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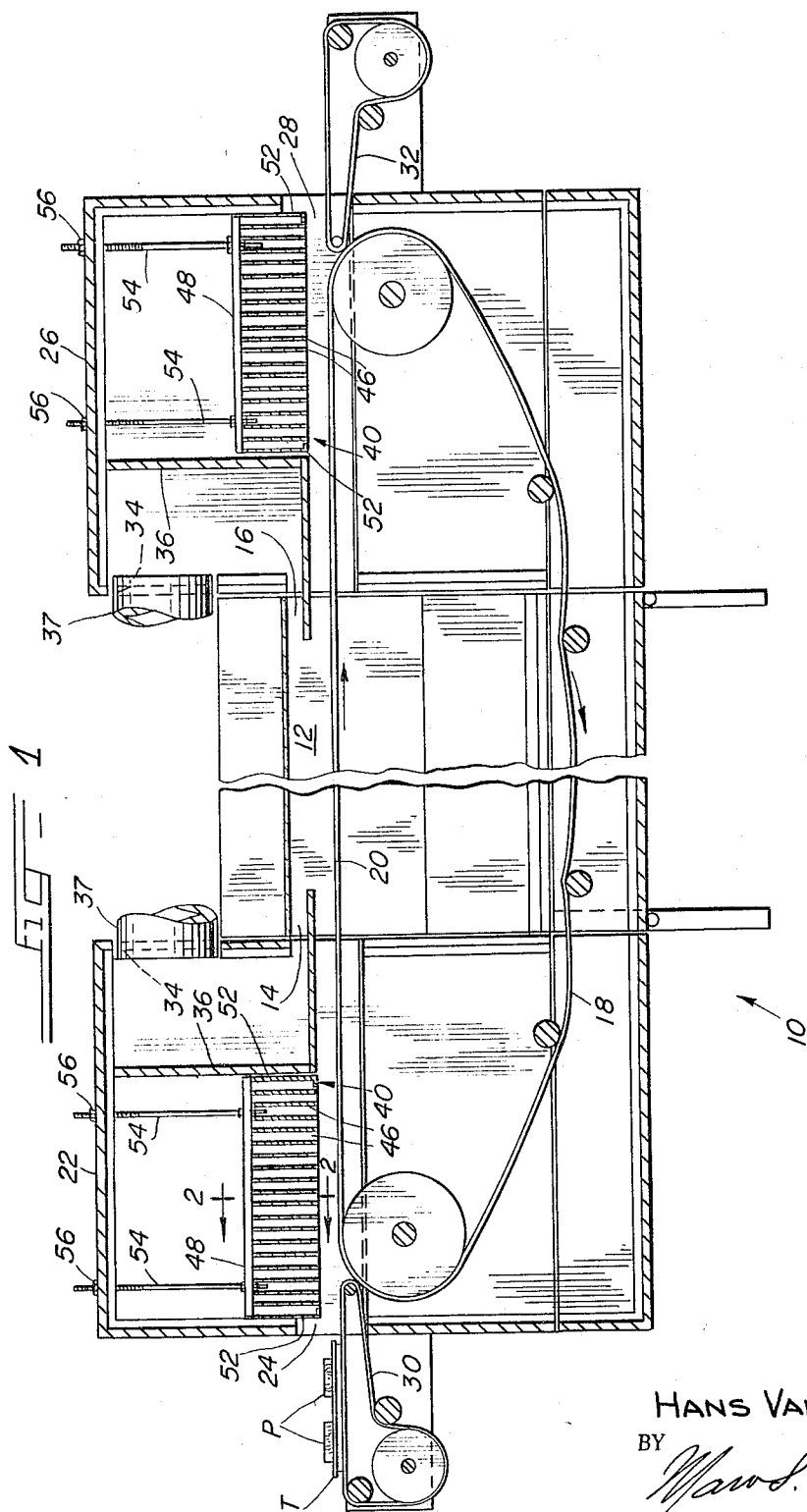
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3,293,879

GAS BARRIERS FOR AN ARTICLE CONVEYOR

Filed Jan. 11, 1965

2 Sheets-Sheet 1



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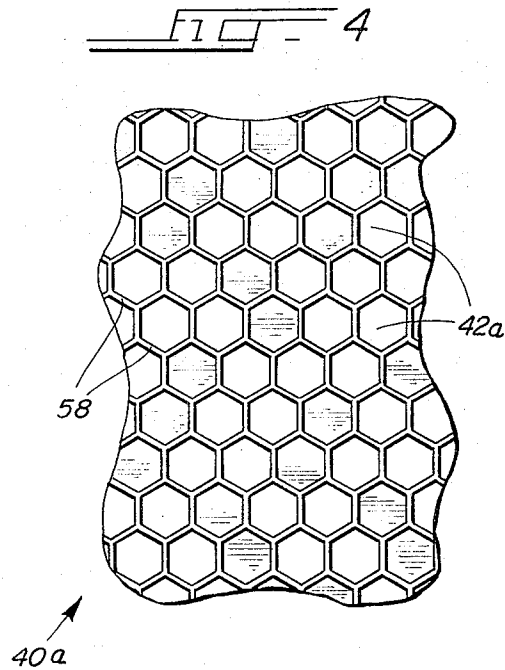
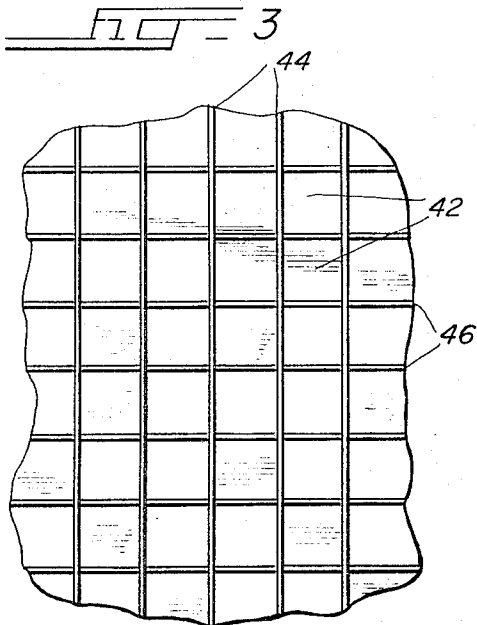
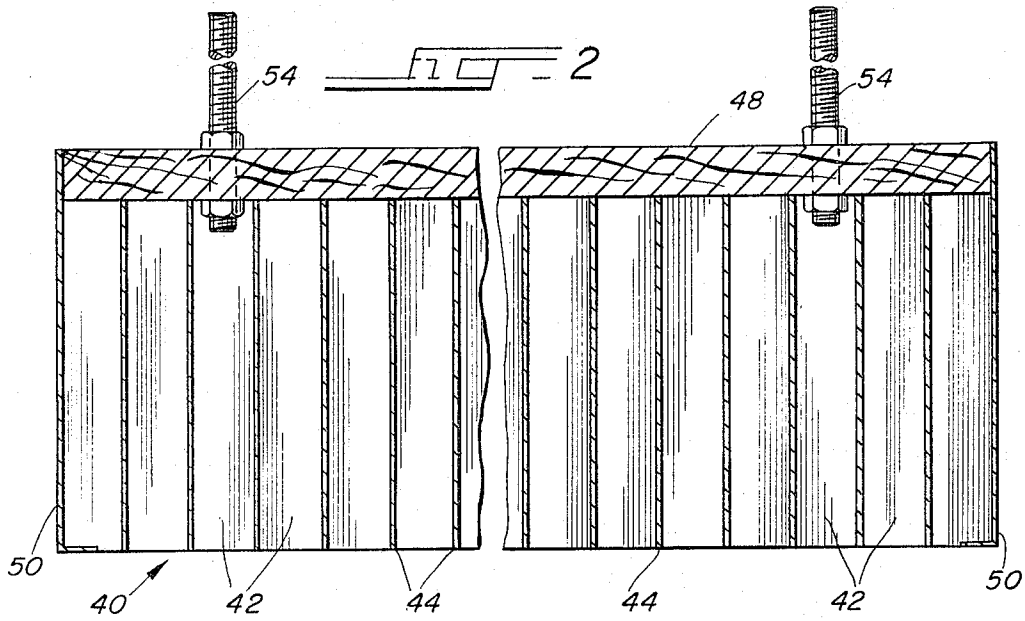
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GAS BARRIERS FOR AN ARTICLE CONVEYOR

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2 Sheets-Sheet 2



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3,293,879

GAS BARRIERS FOR AN ARTICLE CONVEYOR
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This invention relates generally to barriers for preventing the movement of gases and more particularly to gas barriers for use with open-ended chambers having atmospheres of desired temperatures and relative humidities, such as freezers and ovens, to maintain such atmospheres and prevent the loss or seepage thereof out of said chambers.

The advent of mass production techniques in various fields, such as baking and food processing, has given rise to numerous problems relating to the efficient use of heating and/or cooling chambers such as ovens and freezers. Typically, the mass production techniques employ a conveyor for continuously feeding the products into the particular chamber, moving the same through the chamber and then removing the products from the chamber for some further operation. As will be appreciated by those versed in the art, the use of such constant flow systems required that the ovens or freezers be open at both ends thereof in order to permit passage therethrough of the conveyor and goods.

In the baking art, it is of course necessary that conditions of temperature and relative humidity in the oven be maintained relatively constant for purposes of quality control and consistency of baked products. Thus, it is desirable to prevent the atmosphere of the oven from seeping out of the open ends thereof and to prevent the ambient atmosphere from entering the oven in the same manner. Similarly, when freezing with liquid nitrogen or the like, any waste of the relatively expensive liquid gas should be avoided. Thus, it is desirable to prevent premature seepage of the cold gases out of, or passage of the relatively warm ambient atmosphere into, the open-ended freezer. In any case, it will be appreciated that the movement of the conveyor and goods thereon has the undesirable and unavoidable effect of creating gas currents and carrying clinging gases with them.

It is therefore an important object of this invention to provide a gas barrier which may be employed in open-ended chambers to overcome all of the gas movement problems described hereinabove.

Another object is to afford a gas barrier of the character described which prevents undesirable movements of gases into or out of the associated chamber but which nonetheless does not impede the free movement of the conveyor and goods into and through said chamber.

A further object is to provide a gas barrier of the character described which is positioned adjacent the openings of a chamber and which may be readily adjusted with relation to said openings to permit articles of varying size to pass therethrough.

Still another object is to afford a gas barrier of the character described which has no moving parts and requires no special adjustments or changes in the conveyor structure.

Yet another object is to provide a gas barrier of the character described which operates without the need for directing streams of gas under relatively high pressures against the products, such streams of gas being frequently injurious to certain food products, particularly if in a plastic state.

Still a further object is to afford a gas barrier of the character described which is relatively inexpensive to manufacture, extremely durable and virtually maintenance free, and yet is most efficient for the purposes intended.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of my invention, I have illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, my invention, its mode of construction, assembly and operation, and many of its advantages should be readily understood and appreciated.

Referring to the drawings in which the same characters of reference are employed to indicate corresponding or similar parts throughout the several figures of the drawings:

FIG. 1 is a fragmentary longitudinal sectional view of an open-ended freezer system incorporating therein gas barriers embodying the principles of the invention;

FIG. 2 is an enlarged fragmentary sectional view of one of the gas barriers taken on the plane of line 2-2 in FIG. 1 and viewed in the direction indicated;

FIG. 3 is a fragmentary bottom plan view of the gas barrier shown in FIG. 2; and

FIG. 4 is a similar view but illustrating another possible form of cell structure for the gas barriers.

Referring more particularly to FIG. 1 of the drawings, it will be seen that the reference numeral 10 indicates generally a freezer system incorporating therein gas barriers which embody the principles of the invention. Since the freezer system 10 is merely typical of one of the invention's applications and does not in and of itself comprise a part of the invention, the same will be described only in so much details as is necessary for an understanding of the invention.

The freezer system 10 comprises a central elongated freezer chamber 12 within which is employed a suitable cooling medium, such as, for example, a spray of liquid nitrogen. The freezer chamber 12 is open at both ends thereof and is thus provided with an inlet opening 14 and an exit opening 16. A conveyor 18 is associated with the freezer system, and the top horizontal span 20 of the belt thereof passes through the chamber 12 and is adapted to convey articles positioned thereon through said chamber.

An inlet ante-chamber 22 is connected to the freezer chamber 12 and said ante-chamber is formed with an inlet opening 24. In similar manner, an exit ante-chamber 26 is connected to the opposite end of the freezer chamber 12 and is provided with an exit opening 28. Conveyors such as 30 and 32 are respectively associated with the ante-chambers 22 and 26 for conveying articles such as hot food packages P on a tray T to and from the conveyor 18. Each of the ante-chambers is likewise formed with an exhaust opening 34 and a baffle or deflector member 36 adjacent the associated chamber opening 14 and 16. An exhaust pipe 37 and fan (not shown) is associated with each of the exhaust openings 34 for reasons which will become apparent as the description proceeds.

A gas barrier indicated generally by the numeral 40 is mounted in each of the ante-chambers 22 and 26 and positioned directly behind the openings 24 and 28. Turning to FIGS. 2 and 3, it will be seen that each of the gas barriers 40 comprises a honeycomb-like or cellular structure free, and yet is most efficient for the purposes intended.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

ture having a plurality of contiguous elongated cells or columns 42. The cells 42 may be formed in any suitable way such as with parallel intersecting walls such as 44 and 46, although it is desirable that each of the cells have its own airtight integrity and have no communication with adjacent cells. All of the cells 42 are sealed at one end thereof, the top end in the embodiment illustrated, by a closure panel 48. End panels such as 50, 50 and 52, 52 may be employed for finishing off the barrier structure (see FIGS. 1 and 2). It will thus be seen that the barrier 40 comprises a cellular structure having a plurality of elongated cells or columns 42 which are open at only one end thereof. The width of the barriers 40 is substantially the same as the conveyor belts 20, 30 and 32 so that they completely overlie said belts.

As indicated in FIG. 1 of the drawings, the barriers 40 are mounted in the ante-chambers so that the open or bottom ends of the cells 42 are facing and directly over the packages P as they pass thereunder. It has been determined experimentally that the barriers 40 operate most efficiently when the open ends of the cells 42 are as close as possible to the packages passing thereunder. Accordingly, means is provided for adjusting the height of the barriers to accommodate packages of varying height, said means comprising elongated mounting rods 54 which are threaded and cooperate with locking nuts 56 to fix the length of the rods within the ante-chambers.

With the structure and arrangement described above, it has been found that the gas barriers 40 function most efficiently to form an invisible barrier or wall which prevents warm ambient air from entering, and the cold freezing gas from discharging, through the openings 24 and 28. The phenomena which occur in and adjacent the barriers 40 to produce the invisible wall are not at this time fully understood. However, it may be theorized that the results are at least partially due to Bernoulli's effect. Thus, for example, the movement of the conveyors and surrounding gases in a plane normal to the open ends of the cells 42 tends to lower the pressure at the bottom of the cells so that the gases in said cells tend to flow downwardly. Similarly, the movement of the warming and expanding nitrogen also tends to lower the pressure at the bottom of the cells 42, thereby tending to cause the gases therein to flow downwardly. As a result of this turbulence and movement of gases in and out of the open ends of the cells, there is formed a veritable wall of gas which prevents movement of other gases therethrough without in any way inhibiting the passage of the conveyor belts and packages and trays thereon.

For purposes of achieving an efficient state of equilibrium in the freezer system 10, the exhaust fans associated with the exhaust openings 34 may be employed. By this means, the spent and warmed nitrogen gases may be efficiently removed from both ends of the freezer.

The specific cross sectional configuration of the cells 42 is not critical and forms other than the illustrated squares may be employed if desired. Thus, in FIG. 4 of the drawings, there is illustrated an alternative form or barrier 40a in which the individual cells or columns 42a are hexagonal in cross section, being formed by honeycomb or prismatic walls 58. In like manner, other cell forms such as triangular may be employed.

As already indicated above, the novel gas barriers 40 may be employed for the purposes described in any open-ended chamber, such as an oven, for maintaining the desired atmosphere therein. In this respect, it will of course be appreciated, that although the specific application described shows the mounting of the gas barriers within ante-chambers to the actual central chamber, such ante-chambers are not necessarily required. Thus, for example, the gas barriers 40 may be mounted within the main chamber itself directly behind the inlet and exit openings therein. On the other hand, if desired, a plurality of ante-chambers may be employed in series at either end of the main chamber, each of which has a

gas barrier mounted therein. In addition, the gas barriers may also be used within an oven or freezer unit to separate one zone from another.

Although the invention has been described and illustrated in an application wherein only a single gas barrier 40 is mounted above the conveyor passing through the chamber, other arrangements are also possible. Thus, for example, a gas barrier 40 may also be positioned beneath the conveyor and at either side thereof. In any event, it is only necessary that each gas barrier be positioned so that the open ends of the cells face toward the conveyor and the articles being transported thereon.

From the foregoing description and drawings, it should be apparent that I have provided a novel gas barrier which most efficiently maintains the desired atmosphere within open-ended chambers. The barriers are relatively inexpensive to manufacture, have no moving parts in their operation and are virtually maintenance free. Despite their obvious advantages, the barriers offer no impediment to the free and uninterrupted flow of articles into and through the particular chamber with which they are employed.

It is believed that my invention, its mode of construction and assembly, and many of its advantages should be readily understood from the foregoing without further description, and it should also be manifest that while a preferred embodiment of the invention has been shown and described for illustrative purposes, the structural details are nonetheless capable of wide variation within the purview of my invention as defined in the appended claim.

What I claim and desire to secure by Letters Patent of the United States is:

1. A freezer system comprising
 - a elongated freezing chamber having input and exit openings at the ends thereof,
 - a conveyor associated with said freezing chamber and including a substantially horizontal belt span passing therethrough, a gaseous cooling medium in said freezing chamber,
 - an input ante-chamber connected to the input end of said freezing chamber and communicating with said input opening,
 - said input ante-chamber being formed with an inlet opening in alignment with said input opening,
 - an exit ante-chamber connected to the exit end of said freezer chamber and communicating with said exit opening,
 - said exit ante-chamber being formed with an outlet opening in alignment with said exit opening,
 - a honeycomb structure mounted in each of said ante-chambers and positioned respectively behind said inlet and outlet openings,
 - each of said structures comprising a plurality of contiguous elongated cells, and
 - means sealing off the top end of each of said cells, said structures being mounted with the longitudinal axes of said cells in substantially vertical relationship and the open ends of said cells facing downwardly toward said belt span and having no physical contact therewith so that articles on said conveyor pass freely therebeneath, whereby said structures function to create a gas barrier which prevents movement of gases from said freezer chamber into the ambient atmosphere and from the ambient atmosphere into said freezer chamber through said inlet and outlet openings.
2. The freezer system of claim 1 in which means is associated with said structures for adjusting the height of said structures above said belt span.
3. The freezer system of claim 2 in which exhaust means are positioned at opposite ends of said chamber for exhausting the warmed and expanding cooling medium gases therefrom.
4. The freezer system of claim 3 in which a deflector is associated with said input and exit openings,

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said deflectors directing said warmed and expanding cooling medium gases toward said exhaust means.

5. In combination,

an elongated freezer chamber having an input opening and an exit opening at opposite ends thereof, 5

a gaseous cooling medium in said chamber,

exhaust means at opposite ends of said chamber for

exhausting the warmed and expanding cooling medium

gases from said chamber,

conveyor means within said chamber and passing 10

through said input and exit openings,

a pair of honeycomb structures,

each of said structures comprising a plurality of con-

tiguous elongated cells, and 15

means sealing off the top end of said cells,

the bottom end of said cells being open,

said structures being mounted in said chamber one

adjacent each of said openings and above said con-

veyor means with the open end of said cells facing 20

said conveyor means and having no physical contact

therewith so that articles transported on said con-

veyor means pass freely therebeneath, whereby the

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movement of said conveyor means causes said structures to create a gas barrier to prevent movement of gases into or out of said chamber through said openings, and

adjustment means associated with said structures for adjusting the distance between the bottom end of said cells and said conveyor means.

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