METHOD OF DEOXYGENATING AND PACKAGING OF FOOD PRODUCTS

Filed July 15, 1968 2 Sheets-Sheet 1

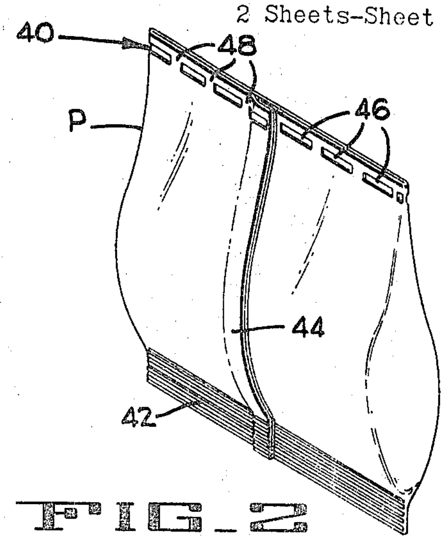

FIG_2

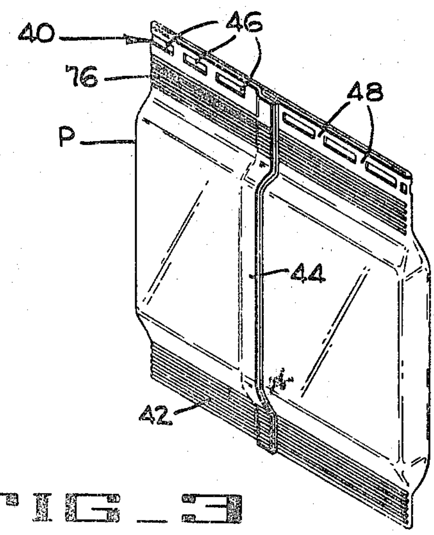

FIG_3

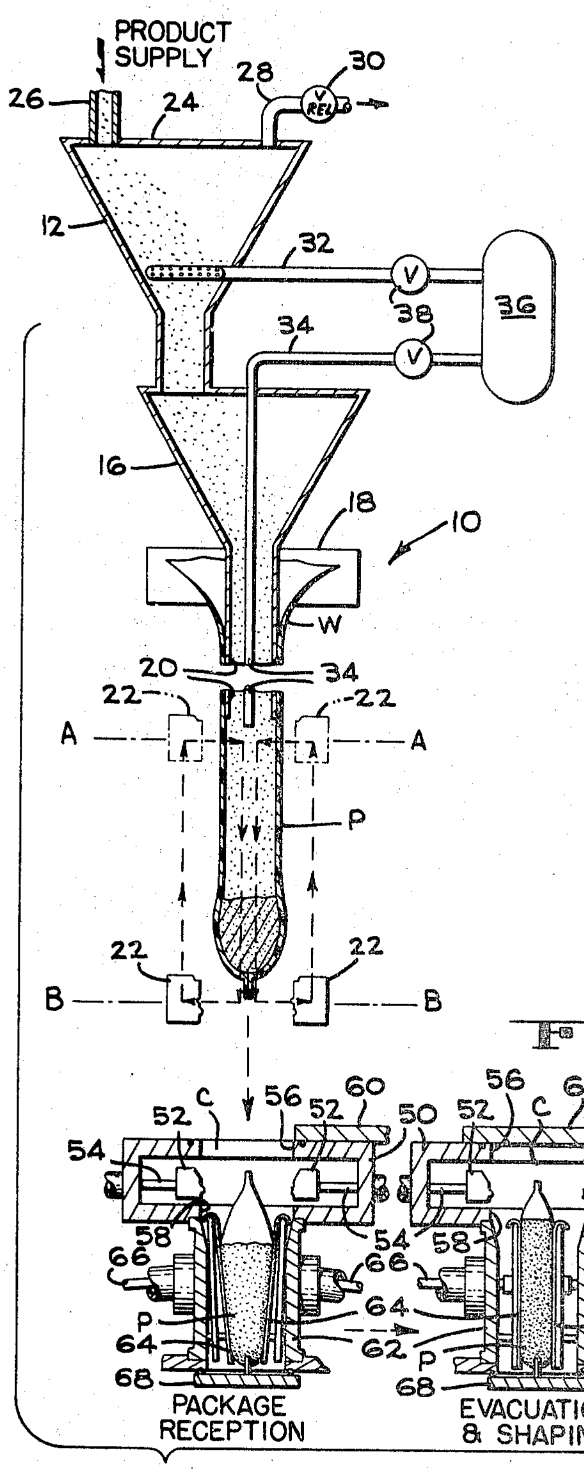

FIG_1

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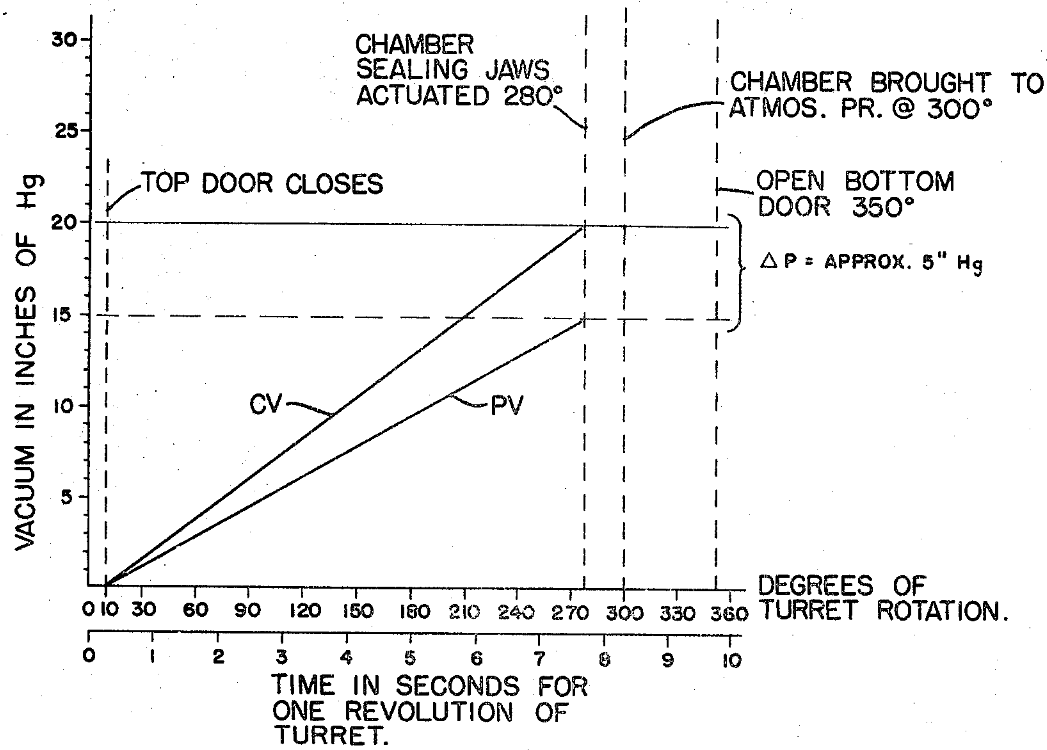
FIG_4



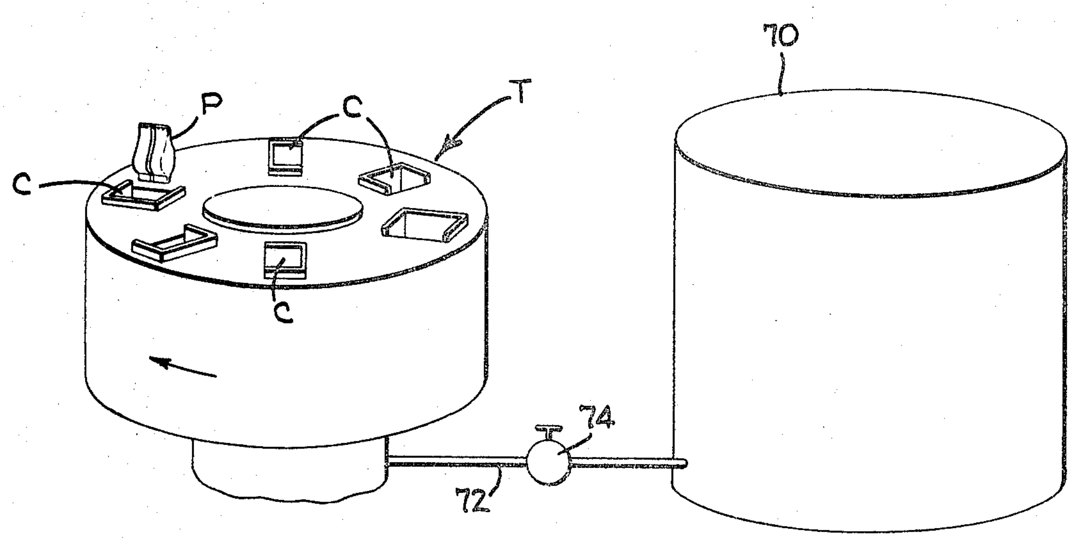


FIG_5

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METHOD OF DEOXYGENATING AND PACKAGING OF FOOD PRODUCTS

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ABSTRACT OF THE DISCLOSURE

A free flowing granular food product is packaged in packages made of suitable thermoplastic web material. The product is stripped of a major portion of its oxygen by the action of an inert gas, such as nitrogen, before it is deposited in the package. The package is of the type produced by a form, fill and seal machine and it is provided with an upper interim seal which allow flow of fluid from the package. Further reduction of the oxygen content is achieved by putting the package in a vacuumizing chamber, which includes sealing tools therein, for hermetically sealing the package while flow of fluid is occurring from the package to the chamber.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a novel food package and a novel method for reducing the oxygen content of the package and yet result in a package which is substantially wrinkle-free and resistant to leaks occasioned by rough handling during shipping.

Description of the prior art

Continual efforts are being made to package perishable foods attractively and to increase their shelf life. It has been a long standing practice to package such foods in rigid hermetically sealed containers such as glass or cans at reduced pressures. This method is more commonly referred to as vacuum packaging. Some perishable foods which heretofore have been packaged in this manner are now packaged in flexible, usually transparent, webs of cellophane, foil or plastic which can be coated and laminated or combined in an infinite variety of ways to provide for a specific product the exact amount of strength, moisture proof, grease proofness or other protective quality needed. Packages of this nature can be formed and heat sealed to provide barriers against gases, watervapors, odors, etc., to guard product sterility or to retain vacuum.

Certain packaged food products, an example of which is coffee, will become rancid unless they are deoxygenated. One method used is to expose the product to an atmosphere of inert gas, nitrogen and carbon dioxide being the most common. This method is commonly referred to as washing or stripping. Methods of this nature are disclosed in U.S. Pats. 2,830,911, 3,077,405, 3,039,882 and 2,102,716.

Further reduction of the oxygen content of foods packaged in flexible material has been achieved by evacuating the container. A representative patent showing gas treatment and evacuation of packages is shown and disclosed in patent to Maxwell 2,145,941.

SUMMARY OF THE INVENTION

In accordance with the present invention packages of flexible material are filled with product which has been stripped by an inert gas and the package, whether of the pillow or four seal type, is provided with an interim seal

at one of its margins serving to prevent the infiltration of oxygen during the period when the package is transferred to a vacuumizing apparatus and to control the rate at which evacuation of the package occurs. Moreover, the package is finally hermetically sealed while flow of gas is occurring from the package. Sealing under this condition further prevents the diffusion of oxygen into the package since the internal pressure of the package is higher than that of its surroundings. Such a result follows from the fact that the partial interim seal is made with one or more restricted openings, sometimes referred to as throttles or orifices, which establish a pressure drop during flow of gas from the package. The size and number of the orifices depends upon such factors as the rate of vacuum draw, the physical property of the film and the packaged product.

Further, in accordance with this invention a method of packaging perishable foods in packages is achieved which reduces the oxygen content to 1½ percent or less by initially stripping a portion of the oxygen by exposing the food to flowing inert gas before it is put in the package, depositing the package in a chamber which is initially open to the atmosphere, closing the chamber and immediately thereafter connecting the chamber to a source of vacuum to with draw the oxygen-containing atmosphere therefrom at a rate which establishes a lower pressure in the chamber than that of the package to thereby cause fluid flow from the package to the chamber through the orifices. When the chamber reaches a certain level of vacuum, dictated by the desired package hardness, the package is hermetically sealed by sealing jaws in the chamber. Sealing of the package occurs while there is fluid flowing from the package to the chamber. The vacuum to the chamber is then interrupted and the chamber is returned to atmospheric conditions which facilitates opening the chamber to remove the package.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic representation of a portion of a form, fill and seal machine showing the product supply and feed hoppers provided with means for supplying inert gas into the hoppers and also showing a package in one stage of its formation. FIG. 1 also shows diagrammatic longitudinal sections, on reduced scale, of various stages of a vacuum chamber used to evacuate a package.

FIG. 2 is a pictorial representation of a package that has been made and filled on the form, fill and seal machine particularly illustrating its bulbous or tear drop shape and the preferred form of the interim seal adjacent the top margin thereof.

FIG. 3 is another pictorial representation of the final package which has been evacuated, shaped and sealed in the vacuum chamber.

FIG. 4 is a graph plotting vacuum in inches of mercury on the ordinate against degrees of turret rotation and the rate of turret rotation on the abscissa. The curves represent the rate of change of the chamber vacuum and package vacuum.

FIG. 5 is a diagrammatic illustration of the vacuum turret connected to a source of vacuum.

Referring to FIG. 1 which diagrammatically illustrates a portion of a form, fill and seal machine, generally indicated by the numeral **10**, it will be seen that it comprises a supply hopper **12** connected by a conduit **14** to a feed hopper **16**. The machine also includes the usual former **18** for constraining an elongate web W to assume a tubular configuration embracing the outer surface of a feed tube **20** which is connected to the lower end of the feed hopper **16**. A series of packages P, containing a measured amount of product, are formed by an opposed pair of sealing and cut off tools **22** each of which trace a generally rectangular path shown in dotted outline. When the tools 22 are in their upper position, shown in phantom outline and indicated by the reference plane A—A, they are concurrently moved toward each other and come into contact with the web tube and thereby cause flattening and sealing thereof. While the tools are in firm contact with the web they are moved downwardly feeding the web until they reach the approximate position of the reference plane B—B at which time they are concurrently moved away from each other. Prior to the time the tools disengage the web at the plane B—B, means, conventional in the art, are actuated to sever the package thus formed from the web tube.

The tools 22 are provided with sealing faces which simultaneously form an upper interim tack seal on the package and the lower final seal on the succeeding package. The nature of these seals will be explained in connection with the package shown in FIG. 2.

While it is not shown in the drawings it is to be understood that any conventional means, such as an auger, may be provided for dispensing measured amounts of product into the successive packages.

After the package has been severed from the web it freely falls into a chamber, generally designated by the letter C, carried by a turret T, shown in FIG. 5. For structural and operational details of the turret and an associated form, fill and seal machine reference should be made to U.S. applications Ser. Nos. 459,768 filed May 28, 1965 now U.S. Pat. No. 3,488,914 and Ser. No. 579,588 filed Sept. 15, 1966 now U.S. Pat No. 3,488,915 both of which are assigned to the assignee of the present invention. These applications are included herein by reference. After the package has been received in one of the chambers, the chamber is hermetically sealed and evacuated while the package is subjected to the action of shaping members which are rocked alternately bringing the respective upper and lower edges of the shaping members toward each other thereby substantially evenly distributing the material therein which has the beneficial effect of reducing to an absolute minimum the stress on the packaging material and to produce packages of substantially the same envelope shape. The appearance of the completed package is shown in FIG. 3.

The apparatus shown in FIG. 1 includes diagrammatic longitudinal sections of three stages of chamber operation wherein the first (from left to right) shows the package located in the chamber in contact with spaced angularly disposed shaping plates, the second shows the shape the package assumes at the completion of the shaping operation and while evacuation of the chamber and the package is continuing and the third, final sealing of the package while flow of gas or fluid is occurring from the package to the chamber. The legends applied to the respective stages are intended to relate to the above mentioned functions. After the package has been shaped, evacuated and sealed it is removed from the chamber either by allowing it to fall by gravity out of the chamber or removing it manually.

In accordance with an important and fundamental feature of the present invention a food product, preferably of granular form such as coffee, is brought in contact with flowing inert gas to remove a major portion of the oxygen therefrom to a level of approximately two to three percent, depositing the partially deoxygenated product in a package made of flexible thermoplastic material, and thereafter evacuating the package under conditions which reliably prevent infiltration of oxygen into the package before it is finally hermetically sealed. To perform these functions in the desired sequence the representative apparatus shown in FIG. 1 can be utilized although various other apparatus may be used as indicated by the prior art patents specified above.

Referring to FIG. 1 it will be observed that the supply hopper 12 is provided with a tightly fitting cover plate 24 having attached thereto a conduit 26 for feeding product, from any convenient source, to the supply hopper 12. Another conduit 28 having a conventional relief valve 30 therein is also connected to the cover plate 24. Inert gas, preferably nitrogen, is supplied to the hopper 12 and the hopper 16 by conduits 32 and 34 which are in communication with a source of nitrogen 36. Regulation of the rate at which nitrogen is supplied to the conduits 32 and 34 is determined by flow control valves 38. The portion of the conduit 32 extending into the supply hopper 12 may take any form such as a torus or a straight section however that portion in the hopper 12 is provided with a series of small jets or an opening for allowing the nitrogen to enter the hopper 12 in sufficient quantity and in a pattern of distribution which will insure contact with all or a major portion of the product entering and passing through the supply hopper 12. One way of ensuring against the infiltration of oxygen into the product feed system is to maintain a pressure within the product feed system slightly greater than that of the ambient conditions. Valve 30 is provided for serving this function since it is adjusted to maintain a slightly higher pressure in the product feed system and to maintain such differential pressure by exhausting the injected nitrogen and the oxygen stripped from the product.

To further increase the amount of oxygen removed from the product the conduit 34 extends slightly below the end of the feed tube 20 to thereby bring the product in contact with the nitrogen while it is being dispensed to the partially formed package or pouch P. The conduit 34 may also take any desired configuration and may include in addition to the opening at the end thereof a series of jets along its length to produce a progressive reduction of oxygen in the product before it is deposited in the package. It is also considered within the scope of this invention to shape a portion of the conduit 34 in the form of a helix extending along the length of the feed tube 20. Such an arrangement would also expose all or a substantial portion of the granular product to the influence of the nitrogen.

According to the above description it should be readily apparent that the product feed system of the present invention provides a closed product feed system wherein the product is constantly subjected to flowing inert gas while effects removal of a substantial portion of the oxygen from the product.

In accordance with another and equally important feature of this invention the package or pouch produced by the form, fill and seal machine, shown in FIG. 2, is made with an interim seal, generally designated as 40, adjacent the upper marginal end thereof which serves two important functions. The first is that it prevents the infiltration of oxygen into the package during the interval of time that the package is completed on the form, fill and seal machine and is finally sealed in one of the chambers of the vacuum turret. And secondly it controls the rate at which the fluid or gas is withdrawn from the package during the evacuation procedure of the vacuum chambers. Therefore in combination with nitrogen washing or stripping of the product before it is deposited into the package, an essential feature of this invention involves the provision of the interim seal 40. Referring particularly to FIG. 2 it will be seen that the package produced by the form, fill and seal machine 10 comprises a bottom final seal 42 and a longitudinal seal 44 made by overlapping the opposite longitudinal margins of the web as is usual in this type of machine. The interim seal 40 comprises a series of spaced tack seals 46 providing unsealed portions 48 therebetween which together define orifices through which gas or fluid may flow from the package to the chamber during evacuation. It has been analytically determined that the total unsealed area o fthe portions 48 comprise approximately five to ten percent of the tack seals 46. While several unsealed portions of 48 are shown it is to be understood that one opening for expelling gas from the pouch would function just as well for most food products although in some instances the time for effecting evacuation of the package would be increased thus reducing the production rate of the machine. Details of the function of the unsealed portions **48**, which define flow orifices, will be explained in greater detail hereinafter in connection with the graph shown in FIG. 4.

The vacuum chamber shown in FIG. 1 will be described to the extent that is necessary for an understanding of the present invention. It is to be understood however that reference should be made to the above mentioned applications for the specific constructional details of the chambers. Each of the chambers of the vacuum turret comprise a jaw housing **50** containing opposed final sealing jaws **52** actuated toward and away from each other in synchronism with the rotation of the turret by pneumatic linear actuators (not shown) having rods **54** connected to the jaws **52**. The jaw housing **50** is provided with an upper opening **56** and a lower opening **58** which are substantially in alignment. The upper opening **56** is associated with a reciprocating door **60** which serves to close the upper opening **56** during evacuation of the chamber. Attached to the lower wall of the jaw housing **50**, and in alignment with the lower opening **58**, is a chamber portion **62** having shaping members or plates **64** respectively attached to rods **66** of linear actuators (not shown) for actuating the plates **64** to thereby effect shaping of the package. As shown and explained in the above referenced applications, the shaping plate actuators are oscillated in a vertical plane to thereby effect rocking of the shaping plate **64** which causes substantially even distribution of the packaged material in the package. The lower end of the chamber portion **62** is provided with another door **68** which is opened and closed in time relation to the rotation of the turret and when opened the completed shaped and evacuated package is free to fall therefrom for reception by any desired receptacle.

Referring now to the graph shown in FIG. 4, it is to be understood that zero degrees of turret rotation is determined when the package has entered a chamber of the vacuum turret T shown in FIG. 1 and identified by the legend, PACKAGE RECEPTION. After the turret has rotated ten degrees the top door closes hermetically sealing the vacuum chamber and simultaneously therewith communication is established between the source of vacuum **70** shown in FIG. 5, connected to the manifold of the vacuum turret by conduit **72** having a throttle valve **74** therein for determining the maximum vacuum draw desired for the chambers of the turret. The vacuum in the chambers of the vacuum turret will be established at a level to produce a package of suitable hardness and oxygen level to suit product requirements. A package of medium hardness has less wrinkles, will yield to impact of external forces and the stress on the film is substantially less than a hard package produced at a high level of vacuum. The fact that there are less wrinkles in a medium hard package reduces the likelihood of "leakers" during shipping since these raised wrinkled portions come in contact with the shipping carton and the constant jostling and resultant friction wears out the film at the raised wrinkled portions. This obviously destroys the acceptability of the package.

The final stages of the process occur, as indicated above, in the chambers of the vacuum turret T. After a package is located in a chamber of the turrent the top door **60** is closed in approximately the first ten degrees of turret rotation and upon closing the chamber is connected to the vacuum source **70**. The pressure of the chamber is reduced substantially in accordance with the curve CV, chamber vacuum, while the pressure in the package is reduced substantially in accordance with the curve PV, package vacuum. It is to be noted that the package vacuum lags the chamber vacuum at all times and at an increasing rate. When the chamber vacuum reaches a value of approximately twenty inches of mercury the sealing jaws

52 are actuated to make a seal **76** which is located immediately below the interim seal **40**. The relationship of these seals is shown in FIG. 3.

Contributing significantly to the lag of the curve PV relative to the curve CV is a fact that unsealed portions **48** define an area of flow which requires a relatively significant pressure difference across the portions **48** before flow will occur from the package to the chamber. The unsealed portions **48** may therefore be characterized as throttling orifices which controllably restrict the flow of fluid thereacross. The orifices **48** also serve the important function of preventing or restricting, to an absolute minimum, the infiltration of oxygen into the package during that interval of time when it is severed from the parent web until the vacuumization of the chamber C is commenced since this is the only time that the stripped package product is exposed to an oxygen rich atmosphere. After the package is received in the chamber the top door **60** of the chamber closes within approximately ten degrees of turret rotation. As mentioned, at this time vacuumization of the chamber commences and the rate of pressure reduction of the chamber substantially follows the curve CV until a value of vacuum of twenty inches of mercury is reached. As shown on FIG. 4 after the turret has completed approximately 280 degrees of rotation the chamber sealing jaws **52** are actuated forming the final seal **76**. At this time the level of vacuum in the package is approximately 15 inches of mercury clearly demonstrating the fact that flow of fluid always accurs from the package to the chamber. Such a physical condition is mainly attributable to the orifices **48** which reliably ensure that the level of vacuum in the package and the chamber never reached a point of equilibrium before the jaws **52** are actuated.

Another condition which must be fulfilled is that the velocity of flow from the package to the chamber is in the range which will not cause induction of the pulverant or granular material into the stream of fluid since this would reduce the measured weight of the product, possibly contaminate the seal area and possibly render some of the turret functions inoperative. Referring to the sequence of chamber operation shown in FIG. 1, it will be noted that during the evacuation and shaping the package experiences a slight ballooning effect since the pressure of the chamber is less than that of the package. This condition is also evident by inspection of the chamber condition legended as PACKAGE SEALING.

When the turret has rotated 300 degrees the chamber is vented to the atmosphere so that its pressure may rise to that of ambient conditions allowing the bottom door **68** to be opened. The bottom door is opened at approximately 350 degrees of turrent rotation and at this time the package drops therefrom.

Once the package is exposed to standard atmospheric conditions the packaging material is collapsed tightly against the packaged product and such collapsing is mainly confined to that portion of the material above the level of the product because the product shaping plates **64** hold the material against the product while the package is in the chamber C.

In view of the above description it is readily apparent that the present invention provides a novel package and method of reducing the oxygen content of such package by vacuumizing the package to remove the gas contained therein with such vacuumization occurring in a vacuum chamber and at a rate which lags the chamber level of vacuum. Under such conditions of vacuum packaging the possibility of contaminating the package with oxygen is reliably prevented since flow always occurs from the package to the vacuum chamber.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention as set forth in the appended claims.

Having completed a detailed description of the invention so that those skilled in the art could practice the same, I claim:

1. In the method of deoxygenating a food product by bringing it in contact with a flowing inert gas such as nitrogen, and subsequently packaging such product in flexible package of thermoplastic material having at one of its margins an interim seal with at least one restricted opening for allowing the passage of gas from such package, the improvement comprising removing the gas from the package by depositing it in a chamber connected to an apparatus for reducing the pressure of such chamber, reducing the pressure of such chamber at a rate to maintain flow of gas from the package to the chamber with such flow taking place through the restricted opening of the package, and completely sealing the package while flow of gas from said package to the chamber is occurring.

2. The method according to claim **1** further comprising subjecting the package to shaping forces for substantially evenly distributing the material thereon and for assisting in exhausting gas from the package.

3. The method according to claim **2** wherein said shaping forces produce a package of desired shape and minimize wrinkling of the thermoplastic material.

4. The method according to claim **1** wherein such chamber is open to the atmosphere when said package is deposited therein, and such interim seal being effective to prevent the infiltration of atmospheric oxygen into the package before the chamber is evacuated.

5. A method of reducing the oxygen content of food

products in packages made of flexible thermoplastic material comprising the steps of sequentially stripping a major portion of the oxygen from the food by bringing the food in contact with flowing inert gas, feeding the food into the mouth of said package, partially sealing the mouth of said package, said partial seal being made to provide at least one opening for the passage of gas from said package, evacuating said package by depositing it in a chamber connectible to a source of vacuum which maintains the pressure in such chamber at a lower level than the pressure in said package thereby causing flow of gas through said opening from the package to the chamber, and finally sealing the package while flow of gas from said package to the chamber is occurring.

6. The method according to claim **5** wherein the oxygen content of such product is in the range of 2 to 3 percent by volume after treatment by the inert gas and wherein the oxygen content is further reduced after evacuation in the chamber.

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U.S. Cl. X.R.

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