(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 758 977 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
16.08.2000 Bulletin 2000/33

(21) Application number: **95921287.9**

(22) Date of filing: **17.05.1995**

(51) Int. Cl.[7]: **B65B 31/00**, B65B 31/04

(86) International application number:
PCT/US95/06248

(87) International publication number:
WO 95/31375 (23.11.1995 Gazette 1995/50)

(54) **SYSTEM AND METHOD FOR FILLING AND SEALING CONTAINERS IN CONTROLLED ENVIRONMENTS**

SYSTEM UND VERFAHREN ZUM FÜLLEN UND ABDICHTEN VON BEHÄLTERN IN KONTROLLIERTER UMGEBUNG

SYSTEME ET PROCEDE DE REMPLISSAGE ET SCELLEMENT DE RECIPIENTS EN ATMOSPHERE CONTROLEE

(84) Designated Contracting States:
AT BE CH DE ES FR GB IE IT LI NL

(30) Priority: **17.05.1994 US 245249**
21.02.1995 US 394345

(43) Date of publication of application:
26.02.1997 Bulletin 1997/09

(73) Proprietors:
- **Sanfilippo, James J.**
  Chicago, IL 60611 (US)
- **Sanfilippo, John E.**
  Barrington, IL 60011 (US)

(72) Inventors:
- **Sanfilippo, James J.**
  Chicago, IL 60611 (US)
- **Sanfilippo, John E.**
  Barrington, IL 60011 (US)

(74) Representative:
Bayliss, Geoffrey Cyril et al
BOULT WADE TENNANT,
Verulam Gardens
70 Gray's Inn Road
London WC1X 8BT (GB)

(56) References cited:

EP-A- 0 184 166	**CH-A- 466 786**
GB-A- 551 271	**GB-A- 2 086 834**
GB-A- 2 217 672	**JP-A- 2 139 313**
US-A- 2 534 305	**US-A- 2 630 958**
US-A- 2 869 301	**US-A- 3 789 888**
US-A- 3 942 301	**US-A- 5 069 020**
US-A- 5 417 255	

Printed by Xerox (UK) Business Services
2.16.7 (HRS)/3.6

Description

TECHNICAL FIELD

[0001] The invention relates to apparatus and method for packaging materials in selected alternate environments, and in particular for substantially oxygen-free packaging of food products in containers.

BACKGROUND ART

[0002] In the food packaging industry various techniques exist for sequentially packaging containers of food product in alternate environments such as an inert atmosphere to substantially reduce the oxygen level and thereby preserve freshness. Such processes are beneficial for packaging of various food products, including edible nuts, coffee, powdered milk, infant formula, among others. Existing systems have limitations which reduce the efficiency and speed of the packaging operation. In addition, certain packaging system designs remove the choice of using a variety of modern filling and seaming equipment.

[0003] For example, techniques are known for flushing the interior of empty containers before filling with contents, to reduce residual oxygen. Techniques are also known for reducing oxygen content in the food material prior to packaging, and for transporting filled containers. However, known apparatus for performing these functions have shortcomings which have prevented their widespread adoption. These include excessive gas consumption, inflexible design which restricts operator access, lower operating speeds, requirements for vacuum sources or bulky apparatus, and long start-up and re-start delays.

[0004] By way of example, U.S. Patent Nos. 3,871,157, 3,942,301 and 4,140,159 and German OS 3323710 disclose various apparatus for low-oxygen packaging including particular forms of gas distributors and bulk product purging. U.S.Patent No.3,860,047 discloses an apparatus for flushing oxygen from bulk material to be packaged, including gas delivery tubes. U.S.Patent No.4,094,121 discloses another apparatus for packaging products in substantially oxygen free atmosphere, including a simple inlet for inserting inert gas to be forced upwards through a filling tube and filling funnel. These known systems all suffer from inflexible structure, undesirably high gas consumption, potential adverse stratification of bulk product as a result of flushing gas flows, and limited speed.

[0005] British Patent No.551271 discloses a system and a method in accordance with the preambles of claims 1 and 47 respectively, and provides means for evacuating the head space of containers of air and for sterilizing closures for the containers. Means are provided for directing steam into the containers travelling through a tunnel, in which steam jets are directed into the container head spaces to sweep air therefrom immediately before the containers reach a closure effecting turret. Another system including jets of steam for removing air from the container prior to sealing the container is described in U.S. Patent No.2534305.

[0006] It is therefore desired to provide a system and method for packaging product in selected (e.g. inert) environments using generally open and accessible structures. Further, it is desirable to provide such a system which will permit very low residual oxygen levels in packaged product, while consuming less inert gas and avoid stratification of bulk material. Finally, it is highly desirable to provide such an integrated gassing system which is adaptable to containers having multiple sizes, and is usable at high throughputs.

DISCLOSURE OF INVENTION

[0007] The invention relates to a system for the flushing of oxygen from open containers according to Claim 1, and to a method according to Claim 47.

[0008] An open architecture, integrated container filling and sealing system is provided which comprises a pre-purging system (e.g. rail), a filling station including apparatus for removing oxygen from a bulk material prior to packaging, a headspace purging rail, and a permanent sealing station. In a particular embodiment, the system consists essentially of only these major processing elements, without need for other inert gas or vacuum processors, yet is capable of commercial packaging of e.g. infant formula at high rates (e.g. 90.7 kg (200 pounds) per minute and higher) with residual oxygen levels of 1% or less.

[0009] In a preferred embodiment, empty containers are transported beneath a specially designed purging rail, then filled with product which has been processed itself to remove substantially all oxygen, and finally the filled container is transported beneath a headspace purging rail to an apparatus for sealing the container. Preferably both the container purging rail and the headspace purging rail comprise one or more plenums mounted above open containers on a conveying apparatus, in close proximity to the container openings. The plenum is supplied with a desired alternate environment, such as inert gas. A longitudinally extended manifold for controlled passage of gas from the interior of the plenum toward the container openings is provided in the surface of the plenum proximate the containers, which is narrower than the container opening and preferably less than or equal to one half of the width of the container opening, and in a particularly preferred embodiment, one quarter of the width of the container opening or less.

[0010] The rails preferably comprise a plurality of segments, mounted to permit individual segments to be easily moved away from the associated conveyor and containers to allow access to a portion of the system and containers being processed. In particular embodiments, segments may be hinged or slide mounted to allow rotational and/or translational movement from a first operating position to a second service position.

[0011] Exhaust plenums may be provided in conjunction with a gas distributor (such as a gassing rail) to receive the expelled gas and oxygen. In preferred embodiments, the exhaust plenums include an extended manifold for controlled (preferably laminar) gas induction.

[0012] A filling station includes apparatus for removing substantially all oxygen from a product to be packaged, prior to filling the container. Preferably the filling station includes a hopper, an on-demand gas exchanger, and a filler. The hopper (when used) may include at least one gassing region for providing a controlled and preferably laminarized flow of inert gas into the hopper. The on-demand gas exchanger (when used) provides a more compact vessel (providing greater installation flexibility), including an enclosed volume through which the product flows just prior to packaging, and includes gassing elements for providing a controlled flow of inert gas through the product to displace oxygen in real time as product flows to the filler for filling. In some embodiments the hopper and gas exchanger may be integral. The filler may be of any conventional type, though modified (if necessary) to prevent oxygen entrainment as the processed product passes into the processed containers and as the containers enter and exit the filler.

[0013] In preferred embodiments, the hopper (or gas exchanger) is provided with a plurality of individual gassing elements arranged so as to generate overlapping gassing regions. In a preferred embodiment the elements are substantially coplanar and spaced about the interior volume of a vessel. In particularly preferred embodiments, more than one level of gassing elements is provided, to create multiple zones of oxygen exclusion as product moves through the associated hopper or gas exchanger. For example, two levels, each having three or four gassing elements and offset relative to each other, are preferred. The gassing elements preferably include an extended manifold surface for injecting gas in a controlled (preferably laminar) manner over a significant surface area, thereby preventing excessive velocity or turbulence. In preferred embodiments, a rigid support frame supports an extended wire mesh manifold surface, defining an interior plenum which receives an inert gas supply. Preferably the wire mesh manifold has a top portion (in the direction of approaching product) which is tapered. A lower portion with generally parallel sides may also be included, to provide additional surface area without adversely affecting flow of particulate material through the vessel.

[0014] In certain embodiments, merging rails (such as headspace purging rails) may be provided proximate the main rail(s) for introduction of containers to the container stream. In a system, a secondary oxygen flushing station may be included for processing containers, which may then be transported beneath a merging rail for introduction into a stream of containers, without risk of oxygen contamination.

[0015] Other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a schematic view of an integrated container filling and sealing system.

FIG. 2 is a bottom view of a gassing rail showing the outer face of a preferred gas distribution manifold.

FIG. 3 is a sectional view of a single container being purged by a pre-purging rail, taken along line 3-3 in FIG. 2.

FIG. 4 is a sectional view of a single container being purged by a headspace purging rail, taken along line 3-3 in FIG. 2.

FIG. 5 is a bottom view of another gassing rail showing two embodiments of exhaust plenums.

FIG. 6 is a side sectional view of a preferred rail and manifold structure.

FIG. 7 is a partially sectional view of preferred conveyor and rail support members including hinges.

FIG. 8 is a side view of a representative commercial embodiment of the present invention, including a supply hopper having a plurality of gassing elements, and an optional secondary processor and merging rails.

FIG. 9 is a top view of the embodiment shown in FIG. 8.

FIG. 10 is a top view of the gassing hopper shown in FIGS. 8-9.

FIG. 11 is a diagrammatic representation of an alternative commercial embodiment, including an on-demand gas exchanger.

FIG. 12 is a side view of one embodiment of an on-demand gas exchanger.

FIG. 13 is a top view of the gas exchanger shown in FIG. 12.

FIG. 14 is a partially sectional side view of a representative gassing element for use with a gassing hopper or gas exchanger.

FIG. 15 is an end view of the gassing element, taken from line 15-15 in FIG. 14.

BEST MODE FOR CARRYING OUT THE INVENTION

[0017] Referring to FIG. 1, a schematic view of an integrated controlled environment filling and sealing system is shown having gas purging rails 10 including a pre-purging rail 1 and a headspace purging rail 3, a filler station 2 between the rails 1 and 3, and a sealing station 6 (such as a double seamer). The filling station 2 preferably includes a controlled environment processor 5.

[0018] The gas purging rails 10 include a longitudinal plenum 11 having one or more inlets 12 for receiving e.g. inert gas from a source (not shown), and a distribution manifold 13 for distributing the gas into the open containers. The distribution manifold 13 is located on a surface of the rail 10 facing the containers. There extended rails are desired (e.g. to increase residence time of the containers beneath the rail to allow adequate time at a given line speed for sufficient oxygen displacement), the gas purging rail 10 may comprise a plurality of individual segments (e.g. 7, 8) each having its own plenum 11 and gas inlet(s) 12. Preferably, the manifolds 13 of adjacent segments are closely proximate one another (i.e. most preferably within 0.32 cm (1/8 inch)) to minimize any disruption of the longitudinally smooth gas flow from the manifolds. For a preferred line speed of about 400 size 401 containers per minute, a total pre-purging rail length of approximately 366 cm (12 feet) and residence time beneath the rail of 4-6 seconds is desirable.

[0019] The vertical distance between the manifold 13 and the tops of the open top containers is preferably small, and ideally should not exceed about 0.953 cm (0.375 inches) for the embodiments illustrated. Preferably, for a pre-purge rail 1 this separation is between about 0.1588 and 0.635 cm (0.0625 and about 0.25 inches), not exceeding about 0.79 cm (0.31 inches), and optimally about 0.32 cm (0.125 inch). For a headspace rail the separation is preferably between about 0.047 and 0.483 cm (0.016 and about 0.19 inches), not exceeding about 0.953 cm (0.375 inches), and optimally as small as possible without physical interference between the rail and containers. For size 401 cans, a segment of plenum 11 may have a height of about 2.54 cm (1 inch), a length of about 122 cm (4 feet), and a width of about 12.7 cm (5.0 inches). A standard 401 container has a height of 13.813 cm (5.438 inches) and an outer diameter of 10.4 cm (4.1 inches). The inert gas has an inlet and an outlet flow rate of about 0.057 to 0.425 cubic m per minute (2 to about 15 standard cubic feet per minute (2-15 scfm)), preferably about 0.283 cubic m per minute (10 scfm) per 122 cm (4 foot) segment at 100% flow when packaging size 401 x 502 containers at a line speed of 300 containers per minute. For a headspace rail segment, the optimum rate is about 0.142 cubic m per minute (5 scfm) per segment at 100% flow rate. The optimum inert gas flow rate will vary depending on line speed and container dimensions, and can be determined through wind tunnel testing of the various sized containers.

[0020] Preferably, the plenum 11 is closed except for the inert gas inlet(s) 12 and the distribution manifold 13. The plenum 11 may be rectangular as shown, and may be constructed of stainless steel, aluminium, rigid plastic or any other rigid material. The plenum 11 should preferably be at least as wide as, and more preferably somewhat wider than, the diameters of the open top of the containers. In a preferred embodiment, a 6.35 cm (2.5 inch) strip of 40 micron 5-ply stainless steel screen 23 is mounted on a 6.35 cm (2.5 inch) strip of 80 micron 2-ply stainless steel screen 24 and forms in part the exposed gas manifold. By providing opening regions in one or both of the mesh layers (preferably not overlapping), differing regions of flow resistance are provided.

[0021] In operation of a preferred embodiment, an open empty container 50 may be exposed to a controlled (preferably laminarized) flow of inert gas from the prepurging rail 1 as it is transported by conveyor 59, which may reduce the oxygen levels within the container from 20.9% to less than 2.0% residual oxygen. It has been found that oxygen residuals as low as a few hundred parts per million oxygen or less are possible with residence times of 4-6 seconds. Because the rails 1 as described herein do not require vacuum, side panels or a sealed enclosure to process the empty containers 50, an open architecture is provided which permits easy access to the containers when necessary. Preferably the pre-purging rails 1 include at least one longitudinally oriented gas distribution manifold region substantially aligned with the direction of movement of containers being transported in association with the pre-purging rail. The manifold provides a controlled flow of e.g. inert gas into the open containers, which flow is substantially continuous and uniform in the direction of container movement. Preferably the manifold provides at least two extended longitudinal regions of differing gas flow resistance. Preferably the manifold has a width which is less than the width of the container opening, and most preferably one half or one quarter or less of the container opening width. It should be understood that "longitudinal" direction is used herein to refer to the direction of container movement, which may be linear or non-linear (e.g. curved), planar or non-planar, depending on the conveyor or transport system associated with the gas rail.

[0022] The filler station 2 includes apparatus for portioning the bulk product 9 to be packaged and delivering it to the empty containers 50. In addition, apparatus 5 is provided for removing oxygen from the bulk product 9 prior to filling the container 50. This alternate environment processor 5 preferably has a plurality of gassing elements in the flow stream of the bulk product 9, to provide a laminarized flow of inert gas through the bulk product to substantially reduce oxygen levels in the product and prevent reintroduction of oxygen during filling of the pre-purged container.

[0023] The filled containers 52 then exit the filler station 2, beneath a headspace purging rail 3. The headspace purging rail 3 flushes the headspace of the filled container 52 with a controlled flow pattern of inert gas to remove any oxygen contamination that may occur as containers exit the filler station, and to maintain the inert environment as the container is transported. Like the pre-purging rail 1, the headspace rail 3 may preferably have an open architecture to permit access to filled containers 52, and manifolds of the type described above.

[0024] It has been discovered that highly efficient, high speed, very low oxygen residuals may be achieved by a system consisting essentially only of the processing elements discussed. In other embodiments, the container 52 may enter further environmental processing station(s) (not shown), such as a vacuum chamber or additional gassing station. A lid placement system 4 may be provided. The container 52 may be transported to a permanent sealing station 6 where a closure is secured. The sealed container 58 may then be removed.

[0025] This unique combination of container processing elements, including pre-purging and headspace purging by means of open architecture gassing rails and manifolds as described herein, provides for low oxygen residual in the filled container and very efficient (minimized) use of inert gas. The resulting open architecture allows easy access to containers 50, 52, and avoids complex tunnels, gas seals, vacuum processors, and other interfering structures. Segmented rails and hinged mounting of segments as discussed below further enhance the openness of the resulting system, and add to its superior operation.

[0026] Referring to FIGS 2-4, a preferred distribution manifold 13 for the pre-purging rail and headspace purging rail includes a longitudinally oriented center area 15 of lower flow resistance, between and adjacent to two longitudinally oriented areas 16 and 17 of higher flow resistance. Each of the flow regions 15, 16 and 17 extends the length of the bottom surface of plenum 11, is positioned above the open tops of the containers 50, 52, and is oriented in the direction of travel of the containers. In a preferred embodiment, the overall width of the distribution manifold 13 is smaller than the diameter of the openings of the containers, and most preferably less than one quarter of the width of the container opening.

[0027] For example, the manifold 13 may have an overall width of about 19 to 25.4 mm (0.75-1.0 inch), for containers having opening diameters of about 10.2 to 15.3 cm (4-6 inches). The central region 15 of lower flow resistance may have a width of about 0.64 cm (0.25 inch), and the surrounding regions 16 and 17 of higher flow resistance may each have a width of about 0.64 to 1.28 cm (0.25-0.5 inch). Smaller containers may utilize smaller optimum manifold widths. For containers having opening diameters of about 5.08 to 7.62 cm (2-3 inches), the manifold may have an overall width of 1.27 cm (0.5 inches), with correspondingly smaller widths for the regions of higher and lower flow resistance.

[0028] The distribution manifold 13 is preferably positioned longitudinally in the center bottom surface of the plenum 11 and over the centers of moving containers 50, 52. In the pre-purging rails 1 inert gas passing through the center area 15 of lower flow resistance has a relatively high velocity, sufficient to carry the gas to the bottom of each container 50. In the headspace purging rails 3, the velocity of the inert gas passing through center area 15 is sufficient to carry to the top surface of the packaged product in the filled containers 52 and overcome any air infiltration during container transport. The arrows in FIGS. 3 and 4 show the preferred direction of travel of a preferably laminarized flow of inert gas. Inert gas passing through adjacent regions 16 and 17 of higher flow resistance may be partially carried into the containers 50, 52 by a "venturi" effect from the higher velocity gas. Otherwise, the gas passing through areas 16 and 17 has a lower velocity. Because the regions 15, 16 and 17 are oriented parallel to the direction of travel of the containers, the gas flow patterns (including the outflow) exist continuously and substantially at steady state for the entire time that each container remains underneath the surface of plenum 11. Therefore, there is no opportunity for Oxygen to enter the containers from the outside. The oxygen content inside the containers steadily decreases as each container moves below the manifold 13 until the oxygen content is reduced to target levels or below, whereby the purging is completed.

[0029] The regions 15, 16 and 17 of high and low flow resistance can be created using adjacent welded screens of different opening size, selectively layered screens, porous plastic (e.g. porous high molecular weight high density polyethylene), porous plates, or any selectively porous material that acts as a diffuser.

[0030] In preferred embodiments of both the pre-purging rail 1 and the headspace purging rail 3, the manifold 13 may include a series of 0.64 cm (0.25 inch) wide and 7.62 cm (3 inch) long slots 25 formed in the center of a 5-ply 40 micron screen parallel to the direction of container travel (Fig.2). The slots can be spaced about 1.9 cm (0.75 inch) apart from each other and provide a region of lower resistance to allow a higher velocity flow. The 1.9 cm (0.75 inch) spacing of the slots gives the rail more structural integrity, but a long continuous slot may be preferable. The screened regions on either side of the slots provide the high resistance regions 16, 17 which allow a lower velocity flow parallel to the low resistance region 15 and to the direction of container travel 7. In an alternative embodiment where a reduced requirement for inert gas exists, smaller holes 26 may be substituted for slots (FIG. 5).

[0031] FIG. 4 also illustrates two embodiments of exhaust plenums 37a,b. Such exhaust plenums may be provided in conjunction with a gas distributor, such as (but not limited to) a gassing rail 10, to receive all or a portion of the exiting gas and displaced oxygen-containing atmosphere. This may be advantageous, for example, where it is desired to minimize accumulation of exhausted inert gas, or where more precise control of the gas flow pattern in the regions adjacent the container openings is desirable. A source of exhaust (e.g. high or low vacuum) may be attached to outlets 38. The plenum 37 is then provided with one or more ports 39 through which the exhausted gases are drawn. Ports 39 may in some embodiment comprise an extended manifold, and may preferably be substantially coextensive longitudinally with the distribution manifold 13. In preferred embodiments, the ports may comprise a longitudinally extended opening, and may be covered by a fine wire mesh (see FIG. 5). In this manner, the gas flow patterns proximate to the port(s) is smoothed and preferably laminarized, to further reduce disruptive currents in the area of the container openings.

[0032] In the embodiment shown to the left of plenum 11 in FIG. 4, an exhaust plenum 37a is substantially contiguous with the gas plenum 11, and may share common elements with plenum 11. The gas ports 39a, which may comprise individual apertures, slots, mesh-covered manifold, or other configurations, are substantially co-planar with the distribution manifold 13 or lower surface of the rail. In the alternative embodiment illustrated to the right of plenum 11, exhaust ports 39b are provided at a level below rail, at or below the open surface of the container. These and other physical embodiments are possible, without departing from the scope of the present invention. Further, although exhaust plenums have been described in combination with certain preferred forms of gas distributors (such as gassing rails), they may be beneficial as well in combination with other known types of gas distributors or flushing systems.

[0033] FIG. 6 illustrates a particularly preferred configuration for the gas rail 10 and manifold 13. In particular, the rail comprises two major elements, an upper assembly 91 and a lower assembly 92. Assembly 91 may comprise a top plate 20 having a generally U-shaped cross section. All relatively permanent connections to the gas rail are preferably made to upper assembly 91, which therefore preferably comprises gas inlet 12 and means for mechanically supporting the assembled gas rail.

[0034] Lower assembly 92 is designed to be easily removable for cleaning, service or replacement of the manifold. In the embodiment illustrated, side members 21, 22 form a box which, when joined with upper assembly 91, defines a closed plenum 11. Quick-mount latches 30 are provided to selectively secure lower assembly 92 to upper assembly 91. In the embodiment illustrated, knobs or slotted members 30 are provided, attached to helical clamps 32 such that, when rotated, clamps 32 engage and secure a portion of side members 21, 22 against a cooperating portion of top member 20. Gaskets 33 may be provided to assure a gas tight seal. It will be understood that alternative means for connecting assemblies 91, 92 may instead be employed without departing from the scope of the present invention, as can alternate designs for the various elements comprising the plenum.

[0035] Lower assembly 92 may therefore be quickly separated from the more permanently attached upper assembly 91. In this manner, the lower elements can be quickly exchanged for others, such as when it is necessary to provide a clean manifold. This may be particularly important where different products are packaged at different times, and contamination must be carefully avoided.

[0036] Also illustrated in FIG. 6 are preferred means for mounting the manifold screens or elements to the lower assembly 92 to permit improved access for service and cleaning. In particular, threaded studs 34 are attached to the sides 21, 22. Cooperating apertures are provided in the manifold elements, which are then passed over the studs 34. Flattening bars or clamps 35 may be provided to assure a longitudinal seal to the manifold elements, which may be secured by e.g. wing nuts 36. A quick-mount structure 72 thereby results. It will be understood that other mounting structures 72 may alternatively be employed, such as spring or friction mounts. Alternatively, the manifold elements may be permanently attached to the supporting plenum structures.

[0037] As shown in FIG. 7, a baffle 71 may be located beneath gas inlet 12 to disperse the incoming gas within the plenum 11 and minimize noise. Although preferably solid, other embodiments may utilize permeable baffles, such as stainless steel mesh or perforated plate.

[0038] FIG. 7 also illustrates a preferred open architecture for the gassing rail systems. A conveyor 59 is provided to transport the containers (50, 52). Conveyor 59 may be any suitable type, including linear, curvilinear, circular, screw-feed, roller or other systems. In a preferred embodiment, support channel 54 supports interconnected conveyor elements 55, which are driven by motive means (not illustrated).

[0039] Proper orientation of the containers relative to the conveyor 59 may be assisted by means of optional guides 76. Preferably guides 76 are adjustable as shown (e.g. supported by adjustment rods 77 and secured by quick-adjustment knobs 78). This permits containers of different sizes to be quickly accommodated, and promotes the desired open architecture by allowing access to the conveyor stream when required.

[0040] Importantly, the gas purging rail segments 10 are preferably mounted in a manner that permits easy adjustment to accommodate different sized containers, and easy access to containers with minimum disruption of a packaging operation. For example, support members 73, 74 may be secured by quick adjustment clamps 75. In this manner, the rail 10 can be easily adjusted laterally to a centered location relative to the containers, and can be adjusted in height relative to conveyor elements 55 to assure a proper location and separation above the open container tops.

[0041] In a particularly preferred embodiment, the upper (horizontal) support member 74 is movable relative to lower (vertical) support member 73, which in turn is linked to the conveyor 59 (e.g. the support structures). The two members are joined by a selectively displaceable joiner such as a pivot or hinge 89, or translational slide. Accordingly, the gas rail 10 and related support structures can be quickly moved from a first operating position proximate the containers, to a second service position away from the stream of containers. As illustrated, hinges 89 may have a generally horizontal axis of rotation, offset from the rail so that the rail structure can be moved, without interference, away from containers. Alternatively, the rail segments 10 may be hinged to swing about a vertical or angled axis, or may be mounted on slides for translational movement. Compound hinges or articulated structures may also be used. In particularly preferred embodiments, the hinges 89 or other support structures permitting movement of the rail 10 provide for movement generally away from the remaining elements of a packaging apparatus, so that the rail segments may be moved from an operating position to a service position without disrupting other elements of the packaging apparatus.

[0042] Use of the present structure provides a highly accessible and open architecture which minimizes down time when a container must be inserted or removed from the system. By merely pivoting (and/or sliding) the relevant segment of the affected rail away from the conveyor, an operator can immediately obtain access to particular containers in process. However, the majority of containers may remain unaffected, since in preferred embodiments only a portion of the rail need be disrupted. Further, when the gassing rail segment is returned to its operating position, the system will quickly return to normal operating conditions since the volume of space contaminated by ambient oxygen is kept relatively small, compared to the large volume of e.g. known gas-filled conveyor tunnels. Although these beneficial mounting structures have been described in connection with preferred forms of gas distributors (e.g. gassing rails), they may be beneficial in combination with other known forms of gas distributors as well.

[0043] A representative commercial system utilizing the present invention is diagrammatically illustrated in FIGS. 8-10. A series of empty containers 50 is supplied to a filler station 2 by conveyor 59, beneath a segmented and hinged pre-purging rail 1. Nitrogen gas is supplied to the plenum of each rail segment, by means of hoses (not illustrated) attached to the gas inlets. The gas supply to each rail segment may be preferably individually controlled, so that interruptions of gas to a single segment (i.e. when that segment must be moved for service) need not require disruption of gas flow to the remaining segments. This assures that only a minimum number of containers will be contaminated. For this purpose, a position detector (e.g. proximity detector 120, FIG. 7) may provide a signal indicating whether the rail segment is in its operating position.

[0044] The conveyor 59 delivers empty containers 50 to a filler station 2, which may comprise any of a number of known product fillers. For example, check weight, auger, rotary valve, in-line indexing, net weigh, and other known apparatus for portioning product and filling containers may be used. The system illustrated includes a circular filler turret 29 for delivering product to the containers and a filler bowl 28 for portioning the bulk feed material and distributing it to the filler turret.

[0045] The filler bowl 28 and other elements of the filler are preferably sealed and supplied with an alternate environment (e.g. inert gas). For example, gas inlets 46 may be provided. By properly enclosing the necessary portions of the filler, oxygen contamination may be prevented as the processed product passes from the hopper 40 into the containers 50. An oxygen sensor 47 may also be provided in the filler bowl or other locations within the filler apparatus.

[0046] The bulk material 9 is supplied to the filler bowl 28 by means of a storage or flow buffer hopper 40. The hopper is provided with a plurality of gassing element inlets 42, 43. In preferred embodiments, an oxygen sensor 44 is provided at the outlet of hopper 40, to permit monitoring of the residual oxygen in the material fed to the filler. Preferably a vent 45 is provided to exhaust any excess flushing gas and the displaced oxygen atmosphere. Vent 45 may, for example, be attached to a roof ventilation outlet, as may exhaust plenums 37 if used. The vent may include a pressure relief valve, to maintain a slight (e.g. 2.54 - 5.08 cm (1-2 inches) water column) positive pressure within the interior of the filler. This helps to exclude oxygen infiltration, particularly during idle periods when the outlets for bulk material (through which the containers are filled) are potentially exposed.

[0047] In a preferred embodiment, the pressure relief valve may include a valve chamber having an interior bore with a lower shoulder, and a "floating" valve member supported on the shoulder. When excessive pressure develops within the filler bowl, this pressure acting against the surface area of the valve element will lift it from the shoulder, providing a path to vent gases. By adjusting the weight of the valve member (or providing other biasing means), the set point of the pressure relief valve may be adjusted for a particular filler and bulk material. The pressure relief valve may be formed with quick connect clamp ferrules on one or both ends, to allow it to be quickly attached to a cooperating ferrule on the filler. A ferrule on the outlet of the valve allows quick connection to e.g. an exhaust system. A filter element is preferably included, to prevent particulate material from entering the exhaust system or fouling the valve.

[0048] In typical rotary fillers, star wheels 48 or other similar systems are used to receive containers from a linear conveyor and place them in the rotating filler apparatus, and similarly to remove filled containers from the rotating apparatus and deliver them to a linear output conveyor. Where such structures are part of the particular filler station 2 utilized, corresponding gas purging rails may be provided to correspond to the curvilinear container path. For example, the pre-purging rail segment 48 includes a curved portion dimensioned to accommodate the path of container travel as empty containers are loaded into the filler illustrated. Similarly, headspace rail segment 49 includes a curved portion corresponding to the travel path of filled containers as they exit the filler. It will be understood that other shapes and dimensions of gas purging rails may be provided to accommodate the particular can paths of numerous filler apparatus.

[0049] Headspace purging rails 3 are shown, in conjunction with conveyor 59, to transport the filled containers 52 to a sealing device 6. This may comprise, in preferred embodiments, a rotary double seam seamer for use with cans and lids having preformed curls. It should be understood that other forms of sealers, in conjunction with cans or other forms of containers, may similarly be utilized. Further, the headspace purging rails should accommodate substantially all travel of the can to, and into, the sealer. If necessary, gassing elements may also be provided within the sealer to prevent oxygen contamination during the sealing operation.

[0050] In the embodiment of FIG. 8, hopper 40 and gassing elements 42, 43 comprise the controlled environment processor 5 (see FIG. 1) for displacing oxygen from the bulk material 9. Two levels of gassing elements (42, 43) are illustrated. As shown in FIG. 10, preferably four elements are provided in each level, at 90° relative to one another, and the two levels are offset 45° relative to each other. The gassing elements are dimensioned and arranged such that the regions of gas exchange generated by each element overlap with those of neighboring elements. It has been found that a zone of oxygen exclusion thereby results which is effectively continuous across the vessel cross-section. Oxygen containing gases entrained in the bulk material passing through the zone are therefore efficiently displaced by inert gas, and the material exits the zone with a substantially lower residual oxygen content. By providing elements on more than one level relative to product flow, two or more exclusion zones may be generated and the bulk material will be made to pass close to at least one, and in most instances two gassing elements. The amount of oxygen removal can be affected by e.g. the number of gassing elements, their location, the flow rate and type of material through the processor, and the flow rate of gas through the elements. For some products a single level of gassing elements is sufficient, although two are preferred.

[0051] At start-up, flow of gas through the manifolds of the pre-purging rails 1 will quickly expel oxygen which may be present in the empty containers 50. Nitrogen is a preferred inert environment, although others may be utilized. Once the various elements have been adequately purged, containers may be processed as previously described. The unique combination of beneficial elements provided by the present invention provides a vary rapid start-up with minimum waste.

[0052] FIGS. 8-9 also illustrate diagrammatically certain optional stations hat may be beneficially incorporated with an overall system. For example, checkweighers may be included, either after the filler 2, before the filler, or both. By monitoring the weight of filled containers 52, any over- or under-filled container may be identified. Preferably an ejector 110 may then remove the improperly filled container from the conveyor 59, such as by ejecting the can laterally off of the conveyor. Imperfectly processed containers (e.g. potentially including undesirable oxygen levels) may also be ejected. Such functions are made easier by the open architecture of the present invention previously described.

[0053] Previously containers which were rejected in this manner were typically discarded, resulting in waste of product and container. To overcome this shortcoming, preferred embodiments of the present invention may include a secondary environmental processor 112. Imperfectly processed containers ejected from the conveyor 59 may be transported to a work and buffer table 113. An operator may then manually adjust the fill of the containers to a proper weight (if necessary), and then process the container by means of the secondary environmental processor 112 to expel oxygen from the container and its contents. By way of example, an apparatus as described in U.S. Patent No. 5,228,269 owned by the present applicants may be used. Once processed, the container may then be transported beneath a secondary headspace rail 114 which merges with the main headspace rail 3 (e.g. is parallel to and contiguous with rail 3 for a distance). By utilizing a headspace flushing rail in this manner, any oxygen which enters the container as it is removed from the secondary processing station is quickly expelled, and contaminating oxygen is excluded from the container as it is reintroduced into the main container stream prior to the sealing station 6. Once again, this beneficial function is optimized by the open architecture design previously described. Although the use of a secondary environmental processor has been described in conjunction with preferred embodiments including particular forms of gassing rails, it should be understood that these aspects of the present invention may have utility in combination with other environmental processing and/or transportation systems as well.

[0054] FIGS. 11-13 illustrate alternative and generally preferred embodiments for the controlled environment processor 5. In particular, an on-demand gas exchanger 60 is illustrated, including a plurality of gassing element inlets 61, 62. Although operation of gas exchanger 60 is somewhat similar to that of hopper 40 previously discussed, the exchanger 60 is optimized for fast on-demand processing of relatively rapidly moving product. In a preferred embodiment, the gas exchanger 60 includes a processing region 63 and preferably two levels of three gassing elements each, offset as illustrated. The central processing region 63 provides sufficient interior volume to accommodate gassing elements having sufficient surface area to provide the necessary gas volumes while retaining a controlled and preferably laminarized flow. Residence time of the product passing through the gassing region may also be optimized. However, the volume of region 63 is preferably small enough to permit fast, intimate real-time processing of material as it flows through for packaging.

[0055] Outlet section 66 is shown, which may preferably have a conical profile to facilitate particulate material flow. In some embodiments, the gassing elements may be located entirely within a main body of the vessel (e.g. FIG. 11), while in other more compact embodiments, some of the elements may be located in the outlet section 66 as well (e.g. FIG. 12). A corresponding conical inlet section 68 attached to inlet 66 may also be provided, as well as a vent 45 for displaced gases.

[0056] An oxygen sensor 64 is preferably provided in the outlet portion 67 to monitor residual oxygen of the material as it is fed to the filler station 2, and one may also be provided at the inlet. Optionally, an isolation or control valve 69 may be provided between the gas exchanger 60 (or hopper 40 of FIG. 8), or other connection means may be utilized to selectively isolate the filler from the controlled environment processor 5.

[0057] In use, each gassing element 80 will establish a surrounding gassing region wherein the inert gas introduced through the manifold displaces the ambient oxygen-containing atmosphere from incoming bulk material. By arranging the gassing elements with respect to a relatively compact processing region 63 within the interior of gas exchanger 60, the gassing regions of neighboring elements can be made to overlap such that an effectively continuous gas substitution (oxygen exclusion) zone is established across the entire cross section of the processing region 63 perpendicular to the direction of bulk material flow. Because of the relatively compact dimensions of the preferred gas exchanger, particulate material passing through the processing region 63 is made to pass closely proximate to at least one, and preferably more than one gassing element.

[0058] It has been discovered that by establishing an oxygen exclusion zone in this manner, a surprisingly efficient gas exchange ratio may be achieved. For example, it has been found that nearly 98% efficient inert gas utilization can be achieved, whereby each volume of incoming inert gas displaces a substantially equal volume of oxygen-containing entrained atmosphere. It had previously been thought that significant countercurrents of excess inert gas flowing back through the incoming material was necessary or beneficial for efficient gas displacement. Surprisingly, applicants have discovered that such a countercurrent flow is not necessary, and indeed not desirable, particularly in products which are sensitive to flavor stripping.

[0059] To facilitate desirable operation, vent 45 may preferably comprise an extended removable filter element to prevent particulate material from entering the exhaust system. For example, a collar having quick connect ferrules on either end can be provided, including means on its interior for receiving a filter element. The filter element may, for example, comprise a 6.35 cm (2.5 inch) diameter cylinder, approximately 22.86 cm (9 inches)long, of 5-ply 40 micron screen. The preferred filter element can then be attached to a vent outlet having a cooperating ferrule, or removed for service or cleaning. An exhaust system may be attached to the ferrule on the outlet end.

[0060] In some configurations, it may also be desirable to provide a check valve or pressure relief valve in conjunction with the vent. For example, a valve having ferrules at its inlet and outlets, as previously described in connection with a filler, may be provided and attached between the filter collar and an exhaust system. By providing each cooperating element (e.g. vent outlet, filter collar, pressure valve, and exhaust connection) with cooperating ferrules, a system results which can accommodate multiple configurations and rapid assembly/disassembly. In certain embodiments, the filter and valve may be provided in a unitized element.

[0061] When material enters the on-demand gas exchanger 60 and encounters the oxygen exclusion zone established by the gassing elements 80, entrained oxygen containing gases will be displaced. This volume of displaced gas may result in an increased pressure in the inlet region 68, which may in turn generate a counter flow of displaced gases. Such a counter flow may disrupt the desired flow of particulate material (e.g. cause bridging or product stratification). To prevent such disruptions, a large input conduit may be used which is dimensioned to accommodate the increased pressure and counter flow. Preferably, however, the pressure relief valve and vent 45 are provided in an inlet region above the gas excluding zone. The displaced gases may then exit without developing a detrimental increased pressure or counter flow of gas, permitting use of more compact transportation conduits.

[0062] Bulk material may be provided to the inlet 66 of gas exchanger 60 by any appropriate means. In preferred embodiments, product is supplied from hopper 40 which also includes gassing elements. In this manner, the bulk material in the hopper can be preliminary processed and maintained at a relatively low oxygen level, with the final oxygen reduction accomplished on-demand in the gas exchanger 60. It should be understood, however, that the use of gassified hoppers is optional. Indeed, in many preferred systems the on-demand gas exchanger 60 provides all or substantially all of the inert gas processing required for the filled product, reducing or eliminating the need for slower pre-processing in hoppers. Use of the on-demand gas exchanger in this manner has the benefit of minimizing dwell time of the bulk product within the inert flushing atmosphere. For certain products (e.g. coffee), this flushing is believed to remove desirable aromatic or flavor volatiles, which is detrimental to the product. By minimizing such contact while simultaneously providing highly effective oxygen displacement, adverse effects are minimized or avoided.

[0063] FIGS. 14-15 illustrate a presently preferred embodiment of a gassing element 80 that may be used in conjunction with hoppers 40 or gas exchanger 60. The gassing elements preferably have an extended length and a porous but rigid construction. A preferred cross-section includes a tapered top section 81 to displace flowing material around the sides of the gassing element. This minimizes forces acting on the gassing element and has been found to prevent bridging or disruption in the flow of particulate material. To provide greater surface area for preferred gentle passage of a suitable volume of inert gas through the gassing element, generally parallel side portions 82 may also be provided. These provide support to the tapered top portion 81 and add significant additional surface area for gas passage, but do not generate significant additional friction relative to the passing particulate material. Both the top portion 81 and sides 82 are preferably comprised of a stainless steel mesh selected to provide a controlled, and preferably laminarized flow of gas into the bulk material, such as 5-ply 20 micron laminated stainless steel mesh. This provides adequate resistance to distribute the inert gas about the entire surface area of the element manifold and provide a uniform, constant laminar flow, while also providing suitable mechanical strength to the element. It has been discovered that substantially laminar flow is desirable to avoid stratification or separation of different sized particles of product. Use of the present invention has also been found to minimize or eliminate breakdown of fragile particles during de-oxygenation, such as instantized coffees or agglomerized product.

[0064] To provide mechanical support to the mesh, a base support 83 and end cap 84 may be provided. Preferably formed of stainless steel, the base support and end cap may include recesses for receiving a removable mesh element, as well as interior strengthening webs if desired. By providing a removable mesh, the manifold may be removed for replacement or cleaning, and all inner portions of the plenum are easily accessible for cleaning.

[0065] The gassing elements preferably extend sufficiently inward from the inner wall of a vessel, so that the ends of the plurality of gassing elements are proximate one another, near enough to provide a uniform oxygen-excluding barrier of inert gas, but without obstructing the flow of particulate matter between the elements. The gassing element 80 may preferably be positioned at a downward sloping angle approximately 5° from horizontal. To permit removal of the elements for cleaning or replacement, they are preferably mounted through inlets 85 sanitary welded or otherwise attached to the vessel. A gasket 86 is positioned between mating surfaces of the gassing element 80 and inlet 85. Gassing elements 80 are preferably secured to the inlet 85 by means of a removable clamp 87, such as a stainless steel quick-clamp tube fitting ferrule (3A sanitary rated).

[0066] Inert gas is supplied to the gassing element 80 through inlet 88. In conjunction with a hopper, a flow rate ranging between about 0.028 to 0.566 cubic m per minute (1-20 scfm) per element and preferably 0.085 to 0.113 cubic m per minute (3-4 scfm) has been found beneficial for elements about 38.1 cm (15 inches) long and 1.9 cm (3/4 inches) wide at the base. As previously noted, the flow rate is dependent on e.g. the type of material being processed, the rate and type of material passing through the hopper, the physical dimensions of the hopper, and the oxygen content of the input material. For example, bulk material which entraps gases (such as in-shell peanuts) may require a higher residence time and/or higher inert gas flow rate. In contrast, relatively large solid products (e.g. shelled and skinned peanuts) may require less residence time and/or gas. By monitoring the residual oxygen content at the output of the hopper, an operator may easily determine an approximate flow rate for a particular product and setup.

[0067] The gassing elements in gas exchanger 60 are preferably identical to those previously described, although the overall dimensions differ to accommodate the smaller size of the gassing region 63. Flow rates per element of 0.028 to 0.142 cubic m per minute (1-5 scfm) per element are desirable, and in particular 0.042 to 0.057 cubic m per minute (1.5-2 scfm) has been found beneficial. In a particularly preferred embodiment, 6 elements in two staggered levels (as shown), each about 17.78 cm (7 inches) long and 1.9 cm (3/4 inches) wide at the base, are provided with 0.011 to 0.05 cubic m per minute (0.4-1.75 scfm) for processing infant formula at 90.7 kg (200 pounds) per minute and higher. It should be understood that other shapes may similarly be used, such as elliptical or other cross-sections.

[0068] While the embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the scope of the invention. The scope of the invention is indicated in the appended claims.

Claims

1. A system for the flushing of oxygen from open containers (50, 52) moving along a conveyor (59) including

   a gas distribution chamber (11) extending longitudinally along the conveyor and the gas distribution chamber including an inlet (12) for receiving alternate environment gas from a source;

the gas distribution chamber including a distribution manifold (13), the distribution manifold including at least one longitudinal region of flow resistance which allows an alternate environment gas flow to pass through the flow resistance region and penetrate into the container, characterised in that the flow resistance region has a differential flow resistance across its width for providing a differential flow rate of the alternate environment gas into the container (50, 52), whereby the alternate environment gas flow creates an inflow and outflow gas pattern that exists substantially continuously and substantially at a steady state for the entire time while the container is being flushed.

2. The system of Claim 1 wherein in use the width of the distribution manifold (13) is about one-half or less of the width of the container opening.

3. The system of Claim 1 wherein in use the width of the distribution manifold (13) is about one-quarter or less of the width of the container opening.

4. The system of Claim 1 wherein the manifold (13) and flow resistance region is substantially continuous along the distribution chamber (11).

5. The system of Claim 1 further comprising a return gas chamber (37a,b) positioned adjacent longitudinal sides of the distribution chamber (11) and receiving gas exiting the container (50, 52).

6. The system of Claim 1 wherein the at least one longitudinally oriented region of flow resistance comprises at least one longitudinally oriented region of higher flow resistance and at least one longitudinally oriented region of lower flow resistance.

7. The system of Claim 1 further comprising at least one exhaust plenum (37a,b) proximate the gas distribution chamber (11) for receiving and conveying away exhausted gases including at least a portion of the alternate environment gas, the exhaust plenum including ports (39a, b) for admitting the exhausted gases and an outlet (38) for attaching the exhaust plenum to an exhaust system.

8. The system of Claim 7 wherein the ports (39a,b) comprise a longitudinally extended exhaust manifold generally parallel to and coextensive with said distribution manifold (13).

9. The system of Claim 8 wherein the exhaust manifold (37a,b) facilitates a substantially laminarized flow of gases in the region between the exhaust manifold and the gas delivery region.

10. The system of Claim 9 wherein the exhaust manifold (37a,b) comprises a fine wire mesh.

11. The system of Claim 7 wherein said ports (39a,b) are substantially coplanar with a surface of the manifold opposite the containers, in a direction toward the containers.

12. The system of Claim 1 wherein the system includes supports (73, 74) for suspending the gas distribution chamber (11) characterised by:

the gas distribution chamber having at least an operating position proximate the container openings, and a service position displaced away from the containers (50, 52), the supports including adjustable supports comprising a first portion (73) linked to a base and a second portion (74) linked to the gas distribution chamber and movable relative to the conveyer (59) between at least two positions corresponding to the operating and service positions; the first and second positions being mechanically joined by a selectively displaceable joiner (89).

13. The system of Claim 12 wherein said selectively displaceable joiner comprises a hinge (89), and said gas distribution chamber (11) is rotationally displaceable between said operating and said service positions about an axis defined by said hinge.

14. The system of Claim 12 wherein said selectively displaceable joiner (89) comprises a slide, and said gas distribution chamber (11) is translationally displaceable between said operating and said service positions.

15. The system of Claim 12 wherein at least said second portion (74) of said adjustable support is further adjustable to provide selectable separation between the conveyor surface and the opposing surface of the gas distribution chamber (11) when said gas distribution chamber is in the operating position.

16. The system of Claim 12 wherein said distribution chamber (11) comprises a plurality of individual distributor segments, at least some of said distributor segments including individual adjustable supports such that one segment may be moved to its respective service position while at least one other segment remains at its respective operating position.

17. The system of Claim 1 wherein the system includes a filler station (2) for filling the containers (50) with at least one bulk material and a sealing station (6) for permanently sealing the containers after they are filled, characterised by:

a prepurging rail (1) including at least one longitudinally oriented gas distribution chamber (11) substantially aligned with the direction of movement of open containers (50) being transported along said conveyor (59), said distribution manifold (13) providing a controlled flow of a selected alternate environment gas into said open containers, said flow being substantially continuous and uniform in said longitudinal direction;

a filler station (2) including a controlled environment processor (5) for removing oxygen from said bulk material (9) prior to filling said open containers (50) with said material; and

a headspace purging rail (3) and conveyor (59) for transporting filled containers (52) from said filler station to said sealing station, said headspace purging rail including at least one longitudinally oriented gas distribution chamber substantially aligned with the direction of movement of said filled containers, said distribution manifold providing a controlled flow of a selected alternate environment into said open containers, said flow being substantially continuous and uniform in said longitudinal direction.

18. The system of Claim 17 wherein the controlled environment processor (5) comprises a gas exchanger for receiving said bulk material (9) as it is transported to said filler station (2) for filling, said gas exchanger comprising a gassing region including gassing elements (42, 43).

19. The system of Claim 18 wherein the controlled environment processor (5) comprises at least one buffer hopper (40) having a plurality of gassing elements (42) in a lower region for injecting said alternate environment into a bulk material in said hopper, and an on-demand gas exchanger for receiving material discharged from said hopper as it is transported to said filler station for filling, said on-demand gas exchanger comprising a gassing region including additional gassing elements.

20. The system of Claim 1 further comprising a gassing rail (10) comprising a first assembly (91) and a second assembly (92):

said first assembly (91) adapted for mounting relative to said conveyor (59), and to releasably support said second assembly; and

said second assembly (92) adapted to be releasably supported by said first assembly, and including said distribution manifold (13).

21. The system of Claim 20 further comprising quick-disconnect latches (75) cooperating with and releasably joining said first and second assemblies (91, 92).

22. The system of Claim 20 wherein in use the width of said distribution manifold (13) is about half or less of the width of the container opening.

23. The system of Claim 20 wherein said distribution chamber (11) comprises cooperating portions of said first and second assemblies (91, 92) when said second assembly (92) is mounted, such that the interior of said distribution chamber is accessible when said second assembly is dismounted.

24. The system of Claim 20 wherein said distribution manifold (13) is removably attached to said second assembly (92).

25. The system of Claim 20 further characterised by at least one longitudinally extended exhaust plenum (37a,b) for receiving and conveying away exhausted gases, said exhaust plenum including ports (39a,b) for admitting the exhausted gases and an outlet (38) for attaching the exhaust plenum to an exhaust system.

26. The system of Claim 20 wherein said distribution manifold (13) comprises apertures.

27. The system of Claim 20 wherein said distribution manifold (13) comprises a wire mesh.

28. The system of Claim 1 wherein the system includes a vessel (40; 60) for processing particular material by means of an alternate environment gas, characterised by:

a plurality of gassing elements (80) having elongated manifold surfaces for passing said alternate environment gas into the regions surrounding said manifolds; and

said gassing elements distributed about the periphery of said vessel with said elongated manifold surfaces passing into the interior of said vessel such that the end of each elongated manifold surface is proximate at least one other gassing element elongated manifold surface.

29. The system of Claim 28 further characterised by:

an on-demand processor for removing said first entrained atmosphere from a flow of particular material in real time, said on-demand processor comprising a vessel having a restricted interior volume for accommodating a flow of said particulate material as part of a processing system.

30. The system of Claim 29 further characterised by each elongated manifold surface of each gassing element (80) generating a gassing region within which said select alternate environment displaces said first entrained atmosphere from a portion of the incoming particulate material flow; and

said gassing elements arranged such that the gassing regions associated with neighbouring manifolds overlap, resulting in an effectively continuous environment displacing zone extending across the entire width of said vessel interior perpendicular to the direction of flow of said particulate material.

31. The system of Claim 28 further characterised by:

each elongated manifold surface of each gassing element (80) generating a gassing region within which said insert gas displaces entrained oxygen from the incoming particulate material; and
said gassing elements arranged such that the gassing regions associated with neighbouring manifolds overlap, resulting in an effectively continuous displacing zone extending across the entire width of said vessel interior perpendicular to the direction of travel of said particulate material.

32. The system of Claim 28 further characterised by two or more substantially coplanar levels of gassing elements (80), each comprising a plurality of gassing elements.

33. The system of Claim 28 wherein said elongated manifolds are substantially radial relative to an axis of said vessel.

34. The system of Claim 33 wherein said elongated manifolds are angled in the direction of flow of said particulate matter through said vessel.

35. The system of Claim 28 wherein said vessel is a hopper (40) having sufficient interior volume adapted for storing bulk quantities of said particulate material and for exposing said particulate material to said inert gas for extended periods to displace oxygen.

36. The system of Claim 28 wherein said vessel is an on-demand processor having restricted interior volume adapted for conveying flowing particulate material in close proximity to said manifolds with minimum residence time within said vessel, while displacing substantially all oxygen from said material as it flows through said vessel.

37. The system of Claim 35 further comprising a vent for exhausting at least a portion of said displaced gases.

38. The system of Claim 36 further comprising a vent for exhausting at least a portion of said displaced gases.

39. The system of Claim 1 including a prepurging system (1) for providing a controlled flow of a selected alternate environment into a sequence of open containers (50) to thereby displace oxygen containing atmosphere within said containers with said alternate environment, a filler station (2) for receiving said open containers from said pre-purging system and filling said containers with portions of at least one bulk material (9), and a sealing station (6) for permanently sealing the filled containers (52), characterised by:

said filler station including an on-demand controlled environment processor (5) for removing oxygen from said bulk material in real time as it flows to a filler for filling said open containers (50), and
a headspace purging rail (3) and conveyor (59) for transporting filled containers (52) from said filler station to said sealing station, said headspace purging rail including at least one gas distribution chamber (11).

40. The system of Claim 28 wherein each gassing element (80) comprises:

a mounting collar for cooperating with an aperture;
a gas inlet port supported by and on a first side of said mounting collar;
an elongated gas manifold on a second side of said mounting collar, said gas manifold comprising a support frame extending away from said mounting collar, and a gas permeable member supported by said frame and defining in part a distribution plenum functionally coupled to said gas inlet;
said gas permeable member including at least a top portion which is generally tapered in a direction transverse to the elongated axis of said gas manifold; and
said elongated gas manifold having a cross-section which permits the manifold to pass through said aperture.

41. The system of Claim 40 wherein said gas permeable member comprises a fine wire mesh, and wherein gas flow from said manifold is substantially laminar.

42. The system of Claim 40 wherein said gas permeable member is removable from said support frame to permit access to the interior of said distribution plenum.

43. The system of Claim 40 wherein said gas permeable member further comprises a lower portion providing additional gas permeable surface area having generally parallel sides.

44. The system of Claim 1 further including a main apparatus having a filler station (2) and an environmental processor (5) for packaging a predetermined quantity of material in each container (50) such that the container interior and packaged material have a reduced oxygen environment, a sealing station (6) for permanently sealing the filled containers, and a main controlled environment transportation system for transporting filled containers (52) to the sealing station, characterised

an independent environmental processing station for separately processing a lesser number of containers to remove substantially all oxygen from the interior of said containers; and
a further transportation system for transporting processed containers from said independent environmental processing station, said further transportation system merging with said main controlled environment transportation system.

45. The system of Claim 44 wherein said main controlled environment transportation system comprises a conveyor (59) and a main headspace purging rail (3) including at least one gas distribution chamber (11) substantially aligned with the direction of movement of the filled containers (52), said manifold (13) providing a controlled flow of a selected alternate environment into said containers; and

said further transportation system comprising a further headspace purging rail (14) having a portion thereof which is proximate to said main headspace purging rail.

46. The system of Claim 44 further including apparatus for detecting underfilled containers having less than said predetermined quantity of bulk material;

apparatus (110) for removing said underfilled containers from said conveyor (59) to said independent environmental processing station, and for topping off said underfilled containers; and
whereby said underfilled containers may be filled to said predetermined quantity, processed by said independent environmental processing station to remove substantially all oxygen from the interior of the topped-off container, and transported at least in part by said further transportation system to said sealing station (6).

47. A method of flushing oxygen from open containers (50, 52) moving along a conveyor (59) in a direction of travel, comprising the steps of:

providing a gas distribution chamber (11) extending longitudinally along the conveyor, the gas distribution chamber including an inlet (12) which receives alternate environment gas from a source and a distribution manifold (13), the distribution manifold including at least one region of flow resistance;
passing the containers along the gas distribution manifold for a period of time;
flowing alternate environment gas through the flow resistance region and penetrating into the container;
supplying a flow of alternate environment gas through the longitudinally oriented distribution manifold which has a width less than the width of the container opening, the incoming flow of alternate environment gas penetrating into the container; characterised by:
the flow resistance region having a differential flow resistance across its width for providing a differential flow rate of the alternate environment gas into the container (50, 52), the alternate environment gas flow creating an inflow and outflow gas pattern that exists substantially continuously and substantially at a steady state for the entire time the container is being flushed.

48. The method of Claim 47 wherein the width of the distribution manifold (13) is about one half or less than the width of the container opening.

49. The method of Claim 47 wherein the width of the distribution manifold (13) is about one quarter or less than the width of the container opening.

50. The method of Claim 47 wherein supplying a flow comprises supplying a higher velocity stream of alternate environment gas through the gas distribution manifold (13) and into the containers (50, 52) through the open tops through a region of lower flow resistance oriented parallel to the direction of travel, while the containers are along the gas distribution manifold, and supplying a steam of lower velocity alternate environment gas through the gas distribution manifold and along the containers, through a region of higher flow resistance oriented parallel to the direction of travel, while the containers are along the gas distribution manifold.

51. The method of Claim 47 including receiving gas exiting the containers (50, 52) through ports (39a,b) in a return gas chamber (37a,b) positioned along the distribution manifold (13).

52. The method of Claim 47 wherein the distribution manifold (13) is covered by a screen providing a substantially laminarized flow.

53. The method of Claim 47 including providing a longitudinally extended exhaust plenum (37a,b) proximate the gas distribution manifold (13), including ports (39a,b) for admitting gases into the exhaust plenum and an outlet (38) for attaching the exhaust plenum to an exhaust system, and

receiving and conveying away by said exhaust plenum at least a portion of the gases exhausted from said container interiors.

54. The method of Claim 53 including generating a differential velocity flow of inert gas by means of said distribution manifold (13) having a differential flow resistance across its width for providing at least two different flow rates of alternate environment into the containers (50, 52).

55. The method of Claim 47 including providing a processor receiving particulate material (9) comprising:

causing said particulate material to flow through a processor (5) having a processing region;
providing a plurality of gassing elements (42, 43) having elongated manifold surfaces for passing said alternate environment gas into regions of said particulate material flow adjacent to said manifolds, said elongated manifold surfaces passing into said processing region of said processor such that the end of each manifold is proximate at least one other gassing element manifold;
each elongated manifold surface of each gassing element generating a gassing region within which said alternate environment gas displaces said first entrained atmosphere from a portion of said particulate material flow, and
said gassing elements arranged such that the gassing regions associated with neighbouring manifolds overlap, resulting in an effectively continuous environment displacing zone extending across the entire width of said processing region perpendicular to the direction of flow of said particulate material.

Patentansprüche

1. System zum Ausspülen von Sauerstoff aus offenen Behältern (50, 52), welche sich entlang eines Förderers (59) bewegen, umfassend:

eine Gasdistributionskammer (11), welche sich in Längsrichtung entlang des Förderers erstreckt und wobei die Gasdistributionskammer einen Einlaß (12) umfaßt, um von einer Quelle ein Alternativ-Umgebungs-Gas aufzunehmen;
wobei die Gasdistributionskammer einen Distributionsverteiler (13) umfaßt, wobei der Distributionsverteiler wenigstens einen Strömungswiderstandslängsbereich umfaßt, welcher einer Strömung des Alternativ-Umgebungs-Gases ermöglicht, durch den Strömungswiderstandsbereich hindurchzutreten und in den Behälter hinein einzudringen, **dadurch gekennzeichnet,** daß der Strömungswiderstandsbereich einen über seine Breite unterschiedlichen Strömungswiderstand aufweist, um eine unterschiedliche Strömungsrate des Alternativ-Umgebungs-Gases in den Behälter (50, 52) hinein bereitzustellen, wodurch die Strömung des Alternativ-Umgebungs-Gases ein Gas-Einström- und ein Gas-Ausströmmuster erzeugt, welches für die gesamte Zeit, während der der Behälter gespült wird, im wesentlichen kontinuierlich und im wesentlichen bei einem Dauerzustand besteht.

2. System nach Anspruch 1, wobei im Gebrauch die Breite des Distributionsverteilers (13) etwa eine Hälfte der Breite der Behälteröffnung oder weniger beträgt.

3. System nach Anspruch 1, wobei im Gebrauch die Breite des Distributionsverteilers (13) etwa ein Viertel der Breite der Behälteröffnung oder weniger beträgt.

4. System nach Anspruch 1, wobei der Verteiler (13) und der Strömungswiderstandsbereich entlang der Distributionskammer (11) im wesentlichen kontinuierlich sind.

5. System nach Anspruch 1, weiterhin umfassend eine Rückkehrgaskammer (37a, b), welche den Längsseiten der Distributionskammer (11) benachbart angeordnet ist und welche das den Behälter (50, 52) verlassende Gas aufnimmt.

6. System nach Anspruch 1, wobei der wenigstens eine in Längsrichtung orientierte Strömungswiderstandsbereich wenigstens einen in Längsrichtung orientierten Bereich mit höherem Strömungswiderstand und wenigstens einen in Längsrichtung orientierten Bereich mit niedrigerem

Strömungswiderstand umfaßt.

7. System nach Anspruch 1, weiterhin umfassend wenigstens einen Abgaskanal (37a, b) in der Nähe der Gasdistributionskammer (11), um Abgase einschließlich wenigstens eines Anteils des Alternativ-Umgebungs-Gases aufzunehmen und wegzufördern, wobei der Abgaskanal Anschlüsse (39a, b) umfaßt um die Abgase einzulassen, und einen Auslaß (38) umfaßt, um den Abgaskanal am Abgassystem anzubringen.

8. System nach Anspruch 7, wobei die Anschlüsse (39a, b) einen in Längsrichtung ausgedehnten Abgasverteiler umfassen, welcher im allgemeinen parallel zum Distributionsverteiler (13) ist und sich gemeinsam mit diesem erstreckt.

9. System nach Anspruch 8, wobei der Abgasverteiler (37a, b) eine im wesentlichen laminarisierte Strömung von Gasen in dem Bereich zwischen dem Abgasverteiler und dem Gaszuleitungsbereich ermöglicht.

10. System nach Anspruch 9, wobei der Abgasverteiler (37a, b) ein feines Drahtgitter umfaßt.

11. System nach Anspruch 7, wobei die Anschlüsse (39a, b) im wesentlichen komplanar mit einer den Behältern gegenüberliegenden Fläche des Verteilers, in einer Richtung auf die Behälter zu, sind.

12. System nach Anspruch 1, wobei das System Lager (73, 74) umfaßt, um die Gasdistributionskammer (11) aufzuhängen, **dadurch gekennzeichnet,** daß:

die Gasdistributionskammer wenigstens eine Betriebsstellung nahe den Behälteröffnungen sowie eine von den Behältern (50, 52) weg verlagerte Wartungsstellung aufweist, wobei die Lager einstellbare Lager umfassen, mit einem ersten Abschnitt (73), welcher mit einer Basis verbunden ist, und einem zweiten Abschnitt (74), welcher mit der Gasdistributionskammer verbunden ist und relativ zu dem Förderer (59) zwischen wenigstens zwei Stellungen, entsprechend der Betriebs- und der Wartungsstellung, bewegbar ist; wobei die erste und die zweite Stellung mechanisch durch ein selektiv verlagerbares Verbindungs

element (89) verbunden sind.

13. System nach Anspruch 12, wobei das selektiv verlagerbare Verbindungselement ein Drehgelenk (89) umfaßt, und wobei die Gasdistributionskammer (11) zwischen der Betriebs- und der Wartungsstellung um eine durch das Drehgelenk definierte Achse drehbar verlagerbar ist.

14. System nach Anspruch 12, wobei das selektiv verlagerbare Verbindungselement (89) einen Schieber umfaßt, und wobei die Gasdistributionskammer (11) zwischen der Betriebs- und der Wartungsstellung translatorisch verlagerbar ist.

15. System nach Anspruch 12, wobei wenigstens der zweite Abschnitt (74) des einstellbaren Lagers weiterhin einstellbar ist, um einen auswählbaren Abstand zwischen der Fördererfläche und der gegenüberliegenden Fläche der Gasdistributionskammer (11) bereitzustellen, wenn die Gasdistributionskammer sich in der Betriebsstellung befindet.

16. System nach Anspruch 12, wobei die Distributionskammer (11) eine Mehrzahl von einzelnen Distributorsegmenten umfaßt, wobei wenigstens einige der Distributorsegmente einzelne einstellbare Lager umfassen, so daß ein Segment in seine jeweilige Wartungsstellung bewegt werden kann, während wenigstens ein anderes Segment in seiner jeweiligen Betriebsstellung verbleibt.

17. System nach Anspruch 1, wobei das System eine Füllstation (2) zum Füllen der Behälter (50) mit wenigstens einem Schüttgut sowie eine Abdichtstation (6) umfaßt, um die Behälter, nachdem sie gefüllt sind, dauerhaft abzudichten, **gekennzeichnet durch:**

eine Vorreinigungs-Schiene (1) umfassend wenigstens eine in Längsrichtung orientierte Gasdistributionskammer (11), welche im wesentlichen in der Bewegungsrichtung der offenen Behälter (50) ausgerichtet ist, welche Behälter entlang des Förderers (59) transportiert werden, wobei der Distributionsverteiler (13) eine gesteuerte/geregelte Strömung eines ausgewählten Alternativ-Umgebungs-Gases in die offenen Behälter hinein bereitstellt, wobei die Strömung in der Längsrichtung im wesentlichen kontinuierlich und gleichförmig ist;
eine Füllstation (2) umfassend einen Prozessor (5) mit einer gesteuerte/geregelte Umgebung, um Sauerstoff aus dem Schüttgut (9) zu entfernen, bevor die offenen Behälter (50) mit dem Material gefüllt werden; sowie
eine Gasraum-Reinigungsschiene (3) und einen Förderer (59), um die gefüllten Behälter (52) von der Füllstation zur Abdichtstation zu transportieren, wobei die Gasraum-Reinigungsschiene wenigstens eine in Längsrichtung orientierte Gasdistributionskammer umfaßt, welche im wesentlichen zu der Bewegungsrichtung der gefüllten Behälter ausgerichtet ist, wobei der Distributionsverteiler eine

gesteuerte/geregelte Strömung einer ausgewählten Alternativ-Umgebung in die offenen Behälter hinein bereitstellt, wobei die Strömung in der Längsrichtung im wesentlichen kontinuierlich und gleichförmig ist.

18. System nach Anspruch 17, wobei der Prozessor (5) mit der gesteuerten/geregelten Umgebung einen Gasaustauscher umfaßt, um das Schüttgut (9) aufzunehmen, während es zum Füllen zur Füllstation (2) transportiert wird, wobei der Gasaustauscher einen Begasungsbereich einschließlich Begasungselemente (42, 43) umfaßt.

19. System nach Anspruch 18, wobei der Prozessor (5) mit der gesteuerten/geregelten Umgebung wenigstens ein Puffersilo (40) mit einer Mehrzahl von Begasungselementen (42) in einem unteren Bereich zum Einblasen der alternativen Umgebung in ein Schüttgut in dem Silo, sowie einen Bedarfs-Gasaustauscher umfaßt, um Material aufzunehmen, welches von dem Silo abgegeben wird, während es zum Füllen zur Füllstation transportiert wird, wobei der Bedarfs-Gasaustauscher einen Begasungsbereich mit zusätzlichen Begasungselementen umfaßt.

20. System nach Anspruch 1, weiterhin umfassend eine Begasungsachiene (10), umfassend eine erste Baugruppe (91) und eine zweite Baugruppe (92):
wobei die erste Baugruppe (91) ausgebildet ist, um relativ zu dem Förderer (59) angebracht zu werden, und um die zweite Baugruppe lösbar zu lagern; und wobei die zweite Baugruppe (92) ausgebildet ist, um von der ersten Baugruppe lösbar gelagert zu werden, und wobei sie den Distributionsverteiler (13) umfaßt.

21. System nach Anspruch 20, weiterhin umfassend Schnell-Trenn-Spanner (75), welche mit der ersten und der zweiten Baugruppe (91, 92) zusammenwirken und diese lösbar verbinden.

22. System nach Anspruch 20, wobei im Gebrauch die Breite des Distributionsverteilers (13) etwa die Hälfte der Breite der Behälteröffnung oder weniger beträgt.

23. System nach Anspruch 20, wobei die Distributionskammer (11) zusammenwirkende Abschnitte der ersten und der zweiten Baugruppe (91, 92) umfaßt, wenn die zweite Baugruppe (92) derart befestigt ist, daß das Innere der Distributionskammer dann zugänglich ist, wenn die zweite Baugruppe abmontiert ist.

24. System nach Anspruch 20, wobei der Distributionsverteiler (13) an der zweiten Baugruppe (92) abnehmbar angebracht ist.

25. System nach Anspruch 20, weiterhin **gekennzeichnet durch** wenigstens einen in Längsrichtung ausgedehnten Abgaskanal (37a, b), um Abgase aufzunehmen und wegzufördern, wobei der Abgaskanal Anschlüsse (39a, b) zum Einlassen der Abgase sowie einen Auslaß (83) zum Anbringen des Abgaskanals an einem Abgassystem umfaßt.

26. System nach Anspruch 20, wobei der Distributionaverteiler (13) Öffnungen umfaßt.

27. System nach Anspruch 20, wobei der Distributionsverteiler (13) ein Drahtgitter umfaßt.

28. System nach Anspruch 1, wobei das System ein Gefäß (40; 60) umfaßt, um ein bestimmtes Material vermittels eines Alternativ-Umgebungs-Gases zu verarbeiten, **gekennzeichnet durch:**

eine Mehrzahl von Begasungselementen (80) mit länglichen Verteilerflächen, um das Alternativ-Umgebungs-Gas in die die Verteiler umgebenden Bereiche hinein durchzuleiten; und
wobei die Begasungselemente um den Umfang des Gefäßes verteilt sind, wobei die länglichen Verteilerflächen derart in das Innere des Gefäßes hinein reichen, daß das Ende einer jeden länglichen Verteilerfläche in der Nähe wenigstens eines anderen Begasungselements mit länglicher Verteilerfläche liegt.

29. System nach Anspruch 28, weiterhin **gekennzeichnet durch:**

einen Bedarfs-Prozessor, um die erste mitgeführte Atmosphäre aus einer Partikelmaterialströmung in Echtzeit zu entfernen, wobei der Bedarfs-Prozessor ein Gefäß mit einem eingeschränkten inneren Volumen zur Aufnahme einer Strömung des Partikelmaterials als Teil eines Verarbeitungssystems umfaßt.

30. System nach Anspruch 29, weiterhin **dadurch gekennzeichnet,** daß jede längliche Verteilerfläche eines jeden Begasungselements (80) einen Begasungsbereich erzeugt, innerhalb dessen die gewählte Alternativ-Umgebung die erste mitgeführte Atmosphäre aus einem Anteil der ankommenden Partikelmaterialströmung verdrängt; und

daß die Begasungselemente derart angeordnet sind, daß sich die Begasungsbereiche überlappen, die benachbarten Verteilern zugeordnet sind, was zu einer effektiv kontinuierlichen Umgebungsverdrängungszone führt, welche sich über die gesamte Breite des Gefäßinnenraums senkrecht zur Strömungsrichtung des Partikelmaterlals erstreckt.

31. System nach Anspruch 28, ferner **dadurch gekennzeichnet,** daß:

jede längliche Verteilerfläche eines jeden Begasungselements (80) einen Begasungsbereich erzeugt, innerhalb dessen das Inert[*]gas mitgeführten Sauerstoff aus dem ankommmenden Partikelmaterial verdrängt; sowie
daß die Begasungselemente derart angeordnet sind, daß sich die Begasungsbereiche überlappen, die benachbarten Verteilern zugeordnet sind, was zu einer effektiv kontinuierlichen Verdrängungszone führt, welche sich über die gesamte Breite des Gefäßinneren senkrecht zur Bewegungsrichtung des Partikelmaterials erstreckt.

32. System nach Anspruch 28, ferner **gekennzeichnet durch** zwei oder mehr im wesentlichen komplanare Niveaus von Begasungselementen (80), wobei jedes eine Mehrzahl von Begasungselementen umfaßt.

33. System nach Anspruch 28, wobei die länglichen Verteiler bezüglich einer Achse des Gefäßes im wesentlichen radial sind.

34. System nach Anspruch 33, wobei die länglichen Verteiler zur Strömungsrichtung der Partikelmaterie durch das Gefäß hindurch abgewinkelt sind.

35. System nach Anspruch 28, wobei das Gefäß ein Silo (40) mit ausreichend Innenvolumen ist, welches ausgebildet ist, um große Mengen des Partikelmaterials zu speichern und um das Partikelmaterial dem Inertgas für ausgedehnte Zeitspannen auszusetzen, um Sauerstoff zu verdrängen.

36. System nach Anspruch 28, wobei das Gefäß ein Bedarfs-Prozessor mit eingeschränktem Innenvolumen ist, welcher ausgebildet ist, um strömendes Partikelmaterial in unmittelbarer Nähe zu den Verteilern mit minimaler Verweilzeit innerhalb des Gefäßes zu befördern, während im wesentlichen der gesamte Sauerstoff aus dem Material verdrängt wird, während es durch das Gefäß hindurch strömt.

37. System nach Anspruch 35, ferner umfassend eine Entlüftung, um wenigstens einen Anteil der verdrängten Gase abzulassen.

38. System nach Anspruch 36, weiterhin umfassend eine Entlüftung, um wenigstens einen Anteil der verdrängten Gase abzulassen.

39. System nach Anspruch 1, umfassend:

ein Vorreinigungssystem (1), um eine gesteuerte/geregelte Strömung einer ausgewählten Alternativ-Umgebung in eine Folge von offenen Behältern (50) hinein bereitzustellen, um dadurch sauerstoffhaltige Atmosphäre innerhalb der Behälter mit der Alternativ-Umgebung zu verdrängen,
eine Füllstation (2), um die offenen Behälter von dem Vorreinigungssystem aufzunehmen und die Behälter mit Anteilen wenigstens eines Schüttguts (9) zu füllen, sowie
eine Abdichtstation (6), um die gefüllten Behälter (52) dauerhaft abzudichten, **dadurch gekennzeichnet,** daß
die Füllstation einen Bedarfs-Prozessor (5) mit einer gesteuerten/geregelten Umgebung umfaßt, um Sauerstoff aus dem Schüttgut in Echtzeit zu entfernen, während es zu einer Füllvorrichtung strömt, um die offenen Behälter (50) zu füllen, und
gekennzeichnet durch eine Gasraum-Reinigungsschiene (3) und einen Förderer (59), um gefüllte Behälter (52) von der Füllstation zu der Abdichtstation zu transportieren, wobei die Gasraum-Reinigungsschiene wenigstens eine Gasdistributionskammer (11) umfaßt.

40. System nach Anspruch 28, wobei jedes Begasungselement (80) umfaßt: einen Anbringungsbund, um mit einer Öffnung zusammenzuwirken;

einen Gaseinlaßanschluß, welcher von und an einer ersten Seite des Anbringungsbundes gelagert ist;
einen länglichen Gasverteiler an einer zweiten Seite des Anbringungsbundes, wobei der Gasverteiler einen Stützrahmen, welcher sich von dem Anbringungsbund weg erstreckt, sowie ein gasdurchlässiges Element umfaßt, welches durch den Rahmen gelagert ist und teilweise einen mit dem Gaseinlaß funktional verbundenen Distributionskanal definiert;
wobei das gasdurchlässige Element wenigstens einen oberen Abschnitt umfaßt, welcher im allgemeinen in einer Querrichtung zur verlängerten Achse des Gasverteilers verjüngt ist; und
wobei der längliche Gasverteiler einen Querschnitt aufweist, welcher dem Verteiler gestattet, durch die Öffnung hindurchzutreten.

41. System nach Anspruch 40, wobei das gasdurchlässige Element ein feines Drahtgitter umfaßt, und wobei eine Gasströmung von dem Verteiler im wesentlichen laminar ist.

42. System nach Anspruch 40, wobei das gasdurchlässige Element von dem Lagerrahmen abnehmbar ist, um einen Zugang zum Inneren des Distributionskanals zu gestatten.

43. System nach Anspruch 40, wobei das gasdurchlässige Element weiterhin einen unteren Abschnitt umfaßt, welcher einen zusätzlichen gasdurchlässigen Flächenbereich mit im allgemeinen parallelen Seiten bereitstellt.

44. System nach Anspruch 1, weiterhin umfassend:

eine Hauptvorrichtung mit einer Füllstation (2) und einen Umgebungsprozessor (5), um eine vorbestimmte Menge an Material in jedem Behälter (50) derart zu verpacken, daß das Behälterinnere und das verpackte Material eine reduzierte Sauerstoffumgebung aufweisen,
eine Abdichtstation (6), um die gefüllten Behälter dauerhaft abzudichten, sowie
ein Haupttransportsystem mit gesteuerter/geregelter Umgebung, um gefüllte Behälter (52) zur Abdichtstation zu transportieren, **gekennzeichnet durch:**
eine unabhängige Umgebungsverarbeitungsstation zum getrennten Verarbeiten einer geringeren Anzahl an Behältern, um im wesentlichen den gesamten Sauerstoff aus dem Inneren der Behälter zu entfernen; sowie
ein weiteres Transportsystem, um verarbeitete Behälter von der unabhängigen Umgebungsverarbeitungsstationzutransportieren, wobei das weitere Transportsystem in das Haupttransportsystem mit gesteuerter/geregelter Umgebung einmündet.

45. System nach Anspruch 44, wobei das Haupttransportsystem mit gesteuerter/geregelter Umgebung einen Förderer (59) und eine Haupt-Gasraum-Reinigungsschiene (3) umfaßt, mit wenigstens einer Gasdistributionskammer (11), welche im wesentlichen in der Bewegungsrichtung der gefüllten Behälter (52) ausgerichtet ist, wobei der Verteiler (13) eine gesteuerte/geregelte Strömung einer ausgewählten Alternativ-Umgebung in die Behälter hinein bereitstellt; und
wobei das weitere Transportsystem eine weitere Gasraum-Reinigungsschiene (14) umfaßt, mit einem Abschnitt derselben, welcher sich in der Nähe der Haupt-Gasraum-Reinigungsschiene befindet.

46. System nach Anspruch 44, weiterhin umfassend:

Vorrichtungen, um unterbefüllte Behälter mit weniger als der vorbestimmten Menge an Schüttgut zu erfassen;
Vorrichtungen (110), um die unterbefüllten Behälter von dem Förderer (59) zu der unabhängigen Umgebungsverarbeitungsstation auszusondern, und um die unterbefüllten Behälter abzudecken; und
wobei die unterbefüllten Behälter bis zur vorbestimmten Menge gefüllt werden können, wobei die Behälter durch die unabhängige Umgebungsverarbeitungsstation verarbeitet werden, um im wesentlichen den gesamten Sauerstoff aus dem Inneren des abgedeckten Behälters zu entfernen, und wobei die Behälter wenigstens teilweise durch das weitere Transportsystem zur Abdichtstation (6) transportiert werden.

47. Verfahren zum Ausspülen von Sauerstoff aus offenen Behältern (50, 52), welche sich entlang eines Förderers (59) in einer Laufrichtung bewegen, umfassend die Schritte:

Bereitstellen einer Gasdistributionskammer (11), welche sich in Längsrichtung entlang des Förderers erstreckt, wobei die Gasdistributionskammer einen Einlaß (12), welcher ein Alternativ-Umgebungs-Gas von einer Quelle empfängt, und einen Distributionsverteiler (13) umfaßt, wobei der Distributionsverteiler wenigstens einen Strömungswiderstandsbereich umfaßt;
Vorbeiführen der Behälter entlang des Gasdistributionsverteilers für eine Zeitdauer;
Strömen eines Alternativ-Umgebungs-Gases durch den Strömungswiderstandsbereich hindurch und Eindringen in den Behälter hinein;
Zuführen einer Strömung von Alternativ-Umgebungs-Gas durch den in Längsrichtung orientierten Distributionsverteiler, welcher eine Breite aufweist, die geringer ist als die Breite der Behälteröffnung, wobei die ankommende Strömung von Alternativ-Umgebungs-Gas in den Behälter hinein eindringt;
dadurch gekennzeichnet, daß
der Strömungswiderstandsbereich über seine Breite einen unterschiedlichen Strömungswiderstand aufweist, um eine unterschiedliche Strömungsrate des Alternativ-Umgebungs-Gases in den Behälter (50, 52) hinein bereitzustellen, wobei die Strömung des Alternativ-Umgebungs-Gases ein Einström- und ein Ausström-Gasmuster erzeugt, welches für die gesamte Zeit, in der der Behälter gespült wird, im wesentlichen kontinuierlich und im wesentlichen bei einem Dauerzustand besteht.

48. Verfahren nach Anspruch 47, wobei die Breite des Distributionsverteilers (13) etwa eine Hälfte oder weniger als die Breite der Behälteröffnung beträgt.

49. Verfahren nach Anspruch 47, wobei die Breite des Distributionsverteilers (13) etwa ein Viertel oder weniger als die Breite der Behälteröffnung beträgt.

50. Verfahren nach Anspruch 47, wobei das Zuführen einer Strömung umfaßt:

ein Zuführen eines Stroms von Alternativ-Umgebungs-Gas mit höherer Geschwindigkeit durch den Gasdistributionsverteiler (13) hindurch und durch die offenen Oberseiten in die Behälter (50, 52) hinein durch einen Bereich mit niedrigerem Strömungswiderstand, welcher parallel zur Verfahrrichtung orientiert ist, während die Behälter sich längs des Gasdistributionsverteilers befinden, sowie
ein Zuführen eines Stroms von Alternativ-Umgebungs-Gas mit niedrigerer Geschwindigkeit durch den Gasdistributionsverteiler und entlang der Behälter, durch einen Bereich mit höherem Strömungswiderstand, welcher parallel zur Verfahrrichtung orientiert ist, während sich die Behälter längs des Gasdistributionsverteilers befinden.

51. Verfahren nach Anspruch 47, umfassend das Aufnehmen von Gas, welches die Behälter (50, 52) verläßt, durch Anschlüsse (39a, b) in einer Rückkehrgaskammer (37a, b), welche entlang des Distributionsverteilers (13) angeordnet sind.

52. Verfahren nach Anspruch 47, wobei der Distributionsverteiler (13) durch ein Sieb bedeckt ist, welches eine im wesentlichen laminarisierte Strömung bereitstellt.

53. Verfahren nach Anspruch 47, umfassend das Bereitstellen eines in Längsrichtung ausgedehnten Abgaskanals (37a, b) in der Nähe des Gasdistributionsverteilers (13), mit Anschlüssen (39a, b), um Gase in den Abgaskanal einzulassen, sowie mit einem Auslaß (38), um den Abgaskanal an einem Abgassystem anzubringen, und

das Aufnehmen und Wegfördern wenigstens eines Anteils der von den Behälterinnenräumen ausgeblasenen Gasen durch den Abgaskanal.

54. Verfahren nach Anspruch 53, umfassend das Erzeugen einer Inertgasströmung mit unterschiedlicher Geschwindigkeit vermittels des Distributionsverteilers (13) mit einem über seine Breite unterschiedlichen Strömunswiderstand, um wenigstens zwei unterschiedliche Strömungsraten einer Alternativ-Umgebung in die Behälter (50, 52) hinein bereitzustellen.

55. Verfahren nach Anspruch 47, umfassend das Bereitstellen eines Prozessors zum Aufnehmen von Partikelmaterial (9), umfassend:

Veranlassen, daß das Partikelmaterial durch einen Prozessor (5) mit einem Verarbeitungsbereich strömt;
Bereitstellen einer Mehrzahl von Begasungselementen (42, 43) mit länglichen Verteilerflächen, um das Alternativ-Umgebungs-Gas in die an die Verteiler angrenzenden Bereiche der Partikelmaterialströmung hinein durchzuleiten, wobei die länglichen Verteilerflächen in den Verarbeitungsbereich des Prozessors derart hineinragen, daß sich das Ende eines jeden Verteilers in der Nähe wenigstens eines anderen Begasungselementverteilers befindet;
wobei jede längliche Verteilerfläche eines jeden Begasungselementes, welche einen Begasungsbereich erzeugt, innerhalb dessen das Alternativ-Umgebungs-Gas die erste mitgeführte Atmosphäre aus einem Anteil der Partikelmaterialströmung verdrängt, und
wobei die Begasungselemente derart angeordnet sind, daß sich die Begasungsbereiche überlappen, die benachbarten Verteilern zugeordnet sind, was zu einer effektiv kontinuierlichen Umgebungsverdrängungszone führt, welche sich über die gesamte Breite des Verarbeitungsbereichs senkrecht zur Strömungsrichtung des Partikelmaterials erstreckt.

Revendications

1. Système pour débarrasser de leur oxygène par balayage des récipients ouverts (50, 52) se déplaçant le long d'un transporteur (59) comprenant :

une chambre de distribution de gaz (11) s'étendant longitudinalement le long du transporteur et la chambre de distribution de gaz comprenant une entrée (12) pour recevoir un gaz d'environnement de substitution d'une source ;
la chambre de distribution de gaz comprenant un collecteur de distribution (13), le collecteur de distribution comprenant au moins une région longitudinale de résistance à l'écoulement qui permet à un flux de gaz d'environnement de substitution de traverser la région de résistance à l'écoulement et de pénétrer dans le récipient, caractérisé en ce que la région de résistance à l'écoulement a une résistance à l'écoulement différentielle en travers de sa largeur pour obtenir un débit différentiel du gaz

d'environnement de substitution dans le récipient (50, 52), de manière que le flux de gaz d'environnement de substitution crée une configuration de gaz d'entrée et de sortie qui existe sensiblement en continu et sensiblement en régime constant pendant toute la durée pendant laquelle le récipient est balayé.

2. Système selon la revendication 1, dans lequel, à l'utilisation, la largeur du collecteur de distribution (13) est inférieure ou égale à environ la moitié de la largeur de l'ouverture du récipient.

3. Système selon la revendication 1, dans lequel, à l'utilisation, la largeur du collecteur de distribution (13) est inférieure ou égale à environ un quart de la largeur de l'ouverture du récipient.

4. Système selon la revendication 1, dans lequel le collecteur (13) et la région de résistance à l'écoulement sont sensiblement continus le long de la chambre de distribution (11).

5. Système selon la revendication 1, comprenant également une chambre de gaz de retour (37a, b) positionnée adjacente aux côtés longitudinaux de la chambre de distribution (11) et recevant un gaz quittant le récipient (50, 52).

6. Système selon la revendication 1, dans lequel ladite au moins une région de résistance à l'écoulement orientée longitudinalement comprend au moins une région orientée longitudinalement de plus grande résistance à l'écoulement et au moins une région orientée longitudinalement de moins grande résistance à l'écoulement.

7. Système selon la revendication 1, comprenant également au moins un plénum d'échappement (37a, b) près de la chambre de distribution de gaz (11) pour recevoir et évacuer des gaz d'échappement comprenant au moins une partie du gaz d'environnement de substitution, le plénum d'échappement comprenant des orifices (39a, b) pour admettre les gaz d'échappement et une sortie (38) pour fixer le plénum d'échappement à un système d'échappement.

8. Système selon la revendication 7, dans lequel les orifices (39a, b) comprennent un collecteur d'échappement s'étendant longitudinalement généralement parallèle audit, et dans l'extension dudit, collecteur de distribution (13).

9. Système selon la revendication 8, dans lequel le collecteur d'échappement (37a, b) facilite un écoulement sensiblement laminaire des gaz dans la région entre le collecteur d'échappement et la région de décharge de gaz.

10. Système selon la revendication 9, dans lequel le collecteur d'échappement (37a, b) comprend un treillis métallique fin.

11. Système selon la revendication 7, dans lequel lesdits orifices (39a, b) sont sensiblement coplanaires avec une surface du collecteur en face des récipients, dans une direction vers les récipients.

12. Système selon la revendication 1, dans lequel le système comprend des supports (73, 74) pour suspendre la chambre de distribution de gaz (11), caractérisé par :

la chambre de distribution de gaz comportant au moins une position de fonctionnement proche des ouvertures des récipients, et une position de service éloignée des récipients (50, 52), les supports comprenant des supports réglables comprenant une première partie (73) reliée à une base et une deuxième partie (74) reliée à la chambre de distribution de gaz et mobile relativement au transporteur (59) entre au moins deux positions correspondant aux positions de fonctionnement et de service ; les première et deuxième positions étant reliées mécaniquement par un organe de jonction (89) adapté à être déplacé sélectivement.

13. Système selon la revendication 12, dans lequel ledit organe de jonction adapté à un déplacement sélectif comprend une articulation (89), et ladite chambre de distribution de gaz (11) est adaptée à être déplacée en rotation entre lesdites positions de fonctionnement et de service autour d'un axe défini par ladite articulation.

14. Système selon la revendication 12, dans lequel ledit organe de jonction (89) adapté à un déplacement sélectif comprend une coulisse, et ladite chambre de distribution de gaz (11) est adaptée à être déplacée en translation entre lesdites positions de fonctionnement et de service.

15. Système selon la revendication 12, dans lequel au moins ladite deuxième partie (74) dudit support réglable est en outre réglable pour permettre une séparation pouvant être sélectionnée entre la surface du transporteur et la surface opposée de la chambre de distribution de gaz (11) lorsque ladite chambre de distribution de gaz est dans la position de fonctionnement.

16. Système selon la revendication 12, dans lequel ladite chambre de distribution de gaz (11) comprend une pluralité de segments distributeurs individuels, au moins certains desdits segments distributeurs comprenant des supports réglables individuels de manière qu'un segment puisse être déplacé jusqu'à sa position de service respective tandis qu'au moins un autre segment demeure à sa position de fonctionnement respective.

17. Système selon la revendication 1, dans lequel le système comprend une station de remplissage (2) pour remplir les récipients (50) d'au moins une matière en vrac et une station de fermeture hermétique (6) pour fermer hermétiquement de manière permanente les récipients après leur remplissage, caractérisé par :

une rampe de purge préalable (1) comprenant au moins une chambre de distribution de gaz orientée longitudinalement (11) sensiblement alignée avec la direction de déplacement de récipients ouverts (50) étant transportés le long dudit transporteur (59), ledit collecteur de distribution (13) permettant un écoulement contrôlé d'un gaz d'environnement de substitution sélectionné dans lesdits récipients ouverts, ledit écoulement étant sensiblement continu et uniforme dans ladite direction longitudinale ;
une station de remplissage (2) comprenant un dispositif de traitement d'environnement contrôlé (5) pour extraire l'oxygène de ladite matière en vrac (9) avant de remplir lesdits récipients ouverts (50) de ladite matière ; et
une rampe de purge d'espace libre de récipient (3) et un transporteur (59) pour transporter les récipients remplis (52) de ladite station de remplissage à ladite station de fermeture hermétique, ladite rampe de purge d'espace libre de récipient comprenant au moins une chambre de distribution de gaz orientée longitudinalement sensiblement alignée avec la direction de déplacement desdits récipients remplis, ledit collecteur de distribution permettant un écoulement contrôlé d'un milieu d'environnement de substitution sélectionné dans lesdits récipients ouverts, ledit écoulement étant sensiblement continu et uniforme dans ladite direction longitudinale.

18. Système selon la revendication 17, dans lequel le dispositif de traitement d'environnement contrôlé (5) comprend un échangeur de gaz pour recevoir ladite matière en vrac (9) lorsqu'elle est transportée jusqu'à ladite station de remplissage (2) pour le remplissage, ledit échangeur de gaz comprenant une région d'injection de gaz comprenant des éléments d'injection de gaz (42, 43).

19. Système selon la revendication 18, dans lequel le dispositif de traitement d'environnement contrôlé (5) comprend au moins une trémie tampon (40) comportant une pluralité d'éléments d'injection de gaz (42) dans une région inférieure pour injecter ledit milieu d'environnement de substitution dans une matière en vrac dans ladite trémie, et un échangeur de gaz sur demande pour recevoir une matière déchargée de ladite trémie lorsqu'elle est transportée jusqu'à ladite station de remplissage pour remplissage, ledit échangeur de gaz sur demande comprenant une région d'injection de gaz comprenant des éléments d'injection de gaz supplémentaires.

20. Système selon la revendication 1, comprenant également une rampe d'injection de gaz (10) comprenant un premier ensemble (91) et un deuxième ensemble (92) ;

ledit premier ensemble (91) adapté à un montage relativement audit transporteur (59), et à supporter avec possibilité de libération ledit deuxième ensemble ; et
ledit deuxième ensemble (92) adapté à être supporté avec possibilité de libération par ledit premier ensemble, et comprenant ledit collecteur de distribution (13).

21. Système selon la revendication 20, comprenant également des organes de verrouillage à débranchement rapide (75) coopérant avec, et raccordant avec possibilité de libération, lesdits premier et deuxième ensembles (91, 92).

22. Système selon la revendication 20, dans lequel, à l'utilisation, la largeur dudit collecteur de distribution (13) est inférieure ou égale à environ la moitié de la largeur de l'ouverture du récipient.

23. Système selon la revendication 20, dans lequel ladite chambre de distribution (11) comprend des parties en coopération desdits premier et deuxième ensembles (91, 92) lorsque ledit deuxième ensemble (92) est monté, de manière que l'intérieur de ladite chambre de distribution soit accessible lorsque ledit deuxième ensemble est démonté.

24. Système selon la revendication 20, dans lequel ledit collecteur de distribution (13) est fixé avec possibilité d'enlèvement audit deuxième ensemble (92).

25. Système selon la revendication 20, également caractérisé par au moins un plénum d'échappement s'étendant longitudinalement (37a, b) pour recevoir et évacuer des gaz d'échappement, ledit plénum d'échappement comprenant des orifices (39a, b) pour admettre les gaz d'échappement et une sortie (38) pour fixer le plénum d'échappement à un système d'échappement.

26. Système selon la revendication 20, dans lequel ledit collecteur de distribution (13) comprend des ouvertures.

27. Système selon la revendication 20, dans lequel ledit collecteur de distribution (13) comprend un treillis métallique.

28. Système selon la revendication 1, dans lequel le système comprend une cuve (40 ; 60) pour traiter une matière particulaire au moyen d'un gaz d'environnement de substitution, caractérisé par :

une pluralité d'éléments d'injection de gaz (80) comportant des surfaces de collecteur allongées pour faire passer ledit gaz d'environnement de substitution dans les régions entourant lesdits collecteurs ; et
lesdits éléments d'injection de gaz répartis autour de la périphérie de ladite cuve avec lesdites surfaces de collecteur allongées passant à l'intérieur de ladite cuve de manière que l'extrémité de chaque surface de collecteur allongée soit proche d'au moins une autre surface de collecteur allongée d'élément d'injection de gaz.

29. Système selon la revendication 28, également caractérisé par :

un dispositif de traitement sur demande pour extraire ladite première atmosphère entraînée d'un flux de matière particulaire en temps réel, ledit dispositif de traitement sur demande comprenant une cuve ayant un volume intérieur restreint pour loger un flux de ladite matière particulaire en tant que partie d'un système de traitement.

30. Système selon la revendication 29, également caractérisé par chaque surface de collecteur allongée de chaque élément d'injection de gaz (80) produisant une région d'injection de gaz au sein de laquelle ledit milieu d'environnement de substitution sélectionné déplace ladite première atmosphère entraînée d'une partie du flux de matière particulaire entrant ; et

lesdits éléments d'injection de gaz agencés de manière que les régions d'injection de gaz associées à des collecteurs voisins se chevauchent, ce qui aboutit à une zone de déplacement d'environnement continue effective s'étendant sur toute la largeur dudit intérieur de la cuve perpendiculairement à la direction d'écoulement de ladite matière particulaire.

31. Système selon la revendication 28, également caractérisé par :

chaque surface de collecteur allongée de chaque élément d'injection de gaz (80) produisant une région d'injection de gaz au sein de laquelle ledit gaz inerte déplace l'oxygène entraîné de la matière particulaire entrant ; et
lesdits éléments d'injection de gaz agencés de manière que les régions d'injection de gaz associées à des collecteurs voisins se chevauchent, ce qui aboutit à une zone de déplacement continue effective s'étendant sur toute la largeur dudit intérieur de la cuve perpendiculairement à la direction de déplacement de ladite matière particulaire.

32. Système selon la revendication 28, également caractérisé par deux ou plus de deux niveaux sensiblement coplanaires d'éléments d'injection de gaz (80), chacun comprenant une pluralité d'éléments d'injection de gaz.

33. Système selon la revendication 28, dans lequel lesdits collecteurs allongés sont sensiblement radiaux relativement à un axe de ladite cuve.

34. Système selon la revendication 33, dans lequel lesdits collecteurs allongés sont angulaires dans la direction d'écoulement de ladite matière particulaire à travers ladite cuve.

35. Système selon la revendication 28, dans lequel ladite cuve est une trémie (40) ayant un volume intérieur suffisant adapté à stocker des quantités en vrac de ladite matière particulaire et à exposer ladite matière particulaire audit gaz inerte pendant des durées prolongées pour le déplacement d'oxygène.

36. Système selon la revendication 28, dans lequel ladite cuve est un dispositif de traitement sur demande ayant un volume intérieur restreint adapté à acheminer une matière particulaire s'écoulant à grande proximité desdits collecteurs avec un temps de séjour minimum au sein de ladite cuve, tout en déplaçant sensiblement tout l'oxygène de ladite matière tandis qu'elle s'écoule à travers ladite cuve.

37. Système selon la revendication 35 comprenant également un évent pour l'échappement d'au moins une partie desdits gaz déplacés.

38. Système selon la revendication 36 comprenant également un évent pour l'échappement d'au moins une partie desdits gaz déplacés.

39. Système selon la revendication 1 comprenant un système de purge préalable (1) pour obtenir un flux contrôlé d'un milieu d'environnement de substitution sélectionné dans une séquence de récipients ouverts (50) de manière à déplacer l'atmosphère renfermant de l'oxygène au sein desdits récipients avec ledit milieu d'environnement de substitution, une station de remplissage (2) pour recevoir lesdits récipients ouverts dudit système de purge préalable et remplir lesdits récipients de parties d'au moins une matière en vrac (9), et une station de fermeture hermétique (6) pour fermer hermétiquement de manière permanente les récipients remplis (52), caractérisé par :

ladite station de remplissage comprenant un dispositif de traitement d'environnement contrôlé sur demande (5) pour extraire l'oxygène de ladite matière en vrac en temps réel tandis que la matière s'écoule jusqu'à une station de remplissage pour remplir lesdits récipients ouverts (50), et
une rampe de purge d'espace libre de récipient (3) et un transporteur (59) pour transporter les récipients remplis (52) de ladite station de remplissage à ladite station de fermeture hermétique, ladite rampe de purge d'espace libre de récipient comprenant au moins une chambre de distribution de gaz (11).

40. Système selon la revendication 28, dans lequel chaque élément d'injection de gaz (80) comprend :

un collier de montage destiné à coopérer avec une ouverture ;
un orifice d'entrée de gaz supporté par, et sur, un premier côté dudit collier de montage ;
un collecteur de gaz allongé sur un deuxième côté dudit collier de montage, ledit collecteur de gaz comprenant un châssis de montage s'étendant loin dudit collier de montage, et un organe perméable aux gaz supporté par ledit châssis et définissant en partie un plénum de distribution fonctionnellement couplé à ladite entrée de gaz ;
ledit organe perméable aux gaz comprenant au moins une partie supérieure qui est généralement conique dans une direction transversale à l'axe allongé dudit collecteur de gaz ; et
ledit collecteur de gaz allongé ayant une section transversale qui permet au collecteur de passer à travers ladite ouverture.

41. Système selon la revendication 40, dans lequel ledit organe perméable aux gaz comprend un treillis métallique fin, et dans lequel l'écoulement de gaz depuis ledit collecteur est sensiblement laminaire.

42. Système selon la revendication 40, dans lequel ledit organe perméable aux gaz peut être enlevé dudit châssis de support pour permettre d'accéder à l'intérieur dudit plénum de distribution.

43. Système selon la revendication 40, dans lequel ledit organe perméable aux gaz comprend également une partie inférieure offrant une superficie perméable aux gaz supplémentaire comportant des côtés généralement parallèles.

44. Système selon la revendication 1, comprenant également un appareil principal comportant une station de remplissage (2) et un dispositif de traitement d'environnement (5) pour emballer une quantité prédéterminée de la matière dans chaque récipient (50) de manière que l'intérieur du récipient et la matière emballée aient un environnement d'oxygène réduit, une station de fermeture hermétique (6) pour fermer hermétiquement de manière permanente les récipients remplis, et un système de transport d'environnement contrôlé principal pour transporter les récipients remplis (52) jusqu'à la station de fermeture hermétique, caractérisé par :

une station de traitement d'environnement indépendante pour traiter séparément un moins grand nombre de récipients de manière à extraire sensiblement la totalité de l'oxygène de l'intérieur desdits récipients ; et
un système de transport supplémentaire pour transporter les récipients traités depuis ladite station de traitement d'environnement indépendante, ledit système de transport supplémentaire fusionnant avec ledit système de transport d'environnement contrôlé principal.

45. Système selon la revendication 44, dans lequel ledit système de transport d'environnement contrôlé principal comprend un transporteur (59) et une rampe de purge d'espace libre de récipient principal (3) comprenant au moins une chambre de distribution de gaz (11) sensiblement alignée avec la direction de déplacement des récipients remplis (52), ledit collecteur (13) permettant un écoulement contrôlé d'un milieu d'environnement de substitution sélectionné dans lesdits récipients ; et

ledit système de transport supplémentaire comprenant une rampe de purge d'espace libre de récipient supplémentaire (14) comportant une partie qui est proche de ladite rampe de purge d'espace libre de récipient principal.

46. Système selon la revendication 44 comprenant également un appareil pour détecter des récipients insuffisamment remplis comportant moins que ladite quantité prédéterminée de matière en vrac ;

un appareil (110) pour enlever lesdits récipients insuffisamment remplis dudit transporteur (59) et les acheminer jusqu'à ladite station de traitement d'environnement indépendante, et pour compléter lesdits récipients insuffisamment remplis ; et

de manière que lesdits récipients insuffisamment remplis puissent être remplis jusqu'à ladite quantité prédéterminée, traités par ladite station de traitement d'environnement indépendante pour extraire sensiblement tout l'oxygène de l'intérieur du récipient complété, et transportés au moins en partie par ledit système de transport supplémentaire jusqu'à ladite station de fermeture hermétique (6).

47. Procédé pour débarrasser de leur oxygène par balayage des récipients ouverts (50, 52) se déplaçant le long d'un transporteur (59) dans le sens d'acheminement comprenant les opérations consistant à :

prévoir une chambre de distribution de gaz (11) s'étendant longitudinalement le long du transporteur, la chambre de distribution de gaz comprenant une entrée (12) qui reçoit un gaz d'environnement de substitution d'une source et un collecteur de distribution (13), le collecteur de distribution comprenant au moins une région de résistance à l'écoulement ;
faire passer les récipients le long du collecteur de distribution pendant une certaine durée ;
faire s'écouler un gaz d'environnement de substitution à travers la région de résistance à l'écoulement et le faire pénétrer dans le récipient ;
distribuer un flux de gaz d'environnement de substitution à travers le collecteur de distribution orienté longitudinalement qui a une largeur inférieure à la largeur de l'ouverture du récipient, le flux entrant de gaz d'environnement de substitution pénétrant dans le récipient ; caractérisé par :
la région de résistance à l'écoulement ayant une résistance à l'écoulement différentielle en travers de sa largeur pour obtenir un débit différentiel du gaz d'environnement de substitution dans le récipient (50, 52), le flux de gaz d'environnement de substitution créant une configuration de gaz d'entrée et de sortie qui existe sensiblement en continu et sensiblement en régime constant pendant toute la durée pendant laquelle le récipient est balayé.

48. Procédé selon la revendication 47, dans lequel la largeur du collecteur de distribution (13) est inférieure ou égale à environ la moitié de la largeur de l'ouverture du récipient.

49. Procédé selon la revendication 47, dans lequel la largeur du collecteur de distribution (13) est inférieure ou égale à environ un quart de la largeur de l'ouverture du récipient.

50. Procédé selon la revendication 47, dans lequel distribuer un écoulement de gaz consiste à distribuer un flux à plus grande vitesse de gaz d'environnement de substitution via le collecteur de distribution de gaz (13) et dans les récipients (50, 52) par leur partie supérieure ouverte à travers une région de moins grande résistance à l'écoulement orientée parallèlement à la direction de déplacement, tandis que les récipients se situent le long du collecteur de distribution, et distribuer un flux à moins grande vitesse de gaz d'environnement de substitution via le collecteur de distribution de gaz et le long des récipients, à travers une région de plus grande résistance à l'écoulement orientée parallèlement à la direction de déplacement, tandis que les récipients se situent le long du collecteur de distribution.

51. Procédé selon la revendication 47, comprenant la réception de gaz quittant les récipients (50, 52) via des orifices (39a, b) dans une chambre de gaz de retour (37a, b) positionnée le long du collecteur de distribution (13).

52. Procédé selon la revendication 47, dans lequel le collecteur de distribution (13) est recouvert d'un écran produisant un écoulement sensiblement laminaire.

53. Procédé selon la revendication 47, comprenant les opérations consistant à prévoir un plénum d'échappement s'étendant longitudinalement (37a, b) près du collecteur de distribution de gaz (13), comprenant des orifices (39a, b) pour admettre des gaz dans le plénum d'échappement et une sortie (38) pour fixer le plénum d'échappement à un système d'échappement, et

recevoir et évacuer par ledit plénum d'échappement au moins une partie des gaz échappés de l'intérieur des récipients.

54. Procédé selon la revendication 53, comprenant les opérations consistant à produire un écoulement à vitesse différentielle de gaz inerte au moyen dudit collecteur de distribution (13) ayant une résistance à l'écoulement différentielle en travers de sa largeur pour obtenir au moins deux débits différents de milieu d'environnement de substitution dans les récipients (50, 52).

55. Procédé selon la revendication 47, comprenant les opérations consistant à prévoir un dispositif de traitement recevant une matière particulaire (9) comprenant les opérations consistant à :

amener ladite matière particulaire à s'écouler à travers un dispositif de traitement (5) comportant une région de traitement ;
prévoir une pluralité d'éléments d'injection de gaz (42, 43) comportant des surfaces de collecteur allongées pour faire passer ledit gaz d'environnement de substitution dans des régions dudit écoulement de matière particulaire adjacentes auxdits collecteurs, lesdites surfaces de collecteur allongées passant dans ladite région de traitement dudit dispositif de traitement de manière que l'extrémité de chaque collecteur soit proche d'au moins un autre collecteur d'élément d'injection de gaz ;
chaque surface de collecteur allongée de chaque élément d'injection de gaz produisant une région d'injection de gaz au sein de laquelle ledit gaz d'environnement de substitution déplace ladite première atmosphère entraînée d'une partie dudit écoulement de matière particulaire, et
lesdits éléments d'injection de gaz agencés de manière que les régions d'injection de gaz associées à des collecteurs voisins se chevauchent, ce qui aboutit à une zone de déplacement d'environnement continue effective s'étendant à travers toute la largeur de ladite région de traitement perpendiculairement à la direction d'écoulement de ladite matière particulaire.

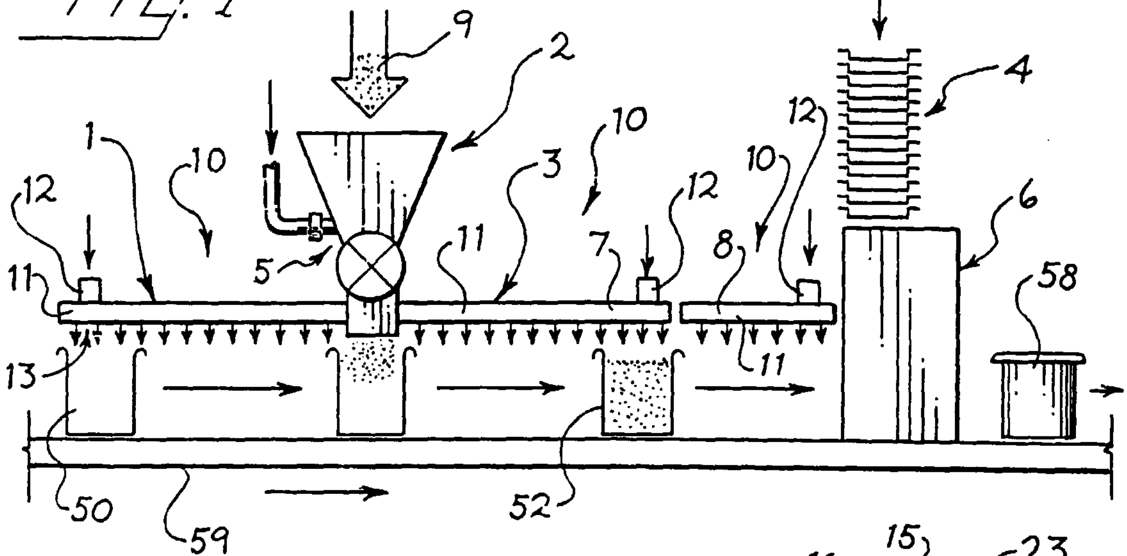


Fig. 1

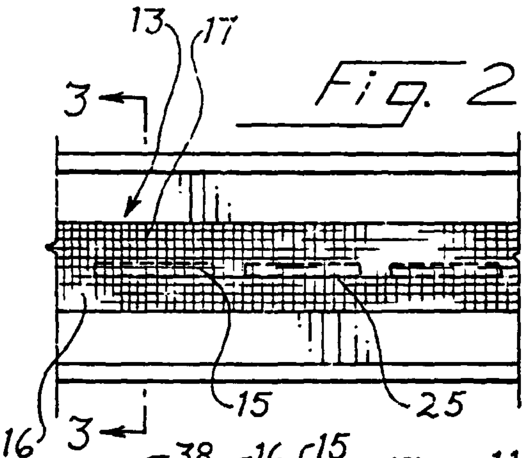


Fig. 2

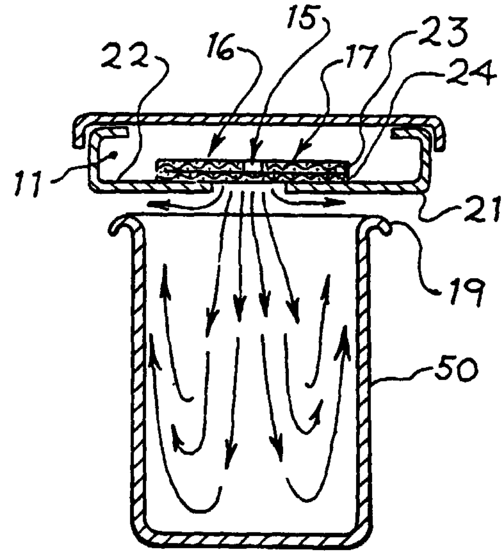


Fig. 3

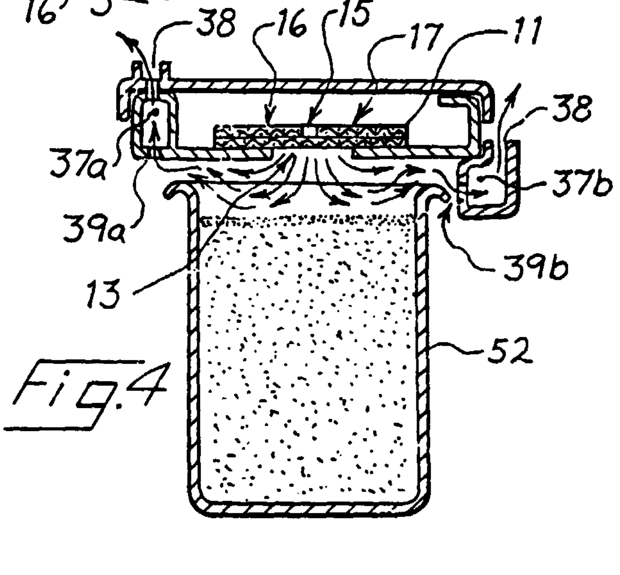


Fig. 4

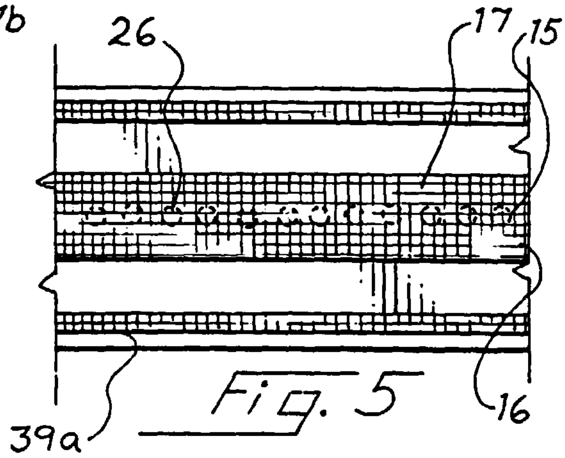


Fig. 5

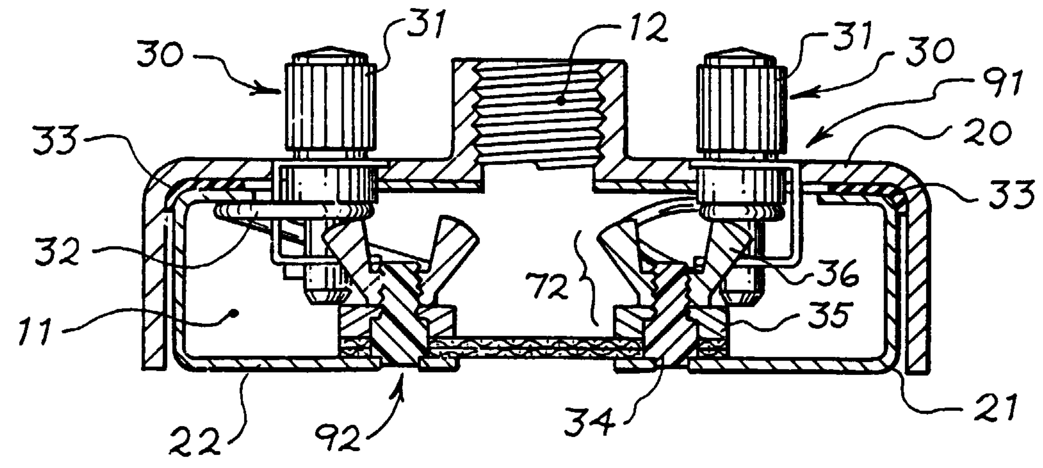

30
31
12
31
30
91
33
20
33
32
36
72
11
35
22
92
34
21

Fig. 6

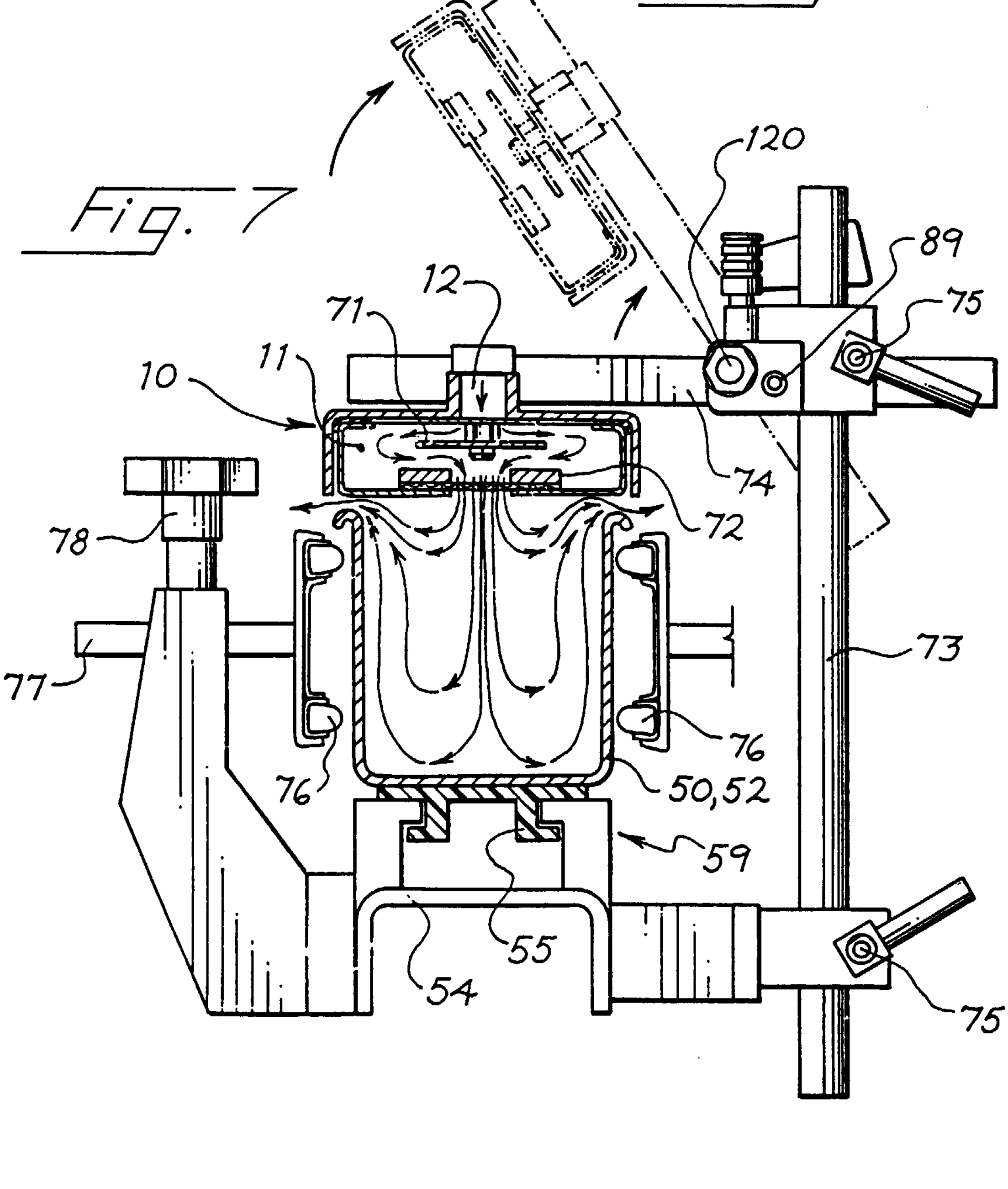

120
89
75
12
71
11
10
74
72
78
73
77
76
76
50,52
59
55
54
75

Fig. 7

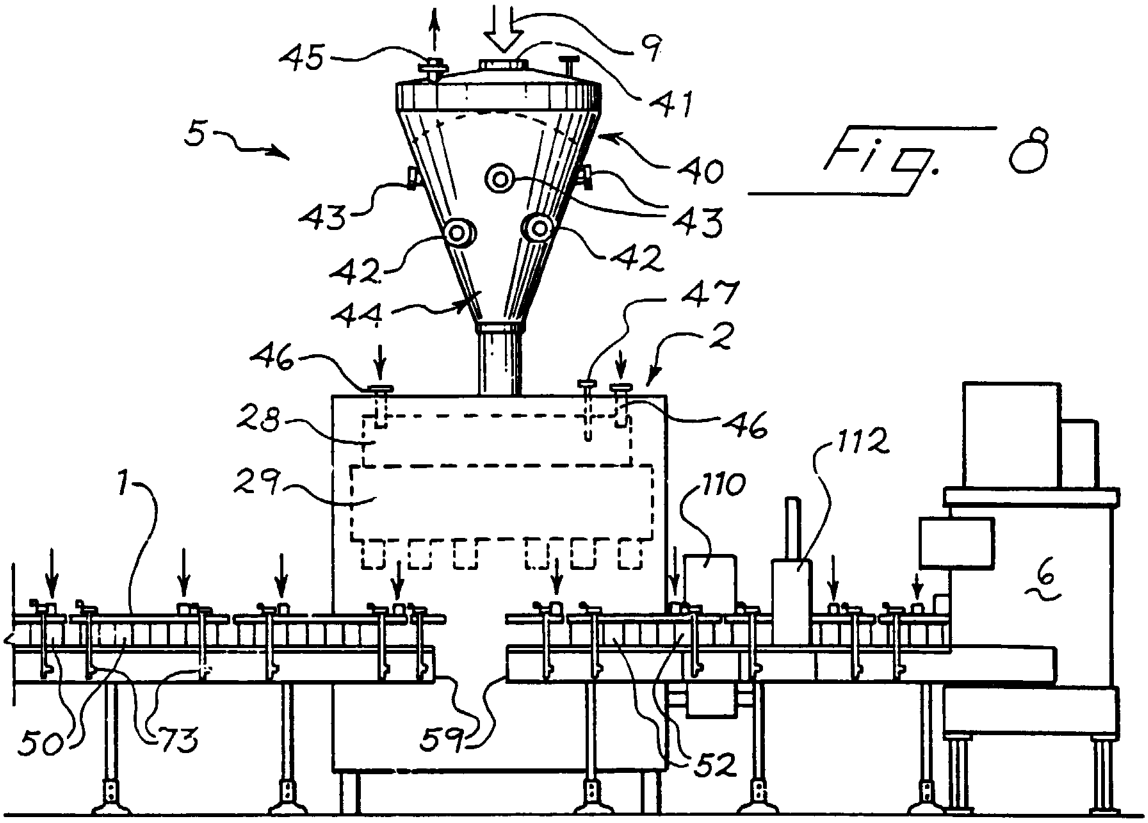


Fig. 8

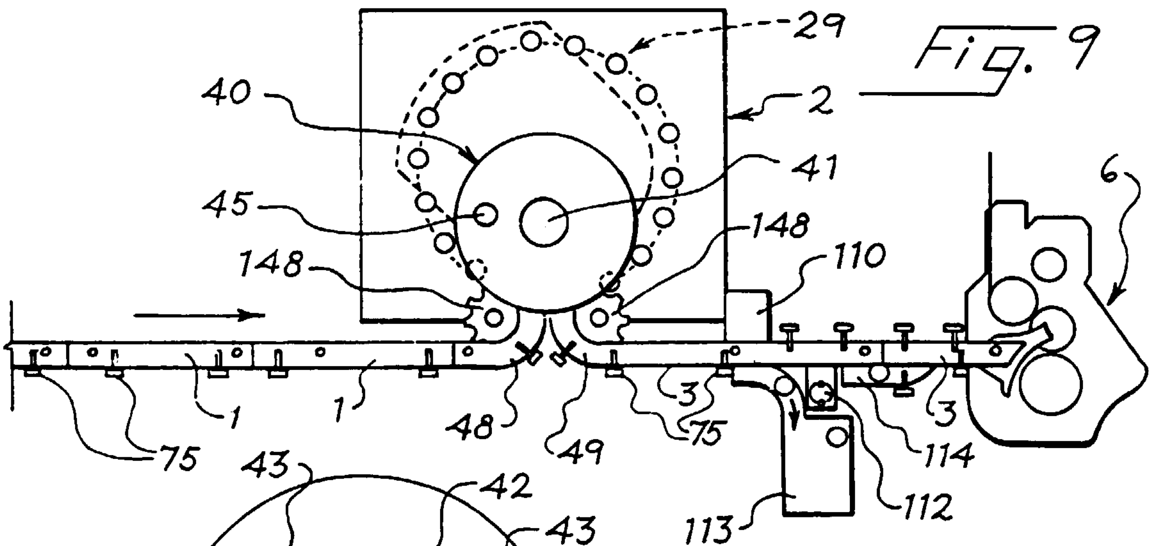


Fig. 9

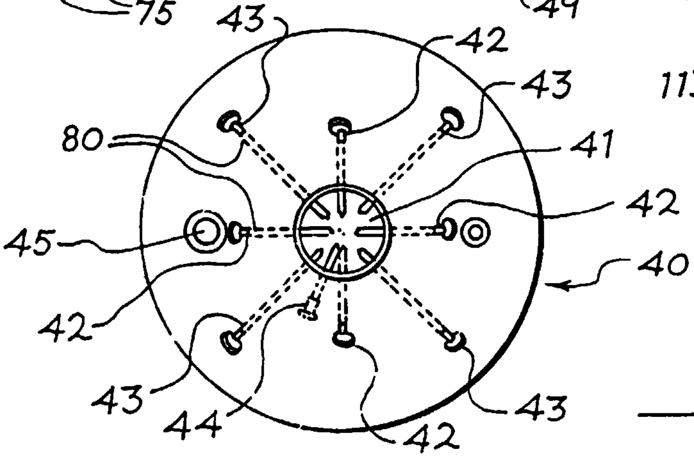


Fig. 10

Fig. 11

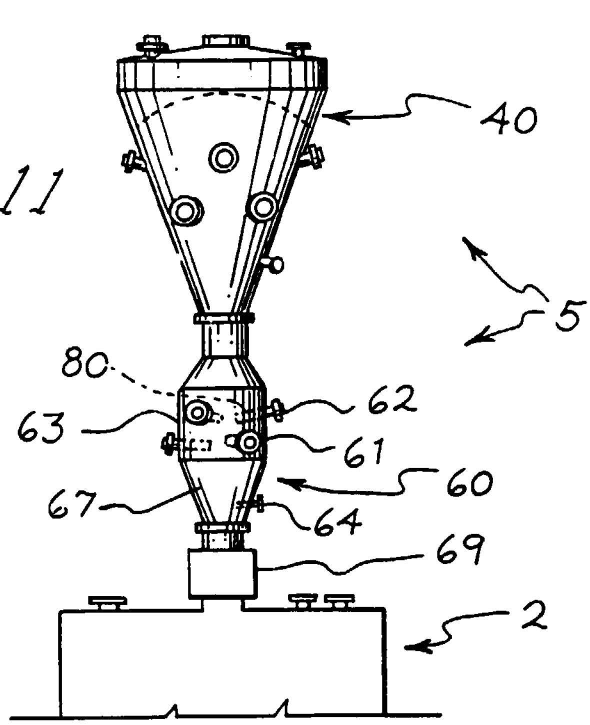


Fig. 12

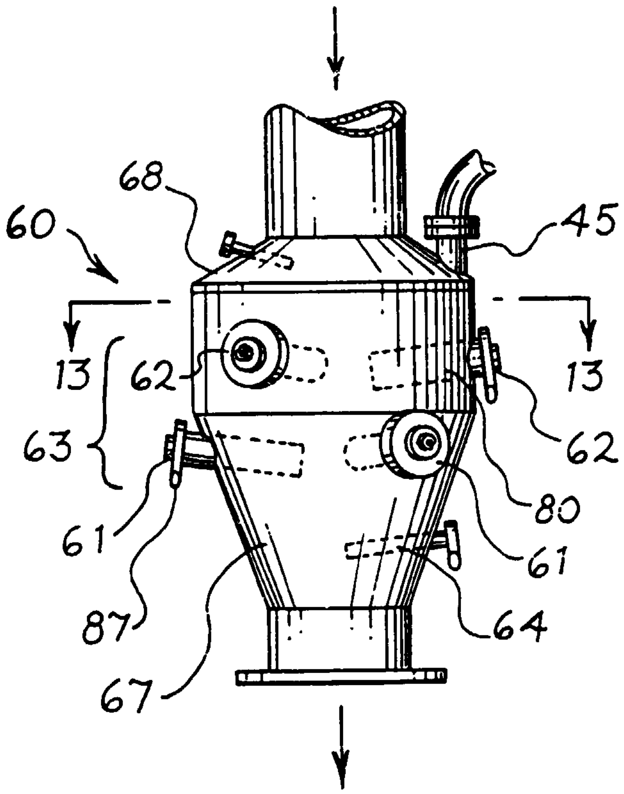


Fig. 13

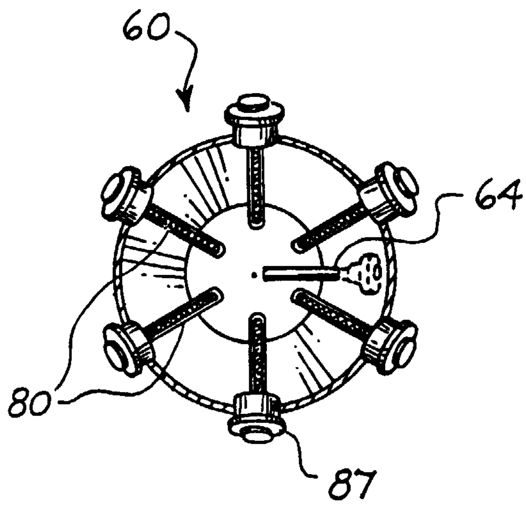
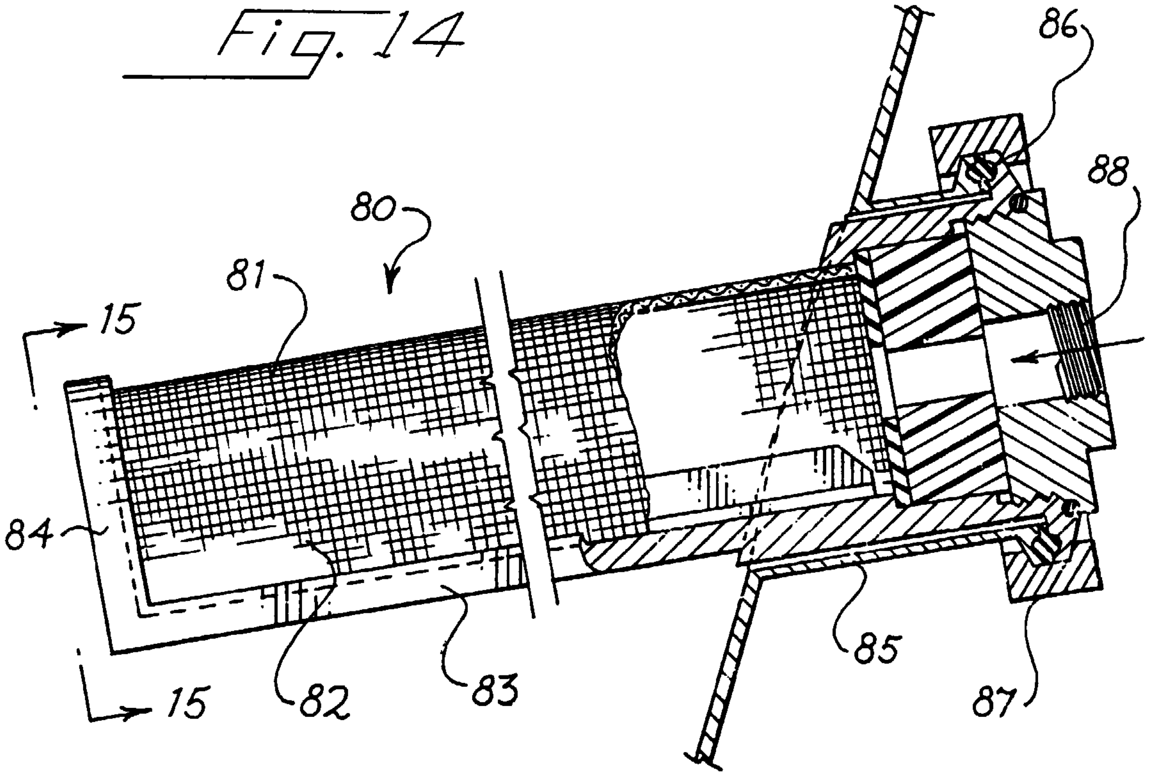


Fig. 14



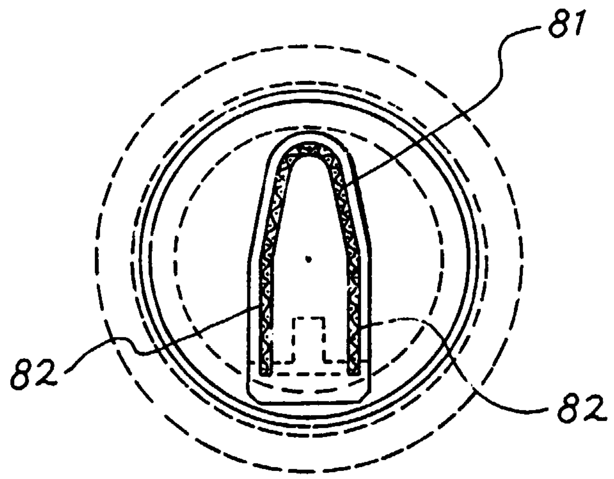


Fig. 15