Dec. 9, 1969 J. W. MORRIS 3,482,373

PACKAGING

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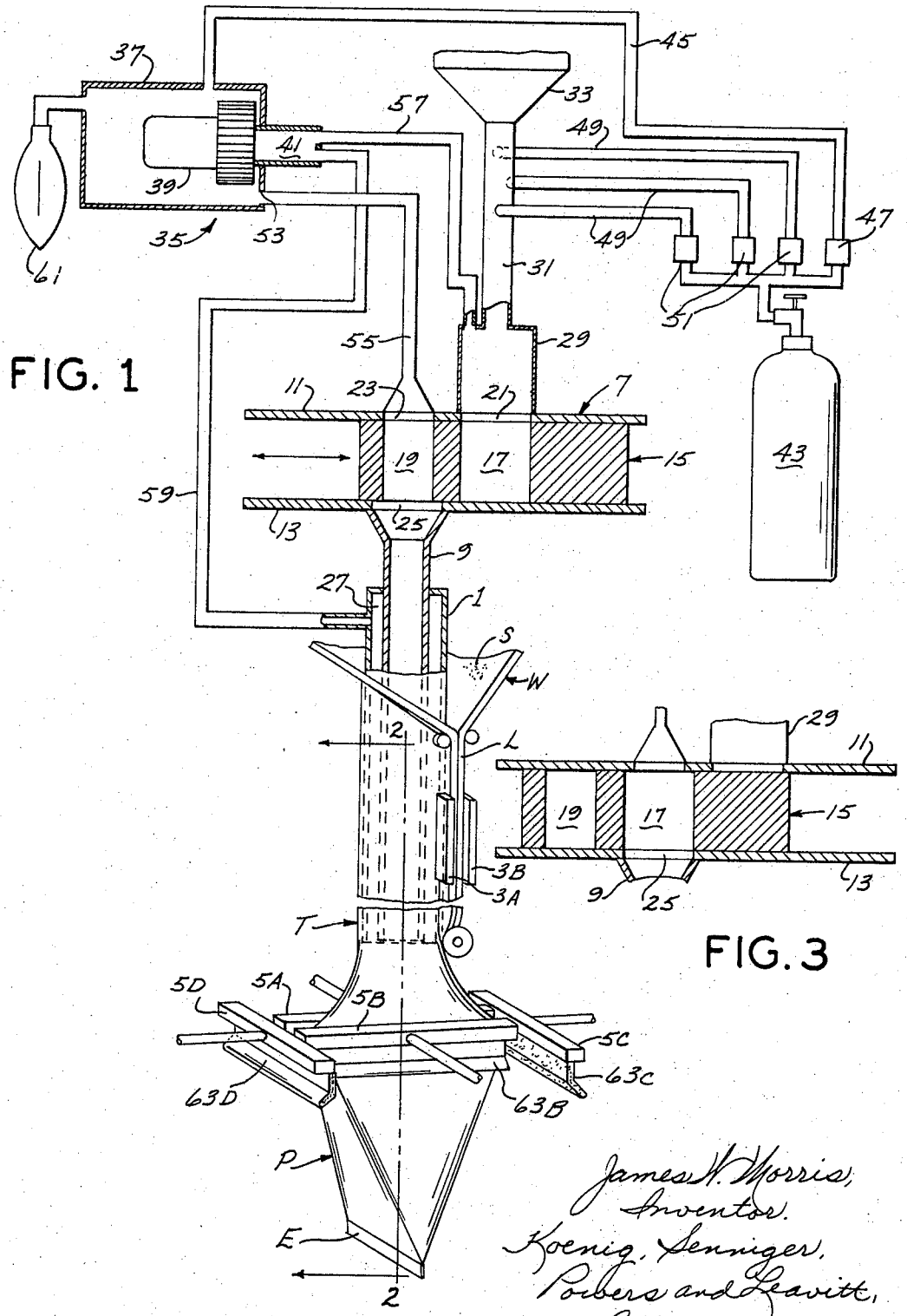


FIG. 1

FIG. 3

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FIG. 2

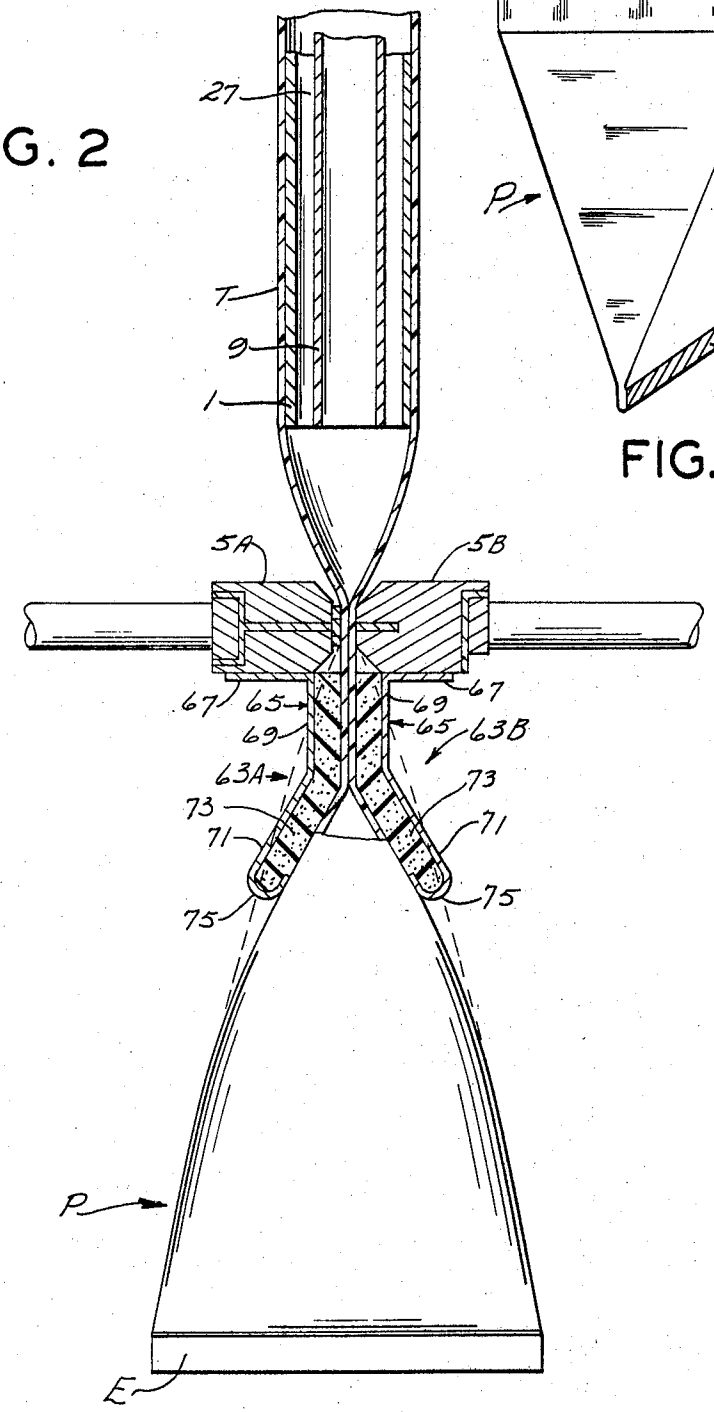


FIG. 4

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PACKAGING

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ABSTRACT OF THE DISCLOSURE

A form-fill-seal packaging machine for packaging of a fluent solid product, e.g., ground coffee, in a tetrahedron-shaped package. The machine has a fill tube concentrically mounted in a mandrel for delivery of the coffee from the lower end of the fill tube into tubing formed around the mandrel from a web of flexible packaging material. Below the lower end of the mandrel are sealing heads for making the package end seals, the sealing heads having resilient pads for flattening the tubing as the end seals are formed so that each package has a deflated portion adapted for inflation on evolution of gas from the coffee in the completed package. A gas, e.g., nitrogen, is supplied to the upper end of the fill tube for delivery to the tubing at the lower end of the mandrel for gas flushing the package, the gas returning between the fill tube and mandrel to a gas pump for recirculation.

Background of the invention

The invention relates to form-fill-seal packaging machines and packages made thereby, more particularly to machines of this class in which a web of packaging material is formed into tubing around a vertical hollow mandrel, the tubing is fed downward off the lower end of the mandrel, transverse seals are formed across the tubing below the lower end of the mandrel at package length intervals to form packages, especially tetrahedron-shaped packages, and the product with which the packages are to be filled is introduced through the mandrel. Reference may be made to the coassigned U.S. Patents 3,221,469, issued Dec. 7, 1965; 3,026,658, issued Mar. 27, 1962; and 3,082,586, issued Mar. 26, 1963 for a showing of machines in this class. A problem which has existed in this field is that of filling the packages with a fluent solid material, such as ground coffee, while simultaneously flushing the tubing with a gas, such as nitrogen, so that the packages are filled in an atmosphere of nitrogen rather than air, the packages thereby containing nitrogen instead of air to prevent product deterioration such as otherwise might be cause by the presence of air in the packages. In addition, some of such products, such as coffee, evolve gases, such as carbon dioxide, after packaging with the result that the packages undesirably balloon and sometimes burst.

Summary of the invention

Among the several objects of the invention may be noted the provision, in form-fill-seal packaging apparatus of the class described, of means for delivering fluent solid material through the mandrel into each package as it is formed with accompanying gas-flushing of the package; the provision of such means adapted intermittently to deliver a measured quantity of fluent solid material into each package as it is formed and to maintain an atmosphere of gas in the package; the provision of such means which recirculates the flushing gas; and the provision of means for forming the packages in such manner as to take care of gas evolved from the product in the packages without undue distortion or bursting of the package, and the package so formed.

Briefly, the present form-fill-seal packaging apparatus comprises a downwardly extending mandrel around which a web of packaging material is formed into tubing. Means are provided for forming a longitudinal seam for the tubing, feeding the tubing downward off the lower end of the mandrel, and forming transverse seals across the tubing below the lower end of the mandrel to form packages. A delivery passage is provided in the mandrel for delivery of product and gas into the portion of the tubing below the lower end of the mandrel, and an exhaust passage is provided for exhaust of gas from the portion of the tubing below the lower end of the mandrel. Passaging interconnects the exhaust passage and the delivery passage and means in this passaging effects a constant circulation of gas downward through the delivery passage into the portion of the tubing below the lower end of the mandrel, through the exhaust passage, the stated passaging and back to the delivery passage. In addition, means is provided for intermittently introducing into the delivery passage a measured charge of product. Each package may be formed with a flattened portion providing a deflated portion of the package adapted for inflation under pressure of gas evolved from the product to accommodate the gas without undue distortion of the package. Other objects and features will be in part apparent and in part pointed out hereinafter.

Brief description of the drawings

FIG. 1 is a partial diagrammatic view illustrating apparatus for forming, filling and sealing tetrahedron-shaped packages in accordance with this invention;

FIG. 2 is an enlarged vertical section on line 2—2 of FIG. 1;

FIG. 3 is a diagrammatic view illustrating a moved position of a part of the apparatus of FIG. 1; and

FIG. 4 is a perspective of a completed package.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Description of the preferred embodiment

The invention as herein illustrated and described is used in apparatus such as shown in the above-noted U.S. Patent 3,221,469 for forming, filling and sealing tetrahedron-shaped packages. Referring to FIG. 1, there is indicated at 1 a vertical hollow mandrel corresponding to mandrel 1 shown in this patent. Briefly, a web of flexible packaging material W, which is heat-sealable on one side as indicated at S, is drawn from a web roll (not shown) and formed into tubing T around the mandrel 1, with its heat-sealable side S on the inside, and with its side margins brought together in inside-face-to-inside-face outwardly projecting relation. The flexible packaging material may comprise, for example, laminated layers of paper and metal foil with a coating of thermoplastic material, such as polyethylene, on the paper layer.

The tubing T is intermittently fed downward off the lower end of the mandrel in package length increments by grasping the outwardly projecting side margins and pulling downward thereon. The grasp on the side margins is taken by a pair of vertically positioned heat-sealing heads 3A and 3B, which apply heat as well as pressure to the side margins as the tubing is fed downward to cause the side margins to become heat-sealed together thereby to form a longitudinal seam L for the tubing. Heads 3A and 3B are brought together to clamp the side margins, then move downward to feed the tubing downward, then open, and then return upward to clamp the side margins and initiate downward feed of the tubing through another package length increment. As the side sealers 3A and 3B move downward, the longitudinal seam L is folded over on the tubing.

There is a dwell interval between successive down strokes of the tubing during which a transverse package-end-forming seal E is made across the tubing below the lower end of the mandrel, successive package-end-forming seals being in vertical planes substantially at right angles to one another thereby establishing the tetrahedron shape for the packages, one of which is shown about to separate from the tubing and designated P. The seals are made by a first pair of heat sealing heads 5A and 5B operating in a horizontal plane below the lower end of the mandrel and by a second pair of heat-sealing heads 5C and 5D operating in the same horizontal plane as the end sealers 5A and 5B, but at right angles thereto.

During production of packages P, the two pairs of end sealers are alternately actuated during successive dwells of the tubing to form the end seals and, when the end sealers are open, a package length increment of tubing T is fed downward by the side sealers 3A and 3B for filling of the package. As each package-end-forming seal is formed, the tubing T is cut on a line located between the upper and lower confines of the seal to segment each package P from the tubing as the formation of the package is completed. Reference may be made to the above-mentioned U.S. Patent 3,221,469 for a full disclosure of the apparatus for carrying out the above-described operations.

In accordance with this invention, means is provided for filling the packages P with a fluent solid product, such as ground coffee, and for flushing the packages with a gas, such as nitrogen, as they are filled, comprising a dispenser 7 feeding a fill or delivery tube 9 concentrically mounted within the mandrel 1. The dispenser 7 is constituted by upper and lower plates or heads 11 and 13, respectively, having a block 15 slidably received therebetween, the block having transverse chambers or openings 17 and 19 therein. The head 11 has a pair of spaced openings 21 and 23 respectively connected to a source of the granular coffee and a supply of the nitrogen, and the lower head 13 has an opening 25 in communication with the upper end of fill tube 9. The mandrel, which is constituted by a cylindric tube, is closed at its upper end and has a larger inner diameter than the outer diameter of the fill tube 9 for forming an annular passage 27 therebetween, the latter constituting a gas exhaust passage as will be more fully set forth hereinafter.

Opening 21 in upper head 11 is in communication with a fill chamber 29 connected via a delivery conduit 31 to a product hopper 33. The arrangement is such that the chamber 17 in slide block 15 is filled with a metered quantity of the product from hopper 33 and the chamber 19 establishes communication between the gas supply and the fill tube 9 when the slide block is in the filling or loading position illustrated in FIG. 1. An air cylinder (not shown) or the like is connected to the slide block 15 for horizontally reciprocating the block between the upper and lower heads 11 and 13 between the loading position of FIG. 1 and the discharge or dispensing position of FIG. 3. In this discharge position, the chamber 17 is disposed over the opening 25 in the lower head 13 for discharge of the product through the fill tube into the tubing T at the bottom of the mandrel 1.

The gas-flushing system is generally designated 35. It includes a plenum 37 having a blower 39 therein. The blower inlet is indicated at 41. The plenum receives the blower output, and receives gas, e.g., nitrogen, from a supply 43 of gas under pressure, e.g., a bottle of gas. The gas is delivered from the bottle 43 to the plenum via a line 45 having a flowmeter 47 therein for regulating the gas feed. Gas for purging the product in the hopper 33, conduit 31 and chamber 29 is delivered from the bottle 43 to conduit 31 via lines such as indicated at 49 each having a flowmeter 51 therein for regulating the gas feed. The plenum 37 has an outlet 53 connected by a line 55 to opening 23 in the upper head 11. Chamber 29 is connected to the blower inlet 41 by a line 57. The annular chamber 27 in the mandrel 1 is connected to the blower inlet 41 by a line 59. A breather bag 61 is provided in communication with the plenum for indicating the pressure therein.

Certain products, in particular coffee, evolve gases, such as carbon dioxide. Gas may be evolved in such quantity as to cause ballooning of the package and even to cause the package to burst, unless provision is made for accommodating the evolved gas. For this purpose, provision is made for deflating each package as it is formed so that each package may expand under internal pressure of gas evolved from the contents of the package, without ballooning and without danger of bursting. As shown in FIGS. 1 and 2, this is accomplished by providing the transverse sealing heads 5A and 5B with pressers 63A and 63B and by providing the transverse sealing heads 5C and 5D with similar pressers 63C and 63D for flattening the tubing adjacent each transverse seal as it is formed in a zone lying below the seal made by heads 5A and 5B or the seal made by heads 5C and 5D, as the case may be. Each presser comprises a sheet metal backing plate 65 having an upper flange 67 by means of which it is secured to the respective transverse sealing head with the backing plate extending down from the head. Each backing plate has an upper vertical section 69 and a lower outwardly flaring section 71. On the inside face of each plate is a resilient pad 73, which may be a polyurethane foam pad. This may be adhered to the plate and the latter may have its lower margin bent around the lower margin of the pad as indicated at 75.

The location of the vertical sections 69 of the backing plates 65 relative to the working faces of the transverse sealing heads and the uncompressed thickness of the resilient pads 73 is such that as the transverse sealing heads 5A and 5B close, the pads 73 carried by these heads engage the tubing T just below the heads and flatten the tubing just before the working faces of the heads come together and form the transverse seal across the tubing, as permitted by compression of the pads. Similarly, as the heads 5C and 5D close, the pads 73 carried by these heads engage the tubing T just below the heads and flatten the tubing just before the working faces of the heads come together and form the transverse seal across the tubing, as permitted by compression of the pads. Thus, as the upper end seal for each package is made, the upper end portion of the package, including a portion below the upper end seal, is pressed together to provide a deflated portion of the package adapted for inflation under pressure of gas evolved from the product in the package to accommodate the gas without undue distortion of the package.

Referring particularly to FIG. 4, a completed package P is shown to be approximately of tetrahedral shape, comprising a length T1 of the tubing T having at one end a flattened portion 77 in a first plane and a transverse seal E1 across this flattened portion in said first plane adjacent this end of the tubing and located adjacent the outer end (the upper end, as shown) of the flattened portion 77. A transverse seal E2 extends across the tubing adjacent its other end in a second plane generally at right angles to the first plane. The package contains a product such as coffee which may evolve a gas, and the flattened portion 77 constitutes a deflated portion adapted for inflation under pressure of gas evolved from the product without undue distortion of the package. Generally, the deflated portion 77 will, under pressure of the gas, expand as indicated by the dotted lines in FIG. 2 to the point where the package, initially formed as a tetrahedron with a flattened end, becomes a full tetrahedron.

Operation is as follows:

FIGS. 1 and 2 show the end sealers 5A and 5B closed on the tubing T below the lower end of the mandrel 1 and fill tube 9, and a completed package P below the sealers having an end seal E at its lower end. This package will also have a seal at its upper end as formed by the closed

sealers 5A and 5B. Closure of end sealers 5A and 5B will also have effected the forming of the lower end seal for the next package, and the segmenting of the completed package from the tubing, as will be apparent from U.S. Patent 3,221,469. Deflators 63A and 63B on end sealers 5A and 5B squeeze the side walls of the package P together at its upper end to allow the package ultimately to expand as gas (e.g., carbon dioxide) is evolved from the product (e.g., coffee). End sealers 5A and 5B then open, and side sealers 3A and 3B move downward to feed a package length of tubing T downward off the lower end of the mandrel preparatory to forming the next successive package. As the tubing T is fed downward, block 15 is reciprocated from its FIG. 1 position wherein the chamber 17 is filled with a metered charge of the coffee from hopper 33 to its FIG. 3 position over opening 25 in lower head 3 for discharge of the coffee through fill tube 9 into the tubing below the mandrel. It should be noted that prior to movement of the block 15, flushing gas is supplied via the pump 39 and conduit 55 through the chamber 19 in the block and down the fill tube 9 into the tubing beneath the lower end of the mandrel. This gas is returned for recirculation through the exhaust passage 27 and the conduit 59 to the pump 39. Additional gas, as may be required from time to time, is supplied to the plenum 37 by the bottle of compressed gas 43 and flowmeter 47 through conduit 45. The bag 61 provides a visual indication of the pressure in the system. The gas also exits via flowmeters 51 through conduits 49 for purging the coffee in the delivery conduit 31 prior to entry into the chamber 17. This gas, and the gas contained in chamber 17 when it returns from its discharge to its loading position, is returned to the pump 39 through conduit 57. It should be noted that the distance between chambers 17 and 19 in block 15 is less than the diameter of opening 23 so that the fill tube 9 is never out of communication with the flushing gas supplied through conduit 55. That is, in the FIG. 1 loading position of the block 15, the flushing gas is supplied directly through the chamber 19 to the delivery tube 9. Furthermore, as the block 15 slides to its FIG. 3 discharge position, the chamber 17 intersects openings 23 and 25 before the chamber 19 slides out of communication with these openings. Thus, the flushing gas is continuously supplied to the tubing T below the lower end of the mandrel during loading and discharging of the chamber 17 with the product. The flow of gas through the chamber 17 during discharge of the product into the fill tube 9 speeds the flow of the product through the fill tube into the tubing T.

After filling of the tubing with the charge of coffee from chamber 17 (the tubing having been sealed at its end by end sealers 5A and 5B), the side sealers 3A and 3B open and return upward. During the ensuing dwell of the tubing, end sealers 5C and 5D close (above the level of the product in the lower end portion of the tubing) to complete the next package. End sealers 5C and 5D then open, and the operation is repeated with end sealers 5A and 5B closing the tubing and so on.

From the above, it will appear that the filling of each package P as it is formed with the fluent solid product metered out by the chamber 17 occurs in an atmosphere of nitrogen, or other suitable gas other than air, and that as a result, each package is sealed with an atmosphere of nitrogen therein rather than air. The excess nitrogen is readily returned to a nitrogen pump for recirculation via the annular passage 27 formed between the fill tube and the mandrel. In addition, each package, as initially formed, is flattened (deflated) at one end thereof over a zone inward of the transverse seal at that end to allow for expansion of the package without any substantial ballooning under pressure of gas evolved from the contents of the package, and thereby avoiding danger of bursting of the package due to internal gas pressure. It will be understood, of course, that in the case of packaging of products which do not evolve a gas, the pressers 63A–63D may be omitted, since there is then no necessity for providing the deflated portion 77 in a package.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In form-fill-seal packaging apparatus having a downwardly extending mandrel around which a web of packaging material is formed into tubing and having means for forming a longitudinal seam for the tubing, feeding the tubing downward off the lower end of the mandrel, and forming transverse seals across the tubing below the lower end of the mandrel to form packages: means for filling the packages as they are formed with a fluent solid product and gas-flushing the packages comprising a delivery passage in the mandrel for delivery of product and gas into the portion of the tubing below the lower end of the mandrel and an exhaust passage for exhaust of gas from the portion of the tubing below the lower end of the mandrel, passaging interconnecting said exhaust passage and said delivery passage, means in said passaging for effecting a constant circulation of gas downward through said delivery passage into the portion of the tubing below the lower end of the mandrel, and through said exhaust passage and through said passaging and back to the delivery passage, and means for intermittently introducing into said delivery passage a measured charge of product.

2. In apparatus as set forth in claim 1, said delivery passage comprising a tube extending downward through the mandrel, said tube having an outer diameter less than the inner diameter of said madrel.

3. In apparatus as set forth in claim 2, said exhaust passage comprising the tubular interspace between the mandrel and the delivery tube.

4. In apparatus as set forth in claim 3, said means for effecting a constant circulation of gas comprising a pump in said passaging.

5. In apparatus as set forth in claim 1, said means for intermittently introducing into said delivery passage a measured charge of product comprising a dispenser having a first chamber therein, said dispenser being movable from a first position wherein said chamber is filled with a charge of the product to a second position wherein said chamber discharges said product into said delivery passage.

6. In apparatus as set forth in claim 5, said dispenser having a second chamber therein, said second chamber registering with said delivery passage when said dispenser is in said first position for delivery of gas therethrough to said delivery passage.

7. In apparatus as set forth in claim 6, said delivery passage comprising a tube extending downward through said mandrel, the tube having an outer diameter less than the inner diameter of the mandrel for forming a tubular interspace therebetween, said tubular interspace constituting said exhaust passage.

8. In apparatus as set forth in claim 7, said means for effecting a constant circulation of gas comprising a pump in said passaging, and a source of gas interconnected to said pump.

9. In apparatus as set forth in claim 8, a product hopper for filling said first chamber with the product, means interconnecting said source of gas and said hopper for purging the product of air, and means interconnecting said hopper and said pump for return of gas from the hopper and the first chamber to said pump.

10. In apparatus as set forth in claim 1, means for flattening a portion of the tubing adjacent each trans-

verse seal as the seal is formed, thereby partially deflating each package to permit expansion of the packages after sealing due to evolution of gas from the product.

11. In apparatus as set forth in claim **10**, the means for forming transverse seals across the tubing comprising first and second pairs of movable sealing heads, and said flattening means comprising pressers carried by said heads and located below said heads.

12. In form-fill-seal packaging apparatus having a downwardly extending mandrel around which a web of packaging material is formed into tubing and having means for forming a longitudinal seam for the tubing, means for feeding the tubing downward off the lower end of the mandrel, and first and second pairs of sealing heads for forming transverse seals across the tubing below the lower end of the mandrel to form packages: means for filling the packages as they are formed with a fluent solid product, means for gas-flushing the packages as they are formed, and means for flattening a portion of the tubing adjacent each transverse seal as the seal is formed, thereby partially deflating each package to permit expansion of the packages after sealing due to evolution of gas from the product.

13. In apparatus as set forth in claim **12**, said flattening means comprising pressers carried by said heads and located below said heads.

14. In apparatus as set forth in claim **13**, each presser comprising a backing having a compressible resilient pad thereon, the pads being engageable with the tubing before the working faces of the heads engage the tubing.

15. In apparatus as set forth in claim **14**, said pressers having vertical sections extending downward from the seal bars and lower sections flaring outward.

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53—182; 206—46