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(54) **CONTROLLED ATMOSPHERE SEA VAN CONTAINER INCLUDING CARBON DIOXIDE SCRUBBER CURTAIN**

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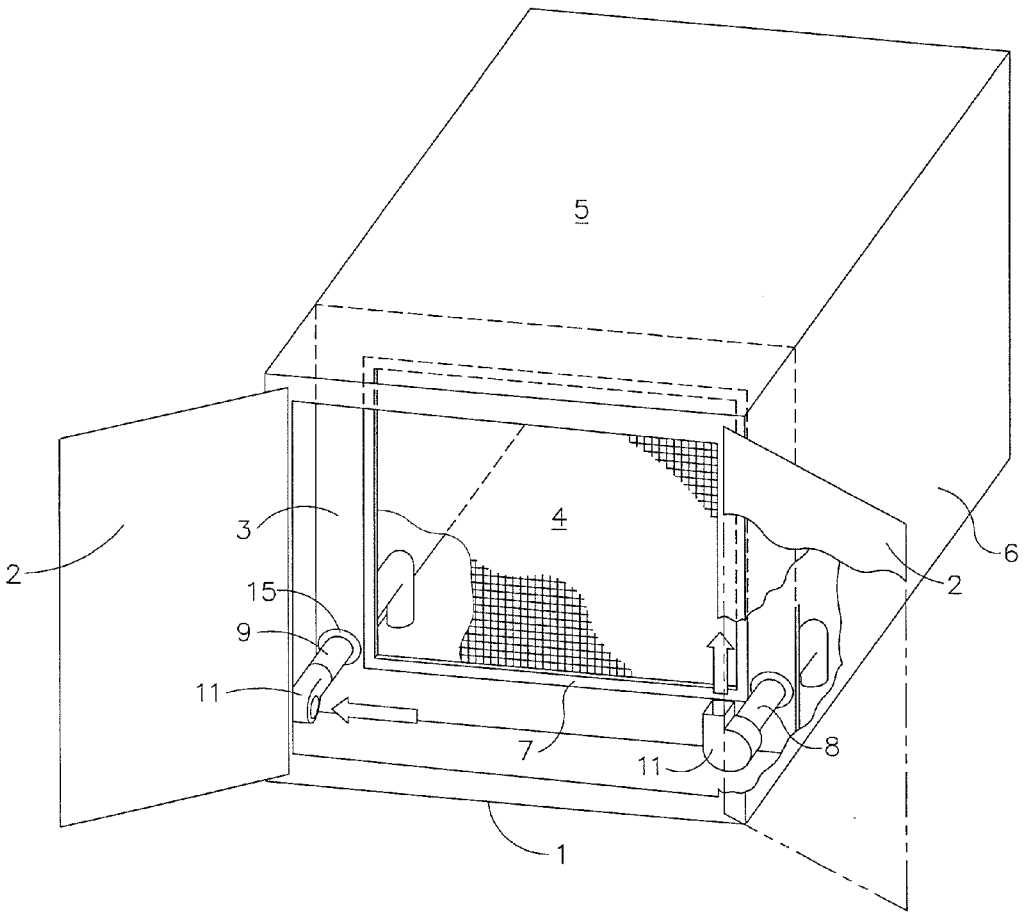
(57) **ABSTRACT**

A scrubber configuration for controlling carbon dioxide levels in a shipping container containing respiring produce is disclosed. The scrubber is made up of a curtain which includes a gas-selective membrane having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain being positioned close to and parallel with the rear wall of said container which includes a door, said curtain forming an air-tight seal dividing the interior of the container into a plenum chamber between said membrane and the (rear wall) door, and the remainder of the container in which the produce is placed. The structure also includes an air intake means for conveying fresh air from outside the container into the plenum chamber; and an air output means for conveying air from the plenum chamber to the outside of the container. A method for controlling the carbon dioxide levels inside a shipping container is also disclosed.



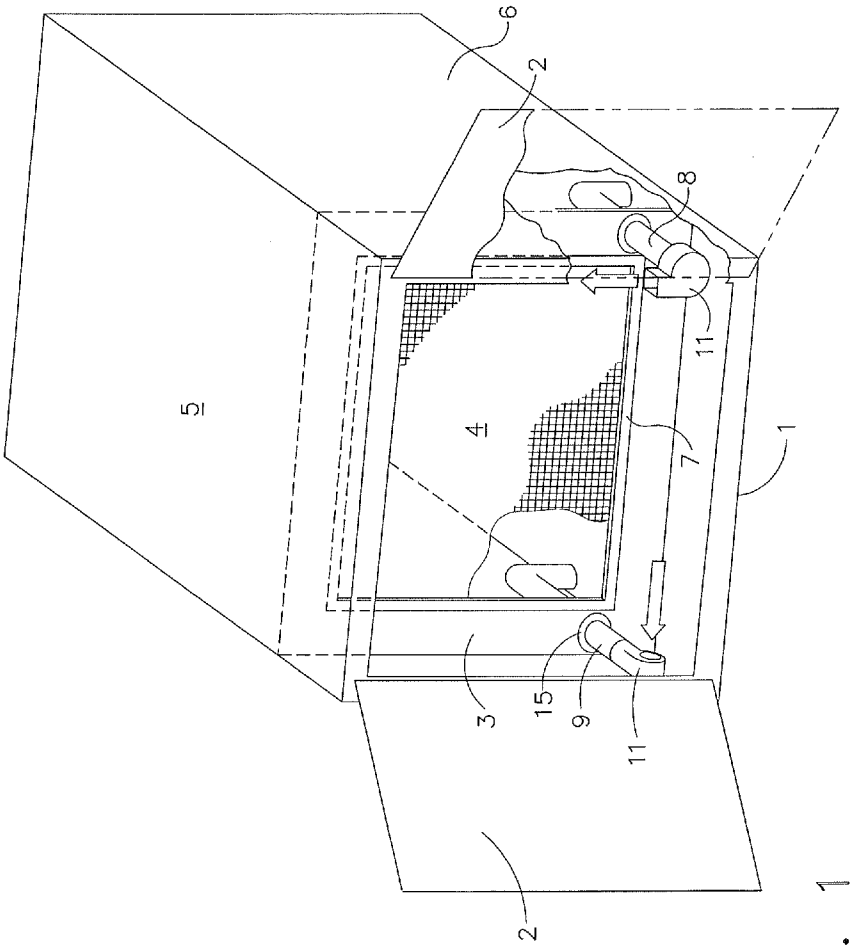


FIG. 1

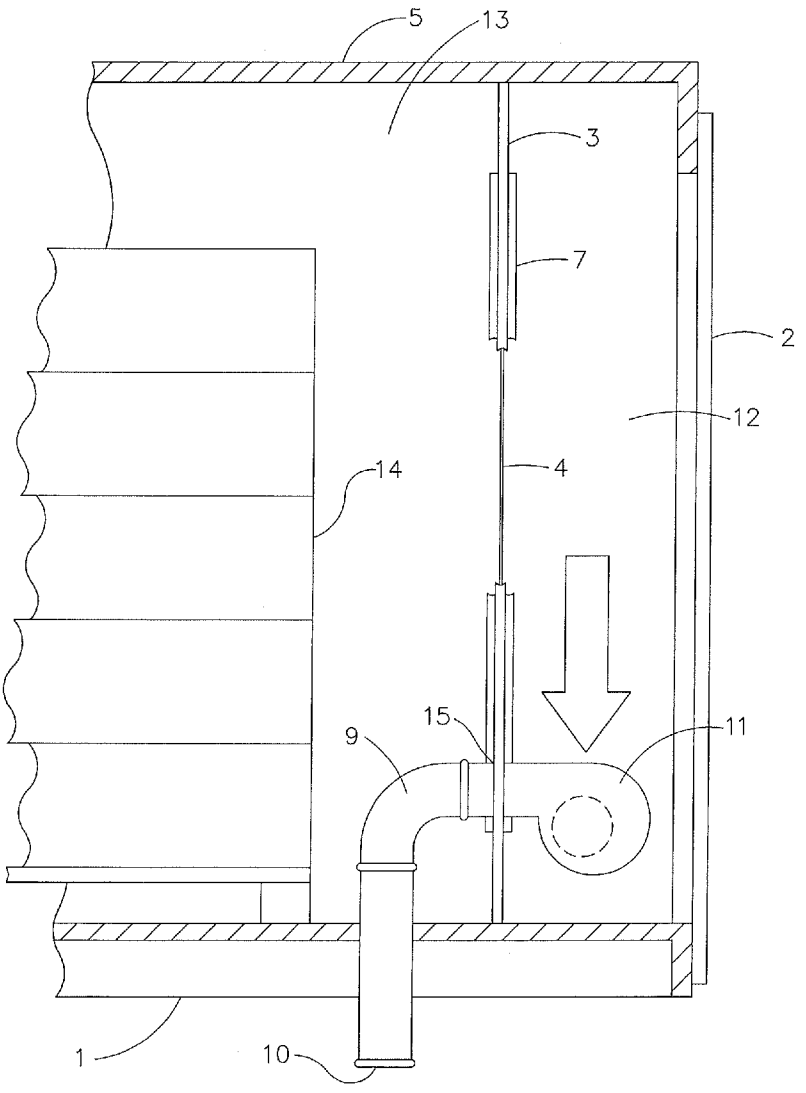


FIG. 2

CONTROLLED ATMOSPHERE SEA VAN CONTAINER INCLUDING CARBON DIOXIDE SCRUBBER CURTAIN

BACKGROUND

[0001] This application is based upon and claims priority from U.S. Provisional Patent Application No. 61/503,938, Gomez et al, filed Jul. 1, 2011, incorporated by reference herein.

[0002] The present invention relates to a sea van container used for shipping produce which includes a carbon dioxide scrubber curtain for controlling the atmospheric content in the container.

[0003] Produce grown in tropical areas (such as bananas) is typically shipped long distances to get to market. This can present challenges in keeping the produce in a desired state of freshness and ripeness. Apart from the length of time involved, such produce is respiring, utilizing oxygen (O_2) in the atmosphere and producing carbon dioxide (CO_2), which means that the composition of the atmosphere around the produce is constantly changing. This gas composition and the temperature surrounding the produce has a direct effect on freshness and ripeness. Controlled Atmosphere (CA) systems, designed for use in sea van containers, typically provide methods for controlling concentrations of atmospheric oxygen (O_2), nitrogen (N_2), and/or carbon dioxide (CO_2) around a perishable product. Typically, O_2 concentrations are reduced to levels below normal atmosphere and CO_2 may or may not be elevated above those found in normal atmosphere. The desired blend of O_2 and CO_2 is often specific to a given perishable commodity. A typical blend might be, for example, 3-5% O_2 and 0-10% CO_2. These concentrations ideally would be maintained inside a sea van container, thereby protecting the perishables from deterioration as they are transited to market.

[0004] Perishable products, such as fruits and vegetables, respire, consume O_2 and give off CO_2 at varying rates. When such perishables are sealed inside an air-tight sea van, or a specific O_2 or CO_2 level is desired, the rate of O_2 consumption and CO_2 production by the fruit/vegetables may be controlled to maintain an effective atmospheric blend in order to keep the products in the desired state of freshness and ripeness over the course of the trip.

[0005] Numerous systems exist to control both O_2 and CO_2 levels in a sea van environment. Engineering complexity and associated service maintenance make some systems unreliable or commercially prohibitive to operate. Others rely on large quantities of hydrated lime (calcium hydroxide) packed in the sea van with the cargo to selectively remove or control CO_2. Hydrated lime systems are expensive, bulky, take valuable cargo space and present a disposal problem at destination ports.

[0006] The current invention overcomes the difficulty of using hydrated lime as a CO_2 control agent. It is relatively simple, inexpensive, and is designed to operate using the O_2 and CO_2 control functions of existing Controlled Atmosphere systems (already present in transport vehicles), such as the "TransFresh Controlled Atmosphere Controller", TransFresh Corporation, Salinas, California. Further, the curtain may be easily removed from the container for replacement or reconfiguration of the container.

[0007] U.S. Published Patent Application 2007/0144638, Fernandez et al, published Jun. 28, 2007, describes a device, connected to and placed outside of a produce shipping sea van container, which acts to control the atmospheric gas content inside the sea van container.

[0008] U.S. Pat. No. 7,866,258, Jorgensen et al, issued Jan. 11, 2011, relates to an apparatus for controlling the composition of the atmosphere within a cargo container. The apparatus includes, as a permanent part of the container, at least one sensor, at least one controller and at least one gas-permeable membrane being adapted to facilitate the passage through that membrane of different molecules at different rates. The membrane is said to define a first region and a second region within the cargo container; the first region holds the cargo and the second region defines a gas buffer region with at least one inlet and/or outlet in the gas buffer region of the container, and a sensor in the gas buffer region.

[0009] U.S. patent application Ser. No. 13/151,390, Macleod et al, filed Jun. 2, 2011, describes a carbon dioxide scrubber, structurally adapted for use inside a shipping container which contains respiring produce, the scrubber comprising an air-tight plenum chamber formed by an outer wall, at least a portion of the outer wall made up of a gas-selective membrane preferably having a CO_2/O_2 selectivity ratio greater than 1:1; an air intake means for conveying air into the interior of the plenum chamber; and an air output means for conveying air out of the interior of the plenum chamber. The method for controlling carbon dioxide levels inside a shipping container which includes respiring produce, utilizing the defined carbon dioxide scrubber, is also defined.

SUMMARY

[0010] The present invention relates to a container for shipping and/or storing respiring produce, said container formed by four side walls, a ceiling and a floor, one of said side walls including a door through which said produce is put in and/or taken out of said container, comprising a curtain which includes a gas-selective membrane, preferably having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain positioned close to said door and forming an air-tight seal dividing the interior of the container into a plenum chamber between said curtain and the door, and the remainder of the container in which the produce is placed (produce storage area); an air intake means for conveying fresh air from outside the container into the plenum chamber; and an air output means for conveying air from the plenum chamber to the outside of the container.

[0011] In one embodiment, the air intake means and air output means are connected to the outside atmosphere through existing drain holes in the container bottom on the produce side of the membrane, and they pass through the membrane (with an air-tight seal where they pass through the membrane), and terminate in the plenum chamber.

[0012] The present invention also relates to a method for controlling the carbon dioxide levels inside a shipping container containing respiring produce, said container formed by four side walls, a ceiling and floor, one of said walls including a door through which said produce is put in and/or taken out of said container, said container comprising a curtain which includes a gas-selective membrane, preferably having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain position close to said door and forming an air-tight seal dividing the interior of the container into a plenum chamber between said curtain and the door, and the remainder of the container in which the produce is placed; an air intake means for conveying fresh air from outside the container into the plenum cham-

ber; and an air output means for conveying air from the plenum chamber to the outside of the chamber; said method comprising circulating fresh air into the plenum chamber, such as when the carbon dioxide level in the storage portion of the container reaches a pre-defined level.

[0013] In one embodiment, fresh air intake in the scrubber plenum area is directed to the membrane so as to maximize air flow across the curtain membrane surface.

[0014] The defined curtain within the sea van container is effective at controlling the oxygen and carbon dioxide content within the sea van container without decreasing the amount of produce which can be shipped within the container. Further, the curtain is lightweight and relatively simple, and does not present the weight or disposal problems which are found with conventional hydrated lime carbon dioxide control systems.

[0015] All percentages and ratios noted herein are "by weight", unless otherwise noted, and all documents cited in this application are incorporated herein by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The drawings included within this provisional patent application illustrate non-limiting examples of the structures defined herein, as well as the method of using those structures in the shipment and storage of produce. They are intended merely to be illustrative and not limiting of the present invention.

[0017] FIG. **1** illustrates a perspective view of an embodiment of the present invention looking into the sea van container through the open rear doors of that container so as to see the gas plenum area and an embodiment of the curtain which includes the gas-selective membrane.

[0018] FIG. **2** is a cutaway view looking into the side of the defined sea van container illustrating the produce load (in the produce storage area), an embodiment of the curtain which includes the gas-selective gas-permeable membrane and the gas plenum chamber area located between the curtain and the door of the sea van container.

DETAILED DESCRIPTION

[0019] The present invention defines modifications to the large shipping containers (for example, generally a minimum of about 40 feet in length) used for shipping respiring produce from their growing/harvesting areas to locations for retail sale. The containers, themselves, are well-known in the art, for example, as sea van containers. The containers are generally rectangular in shape, formed by four side walls, a ceiling and a floor, one of the side walls (usually the rear side wall) including a door through which the produce is put in and/or taken out of the container. As used herein, the term "door" encompasses both a single door and a plurality of doors. The containers are generally made from metal. The side walls include two long walls (opposite each other) which define the length and the height of the container; and two short walls (i.e., the front and back walls), also opposite each other and perpendicular to the long walls, which define the width and the height of the container. The rear wall of the container is one of these short walls and the doors are typically included in that rear wall. The front wall typically (although not necessarily) includes a refrigeration system which maintains cargo temperatures at pre-determined levels.

[0020] The interior of the container includes a curtain which is located close to said door. As used herein, "close to said door" means that the curtain is essentially parallel to the wall which includes the door(s) and is located from about two inches to about two feet (preferably from about 2 inches to about 12 inches) away from said doors. The sea van container may include a track located within a foot of the door for mounting of a curtain. The curtain/membrane of the present invention can be snapped into this track using a plastic ribbon. The curtain is made from a flexible plastic material, such as vinyl, polyethylene or similar flexible materials, and includes (preferably in its approximate center) a gas-selective membrane preferably having a CO_2/O_2 selectivity ratio greater than 1:1 (i.e., more CO_2 molecules pass through the membrane than molecules of O_2), preferably greater than about 2:1, more preferably greater than about 8:1. The membrane generally has an area of from about 8,000 to about 10,000 square inches and is integral to the curtain. The flexible curtain material can be fastened to the membrane, for example, using tape, glue or heat seal. The curtain can optionally include a stiffener or other devices to maintain complete or partial rigidity of the curtain/membrane. The stiffener can be a stiff plastic or light metal piece (or pieces), or corrugated material, and can be attached to and located on either side and/or the top and/or bottom of the curtain.

[0021] The curtain is located generally parallel to the rear wall and door of the container. It is attached all around to the side walls, the ceiling and the floor of the container in such a way as to provide an air-tight seal between the two sections it forms within the container. The curtain may be attached to the container walls in any way known in the art, for example, by snapping it into a track, as described above, or using pressure, tape or glue, or other appropriate method. The curtain divides the sea van container into two zones: a gas plenum chamber between the curtain and the rear wall containing the door, and the produce storage or shipment area between the curtain and the front wall of the container. The produce shipment area is much larger in volume when compared to the gas plenum area. The gas plenum area generally has a volume of from about 25 to about 50 cubic feet. The seal between the produce storage area and the gas plenum area is air tight (i.e., other than through the membrane, substantially no air flows through the curtain or the seals between the two areas).

[0022] The gas-selective membranes utilized in the present invention are well-known in the art. Such membranes selectively allow O_2 and CO_2 molecules to pass through in one direction in a pre-determined ratio. Examples of such membranes are disclosed in U.S. Pat. No. 6,376,032, Clarke et al, issued Apr. 23, 2002; U.S. Pat. No. 6,548,132, Clarke et al, issued Apr. 15, 2003; U.S. Pat. No. 7,169,451, Clarke et al, issued Jan. 30, 2007; and U.S. Pat. No. 7,601,374, Clarke, issued Oct. 13, 2009, all of which are incorporated by reference herein.

[0023] For the membrane to function efficiently, fresh air must be delivered in sufficient quantities to one side of the membrane. It is highly desirable that the membrane be designed to be highly permeable to CO_2 with less permeability to O_2. The purpose of that membrane is to pass more CO_2 through from the produce storage area of the sea van container into the gas plenum area. Ideally, relatively little CO_2 passes from the gas plenum area back into the produce storage atmosphere. Depending upon the desired level of CO_2 to be maintained in the sea van container, air flow into the plenum chamber can be activated on a variable basis.

[0024] The membrane is used to control the concentration of carbon dioxide and/or oxygen passing from the gas plenum

area into the produce storage area of the sea van container, and vice versa. In one embodiment, the membrane allows carbon dioxide to pass through it while allowing substantially less oxygen to pass through. This is beneficial because, during the produce respiration process, carbon dioxide is produced and it is important to prevent the carbon dioxide level from exceeding pre-determined levels in the produce shipment area of the container. Thus, in one embodiment, the membrane has a CO_2/O_2 selectivity ratio greater than 1:1 (i.e., the membrane allows more CO_2 molecules than O_2 molecules through). In another embodiment, that ratio is greater than or equal to about 2:1, and even greater than or equal to about 8:1.

[0025] It is to be noted that in some instances it may be desirable to control the oxygen level in the container; the present invention is intended to encompass that embodiment as well. In that instance, it may be desirable to use a gas-permeable membrane which has a CO_2/O_2 selectivity ratio less than 1:1. Other control systems may also be used if the O_2 level is to be controlled.

[0026] In addition to the CO_2/O_2 selectivity ratio, another factor which is important to properly controlling the gas content of the produce storage area of the sea van container is the optimization and maximization of the surface area of the gas-selective membrane. It is largely the combination of the surface area and the CO_2/O_2 selectivity ratio which will govern the oxygen and carbon dioxide levels in the produce storage atmosphere of the sea van container. It is preferred that the membrane utilized in the scrubbers of the present invention have a one-side surface area of from about 3,000 to about 12,000 square inches, for example from about 8,000 to about 10,000 square inches of membrane.

[0027] Since the gas plenum area is located between the curtain and the door, and one of the overall purposes of the invention is to deliver fresh air from outside the container to the gas plenum area (i.e., to the door side of the membrane), the door seal does not have to be air-tight in order for the present invention to work properly.

[0028] The present invention generally will include a pressure compensator in the produce shipment area of the sea van container. Since the membrane may remove more carbon dioxide by volume from the produce shipment area of the sea van container than can be replaced, this would form a vacuum to some degree within the container. The pressure compensator is generally a pressure relief valve that meters small amounts of air into the produce shipment area of the container (for example, a one-way valve that allows air into the container to about 0.5 inches water column), to prevent excessive negative pressure from forming.

[0029] The defined scrubber structure also includes air intake means and air output means which connect the interior of the plenum chamber to the atmosphere outside the sea van container. The air intake and output means will generally be made up of flexible tubes which may or may not include a valve to control the flow of air through the air intake/output means. The purpose of the air intake and air output means is to circulate fresh air from the exterior of the container into the gas plenum area, and then to remove "conditioned" (i.e., high CO_2) air from inside the gas plenum area. For example, as the gas plenum/scrubber operates and carbon dioxide is brought in from the produce storage area of the sea van container into the gas plenum area (through the gas-permeable membrane), the atmosphere within the gas plenum area accumulates higher levels of carbon dioxide. The air containing excess CO_2 within the gas plenum area is flushed out and is exhausted to the exterior of the sea van container through the air output means, and fresh air from outside the sea van container (having a lower level of carbon dioxide) is brought into the chamber through the air input means. This flushing process keeps CO_2 concentrations lower inside the gas plenum, which allows the gas-selective membrane to bring more carbon dioxide into the interior of the gas plenum area, thereby controlling the carbon dioxide level in the produce storage area of the sea van container. The process is repeated as required to achieve the desired carbon dioxide (and oxygen) levels in the sea van container.

[0030] The air intake and output tubes are frequently attached to existing penetrations or holes in the sea van container (although other holes or openings may be fashioned in the sea van container for attachment to the air intake and output tubes). An example is the "drain holes" that are customarily built into the floor of sea van containers both at the rear (door) and reefer end. The "reefer end" of the container refers to the end of the container where the refrigeration equipment is located. It is desirable that the diameter of such holes allow for as much unrestricted air flow as possible. The present invention can, however, operate even with the highly restricted drain hole openings frequently found in sea van containers. Other options for access to fresh air and exhausting of carbon dioxide enriched air may exist within the reefer unit configuration. Thus, the air intake and output tubes are of such length and diameter as to allow them to hook into holes to the outside of the container. The connections between the air input and output means with the outside of the sea van container can either be made within the gas plenum area or the tubes can go through the curtain and be connected to the outside of the container in the produce storage area. If the air input/output tubes go through the curtain, the seal around the tubes through the curtain must be air-tight. For example, such seals can be formed by gasket fittings, screw-tightened fittings, sealants, glues, or tape; they do not allow air to flow through them (i.e., the seals) between the produce storage area and the gas plenum area.

[0031] In one embodiment, the air input means can be structured to deliver fresh air to the top of the curtain. If that is the configuration, then the fresh air will wash down the height of the membrane thereby maximizing the contact of the fresh air with the membrane and, consequently, the efficiency of the membrane.

[0032] The scrubber of the present invention can include fans for moving air through the intake and output means (i.e., air intake fans and air output fans). The fans can be actuated by control means or control devices associated with the controlled atmosphere systems which typically are present in the sea van container (e.g., in the produce storage area of the sea van container or in conjunction with the refrigeration unit), so that the air circulates efficiently and at the appropriate time. For example, the recirculation of fresh air within the gas plenum area can take place upon the occurrence of a specified or defined condition or conditions, such as when the carbon dioxide level in the gas plenum area or in the produce storage area reaches a defined level. The specified condition(s) for actuating the air circulation can be based on a variety of criteria including, for example, respiration rate of produce in the sea van container, temperature of produce in the sea van container, length of the shipment/storage period of the produce, desired carbon dioxide and/or oxygen levels in the gas plenum area or the produce storage area of the sea van con-

tainer, carbon dioxide and oxygen selectivity of the membrane, size (surface area) of the membrane, and combinations of any of those criteria.

[0033] The present invention also encompasses a method for controlling the carbon dioxide (or oxygen) levels inside a shipping container which contains respiring produce, the container formed by four side walls, a ceiling and a floor, one of said side walls including a door through which said produce is put in and/or taken out of said container, said container comprising a curtain which includes a gas-selective membrane, preferably having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain positioned close to said door and forming an air-tight seal dividing the interior of the container into a plenum chamber between said membrane and the door, and the remainder of the container in which the produce is placed; an air intake means for conveying fresh air from outside the container into the plenum chamber; and an air output means for conveying air from the plenum chamber to the outside of the container; said method comprising circulating fresh air into the plenum chamber, preferably when the carbon dioxide level in the produce storage area reaches a defined level.

[0034] This circulation of fresh air can be continuous, but frequently it will take place upon the occurrence of specified conditions, such as when the carbon dioxide level in the plenum area or the produce storage area reaches a pre-defined level. The specified conditions which trigger circulation of the fresh air can be based on criteria selected from, for example, respiration rate of the produce in the sea van container, temperature of the produce in the sea van container, length of the produce shipment/storage period, the desired carbon dioxide and/or oxygen levels in the gas plenum area or the produce storage area of the sea van container, carbon dioxide and oxygen selectivity of the membrane, the size (surface area) of the membrane, and combinations of any of those criteria. One or more fans can be used to circulate air into and out of the gas plenum area and the fans can be actuated by a control device, such as one located in the produce storage area of the sea van container.

[0035] The described design works as a substitute for the existing hydrated lime scrubbers currently used in the shipping of respiring produce. Control of the scrubber and power requirements are compatible with existing controlled atmosphere systems and sea van electrical power system constraints. The scrubber configuration of the present invention is inexpensive, easily portable and easy to assemble in the field. Little or no cargo is displaced by use of the scrubber configuration in the sea van container. Sea van refrigerated air flow is not compromised and the scrubber components can be recycled for reuse.

[0036] The figures which exemplify an embodiment of the present invention will now be briefly described. They illustrate one embodiment of the invention; they are not intended to be limiting. Component identifying numbers are used consistently throughout the figures.

[0037] FIG. **1** shows a view of the curtain (**3**) and gas-selective membrane (**4**) looking into the sea van container through the open doors (**2**) in the rear wall of the container. A flexible vinyl material may comprise the periphery of the curtain (**3**). This outer material is attached to the ceiling (**5**), the floor (**1**) and the two side walls (**6**) of the container forming an air-tight seal. The curtain (**3**) is located quite close to the rear wall/doors (**2**) of the sea van container. The approximate center of the curtain is comprised of a gas-selective membrane (**4**) and a stiffening frame (**7**) surrounds the membrane (**4**) to keep it from folding on itself. The stiffening frame maintains the membrane in its optimal gas selection configuration. The gas plenum area (**12**) is located between the doors (**2**) (when closed) and the curtain (**3**). The air input (**8**) and air output (**9**) means are noted and are shown to penetrate through the curtain and attach to the drain holes (**10**) in the interior of the sea van container (i.e.,. in the produce storage area (**13**)). The seals (**15**) around the air input (**8**) and output (**9**) means as they penetrate through the curtain are air-tight.

[0038] FIG. **2** is a side cutaway view of the interior of the sea van container. In this view, the curtain (**3**) which includes the membrane (**4**) can be seen separating the interior of the sea van container into the gas plenum area (**12**) (i.e., between the curtain and the door), and the produce storage area (**13**) (i.e., between the curtain and the front of the sea van) which holds the load being shipped (**14**). The air input/output means (**8** and **9**), which pass through the curtain (**3**) and which attach to the existing drain hole (**10**) in the sea van floor are also shown. A fan (**11**) for controlling the flow of air through the air input/output means is also shown. A controller with sensors may be included in the plenum area and/or the produce storage area to control the flow of air between the outside atmosphere and the plenum area (for example, based on defined criteria, such as CO_2 content in the plenum area).

What is claimed is:

1. A container for shipping and/or storing respiring produce, said container formed by four side walls, a ceiling and a floor, one of said side walls including a door through which said produce is put in and/or taken out of said container, comprising a curtain which includes a gas-selective membrane having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain positioned close to said door and forming an air-tight seal dividing the interior of the container into a plenum chamber between said membrane and the door, and the remainder of the container in which the produce is placed; an air intake means for conveying fresh air from outside the container into the plenum chamber; and an air output means for conveying air from the plenum chamber to the outside of the container.

2. The container of claim **1** which additionally comprises a controller and one or more sensors to control the flow of air into and out of the plenum chamber.

3. The container of claim **2** wherein the sensors measure the carbon dioxide level in the produce storage area and the flow of air into and out of the plenum chamber is controlled based on that measurement.

4. The container of claim **1** wherein the gas-selective membrane has a CO_2/O_2 selectivity ratio greater than about 2:1.

5. The container of claim **1** wherein the air intake and output means are connected to the outside atmosphere using drainage openings existing in the container.

6. The container of claim **5** wherein the existing openings are located in the produce storage area of the container and the air input and output means pass through the curtain into the plenum area.

7. The container of claim **6** wherein the seals which surround the air input and air output means at the joint where they pass through the curtain is airtight.

8. The container of claim **1** which additionally comprises one or more fans to assist flow of air in the air input and output means.

9. The container of claim **1** wherein the curtain is positioned from about 2 inches to about 2 feet away from said door.

10. The container of claim **1** wherein the gas-selective membrane has a one-side surface area of from about 3,000 to about 12,000 square inches.

11. The container of claim **1** which additionally comprises a stiffener attached to said curtain or membrane to maintain the shape of said membrane.

12. A method for controlling the carbon dioxide levels inside a shipping container containing respiring produce, said container formed by four side walls, a ceiling and a floor, one of said side walls including a door through which said produce is put in and/or taken out of said container, said container comprising a curtain which includes a gas-selective membrane having a CO_2/O_2 selectivity ratio greater than 1:1, said curtain positioned close to said door and forming an air-tight seal dividing the interior of the container into a plenum chamber between said membrane and the door, and the remainder of the container in which the produce is placed; an air intake means for conveying fresh air from outside the chamber into the plenum chamber; and an air output means for conveying air from the plenum chamber to the outside of the container; said method comprising circulating fresh air into the plenum chamber, preferably when the carbon dioxide level in the produce storage area reaches a defined level.

13. The method of claim **12** wherein the fresh air is circulated into the plenum chamber when the carbon dioxide level in the produce storage area reaches a pre-defined level.

14. The method of claim **13** which utilizes a controller and one or more sensors to measure the carbon dioxide level in the produce storage area and control the flow of air into and out of the plenum based on those measurements.

15. The method of claim **12** wherein the air intake and output means are connected to the outside atmosphere using drainage openings existing in the container.

16. The method of claim **15** wherein the existing openings are located in the produce storage area of the container and the air input and output means pass through the curtain/membrane into the plenum area.

17. The method of claim **16** wherein the seals which surround the air input and air output means at the point where they pass through the curtain/membrane is airtight.

18. The method of claim **12** wherein the gas-selective membrane has a CO_2/O_2 selectivity ratio greater than about **2**:**1**.

19. The method of claim **12** wherein the container additionally comprises one or more fans to assist flow of air in the air input and output means.

20. The method of claim **12** wherein, in the container, the curtain is positioned from about 2 inches to about 2 feet away from said door.

21. The method of claim **12** wherein, in the container, the gas-selective membrane has a one-side surface area of from about 3,000 to about 12,000 square inches.

22. The method of claim **12** wherein, in the container, the curtain additionally comprises a stiffener to maintain the shape of said curtain.

23. A curtain for use as a carbon dioxide scrubber in a container for shipping and/or storing respiring produce, comprising a flexible material attached to and surrounding a gas-selective membrane having a CO_2/O_2 selectivity ratio greater than 1:1, the curtain being of such size that it can be sealed to the side walls, the ceiling and the floor of said container so as to form an air-tight seal.

24. The curtain according to claim **23** wherein the gas-selective membrane has a CO_2/O_2 selectivity ratio greater than about 2:1.

25. The curtain according to claim **23** wherein the gas-selective membrane has a one-side surface area of from about 3,000 to about 12,000 square inches.

26. The curtain according to claim **23** made from a flexible vinyl material.

27. The curtain according to claim **23** which additionally comprises one or more stiffening means attached to said flexible material to maintain complete or partial rigidity of the curtain.

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