

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 525 097 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **15.02.95** (51) Int. Cl.⁶: **B65B 31/04**

(21) Application number: **91908769.2**

(22) Date of filing: **19.04.91**

(86) International application number:
PCT/US91/02697

(87) International publication number:
WO 91/16237 (31.10.91 91/25)

(54) **METHOD AND APPARATUS TO PROMOTE GAS EXCHANGE FROM A SEALED RECEPTACLE.**

(30) Priority: **19.04.90 US 510938**
01.02.91 US 649583

(43) Date of publication of application:
03.02.93 Bulletin 93/05

(45) Publication of the grant of the patent:
15.02.95 Bulletin 95/07

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(56) References cited:
GB-A- 2 200 614
US-A- 1 591 932
US-A- 4 548 824

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Description

The present invention relates to a method and apparatus according to the precharacterizing parts of claims 1, 6, and 9. The precharacterizing parts of claims 1 and 6 are disclosed by US-A-1 591 932.

The invention is especially concerned with treating foods directly in transparent, flexible packages in which the foods are wrapped or otherwise sealed for display and marketing.

The shelf life, both refrigerated and at room temperature, of many food products can be greatly extended if the food product is placed in a substantially oxygen free environment. One way of achieving this oxygen free environment is to evacuate a package containing the food product to a very high level of vacuum. However, when flexible packaging is involved, the use of a high vacuum can distort, compact and crush the enclosed product as the vacuum is applied. For example, bakery products can readily be squeezed or compressed so that they lose their consumer appeal. Shredded cheeses can be compacted to such an extent that they require reshredding. Fruit products can be bruised with a resultant loss of both appearance and flavor.

Meat, fruit and vegetable products subjected to vacuum packing can also undergo liquid purge which diminishes their appearance and flavor. Additionally, meat products subjected to vacuum packaging often adopt a purplish color since no oxy-myoglobin is formed due to the lack of oxygen. This color is sometimes unacceptable for domestic retail marketing, and hence the product must be removed from the vacuum package prior to display and repackaged in a way so as to allow the characteristic red "bloom" to appear in the meat product.

To overcome the aforescribed disadvantages, gas packaging has been used as an alternative to vacuum packing. Gas packaging entails a modification of the atmosphere within the receptacle housing the product so as to introduce a growth inhibiting agent, i.e. an inert gas, or an oxygenating agent, into the receptacle.

It may also be desirable to modify the gas within the receptacle to include a desired concentration of an oxidizing agent, e.g. ozone, so as to reduce or eliminate bacterial concentration within the receptacle.

In instances where gas flush packaging is utilized, it is often desirable to remove a substantial portion of the original, resident atmosphere within the receptacle before introducing a second gas or gas combination. This is desirable so as to decrease the amount of the secondary gas necessary to beneficially affect the containerized product. If

evacuation or partial evacuation of the receptacle is not first undertaken, the secondary gas will be diluted and will therefore be required in greater quantities in order to achieve its intended purpose. At least partial gas extraction is therefore desirable in order to remove the resident gas preliminary to the introduction of a second gas. This gas extraction, however, if conducted in a conventional manner, will also bring about the disadvantages noted above in connection with vacuum packaging in that the package will undergo, if only temporarily, distortion or collapse.

A variety of devices have been developed to address the problems associated with the collapse of a flexible container or receptacle during gas exchange or extraction. One such device is seen in U.S. Patent No. 1,591,932 (the '932 patent) as issued to Young. The '932 patent discloses a method and apparatus for replacing air in a filled container with an inert gas. In the '932 patent, the receptacle is placed within a vacuum chamber and the pressures inside and outside the receptacle regulated so as to avoid the deformation or collapse of the walls of the receptacle. Gas exchange in the '932 patent is accomplished by withdrawing the resident atmosphere from the receptacle via a vent hole while maintaining an equal pressure within the vacuum chamber. When the addition of the inert gas is desired, pressure equalization is accomplished via a yoke which is activated by the pressure of the gas injected into the receptacle.

Disadvantages of the aforescribed apparatus include the need to form an aperture in the container in order to achieve evacuation and repressurization in addition to the need to utilize a secondary sealing step to maintain the second atmosphere within the receptacle.

The present invention addresses the aforescribed and other disadvantages for modifying the gaseous atmosphere in a closed receptacle. More specifically, the present invention addresses the disadvantages associated with the preservation of perishable products by providing a method and apparatus to exchange the gases within said receptacle without inducing distortion or collapse. Moreover, the present invention enables gas exchange to be undertaken in an economical and automated fashion which may be accomplished at various levels along the wholesale or retail chain of distribution.

The solution of the problem underlying the invention is mentioned in claims 1, 6 and 9.

The present invention generally comprises a vacuum chamber provided with a means to move and align a sealed receptacle from a position exterior to the chamber to a desired position within the chamber whereupon the chamber is automatically closed and sealed. Once the chamber is

closed and sealed, a gas exchange probe is automatically inserted into the receptacle through a resealable valve so as to establish flow communication between the interior of the receptacle and the vacuum chamber. The valve is preferably a septum-type valve capable of being penetrated by the probe in a self-sealing relation. A vacuum is then drawn in said chamber thereby evacuating the interior of the receptacle through the gas exchange probe. In such a fashion, distortion or collapse of a flexible receptacle is avoided, since the gas exchange operation does not cause a pressure differential between the interior and exterior of the receptacle.

Gas introduction and exchange is accomplished in a similar manner insofar as the balanced introduction of gas pressure about both the interior and exterior of the receptacle. During the gas reintroduction phase, however, gas introduced into the package is separately valved from the gas used to repressurize the vacuum chamber. In such a fashion, the exchange gas flows only into the interior of the package, while pressure inside the chamber exterior to the package may be maintained by the introduction of a third, less expensive gas, or even outside air.

The present invention has particular application to the packaging of food products in polystyrene foam or other plastic trays which are hermetically sealed with transparent plastic wrap. While many other products may be sealed and marketed in this manner, food products require special care in order to preserve both their quality and appearance.

The present invention has a number of advantages over the art. One such advantage is the ability to maintain a minimum pressure differential between the inside and the outside of the receptacle during gas exchange operations. In such a fashion, distortion of the package and liquid purge of the product is minimized.

A second advantage of the invention is the ability to accommodate automated gas exchange operations without the need to reseal the receptacle in a second, separate operation.

Another advantage is the ability to produce a package having a controlled positive pressure so as to reduce or avoid liquid purging as well as other physical aesthetic benefits.

Other objects and advantages of the invention will become apparent from the following detailed description made in conjunction with the accompanying drawings.

Fig. 1 illustrates a partial cutaway, perspective view of one preferred embodiment of the invention.

Fig. 2 illustrates a side, detail view of the door mechanism illustrated in Fig. 1.

Fig. 3 illustrates a perspective view of a gas exchange apparatus of the present invention as it

may relate to a preferred package design.

Fig. 4 illustrates a top, cut away view of the embodiment illustrated in Fig. 1.

Fig. 5 illustrates a side, detail view of the gas exchange apparatus and accompanying activation means.

Fig. 6 illustrates a schematic view of the gas exchange apparatus.

Fig. 7 illustrates a schematic view of the electrical layout of one embodiment of the invention.

Fig. 1 illustrates a vacuum chamber 6 supported on a frame 2. Chamber 6 is provided with doors 21 and 21A situated on opposite sides thereof so as to allow the progressive movement of receptacles or containers 100 which are preferably moved along conveyor track 4 into and through chamber 6 for purposes of gas exchange and modification as will be further discussed herein.

As illustrated in Fig. 1, conveyor track 4 is preferably situated such that it abuts chamber 6 on opposite sides thereof at a height generally compatible with the operation of internal conveyor assembly 83 as will be further described. Conveyor track 4 may be comprised of a series of rollers 17 linearly assembled along a frame 18 in a generally conventional fashion. Alternatively, track 4 may be comprised of a conventional endless track conveyor assembly. Preferably, however, track 4 should be provided with a means to automatically regulate and govern the linear movement of articles placed thereon. In such a fashion, it is preferred that track 4 be automatically rather than manually operated.

In the embodiment illustrated in Fig. 1, doors 21 and 21A are pivotally attached to chamber 6 about hinges 7 such that they open in an upward fashion as illustrated in Fig. 2. (See arrow B). When in a closed position such as that illustrated in Fig. 1, doors 21 and 21A maintain an airtight seal with the body of chamber 6. To accomplish this airtight seal, doors 21 are preferably provided with a sealing gasket or the like (not shown) to allow a vacuum to be drawn in chamber 6. Alternately, an appropriate sealing material may be provided on the contact face of chamber 6 receptive to doors 21 when they are situated in a closed position. Doors 21 and 21a are also preferably provided with a locking mechanism of general conventional design to allow for the pressurization of chamber 6.

In the illustrated embodiment, the operation of doors 21 and 21A is independently controlled by motors 24 and 24A, respectively. Motors 24 and 24A are secured to the top exterior 5 of chamber 6 and are operatively coupled to cam 26 which is rotatably coupled to control arm 22. Control arm 22 is in turn rotatably coupled to door bracket 20, which itself is partially connected to the exterior of chamber 6 as a bracket assembly 9 at one end

and to the door at its bottommost extent. In such a fashion, operation of motors 24 and 24A in a "forward" direction results in the upward pivot of doors 21 to an "open" position. Reversal of motors 24 and 24A results in the movement of doors 21 and 21A to a "closed" and locked position. In a preferred embodiment, motors 24 and 24A are electrically coupled to a central control system 39 such as a Toshiba Ex-20 control device in a manner illustrated in Fig. 7. In such a fashion, the operation of doors 21 and 21A may be automatically controlled as will be further discussed herein.

While one preferred embodiment of the invention is illustrated in Fig. 1, other structural configurations of the present invention are also envisioned in accordance with the spirit of the present invention. For example, the door pivoting arrangement illustrated in Figs. 1-2 may be replaced with a sliding door mechanism or the like. Similarly, the overall configuration of chamber 6 may also be modified so as to allow for the introduction of a plurality of receptacles 100 of varying sizes. Alternatively, the operation of the doors may be controlled by a single motor in either an independent or dependent fashion. In all embodiments, however, it is desirable that chamber 6 be fashioned of or provided with a transparent panel or "window" so as to allow for visual inspection of the gas exchange operation.

The gas exchange system of the present invention may be seen by reference to Figs. 1, 4, 5, and 7. Fig. 4 illustrates a top, cutaway view of the interior of chamber 6 revealing a receptacle 100 positioned on an endless track conveyor assembly 83. As illustrated, assembly 83 is comprised of two or more drive rollers 84 and a supporting belt 82. In a preferred embodiment, belt 82 may be made of neoprene or other elastic material, while rollers 84 may be driven by a Dayton Electric 50 RPM, 115 V motor or other comparable equipment. Other conveyance systems are also envisioned and will become obvious to one skilled in the art. It is desirable that any conveyance mechanism be either sealably containable within chamber 6 or otherwise allow for the creation of a vacuum in the chamber.

The gas exchange apparatus of the present invention is designed to be used in association with a presealed receptacle 100 such as that described in US-A-4 548 824. As illustrated in Fig. 3, receptacle 100 generally includes a sidewall 19 and a top 21, the combination forming a sealable, pressurizable unit. In a preferred embodiment, the sidewalls 19 of receptacle 100 are provided with a resealable valve 102 which may be integrated into the sidewall itself or may be affixed to the surface of the package exterior. In the receptacle 100 illustrated in Fig. 3, valve 102 is disposed in a corner of

sidewall 19 so as to be compatible with the gas exchange mechanism in the illustrated embodiment of the present invention.

To provide for gas exchange, receptacle 100 is preferably aligned on assembly 83 so as to rest flush against a retaining rail 29 and stop 150. Lateral positioning of receptacle 100 along assembly 83 may be accomplished via a flexible alignment arm 80. As illustrated in Fig. 4, arm 80 is situated in chamber 6 so as to be capable of flexure in a plane generally co-planar with that described by assembly 83, and in a lateral direction such as to urge receptacle 80 against retaining rail 29. When compelled by the forward movement of assembly 83 (whose direction of movement is indicated by arrow A) and the lateral force exerted by alignment arm 80, receptacle 100 is moved into an abutting relation with stop 125 and rail 29 as previously described. In this fashion, package valve 102 is positioned immediately proximate gas exchange assembly 120.

In a preferred embodiment, package sensor or control stop 150 is electrically coupled to the central control system 39 as previously described in a manner illustrated in Fig. 7. Actuation of control stop 125 results in the transmission of an electrical signal to control system 39. In a preferred embodiment, stop 125 is pressure activated and thus transmits an electrical signal to control system 39 when contacted by package 100. Preferably, the activation mechanism 51 for conveyor assembly 83 is likewise coupled to control system 39. In such a fashion, when receptacle 100 is moved into contact with stop 125, conveyor assembly 83 is disengaged. Solenoids 121, 94, 91, and 92 are likewise coupled to control system 39 in a manner illustrated in Fig. 7.

The aforescribed operations have been described as occurring essentially simultaneously. It is envisioned, however, that it may be desirable to provide a programmed or timed delay in the operational sequence of the apparatus.

A preferred embodiment of the gas exchange assembly 120 may be seen by reference to Figs. 4-5. Gas exchange assembly 120 generally comprises an injector probe 125 mounted on a plunger 123 which is slidably disposed in a housing. Probe 125 may be comprised of a fine hollow tube or needle such as a number 20 hypodermic needle manufactured by Becton, Dickinson and Company. Plunger 123 is itself fixedly mounted on the frontal extremity of solenoid 121 as illustrated. Such a solenoid is conventional in design, such as that manufactured by Dayton Electric. Upon activation, solenoid 121 moves injector probe 125 through resealable valve 102 and into communication with the gases sealed within receptacle 100.

Gas exchange assembly 120 is coupled to a three-way valve union 83 via a gas conduit 88. Referring to Figs. 1, 3, 4, union 83 allows for the routing of gas flow from and into the interior of receptacle 100. Union 83 is coupled to an evacuation valve 95 via a secondary gas conduit 90. Union 83 is also coupled to a second solenoid 92, such as ASCO Model 826014, via conduit 84. Solenoid 92 is in turn coupled to a gas supply source 40 via conduit 41.

The operation of evacuation valve assembly 95 is controlled by a solenoid 94 such as a Dayton Electric Speedair 2A242. Valve assembly 95 includes a gas inlet 96 which communicates with the interior of chamber 6. Solenoid 94 is electrically coupled to control system 39 and thus may be automatically controlled. When solenoid 94 is activated to an "open" position, gas communication is established between the interior of receptacle 100 and the interior of vacuum chamber 6. When deactivated, solenoid 94 moves to a "closed" position, thereby closing valve 95 and thus preventing the escape or introduction of gas between receptacle 100 and chamber 6. Evacuation of package 100 thus takes place when solenoid 94 is urged to an "open" position. Repressurization of package 100 takes place when solenoid 94 is situated in a "closed" position.

Chamber 6 is provided with a valving means 101 which enables the removal or addition of gases thereto. Referring to Figs. 1 and 4, valving means 100 comprises a conduit 99 which is disposed in the sidewall of chamber 6 so as to establish fluid communication therethrough. Conduit 99 is open at its remote end and is coupled to a T 97 at its proximal end. T 97 is also coupled to a solenoid valve 91 and a conduit 98. Solenoid 91, when in an "open" position, enables pressurization between the interior and exterior of chamber 6 through nozzle 103. When in a "closed" position, solenoid 91 enables a vacuum to be drawn in chamber 6 through conduit 98 which is coupled to vacuum pump 43.

It may sometimes be desirable to remove the atmosphere within container 100 independently of atmosphere removal of chamber 6. This may be necessary when receptacle 100 contains a strong oxidizer, e.g. chlorine or bromine. In such a case, gas removal of receptacle 100 may be conducted via a separate vacuum pump (not shown) coupled, for example, to conduit 84 as indicated by dashed lines 84A. In such a setup, solenoid 94 would be maintained in a "closed" position during the evacuation procedure. Alternatively, structures 94, 95, 96 and coupling 90 would be altogether eliminated.

In cases when receptacle 100 contains a high oxygen content, e.g. > 35%, separate gas removal may be carried out via a venturi pump. In such a

fashion, the opportunity for explosion or fire is minimized. Evacuation of chamber 6 may be carried out via a faster, conventional vacuum pump as earlier described in reference to the general embodiment.

The preferred operation of the present invention may be described in sequential fashion as follows. At the completion of the previous gas exchange operation, door 21A is moved to an "open" position via the activation of motor 24A. Conveyor assembly 83 is likewise activated, thus moving the previous receptacle out of chamber 6. Conveyor track 4, which has likewise been activated, moves the receptacle downstream for packaging or further processing. During this operation, a new receptacle 100 is simultaneously moved into chamber 6 through door 21 which has also been moved to an "open" position. Once package 100 is moved into an abutting relationship with stop 125, door 21A is then moved to a sealed and "closed" position. In a preferred embodiment, movement of receptacle 100 may be automatically controlled as earlier described. Alternatively, the operation of the various separate mechanisms may be conducted via a timed program. Once receptacle has been moved partway into chamber 6, the forward movement of receptacle 100 is completed via the movement of conveyor assembly 83. The operation of assembly 83 moves receptacle 100 into contact with alignment arm 80 which exerts a lateral force on said receptacle. This lateral force, in combination with the forward movement of assembly 83, moves receptacle 100 into contact with retaining rail 19 and stop 125. When contacted by receptacle 100, stop 125 carries an electrical impulse to controller 39 which activates motor 24 which in turn moves door 21 into a closed, sealing position. By a subsequent signal from controller 39, conveyor assembly 83 is then deactivated.

To avoid any problems of contamination which might occur in the event receptacle 100 is damaged or punctured at any time during the gas exchange operation, it is desirable to create a positive pressure inside receptacle 100 prior to the initiation of the gas exchange operation. Accordingly, it is preferred that a partial vacuum be created in chamber 6 prior to gas exchange. Subsequently, therefore, vacuum pump 43 is next engaged and solenoid 91 moved to a "closed" position so as to enable the exhaustion of gas through gas lines 99 and 98. The creation of a vacuum or partial vacuum is created immediately prior to the insertion of probe 122 in container 100. Once a vacuum or partial vacuum has been achieved, solenoid 121 is activated, thereby driving probe 122 into receptacle 100 through valve 102 as earlier described. Solenoid 94 is also activated to an "open" position.

The penetration of container 100 by needle 122 enables gas flow through conduit 88 through gas outlet 96 as container 100 is exhausted. Simultaneously, gases within chamber 6 are continuing to be evacuated through inlet 99 via pump 43. In such a fashion, evacuation of chamber 6 results in a simultaneous evacuation of the interior of receptacle 100, thus avoiding any resultant modification in the shape of said receptacle. When a vacuum has been drawn in the interior chamber 6, pump 43 is deactivated, and solenoid 94 is moved to a "closed" position. Actuation of pump 43 and solenoid 94 may be accomplished by vacuum sensors which are activated when a satisfactory vacuum is achieved in chamber 6, or may alternatively be accomplished via the operation of a timer (both not shown).

The present invention has particular application to processes where gas withdrawal and exchange is contemplated. In the event the introduction of a second gas mixture into the receptacle 100 is desired, solenoid 94 is activated to a "closed" position, while solenoid 92 is moved to an "open" position. Gas flow from gas supply 40 may now commence into container 100. Very shortly thereafter, solenoid 91 is activated to an "open" position so as to allow gas flow communication between the interior and exterior of chamber 6. In such a fashion, pressure equalization is thereby maintained between the interior and the exterior of the package 100, thereby eliminating or substantially reducing any collapse. In an alternate embodiment, repressurization of container 100 may be accomplished via a secondary solenoid valve 107 and a pump 192 (see Fig. 6). In such a fashion, more precise pressure regulation may be achieved.

Upon completion of the gas exchange operation, probe 122 is automatically withdrawn from receptacle 100 whereupon assembly 83 is reactivated to move receptacle 100 forward. Concurrently, motor 24A is activated, thus moving door 21A to an "open" position. Receptacle 100 is then moved forward until it establishes contact with track 4, which automatically moves receptacle 100 downstream for further processing or packaging.

Claims

1. A method for replacing a first gas contained within a sealed, receptacle (100) with a second gas, while maintaining the structural integrity of said receptacle, the method comprising the sequential steps of:
 - a) placing the sealed receptacle in a vacuum chamber (6);
 - b) closing and sealing said vacuum chamber;

c) evacuating the first gas contained in the receptacle into the chamber while simultaneously evacuating said chamber;

d) introducing the second gas into the evacuated receptacle while simultaneously introducing a third gas into the evacuated chamber at a rate so as to substantially eliminate any pressure differential between the interior of said receptacle and the interior of said chamber

characterized by

e) operating a probe (125) in one position to communicate between the interior of said receptacle and either the interior or exterior of said chamber in order to introduce the second gas;

f) maintaining a resealable valving means (102) open with said probe when said probe is operated in said one position.

2. The method of claim 1, wherein said second gas is inert.
3. The method of claim 2, wherein said inert gas includes CO₂.
4. The method of claim 4, wherein said second gas includes an oxidizer.
5. The method of claim 4, wherein said oxidizer includes ozone gas.
6. An apparatus for removing a first gas surrounding a given material in a sealed receptacle (100) and exchanging said first gas with a second gas so as to avoid the collapse or loss of structural integrity in said receptacle during such exchange, comprising:
 - a) a vacuum chamber (6) for maintaining a controlled pressure and environment about said receptacle;
 - b) valve means (95) to selectively enable gas communication between the interior of said receptacle and the interior of said chamber;
 - c) means (101) to simultaneously evacuate said receptacle through said valve means and said chamber at a rate to control the pressure differential between the inside and the outside of the receptacle;
 - d) means (40, 91, 92) to introduce a second gas into the evacuated receptacle while simultaneously introducing a third gas into the evacuated chamber

characterized by

e) a probe (125) between the valve means and the receptacle opened to communicate in one position between the valve means

- and the receptacle or between the receptacle and the exterior of the chamber;
f) a resealable valving means (102) attached to said receptacle which is opened by said probe in said one position. 5
7. The apparatus of claim 6, wherein said probe is hollow.
8. The apparatus of claim 7, which further comprises a septum valve (102) in said receptacle adapted to receive said hollow probe. 10
9. Apparatus adapted to remove, modify, or exchange a first gas contained within a sealed flexible receptacle (100) through a valving means (102) attachable to said receptacle while maintaining a positive pressure within said receptacle comprising: 15
- a) a sealable, pressurizable chamber (6) adapted to receive said receptacle; 20
 - b) a probe (125) automatically insertable through said valving means (102) upon such receipt of said receptacle in said chamber; 25
- characterized by** 25
- c) selective valving means (95) operable in a first condition to enable gas communication between the interior of said chamber and said receptacle, and in a second condition between said receptacle and the exterior of said chamber. 30
10. The apparatus of claim 6, wherein said vacuum chamber (6) is adapted to receive a tray (100) containing a food product hermetically sealed with a plastic wrap and a valve (102) and further including: 35
- a) closure means (21, 21a) at the first and second ends of the chamber operable to seal said vacuum chamber; 40
 - b) guide means (80, 29) within said chamber operable to guide such packages of various sizes into a position within said chamber, such that the valves of the various size packages engage a common point of the chamber; 45
 - c) a forked conduit (88) connecting said probe via a first fork (90) to the interior of said chamber and via a second fork (84) to the exterior of said chamber; 50
 - d) a first valve (95) in said first fork corresponding to said valve means; 55
 - e) a second valve (101) operable to connect the interior of said chamber to the exterior of said chamber and corresponding to the evacuating means.

11. The apparatus of claim 10, which further comprises a vacuum pump (43) positioned external of the chamber and connected to said second valve.
12. The apparatus of claim 11, which further comprises a source of gas (40) positioned external of the chamber and connected to the second fork of the forked conduit.
13. The apparatus of claim 9, wherein said vacuum chamber is provided with a sealable entrance and exit, said apparatus including a conveyor assembly (82) sealably disposed in said chamber and operable to move said receptacles sequentially from said entrance to said exit.
14. The apparatus of claim 13, wherein said probe is rigidly coupled to a solenoid (121) such that activation of said solenoid moves said probe through said valving means into fluid communication with the interior of said receptacle, said probe coupled to said valving means and a supply of gas (40), where said valving means is actuated via a second solenoid (94), said apparatus including a second chamber valve (101) adapted to evacuate said chamber.

Patentansprüche

1. Verfahren zum Ersetzen eines innerhalb eines versiegelten Behälters (100) enthaltenen ersten Gases durch ein zweites Gas, während die strukturelle Integrität des Behälters beibehalten wird, wobei das Verfahren die Abfolgeschritte aufweist:
- a) Anordnen des versiegelten Behälters in einer Vakuumkammer (6);
 - b) Schließen und Abdichten der Vakuumkammer;
 - c) Evakuieren des in dem Behälter enthaltenen ersten Gases in die Kammer, während gleichzeitig die Kammer evakuiert wird;
 - d) Einführen des zweiten Gases in den evakuierten Behälter, während gleichzeitig ein drittes Gas in die evakuierte Kammer bei einer Rate eingeführt wird, daß jegliche Druckdifferenz zwischen dem Inneren des Behälters und dem Inneren der Kammer im wesentlichen eliminiert wird,
- gekennzeichnet durch**
- e) Betätigen eines Meßfühlers (125) in eine Position zur Kommunikation zwischen dem Inneren des Behälters und entweder dem Inneren oder dem Äußeren der Kammer, um das zweite Gas einzuführen; und
 - f) Offenhalten einer wiederabdichtbaren Ventileinrichtung (102) mit dem Meßfühler,

wenn der Meßfühler in der einen Position betätigt wird.

2. Verfahren nach Anspruch 1, bei welchem das zweite Gas inert ist. 5
3. Verfahren nach Anspruch 2, bei welchen das Inertgas CO₂ aufweist.
4. Verfahren nach Anspruch 1, bei welchem das zweite Gas ein Oxidationsmittel ist. 10
5. Verfahren nach Anspruch 4, bei welchem das Oxidationsmittel Ozongas ist. 15
6. Vorrichtung zum Entfernen eines ersten Gases, das ein gegebenes Material in einem versiegelten Behälter (100) umgibt, und Auswechseln des ersten Gases durch ein zweites Gas, um somit ein Zusammenfallen oder einen Verlust an struktureller Integrität des Behälters während eines derartigen Austausches zu vermeiden, welche aufweist: 20
 - a) eine Vakuumkammer (6) zum Aufrechterhalten eines gesteuerten Druckes und einer Umgebung um den Behälter; 25
 - b) eine Ventileinrichtung (95), um wahlweise eine Gaskommunikation zwischen dem Inneren des Behälters und dem Inneren der Kammer zu ermöglichen; 30
 - c) eine Einrichtung (101), um den Behälter durch die Ventileinrichtung und die Kammer bei einer Rate simultan zu evakuieren, um die Druckdifferenz zwischen dem Inneren und dem Äußeren des Behälters zu steuern; 35
 - d) eine Einrichtung (40, 91, 92), um ein zweites Gas in den evakuierten Behälter einzuführen, während gleichzeitig ein drittes Gas in die evakuierte Kammer eingeführt wird; 40

gekennzeichnet durch

 - e) einen Meßfühler (125) zwischen der Ventileinrichtung und dem Behälter, der geöffnet ist, um eine Kommunikation in einer Position zwischen der Ventileinrichtung und dem Behälter oder zwischen dem Behälter und dem Äußeren der Kammer herzustellen; und 45
 - f) eine wiederabdichtbare Ventileinrichtung (102), die an dem Behälter angebracht ist, welche durch den Meßfühler in der einen Position geöffnet ist. 50
7. Vorrichtung nach Anspruch 6, wobei der Meßfühler hohl ist. 55
8. Vorrichtung nach Anspruch 7, welche des weiteren ein Trennwandventil (102) in dem Behälter

ter aufweist, das so angepaßt ist, daß es den hohlen Meßfühler aufnimmt.

9. Vorrichtung zur Verwendung zum Entfernen, Modifizieren oder Austauschen eines innerhalb eines versiegelten flexiblen Behälters (100) enthaltenen ersten Gases über eine Ventileinrichtung (102), die an dem Behälter anbringbar ist, während ein positiver Druck innerhalb des Behälters aufrechterhalten wird, aufweisend:
 - a) eine abdichtbare, unterdrucksetzbare Kammer (6), die so angepaßt ist, daß sie den Behälter aufnimmt;
 - b) einen Meßfühler (125), der automatisch durch die Ventileinrichtung (102) bei einer derartigen Aufnahme des Behälters in der Kammer einführbar ist;

gekennzeichnet durch

 - c) eine selektive Ventileinrichtung (95), die in einem ersten Zustand zum Ermöglichen einer Gaskommunikation zwischen dem Inneren der Kammer und dem Behälter und in einem zweiten Zustand zwischen dem Behälter und dem Äußeren der Kammer betreibbar ist.
10. Vorrichtung nach Anspruch 6, bei welcher die Vakuumkammer (6) so angepaßt ist, daß es ein Tablett (100) aufnimmt, welches ein hermetisch mit einer Kunststoffverpackung und über ein Ventil (102) versiegeltes Lebensmittelprodukt enthält, und die des weiteren aufweist:
 - a) eine Verschließeinrichtung (21, 21a) an den ersten und zweiten Enden der Kammer, die zum Abdichten der Vakuumkammer betreibbar ist;
 - b) eine Führungseinrichtung (80, 29) innerhalb der Kammer, die betreibbar ist, um derartige Verpackungen verschiedener Größen in eine Position innerhalb der Kammer zu führen, daß die Ventile die Verpackungen verschiedener Größen einen gemeinsamen Punkt der Kammer berühren;
 - c) eine gegabelte Leitung (98), die den Meßfühler über eine erste Gabel (90) mit dem Inneren der Kammer und über eine zweite Gabel (84) mit dem Äußeren der Kammer verbindet;
 - d) ein erstes Ventil (95) in der ersten Gabel, das der Ventileinrichtung entspricht; und
 - e) ein zweites Ventil (101), das zur Verbindung des Inneren der Kammer mit dem Äußeren der Kammer betreibbar ist und der Evakuierungseinrichtung entspricht.
11. Vorrichtung nach Anspruch 10, welche des weiteren eine Vakuumpumpe (43) aufweist, die extern von der Kammer angeordnet und mit

dem zweiten Ventil verbunden ist.

12. Vorrichtung nach Anspruch 11, die des weiteren eine Gasquelle (40) aufweist, die extern von der Kammer angeordnet und mit der zweiten Gabel der gegabelten Leitung verbunden ist. 5
13. Vorrichtung nach Anspruch 9, bei der die Vakuumkammer mit einem abdichtbaren Eingang und Ausgang versehen ist, wobei die Vorrichtung eine Förderanordnung (82) aufweist, die abdichtbar in der Kammer angeordnet und betreibbar ist, um die Behälter nacheinander von dem Eingang zu dem Ausgang zu bewegen. 10 15
14. Vorrichtung nach Anspruch 13, bei welcher der Meßfühler fest mit einem Magnetventil (121) derart gekoppelt ist, daß die Aktivierung des Magnetventils den Meßfühler durch die Ventileinrichtung in Fluidkommunikation mit dem Inneren des Behälters bewegt, der Meßfühler mit der Ventileinrichtung und einer Gasversorgung (40) verbunden ist, wobei die Ventileinrichtung über ein zweites Magnetventil (94) betätigt wird, und die Vorrichtung ein zweites Kammerventil (101) aufweist, das so angepaßt ist, daß es die Kammer evakuiert. 20 25

Revendications 30

1. Procédé pour remplacer un premier gaz contenu à l'intérieur d'un récipient (100) scellé par un deuxième gaz tout en maintenant l'intégrité structurale dudit récipient, le procédé comprenant les étapes successives suivantes: 35
 - a) placer le récipient scellé dans une enceinte à vide (6);
 - b) fermer et sceller ladite enceinte à vide;
 - c) évacuer le premier gaz contenu dans le récipient vers l'enceinte tout en évacuant simultanément ladite enceinte;
 - d) introduire le deuxième gaz à l'intérieur du récipient évacué tout en introduisant simultanément un troisième gaz dans l'enceinte évacué à une vitesse de façon à considérablement éliminer tout différentiel de pression entre l'intérieur dudit récipient et l'intérieur de ladite enceinte, 40

caractérisé par 45

 - e) actionner un sensor (123) dans une position afin de communiquer entre l'intérieur dudit récipient et l'intérieur ou l'extérieur de ladite enceinte afin d'introduire le deuxième gaz; 50
 - f) maintenir des moyens de soupape (102) rescellable ouverts avec ledit sensor lorsque ledit sensor est actionné dans ladite position. 55

tion.

2. Procédé selon la revendication 1, dans lequel ledit deuxième gaz est inerte.
3. Procédé selon la revendication 2, dans lequel ledit gaz inerte comprend du CO₂.
4. Procédé selon la revendication 1, dans lequel ledit deuxième gaz comprend un agent d'oxydation.
5. Procédé selon la revendication 4, dans lequel ledit agent d'oxydation comprend du gaz d'ozone.
6. Appareil pour enlever un premier gaz qui entoure un matériau donné dans un récipient scellé (100) et pour échanger ledit premier gaz contre un deuxième gaz afin d'éviter l'effondrement ou la perte de l'intégrité structurale dans ledit récipient lors d'un tel échange, comprenant:
 - a) une enceinte à vide (6) pour maintenir une pression et un environnement contrôlés autour dudit récipient;
 - b) des moyens de soupape (95) pour permettre sélectivement une communication de gaz entre l'intérieur dudit récipient et l'intérieur de ladite enceinte;
 - c) des moyens (101) pour évacuer simultanément ledit récipient à travers lesdits moyens de soupape et ladite enceinte à une vitesse pour contrôler le différentiel de pression entre l'intérieur et l'extérieur du récipient;
 - d) des moyens (40, 91, 92) pour introduire un deuxième gaz dans le récipient évacué tout en introduisant simultanément un troisième gaz dans l'enceinte évacuée, 60

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 - e) un sensor (125) entre les moyens de soupape et le récipient ouvert pour communiquer dans une position entre les moyens de soupape et le récipient ou entre le récipient et l'extérieur de l'enceinte;
 - f) des moyens de soupape (102) rescellables et attachés audit récipient qui est ouvert par le sensor dans ladite position.
7. Appareil selon la revendication 6, dans lequel ledit sensor est creux.
8. Appareil selon la revendication 7, qui comprend en outre une soupape à cloison (102) dans ledit récipient adapté pour recevoir ledit sensor creux.

9. Appareil adapté pour enlever, modifier ou échanger un premier gaz, contenu à l'intérieur d'un récipient (100) flexible et scellé, à travers des moyens de soupape (102) qui peuvent être attachés audit récipient tout en maintenant une pression positive à l'intérieur dudit récipient, comprenant:
- a) une enceinte (6) pressurisable et scellée, qui est adaptée pour recevoir ledit récipient;
 - b) un sensor (125), qui peut être inséré automatiquement à travers lesdits moyens de soupape (102) lorsque ledit récipient est reçu de cette façon dans ladite enceinte;
- caractérisé par**
- c) des moyens de soupape (95) sélectifs qui peuvent être actionnés dans une première condition afin de permettre une communication de gaz entre l'intérieur de ladite enceinte et ledit récipient, et dans une deuxième condition entre ledit récipient et l'extérieur de ladite enceinte.
10. Appareil selon la revendication 6, dans lequel ladite enceinte à vide (6) est adaptée pour recevoir un plateau (100) contenant un produit comestible hermétiquement scellé par un emballage en plastique et une soupape (102), et comprenant en outre:
- a) des moyens de fermeture (21, 21a) aux premières et deuxièmes extrémités de l'enceinte qui peuvent être actionnés pour sceller ladite enceinte à vide;
 - b) des moyens de guidage (80, 29) à l'intérieur de ladite enceinte qui peuvent être actionnés pour guider de tels paquets de différentes dimensions dans une position à l'intérieur de ladite enceinte, de façon à ce que les soupapes des paquets de différentes dimensions touchent un point commun de l'enceinte;
 - c) un conduit à fourche (98) connectant ledit sensor par une première fourche (90) avec l'intérieur de ladite enceinte et par une seconde fourche (84) avec l'extérieur de ladite enceinte;
 - d) une première soupape (95) dans ladite première fourche correspondant auxdits moyens de soupape;
 - e) une deuxième soupape (101) qui peut être actionnée pour connecter l'intérieur de ladite enceinte avec l'extérieur de ladite enceinte et correspondant aux moyens d'évacuation.
11. Appareil selon la revendication 10, qui comprend en outre une pompe à vide (43) positionnée à l'extérieur de l'enceinte et connectée avec ladite deuxième soupape.
12. Appareil selon la revendication 11, qui comprend en outre une source de gaz (40) positionnée à l'extérieur de l'enceinte et connectée avec la deuxième fourchette du conduit fourché.
13. Appareil selon la revendication 9, dans lequel ladite enceinte à vide est pourvue d'une entrée et d'une sortie scellables, ledit appareil comprenant un ensemble d'un convoyeur à bande (42) disposé de façon scellable dans ladite enceinte et qui peut être actionné pour mouvoir ledit récipient de façon séquentielle de ladite entrée jusqu'à ladite sortie.
14. Appareil selon la revendication 13, dans lequel ledit sensor est couplé de façon rigide avec un solénoïd (121) de façon à ce qu'une activation dudit solénoïd mouvoie ledit sensor à travers les moyens de soupape dans une communication fluide avec l'intérieur dudit récipient, ledit sensor étant couplé auxdits moyens de soupape et à un distributeur de gaz (40), lesdits moyens de soupape étant actionnés par un deuxième solénoïd (94), ledit appareil comprenant une deuxième soupape d'enceinte (101) adaptée pour évacuer ladite enceinte.

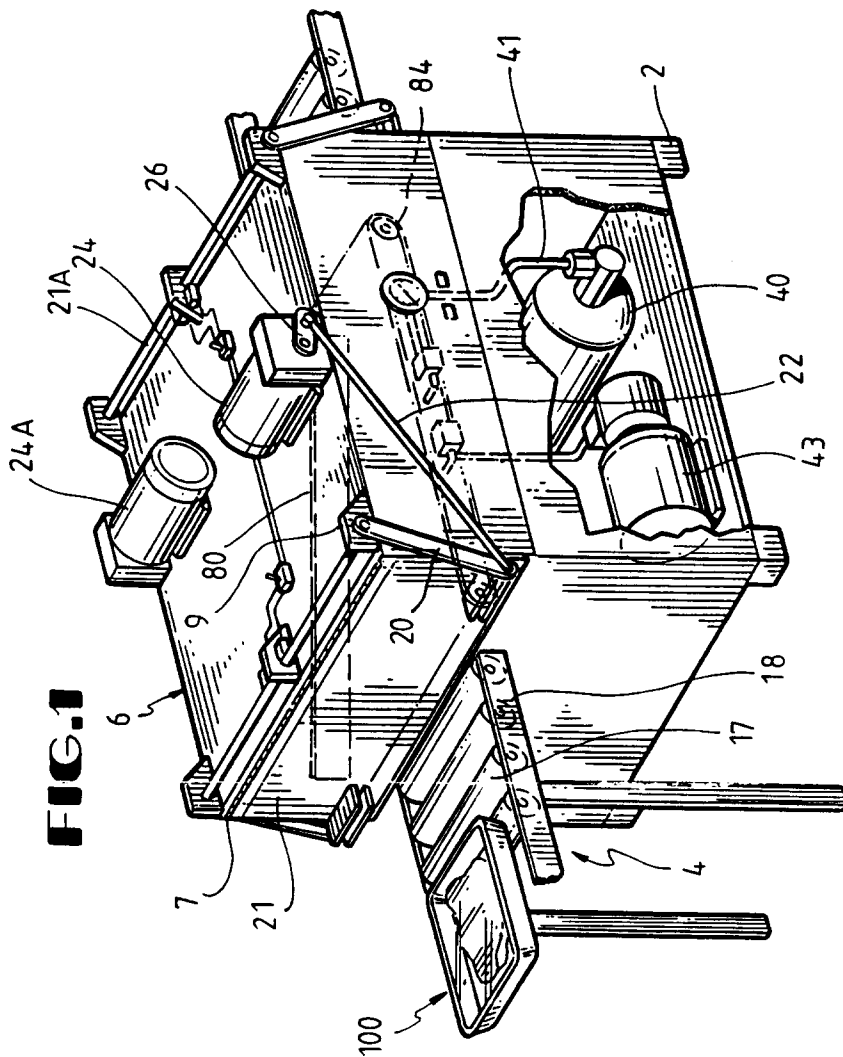
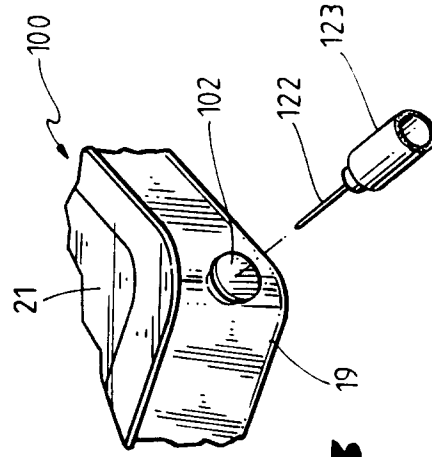
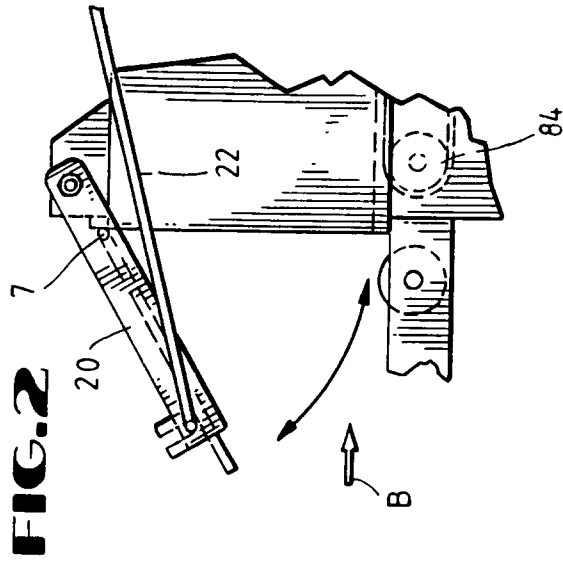


FIG.4

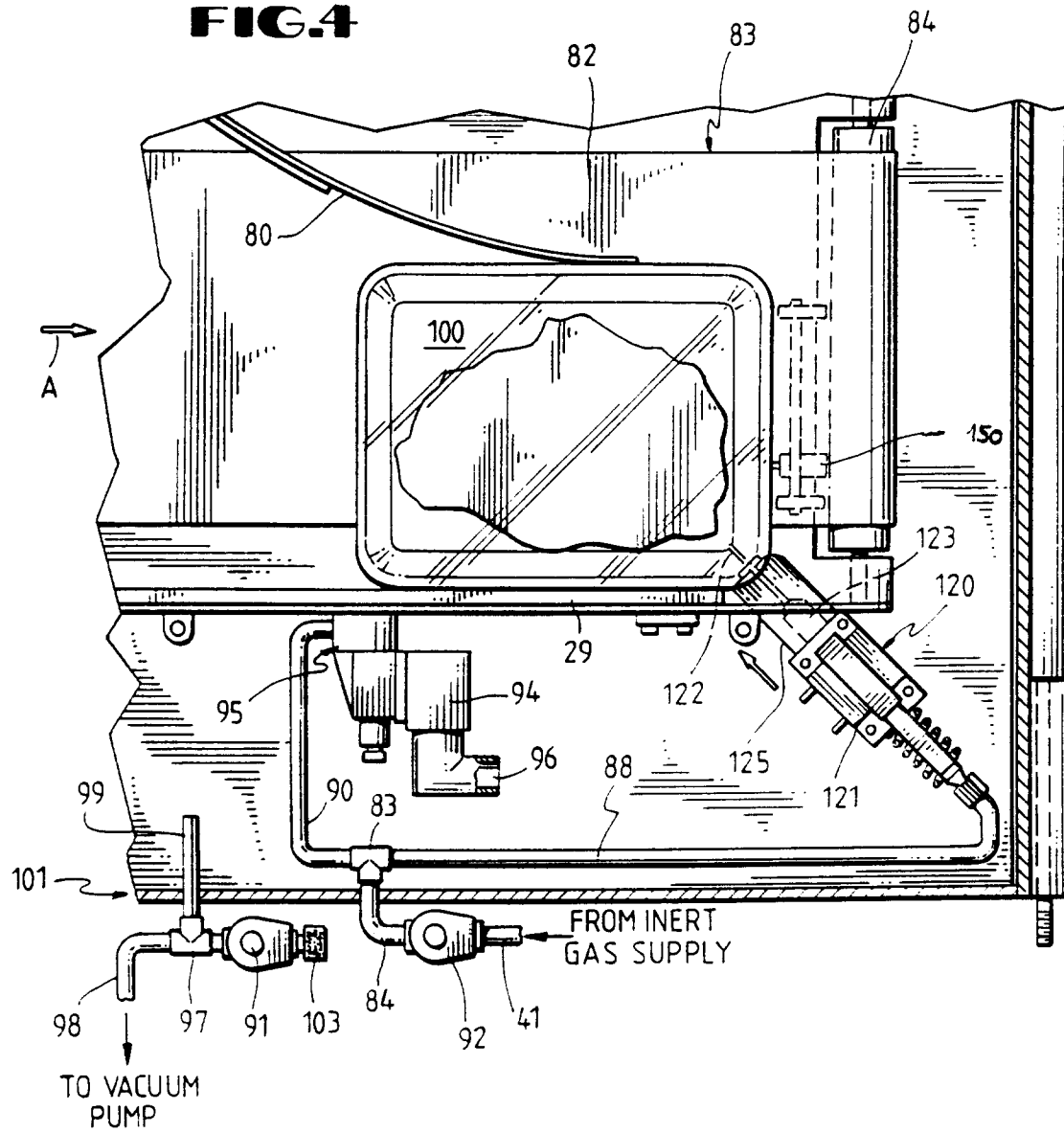


FIG.5

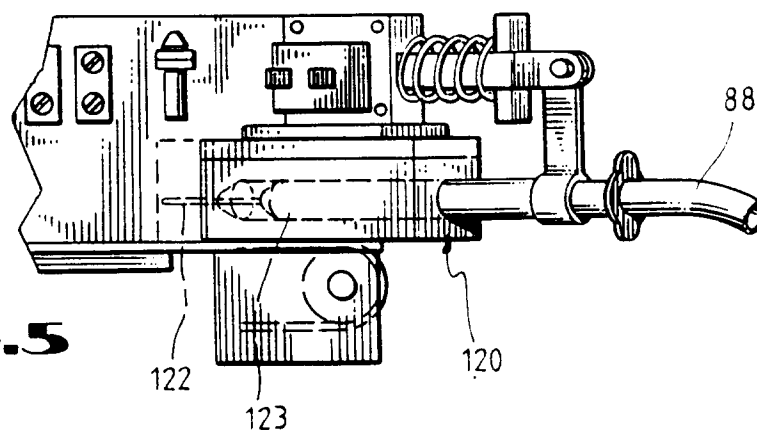


FIG. 6

