

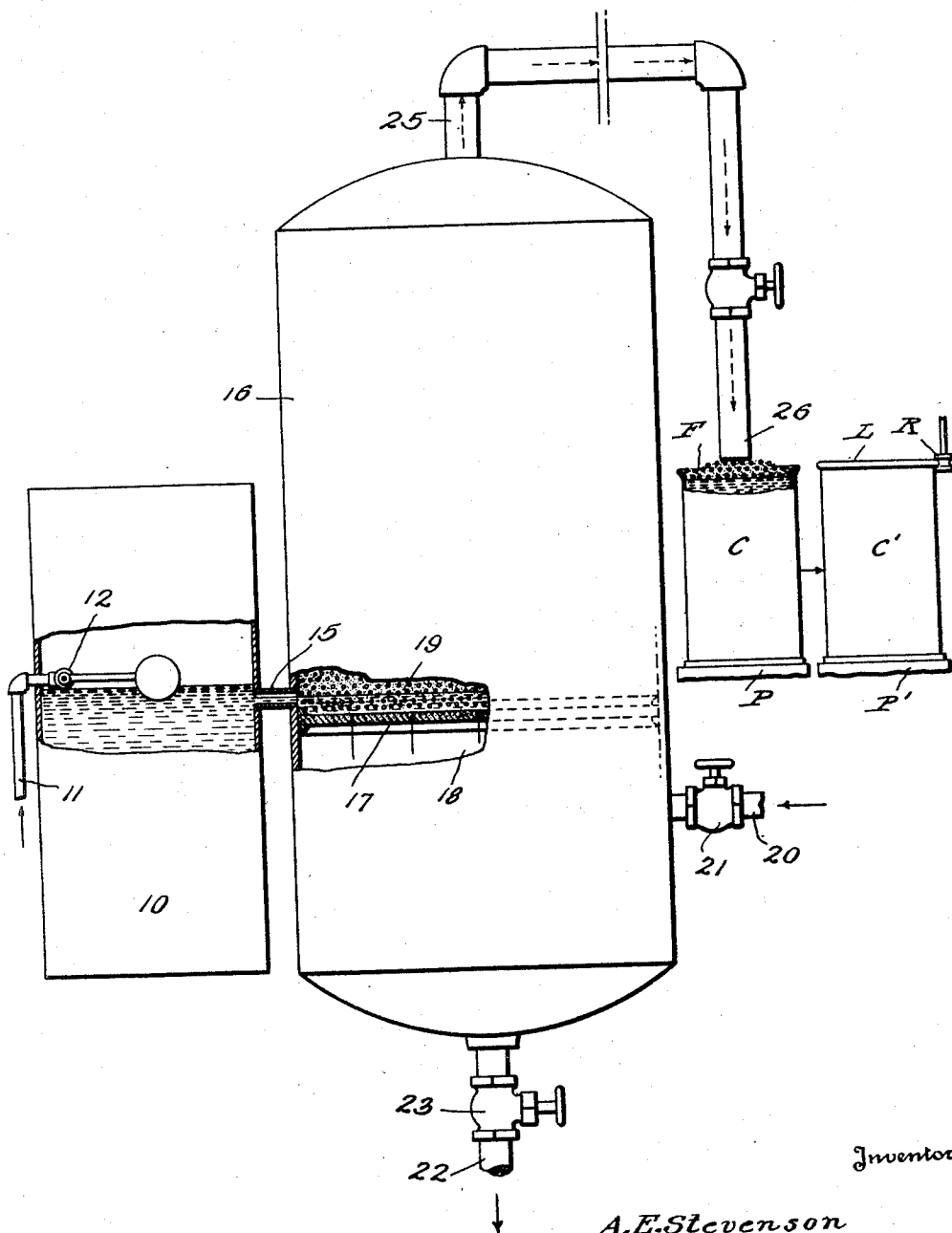
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ART OF DISPLACING AIR IN THE PACKAGING OF PRODUCTS
BY THE USE OF BUBBLES OF INERT GAS

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ART OF DISPLACING AIR IN THE PACKAGING OF PRODUCTS BY THE USE OF BUBBLES OF INERT GAS

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1 In packaging products, it is often desirable to exclude air from the container as an incident of the packaging and sealing.

It has heretofore been proposed to employ evacuation of the air, followed by admission of a replacement gas prior to closure, as well as closing while the container is under reduced pressure; likewise, to employ jets or currents of gases and vapors for eliminating air from the containers as an incident of filling and closing; and to provoke the formation of foam within the filled container by causing a gas to bubble through a liquid content in the container.

The present invention is concerned with the production of a foam externally of the container, and the delivery of this foam into the filled container for displacing air from the head space thereof, and with the closing of the container while the head space is occupied by such a foam.

In practice, it is preferred to employ for the foam-producing liquid a material which is natural to the product to be packaged; and to employ for the gas an inert or non-oxidizing substance such as nitrogen, carbon dioxide, hydrogen, steam, etc.

In packaging products, the containers are ordinarily not completely filled, and a small space is left at the top which is commonly termed the "head space." This provision is necessary because, if the container is completely filled, there is interference with the sealing operation. At the time of closing, this head space contains some air and usually some vapor from the product being packaged, the total vapor pressure being that of the atmosphere, and with the partial pressure of air depending on the temperature of the product in the container, and the actual volume of such air being dependent upon partial pressure and upon the volume of the head space.

This air should be removed as completely as possible, because the oxygen thereof may cause changes in the product with resultant undesirable changes in flavor, and, in some instances, in color. Further, if the container includes a metal such as iron or tin-plate, the oxygen may cause corrosion of the interior of the container, particularly adjacent the head space. In employing jets or currents of inert gases such as steam, nitrogen or carbon dioxide, just previous to the closing, difficulty has been encountered in effectively replacing the air because of the relatively low density and high molecular velocity of such gases; and, in addition, diffusion and air currents tend to carry these gases out of the head

2 space again, whereby air is again present in the head space.

When the gas is incorporated in a foam, and this foam is delivered into the head space for filling the same, the foam behaves as a viscous liquid rather than as a vapor or gas, and is sufficiently heavier than air to displace the air from the head space; and the foam can be caused to remain in place in the head space until the can is closed. The compressibility of the gas in the foam permits the seating and sealing of a cover without difficulty, as compared with the troubles of attempting to close and seal a container which has been completely filled with liquid.

It is further a part of the present invention to introduce to the liquid which is to form the foam a substance in the nature of a surface tension controlling agent which will assure a stability to the foam over the time interval incident to the placing and closing of the cover.

An illustrative form of apparatus for practicing the procedure is shown in the accompanying drawing.

In this drawing, a liquid reservoir 10 is supplied with a liquid through a pipe 11 and under control of a float valve 12 whereby a substantially constant liquid level is maintained in the reservoir 10.

A restricted conduit 15 connects the reservoir 10 with a foam chamber 16 which includes closing walls and a partition 17 which is positioned essentially horizontally for dividing the foam chamber into a lower compartment 18 and an upper compartment 19. This partition plate 17 is porous so that it permits movement of gas therethrough: but the pores are of such small individual size that liquid is essentially prevented from any downward flow. Therefore, the flow of liquid from the reservoir 10 through the restricted conduit 15 leads to the formation of a thin layer of liquid on the upper surface of the porous partition plate 17.

A source of inert gas under pressure is connected to the lower compartment 18 of the foam chamber, illustratively by the employment of a conduit 20 for such gas, and with inclusion of a control valve 21 whereby the rate or volume of flow may be varied. This lower compartment 18 is also preferably provided with a bottom discharge conduit 22 including a shut-off valve 23.

The upper compartment 19 of the foam chamber is normally larger than the lower compartment 18, and leads into a discharge conduit 25 at its top, this conduit being continued to a nozzle end 26 positioned over a container C resting

ing upon a platform P. The container C is illustrated as filled to a normal level with a product including a liquid. Illustratively, the product may be orange juice, peas or corn with the usual sauce or juice, etc.

When a filling F of foam has totally occupied the head space of the container C, this container is moved to a position C' upon platform P', being provided meanwhile with a cover L, which can be secured in place by suitable means illustrated conventionally as a double seaming roll R.

During operation of the device, an essentially constant film of liquid is maintained on the porous partition plate 17, and an inert gas at constant pressure and in constant volume enters from the source 20 into the lower compartment 18, flows upwardly through the partition 17, and produces bubbles in the liquid layer, these bubbles rising and forming a foam filling within the upper compartment 19, and establishing therein a sufficient pressure so that the flow continues through the conduit 25, with expulsion of all original air from the foam chamber and from the conduit, until the foam flows essentially as a viscous liquid from the nozzle end 26. The container C is positioned beneath the nozzle end 26 as stated, is over-filled with the foam, advanced to the position C', closed and sealed, and this operation continues in the same fashion.

When the packaged material is orange juice, it is preferred likewise to provide orange juice as the liquid entering through the pipe 11, wherewith the liquid position of the foam is natural to the material being packaged in the container C, and no foreign materials save the inert gas itself are introduced incident to the de-aeration of the head space.

When peas, beans, corn, etc., are being packaged, it is feasible to employ a part of the sauce in normal or dilute state as the liquid entering through the pipe 11 for producing the foam in quantity and concentration to obtain the desired amount and strength of same in the sealed container.

When the liquid to be contained in the package does not provide a sufficiently stable foam for permitting the delivery into the container and the maintenance therein for the time required for closing, a surface tension reducing substance can be introduced. The selection of this substance depends upon the nature of the material being packaged. Dried egg albumin, in amounts of $\frac{1}{4}$ to $\frac{1}{2}$ ounce per gallon of water (i. e., about 0.2 to 0.4 percent by weight) is satisfactory where the temperature is kept below about 140 degrees F., to avoid coagulation. Gelatin in an amount of 1 ounce per gallon gave satisfactory results with cold and hot water solutions. Sodium alginate in the proportion of 1 ounce per gallon of water is very satisfactory; and as low as $\frac{1}{2}$ ounce may be used. Gum arabic in the proportion of 1 ounce per gallon of water has given fair results. Casein can be employed. In general, the substances for use with foodstuffs are non-toxic and preferably edible, and are present in quantities of 0.1 to 1.0 percent of the weight of the water.

It is preferred to have the foaming liquid produce a foam of high stability, to ensure that the foam will remain in form until the closure can be applied and sealed; and it will be understood that this can be effected even though the size of the individual bubble increases by rupture of intervening walls. Usually the bubbles have a diameter of 1 to 3 millimeters as formed. In prac-

tical tests of foam with cold orange juice and a gas, 400 cc. of foam contained 16 cc. of liquid: the same juice when heated had 8 to 10 cc. of liquid per 400 cc. Water containing $\frac{1}{2}$ ounce of albumin per gallon left 13 cc. of liquid from 400 cc. of foam, and usually is less than 5 percent. As the head space is small in comparison to the container volume, it will be noted that any tension controlling agent is present in very small ratio to the total contents of the container.

It is obvious that the invention is not limited to the form of practice shown, but that it may be employed in many ways within the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. The method of packaging material in a container and eliminating air from the head space thereof, which comprises passing an inert gas into a foam-forming liquid outside of the container whereby to form a foam, delivering the foam into the container whereby to displace the air therefrom, the container having a partial filling thereof, and therewith having a head space, and then sealing the container with the foam filling the head space thereof.

2. The method of packaging material in a container and eliminating air from the head space thereof, which comprises preparing a foam-forming liquid for forming a part of the contents of the container, passing an inert gas into the liquid outside of the container whereby to provoke the formation of foam, delivering the foam into the container whereby to displace the air therefrom, the container having a partial filling therein and therewith having a headspace, and then sealing the container with the foam filling the head space thereof.

3. The method of packaging material in a container and eliminating air from the head space thereof, which comprises preparing foam-forming liquid for forming a part of the contents of the container, said liquid including a surface tension reducing agent, passing an inert gas into the liquid outside of the container whereby to provoke the formation of foam, and then delivering the foam into the container whereby to displace air therefrom.

4. The method of packaging a foodstuff in the substantial absence of air, which comprises preparing an aqueous foam-forming liquid for forming a part of the contents of the container, said liquid including 0.1 to 1.0 percent by weight of a non-toxic and edible surface tension reducing agent, passing an inert gas into the liquid outside of the container whereby to provoke the formation of foam, delivering the foam into a container having the foodstuff therein whereby to displace the air from the headspace thereof, and then sealing the container with the foam filling the headspace.

5. The method of packaging a foodstuff in a container in the substantial absence of air, which comprises passing an inert gas into a foam-forming liquid outside of the container whereby to form a foam, delivering the foam into the container whereby to displace the air therefrom, the container also receiving a quantity of the foodstuff to be packaged in amount insufficient to completely fill the container, and then sealing the container with the foam completing the filling thereof.

6. The method of packaging a material in a

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container, which comprises passing an inert gas into a foam-forming liquid outside of the container whereby to form a supply of foam, and then delivering the foam into the container whereby to displace the air therefrom.

7. The method of packaging a foodstuff in and eliminating air from a container having an incomplete filling of foodstuff therein which comprises passing an inert gas into a foam-forming liquid outside of the container for providing a supply of foam, delivering a sufficient quantity of foam into the head space of the container to

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totally displace the air therein, and then sealing the container with the foam filling the voids thereof.

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