

ENCLOSURE ASSEMBLY

FIELD OF THE INVENTION

- 5 The present invention generally relates to a warehouse or a cold storage for storing products. Particularly, the present invention relates to a controlled microclimate enclosure assembly for storing temperature-sensitive products.

BACKGROUND OF THE INVENTION

- 10 Warehousing is an essential part of a product's supply chain. Warehousing enables businesses to stock and/or store products to distribute or sell them later.

Today, increase in global demands have resulted in a need to prolong shelf life of products and at the same time maintain the product quality while they are being stored
15 in the warehouses. Therefore, many temperatures sensitive products are now being stored in cold rooms rather than in normal warehouses. Due to these changes, businesses involved in warehousing are required to upgrade their existing warehouses to cold storages. However, this upgrade requires huge investment on cooling equipment and storage infrastructure to convert a normal warehouse into a cold
20 storage space. The conversion involves rework on the existing structure including but not limited to investing in a huge refrigeration system, the flooring, suspended ceiling, huge segregation insulated wall, roller doors and the like.

Moreover, conventionally, mechanical compression refrigeration systems are
25 commonly used in the warehouse industry. These conventional systems use liquids that have a low gasification temperature as refrigerant and that evaporate it under low pressure such that the refrigerant absorbs the heat in the surroundings to achieve a cooling environment. Further, these conventional systems tend to require high power consumption as they work by removing unwanted heat from surroundings of the
30 storage area. However, heat is constantly generated in the working area of warehouse either through human activity and/or machinery, thereby more energy and cold air is needed to keep the storage constantly cool.

Additionally, products in a warehouse or a cold room are usually placed on storage
35 shelves or racks, but the current refrigeration system is required to cool the entire room to keep the products constantly in a cold environment. This results in high consumption

of energy as a wider area and voluminous space than the one restricted to the shelves or racks needs to be constantly cooled. This may also pose a safety concern to operators and equipment alike, as prolonged exposure to cold environment may have detrimental effects on their health and operation respectively.

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There is therefore a need for an energy efficient solution for overcoming the aforementioned drawbacks while converting the warehouses into cold storages for products. In addition, there is also a need for minimizing the use of infrastructure and specialized equipment for creation of a conducive environment for storage of products.

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SUMMARY OF THE INVENTION

The present invention discloses an enclosure assembly for storage of products. The enclosure assembly comprises a plurality of panels, wherein the panels are joinable to form at least one enclosure; and at least one cooling means coupled to the enclosure to introduce a cooling medium and maintain a predetermined temperature within said enclosure.

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Typically, a panel is securable with an adjacent panel to form at least one airtight enclosure. The panel includes a sealing means attached to its peripheral edges.

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Further, a panel is securable to an adjacent panel using the sealing means.

Still further, at least one panel is pivotable, removable or slidable to access the products stored within the enclosure.

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Additionally, the cooling medium is a gas. Preferably, the cooling medium is an inert gas. Alternatively, the cooling medium is selected from the group comprising of chilled water, refrigerant, coolant or dry ice.

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Furthermore, the assembly includes a frame, wherein the enclosure is removably secured to the frame. The enclosure is removably secured to the frame using at least one support and locking means, wherein one end of the support and locking means is mechanically fitted to the frame and the other end is fastenable to the enclosure.

According to the invention, the frame is a storage rack. Alternatively, the enclosure is configurable to accommodate a storage rack.

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Various objects, features, aspects, and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

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BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention will be fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, wherein:

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FIGURE 1 is left, front perspective view of the enclosure assembly.

FIGURE 2 is a rear perspective view of the enclosure assembly.

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FIGURE 3 is right, side view of the enclosure assembly.

FIGURE 4 is a schematic diagram of a storage rack affixed with support and locking means.

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FIGURE 5 depicts a magnified view of the joined panels.

FIGURE 6 is front perspective view of the enclosure illustrating the operation of the panels as an automated door.

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FIGURE 7 is a schematic diagram of the temperature control system.

DETAILED DESCRIPTION

In accordance with the present invention, there is provided an enclosure assembly for storing products which will now be described with reference to the embodiment shown in the accompanying drawings. The embodiment does not limit the scope and ambit of the invention. The description and phraseology or terminology employed herein is for the purpose of description and not of limitation.

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The embodiment herein and the various features and advantageous details thereof are explained with reference to the non-limiting embodiment in the following description. Descriptions of well-known components and processing techniques are omitted to not unnecessarily obscure the embodiments herein. The examples used

herein are intended merely to facilitate an understanding of ways in which the embodiment herein may be practiced and to further enable those of skill in the art to practice the embodiment herein. Accordingly, the description should not be construed as limiting the scope of the invention herein.

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Referring to the accompanying drawings, **FIGURES 1 to 3** disclose a left front perspective view, rear perspective view and side view respectively of an enclosure assembly (100) of the present invention.

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According to the present invention, the enclosure assembly (100) is used for storage of products that require a constant cold environment to be maintained for their storage and prolonged shelf life. These products can include perishable goods, medicines, or the like items which have a limited shelf life. Although, the present invention discloses the enclosure assembly (100) for use in warehousing applications, particularly using

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warehousing racking systems, one skilled in the art would appreciate that these teachings can be applied for any application where products are to be stored in a controlled environment. For instance, the enclosure assembly (100) can be used by supermarkets, grocery stores or medical facilities or the like for storage of temperature-sensitive products.

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Referring to **FIGURES 1 to 3**, the enclosure assembly (100) comprises of two main components which are panels (102) and at least one cooling means (106). A warehouse can have one or more of such enclosure assemblies for storing products. The cooling means (106) is configurable to maintain a discrete temperature within the enclosure (104) based on the nature of the product stored therein.

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According to the invention, the enclosure (104) is formed by joining the panels (102) together to form a sealed compartment. Preferably, the panels (102) are fabricated using an insulating material and include a sealing means (118) attached to their peripheral edges. Alternatively, the panels (102) are formed of a rigid material and covered with an insulating material.

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Further, a panel (102) is joinable to an adjacent panel (102) using the sealing means (118) to form an airtight enclosure (104). Typically, the insulating material is at least one polymeric material selected from fiberglass, polyurethane, polystyrene, vacuum

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insulation panel, or insulated concrete forms, preferably polyvinyl chloride (PVC) form. The sealing means (118) is an adhesive material. The adhesive material is at least one material selected from ethylene propylene diene terpolymer, nitrile butadiene rubber or other sealing means (118) known in the art, preferably silicon gasket.

5 Alternatively, the panels (102) are joinable using other sealing means (118) such as magnets, whereby magnets are mounted on predesignated positions on the peripheral edges of the panels (102) and the panels (102) are joinable together using magnetism.

10 According to a first embodiment of the present invention, the enclosure assembly (100) includes a frame (108), wherein one or more panels (104) are removably secured to the frame (108) using at least one support and locking means (110). At one end the support and locking means (110) is mechanically fitted to the frame (108) and the other end is fastenable to hold and support one or more panels (102).

15 In accordance with the first embodiment of the present invention, the frame (108) is a storage rack, which can be a pre-existing shelf, rack or multi-level storage structure present in a warehouse. Alternatively, the frame (108) is a rigid structure capable of bearing weight which is a six-sided substantially rectangular or cuboidal shaped hollow columnar structure that can be used for storing products.

20 The first embodiment assembly of this invention, when used in conjunction with pre-existing warehouse or cold room racking, shelves or storage structures are shown in **FIGURES 1 to 7**. The objective of the invention is to minimize the consumption of energy required for providing a cold environment for the products along with minimizing the need for investment in specialized equipment and infrastructure. In view of this objective and according to the first embodiment, the enclosure assembly (100) is formed on a pre-existing warehouse or cold room racking, shelf or storage structure. According to this embodiment, the panels (102) are shaped and sized to conform the dimensions of the pre-existing rack (108), shelf, or storage structure.

30 **FIGURE 4** is a schematic diagram of a storage rack or frame (108) affixed with support and locking means (110). As seen in **FIGURE 4**, multiple support and locking means (110) are mechanically engaged at pre-designated positions on at least one vertical column of the frame (108) to provide stability in its upright position. The other end of the support and locking means (110) is engaged with the corresponding panels (102)

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to securely hold and support the enclosure (104) to the frame (108). Preferably, the support and locking means (110) include hitch pins and hanging clamps that engage with the upright frame (108) and retain the enclosure (104) in place.

5 **FIGURE 5** shows a magnified view of the panels (102) which are joinable together to form the enclosure (104). As seen in **FIGURE 5**, the two or more panels (102) are sealably joinable together using a tongue and groove fitting along with the sealing means (118). Alternatively, the two or more panels (102) are sealably joinable together using a biscuit connection or a box connection. Further, a groove (112) is formed on
10 at least one opposing pair of edges of the panels (102). The groove (112) is configured in a manner to form a fitting alignment with an adjacent panel (102) when they are joined to form the enclosure (104). The groove (112) also facilitates in increasing the airtightness of the enclosure (104).

15 According to the invention, the panels (102) are joined together to form the enclosure (104). However, at least one or more panels (102) in the enclosure can be pivotable, removable or slidable to provide an opening to enable access to personnel or lifting mechanisms to place, organize or remove products stored within the enclosure (104). **FIGURE 6** is front perspective view of the enclosure (104) showing an alternate
20 arrangement of the panels. As seen in **FIGURE 6**, the panels (102) on the front side of the enclosure (104) are placed on a guided track (114) and coupled to an automated sensing and movement control system (not shown) to enable contactless opening and closing of the panels (102), like an automated door. The guided track (114) is secured and engaged on two columns of the frame (108). Further, the sealing means (118)
25 arranged on the peripheral edges of the panel (102) prevent any air leakage into or out of the enclosure (104).

According to another embodiment of the present invention, the panels (102) are joined together to form a rigid compartment like enclosure (104) and can accommodate a
30 pre-existing storage rack (108) therein. Alternatively, the panels (102) form a rigid compartment like enclosure (104) to overlay pelleted products or packed stacks of products. In this embodiment, the metal frame may not be used for holding and supporting the enclosure (104).

FIGURE 7 shows a schematic diagram of the cooling means (106) which facilitates to create a controllable microclimate within the enclosure (104). The cooling means (106) is coupled to the enclosure (104) to introduce a cooling medium and maintain a predetermined temperature therein. Typically, the cooling medium is a gas, preferably an inert gas. The gas can be selected from nitrogen, argon, carbon dioxide, preferably, nitrogen. Alternatively, the cooling medium is selected from chilled water, a refrigerant, a coolant, or dry ice.

According to one aspect of the present invention, the cooling means (106) comprises a compressor (not shown) which uses liquid nitrogen as a refrigerant, a nitrogen generator (not shown) and a heat exchanger (not shown) to maintain a predetermined temperature within the enclosure (104). In addition, the cooling means (106) also includes an on-board computing device (not shown), at least one sensor (116) and one or more communication interfaces.

The sensor (116) along with the computing device facilitates to monitor the actual condition of the enclosure (104), if a predetermined nitrogen percent level is not attained within the enclosure (104) then the computing device operates one or more valves (not shown) to introduce the cooling medium and achieve the predetermined temperature within the enclosure (104).

The communication interfaces provided with each of the enclosure assemblies (100) enable the enclosures (104) to relay their sensor reading or one or more sensed parameters such as temperature to a remote computer (not shown). The remote computer could facilitate in monitoring of the individual enclosures (104) as well as remotely adjusting the microclimate parameters for a particular enclosure (104).

One skilled in the art would appreciate that the components used within the cooling means (106) are not limited to a compressor which uses liquid nitrogen as a refrigerant to maintain a predetermined temperature within the enclosure (104). Alternate cooling systems can be coupled with the enclosure (104) for supplying a cooling medium to create a microclimate environment within the enclosure (104). These cooling systems can include components such as gas cylinders or canisters. The cooling systems can

also include direct pipping for circulating chilled water across the enclosure (104) for creating the microclimate environment.

5 According to another aspect of the present invention, the panels (102) can facilitate to create more than one enclosure (104) within the same frame (108) in case of a multi-shelf or multi-level storage racking, wherein each shelf can be an enclosure (104) formed by securing one panel (102) with an adjacent panel (102) and introducing gas in the corresponding enclosure (104) to create a microclimate prescribed for the products stored therein. Alternatively, two or more shelves can be secured by panels
10 (102) to create a single enclosure (108).

The technical advantage of the present invention includes eliminating the need for re-working or investing in specialized equipment or infrastructure to convert a warehouse to a cold storage. This is achieved by providing a controllable microclimate enclosure
15 assembly that is formed using prefabricated panels which are joined together to envelope one or more pre-existing warehouse shelves or racks.

A further advantage of the present invention includes eliminating the need for cooling the entire warehouse or designated temperature zones and as a result saving energy
20 / power consumed by the warehouse. This is achieved by facilitating assembling of varied microclimate enclosures within the same warehouse space and limiting the supply of cooling gas within the airtight enclosures.

Still further, the assembly of the enclosure encircles the base of the storage shelves
25 or racks and uses the upright frame as the foundation for supporting the enclosure. As a result, no additional stress and/or weight of the enclosure is added to the frame.

As used herein, the singular forms "a", "an" and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The use of the
30 expression "at least" or "at least one" suggests the use of one or more elements, as the use may be in one of the embodiments to achieve one or more of the desired objects or results.

The invention being thus described, it will be readily appreciated by those skilled in
35 the art that modifications may be made to the invention without departing from the

embodiments as disclosed therein. Such modifications are to be considered as included in the following claim unless the claim by its language expressly states otherwise.

5 List of reference signs

(100) Enclosure Assembly

(102) Panel

(104) Enclosure

10 (106) Cooling means

(108) Frame

(110) Support and locking means

(112) Groove

(114) Track

15 (116) Sensor

(118) Sealing means

CLAIMS

1. An enclosure assembly (100) for storage of products, comprising:
 - a plurality of panels (102), wherein the panels (102) are joinable to form at least
 - 5 one enclosure (104) and wherein each panel (102) includes at least one groove (112) formed on at least one opposing pair of edges of the panel (102);
 - at least one cooling means (106) coupled to said enclosure (104) to introduce a cooling medium and maintain a predetermined temperature within said enclosure (104); and
 - 10 a frame (108), wherein the enclosure (104) is removably secured to the frame (108) using at least one support and locking means (110), wherein one end of the support and locking means (110) is mechanically fitted to the frame (108) and the other end is fastenable to the enclosure (104), wherein the frame (108) is a storage rack and wherein the enclosure (104) is configurable to accommodate a storage
 - 15 rack.
2. The assembly (100) of claim 1, wherein a panel (102) is securable with an adjacent panel (102) to form at least one airtight enclosure (104).
- 20 3. The assembly (100) of claim 1, wherein each panel (102) includes a sealing means (118) attached to its peripheral edges.
4. The assembly (100) of claim 3, wherein the sealing means (118) is an adhesive material.
- 25 5. The assembly (100) of claim 4, wherein the adhesive material is selected from the group consisting of ethylene propylene diene terpolymer, nitrile butadiene rubber and silicon gasket.
- 30 6. The assembly (100) of claim 3, wherein a panel (102) is securable to an adjacent panel (102) using the sealing means (118).
7. The assembly (100) of any of the claims 1 to 4, wherein at least one panel (102) is pivotable, removable or slidable to access the products stored within the enclosure
- 35 (104).

8. The assembly (100) of claim 1, wherein the cooling medium is a gas.
9. The assembly (100) of claim 1, wherein the cooling medium is an inert gas.
- 5 10. The assembly (100) of claim 7, wherein the cooling medium is selected from the group comprising of chilled water, refrigerant, coolant or dry ice.