BUILT-IN FLUIDIZING SYSTEM FOR LINER-BAGS TRANSPORTING HARD-TO-FLOW DRY SOLID BULK COMMODITIES IN MARINE SHIPPING CONTAINER OR OTHER FREIGHT TYPE CONTAINERS

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Publication Classification

Int. Cl. B65D 48/72 (2006.01)

U.S. Cl. 137/561 A

ABSTRACT

A dry bulk commodities cargo fluidizing system, composed of foldable flat non-interferring air bed, built into liner bags, used in shipping containers for transporting commodities, as a second-floor in the liner bag. The fluidizing is enhanced by sandwiching plastic mesh strips of varying width across the floor of the container into compartments by thermal sealing both floor layers to form air chambers. These individual air chambers form manifolds to maximize the uniform air bed effect and prevent spotty pressure loss. Air is injected from an air hose into the plastic mesh strip chambers to create fluidization effect by multiple pinholes on the top floor layer. These holes can vary in number and density across the length of the strips with a higher density of pinholes toward the end of the strip, and the lower density pinholes toward the beginning of the strip closest to the air hose.
FIG. 3

Air Chambers

Plastic Mesh Strips

Pinholes on top layer at higher density

Pinholes on top layer at medium density

Pinholes on top layer at low density

Pneumatic Hoses
BUILT-IN FLUIDIZING SYSTEM FOR LINER-BAGS TRANSPORTING HARD-TO-FLOW DRY SOLID BULK COMMODITIES IN MARINE SHIPPING CONTAINER OR OTHER FREIGHT TYPE CONTAINERS

RELATED APPLICATION

[0001] This application is related to and claims priority from U.S. Provisional Application No. 61/960,701 entitled “Built-In Flat Fluidizing System For Liner-Bags Transporting Hard-To-Flow Dry Solid Bulk Commodities In Marine Shipping Container Or Other Freight Type Containers” filed 25 Sep. 2013, the entire contents of which are hereby fully incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invented subject matter relates to the transportation of bulk products, such as dry granular products and the like, into flexible bulk packaging formats such as liner-bags for marine containers.

[0004] 2. Background of the Invention

[0005] As the use of marine containers internally lined with bags, becomes more common for the transportation of dry flowable bulk products, as an alternative to the transportation in bulk vessels, the number and types of bulk products being transported in such marine containers is also growing; chemicals, minerals, agricultural and many other varied bulk products.

[0006] Such a variety of bulk products need to be matched with an appropriate bulk packaging format able not only to contain the product inside of the marine container for transportation, but also facilitate its loading and unloading. Container liner-bags fulfill that task, they are flexible bags made of plastic laminated woven or film material, typically Polyethylene, that once hung inside of the container, they occupy the full cargo volume inside of the marine container, and they allow for the loading, transportation and unloading of any dry flowable bulk product.

[0007] Therefore the design of the marine container liner-bag will vary depending on the methodology or equipment used by the shipper to load its bulk product into the marine container, and the methodology or equipment used by the receiver of the bulk cargo to unload it from the marine container.

[0008] Another crucial factor in the design of a marine container liner-bag will be the material characteristics of the bulk product itself: density, bulk density, angle of repose, hygroscopicity, physical aspect, temperature, and other physical attributes of the bulk product. All these physical characteristics determine how easy or difficult is the product to handle when loading or unloading. Dry bulk products that are easy to handle flow easily. Examples of easy to flow products are plastic resins in pellet form, dry whole grains and in general any material of grain or pellet nature. Dry bulk products that are difficult to handle flow poorly. Examples of hard to flow products are cement, titanium dioxide, starches and in general most powder type products.

[0009] In general, product compaction is typically a function of the angle of repose of the bulk product, the attrition and rheology of its particles, humidity absorption tendency, and the degree of settling inside of the liner-bag over the transportation journey.

[0010] These hard-to-flow bulk products in particular pose a real challenge to their transportation in marine container liner-bags. Their handling is especially difficult when attempted to unload due to its very poor flow properties and the inherent settling over time during transportation. This difficulty results in the product compacting inside of the marine container, and only dischargeable by manual removal, instead of the typical gravity method of lifting the container to a maximum of 45 degrees.

[0011] Although air fluidization is not the solution to all products’ flow issues (for instance bulk commodities exhibiting bridging or tunneling do not respond to pneumatic fluidization), it is the most prevalent solution for most hard to flow bulk commodities, and even on those cases where the bulk commodity is not sensitive to pneumatic fluidization, it can be used in combination with other type of fluidization (shaking, vibrating, etc.) that renders the pneumatic fluidization effective as well.

[0012] Many devices exist to aid in the fluidization of the product, outside of the container liner-bag, and typically applied at the discharge port of the liner-bag: fluidizing lances, fluidizing hoppers, de-compacting hoppers with built-in conveyors, industrial vibrators, shaking platforms, and very often even a combination of some of these devices into one.

[0013] However, a comprehensive solution to fluidization, requires the creation of fluidization bed inside of the container liner-bag as well.

[0014] One of the most prevalent methods to create an airbed inside of the container liner-bag, consists of inserting on top the floor panel of the liner-bag, a perforated plastic hose evenly distributed across the width and length in an S-like shape, the two ends of the hose are kept outside of the liner-bag, and pressurized air is injected through them to provide continuous air flow that escapes through the small perforations of the hose. As the air escapes through the minute holes into the container liner-bag interior, it creates (in theory) a continuous stream of aeration that as it trickles up the product, it eventually achieves the desired fluidization on the bulk product in direct contact with these air jets.

[0015] Although this method is effective at creating an airbed, its use in praxis has numerous shortcomings.

[0016] As the product depletes the container, the air hoses start to become exposed on the front end of the container.

[0017] A growing percentage of the injected air just escapes, and therefore the airbed increasingly loses its effectiveness; the perforated hose across the floor of the container eventually becomes a barrier itself to the outflow of the product.

[0018] Because the air hose ends up becoming a barrier to the product’s outflow, the product starts dragging down on the liner the perforated hose, which ends up jammed down on the back end of the container and the airbed rendered almost useless. An attempted solution to this problem, has been to affix the perforated hose to the floor as to prevent its movement, but in many instances this results in the liner floor being torn by the effect of the product pulling down on the fixed hose.

[0019] The air hoses are often bent or pinched, and therefore rendered useless, when the container liner-bag is
unfolded, due to the nature of the packing process that requires the liner to be folded.

BRIEF DESCRIPTION OF THE INVENTION

The subject of the invention relates to a flat and non-interfering airbed system, built as a second floor, into the liner-bag’s floor, that has the capability of injecting air across a maximum surface of the container floor and at a higher density levels than current prevailing systems, and therefore creating more uniform and powerful fluidization effect.

DETAILED DESCRIPTION OF THE INVENTION

The flat built-in floor air-mattress like device, is formed by adding a 2nd floor panel to the liner floor, and inserting in between, in sandwich like manner, several plastic mesh material strips of varying width, across a maximum surface area of the floor.

The plastic mesh strips are compartmentalized from each other by applying thermal seal to both floor layers, in their entire length, encasing them therefore to form an air chamber. As each strip becomes insulated in these individual air chambers across the entire floor, each one can be injected individually, through a regular air hose, to maximize a uniform airbed effect that minimizes pneumatic pressure loss.

The air that is injected into the plastic mesh strip chambers by the air hose at each end of the strip, escapes into the interior of the liner-bag in order to create the fluidization effect, by means of making a multitude of pinholes on the top floor layer on top of the plastic mesh strip.

These holes can vary in number and density across the length of the strip, but a typical configuration consists of a higher density of pinholes towards the end of the strip, the farthest end from the air hose, versus a lower density of pinholes towards the beginning of the strip, the closest end from the air hose.

The purpose of such uneven distribution on the density of the pinholes throughout the length of the strip, is that areas of the plastic mesh strip the farthest from the air source do not experience significant air pressure loss, and therefore the fluidization effect stays uniform, across all the liner-bag surface.

Another way to address this issue would be to position the air injecting hose farther into the mesh strip, but this setup is not as ideal, as the air hose then might pose a risk of being bent or pinched during the folding process when packing the container.

This flat airbed system conforming of individually air pressured air chambers, provides therefore a flat surface for the product to flow unobstructed, a more powerful fluidization effect due to the numerous pinholes, a more uniform fluidization effect due to the extensive distribution of those pinholes, and much less risk non airbed system due to pinched or bent hoses.

Applicant would like to add the following section to the application as it was not previously provided in the application as filed:

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only with reference to the accompanying drawings wherein the detailed descriptions are for the purpose of fully disclosing preferred embodiments of the invention without placing limitations thereon.

FIG. 1 is a top and side perspective view with the Liner bag shown in phantom lines and with a double layer floor with 3 rectangular shaped thermally sealed air chambers, with top side perforated with fluidizing pinholes and fed by pneumatic hoses.

FIG. 2 is a top and side perspective view with the Liner bag shown in phantom lines and with a double layer floor with 3 rectangular shaped thermally sealed air chambers which have plastic mesh strips in the sealed air chambers, with top side perforated with fluidizing pinholes, at low density, medium density, and higher density.

FIG. 3 is a top view of the double layer floor with 7 rectangular thermally sealed air chambers with fluidizing top holes and inserted mesh strips in the 7 sealed air chambers with corresponding pneumatic injecting hoses.

FIGS. 4A and 4B is a magnified top view of the plastic mesh which shows the plastic mesh in detail and delimitates a section of the plastic mesh detail as “bridge air passage” for further magnification of “bridge air passage detail” to show the “air passages” in the plastic mesh.

1. Use of plastic mesh sandwiched in between the double layer floor film portions, to enable the complete air distribution throughout the sandwiched chamber.

2. Use of several sandwiched plastic mesh pneumatic injected chambers throughout the floor, to maximize fluidization coverage, effect and failure redundancy. Range can vary from 1-8 chambers.

3. Adjacent plastic mesh sandwiched pneumatic chambers might be interconnected.

4. Use of plastic mesh sandwiched in between the double layer floor film portions, to enable the complete air distribution throughout the sandwiched chamber as in claim 1 further comprising:

a. pinholes on the top layer of the sandwich vary in density in direct relation to the distance of the air injection source (typically a hose).

5. Pinholes on the top layer of the sandwich vary in density in direct relation to the distance of the air injection source (typically a hose) as in claim 4 further comprising:

a. pinholes on the top layer of the sandwich vary in diameter in direct relation to the distance of the air injection source (typically a hose).

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