# United States Patent

[11] 3,597,895


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[54] **PACKAGING METHOD AND MACHINE**
**7 Claims, 21 Drawing Figs.**


[52] **U.S. Cl.** ..... **53/29,** 53/183, 53/187, 53/385
[51] **Int. Cl.** ..... **B65b 43/12,** B65b 43/30, B65b 43/36
[50] **Field of Search** ..... 53/28, 29, 180, 182, 183, 187, 384—5



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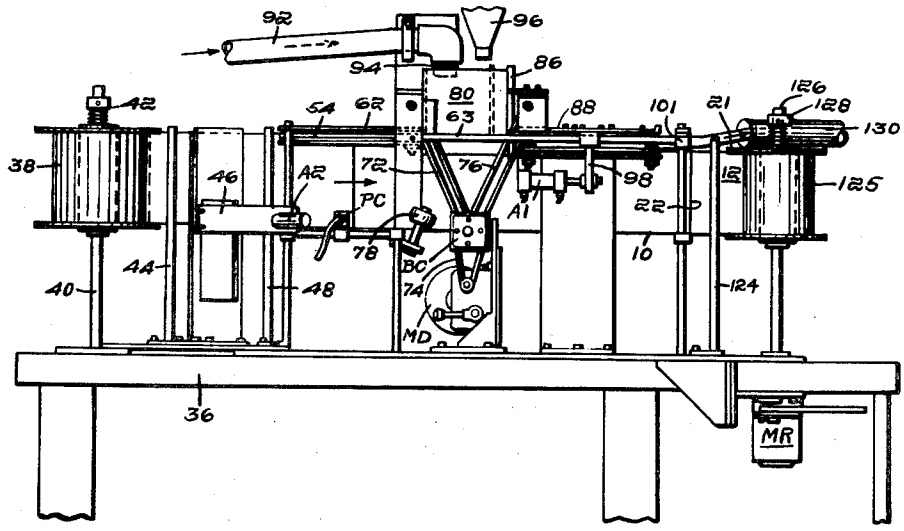
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**ABSTRACT:** The packaging method involves forming a continuous strip of connected bags by folding a sheet longitudinally, and forming a series of transverse seams extending only partially across the strip from the fold toward the unfolded edge of the strip. The strip is fed lengthwise to position a bag at a loading station; then a portion of the strip is retracted to open that bag for loading, aided by a collapsible tube and a blower. A reversal of the retraction recloses each bag after loading, and it is then sealed by a longitudinal seam joining the transverse seams between the edges of the strip. The excess material at the unfolded edge of the strip is removed before the bags are separated.

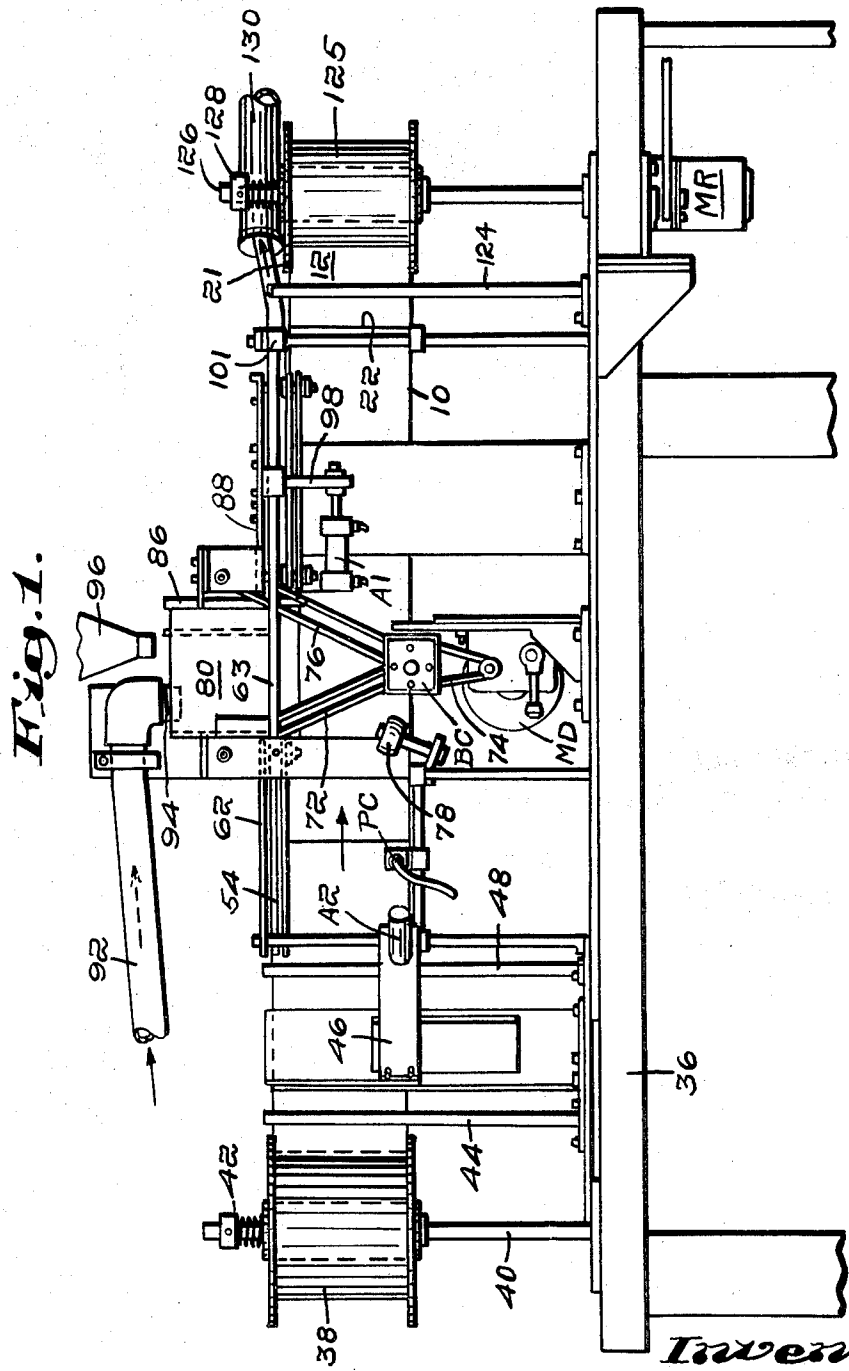



Fig. 1.

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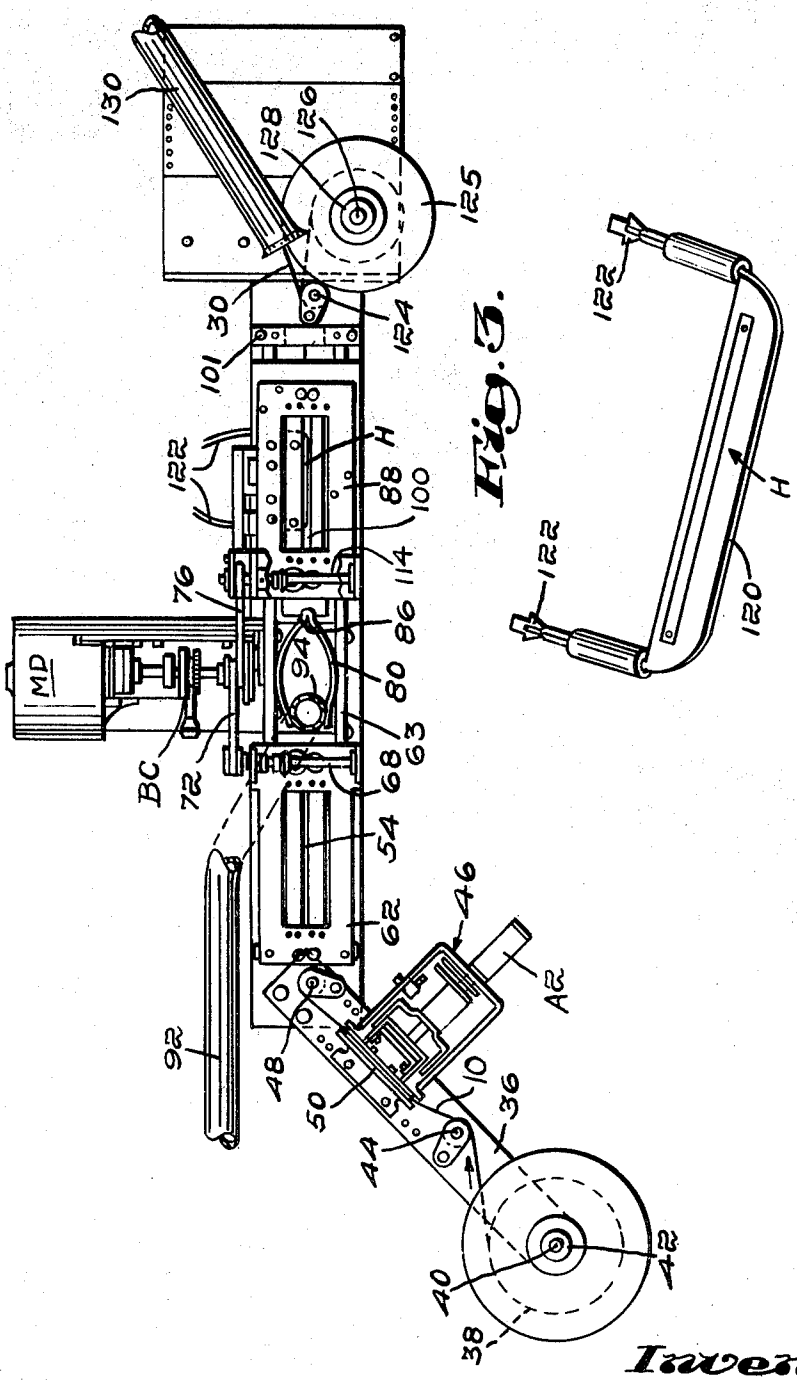
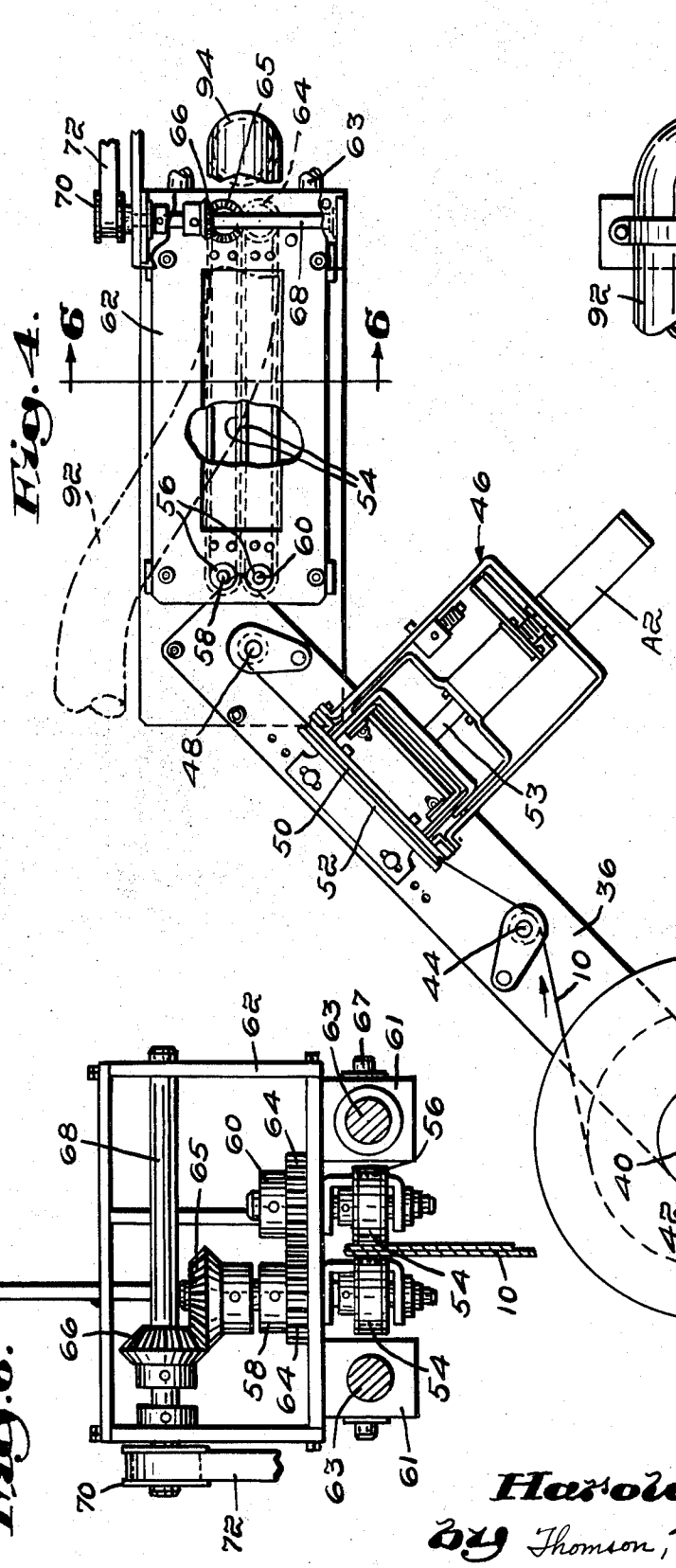


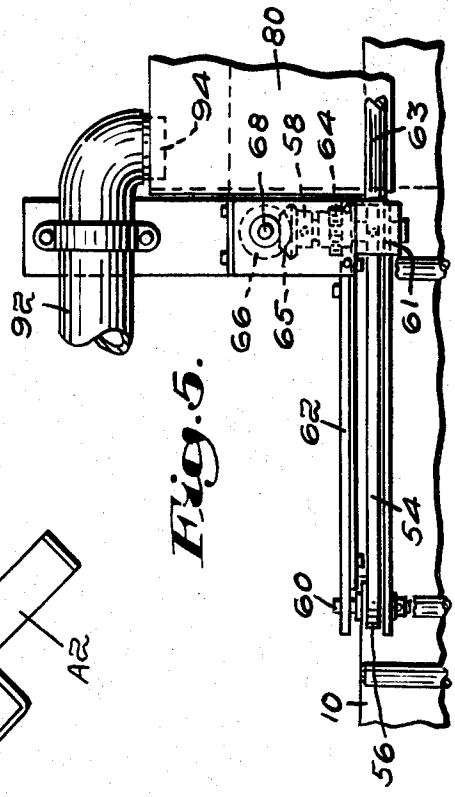

Fig. 2.




Fig. 3.

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Fig. 7.

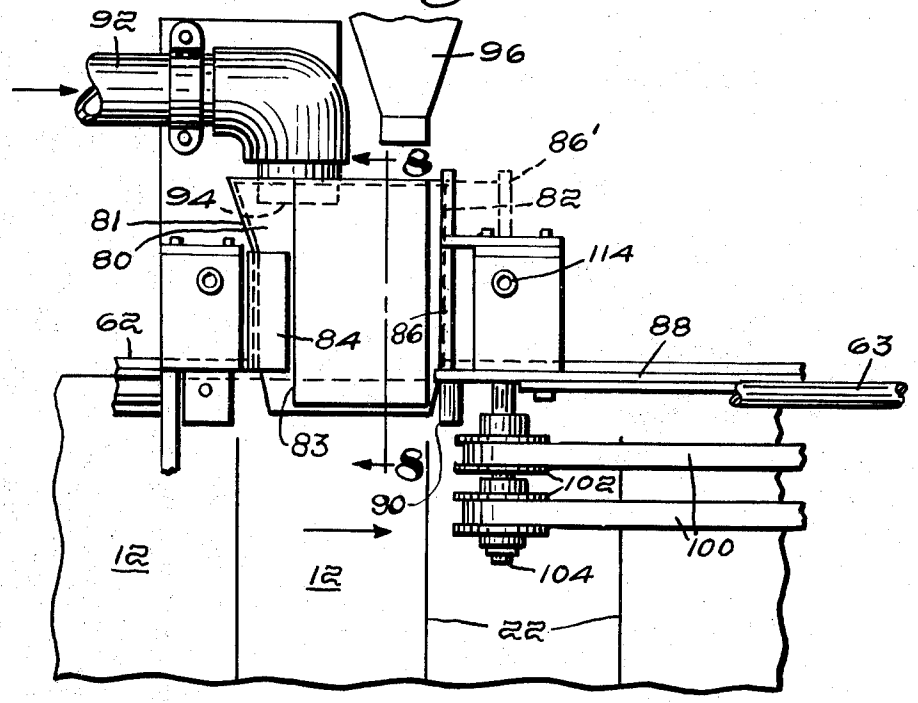



Fig. 8.

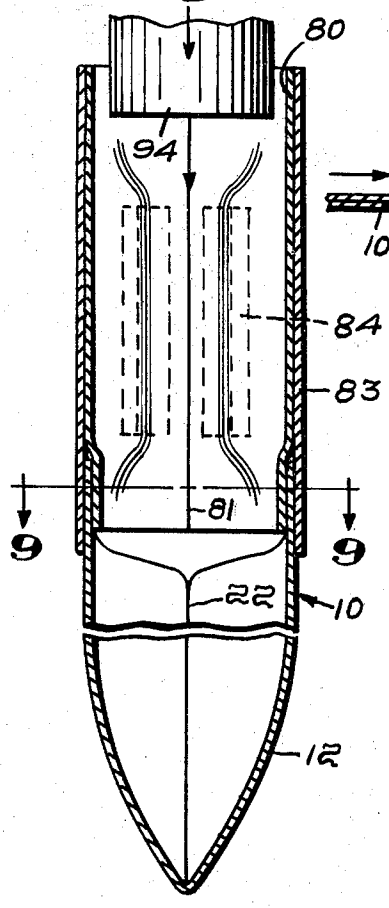
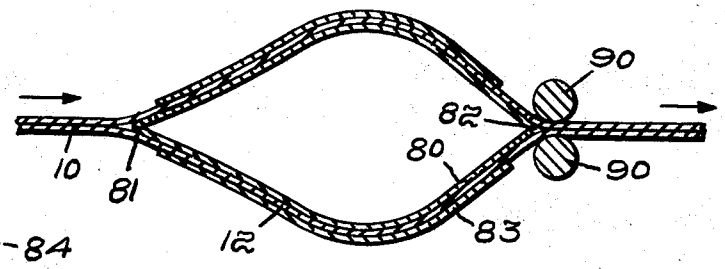



Fig. 9.




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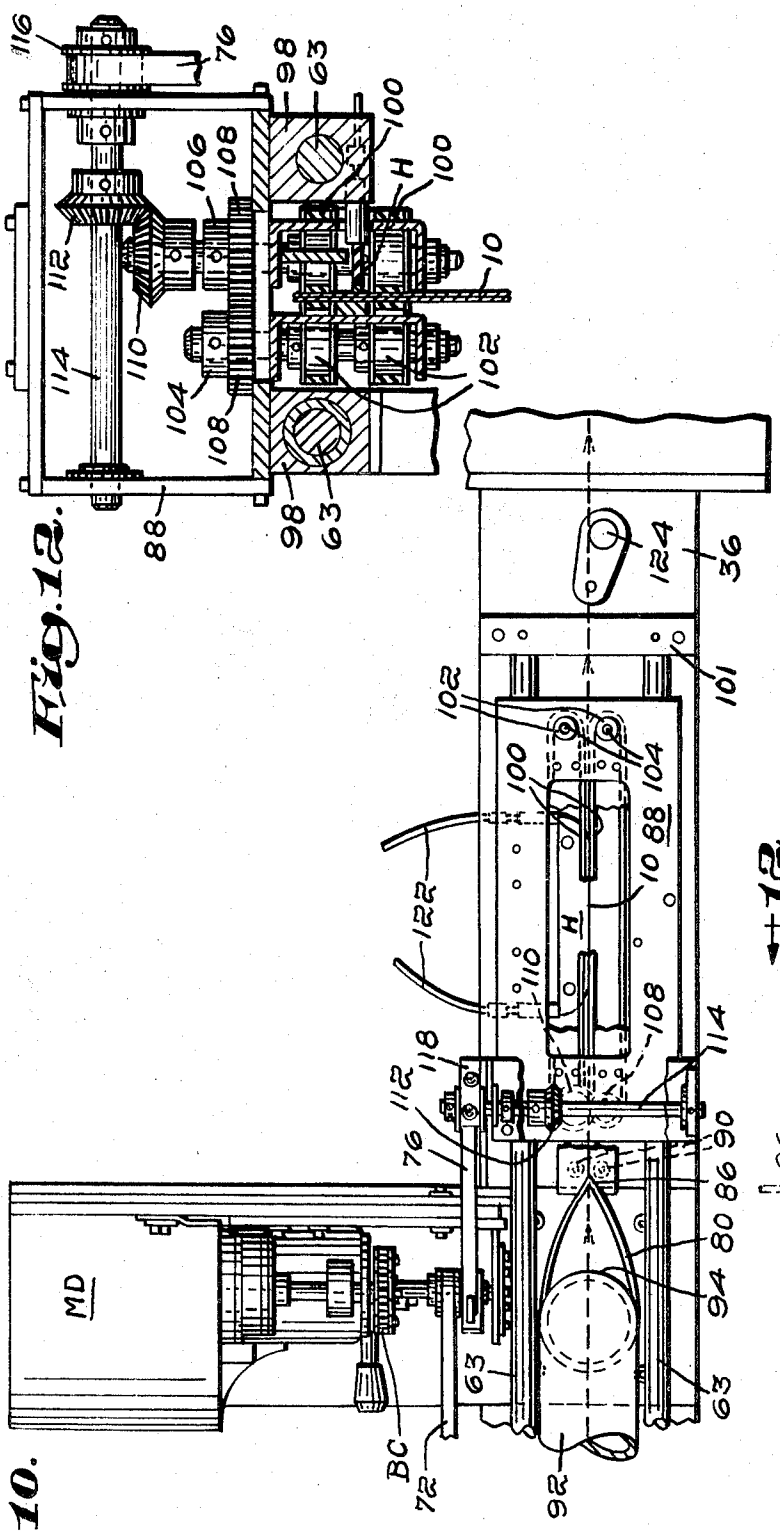



Fig. 10.




Fig. 12.

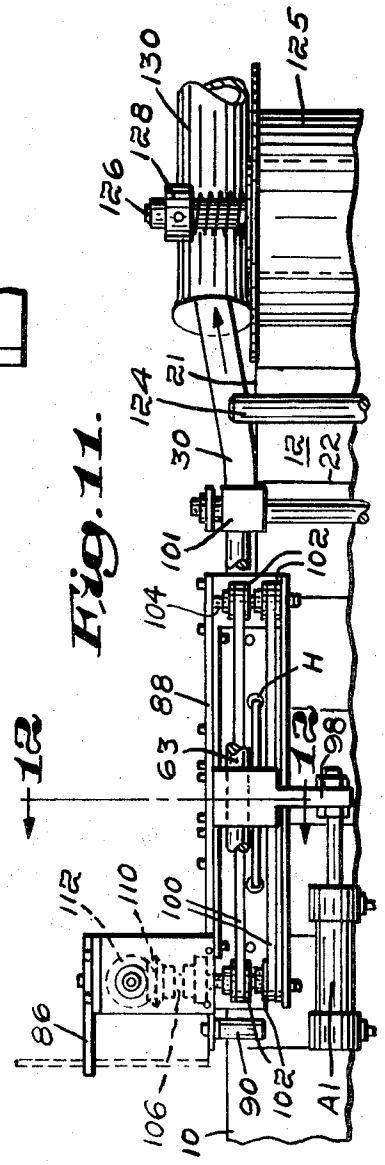



Fig. 11.

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Fig. 16.

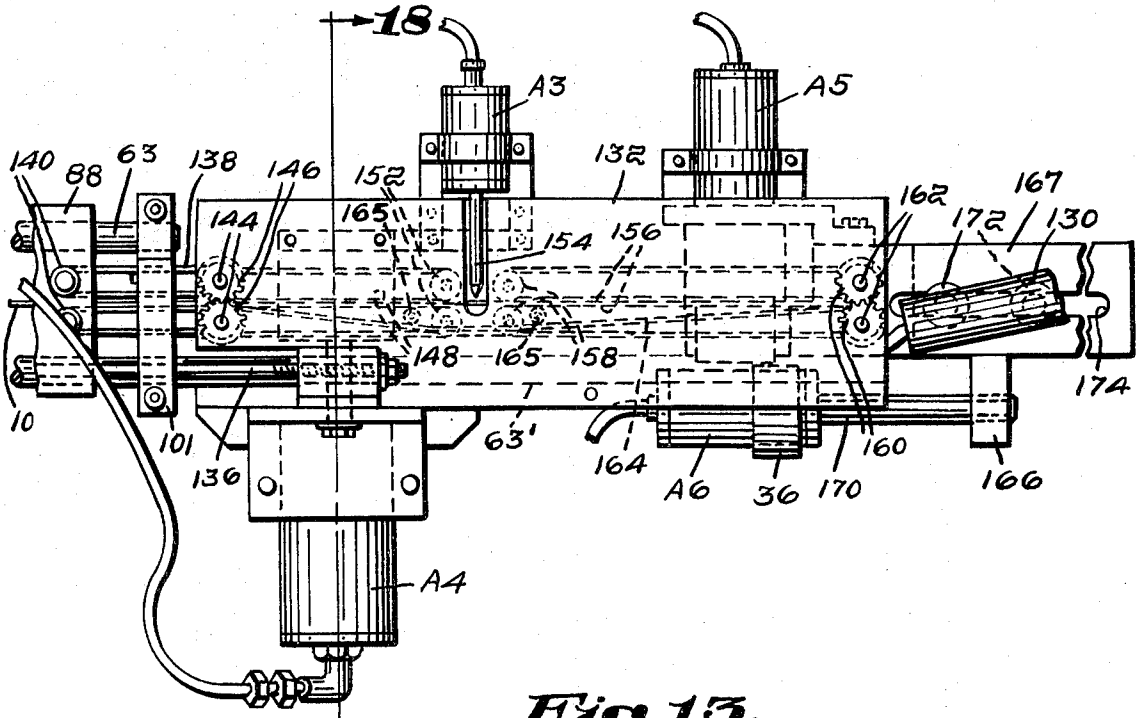



Fig. 13.

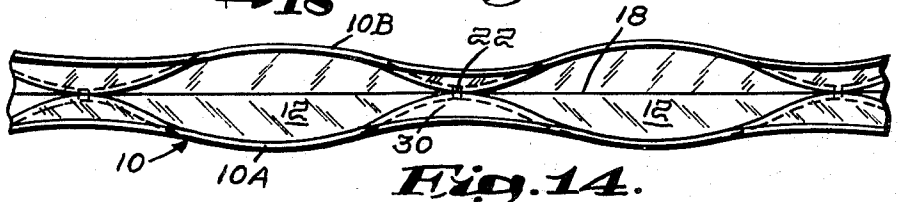
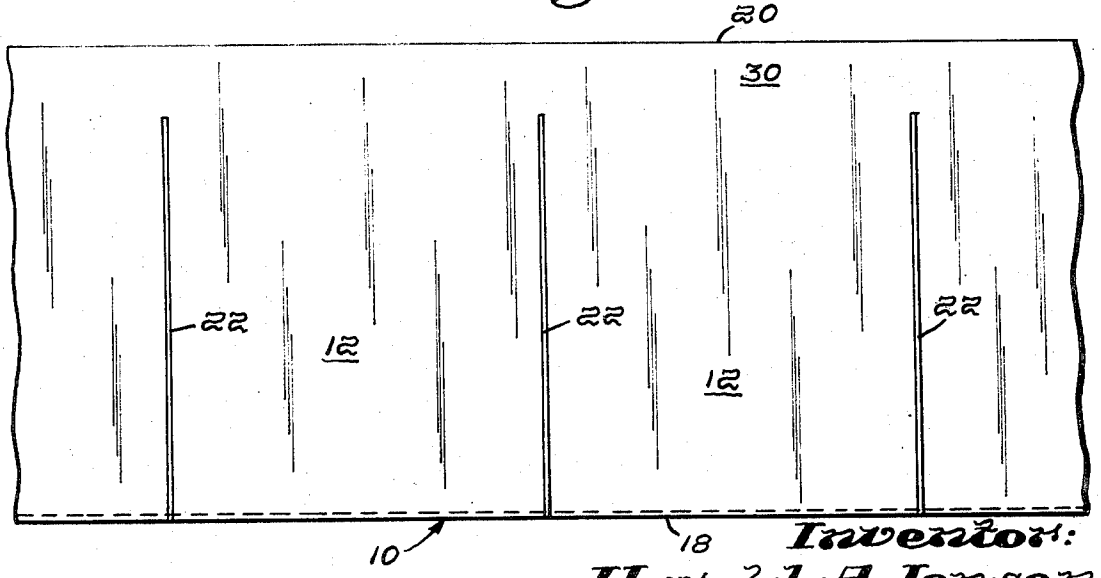



Fig. 14.




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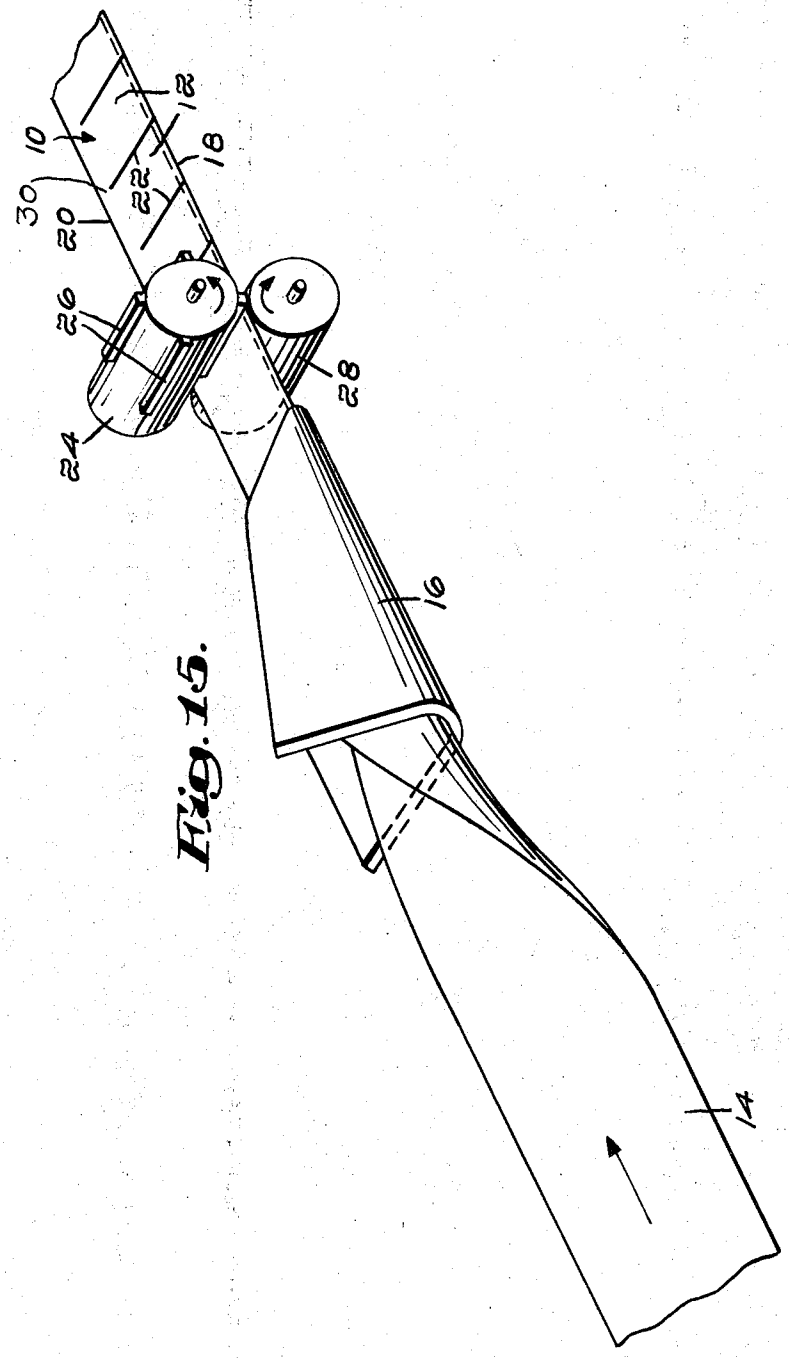
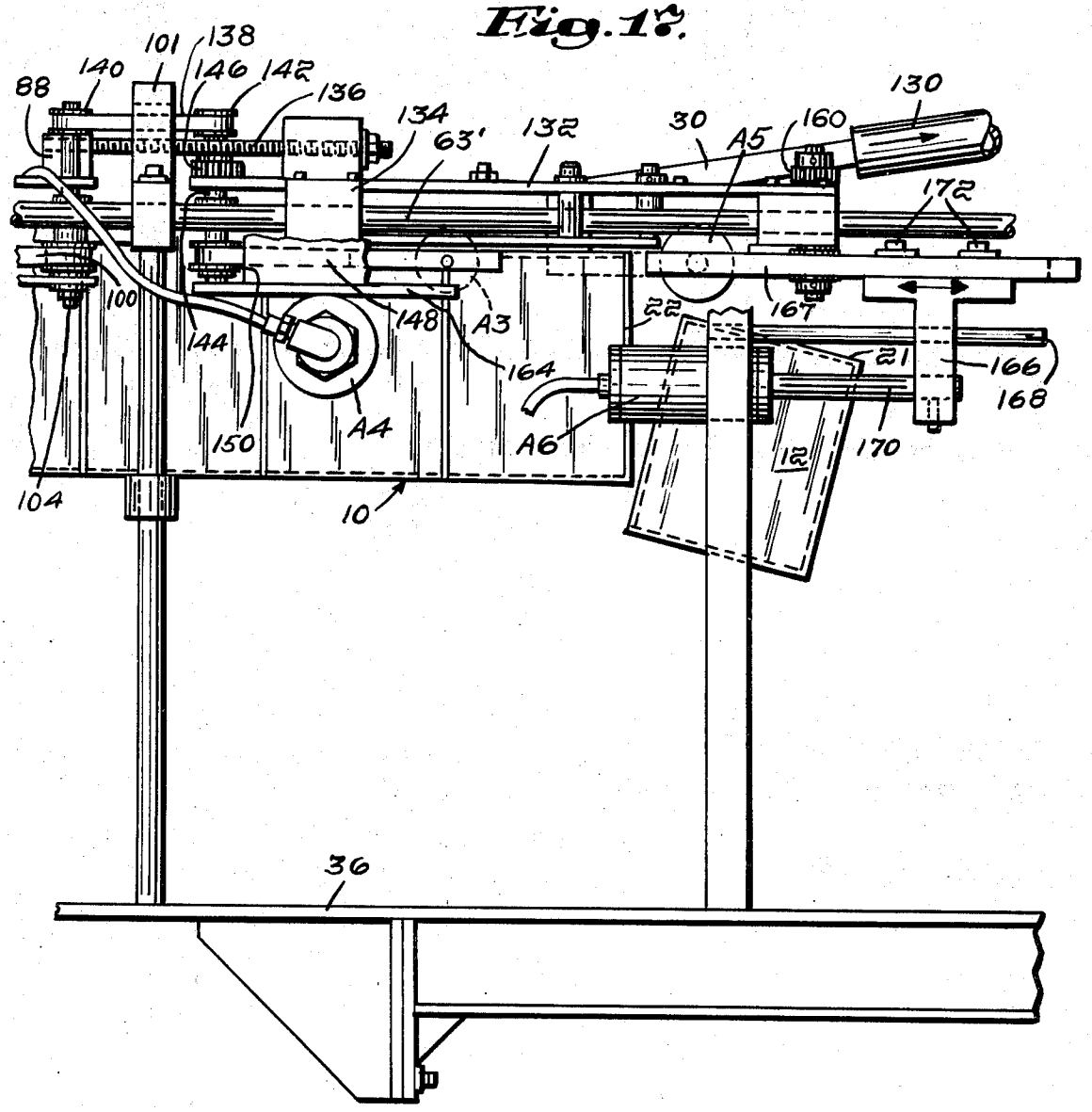



Fig. 15.

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Fig. 12.




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Fig. 18.

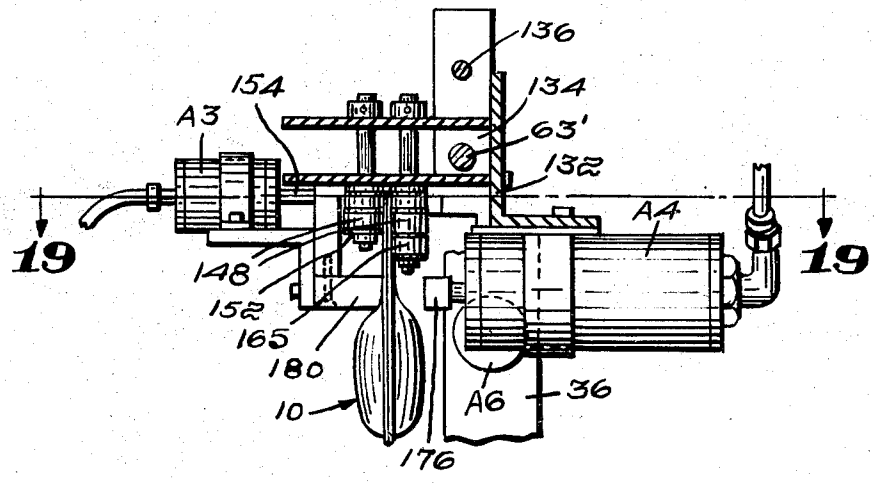
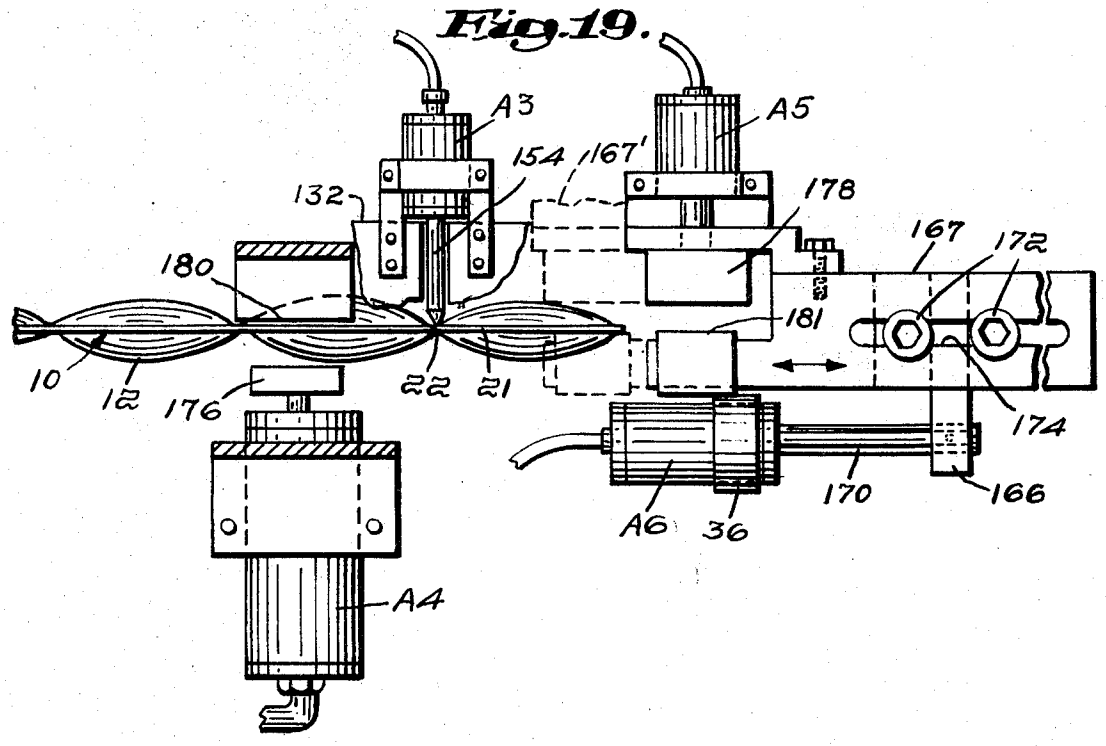



Fig. 19.




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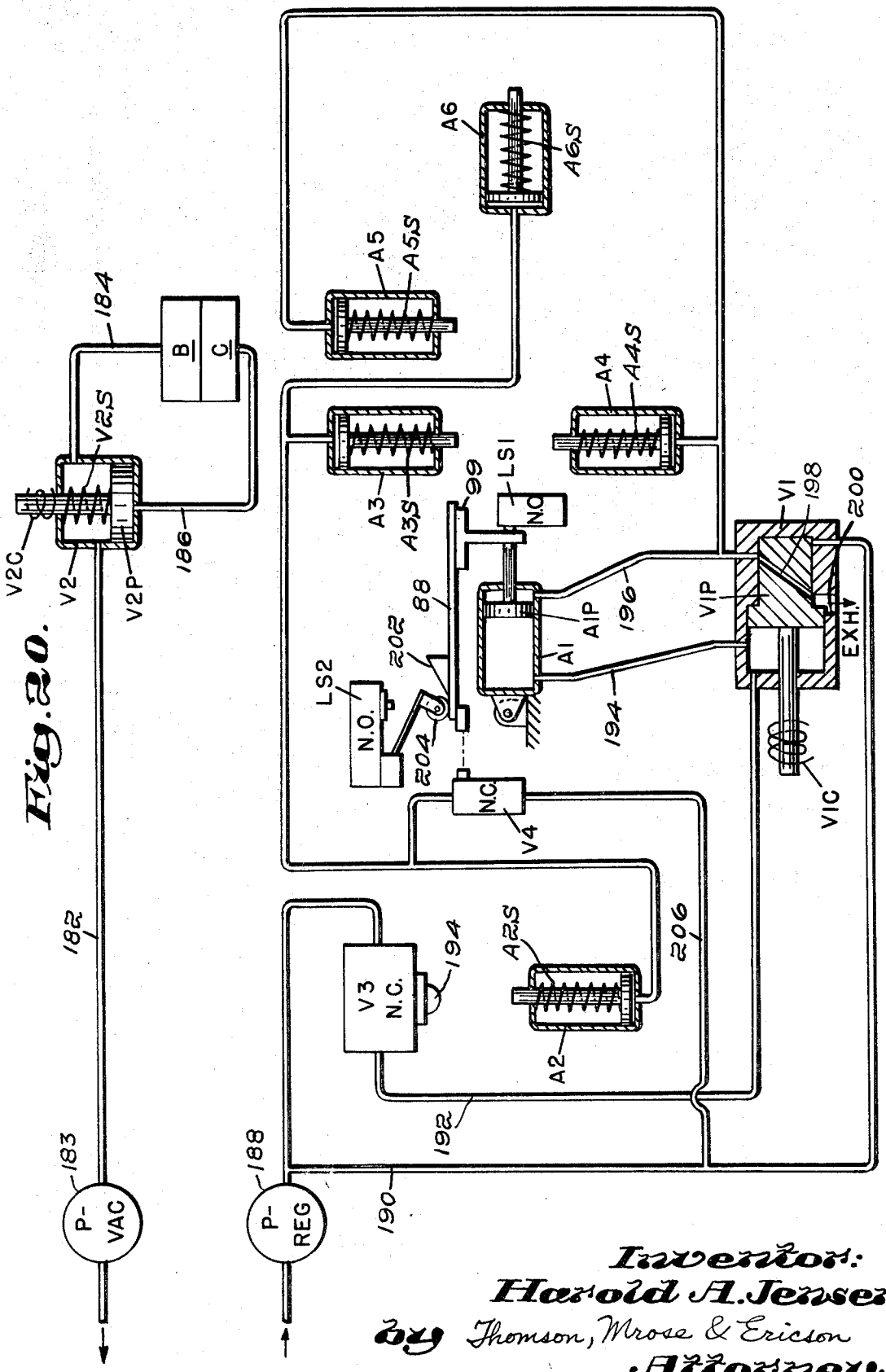
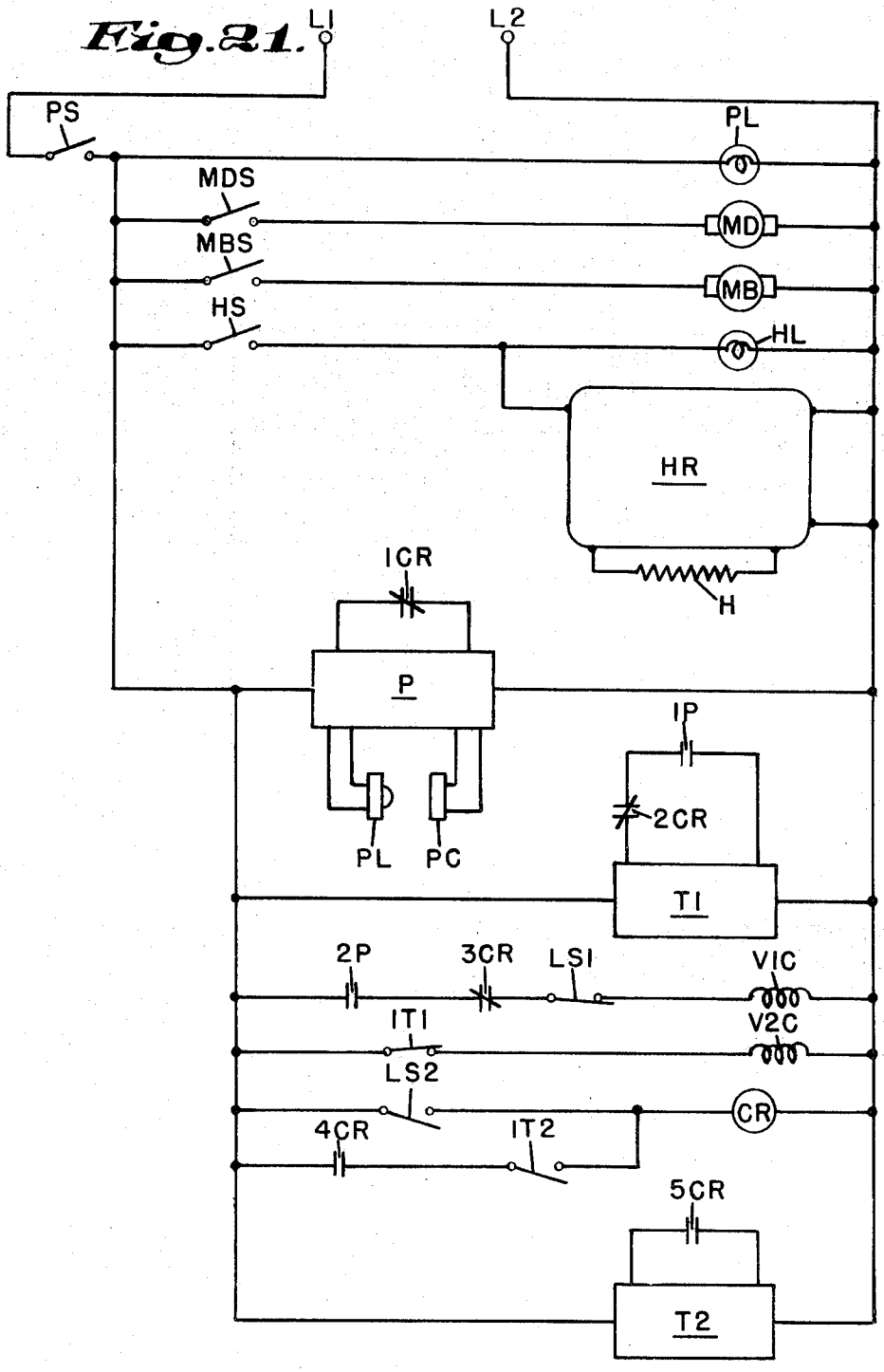



Fig. 20.

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Fig. 21.




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# PACKAGING METHOD AND MACHINE

## BRIEF DESCRIPTION OF THE INVENTION

The primary objects of this invention are to provide an improved method for packaging articles in bags, to afford an improved packaging material for use with the method, and also to provide an improved machine for bagging articles in an automatic and continuous manner. Further objects and advantages of the invention will appear as the following description proceeds.

Briefly stated, I form a strip of bags by folding a sheet of packaging material, preferably a heat-sealable plastic, along a longitudinal fold to form opposed face panels of equal width. The panels are joined by transverse seams at regular intervals to define a series of open bags; these seams extend from the folded edge of the strip and terminate short of the unfolded edge.

I feed the strip intermittently, using the transverse seams as a reference, and halt the strip when each successive bag is aligned at a loading station. The bag is opened by retracting a part of the strip that has passed the loading station, while holding the incoming part stationary. Opening is assisted by a collapsible, flexible tube at the loading station; this tube is fitted between the layers of the strip at the unfolded edge, but does not enter the bags far enough to interfere with the transverse seams. Exterior flaps on the tube overlap the exterior of the strip to hold its shape in conformity with the tube. The tube is opened as the strip is partially retracted; and a blower connected to the tube aids in distending the bag fully. The open bag is then filled by conventional dispensing means which are not part of this invention. After a bag is filled, I advance the previously retracted portion of the strip to close the bag, and resume forward feeding of the entire strip to advance a succeeding bag to the loading station.

After the reclosed bags leave the loading station, I pass them over a sealing device which forms a seam longitudinal to the strip and connecting the transverse seams; that is, the longitudinal seam is spaced from the unfolded edge of the strip. In a preferred practice, I heat seal the layers of the strip together, and carry this step out at a temperature and for an interval that not only forms the seam, but separates the unfolded edge portion from the strip of bags. This separated portion may be removed conveniently by a vacuum tube.

The strip of filled bags may then be rerolled for later separation, if that is the desired manner of packaging the articles in question. However, if it is intended to separate the filled bags, I carry out this operation while the portion of the strip past the loading station is held in the retracted position, that is, during a bag-loading operation. The strip is gripped at two points spaced on either side of a transverse seam which it is desired to tear, and a separator punch initiates a tear in this seam; the bag to be removed is then advanced in the direction of strip feeding to complete the tearing of the seam and separate the bag from the remainder of the strip, which is held stationary at this time.

## DETAILED DESCRIPTION OF THE DRAWINGS AND PREFERRED EMBODIMENTS

While the specification concludes with claims particularly pointing out the subject matter which I regard as my invention, it is believed that a clearer understanding may be gained from the following detailed description of preferred embodiments, referring to the accompanying drawings, in which:

FIG. 1 is a fragmentary view in side elevation of a first form of the improved machine, which rerolls a strip of bags after they are loaded and sealed;

FIG. 2 is a fragmentary plan view;

FIG. 3 is a pictorial view of a heat-sealing element which is a part of the machine;

FIG. 4 is a fragmentary plan view on an enlarged scale of the left-hand portion of the machine of FIGS. 1 and 2, showing the parts in more detail;



FIG. 5 is a fragmentary view in side elevation and on an enlarged scale, showing the left-hand portion of the machine of FIGS. 1 and 2;

FIG. 6 is a sectional view taken along line 6–6 in FIG. 4, looking in the direction of the arrows;

FIG. 7 is a fragmentary view in side elevation and on an enlarged scale, showing a central portion and bag-loading station of the machine of FIGS. 1 and 2;

FIG. 8 is a sectional view taken along line 8–8 in FIG. 7, looking in the direction of the arrows;

FIG. 9 is a sectional view taken along line 9–9 in FIG. 8, looking in the direction of the arrows;

FIG. 10 is a fragmentary plan view on an enlarged scale of the central and right-hand portions of the machine of FIGS. 1 and 2;

FIG. 11 is a fragmentary view in side elevation and on an enlarged scale, showing the right-hand portion of the machine of FIGS. 1 and 2;

FIG. 12 is a sectional view taken along line 12–12 in FIG. 11, looking in the direction of the arrows;

FIG. 13 is a plan view showing a strip of bags made in accordance with the one aspect of the invention, shown in an open condition;

FIG. 14 is a view in side elevation of the strip of bags of FIG. 13;

FIG. 15 is a schematic view showing the steps used to prepare the strip of bags of FIGS. 13 and 14;

FIG. 16 is a fragmentary plan view showing a modification of the right-hand end of the packaging machine, having means for separating the bags after filling and sealing;

FIG. 17 is a fragmentary view in side elevation of the modified construction of FIG. 16;

FIG. 18 is a sectional view in end elevation taken along line 18–18 in FIG. 16, looking in the direction of the arrows;

FIG. 19 is a sectional plan view taken along line 19–19 in FIG. 18, looking in the direction of the arrows;

FIG. 20 is a schematic diagram showing electrical and pneumatic elements of a control circuit for the packaging machine; and

FIG. 21 is a diagram of the electrical control circuit.

Referring first to FIGS. 13—15, I prepare a strip 10 of connected bags 12 from an indefinite length 14 of packaging material, which is preferably a heat-sealable plastic such as polyethylene, but may be made of paper or other material appropriate to any particular bagging requirement. The material is fed in the direction shown by the arrow through a folding shoe 16, or otherwise folded in half longitudinally. The resulting folded strip has a folded edge 18 and an unfolded edge 20, and the layers of the strip formed opposed face panels 10A and 10B of the bags 12. These face panels are then connected by transverse seams 22 at regularly spaced intervals along the length of the strip; these seams do not extend entirely across the strip from the folded edge 18, but terminate at a distance from the unfolded edge 20, for reasons which will appear hereinafter. To form these seams in a heat-sealable plastic material, I prefer to roll the strip 10 between a heated roller 24, having a set of seam-forming longitudinal protrusions 26 spaced around its diameter at arc lengths equal to the desired spacing between the seams 22, which is equal to the with of the bags 12. An idler roll 28 supports the strip against the protrusions 26. The protrusions 26 extend from the folded edge 18 to the terminations of the transverse seams 22, whose length determines the height of the bags 12.

The unfolded edge portion 30, included in an area whose width extends from the ends of the seams 22 to the edge 20 of the strip, does not form a part of the completed bags after filling and sealing; it is removed in the packaging operation in the event that the bags are to be separated before distribution, or may be left intact if the bags are to be shipped in a connected strip.

FIGS. 1—12 show a first form of my improved packaging machine, which is adapted to package articles in a strip 10 of bags 12, to seal the filled bags, and to reroll the strip of bags for later separation by a distributor or consumer.

The packaging machine of FIGS. 1—12 is organized on a frame 36, mounting a roll 38 of the strip 10 of bags on a spindle 40, which has a spring-loaded slip clutch 42 acting against the roll at its upper end to maintain back tension on the strip.

The strip is fed longitudinally in the direction shown by the arrows around a guide post 44, through a bag printer 46 and around a further guide post 48. The printer is of a conventional type, adapted to print any desired identification on each bag on a forward stroke of a printing plate 50 (FIG. 4) against a stationary platen 52, which is mounted on the frame 36. The plate 50 is actuable by the piston rod 53 of a single-acting spring-return air motor A2.

The strip 10 is fed in the direction shown by the arrows by means of a pair of continuous toothed feed belts 54 (best shown in FIGS. 4—6) which grip the strip between them. These belts are trained about sprockets 56, which are rotatably mounted by spindles 58 and 60 in a supporting frame 62, having slide blocks 61 fixed on horizontal rods 63 by set screws 67. The spindles are drivingly connected by gears 64 to drive the belts 54 with the same direction and speed. The spindle 58 is driven by conical gears 65 and 66, the latter being fixed on a cross-shaft 68 which is driven by a pulley 70 and a drive belt 72. This belt is driven intermittently by a drive motor MD, through a belt 74 and an air-operated combination brake and clutch BC, best shown in FIGS. 1, 2, and 10. The brake and clutch also powers a second drive belt 76.

A photoelectric cell PC is positioned along the path of the strip 10, and a light source (not shown in FIG. 1) is positioned adjacent an opposite surface of the strip, to detect the passage of the seams 22 of the bags. A pair of nip rolls 78 are mounted on the frame, with their axes at an angle to the direction of motion of the strip 10, to maintain lateral tension and hold the strip flat and smooth.

A loading station is defined by the location of a flexible, collapsible tube 80, best shown in FIGS. 7—10, which is made of two sheets of flexible plastic of substantially heavier gage than the strip 10, secured together at a leading edge 81 and a trailing edge 82. The tube is supported at its leading edge by a V-shaped shoe 84 mounted on the frame 62, and extends between the face panels of the bags 12, terminating above the transverse seams 22 so as not to interfere with the freedom of the strip 10 to feed longitudinally in the direction shown by the arrow in FIG. 7. A pair of flaps 83 are secured on the outside surfaces of the tube near the upper end thereof, and overlie the outer surfaces of the strip 10 to ensure that they will pass smoothly over the tube without wrinkling.

The tube 80 tends to flatten itself, but can be deflected into an open form as shown in FIGS. 8—10, by means of a V-shaped shoe 86 acting against the trailing edge 82. This shoe is carried by a reciprocating carriage 88, which is movable to displace the shoe between a retracted position shown in solid lines in FIG. 7, in which the tube 80 is open and a bag 12 at the loading station is opened, and an advanced position shown in dotted lines at 86', in which the bag is allowed to close. The carriage 88 carries two depending rollers 90 which serve to reclose the mouth of the bag snugly as it passes from the loading station.

A motor-driven blower (not shown) of a conventional type supplies a flow of air through a pipe 92 and a nozzle 94, which projects into the upper opening of the tube 80, for blowing open a bag 12 whose mouth is opened by the tube 80 at the loading station. Each bag is filled, after it arrives in the loading station and is opened, by a conventional dispensing device (not shown) having an outlet spout 96 aligned over the upper opening of the tube 80. Generally, a dispenser would be used which automatically counts and discharges the number of articles desired to be packaged in each bag, but the loading may be done by a dispenser under manual control, or entirely by hand if desired. The dispensing device forms no part of the present invention, and no further detailed description is believed necessary.

As best shown in FIGS. 10—12, the carriage 88 is mounted on slide blocks 98, (FIG. 12) which are reciprocably slidable on the parallel horizontal rods 63. The carriage 88 is reciprocated by a double-acting pneumatic motor A1, mounted on the frame 36 and connected to a slide block 98 which is fixed to the carriage. Reciprocating movement of the carriage drives the shoe 86 between the retracted and advanced positions, which respectively open and close the tube 80, as previously described. The carriage is shown in the retracted position in FIGS. 10 and 11, at the left end of its stroke. The advanced position is defined by abutment of the carriage against a stop 101, supporting the rods 63 on the frame 36.

The carriage 88 supports four toothed feed belts 100, which are arranged in vertically spaced pairs, each pair gripping the strip 10 between them in order to feed it forwardly from the loading station and the tube 80. These belts are trained about sprockets 102, which are rotatably mounted by spindles 104 and 106 in the carriage 88. The spindles are drivingly connected by gears 108 to drive the feed belts 100 with the same direction and speed. The spindle 106 is driven by conical gears 110 and 112, the latter being fixed on a cross-shaft 114 which is driven by a pulley 116 and the drive belt 76. The belt 76 is connected to the drive motor MD and combination brake and clutch BC, as previously described.

A retracting movement of the carriage 88, to the left as it is illustrated in FIGS. 10 and 11, slackens the drive belt 76, which is not operated during the retracting and advancing movement of the carriage. The drive belt remains stationary while a bag is opened and reclosed by the reciprocating motion of the carriage 88, and drives the feed belts 100 only when the carriage returns to the right and is at rest in its advanced position. To prevent the belt 76 from being disengaged from the pulley 116 as the carriage retracts, an arcuate cover plate 118 is mounted on the carriage to extend arcuately about the pulley.

As the strip of bags leaves the tube 80 at the loading station, feeding forwardly with the belts 100, a longitudinal closing seam 21 is formed to close the upper open end of each bag 12, by means of a heat-sealing element H best shown in FIGS. 3 and 10—12. This sealing element has a straight sealing edge 120 for engaging and heating the strip 10 at a sufficient temperature and duration not only to seal the face panels of the bags together, but to sever the edge portion 30 which lies between the upper, unfolded edge of the strip and the ends of the transverse seams 22, as previously described in connection with FIGS. 13 and 14.

The strip 10 remains stationary as the carriage 88 is retracted, the bag 12 in the loading station is filled, and the carriage is advanced again to close the bag; during this interval, the drive belts 100 are stationary, and the heater H performs the operations of forming the seam 21 in a bag resting against it, and severing the edge portion 30 previously attached to it. As the strip advances intermittently, each successive bag is sealed and separated from the edge portion. The heater H has an internal resistance heating element (not shown) and terminals 122 for supplying current to the heating element. It is positioned intermediate the feed belts 100, and the upper set of these belts serves to feed the severed edge portion 30, while the lower set feeds the closed bags 12 forwardly from the heater.

The severed edge portion 30 and the closed but still connected strip 10 of bags 12 pass around a guide post 124. In this embodiment, the closed and filled bags are rewound into a roll 125 on a spindle 126, which has a spring-loaded slip clutch 128 acting to allow the strip to slip while it is held intermittently stationary, but maintaining forward tension. The spindle 126 is driven by a rewind motor MR.

The severed edge portion 30 is drawn off as a continuous strip by a vacuum tube 130, connecting to a suitable vacuum pump, and is discarded as waste.

A modification of the packaging machine is shown in FIGS. 16—19, in which means are provided for separating the individual sealed bags 12 from the strip 10. In place of the rewinding spindle 126, a further reciprocating carriage 132 is slidably mounted on an extension 63' of one of the horizontal

parallel rods 63, by means of slide blocks 134. The carriage 132 is movable with the carriage 88, being attached thereto by an adjustable threaded rod 136, which passes freely through the stop 101.

To extend the strip-feeding means to the carriage 132, short drive belts 138 are reeved about pulleys 140 affixed to extensions of the spindles 104 at the right end of the carriage 88, and about pulleys 142 affixed to the upper ends of a pair of spindles 144 rotatably mounted in the carriage 132. The spindles are drivingly connected by gears 146. A pair of opposed feed belts 148 are trained around pulleys 150 mounted on the spindles 144. These belts extend to pulleys 152, leaving clearance for a tearing plunger 154 to pass transversely through the strip 10 (See FIGS. 16 and 18).

The feeding means are continued after the strip leaves the plunger 154, and include a further pair of opposed feed belts 156 trained around pairs of pulleys 158 and 162. One pair of these pulleys is connected by gears 160 for driving the belts 156 at the same speed. The drive is transferred from one of the spindles 146 to one of the gears 160, by means of a transfer belt 164 which passes below the feed belts 148 and 156, and is set off from the plunger 154 by idler rollers 165. By these means, the strip 10 is fed forwardly through the carriage 132.

The location of the carriage 132 is set by the threaded rod 136 so that the tearing plunger 154 will be aligned with one of the transverse seams 22 joining two adjacent bags 12 when another bag is aligned with the tube 80 at the loading station. That is, the plunger 154 is spaced an even number of multiples of the particular bag width from the transverse seam 22 of a bag at the loading station. The plunger 154 is extensible by a single-acting spring-return air motor A3 mounted on the carriage 132, and partially tears a seam 22 near the upper edge of the bag, the edge portion 30 having already been removed, as previously explained.

Coincident with the operation of the tearing plunger 154, the strip of bags is held by a first gripping means comprising a clamp 176 and a second gripping means comprising a clamp 178, respectively located ahead of and behind the plunger in the direction of strip movement (See FIG. 19). The clamp 176 is actuable by a single-acting spring-return air motor A4 against a stationary pad 180, while the clamp 178 is actuable by a single-acting spring-return air motor A5 against a stationary pad 181.

The air motor A4, clamp 176 and pad 180 are supported by the carriage 132. However, the air motor A5, clamp 178, and pad 181 are mounted on a slide 167, which is reciprocable independently of the carriage 132 by a single-acting spring-return air motor A6 mounted on a portion of the machine frame 36. The slide 167 has a supporting bracket 166 which is slidable supported on horizontal rods 168, and is attached to the actuating rod 170 of the air motor A6. The bracket 166 is adjustably affixed to the slide 167 by machine screws 172 received in an elongated slot 174, so that the spacing of the clamp 178 from the plunger 154 can be adjusted to accommodate bags 12 of different widths.

The purpose of the slide 167 and its clamp 178 is to pull individual bags 12 from the strip after the tearing plunger 154 has initiated a tear along the transverse seam 22. The motor A6 is actuated at a time when the carriages 88 and 132 are stationary in the retracted position, the strip 10 is not feeding, and the clamps 176 and 178 are closed. This drives the slide 167 to the right as viewed in FIGS. 17 and 19, and thereby tears off an individual bag 12, as illustrated in FIG. 17. The motors A3, A4, A5, and A6 are subsequently deenergized, releasing the strip 10 and returning the slide 167 to the left as viewed in FIGS. 17 and 19, to a retracted position shown at 167; ready to separate a succeeding bag 12.

A pneumatic control circuit for a packaging machine, of the kind which includes the bag-separating means of FIGS. 16—19, is illustrated in FIG. 20, together with certain mechanically actuated electrical switches. The combination brake and clutch BC is controlled by a solenoid valve V2 having a valve piston V2P, a solenoid coil V2C for raising the piston, and a spring V2S for driving the piston to the illustrated position when the coil is deenergized. A vacuum pump 183 is connected by a conduit 182 to the valve chamber of the valve V2, which energizes the brake B through a conduit 184 when the valve is deenergized as shown. Energization of the coil V2C raises the piston V2P, deenergizing the brake B and energizing the clutch C through a conduit 186. A combination brake and clutch of a conventional type is used, and detailed description thereof is believed to be unnecessary.

The actuators A1 for reciprocating the carriage 88, A4 for operating the bag clamp 176, and A5 for operating the bag clamp 178, are all controlled by a valve V1. This valve is supplied with compressed air from a regulated pressure pump 188 of any suitable type, through alternate paths defined by a conduit 190, and by a conduit 192 including a normally closed valve V3 which is opened by pressure contact on an operating button 194 by the printing plate 50 (see FIG. 4) as it moves against the platen 52.

The valve V1 has a double-ended piston V1P, which is movable to the left as viewed in FIG. 20 by energization of a coil V1C, and to the right by pressure received from the conduit 192 when the valve V3 is opened and the coil is deenergized. The left end of the piston V1P has a larger area than the right end, so that pressure applied at the left will overcome pressure applied at the right by the conduit 190, and so drive the piston to the right. The valve chamber of the valve V1 is provided with an outlet conduit 194 communicating with the left end of the air motor A1 when the piston V1P is to the right as shown; and a branched outlet conduit 196 communicating with right end of the air motor A1, and the actuators A4 and A5, when the piston V1P is moved to the left by the coil V1C. A transverse passage 198 serves to exhaust the right end of the actuator A1 and relieve actuators A4 and A5 to an exhaust port 200, when the piston V1P is in its right-hand position as shown. Movement of the piston V1P to the left exhausts the left end of the actuator A1 to the port 200 around the reduced portion of the piston. When the actuators A4 and A5 are relieved, they are retracted by springs A4S and A5S, respectively, to withdraw the clamps 176 and 178 from the strip of bags.

Actuation of the valve V3 thus drives the valve piston V1P to the right as shown, thereby causing the piston A1P to drive the carriage 88 to the advanced or right-hand position, in which a bag in the loading station is closed, as previously described. During this advancing motion, a trip cam 202 engages an operating arm 204 of a normally open limit switch LS2, closing this switch for a short interval of time. The switch LS2 is so constructed that a return movement of the carriage 88 and the cam 202 does not reclose the switch.

An arrival of the carriage 88 at the advanced position, or the right end of its stroke, causes its bracket 99 to close a normally open limit switch LS1. At the left-hand or retracted position of the carriage, it opens a normally closed valve V4, and thereby supplies air pressure through a branch conduit 206 to the printer actuator A2, the tear plunger actuator A3, and the actuator A6 for the bag separator slide 167. As the carriage 88 moves to the right and away from the retracted position, it allows the valve V4 to close, and the actuators A2, A3, and A6 are retracted by return springs A2S, A3S, and A6S, respectively.

## OPERATION OF THE MACHINE

The operation of the type of packaging machine which includes the bag-separating means of FIGS. 16—19 will now be described, in conjunction with the electrical control circuit shown in FIG. 21, reference also being made to the pneumatic control circuit of FIG. 20, and to the previously described machine drawings in FIGS. 1—19. Electrical power is supplied by conductor lines L1 and L2 from a conventional power source, under the control of a toggle switch PS, which is monitored by a pilot lamp PL. The operator closes a switch MDS energizing the drive motor MD, a switch MBS energizing a blower motor MB supplying air to the conduit 92, and a switch

HS energizing a heater rheostat HR and a heater pilot lamp HL, all connected in parallel across lines L1 and L2. The heater rheostat is connected to apply a manually regulated voltage across the heating resistance of the heater H, to maintain a temperature sufficient to form the longitudinal seam **21** in the strip of bags **12** and to sever the edge portion **30**, as previously described. The operator also actuates the vacuum supply **183** and pressure supply **188** shown in FIG. **20**. Closure of the power switch PS also energizes a parallel connected photocell amplifier P, a first timer T1, and a second timer T2. The photocell amplifier energizes the photocell PC and its light source PL. The timers do not start timing, being inactivated by open relay contacts which will be described hereinafter.

Referring again to FIG. **20**, it is assumed that at the beginning of the cycle the actuator piston A1P and the carriage **88** are their right-hand or advanced positions, closing the limit switch LS1 and allowing the valve V4 to be closed and the limit switch LS2 to be open. The valve piston V1P is at rest in its right-hand position, although the valve V3 is closed by retraction of the printer actuator A2; and the actuators A3, A4, A5 and A6 are all retracted, disengaged from the strip of bags and holding the separator slide **167** in its left-hand position as shown in FIGS. 17—19.

Referring again to FIG. **21**, the timer T1 has a relay contact 1T1 which initially energizes the coil V2C, raising the valve piston V2P and energizing the clutch C while disengaging the brake B. This causes the drive motor MD to drive the strip **10** of bags **12** forwardly through the machine.

As one of the transverse seams **22** between bags **12** passes between the photocell PC and its light source PL, the photocell amplifier closes a normally open relay contact 1P to deenergize the timer T1, which does not start timing, but opens the contact 1T1 and deenergizing the coil V2C. This drops the valve piston V2P (FIG. **20**) to actuate the brake B and deactivate the clutch C, halting the forward motion of the strip of bags with one bag **12** located in the loading station.

At the same time, the closure by the photocell of the relay contact 2P energizes the coil V1C through a normally closed relay contact 3CR and the closed limit switch LS1, driving the valve piston V1P to the left as seen in FIG. **20**. This supplies air pressure to the actuators A4 and A5, closing the clamps **176** and **178** on the strip **10**, and also drives the piston A1P to the left, retracting the carriage **88**. The tube **80** is opened by the shoe **86** (see FIGS. 7—10), and a bag **12** located at the loading station is opened by air pressure in the blower tube **92**, for loading through the dispenser chute **96**.

The retracting motion of the carriage **88** releases the limit switch LS1, deenergizing the coil V1C, but the carriage completes its leftward stroke because the air pressure in the right end of the valve V1 holds the piston V1P at the left. There is no opposing pressure in the branch conduit **192** at this time, because the valve V3 remains closed.

Completion of the retracting movement of the carriage **88** opens the normally closed valve V4, supplying air pressure to extend the printer actuator A2, the seam-tearing actuator A3, and the tear slide actuator A6. This causes one bag **12** to be imprinted (see FIG. 4) while another is partially torn by the plunger **154** at a transverse seam **22**, and still another is pulled off the strip **10** by the slide **167** and the now closed clamps **176** and **178** (see FIGS. 16—19).

As the forward stroke of the printer actuator is completed, it opens the valve V3, supplying pressure to the left face of the valve piston V1P and driving it to the right. The reversal of the valve V1 exhausts the clamp actuators A4 and A5, causing them to retract from the strip **10**, and drives the actuator piston A1P to the right, producing an advancing movement of the carriage **88**. The valve V4 recloses, relieving the printing actuator A2, tear actuator A3, and slide actuator A6, whose springs cause them to retract, clearing the strip **10**, returning the slide **167** to the left, and allowing the valve V3 to reclose. The valve piston V1P remains at the right end of its stroke although the pressure supply in the conduit **192** is discontinued.

The advancing motion of the carriage **88**, to the right as seen in FIG. **20**, momentarily closes the limit switch LS2. This energizes a relay CR, whose energization is then maintained by a holding relay contact 4CR, through a relay contact 1T2 of the timer T2. The timer T2 is also activated by a normally open relay contact 5CR, and serves to hold the contact 1T2 closed and the relay CR energized during a sufficiently long interval to insure that a double retracting, loading, and closing cycle will not be carried out before the strip of bags is advanced, which might occur if the photocell PC were reactivated by a transverse seam **22** coming to a full stop directly between the photocell and its light source PL. To this end, normally closed relay contact 1CR deactivates the photocell amplifier during the interval of operation of the timer T2.

The relay CR also opens a normally closed relay contact 2CR, causing the timer T1 to maintain the relay contact 1T1 open for a timed interval sufficient to insure that the carriage **88** has fully completed its advance stroke and closed the bag in the loading station before the clutch C can be reengaged by energization of the coil V2C.

A further relay contact 3CR is opened to prevent energization of the coil V1C, and a resulting retraction of the carriage **88**, by the limit switch LS1 as it is closed by the completion of the advancing movement of that carriage.

When the timing cycle of the timer T1 is completed, it recloses the contact 1T1 and thus reenergizes the coil V2C, reactivating the clutch C and releasing the brake B through the valve V2, to reinstitute forward feeding of the strip **10**.

At the end of the cycle of the timer T2, it reopens the contact 1T2 and thereby deenergizes the relay CR. The resulting closure of the relay contact 1CR reactivates the photocell amplifier P; closure of the contact 2CR reenergizes the timer T1 but does not start its timing cycle; closure of the contact 3CR enables the coil V1C to be energized by the photocell PC through the contact 2P when the seam **22** of the next bag passes; and opening of the contacts 4CR and 5CR prepare the holding circuit of the relay CR, and the timer T2, respectively, for the next cycle. All of the parts are thus returned to their original states, ready to process further bags.

## THE PACKAGING PROCESS

The portion of my packaging method involved with the initial preparation of the strip **10** of bags **12**, has already been described in connection with FIGS. 13—15. The part of the method which concerns the packaging of articles in these bags, which may be carried out by the packaging machine just described, can be summarized in the following steps:

1. The strip is fed longitudinally and in intermittent steps to position each successive bag at a loading station.

2. The portion of the strip which has passed the loading station is retracted to open a bag in that station, which is then filled.

3. Concurrently with this loading, bags which have left the loading station are closed by a longitudinal seam joining the transverse seams, and the waste portion of the strip, lying between the ends of the transverse seams and the unfolded edge of the strip, is separated. Both the closing and the waste separation steps may be carried out by a heat-sealing process, if the packaging material selected is suitable for this purpose.

4. The transverse seams may be left intact if it is desired to ship to bags in a connected strip. Separation of the bags may be effected by gripping adjacent bags on which the sealing and waste-separating steps have been performed, by initiating a tear in the transverse seam joining these bags, and moving these bags apart to complete the separation of the seam. Separation is carried out concurrently with the loading of another bag.

I claim:

1. A method of packaging using a strip of connected bags formed from a longitudinally folded length of heat-sealable material having a series of transverse seams at spaced intervals along the strip and extending from the folded edge of the strip only partially across the strip toward the unfolded edge thereof, said method comprising the steps of:

feeding said strip to position each successive bag at a loading station, then holding the portion of the strip which has not reached the loading station stationary while retracting the portion which has passed the loading station to open the unfolded longitudinal edge of the bag which is at the loading station for loading, then advancing only that portion of the strip which has passed the loading station to close the loaded bag, and repeating the advancing, opening and closing steps cyclically;

heat-sealing the bags which have passed the loading station along a longitudinal seam joining the transverse seams and spaced inwardly from the unfolded longitudinal edge of the strip, and separating the connected bags from the portion of the strip lying between the longitudinal seam and the unfolded longitudinal edge of the strip;

and carrying out the further steps, after the completion of said retracting step and prior to said advancing step, of gripping the portion of said strip which has previously passed the loading station and has been heat sealed, in either longitudinal direction from one of said transverse seams, partially tearing said one transverse seam, moving the gripped bags relatively to one another in opposite directions to tear said one transverse seam and thus separate one bag from the strip, and releasing the strip and the separated bag.

2. A packaging machine for bagging articles in a strip of connected bags formed from a longitudinally folded length of material having a series of transverse seams at spaced intervals along the strip and extending only partially across the strip toward the unfolded edge thereof, said machine comprising:

means for feeding the strip longitudinally to a loading station; reversible means for retracting the portion of the strip which has passed the loading station, in a direction opposite to the feeding direction; and control means constructed and arranged to advance said feeding means, interrupt the operation of said feeding means as each successive bag arrives at the loading station, actuate said retracting means to open a bag at the loading station, reverse said retracting means to close the opened bag, and reactuate said feeding means to advance the strip to bring a succeeding bag to the loading station;

bag-opening means comprising a flexible, collapsible tube interposed at the loading station between the opposed folds of said strip, and extending in a collapsed condition substantially parallel to the layers of the strip from the unfolded edge to terminate short of said transverse seams so that the strip may be fed freely in a longitudinal direction, said retracting means including tube-engaging means for opening said tube coincident with actuation of said retracting means to open a bag at the loading station.

3. A packaging machine for bagging articles in a strip of connected bags formed from a longitudinally folded length of material having a series of transverse seams at spaced intervals along the strip and extending only partially across the strip toward the unfolded edge thereof, said machine comprising;

means for feeding the strip longitudinally to a loading station; reversible means for retracting the portion of the strip which has passed the loading station, in a direction opposite to the feeding direction; and control means constructed and arranged to advance said feeding means, interrupt the operation of said feeding means as each successive bag arrives at the loading station, actuate said retracting means to open a bag at the loading station, reverse said retracting means to close the opened bag, and reactuate said feeding means to advance the strip to bring a succeeding bag to the loading station;

heat-sealing means comprising an elongated heating element constructed and arranged to heat seal the connected bags along a longitudinal seam and to sever the sealed bags from an edge portion of the strip lying between the longitudinal seam and the unfolded longitudinal edge of the strip;

first and second gripping means located in the direction of motion of the strip from said loading station at a distance to grip adjacent sealed bags on either side of an intervening transverse seam when another of said bags is located at the loading station, tearing means located between said gripping means to partially tear said intervening seam, and actuating means for moving said gripping means relative to one another in opposite directions to separate said adjacent bags;

said control means being constructed and arranged to actuate said gripping and tearing means after retracting but before reversing said retracting means, then to move said gripping means to separate a bag from the strip, and finally to release said gripping and tearing means from the strip.

4. A packaging machine for bagging articles in a strip of connected bags formed from a longitudinally folded length of heat-sealable material having a series of transverse seams at spaced intervals along the strip and extending only partially across the strip toward the unfolded edge thereof, said machine comprising:

means for feeding the strip longitudinally through a loading station, means for loading the bags successively, heat-sealing means comprising an elongated heating element arranged to engage the strip of bags at a point where they have passed said loading station, said heating element being constructed and arranged to heat seal the connected bags along a longitudinal seam and to sever the sealed bags from an edge portion of the strip lying between the longitudinal seam and the unfolded longitudinal edge of the strip;

first and second gripping means located in the direction of motion of the strip from said loading station at a distance to grip adjacent sealed bags on either side of an intervening transverse seam when another of said bags is located at the loading station, tearing means located between said gripping means to partially tear said intervening seam, actuating means for moving said gripping means relative to one another in opposite directions to separate said adjacent bags, and control means constructed and arranged to successively actuate said gripping and tearing means, move said gripping means to separate a bag from the strip, and release said gripping and tearing means from the strip.

5. A packaging machine as recited in claim 2, together with blower means communicating with said tube to assist in opening bags in the loading station.

6. A packaging machine as recited in claim 2, in which said tube is formed by opposed layers of material stiffer than the material of said strip, said layers being joined at forward and rearward edges, relative to the direction of feeding of the strip, into V-shaped cross sections to open and close the bags gradually.

7. A packaging machine as recited in claim 2, said tube having a pair of flaps attached to opposite external walls thereof to overly exterior surfaces of the opposed folds of a portion of the strip in which said tube is inserted, to hold the folds in close conformity to the outer surfaces of said tube.