spur gear 185, an idler spur pinion 186, its integral idler bevel pinion 187 and a bevel gear 188 drives a vertical cam shaft 8 at the #4 conveyor wheel position. This shaft 8 through bevel gears 191, 192 drives a transverse cam shaft 9 at the #4 position. The shafts 8, 9 operate at full speed.

Still referring to Fig. 2, the shaft 3 through its driving bevel gear 158 and a mating bevel gear 194 operates an inclined cam shaft 10 at the #5 position. The shaft 10 through bevel gears 196, 197 drives a transverse cam shaft 11 at the #5 position. The shafts 10, 11 operate at full speed.

Still referring to Fig. 2, the shaft 3 through the spur gear 185, an idler spur gear 201, its integral idler bevel gear 202, and a bevel gear 203 drives an inclined cam shaft 12 at the #6 position. The shaft 12 through bevel gears 205, 206 drives a transverse cam shaft 13 at the #6 position. The shaft 13 (Fig. 19) through bevel gears 207, 208 drives a short cam shaft 14. The shafts 12, 13, 14 all operate at full speed.

Referring to Figs. 2 and 19, the idler spur gear 201 at the #6 position carries an integral sprocket 210 which through a sprocket chain 211 and a sprocket 210 drives a cam shaft 15 at the #7 position. The shaft 15 operates at full speed. The chain may be kept tight by an adjustable sprocket 213.

Referring to Fig. 5, the shaft 15 through sprockets 215, 216 and a sprocket chain 217 (Fig. 3) drives a conveyor belt pulley 17 which is rotatably mounted upon a fixed shaft 218. An adjustable idler sprocket 219 regulates the chain.

Referring to Fig. 22a, the conveyor wheel is mounted on a hollow shaft 18 supported concentrically around the main cam shaft 3 by pedestals 220. The hollow shaft is driven by ratchet mechanism which will be described hereinafter.

The intermediate operating mechanisms

Having explained the ultimate operating mechanisms and the primary driving mechanisms, there will now be discussed the intermediate driving mechanisms, such as cams, levers, links and the like. The description will be confined to the specific forms of these mechanisms which have been illustrated but with the understanding that these forms are merely illustrative and that other forms may be substituted for them.

Mechanism for operating the swinging arms 22

As shown in Fig. 27, the arms 22 are mounted upon an oscillating shaft 225. The shaft (Fig. 2) is mounted in suitable bearing brackets 226 secured to the top of the main frame of the machine, and at the right end is provided with a cam arm 227. The arm is rigid with the shaft and on its outer end carries a cam roller which rides upon a cam 228 fast on the cam shaft #1. The cam has a single small elevation so as to swing the arms 22 into the chute a short distance for each bundle that is fed into the machine. Referring to Fig. 4 the cam 228 is located on the right end of shaft #1 outside the main frame. In Fig. 22b, which is reversed with respect to Fig. 4, it is the cam which appears at the left end of shaft #1. The cam arm may be urged toward the cam by a spring 229.

Mechanism for operating the upper feed fingers 23

Referring to Fig. 27, the upper feed fingers 23 are rigidly mounted upon parallel oscillating shafts 230. These shafts are mounted in bearings on the main frame and are geared together (Fig. 3) so as to oscillate in opposite directions by sprockets 231 and a sprocket chain 232. One end of the sprocket chain is attached to one of the sprockets (the right hand one, Fig. 3) and the other end is attached to a coil spring 233. The other end of the spring is attached to the main frame. The spring tends to move the fingers 23 out of the chute. Referring to Fig. 22b, one of the shafts 230 (the front or right hand one, Fig. 3, or the left hand one, Fig. 29) is provided with a cam arm 234. The outer end of the cam arm is provided with a roller which rides on a cam 235 fast on the cam shaft #1. As shown in Fig. 29, the cam has a depressed concentric portion and an elevated concentric portion, the latter being longer than the former so as to hold the fingers 23 inward toward each other for the major part of the revolution of the shaft #1.

Mechanism for operating the lower feed fingers 24

Referring to Fig. 27, the lower feed fingers 24 are rigidly mounted upon parallel oscillating shafts 237. These shafts are mounted in bearings on the main frame and are geared together (Fig. 3) so as to oscillate in opposite directions by sprockets 238 and a sprocket chain 239. One end of the sprocket chain is attached to one of the sprockets (the right hand one, Fig. 3) and the other end is attached to a coil spring 240. The other end of the spring is attached to the main frame. The spring tends to move the fingers out of the chute. Referring to Fig. 22b, one of the shafts 237 (the front or right hand one, Fig. 3 and the left hand one, Fig. 26) is provided with a cam arm 241. The outer end of the cam arm is provided with a roller which rides on a cam 242 fast on the cam shaft #1. The cam is shaped somewhat like the corresponding cam 235 for the upper fingers but is placed in the opposite position on the shaft so that the two sets of fingers open and close at different times.

Mechanism for operating the bundle shifting receptacle 25

As shown in Fig. 27, the receptacle 25 is longitudinally divided into two compartments for alternately feeding bundles to the front or rear. As shown in Fig. 22b, the receptacle is also divided transversely and the mating parts 25a, 25b are spaced away from each other in the center to permit the vertically reciprocating transfer frame 30 to move therebetween as heretofore noted. Each part is provided with an end plate

to confine the ends of the bundles and to these plates are attached slides 244 which move along fixed guides 245 fast on the frame. Referring to Figs. 22b, 26 and 29, the two parts of the receptacle are operated by parallel sets of mechanisms. These sets comprise links 246 which are pivoted to the slides, arms 247 pivoted to the links 246 and loosely mounted to oscillate upon a shaft 248, cam arms 249 rigid with the arms 247, and identical and synchronized cams 250 which are mounted on the main shaft #3. The rollers on the ends of the arms 249 are held down upon the cams by coil springs 251. The cams have depressed and elevated concentric portions of approximately equal length to hold the compartment in front and rear position for equal lengths of time.

Mechanism for operating the bundle flattening plates 26

Referring to Fig. 22b there are two aligned plates 26 on each side. They are spaced apart at the center to permit movement of the vertically reciprocating frame therebetween. A rubber band 253 is stretched around the inner end of each plate for engaging the straws to prevent endwise slippage thereof when the confining bands are pulled off the bundles. Referring to Fig. 29, the plates 26 are mounted on rock shafts 254 mounted in bearing brackets 255 (Fig. 3) secured to the main frame. At the left side of the machine and within the main frame the shafts 254 are provided with rock arms 256 to which are attached connecting rods 257. At their lower ends the connecting rods are attached to cam arms 258, one of which is turnably mounted on the shaft 248 and one of which is mounted upon a corresponding shaft 259. Rollers which are provided at the ends of the cam arms ride upon cams 260 fast on the main shaft #3. The arms are held toward the cams by coil springs 261. The cams are identical but in opposite phase to cause the plates to move in alternation. They merely have a short elevated portion to cause the plates to swing in slightly at the proper time to flatten the bundle. Then they move out again. As seen in Fig. 28, fixed stops 262 are engaged by the rubber bands 253 on the plates when they move out to limit the outward movement.

Mechanism for operating the lowering frames 30

Referring to Fig. 28, the frames 30 are secured to slide rods 264 which are retained for vertical reciprocation by guides 265 attached to the main frame. The rods are pivotally connected by links 266 to the free ends of cam levers 267. The levers are pivoted upon the shafts 248, 259 and intermediate their ends are provided with cam rollers which operate upon cams 268 secured to the main shaft #3. These cams, as shown in Fig. 27, are identical and arranged in opposite phase. They are formed with elevated concentric portions and depressed concentric portions, with the latter longer so as to keep the frames 30 in the lower position longer than they are kept in the higher position. Springs 269 tend to keep the frames in the lower position.

Mechanism for operating the bundle gripping arms 34 on the lowering frame

Referring to Fig. 28, the arms 34 are mounted upon and rigidly secured to hinge pins 271 which are secured in lateral projections 272 of the frames 30. As shown in Fig. 5 the arms are urged into bundle engaging position by helical springs 273 disposed on the hinge pins 271. Returning to Fig. 28, the hinge pins 271 have cam arms 274 rigidly secured to their ends, and these arms are provided at their ends with cam rollers. The cam rollers roll up the outer surfaces of swinging cams 275 as the frames move upward, and at the top move over to the inner sides of the cams and roll back down upon fixed cams 276 which are formed integral with the plate stops 262. The cam 275 is pivoted at its upper end to allow passage of the cam roller on its downward movement. The lower end of the cam 275 drops down upon the lower cam 276 as soon as the roller passes its lower end and acts like a track switch to cause the roller to move outward as it ascends. To assist the inward movement of the arms at the upper end of their stroke, spring pressed rods 277 with rollers on their lower ends are mounted where the rollers will ride over cam surfaces formed on the arms as the arms move upward. The rods 277 are mounted in cross bars 278 of the main frame.

Mechanism for operating the swinging grippers 37

Referring to Fig. 24, the grippers are mounted upon parallel shafts 280. The shafts are swingably mounted in bearings on the main frame, one of which bearings is on the cross bar 278. As shown in Figs. 4 and 5 the shafts 280 are geared together by sprockets 281 and sprocket chains 282. One end of the chains is attached to one of the sprockets and the other is attached to coil springs 283. The spring tends to move the grippers outward away from the bundles. The grippers are swung inward by positive means. Lever arms 284 are attached to one of the shafts 280 (Fig. 5), or to an intermediate shaft 285 which is geared by gears 286 to the shaft 280 to turn it in the proper direction (Fig. 4). Pivotally connected to these arms 284 are cam rods 287 which are forked at their lower ends to embrace the shaft #4 and are provided with rollers which ride upon cams 288 secured to the shaft #4. The cams 288 for the front and rear sets of grippers are identical and in opposite phase and are shaped to give the grippers a long pause in which to grip the bands in their inner positions.

Mechanism for operating the gripper jaws

Referring to Figs. 24 and 25, the grippers comprise fixed jaws which are rigid with the swinging arms 37 and swinging jaws 290 which are pivoted to the fixed jaws. The swinging jaws are operated by connecting rods 291 from levers 292 which are pivoted to the upper ends of the swinging arms 37. Springs 293 urge the jaws into closed position. The levers are provided with cam rollers which ride over the fixed cams 294. The cams are formed with two raised portions, one at each end, to cause the jaws to open, and an intermediate depressed portion to cause the jaws to close. The cams 288 (Fig. 5) have short raised portions within the depressed portions for causing the arms to swing inward and the jaws to close again to regrip the bands while the striker fingers 38 pull them out from the bundle if they have not already been pulled out. The jaws are provided with horns at their upper ends to keep the free ends of the bands from flying around over them to get caught.

Mechanism for operating the striker fingers 38

As shown in Fig. 27, the fingers 38 are mounted

upon shafts 296 oscillatable in bearings on the main frame. Sprockets 297 are secured upon the shafts and about them are sprocket chains 298. At one end the chains are attached to the main frame through coil springs 299 and at the other end are attached by coil springs 300 to pins 301 secured to the cam rods 287 which operate the swinging grippers. There is slack at the spring 300 whereby the fingers are not operated until the grippers have been moved fully outward. The springs 299 normally urge the fingers toward the raised position and pins on the shaft and frame (not shown) limit the movement of the fingers.

Mechanism for timing the air blast from the pipes 39

Referring to Figs. 3 and 4, the valve 303 which controls the flow of air to the pipes 304, 305 for front and back respectively and alternately, is provided with an inlet 306 from the pump P and a cam lever 307 which is operated by a cam 308 on shaft #4. A spring 309 holds the rollers of the arm on the cam.

Mechanism for operating the movable parts 41a of the boxes 41

Referring to Figs. 24 and 25 brackets 311 are secured to bottoms of the movable box parts 41a and to these are pivotally attached the connecting rods 312. The rods are operated by cam levers 313 which are mounted upon pivot pins 314. At their free ends the levers 313 are provided with cam rollers which operate upon cams 315 fast on the cam shaft #4. The rollers are urged against the cams by coil springs 316.

Mechanism for operating the front and rear half speed plungers 43

Referring to Figs. 24 and 25, the plungers 43 operate in fixed guides 320 and are operated by connecting rods 321 from cam levers 322. The levers are pivoted to a pivot shaft 323 and their cam rollers are actuated by cams 324 fast on cam shaft #4. The rollers of the levers are urged toward the cams by coil springs 325. The cams 324 are identical but placed in opposite phase and are provided with an elevated portion which holds the plungers outward most of the time, only allowing them to move inward for a short time on each cycle to push bundles into the shiftable receptacle 42.

Safety mechanism for the half speed plungers

The cams 324 break an electrical circuit by switches 326 near the end of the plunger stroke and if the plungers do not close the circuit by completing their stroke to push the bundles fully into the receptacle 42 by closing the circuit through switches 327 an indication will be given. This may consist of the ringing of a bell or buzzer, the lighting of a lamp, or in the stoppage of the machine, as desired. A lagging or inertia relay may be employed to delay the indication between the time when the switch 326 is opened and the time the switch 327 is normally closed.

Mechanism for operating the shiftable receptacle 42

Referring to Fig. 26, a bracket 330 is secured to the bottom of the double compartment receptacle 42 and to this is attached a link 331. The link is attached to a cam lever 332 mounted upon a rock shaft 333. A cam roller on the lever operates upon a cam 334 fast on the main cam shaft #3. A spring 335 urges the lever toward the cam. The cam has elevated and depressed concentric portions of about equal lengths so as to keep the receptacle in front and rear positions for equal lengths of time.

Safety mechanism for the shiftable receptacle

Referring to Fig. 26, a break switch 336 is located where it will be opened when the receptacle is in the rear position to which it is carried by the spring. A cooperating make switch 337 is placed at the end of and is operated by the #3 cam shaft. The circuit is like that described for the half speed plungers.

Mechanism for operating the vertical compressor 44

Referring to Figs. 2 and 22b, a vertical plunger rod 340 which is secured to the plunger plate 44 is mounted in suitable guides on the frame and is pulled downward by coil springs 341, 342. A cam lever 343 is pivoted to the rod 340 and is mounted on a rock shaft 344. A roller on the end of the lever operates upon a cam 345 secured to cam shaft #1.

Safety mechanism for the compressor plunger

The cam 345 operates a make switch 346 and the plunger rod at its lowermost position operates a break switch 347. A signal is given if the switch 347 is not operated. The circuit is similar to that described for the half speed plunger.

Mechanism for operating the carton charging plunger 45

Referring to Figs. 5 and 22b, the plunger operates in suitable guides on the frame and has a link 350 attached near its outer end. The link is connected to a lever 351 which is fast on a rock shaft 352. To the rear end of the shaft there is rigidly secured a short arm 353 to which is attached a connecting rod 354 operated by a crank disc 355 fast on shaft #5.

Safety mechanism for the central plunger

Referring to Figs. 5 and 22b, the crank disc 355 operates a make switch 357 and the plunger rod operates a break switch 358 thus insuring the full stroke of the plunger on the inserting stroke. The circuit may be similar to those already described.

Mechanism for feeding flat cartons from the stack

Referring to Figs. 10 and 12, brackets 360 are secured to the tops of the pusher slides 54 and these brackets are connected to move together by a rod 361. The pusher slides operate in retaining guides 362 on the table 50 along which the cartons move. As shown in Fig. 13, a link 364 is attached to the rod 361 and this link is operated by a vertical lever arm 365 fast on a rock shaft 366. As shown in Fig. 2, a short arm 367 is secured to the right end of the shaft and to this is attached a telescopic connecting rod 368 which is operated by a crank disc 369 fast on the right end of cam shaft #2. Two springs 370, 371 (see also Fig. 12) are attached to a stud pin 372 fast to the shaft and to a fixed support to urge the slides in the feeding direction. This arrangement of driving mechanism avoids crushing the cartons if they become jammed.

Mechanism for operating the clamp fingers 56

Referring to Fig. 6, the fingers 56 are pivoted upon pins 375 secured in brackets 376 on the

frame. To the outer ends of the fingers are integrally formed cam arms 377 which are bent down along the side of the main frame. Rollers which are disposed on the cam arms cooperate with cams 378 on the cam shafts 7a and 7b. Coil springs 379 urge the fingers toward the table.

Safety mechanism for the clamp arms

One or both of the clamp arms is completely insulated from the main frame and cam in any suitable way and the arm and main frame are connected in an electrical circuit so as to give an indication of some sort if the finger touches the table, indicating that there is no carton beneath the finger. The carton, of course, is an insulating medium and prevents contact if it is present.

Mechanism for operating the clamp blades 59

Referring to Figs. 8 and 9, the blades 59 which hold the long flaps of the carton down while the tips are being broken are mounted upon pivot shafts 382. Integral with the clamp arms are cam arms 383, the rollers of which ride on cams 384 fast on the cam shafts 7a, 7b. Coil springs 385 hold the cam arms toward the cams.

Mechanism for operating the tip folding blades 57

Referring to Fig. 7, the blades 57 are mounted upon pusher rods 387 which are pivoted to cam arms 388. The cam arms are mounted on shafts 389 and are provided with cam rollers which ride on cams 390 fast on the cam shafts 7a, 7b. Springs 391 hold the cam arms toward the cams. The blades 57 have a rising and later a lowering movement as they push the tips over. They are normally held toward the table by small coil springs 392 and cam rollers on the rods 387 move over cams 393 fixed to the table to give the desired movement.

Mechanism for operating the carton opening finger 60

Referring to Fig. 6, the finger 60 is pivotally mounted on a cam arm 395 which is journalled on the shaft 389 on the right hand side of the machine. A small coil spring 396 urges the finger down on the carton and a large coil spring 397 urges a roller on the cam arm against a cam 398 fast on the shaft 7a.

Mechanism for operating the carton opening plate 62 on the arcuate rack 63

As shown in Figs. 7 and 13, the rack 63 is mounted in an arcuate guideway 400 and is in mesh with an operating gear 401 on a flexed stub shaft 402. A gear 403 integral with the gear 401 is engaged by a gear segment 404. The gear segment is mounted upon a pin 405 in a depending bracket 406. A cam arm 407 is formed integral with the gear segment and the roller thereon engages an operating cam 408 fast on the cam shaft #2. A coil spring 409 urges the gear segment in the direction to return the plate 62 to the table.

Mechanism for operating the joint breaking arms 65

Referring to Fig. 13, the arms 65 are mounted on a rock shaft 411 mounted in bearing brackets 412 secured to the carton stack guides 52. An arm 413 is secured to the left end of the shaft and to this arm is pivotally attached an operating rod 414. Referring to Fig. 13, the rod 414 is connected to one arm 415 of a bell crank lever pivoted upon the depending bracket 416. To the other arm 417 of the lever is attached a cam rod 418. The other end of the cam rod is bifurcated to straddle the #6 cam shaft and is provided with a roller which operates upon a cam 419 secured to the #6 shaft. A coil spring 420 connected to the arm 417 and to the frame urges the arms 65 downward.

Mechanism for operating the arms 74 for opening the carton retaining dogs 72 or the carrier wheel

As shown in Fig. 16, the dogs 72 are pivoted at the edges of the carton receiving recesses and are urged downward in carton engaging direction by light coil springs 422. Referring to Fig. 13, the arms 74 for operating the dogs are mounted upon upper and lower rock shafts 423, 424 respectively. As formed the arms on the lower rock shaft are longer than the arms on the upper rock shaft and require less arcuate movement to operate the dogs than the upper arms. Referring to Fig. 15, the shafts 423, 424 are geared together by sprockets 425, 426 and a sprocket chain 427. One end of the chain is attached to the sprocket 426 and the other end is attached to a coil spring 428 secured to the main frame. The spring urges the arms in the direction to release the dogs. The sprockets are made of different diameters so as to equalize the lineal movement of the dog operating pins of the arms 74. Near its left end the lower shaft 424 is provided with a cam arm 429 the roller of which operates on a cam 430 fast on the cam shaft #2.

Mechanism for operating the slides 76 for pushing the carton to the carrier wheel

Referring to Fig. 10, the slides have secured therebeneath the brackets 432 which are yoked together to cause the two slides to move together by a cross rod 433. As shown in Fig. 13 a link 434 is connected to the rod 43 and this link is operated by an arm 435 comprising part of a bell crank lever pivoted upon the rock shaft 436. The other arm 437 of the bell crank lever is provided with a roller which operates upon a cam 438 fast on shaft #2. The slides are pulled rearwardly by a coil spring 439 attached to the arm 435 and to the main frame.

Mechanism for operating the pusher fingers 75

Referring to Fig. 10, the fingers 75 are pivoted upon a shaft 441 and are urged upward by a coil spring 442. After pushing the cartons forward until they are in a position to be engaged and seated by the gripper dogs, the fingers are pushed down by the engagement of a pin 443 secured to an arm on the shaft with a fixed cam 444. When the fingers move down they are engaged and held by the latch pawls 77, the pawls being urged into engaging position by springs 445. The fingers will now move back beneath a carton on the table to a position where they can engage its rear side. The pawls are released from the fingers in the rear position by pins 446 on arms 447 which are mounted on a shaft 448 journalled in bearings in depending brackets 449. The shaft has rigidly secured thereto an arm 450 to which is connected the cam rod 451. The rod straddles the cam shaft #6 and a roller on the rod operates on a cam 452 secured to the shaft. A coil spring 453 secured to the rod 451 and to the main frame urges the roller against the cam.

Mechanism for operating the umbrella plunger 81 and arms 82 for breaking the flap creases at #2 position

Referring to Figs. 30, 31 and 32 the arms 82 are pivoted to the plunger 81 at 455 and are urged toward each other by the springs 456. The arms are spread and allowed to converge again at the proper time, as explained, by the fixed cams 84 upon which the rollers 83 of the arms ride. The plunger operates within a suitable guide within the same member that carries the cams 84. To the rear end of the plunger is attached a connecting link 457 which is pivoted to a cam lever 458. The lever is mounted on a journal 459 and the roller on the lower end operates on a cam 460 fast to the cam shaft #5. The plunger is urged away from the cartons by a coil spring 461.

Mechanism for operating the swinging arm 91 for closing the trailing flap at the right end at #3 position

Referring to Figs. 14 and 23, the arm 91 is urged away from the carton flap by a helical spring 464 placed on the shaft 92. The outward movement of the arm is limited by a pin 465 in the shaft which comes against a stop on the swinging frame. The arm is swung around against the flap by the engagement of a pin 466 in the shaft which comes against a fixed stop 467 secured to the frame as the frame 93 carrying the shaft is swung down. The frame 93 is mounted upon a pivot 468 and is swung downward by a cam rod 469. The cam rod straddles the cam shaft #9 at the #4 position and a roller thereon operates upon a cam 470 which is secured to the shaft. The roller is urged against the cam by a coil spring 471.

Mechanism for turning the conveyor wheel 71

The wheel must be stopped very accurately in its various positions in order that the operations which are carried on in association therewith may proceed properly and promptly. Referring to Figs. 14 and 22*a*, the wheel is provided with oppositely directed turning and escapement ratchet wheels 474, 475 respectively. The wheel is turned by a pawl 476 acting upon the ratchet wheel 474. The pawl is pivoted to the ratchet lever 477 which is mounted on the hollow shaft 18 which surrounds the #3 cam shaft. The lever 477 is operated by an eccentric rod 478 from an eccentric 479 fast on the #2 cam shaft. As the ratchet lever moves back with the pawl its lower end strikes an arm 480 of the escapement pawl 481 and moves it out of a notch ready to drop into the next notch when the pawl again moves forward.

The wheel is held against free turning movement by a brake band 482 held against a drum 483 on the wheel by a coil spring 484, Fig. 15.

The wheel is held accurately in operating positions for the various related mechanisms by a detent arm 485 pivoted at 486. A roller 487 on the end of the arm engages notches of a detent disc 488 fast on the wheel shaft 18. The detent roller is pressed inward by a telescopic spring-expanded connecting rod 489 attached to the arm 485 and to a cam arm 490. A roller on the cam arm operates upon a cam 491 fast on the #2 cam shaft.

Mechanism for operating the flap guide segment 100 at #4 position

Referring to Figs. 15 and 22*a*, the plate 100 is mounted upon a plunger 495 which straddles the cam shaft 9 and operates within fixed guides 496. The plunger is provided with a cam roller which operates upon a cam 497 fast on the #9 shaft. Springs 498 hold the roller down upon the cam.

Mechanism for operating the plate 102 for releasing the carton holding dogs at #4 position

Referring to Figs. 13 and 22*a*, the plate 102 is mounted upon a plunger 500. This plunger straddles shaft 9 and operates within fixed guides 501. A cam roller on the plunger operates upon a cam 502 fast on the shaft #9. Springs 503 hold the roller against the cam.

Safety mechanism for the guide plate

The cam 502 closes a switch 504*a* and the plunger 500 opens a switch 504*b*. If the switch 504*b* is not opened in time the machine is stopped.

Mechanism for operating the carton pushing plunger 104 at the #4 position

Referring to Fig. 22*a*, the plunger 104 is secured to a cam rod 505. A roller on the outer end of the rod operates upon a cam 506 fast on the vertical cam shaft #8. A spring 507 urges the roller against the cam.

Mechanism for operating the gripper plunger 107 for returning the cartons to the wheel at the #4 position

Referring to Figs. 21 and 22*a*, the gripper plunger 107 is provided with a cam roller which operates upon a cam 509 fast on the cam shaft #8. A spring 510 urges the plunger roller against the cam.

Mechanism for operating the curved plate 120 at the #5 position for pushing down the tip of the long flap

Referring to Figs. 17 and 18, the plate 120 is mounted upon a lever 512 which is pivoted at 513. A cam rod 514 which operates within fixed guides 515 has a roller on its lower end which engages the rear end of the lever 512 to lift the plate. A set screw 516 limits the downward movement of the plate so it will place the tip of the flap just at the slit which it is to enter between the carton side and the straws. The cam rod is provided with a roller which operates on a cam 517 fast on the cam shaft #11. Springs 518 attached to a pin in the pivot shaft 513 of the lever 512 and to a fixed part urge the plate down.

Mechanism for operating the squeezers 122 at #5 position

Referring to Figs. 14, 17 and 18, the squeezer arms 122 are pivoted upon pins 521 and are urged in the direction to release the carton by helical springs 522 on the pins 521. The arms have rollers which operate upon cams 523, 524 fast on the cam shaft #11.

Mechanism for operating the side pressing plate 123 at #5 position

Referring to Figs. 14, 17 and 18, the plate 123 is secured to a plunger 526 which straddles the shaft 11 and is provided thereabove with a roller which operates upon a cam 527 fast on the shaft. Springs 528 urge the plunger downward and a set screw 529 limits the downward movement to prevent closing the side of the carton in upon the entering flap too much.

Mechanism for operating the flat plate 121 for closing the long flap at the right end

Referring to Figs. 17 and 18, the plate 121 is pivoted at 531 and is pressed inward by a roller on the end of a cam plunger rod 532. At the other end the rod carries a cam roller which operates upon a cam 533 fast on the inclined shaft #10. The plate 121 is pulled outwardly by a coil spring 534.

Mechanism for operating the squeezer arms 131 at #6 position for closing the short flaps and bowing out the top side of the carton at the left end

Referring to Figs. 15, 19 and 20, the squeezer arms 131 are mounted upon pivot pins 536 and are urged away from carton engaging position by helical springs 537 on the pins. The upper ends of the arms are provided with rollers which operate upon cams 538, 539 fast on the cam shaft #13.

Mechanism for operating the side pressing plate 138 at position #5

Referring to Figs. 15, 19 and 20, the plate 138 is mounted upon a cam plunger 541 which straddles the shaft #13 and thereabove is provided with a cam roller which operates upon a cam 542 fast on the shaft. Springs 543 urge the plunger downward and a set screw 544 prevents the plunger from moving down so far as to injure the carton.

Mechanism for operating the curved plate 133 at position #6 for positioning the ends of the long flaps at the left end

Referring to Figs. 19 and 20, the plate 133 is mounted upon a cam plunger 546 which straddles the cam shaft #13 and thereabove is provided with a roller which operates upon a cam 547 fast on the shaft. Springs 548 urge the plunger downward and a set screw 549 limits its downward movement so as to place the flap tip accurately in position to enter the carton.

Mechanism for operating the end closing plate 134 at position #6

Referring to Figs. 19 and 20, the plate 134 is mounted upon a shaft 136. Upon the shaft is secured a gear 552 which is driven by a gear segment 553 turning about a stub shaft 554. To the segment there is pivoted a cam rod 555 which straddles the cam shaft 14 and is provided with a roller which operates upon a cam 556 fast on the shaft. A coil spring 557 urges the roller against the cam.

Mechanism for operating the swinging arms 141 at position #7 for releasing the carton from the dogs

Referring to Fig. 13, the arms 141 which carry the dog raising pins are mounted upon upper and lower shafts 560. The lower arms are longer than the upper arms. As shown in Fig. 14, the upper shaft is provided with a small sprocket 561 and the lower shaft is provided with a large sprocket 562 to compensate for the difference in length of the arms 141. The sprockets are geared together by a sprocket chain 563. At one end the chain is connected to the large sprocket 562 and at the other end has attached to it a coil spring 564 which is anchored to the main frame. The spring urges the arms toward dog disengaging position. The lower shaft 560 is provided with a cam arm 565 which at its free end carries a cam roller operating upon a cam 566 fast on the cam shaft #15.

Mechanism for operating the carton ejecting arms 142 at position #7

Referring to Fig. 13, the arm 142 is mounted upon a rock shaft 568. A cam arm 569 is rigidly secured to the shaft and at the outer end is provided with a roller which operates upon a cam 570 fast on the shaft #15. The cam arm is urged toward the cam by a coil spring 571.

The operation of the apparatus has already been described. While one embodiment of the apparatus has been described with particularity for purposes of illustration it is to be understood that various changes and modifications may be made within the scope of the invention as defined in the subjoined claims.

I claim:—

1. Apparatus for packaging straws or similar articles, which are received in bundles with elastic bands therearound, in cartons which have closure flaps at each end, which comprises in combination, a conveyor for separately elevating the bundles, a chute into which the conveyor delivers the bundles, movable arms in one side of the chute for pressing the bundles flat, successive fingers for dispensing the bundles downward one at a time, a double-compartment laterally shiftable frame receiving alternate bundles from said chute in alternate compartments, a swinging plate at each side of the central position at the chute for pressing the bundles flat vertically and confining them in said frame, a fixed curved groove-forming bracket on each side above the bundle, vertically movable frames on each side which first move a bundle upward and cause a groove to be formed in it and later descend with it, means on said frames for grasping bundles, grippers which swing longitudinally of the bundles for grasping the elastic bands and pulling them off the ends of the bundles, longitudinally divided boxes into which the bundles are lowered by said vertically movable frame after the bands have been removed, means for forcing the parts of said boxes together after the bundles have been deposited therein, a double-compartment inserting receptacle movable laterally at the ends of said boxes, plungers for pushing bundles from said boxes into a compartment of said receptacle, a carrier for presenting a carton with its open end to the compartments of said receptacle when in a central position, and a plunger for pushing bundles from the receptacle into said carton.

2. Apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in cartons, which comprises in combination, means for feeding the bundles along one by one to a central position, means for shifting alternate bundles to opposite sides of the central position, means at the two side positions for removing the elastic bands off the ends of the bundles, means for grasping the bundles and shifting them downward, means for then shifting them endwise, means for then shifting them back to a central position, means for presenting cartons at the central position, and means for shifting the bundles endwise into the cartons.

3. Apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in cartons, which comprises in combination, means for feeding bundles one by one, swinging grippers for grasping the

bands and removing them from the bundles, means for presenting open cartons to the ends of said bundles, and means for delivering the bundles into said cartons.

4. In apparatus for packaging bundles of straws or similar articles, in combination, a chute down which the bundles descend by gravity, a plurality of pairs of curved fingers entering the chute from each side and arranged in sets at spaced distances along the length of the chute, a frame located at the open lower end of the chute for receiving bundles therefrom, and means for operating the spaced sets of fingers for dropping bundles one at a time from set to set and from the last set to the receiving frame.

5. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting a bundle to a given position, swinging grippers mounted at the given position, grasping jaws for said grippers, means for swinging said grippers into a position where the jaws are on opposite sides of a band, means for closing the jaws for grasping a band, means for swinging the grippers outward beyond the ends of the bundle, and means for opening the jaws at the outer position for releasing the bands.

6. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting bundles to a given position, devices for removing bands from the bundles, said devices being movable from an inner position where they engage the bands to an outer position where they discharge them, and means at the outer position for assisting in the removal of bands from the devices.

7. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting bundles to a given position, devices for removing bands from the bundles, said devices being movable from an inner position where they engage the bands to an outer position where they discharge them, and means for delivering a directed stream of fluid under pressure to said devices when they are located in the outer position for assisting in the removal of bands therefrom.

8. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting bundles to a given position, devices for removing bands from the bundles, said devices being movable from an inner position where they engage the bands to an outer position where they discharge them, and a member movable across the space between the bundle and the device when it is in its outer position for striking the band to pull it away from the bundle in case it should still be held thereto.

9. Apparatus as set forth in claim 8 in which said member consists of a swinging arm.

10. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting bundles to a given position, means for forming a longitudinal groove in the bundles, the bands being left spanning the groove, and means for engaging the bands along the groove and removing them from the bundles.

11. In apparatus for packaging straws or similar articles which are received in bundles with elastic bands therearound, in combination, means for presenting bundles to a given position, a curved bracket mounted at said position, means for pushing a bundle of straws upward at the top to form a groove therein by engagement with said bracket, and means for engaging the bands along the groove and removing them from the bundle.

12. Apparatus as set forth in claim 11 in which said upward pushing means includes a member which moves over against the side of the bundle to change its shape from round to rectangular in cross section and to cause some straws at the top of the bundle to move upward along the sides of the curved bracket to form the groove in the bundle.

13. Apparatus as set forth in claim 11 in which said upward pushing means includes a member which moves upward against the bottom of the bundle to move it upward.

14. Apparatus as set forth in claim 11 in which said upward pushing means comprises a member which moves over against the side of the bundle and a member which moves upward against the bottom of the bundle.

15. In apparatus for packaging straws or similar articles, in combination, a laterally slidable bundle supporting frame which is shorter than the bundle, a vertically slidable frame which engages a bundle while held in the first mentioned frame along the part of the bundle not engaged by the first mentioned frame, said second mentioned frame moving the bundle down after the first mentioned frame moves from beneath it, a third frame which is shorter than the bundle into which the second frame deposits the bundle, and a plunger for pushing the bundle endwise from the third frame so the second frame can move back upward.

16. In apparatus for packaging straws or similar articles, in combination, a narrow frame for grasping a bundle of straws between its ends, a two-part box for receiving the bundle, the parts of the box being disposed at each end of the frame and the frame being movable across the ends of the parts of the box, and means for pushing the parts of the box together after the frame has moved clear of them.

17. In apparatus for packaging straws or similar articles, in combination, a narrow frame for grasping a bundle of straws between its ends, a two-part box for receiving the bundle, the parts of the box being disposed at each end of the frame and the frame being movable across the ends of the parts of the box, means for pushing the parts of the box together after the frame has moved clear of them, and a plunger for pushing the bundle endwise from the box after the parts have been brought together.

18. In apparatus for packaging straws or similar articles, comprising in combination, a receptacle for inserting a bundle of loose straws in a carton, an enclosed ring-shaped member for directing the straws into the end of the carton, and a plunger for compressing the bundle of straws until it will enter the ring shaped member.

19. Apparatus as set forth in claim 18 which includes in further combination, resilient means for moving said plunger on the compressing stroke.

20. Apparatus as set forth in claim 18 which includes in further combination, means for giving an indication if the plunger does not move to a given position on the compressing stroke.

21. In apparatus for packaging straws or similar articles, comprising in combination, a receptacle for presenting bundles of straws to a

given position where they are fed into cartons, means for shifting said receptacle, said means including a resilient element for moving the receptacle in one direction, and means for giving an indication if said receptacle has not moved fully into the feeding position under the influence of the resilient element.

22. In apparatus for packaging straws or similar articles, comprising in combination, a plunger for pushing a bundle of straws toward a carton, means for operating said plunger, said means including a resilient element for moving the plunger in feeding direction, and means for giving an indication if the plunger has not moved the full length of its feeding stroke.

23. Apparatus for packaging articles in cartons which have end closure flaps extending straight from the sides of the cartons, comprising in combination, a carrier wheel provided with means for holding a carton thereon with the flaps extending axially from the sides of the wheel, means for rotating said wheel intermittently and halting cartons at various positions, means for opening the flaps at the charging end of the carton, means for closing the flaps at the other end of the carton, means at a filling position for releasing the carton from the wheel, means for moving the carton endwise for filling, means for charging articles into the carton, and means for returning the carton to its original position on the wheel.

24. Apparatus as set forth in claim 23 in which said means for returning the carton includes grippers which engage the carton.

25. Apparatus as set forth in claim 23 in which said means for returning the carton includes grippers which engage the carton upon the faces of two sides near the corners of another side.

26. Apparatus as set forth in claim 23 in which said means for moving the carton endwise includes a plunger and in which said means for returning the carton comprises gripper jaws, and interacting means between said plunger and said jaws for providing at least a part of the movement of said jaws.

27. In apparatus for packaging straws or similar articles which are received with elastic bands therearound, in combination, means for holding a bundle, a frame movable vertically upward to embrace the bundle on the sides and bottom, a swingable arm mounted upon said frame for moving over and engaging the top of the bundle, and elastic lining elements located interiorly of said frame and arm for direct engagement with the straws to avoid crushing them.

28. In apparatus for packaging straws or similar articles which are received with elastic bands therearound, in combination means for holding a bundle, a frame movable vertically upward to embrace the bundle on the bottom and sides, a swingable arm mounted upon said frame for moving over and engaging the top of the bundle, and means for moving the arm over as the frame approaches the top of its stroke and holding it over as the frame moves downward, said last mentioned means comprising a cam follower arm rigid with said bundle engaging arm, and a cam for operating said cam arm.

29. In apparatus for packaging straws or similar articles which are received with elastic bands therearound, in combination means for holding a bundle, a frame movable vertically upward to embrace the bundle on the bottom and sides, a swingable arm mounted upon said frame for moving over and engaging the top of the bundle, and means for moving the arm over as the frame approaches the top of its stroke and holding it over as the frame moves downward, said last mentioned means comprising a cam follower arm rigid with said bundle engaging arm, a swingable cam pivoted at its upper end along which a part on said cam follower arm moves on one side on its upward stroke and on the other side on its downward stroke, and a fixed cam beneath said swingable cam along which the part moves on the downward stroke.

30. In apparatus for packaging straws or similar articles which are received with elastic bands therearound, in combination means for holding a bundle, a frame movable vertically upward to embrace the bundle on the bottom and sides, a swingable arm mounted upon said frame for moving over and engaging the top of the bundle, and means for moving the arm over as the frame approaches the top of its stroke and holding it over as the frame moves downward, said last mentioned means comprising a cam follower arm rigid with said bundle engaging arm, a cam for operating said cam arm, and an auxiliary member acting upon the bundle engaging arm in its upper position for pushing it over into engagement with the bundle.

31. In apparatus for packaging straws or similar articles which are received with elastic bands therearound in combination means for holding a bundle, a frame movable vertically upward to embrace the bundle on the bottom and sides, a swingable arm mounted upon said frame for moving over and engaging the top of the bundle, and means for moving the arm over as the frame approaches the top of its stroke and holding it over as the frame moves downward, said last mentioned means comprising a cam follower arm rigid with said bundle engaging arm, a cam for operating said cam arm, and an auxiliary resilient member which said bundle engaging arm engages at the upper end of its stroke for pushing the arm over into engagement with the bundle.

32. Apparatus for packaging articles in cartons which have end closure flaps extending straight from the sides of the carton, comprising in combination, a carrier wheel provided with means for holding a carton thereon with the flaps extending axially from the sides of the wheel, means for rotating said wheel intermittently and halting cartons at various positions, means for inserting articles in said cartons and means for closing the flaps at the ends of the cartons, said folding means including means for pushing down the tip of the long flap, means for bowing out a side of the carton as the tip of the flap enters, means for pushing the tip of the flap within the carton, and means for unbowing said side as the tip moves further within the carton.

33. Apparatus for packaging articles in cartons which have end closure flaps extending straight from the sides of the cartons, comprising in combination, a carrier wheel provided with means for holding a carton thereon with the flaps extending axially from the sides of the wheel, means for rotating said wheel intermittently and halting cartons at various positions, means for inserting articles in said cartons, and means for closing the flaps at one end of the carton, said means comprising a blade which swings up to raise a long flap part way as the carton is halted at a given position after being filled, guides for holding the flap up as it moves toward another position, means at the second position for swinging the short side flaps closed, means for closing the

long flap, said closing means for the long flap including a device for pushing the tip of the long flap to a given position where it will enter the carton, arms for bowing out the side of the carton, a plate device for pushing the flap in, and a device for unbowing the side as the tip of the flap enters the carton.

34. Apparatus as set forth in claim 33 in which said plate device also operates the swinging blade at the previous position.

35. Apparatus as set forth in claim 33 in which said bowing arms also carry plates which swing the short side flaps closed.

EUGENE CONTI.