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(54) **INTERMODAL BULK AGGREGATE CONTAINER**

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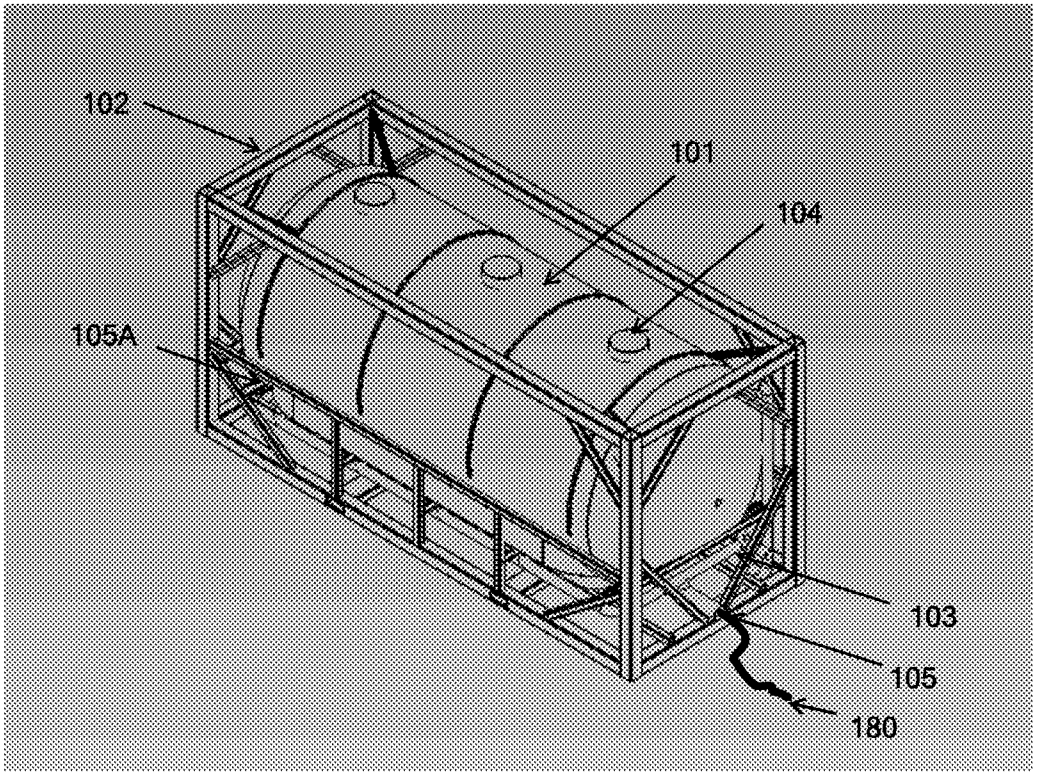
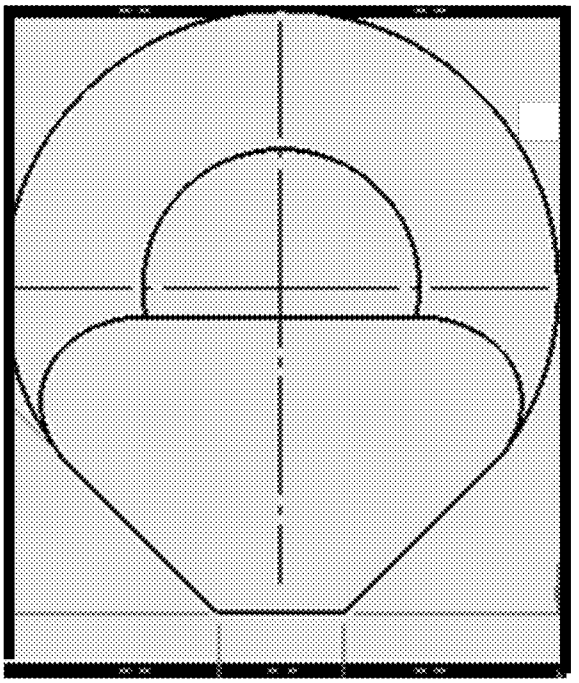
CPC ***B65D 88/26*** (2013.01); ***B65D 88/54*** (2013.01); ***B65D 90/20*** (2013.01)

(57) **ABSTRACT**

An intermodal container for loading, transporting and unloading particulate material comprising a frame that is compatible with intermodal standards, and at least one hopper having a plurality of rows of funnels, each funnel having angled side walls and a bottom having at least one discharge opening. The funnel wall angle is at least as great as the critical angle of repose of the material to be contained therein. The material can be unloaded substantially by gravity, without the need for vibration or other agitation.





PRIOR ART

FIG. 1

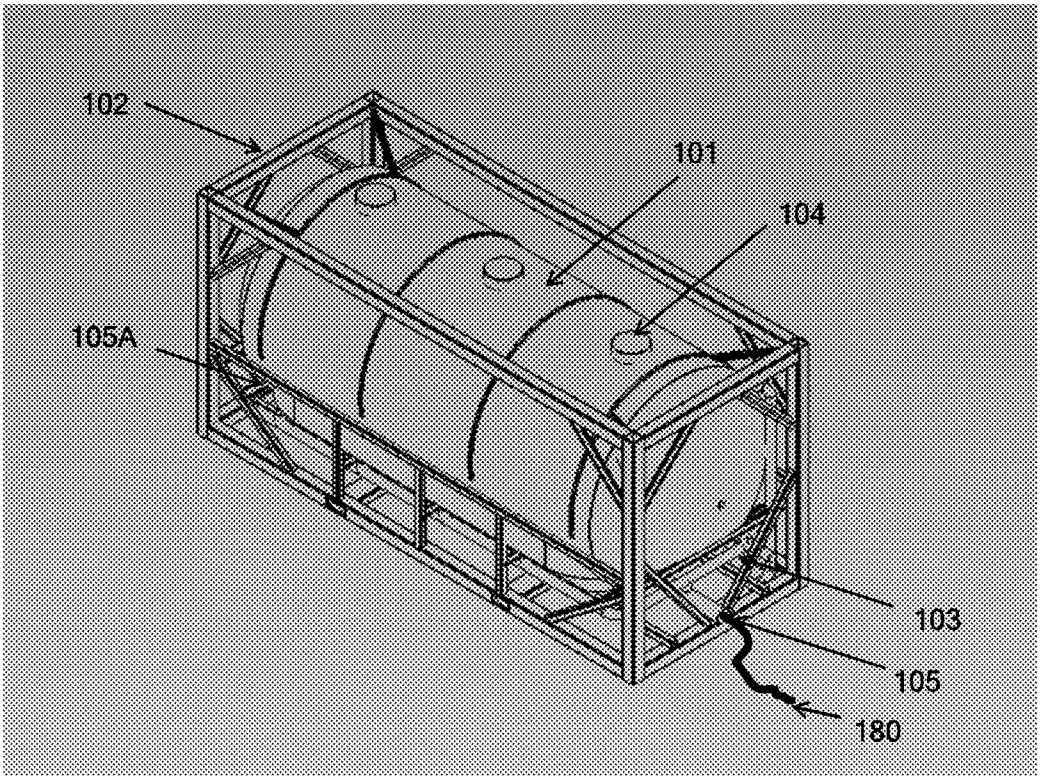


FIG. 2

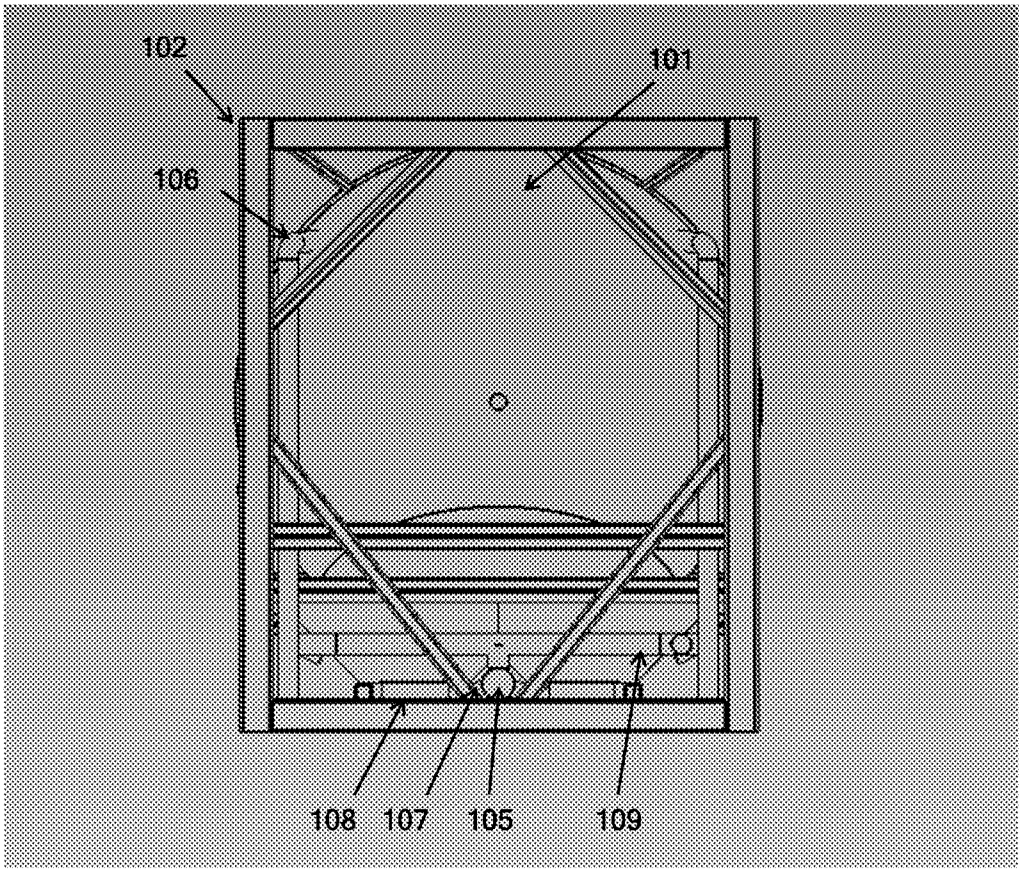


FIG. 3

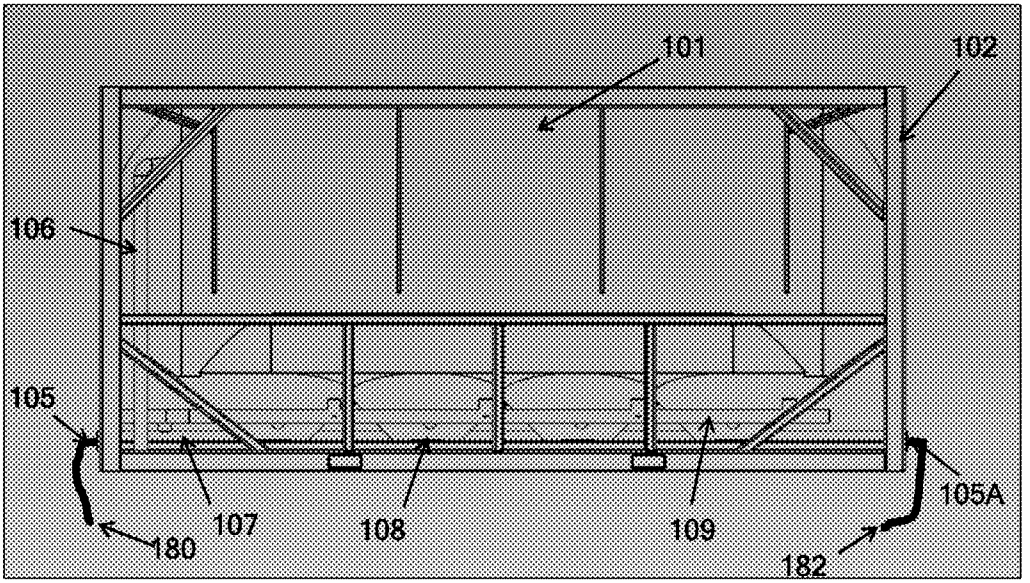


FIG. 4

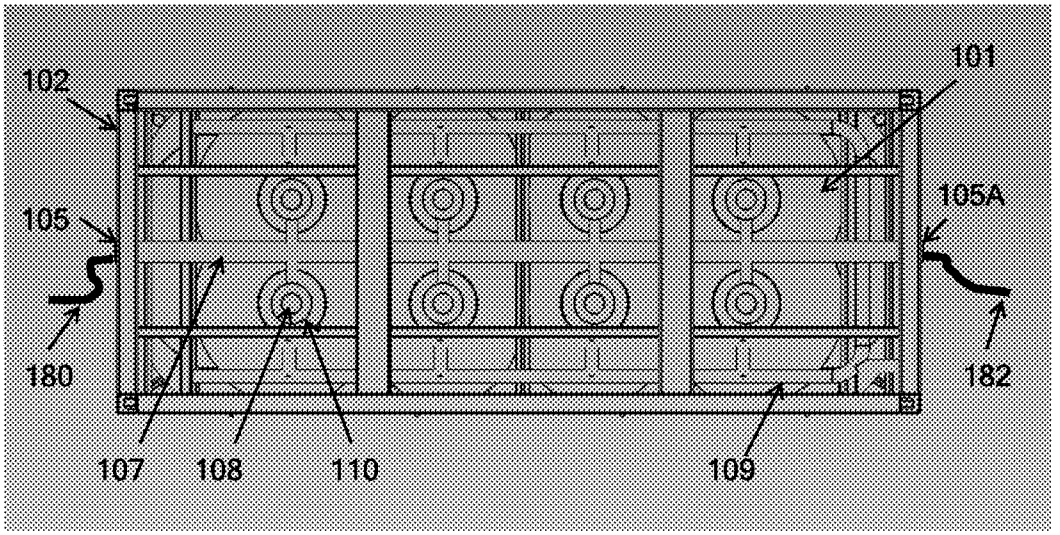


FIG. 5

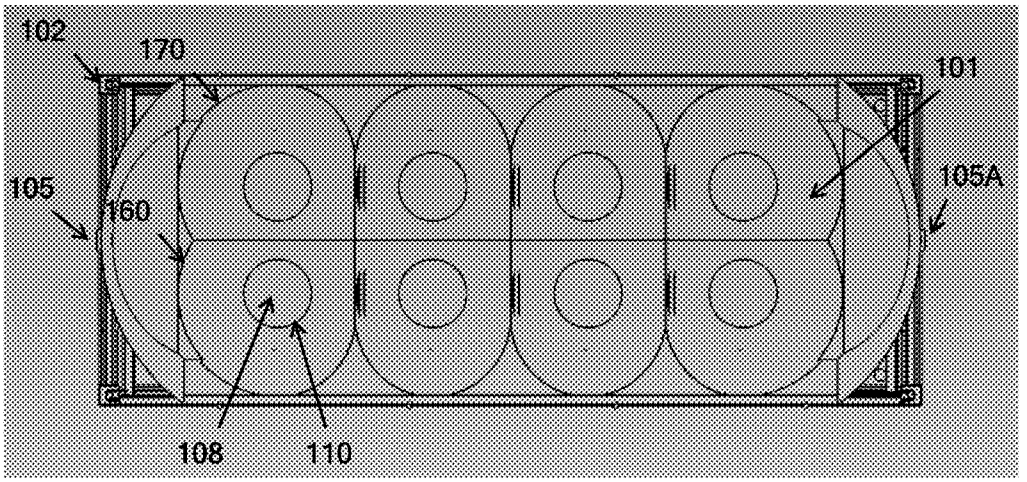


FIG. 6

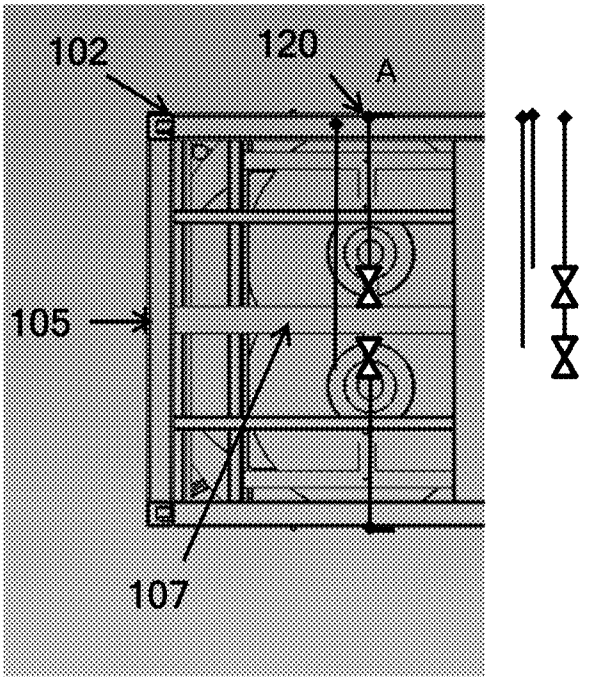


FIG. 7A

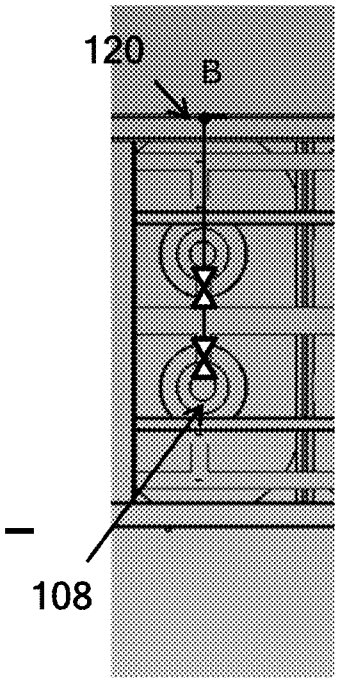


FIG. 7B

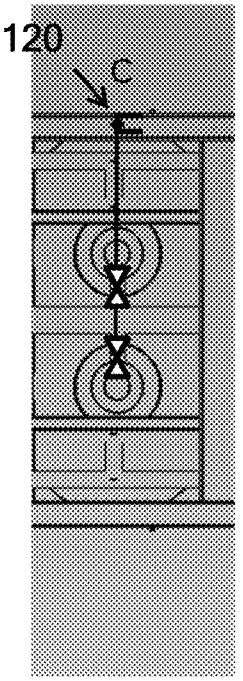


FIG. 7C

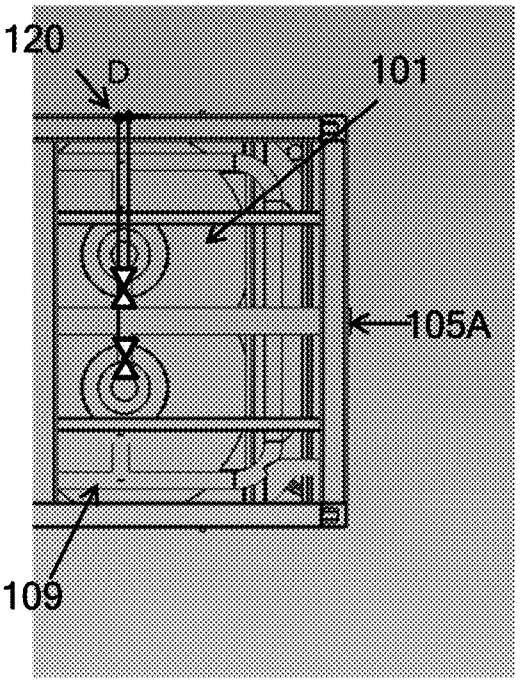


FIG. 7D

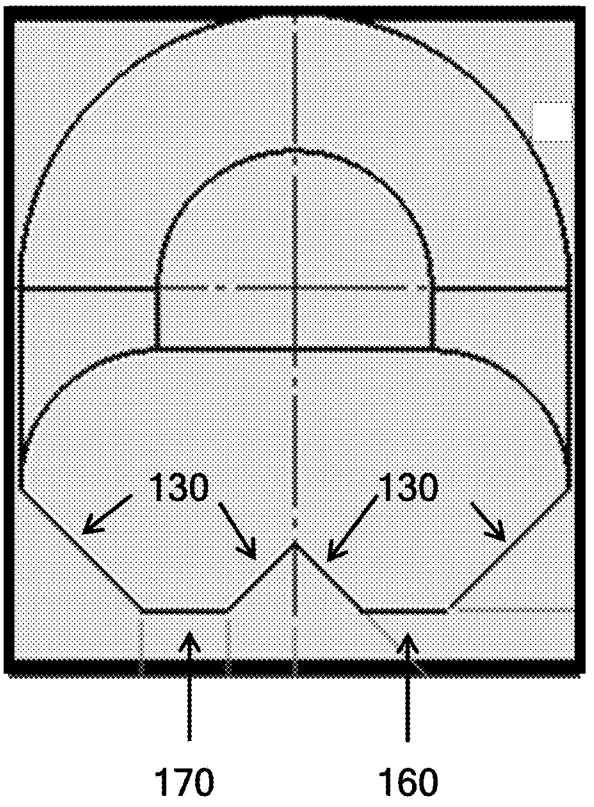


FIG. 8

INTERMODAL BULK AGGREGATE CONTAINER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims benefit of copending U.S. provisional patent application No. 62/102,218, filed Jan. 12, 2015, entitled INTERMODAL BULK AGGREGATE CONTAINER, and commonly assigned to the assignee of the present application, the disclosure of which is incorporated herein in its entirety by reference.

FIELD

[0002] The present disclosure relates generally to shipping containers used to store, transport, and transfer bulk aggregate materials. More specifically, the disclosure relates, in exemplary embodiments, to a closed container system having bottom-mounted valved outlet openings.

BACKGROUND

[0003] Storage and transport container systems for bulk aggregate materials often include a hopper and pneumatic piping system mounted on a trailer or container chassis. Such systems are designed to be loaded through one or more openings on or near the top of the hopper and unloaded through operable discharge valves at or near the hopper bottom.

[0004] Particulate material has a characteristic called the "critical angle of repose," or "angle of repose," which is the steepest angle of descent or dip relative to the horizontal plane to which a material can be piled without slumping. At this angle, the material on the slope face is on the verge of sliding. This characteristic is relevant in the storing and unloading of such material. The speed at which the contents of a container can be loaded and unloaded is also determined by the geometrical attributes of the hopper and pneumatic piping system as well as the type of material to be transported.

[0005] The amount of bulk aggregate material that can be stored, transported, and unloaded is determined by a container's effective interior size and geometry. The hopper volume is sometimes limited by height, width, length, and/or weight restrictions imposed by regulatory agencies such as the Department of Transportation. The hopper typically will have one or more discharge portions at the bottom having angled walls to funnel material down to a discharge opening associated with each portion (see FIG. **7**). The steepness of the wall angle determines, in part, the hopper's volumetric capacity: for a given container outer dimensional size, the steeper the angle, the less volume is available in the hopper. Conversely, for a shallower angle, more volume is available. For example, sand has a lower critical angle of repose than does cement. A particulate material with a higher critical angle of repose requires a steeper angle of the discharge portion wall than a material with a lower critical angle of repose for complete unloading by gravity. If the wall angle is too shallow, material will not funnel to the opening efficiently or completely. It is desirable to maximize the total volumetric capacity of the hopper within a given external container dimensional shape.

[0006] Normal unloading operation involves sequentially opening a row of valves located at the base of the hopper. The valves permit material to flow into a piping system that conveys the material to external storage. It is expected that a container's contents will be totally emptied during this process with a de minimus amount of material or residue remaining in the hopper. Commonly, a container may have several outlet valves in a row that are opened one at a time. It would be desirable to have a hopper and valve configuration that would permit adjacent pairs of valves to be opened simultaneously to increase the unloading speed.

[0007] Intermodal containers present a particular challenge as they must conform to well-established industry standards in addition to being able to efficiently transport and unload materials. Despite the variety of systems currently available, there remains a need for the ability to more efficiently transport and unload bulk aggregate materials.

SUMMARY

[0008] The following presents a simplified summary in order to provide a basic understanding of some aspects of various invention embodiments. The summary is not an extensive overview of the invention. It is neither intended to identify key or critical elements of the invention nor to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to the more detailed description below.

[0009] The present disclosure relates to a container used to store, transport, and unload bulk aggregate materials such as cement and sand. The container provides the ability to carry a higher payload than other comparably sized containers by virtue of improved hopper geometry. The hopper is designed so that materials can fall due to gravity through a series of valves at the hopper bottom allowing the hopper to efficiently empty its contents.

[0010] A collection system for directing material to flow out of and away from the container provides the ability for faster pneumatic unloading than typical bulk aggregate tankers and containerized systems.

[0011] In exemplary embodiments, the presently disclosed container system includes at least one hopper having at least two rows of funnels, each funnel having a discharge opening. Each funnel has a wall angle at least as great as the critical angle of repose of the material to be contained therein. The material loaded into the hopper(s) is unloadable from the bottom. The material is unloadable by gravity alone, or with a gravity assist, such as, but not limited to, blowing from the top of the hopper opening, exerting a negative (sucking) pressure proximate to the discharge opening (such as by a pneumatic hose being attached thereto), or the like. An external agitation mechanism, such as a shaker table to induce vibration of the material, or a stirrer, is not needed. The obviation of an external agitation mechanism reduces the cost associated with the container system or the unloading apparatus, and also improves the unloading time efficiency. In exemplary embodiments, a container system as described herein can hold (and permit efficient unloading of) about 25 tons of cement in a 20-foot long container. In exemplary embodiments, the container frame is compatible with International Organization for Standardization ("ISO") intermodal standards.

[0012] Other features will become apparent upon reading the following detailed description of certain exemplary embodiments, when taken in conjunction with the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention may be better understood and advantages made apparent to those skilled in the art by refer-

encing the accompanying drawings and schematics. The drawings of the subject invention are illustrative of example embodiments and are not intended to limit the scope of the invention. The drawings disclose exemplary embodiments in which like reference characters designate the same or similar parts throughout the figures of which:

[0014] FIG. **1** is a schematic side view of a prior art container design showing a single row of discharge hoppers.

[0015] FIG. **2** is a perspective view of a container system according to a first exemplary embodiment.

[0016] FIG. **3** is a side view of the container of FIG. **2**.

[0017] FIG. **4** is a front elevation view of the container of FIG. **2**.

[0018] FIG. **5** is a bottom plan view of the container of FIG. **2** showing the hopper discharge openings along with the piping and valves.

[0019] FIG. **6** is a top view of the container of FIG. **2** showing the inside of the hopper and the discharge portions.

[0020] FIG. **7**A is a bottom view showing the piping and the discharge valve and handle configurations according to a first exemplary embodiment.

[0021] FIG. **7**B is a bottom view showing the piping and the discharge valve and handle configurations according to a second exemplary embodiment.

[0022] FIG. **7**C is a bottom view showing the piping and the discharge valve and handle configurations according to a third exemplary embodiment.

[0023] FIG. **7**D is a bottom view showing the piping and the discharge valve and handle configurations according to a fourth exemplary embodiment.

[0024] FIG. **8** is a schematic side view of an exemplary container design embodiment of FIG. **2** showing a double row of discharge hoppers.

DETAILED DESCRIPTION

[0025] Unless otherwise indicated, the drawings are intended to be read (for example, cross-hatching, arrangement of parts, proportion, degree, or the like) together with the specification, and are to be considered a portion of the entire written description of this invention. As used in the following description, the terms "horizontal", "vertical", "left", "right", "up" and "down", as well as adjectival and adverbial derivatives thereof (for example, "horizontally", "upwardly", or the like), simply refer to the orientation of the illustrated structure as the particular drawing figure faces the reader. Similarly, the terms "inwardly" and "outwardly" generally refer to the orientation of a surface relative to its axis of elongation, or axis of rotation, as appropriate.

[0026] The description that follows includes exemplary apparatus, methods, and operational sequences of the present invention. However, it is understood that the described embodiments may be practiced without these specific details.

[0027] The schematic views and descriptions depict a containerized pneumatic bulk aggregate storage and transport system designed for intermodal use with aggregate, particulate, granular, pelletized, powder or other dry flowable material (though material not strictly categorized as "dry" may be used). Typically, it is the container frame that must comply with International Organization for Standardization ("ISO") intermodal standards. A person skilled in the art would recognize the applicability of the presently disclosed inventive container systems to other types of bulk aggregate storage or transport systems including those that are not pneumatic, those that are permanently attached to a vehicle or trailer, or those that are temporarily or permanently mounted in another manner. Various embodiments of the presently described container system can be used in applications other than intermodal use, such as, but not limited to other storage container systems.

[0028] In exemplary embodiments, to efficiently unload cement, the angle of the funnel should be at least about 45 degrees. Higher angles may be used but may reduce volumetric capacity or require larger discharge valves on the bottom to achieve complete unloading. Cement and other extremely fine materials with a high critical angle of repose are considered "sluggish" and typically will not unload efficiently in hoppers with lower funnel angles. Cement also packs poorly during loading and creates a secondary issue of requiring a hopper with maximum volume to load it to the maximum weight limits that are typically imposed. Bulk density of cement right after loading can range from about 50-70 lb/ft^3 even though its "settled" bulk density is up to 94 lb/ft^3. Loading must stop when the hopper is full and, therefore, every additional cubic foot of hopper volume allows more material to be loaded. Once the maximum over-the-road weight is reached (in the range of 25 tons), loading additional material is not useful or permitted. But with cement, most bulk transport units are much longer than 20 feet. Sand is different because of its lower critical angle of repose and higher packing density. Sand will also efficiently load and unload from the design described by the invention. In areas where there is an over-the-road weight limit, sand will not necessarily fill the hopper. However, some places do not have load weight limits and this design would, therefore, carry a higher payload.

[0029] FIGS. **2-3** shows a first exemplary embodiment of a containerized bulk aggregate storage and transport system having a container **10** including a hopper **101**, a frame structure **102**, and a pneumatic piping system **103**. Attached to the top of the hopper **101** are multiple openable hatches **104** that may be used to load materials into the hopper **101** and permit access to its interior. The hopper **101** has side walls **130** and lower discharge funnel portion **140** having walls **150** (see FIG. **8**). The funnel portion wall **150** has an angle that can differ depending on the overall container design, which, in part, is a function of the critical angle of repose of the material to be contained, as discussed hereinabove. The funnel portion **140** may comprise a plurality of funnel portions **140** aligned in one or more rows, such as, for example, row **160** and row **170**, as shown in FIG. **6**. In alternative exemplary embodiments, the container **10** may have more than one hopper **101**.

[0030] In exemplary embodiments, the container **10** has a frame **102** that may be constructed to comply with known ISO intermodal container standards. Common ISO-compatible intermodal frame sizes are 20 and 40 feet long, though other sizes are known. Frames compatible with standard intermodal standards enable different manufacturers to make containers that will all stack or connect with the frames of other manufacturers, such as on trucks, trains, ships, and the like, and are able to be grappled by a set of common-dimension grappling mechanisms (such as for loading and unloading containers onto other carriers).

[0031] The hopper **101** is surrounded and supported by a frame and support structure **102**. The frame **102** is designed and sized in conformance with industry recognized standards developed by organizations such as ISO and ABS such that the container may be lifted by crane or forklift and securely attached to and transported by cargo ships, railcars, and semi-

trailer container chassis. The dimensions of the frame **102** constrain the size of the hopper **101** and the amount of material it can hold.

[0032] In exemplary embodiments, a valve and pneumatic piping system (generally shown as **103**) is positioned within the frame **102** and connected to the hopper **101**. When the inlet pipe **105** is connected to a pressurized blower or air supply, the hopper's contents can be transferred through the piping **103** to the outlet pipe and then to another hopper, storage silo, or other type of vessel. In exemplary embodiments, the piping system is used to introduce air, but other gases (for example, nitrogen) can be introduced, depending on the material being contained in the hopper.

[0033] Additional details of the piping system **103** are shown in FIGS. **3-5**. To unload the contents of the hopper **101**, the discharge valves **110** are opened and material flows out substantially by gravity. In exemplary embodiments, a gravity-assist device can be utilized. In one exemplary embodiment, a blower (not shown) is first connected to the inlet pipe **105** positioned at one end of the container with a first flexible hose **180**. A second flexible hose **182** may be connected to the outlet **105**A on the other end of the container to direct the hopper's contents to another location. In exemplary embodiments (such as for those containers which may hold powder or powder-like sized particulate material that does not flow by gravity particularly well), air at low pressure and high volume can be introduced into the top of the hopper **101** through an optional pressure line **106** to increase the internal pressure of the hopper **101** and assist the downward movement of the hopper's contents toward the discharge openings **108**.

[0034] In one exemplary embodiment of a pneumatic piping system, air at high flow rate is directed into the inlet **105** which is associated with a jet line **107** located below the hopper **101**. The jet line **107** is connected to the discharge valves **110** (see FIG. **5**) located beneath each of the hopper's discharge openings **108**. Opening a discharge valve **110** connected between the jet line **107** and a hopper discharge opening **108** permits some of the hopper **101** contents to enter the jet line **107** and be transferred (i.e., blown) out of the hopper **101** and away from the container.

[0035] Aeration lines **109** (see FIGS. **4-5**) can also be used to introduce air into the hopper **101** to disturb material that may be settled on the hopper walls or the discharge portion walls. In so doing, the process of fully evacuating the hopper **101** can be accelerated.

[0036] In exemplary embodiments, a vacuum line can be attached (directly or indirectly) to the discharge openings to induce a vacuum drawing force at the discharge opening **108** to pull material therethrough.

[0037] In one exemplary embodiment, as shown in FIG. **4**, there are multiple hopper discharge openings **108** (typically, one opening per hopper) that all feed into the jet line **107**. Hoppers **101** are typically unloaded by sequentially opening one valve at a time starting with the valve nearest the inlet **105**. The rate at which material is unloaded depends on the type and condition of material in the hopper, the amount of air flow available, the size of the valves and piping, the use of pressurization and supplemental aeration in the hopper, and other factors.

[0038] Once material is no longer flowing through the first open valve **110**, the next valve **110** in line is opened and the first valve **110** is closed to evacuate another portion of the hopper **101**. The number of discharge openings is usually in the range of one to five (though fewer or more are contemplated as being within the scope of the present invention), with three openings being most common. The discharge openings **108** are typically arranged in a line such that each valve **110** can be opened and the preceding one closed until the hopper **101** is empty. Alternatively, the openings **108** can be staggered or offset. A feature of the presently disclosed container system, as discussed in detail hereinbelow, is the ability to have a plurality of hopper valves open simultaneously to increase unloading speed.

[0039] FIG. **5** shows a bottom view of one exemplary embodiment of a hopper **101** configuration in which the hopper **101** discharge openings **108** are configured in two rows **160**, **170** that are parallel to the jet line **107**. Each of the hopper's discharge openings **108** has an openable valve **110** that is connected to the jet line **107**. Only one jet line **107** is used in this example but each row could have its own jet line.

[0040] In exemplary embodiments in which the hopper **101** has two or more rows **160**, **170** of funnel portions, to increase the rate of hopper **101** unloading, a pair of hopper valves **110** in adjacent rows can be opened together to evacuate each section of the hopper **101**. Each valve **110** may be individually operable by a valve opening and closing mechanism. In exemplary embodiments the opening and closing mechanism is a handle **120**. FIGS. **7**A-D show several different exemplary embodiments of discharge valve and handle configurations, illustrated in one container, but which is intended as a nonlimiting example. It is anticipated that in exemplary embodiments typically only one of the four shown configurations (or another configuration) would be incorporated in a single container system design (though it is possible that more than one configuration can be used in a single container system). In exemplary embodiments, the handles **120** may be connected together such that one handle movement operates both valves **110** simultaneously. In another configuration, the valves **110** could be individually operable from a single handle using a concentric tube and shaft arrangement or other mechanism. FIG. **7**A shows a first exemplary embodiment of a valve and handle configuration "A" in which a valve **110** pair (i.e., two adjacent valves **110**) is operated individually from separate handles **120** on opposite sides of the container **10**. FIG. **7**B shows a second exemplary embodiment of a valve and handle configuration "B" of a valve **110** pair operated together from a single handle **120**. FIG. **7**C shows a third exemplary embodiment of a valve and handle configuration "C" in which a valve **110** pair is operated individually from separate handles **120** mounted on the same side of the container **10**. FIG. **7**D shows a fourth exemplary embodiment of a valve and handle configuration "D" in which a valve **110** pair is operated separately by one handle **120**.

[0041] In exemplary embodiments, the handle **120** is hand operated. In alternative exemplary embodiments, the handle **120** may be motor driven. In alternative exemplary embodiments of a valve system, an electrical actuator associated with the valve **120** responsive to a signal can open or close the valve **120**. In such embodiments, the handle **120** is not needed or, alternatively, the handle **120** can be included as a manual override.

[0042] An exemplary embodiment of the interior of the hopper **101**, shown in FIG. **6**, illustrates, in particular, that the use of the double row of discharge openings **108** can permit a much wider usable base section and thus a greater capacity for storing material. The double row of discharge openings **108**

allows a steep wall angle to be maintained while substantially filling the available volume within the frame and support structure **102**.

[0043] Increasing the size of the discharge valves **110** in the traditional single row configuration may help increase the rate of discharge. However, material would not fully unload from a wide base hopper **101** with a single center discharge row. Alternatively, the hopper **101** size and volume could be reduced to maintain the steep wall angle necessary to achieve full evacuation.

[0044] Other variations on the configuration of the hoppers are contemplated as being within the scope of the present invention. For example, a hopper **101** containing two rows of five discharge openings **108** may be used. Similarly, a hopper **101** containing three rows of four discharge openings **108** is also possible. Other numbers of rows are possible as well, depending on the container design needs.

[0045] In another alternative embodiment of a container, a non-pneumatic hopper configuration can be utilized, such as a bottom drop or auger system, both are known to those skilled in the art.

[0046] In exemplary embodiments, another method of loading aggregate into the container is to connect a pneumatic pipe (similar to the ones used for unloading) to an access port near the container top and blow the material into the container. The method described above relies on gravity to load the material and is probably more common than pneumatic loading. The angle of the funnel determines the type(s) of aggregates that will be compatible with the design and those that will not fully unload.

[0047] A conventional hopper design in the prior art is shown in FIG. **1**. In comparison, the design according to one exemplary embodiment, shown in FIG. **8** and having two rows of hoppers **160**, **170**, presents a greater volumetric capacity than one row, and also presents a configuration that allows for faster unloading.

[0048] A feature of the presently disclosed container system is that the container is intermodal-compatible and can be constructed to fit into a 20-foot (about 6 meters) length design while creating an efficient volumetric capacity and a hopper funnel portion wall having a steep angle such that materials with a high critical angle of repose can be efficiently evacuated through the rows of hopper openings. In comparison, conventional containers are typically not designed to have the volumetric capacity as well as the discharge/unload rate while being intermodal-compatible.

[0049] The following numbered clauses include embodiments that are contemplated and nonlimiting.

[0050] Clause (1) A container system for containing and unloading particulate, granular, powdered or other flowable material, comprising: a frame constructed to be compatible with ISO or other standards bodies' intermodal standards; at least one hopper having a plurality of funnel portions, each funnel portion having tapered walls and a bottom portion having a discharge opening, the funnel portions and associated discharge openings being arranged in at least two rows, the walls of each funnel portion having an angle at least as great as the critical angle of repose of the material to be held in the at least one hopper; and, a valve associated with each funnel portion proximate to the discharge opening, wherein the container is configured so that the material is unloadable substantially by gravity from the bottom via the discharge openings.

[0051] Clause (2) The container system of Clause 1, further comprising a piping system having an inlet, an outlet and conduits for conveying air or other gas, the piping system being in communication with each discharge opening.

[0052] Clause (3) The container system of Clause 1, wherein the funnel portion walls have an angle that enables material to be unloadable by gravity without requiring agitation of the material.

[0053] Clause (4) The container system of Clause 1, wherein adjacent rows of discharge openings are arranged in parallel rows.

[0054] Clause (5) The container system of Clause 1, wherein the discharge openings in a first row are offset or staggered with respect to the discharge openings in a second row.

[0055] Clause (6) The container system of Clause 1, further comprising at least one valve operating mechanism, each mechanism being associated with at least one valve, each mechanism being adapted to urge the valve between an open and a closed position.

[0056] Clause (7) The container system of Clause 6 wherein the valve operating mechanism comprises a handle.

[0057] Clause (8) The container system of Clause 7, wherein each handle is associated with at least two valves and can operate to open and close each valve simultaneously.

[0058] Clause (9) The container system of Clause 6, wherein the valve operating mechanism comprises an electrical valve actuator.

[0059] Clause (10) The container system of Clause 1, wherein the container is configured to hold and permit unloading by gravity of 25 tons of cement in a 20-foot ISO-standard dimensioned frame.

[0060] Clause (11) A container system for containing and unloading particulate, granular, powdered or other flowable material, comprising: a frame constructed to be compatible with ISO or other standards bodies' intermodal standards; at least one hopper having a plurality of funnel portions, each funnel portion having tapered walls and a bottom portion having a discharge opening, the funnel portions being arranged in at least two rows, the walls of each funnel portion having an angle at least as great as the critical angle of repose of the material to be held in the at least one hopper; a valve associated with each funnel portion, the valve being proximate to the discharge opening; a valve operating mechanism associated with the valve, wherein the container is configured so that the material is unloadable by gravity from the bottom via the discharge openings.

[0061] Although only a number of exemplary embodiments have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages. Accordingly, all such modifications are intended to be included within the scope of this disclosure as defined in the following claims.

[0062] As used in the specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless the context clearly dictates otherwise.

[0063] "Optional" or "optionally" means that the subsequently described event or circumstance may or may not occur, and that the description includes instances where said event or circumstance occurs and instances where it does not.

[0064] Throughout the description and claims of this specification, the word "comprise" and variations of the word, such

as "comprising" and "comprises," means "including but not limited to," and is not intended to exclude, for example, other additives, components, integers or steps. "Exemplary" means "an example of" and is not intended to convey an indication of a preferred or ideal embodiment. "Such as" is not used in a restrictive sense, but for explanatory purposes.

[0065] Disclosed are components that can be used to perform the disclosed methods, equipment and systems. These and other components are disclosed herein, and it is understood that when combinations, subsets, interactions, groups, etc., of these components are disclosed that while specific reference of each various individual and collective combinations and permutation of these may not be explicitly disclosed, each is specifically contemplated and described herein, for all methods, equipment and systems. This applies to all aspects of this application including, but not limited to, steps in disclosed methods. Thus, if there are a variety of additional steps that can be performed, it is understood that each of these additional steps can be performed with any specific embodiment or combination of embodiments of the disclosed methods.

[0066] It should further be noted that any patents, applications and publications referred to herein are incorporated by reference in their entirety.

What is claimed is:

1. A container system for containing and unloading particulate, granular, powdered or other flowable material, comprising:

a) a frame constructed to be compatible with ISO or other standards bodies' intermodal standards;

b) at least one hopper having a plurality of funnel portions, each funnel portion having tapered walls and a bottom portion having a discharge opening, the funnel portions and associated discharge openings being arranged in at least two rows, the walls of each funnel portion having an angle at least as great as the critical angle of repose of the material to be held in the at least one hopper; and,

c) a valve associated with each funnel portion proximate to the discharge opening,

wherein the container is configured so that the material is unloadable substantially by gravity from the bottom via the discharge openings.

2. The container system of claim **1**, further comprising a piping system having an inlet, an outlet and conduits for conveying air or other gas, the piping system being in communication with each discharge opening.

3. The container system of claim **1**, wherein the funnel portion walls have an angle that enables material to be unloadable by gravity without requiring agitation of the material.

4. The container system of claim **1**, wherein adjacent rows of discharge openings are arranged in parallel rows.

5. The container system of claim **1**, wherein the discharge openings in a first row are offset or staggered with respect to the discharge openings in a second row.

6. The container system of claim **1**, further comprising at least one valve operating mechanism, each mechanism being associated with at least one valve, each mechanism being adapted to urge the valve between an open and a closed position.

7. The container system of claim **6**, wherein the valve operating mechanism comprises a handle.

8. The container system of claim **7**, wherein each handle is associated with at least two valves and can operate to open and close each valve simultaneously.

9. The container system of claim **6**, wherein the valve operating mechanism comprises an electrical valve actuator.

10. The container system of claim **1**, wherein the container is configured to hold and permit unloading by gravity of 25 tons of cement in a 20-foot ISO-standard dimensioned frame.

11. A container system for containing and unloading particulate, granular, powdered or other flowable material, comprising:

a) a frame constructed to be compatible with ISO or other standards bodies' intermodal standards;

b) at least one hopper having a plurality of funnel portions, each funnel portion having tapered walls and a bottom portion having a discharge opening, the funnel portions being arranged in at least two rows, the walls of each funnel portion having an angle at least as great as the critical angle of repose of the material to be held in the at least one hopper;

c) a valve associated with each funnel portion, the valve being proximate to the discharge opening;

d) a valve operating mechanism associated with the valve,

wherein the container is configured so that the material is unloadable by gravity from the bottom via the discharge openings.

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