Aug. 25, 1953 H. L. BARTELT 2,649,671

METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

Filed Dec. 10, 1949 7 Sheets-Sheet 1

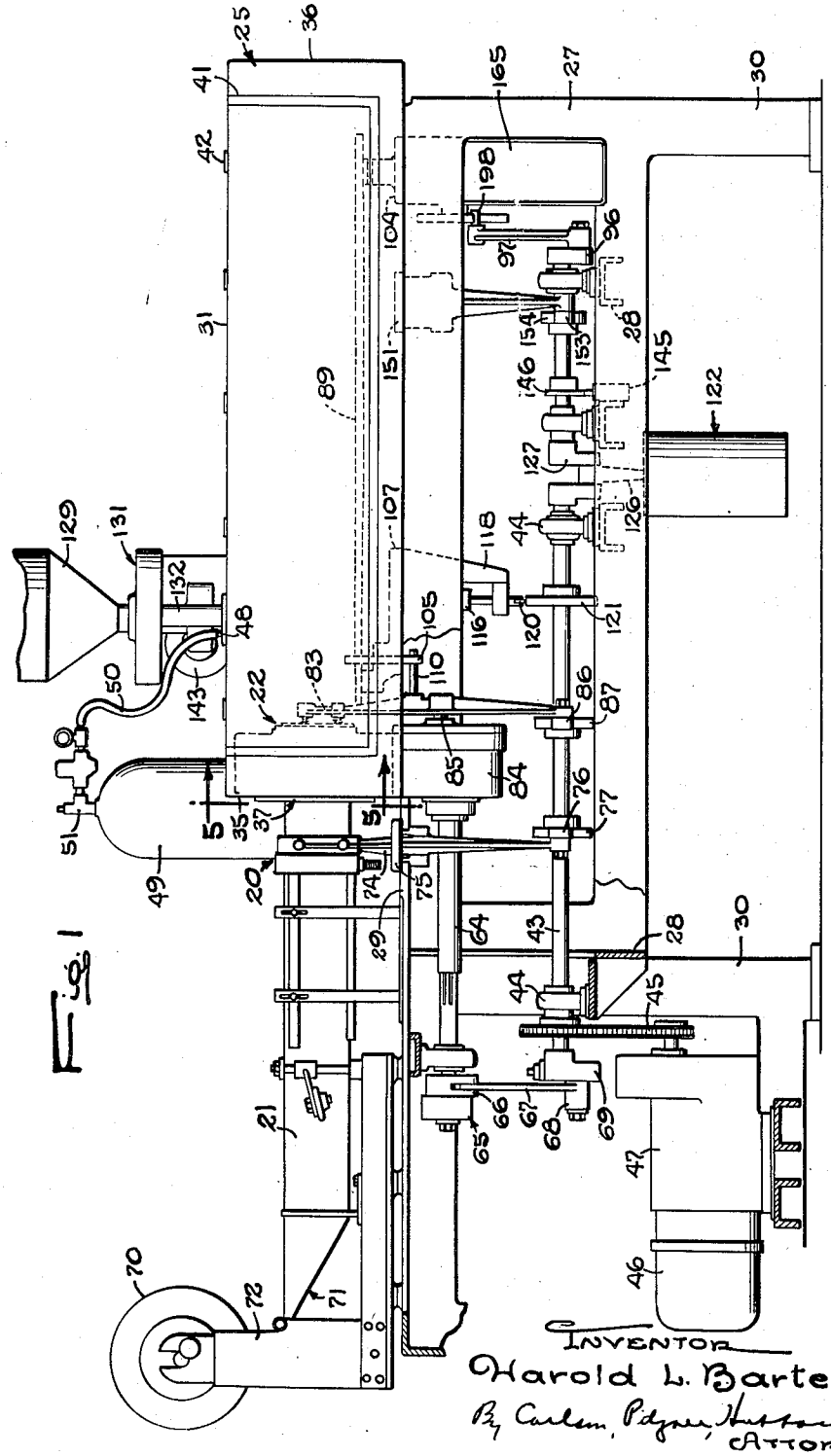

Fig. 1

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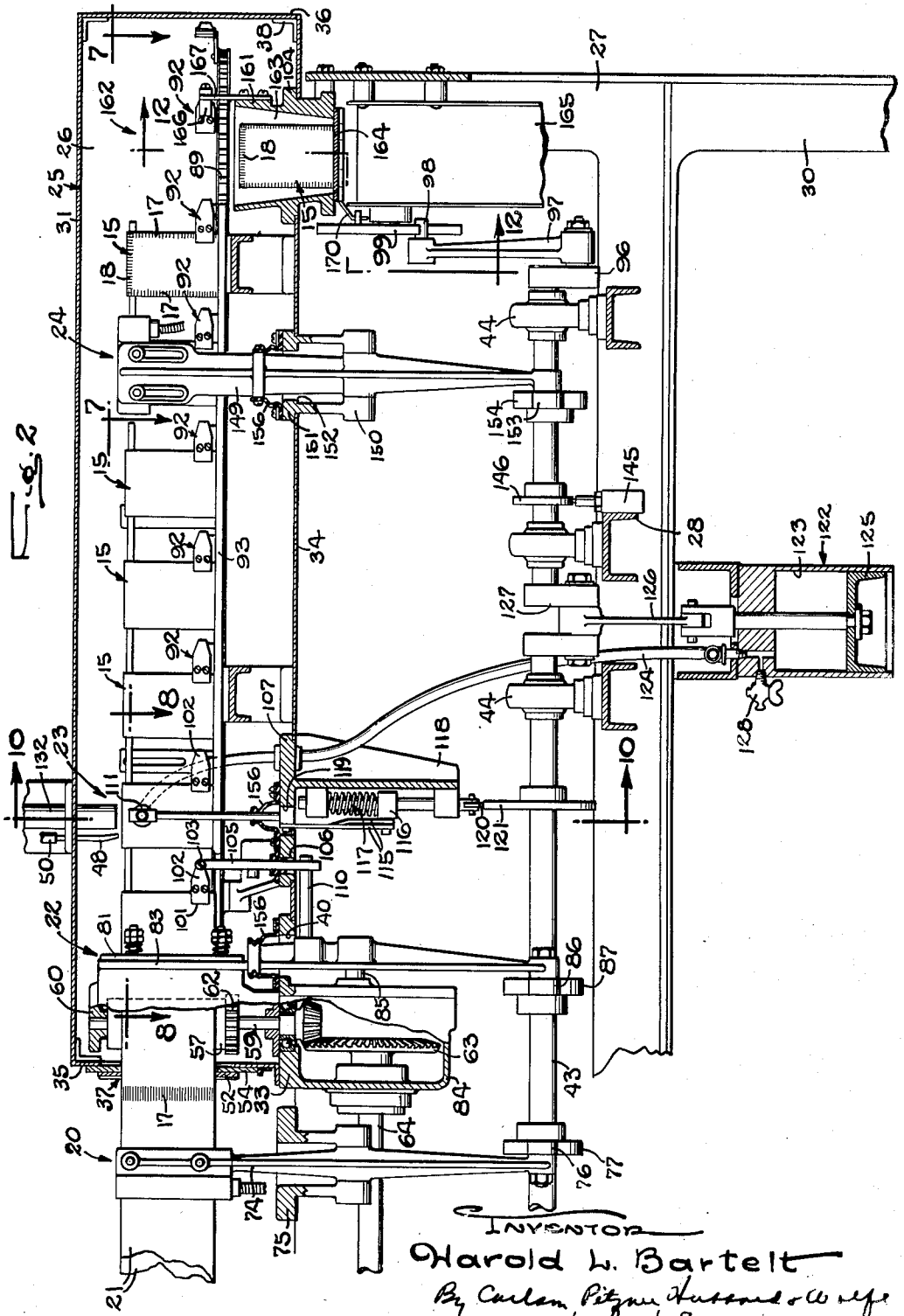

Fig. 2

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METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

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Fig. 3

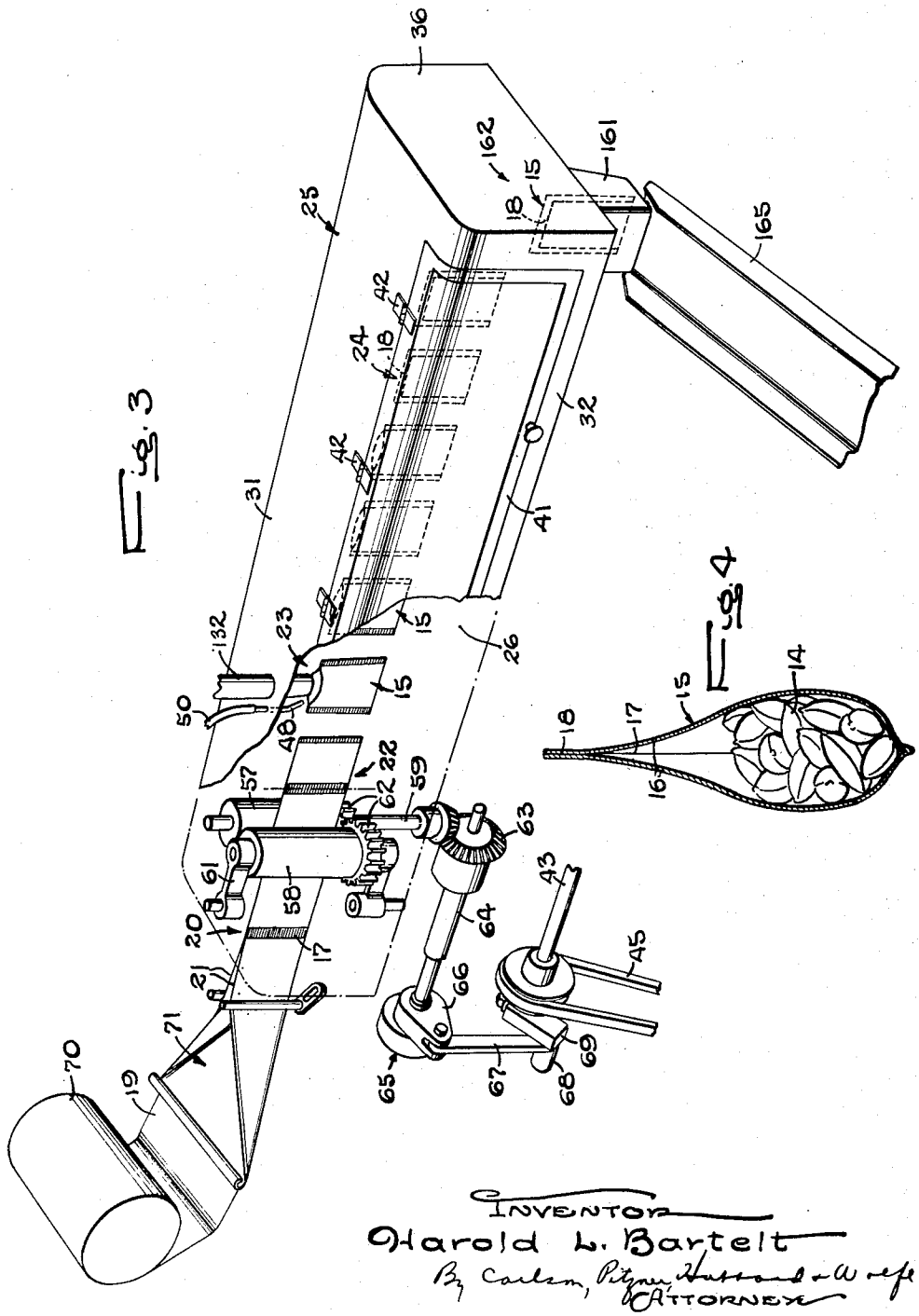

Fig. 4

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Fig. 5

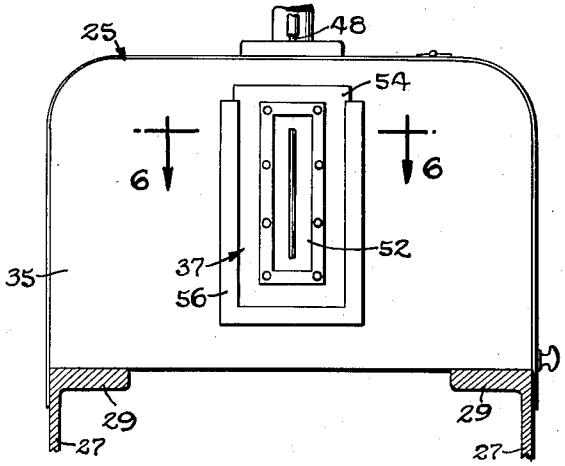
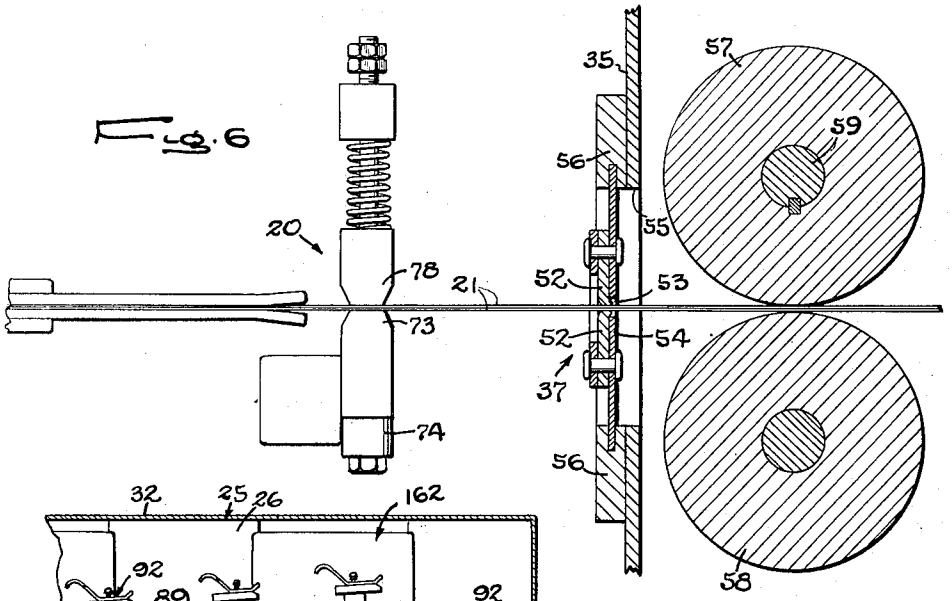


Fig. 6



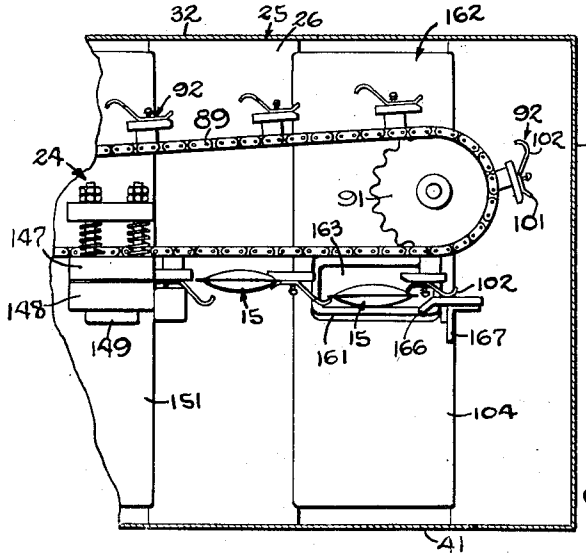


Fig. 7

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METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

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Fig. 8

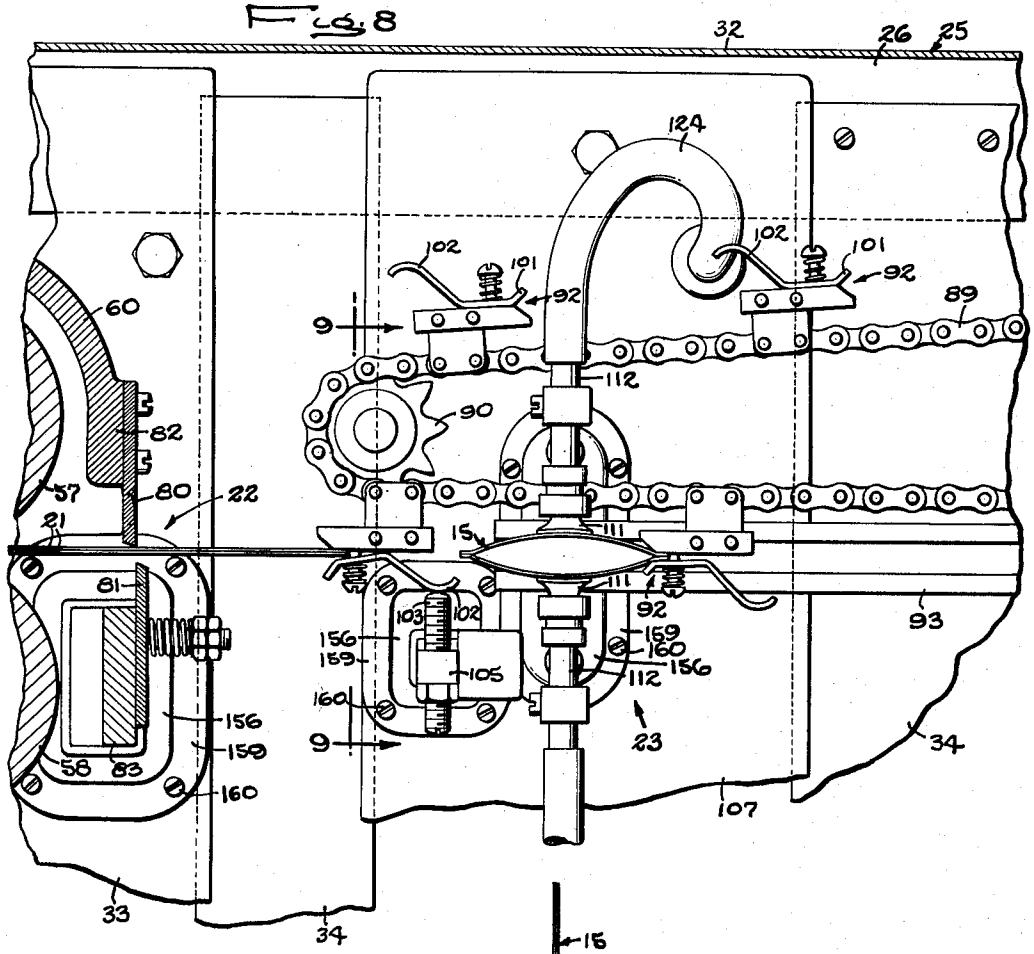
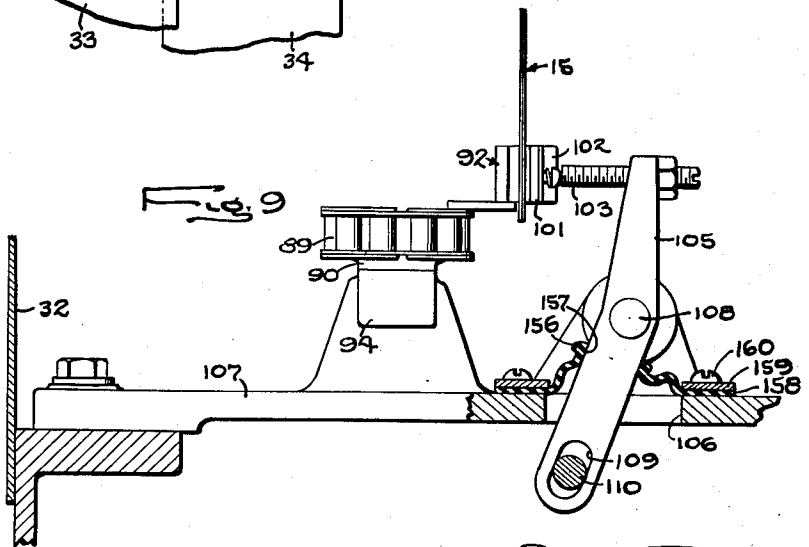


Fig. 9



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METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

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Fig. 10

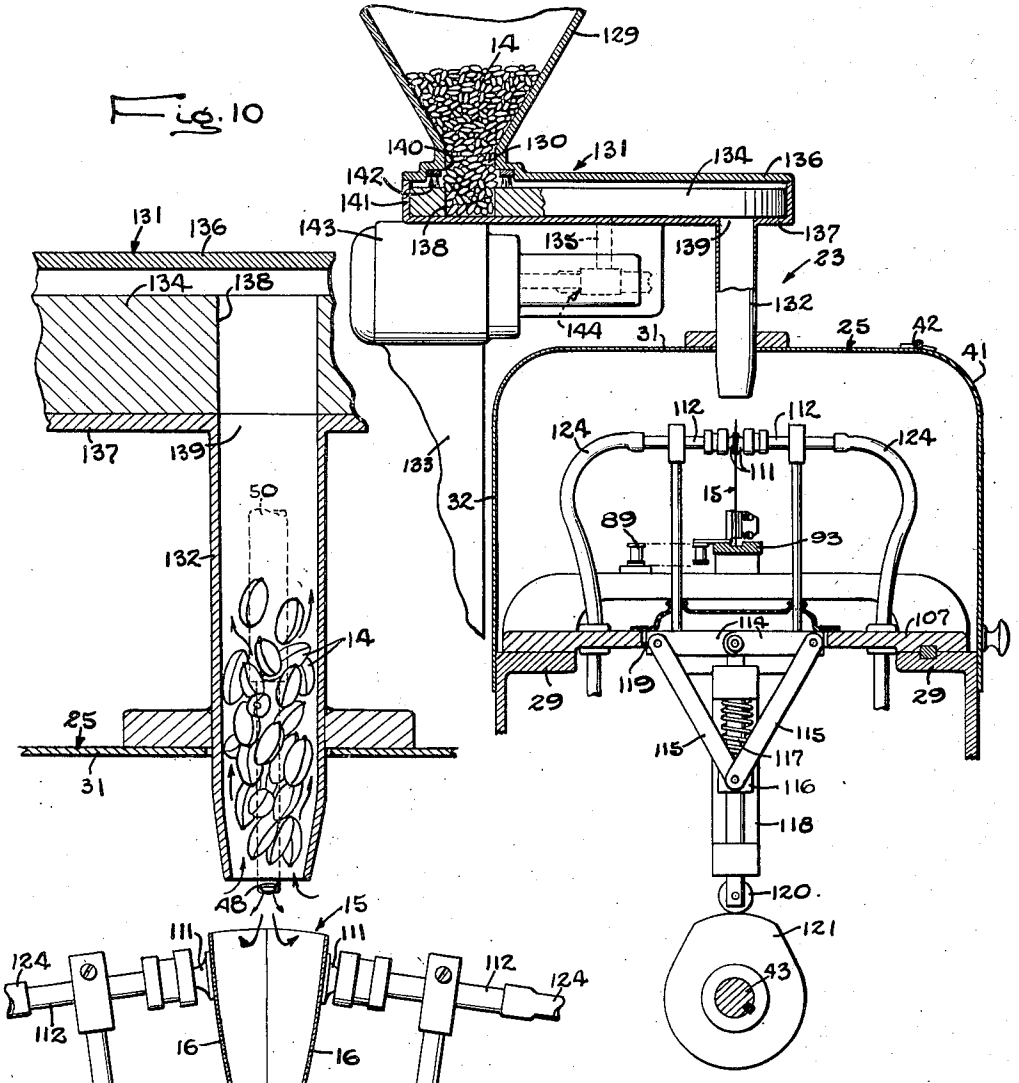
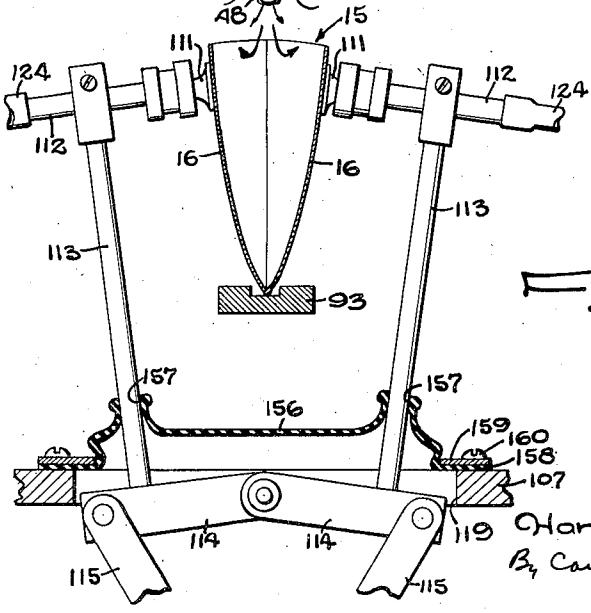


Fig. 11



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METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

Filed Dec. 10, 1949 7 Sheets-Sheet 7

Fig. 12

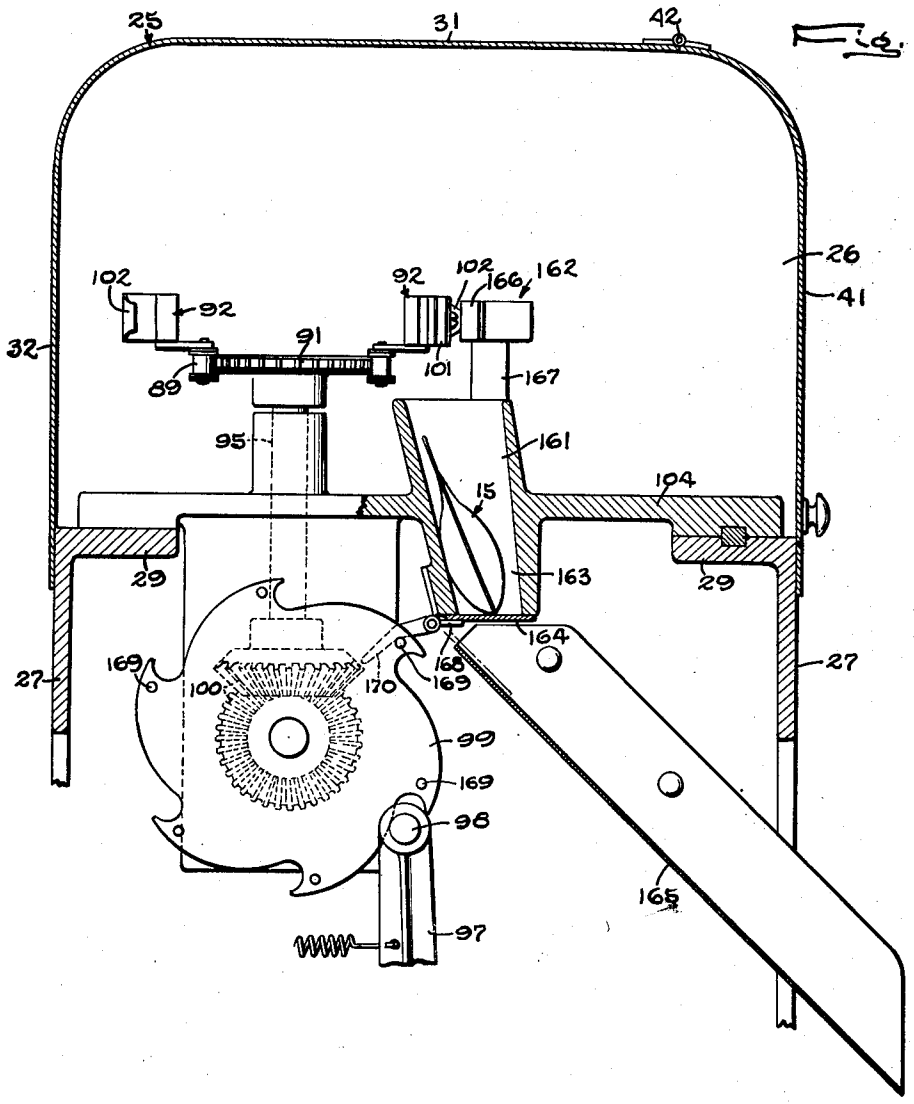
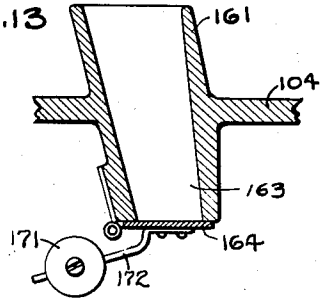


Fig. 13



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UNITED STATES PATENT OFFICE

2,649,671

METHOD OF AND MACHINE FOR PACKAGING MATERIAL IN AN INERT GASEOUS ATMOSPHERE

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Application December 10, 1949, Serial No. 132,378

21 Claims. (Cl. 53—6)

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This invention relates to a method of and machine for packaging material in flexible walled bags filled with an inert or nonoxidizing gas. The invention has more particular reference to the filling and closing of bags which are formed from continuous strips of material advanced endwise through a line of stations at which the various forming and filling and closing operations are performed.

One object is to provide a packaging method and machine of the above character in which the nonoxidizing atmosphere is introduced into the bags in a novel manner such as to eliminate air from the final package.

A more detailed object is to advance the bags with the walls thereof collapsed and the bags thus freed from air into an inert or nonoxidizing gaseous atmosphere and thereafter opening the bag preparatory to filling thereof whereby to utilize the vacuum created by the separation of the bag walls to draw the surrounding gas into the bag and completely fill the latter.

A further object is to adapt the foregoing method to a bag forming and filling process of the continuous type.

Another object is to confine the inert or nonoxidizing gas within a chamber enclosing only part of the bag forming and filling stations while leaving the power driven parts, the material storage hopper, and part of the bag forming stations exposed for convenient adjustment or replenishment.

The invention also resides in the novel manner of transferring the collapsed bags into the gas chamber and removing the filled and sealed bags from the latter.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a fragmentary side elevation of a packaging machine embodying the novel features of the present invention.

Fig. 2 is a fragmentary longitudinal elevational view of the right-hand portion of the machine shown in Fig. 1 with some of the parts shown in section.

Fig. 3 is a diagrammatic perspective view showing the various bag forming, filling, and closing steps.

Fig. 4 is a sectional view of a filled bag.

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 1.

Fig. 6 is a fragmentary sectional view taken along the line 6—6 of Fig. 5.

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Fig. 7 is a fragmentary sectional view taken along the line 7—7 of Fig. 2.

Fig. 8 is a fragmentary sectional view taken along the line 8—8 of Fig. 2.

Fig. 9 is a fragmentary sectional view taken along the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary sectional view taken along the line 10—10 of Fig. 2.

Fig. 11 is an enlargement of a part of Fig. 10 showing the parts in different positions.

Fig. 12 is a fragmentary sectional view taken along the line 12—12 of Fig. 2.

Fig. 13 is a fragmentary view showing a modified form of outlet valve.

The invention is useful for automatically packaging a wide variety of materials subject to deterioration in air including nuts, sauerkraut, pickles, prunes, wieners, cold meats, etc. While the invention is susceptible of various modifications and alternative constructions and may be practiced in various ways, I have illustrated in the drawings and will herein describe the preferred embodiment and manner of carrying out the invention. It is to be understood that I do not thereby intend to limit the invention by such disclosure but aim to cover all modifications, alternative constructions, and methods falling within the spirit and scope of the invention as expressed in the appended claims.

As illustrated in the drawings, the invention is particularly useful in packaging loose or granular material 14 such for example as nuts in a protective gaseous atmosphere retained around the nuts by a bag 15 (Fig. 4) comprising two flexible coextensive walls 16 of transparent sheet material closed at the bottom as by a fold and sealed as indicated at 17 and 18 along the side and top edges. The wall material, which preferably is thermoplastic or thermoplastic coated, must be impervious to and unaffected by the protective or nonoxidizing gas which may be nitrogen, carbon dioxide, or the like.

Packages of the above character may be formed cheaply in a succession of operations performed on strip material followed by filling and closing automatically in a continuation of the bag forming process. Such a process may, as shown, consist in folding a sheet 19 of the wall material as the latter is advanced step by step along a rectilinear path, cross-sealing at a station 20 the two strips 21 thus disposed face to face, severing the cross-seal intermediate its edges at a cutting station 22 thereby completing the formation of the bag, opening and filling the bag at a

station 23, and forming the seal 18 across the upper end of the bag at a final station 24.

As applied to the bag forming and filling method above described, the present invention consists in surrounding at least the bag opening, filling, and closing stations 23 and 24 in an atmosphere of the inert or non-oxidizing gas so that the bags are advanced into the atmosphere while collapsed and free of oxygen containing gas, and filled with the protective gas automatically as an incident to opening of the bag preparatory to filling thereof with the nuts or other material to be packaged. Thus, the opening of the bag which is performed as an incident to depositing the material in the bag is utilized to perform the additional function of introducing the protective gas into the bag so as to envelop the packaged material and eliminate air and oxygen from the package which is completed by the subsequent sealing of the open end of the bag.

The improved method as above described is carried out simply by providing a casing or housing 25 enclosing the filling and closing stations 23 and 24 and supplying the nitrogen or other nonoxidizing gas to the chamber 26 thus defined so as to maintain the latter under pressure at all times and thus exclude air from the space surrounding the bag at the time it is opened preparatory to introducing the material to be packaged and continuing until the filled bag has been closed by forming the top seal 18. As a result of advancing the bag into the gas chamber while the walls thereof are flattened or collapsed together, the vacuum created in the bag by separating the walls is utilized to advantage to draw the gas into the bag and thus fill the latter completely before introduction of the material to be packaged.

In addition to preventing air from entering or being trapped in the final package, the invention also contemplates that the material to be packaged and the power actuators for the various bag forming, filling, and closing mechanisms remain outside of the gas filled enclosure and therefore conveniently accessible for replenishment, adjustment, or repair. These mechanisms together with the casing 25 defining the gas chamber 26 and the conveyor for advancing the bag stock and bags from station to station are all mounted on a frame structure comprising side members 27 rigidly connected by crossbars 28 and having parallel top rails 29 and upright supporting legs 30.

In this instance, the casing 25 defining the gas chamber 26 is generally rectangular in shape and comprises a top wall 31 formed integral with side walls 32 and having openings for the passage therethrough of the nonoxidizing gas and the material to be packaged, a bottom wall formed by spaced cross members and overlapping sheets 34 of metal secured to and spanning the top rails 29 of the frame, and end walls 35 and 36 one of which has an inlet opening 37 therein for the advance of the collapsed bags into the chamber. The top, side, and end walls of the casing are formed of sheet material, the side walls being secured as by screws to the frame top rails and the end walls being secured by brackets 38 to the side, top, and bottom walls. Holes formed in the cross members of the bottom wall receive the connections between the bag forming, filling, and closing mechanisms disposed within the chamber and the power actuators for these mechanisms which actuators are disposed outside of the casing. A door 41 hinged as at 42 to the top wall and forming a part of one side wall permits entrance to the interior of the casing for adjustment of the mechanisms therein.

Actuation of the various bag forming, filling, and closing mechanisms is effected in this instance by a camshaft 43 extending along the frame below the top rails and journaled in spaced bearings 44. This shaft is driven through a belt 45 from an electric motor 46 (Fig. 1) and a speed reducer 47 of well known construction adapted to be adjusted manually to vary the speed of the shaft and therefore the output capacity of the machine.

Introduction of the nonoxidizing gas into the chamber 26 is effected herein by a tube 48 extending through the top wall 31 of the casing 25 adjacent the filling station 23 and communicating with a storage tank 49 for the gas through a supply line 50 and a valve 51. The gas is maintained under a slight pressure within the chamber on the order of a few ounces above atmospheric pressure, the amount of gas flowing into the chamber being determined herein by manual adjustment of the valve 51.

To minimize the loss of the nonoxidizing gas from the chamber 26 through the inlet opening 37, the invention contemplates forming the opening as a slit wide enough to receive the bags only when the latter are flattened or collapsed and moving edgewise through the opening. Advance of the bags alone without any bag feeding mechanism passing through the opening is permitted by locating the cutting station 22 within the chamber and thereby delaying severance of the bags from the strips 21 up to a point within the chamber so that the bags, during their advance into the latter, remain interconnected in a continuous ribbon. With the bags so interconnected, they may be easily pulled into the chamber by feeding mechanism located on the inner side of the end wall 35.

By pulling the strips 21 of the bag material through the inlet opening 37, it is possible to space the defining edges of the opening sufficiently close together to press tightly against the outer sides of the strips so that air is squeezed from between the latter as they advance into the chamber and thereby prevented from being trapped in the final package. In this instance, the opening (Figs. 5 and 6) is defined by adjacent parallel edges of two flaps 52 of flexible material such as leather extending across a hole 53 in a plate 54 and secured to the latter as by rivets. To change the size of the slit readily for bags of varying heights and thicknesses, the plate is detachably mounted on the end wall 35 over a hole 55 therein as by guides 56 which are secured to the wall and slidably receive the plate.

In the present instance, the feeding mechanism for advancing the strips 21 endwise into the chamber through the inlet opening 37 comprises two rollers 57 and 58 (Figs. 2 and 3) which are driven intermittently from the camshaft 43 and are engageable with the outer sides of the strips 21 at a point adjacent the inner side of the end wall 35. One roller 57 is fast on a shaft 59 extending through the bottom wall of the casing and mounted in fixed bearings on a bracket 60 (see Figs. 1 and 2) on a cross member 33 forming a part of the bottom wall. The other roller 58 is carried by a yoke 61 which is pivoted on the bracket 60 and adjustable toward

and away from the fixed roller to produce the pressure required to advance the folded strip without substantial slippage. At their lower ends the rollers carry meshing gears 62 and a bevel gear fast on the shaft of the fixed roller meshes with a gear 63 (Fig. 3) on a shaft 64 which is coupled through a one-way clutch 65, such as a so-called Sprag clutch, to an arm 66 loosely mounted at one end on the shaft 64 (Figs. 1 and 3). The bevel gears are enclosed in a housing 84 depending from the cross member 33. The other end of the arm 66 is joined by a link 67 to the pin 68 of a crank 69 fast on the camshaft 43. During each revolution of the latter, the rollers are turned to advance the strips a predetermined distance determined by the position of the pin along the crank.

To form the strips 21, the continuous sheet 19 of bag material is unwound by the feed rollers 57 and 58 from a roll 70 and advanced through a mechanism 71 by which the sheet is folded longitudinally. The roll 70 is mounted on a shaft journaled at opposite ends in supports 72 disposed outside of the casing and secured to the frame at one end of the latter.

From the folding mechanism 71, the strips 21 are advanced through the cross-sealing station 20 which is located adjacent the outer side of the end wall 35. Such location of the cross-sealing station renders the sealing mechanism convenient for adjustment and repair and enables the casing 25 to be made smaller so as to reduce the consumption of the nonoxidizing gas. To effect cross-sealing of the strips, a shoe 73 heated to a temperature sufficiently high to soften the thermosensitive bag material is secured to the upper end of a vertically disposed lever 74 which is pivoted intermediate its ends on a cross member 75 on the frame and carries at its lower end a follower roller 76 engageable with a cam 77 on the camshaft 43. When the follower roller engages a rise surface on the cam, which occurs during a dwell of the strips, the heated shoe is swung against the strips and pushes the same against a yieldable backing surface 78 supported on the cross member, the areas of the strips pressed between the shoe and the backing being sealed together under the resulting heat and pressure.

Severance of the strips 21 after the latter have been advanced into the chamber 26 is effected herein by two vertically disposed blades 80 and 81 which are located at the cutting station 22 between the filling station 23 and the feed rollers 57 and 58. One of the blades is mounted on one side of the strips on a standard 82 projecting upwardly from the cross member 33 supporting the bracket 60 for the feed rollers 57 and 58. The other blade 81 is mounted on the upper end of an upright lever 83 which extends through a hole 40 in the cross members 33 and is fast on a rock shaft 85 journaled in the plane of the strips on the housing 84 for the bevel gear 63. At its lower end, the lever 83 carries a follower roller 86 engageable with a cam 87 on the camshaft 43 and swingable thereby during a dwell of the strips to carry the moving blade edge across the stationary edge and sever the strips along a sealed portion thereof. By positioning the blades from the heated shoe at the sealing station 20 a distance equal to a multiple of the distance the strips are advanced during each revolution of the camshaft, the center of a sealed portion of the strips is positioned in the path of the swinging blade 81 during each dwell of the strips. When the follower 86 is engaging the low part of the cam, the blade 81 is retracted and the strips may be advanced between the blades.

In each advance of the folded strip, the leading end portion thereof is moved past the cut-off position and onto a conveyor (see Figs. 7, 8, 9, and 10) which grips the bag prior to cut-off and advances the same step by step to the filling and closing stations 23 and 24. Herein, the conveyor comprises an endless chain 89 of the roller type extending around sprockets 90 and 91 and having spaced uniformly therealong gripping devices 92 which are closed and opened automatically and carry the bag along a horizontal track formed by a bar 93 (Figs. 8 and 11) and supporting the bottom of the bag above the frame cross-pieces. The chain and the sprockets therefor are disposed in a horizontal plane above the frame rails 29 with one run of the chain extending alongside the line of advance of the bags. A bearing 94 (Fig. 9) on the frame supports one sprocket 90 while the other sprocket 91 which drives the chain is fast on a shaft 95 journaled in a bearing (Fig. 12) supported by a cross member 104 on the frame.

Advance of the chain step by step is effected herein by a crank 96 (Figs. 1 and 2) fixed on the far end of the camshaft 43 and connected to one end of a rod 97 whose other end carries a pawl 98 which is held by a spring in engagement with the teeth of a ratchet wheel 99 (Fig. 12). The latter is fast on a shaft connected to the shaft 95 of the sprocket 91 through bevel gears 100. During each upward movement of the rod 97, the chain and all of the gripping devices 92 thereon will be moved through a fixed distance which preferably is longer than the width of the widest bag to enable the conveyor to handle all of the bag sizes without changing its stroke. The crank 96 is so positioned on the camshaft that the chain will be indexed while the strips 21 at the cross-sealing and cutting stations 20 and 22 are stationary and immediately after the blade 81 has been advanced to sever the strip. The conveyor motion is completed before the blade is retracted and the subsequent feeding of the folded strip is initiated.

The gripping devices 92 each comprise a block (Fig. 8) secured to extensions of the pivot pins of adjacent chain links and disposed at the side of the chain with the exposed surface of the block disposed close to the path of advance of the strips 21. Cooperating with the block surface to form a clamp is a jaw 101 (Figs. 8, 9, and 12) pivoted on the block to permit the trailing end of the jaw to rock away from the latter. The trailing end of the jaw is yieldably urged by a spring toward a closed position against the block surface and is bent outwardly to cooperate with the beveled trailing end of the block to guide the entry of the leading end of the folded strip into the gripping device.

To open the clamp, the leading end portion 102 of the jaw 101 is inclined outwardly and away from the block 92 for engagement by a finger 103 (Figs. 8 and 9) on the upper end portion of a lever 105 which extends through a hole 106 in a cross member 107 of the frame and is swingable about a pivot 108 supported by a bearing on the cross member 107. A slot 109 in the depending end portion of the lever receives a pin 110 projecting rigidly from the lever 83 carrying the movable cutting blade 81 (Fig. 2). When the cut-off blade is retracted, the finger 103 will be swung against the end 102 of the jaw 101 then

disposed at the cutting station thereby rocking the trailing end of the jaw outwardly and holding the gripping device open. When the blade 81 is advanced, the lever 105 is swung with the cut-off lever to retract the finger 103 and allow the jaw to close. Thus, the leading end of the bag bottom is clamped to the chain for movement with the latter to the filling station.

Each bag 15, after it has been severed from the folded strip and while it is supported by the chain 89, is advanced in a collapsed condition to the filling station 23 where the side walls 16 of the bag are engaged adjacent the open end thereof and separated to open the bag and draw the nonoxidizing gas into the latter preparatory to the delivery of the material into the bag. In the present instance, the side walls 16 are separated to open the bag through the use of suction cups 111 (Figs. 8 and 11) which are moved against the outer surfaces of the walls adjacent the open end thereof, subjected to a vacuum, and then moved outwardly all in timed relation to the indexing movements of the chain and the operation of the associated filling mechanism. The cups which are made of soft rubber material are mounted on the ends of horizontally disposed tubes 112 rigid with the upper ends of upstanding arms 113 of bell crank levers 114 disposed on opposite sides of the bag at the filling station 23 and swingable about a common pivot on the cross member 107. Swinging of the bell cranks is effected through links 115 connecting the outer ends of the cranks with a slide 116 urged downwardly by a spring 117 and guided for vertical movement in a bracket 118. The latter depends from the cross member 107 (Fig. 2) which is formed with a hole 119 therein to receive the bell cranks. On the lower end of the slide is the follower 120 of a cam 121 fast on the camshaft 43 and adapted to raise the slide as shown in Fig. 10 and thereby swing the cups into alinement with each other and against opposite side walls of the bag then disposed at the filling station. As the follower rides off the high point of the cam, the bell cranks swing outwardly to the positions shown in Fig. 11 thereby separating the upper end portions of the bag walls.

Before such separation of the cups 111 occurs, a vacuum is created therein by the action of a pump 122 (Figs. 1 and 2) which is actuated from the camshaft 43 and comprises a cylinder 123 mounted on the machine frame and communicating at its upper end with flexible conduits 124 extending through sealed apertures in the cross member 107 and connected to the tubes 112 leading to the suction cups. A piston 125 reciprocable in the cylinder has a rod connected by a link 126 to the free end of a crank 127 which is positioned on the camshaft to initiate downward movement of the piston and the application of a vacuum to the suction cups as soon as the latter are brought against the bag walls 16. The vacuum continues for the remainder of a half revolution of the camshaft during which the cups are separated to open the bag and the latter is filled. As the crank motion reverses, which occurs while the cups are held apart, the vacuum is relieved and the bag walls released to permit the bag to be pulled forwardly in the next advance of the conveyor. The degree of vacuum may be varied by adjusting a valve 128 on the pump (Fig. 2).

As noted above, the material to be packaged is stored outside of the casing 25, herein in a cone-shaped hopper 129 (Figs. 1 and 10) mounted on a measuring mechanism 131 (Figs. 10 and 11) and having a bottom opening 130 communicating through the measuring mechanism with the top of a filler tube 132. The latter extends vertically through the top wall 31 of the casing so that the material falls by gravity through the tube into bags at the filling station while the walls of the bags are separated. The measuring mechanism is mounted on a support 133 secured to the frame and comprises a circular disk 134 fixed to a vertical shaft 135 for rotation between two spaced parallel plates 136 and 137. Spaced angularly around the disk are a plurality of holes 138 which extend axially therethrough. A hole 139 in the lower plate 137 is alined with the filler tube 132 while a hole 140 in the upper plate 136 is alined with the opening in the hopper bottom. Both plates together with a side wall 141 cooperate to form a casing around the disk, the upper plate being spaced slightly above the top surface of the disk.

When one of the holes 138 in the disk is alined axially with the hopper opening 130 and the hole 140 in the upper plate, a quantity of the material 14 determined by the size of the hole 138 and the thickness of the disk falls by gravity into the hole. Upon rotation of the disk, each quantity of material in a disk hole thus filled is first carried around the axis of rotation of the disk between the plates and then, when the hole is alined with the filler tube 132 and the hole 139 in the lower plate, falls by gravity down through the tube and into a bag being held open under the latter. Scrapers in the form of stiff brushes 142 secured to the upper plate 136 may be positioned around the periphery of the hole 140 therein to maintain the level of material in the disk hole 138 flush with the upper face of the disk. By turning the disk in the proper timed relation to the motion of the camshaft 43, a measured quantity of the material falls from one of the holes 138 in the disk through the tube 132 at the same time that a bag is being held open by the suction cups 111.

While the disk 134 may be turned by a connection with the camshaft 43, it is preferred to use a motor 143 which, when started, goes through a cycle to present an empty one of the holes 138 in the disk under the hopper 129 and a filled one of the holes in axial alinement with the filler tube 132 and then stops. Herein, the motor (see Fig. 10) is mounted on the support 133 and connected to the shaft 135 of the disk through gearing 144. Starting of the motor in its cycle in the proper timed relation to separation of the bag walls is effected by a switch 145 (Figs. 1 and 2) mounted on one of the cross bars 28 of the frame so as to be engaged by a cam 146 fast on the camshaft 43 and shaped to actuate the switch as the bag at the filling station is opened. When the switch is actuated the motor turns the disk through a predetermined angle depending on the number of holes in the disk 134 to present a filled hole in alinement with the filler tube and then stops until the switch is actuated again when the next bag is opened.

After passing the filling station 23, each bag 15 is moved along with the chain 89 into the closing station 24 at which the bag is heat sealed across the top to effect final closure of the bag. This is accomplished by mechanism which is similar to that for cross-sealing the strips 21 at the station 20 and comprises a backing block 147 (Figs. 2 and 7) and a heated block 148 between which the upper edge of the bag is pressed momentarily. The block 148 in which a suitable

electric heater is embedded is fixed to the upper end of an upright lever 149 swingable about a pivot 150 on a cross member 151 on the rails 29 and extending through a hole 152 therein. At its lower end the lever 149 carries a follower 153 riding a cam 154 which is fast on the camshaft 43 and shaped to hold the heater retracted during the advance of a bag into the sealing station and to advance the block 148 to press the top of the bag against the backing 147 momentarily during a dwell of the latter to effect sealing across the entire width of the bag.

The holes 40, 106, 119, and 152 in the cross members 33, 107, and 151 through which the actuating levers for the various mechanisms at the cutting, filling, and closing stations 22, 23, and 24 pass are sealed to prevent the loss of the non-oxidizing gas from the chamber 26 while permitting relative movement between the actuating levers and the cross members. For this purpose, a flexible seal or diaphragm 156 (Figs. 2, 8, and 11) is interposed between each lever and the cross member through which the latter extends. Each seal which herein is molded from rubber or other flexible material corresponds in shape to the hole closed thereby and is formed with a hole 157 for each lever extending through the seal and a flange 158 adapted to be clamped to the cross member as by a metal ring 159 and screws 160.

The invention contemplates removing filled and sealed bags from the chamber 26 with a minimum loss of gas therefrom by momentarily opening a wall of the chamber and moving a bag out of the chamber through the opened wall. For this purpose, the bags are released from the chain 89 within the chamber above a receptacle 161 in the form of a vertically disposed tube which catches each bag as it is released from the conveyor and extends through the cross member 104 of the casing 25 at a discharge station 162 beyond the closing station 24 to define an outlet opening 163 in the bottom wall. Normally closing the open bottom end of the receptacle is a trap door or gate 164 which is moved to an open position automatically in timed relation to advance of the conveyor to permit removal of the bags and then closed. Such a momentary opening of the chamber is permitted by releasing the bags from the conveyor within the chamber so that the conveyor remains at all times enclosed within the casing and does not pass through the outlet opening 163. An inclined chute 165 is disposed outside of the casing under the bottom end of the receptacle to receive the bags as they are discharged from the chamber and transfer the same to a suitable container (not shown).

Release of the filled and sealed bags from the chain 89 so that the bags may fall into the receptacle 161 is effected herein by a stationary cam 166 (Figs. 7 and 12) which is disposed in the path of the curved portions 102 of the jaws 101 of the gripping devices and is carried by a bar 167 secured as by bolts to a wall of the receptacle. As a gripping device with a bag clamped therein as shown in Fig. 2 reaches the cam, the latter acts in the leading end of the jaw 101 and wedges this end laterally of the path of travel toward the chain to open the gripping device and release the bag so that the latter falls into the receptacle. Herein, release of the bag occurs just before each advance of the conveyor is completed.

The trap door 164 is in the form of a plate pivoted on the lower end of the receptacle 161 to swing from a position in which the receptacle is open and bags may fall onto the chute 165 to a closed position in which the receptacle is closed (see Fig. 12). In the form shown in Fig. 12, the door is urged into closed position by a spring 168 and opened as an incident to advance of the chain 89. Such opening is effected herein by pins 169 projecting from the ratchet wheel 99 and engageable with a finger 170 which projects from the door and is cammed by the pins in a direction to open the door. The pins are so positioned on the ratchet wheel that the door is opened to release each bag thereon at the beginning of each advance of the chain, the bag having been released from the latter at the end of the next preceding advance thereof. By providing short fingers 170, the door is held open only momentarily.

In a modified form of means for actuating the trap door 164 shown in Fig. 13, the door is held balanced in a closed position by a counterweight 171 carried on an arm 172 projecting from the door across the pivot therefor. By making the counterweight slightly heavier than the door but lighter than the combined weight of a filled bag and the door, the latter is opened automatically each time a bag hits the door after being released from the conveyor, the weight of the door and bag overbalancing that of the counterweight 171. After the bag slides onto the chute and off from the door, the latter again swings to a closed position. With the use of a counterweight, the trap door is opened in timed relation to release a bag from the conveyor, is held open for a short period of time in which the bag falls by gravity from the chamber, and is then closed automatically.

The various mechanisms above described are typical of those which might be used to convert a continuously moving sheet or strip of material into bags, fill the bags, and then close the same. By actuating the mechanisms in timed relation and from a single camshaft it is possible during each revolution of the latter to complete an automatic cycle in which each mechanism is actuated once.

As the camshaft 43 is turned by the motor 46 through one revolution, a length of the sheet 19 of bag material is pulled by the feed rollers 57 and 58 from the roll 70 and through the folding mechanism 71 to form the two strips 21 which are advanced between the separated shoe 73 and backing surface 78 at the sealing station, are slid into the chamber 26 between the flaps 52 which squeeze air from between the strips, and are advanced between the separated blades 80 and 81 at the cutting station with the leading ends of the strips advancing into an open gripping device on the chain 89. During a dwell of the strips following such advance, the heated shoe 73 is moved toward the backing surface 78 to seal the strips together and the blades 80 and 81 are moved together to sever a bag from the strips.

Immediately before a bag is severed from the strips 21 the gripping device is closed to clamp the leading end of the bag and the chain 89 is advanced through one step to position an empty bag between the suction cups 111 at the filling station 23, a filled bag 148 between the separated shoe and backing surface 147 at the closing station 24, and a filled and sealed bag at the discharge station 162. In such movement of the chain, the filled and sealed bag presented at the discharge station in the previous advance of the

chain is released from the latter to fall into the receptacle 161. After the released bag has fallen on to the trap door 164, the latter is automatically opened momentarily to permit the bag to slide onto the chute 165 and then closed.

During a dwell of the chain, the heated shoe 148 is advanced to close the filled bag at the closing station by sealing the walls thereof together at the top and the suction cups 111 are advanced and retracted to open the collapsed and empty bag at the filling station 23. While the bag is held open, the switch 145 is actuated to start the motor 143 and turn the disk 134 to deposit a measured quantity of the material 14 into the filler tube 132 from which the material falls into the bag. Since the filling station is surrounded by the nonoxidizing gas, the bag upon separation of the walls thereof is filled with the gas to provide a protecting atmosphere for the material deposited in the bag.

It will be apparent that the location of the cross-sealing station 20, the camshaft 43, the hopper 129, and the measuring mechanism 131 all outside of the casing 25 and the chain 89 entirely within the latter makes it possible to provide a small chamber having few openings in the walls thereof with the result that the amount of the nonoxidizing gas consumed is very low. Also, the parts outside of the chamber are conveniently accessible for replenishment, adjustment, and repair. The loss of gas from the openings in the casing is minimized because the discharge outlet 163 is opened only momentarily to release the completed bag and because a close sealing is effected at the inlet opening 37. By advancing the bags into the chamber while their walls are collapsed together and by closing the bags while the latter are in the nonoxidizing atmosphere, there is little possibility of air being trapped in the filled and sealed bags. During delivery of the material 14 into the opened bag, some of the protective gas escapes from the chamber 26 upwardly through the tube 132 past the downwardly moving material. The danger of air being carried into the bag with the material is thus reduced to a minimum.

I claim as my invention:

1. In a packaging machine, the combination of, a casing defining a chamber having a slit in one wall thereof, means for introducing a nonoxidizing gas into said chamber and maintaining the same under pressure therein, mechanism for supporting two strips of flexible material side by side and advancing the same periodically in successive steps endwise along a path extending through said slit and into said chamber, sealing elements disposed outside of said chamber and operable to cross-seal said strips to form pockets opening upwardly at one end, a cutter disposed within said chamber and operable during a dwell of said strips to sever the latter along the cross-sealed portions thereof and divide said pockets into separate bags, grippers within said chamber engageable with each bag, a conveyor mounting said grippers and movable to advance said bags beyond said path, a bag opener disposed within said chamber for engagement with the walls of each bag adjacent the open end thereof and operable to separate the walls and create a vacuum in the bag for drawing the gas into the same through said open end, a filler operable to deliver a measured quantity of material through a wall of said chamber into said bag while the latter is held open, and sealing elements within said chamber engageable with the filled bag and operable to seal the walls of the bag across said open end.

2. In a packaging machine, the combination of, a support for two strips of flexible material disposed side by side and lying flat against each other, feed mechanism engageable with said strips and operable to advance the same endwise, heat sealing mechanism engageable with said strips and operable to seal the same together at points spaced along the strips and form intervening pockets open at one end, cutting mechanism engageable with said strips along the sealed portions thereof and operable to sever the same and form separate bags, bag opening mechanism engageable with the walls of each bag and operable to move the walls apart to open the bag, closing mechanism operable to seal the walls of each bag together across the open end thereof, a casing having an inlet opening in one end wall for the passage of said strips therethrough and enclosing a plurality of said mechanisms including said cutting, said bag opening, and said closing mechanisms, said sealing mechanism being disposed outside of said casing, means for introducing an inert gas into said casing and maintaining the same under pressure therein, and a filler tube extending through a wall of said casing for delivering a measured quantity of material to be packaged into said open bag.

3. In a packaging machine, the combination of, a casing defining a chamber and having a slit in one wall thereof, means for introducing non-oxidizing gas into said chamber and maintaining the same under pressure therein, mechanism disposed outside of said chamber for partially forming from two strips of flexible material a bag having an opening in one end and two side walls disposed side by side and lying flat against each other, feeding elements engageable with said strips and operable to advance the same endwise through said slit and into said chamber, the edges of said slit being defined by flexible members yieldably engaging said strips, mechanism disposed within said chamber for completing the formation of said bag and severing the same from said strips, a bag opener within said chamber engageable with the outer surfaces of said bag and operable to move the walls thereof apart and thereafter release the walls, a filler operable while the bag walls are held apart to deliver material through a wall of said casing into said bag, sealing elements within said chamber for sealing the walls of the filled bag across the open end thereof, and means for removing the filled and sealed bag from said chamber.

4. In a packaging machine, the combination of, a casing, means for maintaining said casing filled with a gas of predetermined composition under pressure, mechanism for holding a flexible walled bag collapsed and supported within said casing, said bag having an opening in one end thereof, bag opening means within said casing acting on the walls of said bag and movable to separate the walls to create a vacuum in the bag and draw said gas into the bag through the opening therein, mechanism for delivering a measured quantity of material through a wall of said chamber and into the open bag, and sealing elements within said chamber engageable with the filled bag and operable to seal the walls of the bag together across the open end thereof.

5. In a packaging machine, the combination of, means defining a chamber, means for maintain-

ing said chamber filled with a non-oxidizing gas under pressure, mechanism for supporting within said chamber a collapsed flexible walled bag having an opening at one end thereof, a pair of elements disposed within said chamber and adapted to grip the outer surfaces of said bag, mechanism disposed outside of said chamber and operable to move said elements relative to each other to bring them into gripping engagement with the walls of the bag and then separate the elements to move the walls apart and create a vacuum in the bag to draw the gas through said opening and into the bag, and means for transmitting motion to said elements to operate the same including connections extending through a wall of said chamber and sealed in said wall.

6. In a packaging machine, the combination of, means for supporting a pair of strips of flexible material side by side and advancing the same through cross-sealing, cut-off, filling, and closing stations, a casing enclosing said cut-off, filling, and closing stations and having an opening in one end wall thereof for the passage of said strips therethrough, said cross-sealing station being disposed outside of said casing adjacent said end wall, means for introducing a non-oxidizing gas into said casing, mechanisms at said stations operable on said strips to form, fill, and close separate flexible walled bags, power driven means disposed outside of said casing and operable to actuate said mechanisms in timed relation to each other, and actuating elements connecting said power driven means and said mechanisms.

7. In a packaging machine, the combination of, a casing, means for maintaining said casing filled with a non-oxidizing gas under pressure, mechanism for holding an upwardly opening flexible walled bag collapsed and supported within said casing, means within said casing engageable with said bag and movable to separate the walls thereof to create a vacuum in the bag and draw said gas into the bag through the bag opening, a hopper disposed outside of said casing and adapted to receive material to be packaged, a filler tube extending through an opening in one wall of said casing and having an aperture therein disposed above the open end of said bag, filling mechanism communicating with said tube and said hopper and operable to deliver measured quantities of material into said tube for delivery into the open bag, and means engageable with the filled bag within said chamber to seal the bag across its open end.

8. The method of packaging material in a flexible walled bag including the steps of, maintaining a gas of predetermined composition under pressure in a housing having a slit in one end wall thereof, advancing a pair of strips of flexible material endwise and step by step into said housing through said slit with adjacent sides of the strips lying in contact with each other and joined along one of their longitudinal margins, cross-sealing said strips together at spaced points to form pockets having top openings, severing said strips within said housing along the cross-sealed portions of the strips to divide said pockets into separate upwardly opening bags, separating the walls of each bag within said housing while simultaneously introducing said gas into the bag through said opening therein, delivering material to be packaged through said bag opening into said gas-filled bag, sealing the walls of said bag across the opening therein, and removing said bag from said housing.

9. The method of packaging material in a flexible walled bag including the steps of, maintaining an inert gas under pressure in a chamber having a slit in one end wall and an outlet opening in another wall of the chamber at the other end thereof, partially forming outside of said chamber a bag having an opening in one end and flexible side walls lying flat against each other, advancing said flattened partially formed bag edgewise into said chamber through said slit, separating the walls of said bag within said chamber to create a vacuum within the bag and draw the gas into the bag through said bag opening, delivering material to be packaged into said gas-filled bag through said bag opening, sealing the walls of said bag together across said bag opening, and removing said bag from said chamber through said outlet opening.

10. In a packaging machine, the combination of, a housing having an inlet opening in one wall thereof, means for maintaining said housing filled with a non-oxidizing gas, means for advancing partially formed bags in the form of two strips of flexible material endwise through said opening and into said housing, mechanism disposed within said housing and operable to complete the formation of said bags and sever the same from said strip to form separate bags, a conveyor adapted to receive and grip a bag within said housing and advance the same to present the bag to filling and closing stations within the housing, mechanism at said stations operable to open, fill, and close said bag, power driven means disposed outside of said housing for actuating the various ones of said mechanisms in timed relation to each other, actuating members extending through apertures in a wall of said housing and connecting said power driven means and said mechanisms, and flexible seals interposed between said members and said housing wall to permit movement of the members relative to the wall while closing said apertures to retain the gas within said housing.

11. In a packaging machine, the combination of, means for supporting two flexible strips side by side and advancing the same endwise along a predetermined path, sealing elements along said path engageable with said strips and adapted to seal the same crosswise at spaced intervals, a cut-off mechanism spaced along said path from said sealing elements and operable to sever said strips along the sealed portions thereof and form separate bags, a conveyor for gripping the separate bags and advancing the same successively through a filling station and a closing station, a bag opening mechanism associated with said bag at said filling station and operable to move the bag walls apart and then release the walls, a sealing mechanism at said closing station operable to seal the walls of the bag together across the open end thereof, a casing enclosing said mechanisms and having an opening in one wall for the passage of said strips therethrough, said sealing elements being disposed outside of said casing, means for introducing a non-oxidizing gas into said casing and maintaining the same under pressure therein, a camshaft disposed outside of said casing, cams on said camshaft, actuating members connecting said cams and said mechanisms and extending through apertures in said casing, and flexible seals interposed between said members and said casing walls to permit movement of the members relative to the walls while closing said apertures to retain said gas within said casing.

12. In a packaging machine, the combination of, a casing defining a chamber and having a slit in one end wall thereof, means for introducing a non-oxidizing gas into said chamber, a cross-sealing station disposed outside of said casing adjacent said end wall, a cutting station disposed within said chamber, and a pair of rotatable feed rollers disposed within said casing adjacent the inner side of said end wall and between said stations and spaced close together to engage the outer sides of two strips of flexible material lying side by side and pull the strips endwise through said slit to present the strips at said cutting station, the defining edges of said slit being spaced close together to squeeze air from between said strips as the latter are pulled by said rollers through the slit.

13. In a packaging machine, the combination of, a casing having a slit in one end wall thereof and an exit opening in another wall adjacent the other end of the casing, means for introducing a gas of predetermined composition into said casing and maintaining the same under pressure, mechanism disposed outside of said casing for supporting a partially formed flexible walled bag, mechanism disposed within said casing for completing the formation of the bag with an opening in one end thereof, mechanism disposed within said casing for holding said completed bag open, mechanism for delivering a measured quantity of material through a wall of said casing and depositing the same in the open bag, mechanism disposed within said casing for sealing the walls of the bag together across the open end thereof, and transfer mechanism for advancing said partially formed bag edgewise into said casing through said slit into engagement successively with the various ones of said mechanisms to complete, fill, and seal the bag, and then advance the same out through said outlet opening.

14. In a packaging machine, the combination of, feeding mechanism operable to advance along a predetermined path and present to successive bag forming and filling stations a plurality of partially formed bags in the form of a pair of strips of flexible material lying side by side, said feeding mechanism comprising a pair of feed rolls at least one of which is power driven and which engage the strips on the outer sides thereof to squeeze the strips between them and advance the same through said stations, and a casing enclosing said rolls and said stations with one end wall of the casing disposed adjacent said feed rolls and having a slit therein through which said strips are pulled by the rolls into said casing, the defining edges of said slit being spaced close together to squeeze said strips together and remove air from between them as the strips are pulled through said slit by said rolls.

15. In a packaging machine, the combination of, a casing defining a chamber, and having an inlet opening in one end wall thereof in the form of a narrow slit, means for introducing a non-oxidizing gas into said chamber and maintaining the same under pressure therein, means for supporting a length of bag stock including a pair of strips of flexible material disposed side by side and lying flat against each other, feeding mechanism disposed within said chamber adjacent said casing end wall and engageable with said strips to pull the strips through said slit and present the same to a cross-sealing station and a cut-off station within said chamber, and means disposed at the respective stations and operable to seal said strips together transversely and cut the strips intermediate the edges of the seal thus formed, said slit being defined by parallel flexible edges yieldably engaging said strips and spaced close together to squeeze the strips and remove air from between the same as the strips are drawn by said mechanism through the slit.

16. In a machine for packaging material in flexible walled bags open at one of their ends, the combination of, means disposed at a filling station and operable to hold each bag open and deposit a measured quantity of material therein, sealing elements disposed at a closing station and operable to seal the walls of the bag together across the open end thereof, a casing enclosing said stations and having a discharge opening in one wall thereof, means for introducing a gas other than air into said casing and maintaining the same under pressure therein, a conveyor disposed entirely within said casing and adapted to grip each bag and advance the same successively step by step through said filling and closing stations to a discharge station adjacent said discharge opening, and means for releasing said bags from said conveyor at said discharge station.

17. In a packaging machine, the combination of, a casing defining a chamber and having a bottom opening therein, means for introducing an inert gas into said chamber and maintaining the same under pressure therein, a conveyor within said chamber operable to carry filled and sealed bags to a point above said opening, means engageable with said conveyor and operable to release each bag from said conveyor at said point, a trap door normally closing said bottom opening and adapted to receive each bag as the latter is released from said conveyor, and mechanism operable in timed relation to advance of said conveyor to open said trap door and permit each released bag to fall by gravity from said chamber before release of the next succeeding bag from said conveyor.

18. In a packaging machine, the combination of, means defining a chamber having an outlet opening therein, means for introducing an inert gas into said chamber and maintaining the same under pressure therein, a conveyor within said chamber for carrying filled and sealed bags to a point adjacent said outlet opening and releasing the bags at said point, a movable door normally closing said outlet opening and adapted to receive each bag upon release thereof from said conveyor, and power driven mechanism engageable with said door and operable in timed relation to operation of said conveyor to open the door for a short period of time and permit the discharge of said released bag from said chamber with the loss of only a small amount of said gas from the chamber.

19. In a packaging machine, the combination of, a casing defining a chamber having a bottom opening therein, means for introducing a non-oxidizing gas into said casing and maintaining the same under pressure therein, a conveyor within said chamber operable to carry filled and sealed bags to a point above said opening and release said bags at said point, a balanced door normally closing said opening and adapted to receive each bag upon release thereof from said conveyor, and means mounting said door to swing under the weight of each released bag and permit the same to fall by gravity through said opening and from said chamber before release of the next bag from the conveyor.

20. In a machine of the class described, the combination of, means defining a gas chamber maintained under pressure and having a bottom opening, a conveyor within said chamber for carrying filled and sealed bags to a point above said opening and releasing the same at said point, a gate normally closing said opening and adapted to receive each bag upon release thereof from said conveyor, and means associated with said gate and operable to effect opening of the latter and release of the bag from said chamber in timed relation to the operation of said conveyor and before release of the next bag therefrom.

21. In a packaging machine, the combination of, a casing defining a substantially closed chamber, means for maintaining said casing filled with a non-oxidizing gas, a support for holding a flexible walled bag within said chamber and in the collapsed condition with one wall lying flat against the opposite wall, said bag being open at one end, means disposed within said casing for separating said walls to form an opening and create a vacuum in the bag whereby to draw said gas from said chamber into the bag through said opening therein, filling mechanism having an outlet disposed within said chamber and operable while said walls are held apart to deliver material into the bag through said opening, and sealing means within said chamber engageable with the filled bag to seal the walls of the bag together and thereby close said opening.

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