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GAS LOCK FOR OPENINGS IN PRESSURIZED CHAMBERS

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FIGURE 1

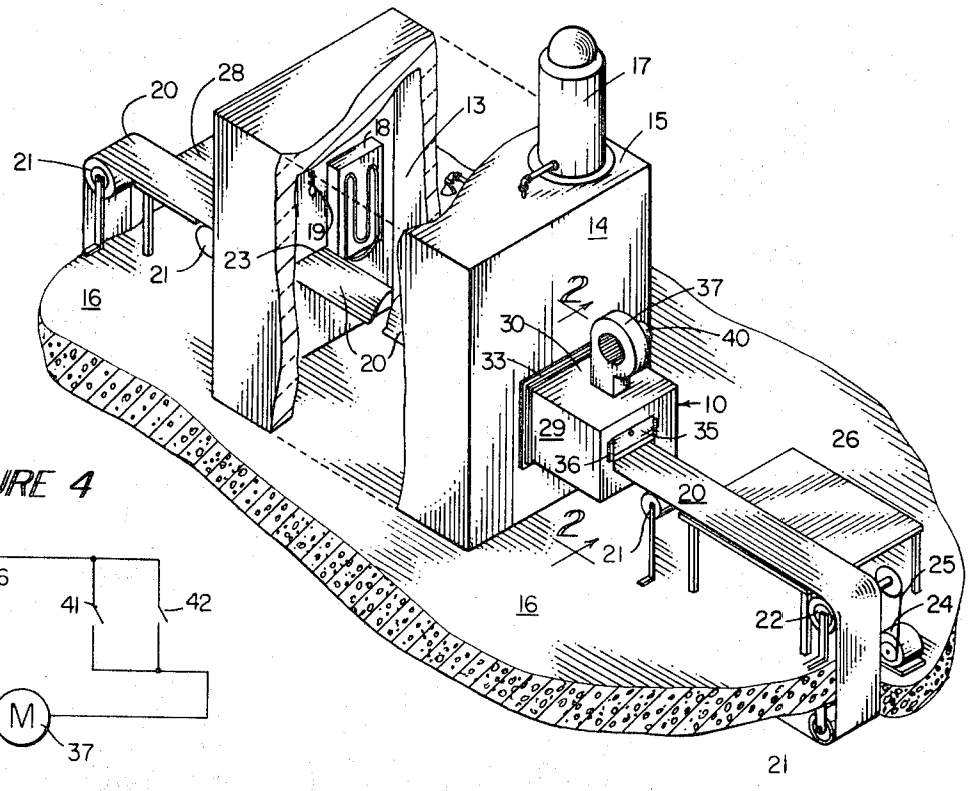


FIGURE 4

FIGURE 2

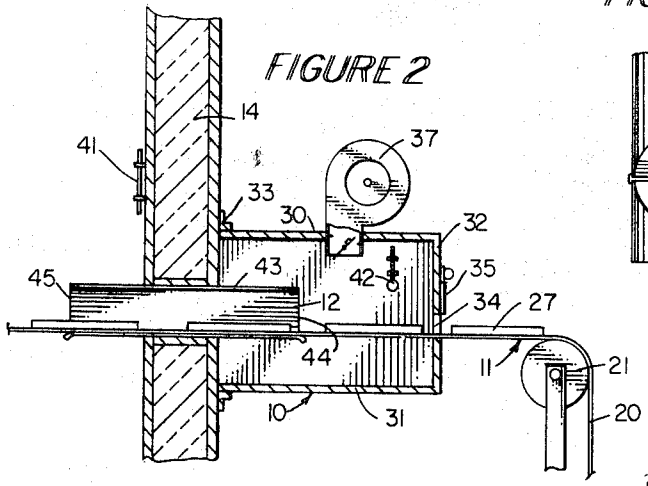
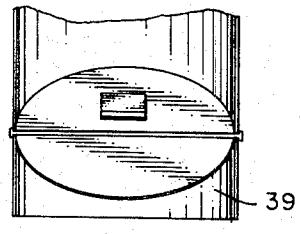


FIGURE 3



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ABSTRACT OF THE DISCLOSURE

A gas lock to allow entry of a continuous conveyor to a pressurized chamber and prevent escape of pressurized gas therefrom. The lock provides a larger chamber with smaller channel communicating therefrom to the freezing chamber with means of providing pressurized gas in the lock chamber to create a static pressure front in the channel so that matter may pass therethrough without allowing escapement of gas from the freezing chamber. The embodiment is particularly adapted to use in the liquid gas cryogenic field.

BACKGROUND OF THE INVENTION

Field of invention

This invention relates generally to a gas lock and more particularly to such a structure that allows the passage of a continuous product carrying conveyor into a pressurized chamber while preventing the exit of gas from the chamber.

Description of prior art

In the cryogenic industries and especially in that branch dealing with food it has heretofore become desirable to freeze product by means of a liquid gas process, either completely or in combination with mechanical freezing. The liquid gas freezing of product generally is carried out, generally at pressures somewhat above atmospheric, within an enclosed chamber to contain the gas cryogen. If the process be adapted to continuous operation it is necessary to provide in such a system some type of entrance and exit into the freezing chamber for product to be operated upon; in so doing, however, the gas cryogen must be maintained within the freezing chamber for economy of operation and to prevent contamination of the ambient atmosphere about the chamber since the liquid cryogens generaly used are deleterious to humans.

Heretofore the general problem of maintaining an atmosphere within a freezing chamber has been considered to some extent and various solutions offered. Most solutions, however, have been concerned with freezing processes other than one embodying liquid gas cryogen—their purpose generally being to prevent the entry of warmer, moist ambient air into a freezing chamber with attendant heat transfer and coil frosting.

The method heretofore known of sealing conveyor orifices through chamber walls have in general embodied a moveable physical barrier of one sort or another that is normally biased to a sealing position, but moveable therefrom, generally by the product, to allow its entry. Some devices of this nature have embodied plural sequentially entered closures to lessen the possibility of gaseous transfer through the orifice. In some instances the barriers have been flexible, in others rigid and in still others screen type barriers and brush bristles have been used. In all this prior art, however, there generally is a substantial transfer of gas through the chamber orifice and there generally is some type of closure contact with

product which oftentimes may be deleterious to the product, especially uncontained product prior to freezing.

With this background in mind the instant invention was conceived to provide a gas lock communicating between the ambient atmosphere and the freeing chamber to allow the free passage of a continuous conveyor and carried product therethrough, but yet prevent the exit of gas, particularly in a pressurized state, from the freezing chamber.

This invention is distinguished from the prior art in that it does not use a physical barrier or closure, either singular or plural, to prevent gas exit and has no physically moveable element that in any way contacts the product. The invention further uses a gas barrier within an elongate communicating channel to prevent exit of gas from the freezing chamber and this structure prevents substantially more gas escape than the various physical barriers heretofore known with lower cost, greater ease of construction and greater adaptability to existing structures. The lock is particularly useful in the liquid nitrogen cryogenic field as it prevents any substantial quantities of pressuried nitrogen mixture within the freezing chamber from exiting into the ambient atmosphere through the conveyor orifices, while the known devices are not efficient for this purpose.

SUMMARY OF INVENTION

The instant invention provides an air lock structure communicating between a freezing chamber and the ambient atmosphere thereabout to allow passage of a conveyor and product therethrough but yet maintain pressurized gas within the freezing chamber from exiting through the lock.

This function is accomplished by providing a lock chamber communicating to the ambient atmosphere with an elongate channel communicating between the lock chamber and the freezing chamber, all arranged so that a conveyor and product carried thereon may transit through the lock chamber and channel to the freezing chamber. Pressurized air is supplied from the ambient atmosphere to the lock chamber and maintained by automatic control means at substantially the same pressure as that of the cryogenic atmosphere within the freezing chamber, so that a front of communication of substantially equal pressure between the two atmospheres is maintained in the elongate channel communicating between the lock chamber and the freezing chamber. The pressurized gas in the lock chamber will pass to a degree to the ambient atmosphere through the conveyor opening therein, the gas cryogen within the freezing chamber will be maintained therein by reason of the air seal in the lock channel, and product will be free to pass through the lock during existence of this condition.

In providing such a structure it is:

A principal object of our invention to provide a gas lock communicating between a freezing chamber and the ambient atmosphere thereabout that allows free passage of product therethrough into the freezing chamber but prevent exit of gas from the freezing chamber through the lock.

A further object of our invention to provide such a structure that may be modified substantially in dimension and configuration without departing from its principle to allow adaptation to most existing freezing chambers and conveyor structures of present day commerce without substantial modification of either.

A still further object of our invention to provide such an air lock that provides no physical contact of sealing structures of any nature with the product, especially prior to its freezing.

A still further object of our invention to provide such a device of the nature aforesaid that is readily adaptable

to the liquid nitrogen cryogenic industry to prevent any substantial quantities of pressurized gas of high nitrogen content from exiting from the freezing chamber through the lock to contaminate the atmosphere thereabout.

A still further object of our invention to provide such a device that is of new and novel design, of sturdy and durable nature, of simple and economic manufacture and one that is otherwise well adapted to the uses and purposes for which it is intended.

Other and further objects of our invention will appear from the following specification and accompanying drawings which form a part of this application. In carrying out the objects of our invention, however, it is to be understood that its essential features are susceptible of change in design and structural arrangement with only one preferred practical embodiment being illustrated in the accompanying drawings, as required.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings wherein like numbers of reference refer to similar parts throughout:

FIG. 1 is a partially cutaway isometric view of an idealized freezing chamber showing a conveyor passing therethrough with my invention in place thereon.

FIG. 2 is a somewhat enlarged cross-sectional view of the freezing chamber of FIG. 1 taken on the line 2—2 thereon, in the direction indicated by the arrows, to show the various parts of the freezing chamber, their configuration and relationship.

FIG. 3 is a cross-sectional view of FIG. 2 taken on the line 3—3 thereon, in the direction indicated by the arrows, to show the detailed structure of the damper in the fan channel.

FIG. 4 is an electrical diagram, illustrated in normal symbology, to show a simple control system for my invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in more detail and particularly to that of FIG. 2, it will there be seen that our invention comprises generally lock chamber **10** communicating to the ambient atmosphere to receive conveyor structure **11** and allow its passage through lock channel **12** communicating between the lock chamber and freezing chamber **13**.

Freezing chamber **13** is defined by structurally rigid, insulating peripheral walls **14**, ceiling **15** and bottom **16**. The walls typically support within the chamber liquid gas cryogenic system **17** adapted to supply liquid gas within freezing chamber **13**, whence it might expand to fulfill its cryogenic function. Commonly the chamber also carries mechanical refrigeration **18** and various control structures **19** to determine the operation and freezing characteristics of both systems. Most commonly this type of liquid cryogenic freezing chamber is adapted to maintain a gaseous pressure within the chamber somewhat above that of the ambient atmosphere—generally in the neighborhood of five pounds per square inch above the normal atmospheric pressure. Our invention is adapted particularly to function with this pressurized type of freezing system; it will function with a system at atmospheric pressure, but in such an installation normally an excessive amount of ambient air would be transferred into the freezing chamber.

Conveying structure **11** associated with our invention may be of any of the common types of commerce, that illustrated providing flexible carrying belt **20** passing over appropriate support rollers **21** and driving roller **22** to define a course through conveyor orifices **23** in walls **14** of the freezing chamber. Driving roll **22** is driven by motor **24**, communicating therewith by appropriate mechanical linkage **25**. In the embodiment shown the conveyor is an endless type providing one course of transit through the freezing chamber with a return externally thereof, but obviously the invention might well be applied to any of the various common conveying systems whether they might return externally of the freezing chamber or through it and whether they might provide a singular or plural course therein, our particular invention being concerned only with one passage of the conveyor through the wall of the freezing chamber.

Commonly with such conveyor systems there will be a placement station **26** for product **27** and a removal station **28** both external of the freezing chamber.

Lock chamber **10** is defined by similar opposed sides **29** structurally communicating with top **30**, bottom **31**, and input end **32**, all cojointly communicating with the external periphery of wall **14** of the freezer chamber by means of seal **33** to define an enclosed chamber about conveyor orifice **23** in the freezing chamber wall. Conveyor orifice **34** is provided in input end **32** of the chamber to allow passage of the conveyor; paired opposed slides **35** are provided for sliding motion in guide channels **36** to substantially close this orifice during periods of nonuse to prevent exit of cryogenic gases therethrough during these periods.

Fan **37** is supported by the peripheral surface of the lock chamber to communicate therewith through duct **38** carrying biased normally closed valve **39**. The fan is motivated by motor **40** and controlled by thermostatic switch **41** and pressure switch **42**.

Lock channel **12** is defined by elongate tubular peripheral channel member **43** having open input end **44** and exit end **45**. This member has some substantial length and communicates with its ingress end **44** within lock chamber **12** and its egress end **45** within freezing chamber **13**, preferably with cross-sectional areas of some 2 or 3 square feet and freezing chamber pressure of some five pounds above atmosphere, this member has a length of some 3 to 4 feet. Obviously the physical dimensioning of the structure may be rather exactly determined by well known methods of the engineering arts. Peripheral channel member **43** is positioned to extend through conveyor orifice **23** in wall **14** of the freezing chamber and is so configured as to allow passage of conveyor belt **20** and carried product **27** therethrough.

The electrical circuitry of my invention shown in FIG. 4, is seen to provide a source of electrical energy **46** communicating through thermostatic switch **41** and pressure switch **42**, in series with the energy source but in parallel with each other, to motor **40** to supply energy thereto and thusly activate fan **37** in response to the condition of the two switches. This control circuitry again might be sophisticated and modified by many known methods to control the activity of fan **37** to maintain an appropriate air pressure within lock chamber **10**.

Having thusly described the structure of our invention its operation may now be understood.

An air lock of the nature specified is formed and placed as heretofore specified with conveyor **11** transiting therethrough in its course from the ambient atmosphere thereabout into freezing chamber **13**. Freezing chamber **13** is of the type having a cryogenic atmosphere therein of a pressure somewhat above that of the ambient atmosphere. By reason of the pressure differential the tendency of the freezer chamber atmosphere will be to exit outwardly to the ambient atmosphere to equalize the pressure differential.

With this condition then pressure switch **42** is either appropriately chosen, or set if it be an adjustable type, to activated motor **40** and thusly fan **37** to maintain gas pressure within lock chamber **10** substantially equal to that in freezing chamber **13**. As this occurs a portion of the pressurized air within lock chamber **10** will pass to the ambient atmosphere through conveyor orifice **34** in input end **32** of the lock chamber, but at the same time pressure will be created within the lock channel **12** substantially equal to the outward pressure of the cryogenic gas within the freezing chamber so that the two substantially nullify each other and the communication therebetween exists only in a small area within lock channel

12. There will at this communication between the two atmospheres be some slight intermixing, but by reason of the small areas involved this intermixing will be quite negligible and substantially no gas will flow from the freezing chamber **13** through the channel to the ambient atmosphere.

With the device in this condition the conveyor may then be activated to transit product within the freezing chamber through the lock and the gas balance as aforestated will be substantially maintained between the lock and freezing chamber.

It may oftentimes be desirable to stop operation of the conveyor for substantial periods and yet prevent escape of gas from the freezing chamber during such periods. Obviously, the air lock could continue its function then as aforestated to serve this purpose, but since the conveyor be not running it is generally more convenient to shut off the various orifices communicating from the lock to the ambient atmosphere. To this end the biased valve **39** in fan duct **38** will automatically close against any pressure to prevent passage of gas through this orifice and slides **35** may be manually closed against the conveyor belt **20** to substantially prevent escape of gas through this orifice.

It is to be particularly noted from the foregoing description that the size and configuration of the various elements of the air lock might be varied within substantial limits to accommodate the structure to various existing configurations of freezing box, external environment and conveyor, while still maintaining the essential principles of my invention. In general, however, it should be remembered that conveyor orifice **34** in the peripheral closure of lock chamber **10** should be relatively small to prevent an excessive required output of the fan and that lock chamber **10** should be relatively large to provide a pressure reservoir to accommodate for slight changes in pressure of the freezing system. Lock channel **12** should also be of as small cross section as possible and of relatively long nature to prevent any substantial mixing of ambient atmosphere and cryogenic atmosphere, especially by turbulance or convection.

The foregoing description of our invention is necessarily of a detailed nature so that a specific embodiment of it might be set forth as required, but it is to understood that various modifications of detail, rearrangement and multiplication of parts may be resorted to without departing from its spirit, essence or scope.

Having thusly described our invention, what we desire to protect by Letters Patent, and what we claim is:

1. A gas lock associated with a pressurized chamber to maintain pressurized gas within the chamber and yet provide an orifice for product transfer relative the chamber, comprising in combination:

an enclosed lock chamber of some volume associated with the pressurized chamber to communicate between the pressurized chamber and the ambient atmosphere thereabout;

a passageway from the ambient atmosphere to the lock chamber of such size as to allow product transfer there thru, a lock channel of such size as to allow product transfer there thru and being of an elongate nature with a first end terminating inside the pressurized chamber and a second end terminating inside the lock chamber; and a source of pressurized gas from the ambient to the lock chamber, said source of gas being of such pressure and so oriented as to provide a pressure front adjacent the second end of the lock channel thereby preventing excessive egress of pressurized gas from the chamber.

2. A gas lock of the nature aforesaid to prevent the exit of pressurized gas from a pressure chamber through an orifice therein, comprising, in combination:

a lock chamber defined by peripheral members communicating with the pressurized chamber about a first orifice therein, the lock periphery having a second orifice for product transfer from the ambient atmosphere;

an elongate pipelike lock channel extending from the lock chamber, coincidentally through the orifice in the pressurized chamber periphery and with a first end terminating inside the pressurized chamber and the second end terminating inside the lock chamber, and a source of pressurized gas from the ambient to the lock chamber, said source of gas being of such pressure and so oriented size as to provide a pressure front adjacent said second end of the lock channel thereby preventing excessive egress of pressurized gas from the chamber.

3. The invention of claim **2** wherein the lock chamber is of substantially greater volume than that of the lock channel.

4. The invention of claim **2** wherein the means of supplying pressurized gas to the lock chamber comprises a fan motivated by a motor controlled by at least a pressure sensitive switch to maintain a constant predetermined gas pressure within the chamber.

5. The invention of claim **2** wherein the orifices communicating from the lock chamber to the ambient atmosphere may be substantially closed during inoperative periods to prevent the escape of gas therethrough.

6. The invention of claim **2** wherein the orifice in the lock chamber periphery is so configured and positioned relative the lock channel as to allow passage of a linear product conveyor therethrough.

7. The combination of claim **2** in which the pressurized chamber is a cryogenic freezing device having means to cool product therein with liquid cryogenic coolant.

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U.S. Cl. X.R.

34—242; 263—50