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[54] STRUCTURE FOR TRANSPORTING AND STORING FLOWABLE MATERIALS

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[30] **Foreign Application Priority Data**

Aug. 2, 1968 Austria ..... A 7537/68

[52] U.S. Cl. ..... **150/.5**, 222/105, 222/181, 280/5 C

[51] Int. Cl. **B65d 33/14**

[58] Field of Search 150/.5, 1, 49, 51; 222/105, 222/181, 183, 185

[56] **References Cited**

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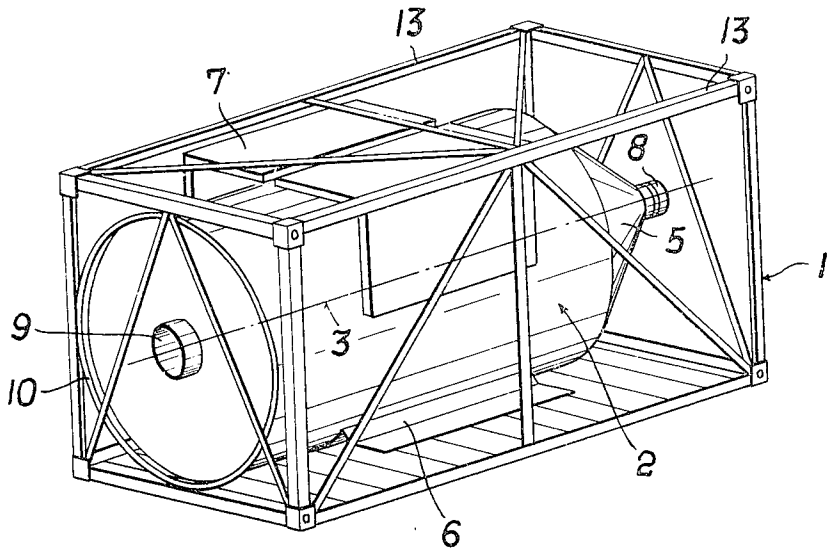
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[57] **ABSTRACT**

A structure for transporting and storing flowable materials. The structure includes a silo compartment, which has a central axis, this compartment being adapted to receive and discharge flowable materials when its axis is upright and being adapted to transport the materials when its axis is in a substantially horizontal attitude. The silo compartment is made of a foldable sheet material so that it can be readily placed in a collapsed condition when it is not used. A supporting framework extends around and is operatively connected with the silo compartment to support the latter both with its axis upright and with its axis in the substantially horizontal attitude.

5 Claims, 10 Drawing Figures



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SHEET 1 OF 2

FIG. 1

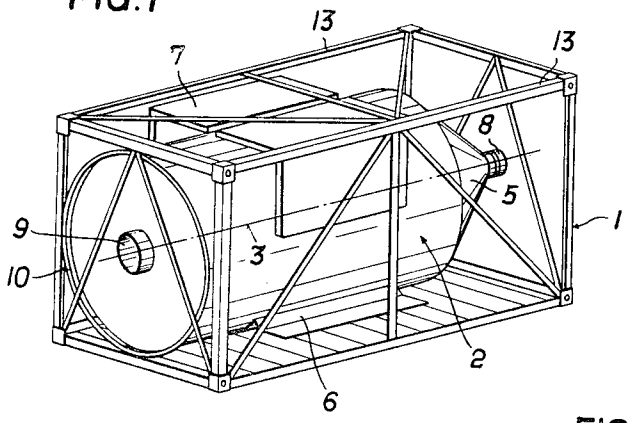


FIG. 2

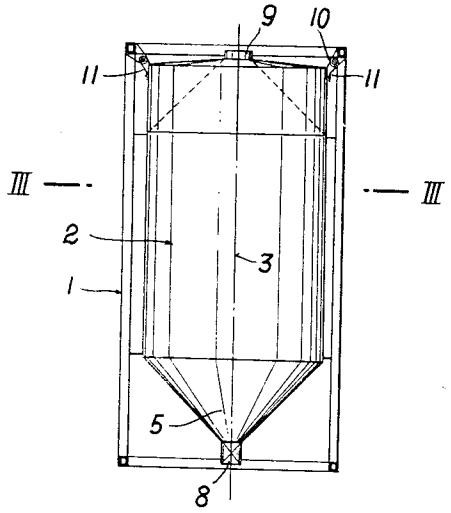


FIG. 3

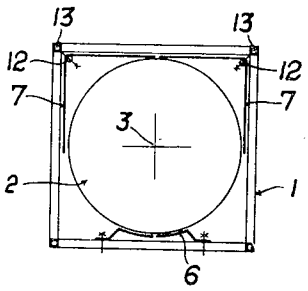


FIG. 4

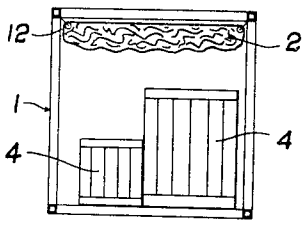


FIG. 5

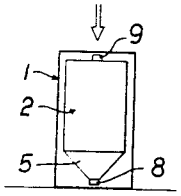


FIG. 6

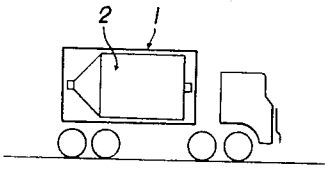
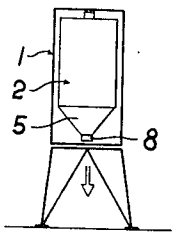


FIG. 7



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FIG. 8

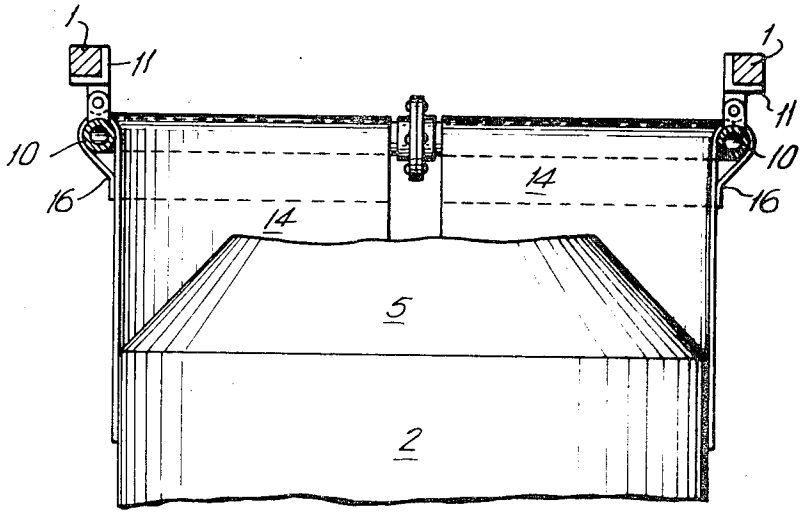


FIG. 9

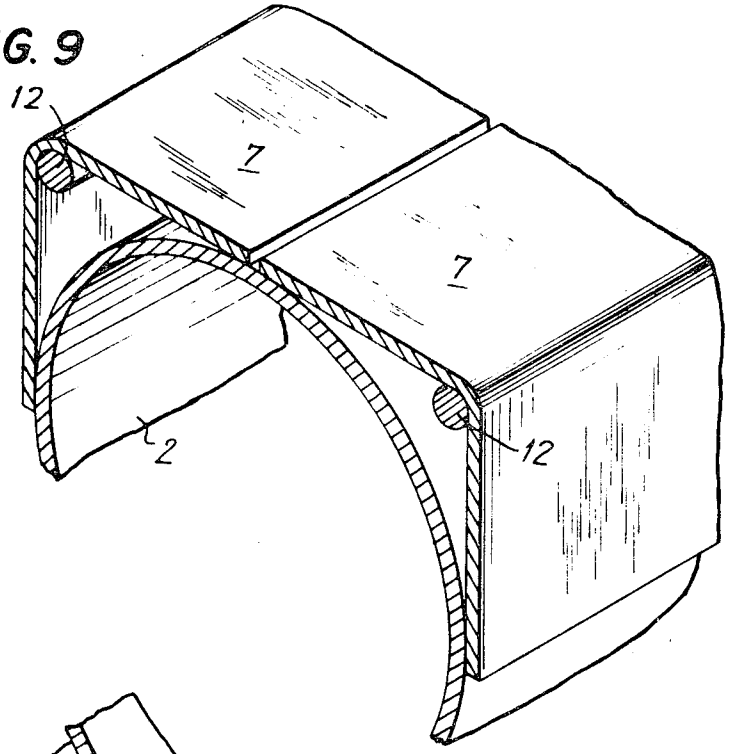
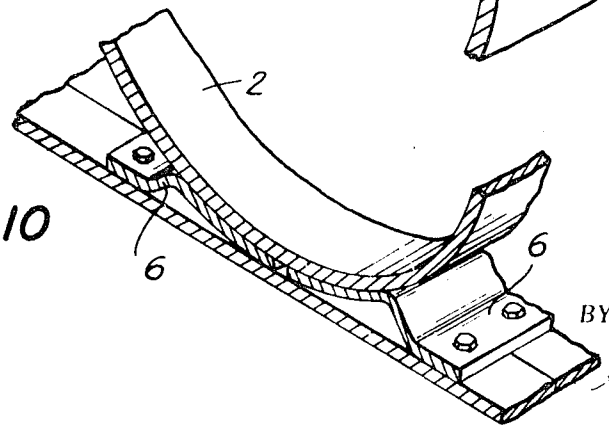


FIG. 10



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STRUCTURE FOR TRANSPORTING AND STORING FLOWABLE MATERIALS

BACKGROUND OF THE INVENTION

The invention relates to a structure, particularly a containerized structure, for transporting and storing flowable materials such as liquids or solids in a particulate condition, as well as materials having pasty, semiliquid conditions or liquids in which solids are suspended. At the present time it is conventional to transport materials of this type in trucks which are provided with tanks which are specially designed for the particular materials which are transported. When such trucks arrive at their destination, the flowable materials in the special truck tanks are necessarily transferred to other containers where the flowable materials are stored. The latter containers of course are not identical with the truck tanks in which the flowable materials are transported.

The conventional operations of this type, in connection with the transporting of the materials and the storing thereof necessarily requires a large technical expense, inasmuch as vehicles of special construction and storage sheds of special construction are essential.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a structure which will avoid the above drawbacks.

In particular, it is an object of the invention to provide a structure which will avoid the necessity of having on hand vehicles of a special construction and sheds of a special construction in which there are storage containers different from those of the vehicles.

Thus, it is an object of the invention to provide a structure which can be used both during transportation and during storage.

In addition, it is an object of the invention to provide a structure which can be collapsed to occupy a small volume when the structure is in a condition of nonuse.

In addition, it is an object of the invention to provide a structure which can be quickly and inexpensively manipulated for receiving the flowable materials, for discharging the flowable materials and for transporting the flowable materials.

Yet another object of the invention is to provide a construction where braking forces, as well as kinetic and static forces are reliably absorbed.

Furthermore, it is an object of the invention to provide a structure which can be used for transporting other articles when flowable materials are not transported.

In particular, it is an object of the invention to provide a structure which can accomplish the above objects while at the same time being made up of simply inexpensive components which will operate very reliably and which will have a long, trouble-free operating life.

According to the invention the structure includes a silo compartment means, which has a central axis, for receiving flowable materials and for discharging these materials when this central axis is upright and for transporting the flowable materials when the central axis is in a substantially horizontal attitude. A support means extends around and is operatively connected with the silo compartment means to support the latter both with its axis upright and with its axis in the substantially horizontal attitude. The silo compartment means is made of a flexible sheet material which can be folded to place the compartment means in a collapsed condition of nonuse. The support means is in the form of a framework which is adapted to receive articles for transportation when the silo compartment means is in its collapsed condition of nonuse. This framework is itself collapsible so that when empty the framework itself will occupy only a small volume and can be shipped in a relatively small space. The silo compartment means of the invention preferably has a cylindrical configuration except for its opposed ends which are preferably tapered and of a substantially frustoconical configuration, so that in this way braking forces which act in the direction of movement can be absorbed. In particular, it is preferred to provide a construction where the silo compartment fixedly carries lugs which engage the supporting framework as well as loops which are fixed to the supporting framework, so that in this way it is possible for kinetic and static forces to be transferred to the supporting framework which extends around the flexible silo compartment means. When the silo compartment means is in its upright position it is preferably suspended from a multipartite ring which is in turn removably connected with the supporting framework.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a perspective, schematic illustration of one embodiment of a structure according to the invention;

FIG. 2 shows the structure in an upright position;

FIG. 3 is a transverse section taken along line III—III of FIG. 2 where the structure has its central axis extending horizontally rather than in the upright position of FIG. 2;

FIG. 4 is an end view schematically illustrating how the structure can accommodate various articles which are to be transported;

Flg. 5 is a schematic illustration of the structure in an upright position during filling operations;

FIG. 6 is a schematic illustration of the structure during transporting thereof;

FIG. 7 is a schematic illustration of the structure when in an upright storing condition;

FIG. 8 is a fragmentary schematic partly sectional elevation showing details of the manner in which the compartment means is suspended from the support means;

FIG. 9 is a fragmentary partly sectional perspective illustration showing the manner in which loops support the compartment means when it is in a horizontal attitude; and

FIG. 10 is a fragmentary perspective illustration showing the manner in which lugs fix the compartment means to a floor of the support means.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. 1, there is schematically illustrated therein a silo compartment means 2 of the invention suspended within and carried by a support means 1 in the form of a framework, made up of bars and struts, which extends around the silo compartment means 2 which is itself made up of a flexible sheet material, which may be elastic, and which can be folded to a collapsed condition of nonuse when the silo compartment means is empty. The silo compartment means 2 has a central axis 3 which extends in an upright position (FIG. 2) during filling and discharge of flowable materials into and out of the silo compartment means 2, respectively, while this axis 3 is in substantially horizontal attitude during transportation of the structure. The silo compartment means 2 is fixedly connected with a pair of longitudinally extending lugs 6 having the configuration of longitudinally extending fins which can be releasably fixed with the support means 1. Thus it will be seen that the support means 1, in addition to having walls in the form of open frameworks has a lower floor, as viewed in FIG. 1, to which the stabilizing lugs or fins 6 may be removably connected in any suitable way as by suitable screws, schematically indicated in FIG. 3.

As is particularly apparent from FIG. 2, the silo compartment means 2 is of a cylindrical configuration except that it has opposed ends 5 of tapered or frustoconical configuration. This configuration enables the structure to absorb braking forces which act in the direction of movement.

In addition to the lugs 6 the structure includes elongated tubular sleeves or loops 7 which may be made also of a flexible material and which are operatively connected with the support means 1, in a manner described in greater detail below, so as to connect the silo compartment means 2 through the loops

7 also to the support means 1. As a result of these loops 7 and the lugs 6 it is possible for kinetic and static forces to be transmitted to the framework 1 so as to be absorbed thereby.

As is particularly apparent from FIGS. 1 and 2, the silo compartment means 2 is provided with an upper plug 9 which is removed for filling the compartment means 2 and with a lower plug 8 which is removed for discharging flowable material out of the compartment means 2. Thus, the flexible sheet material of the compartment can be fixed at the top and bottom ends thereof to relatively rigid rings which will receive the plugs 8 and 9 which may, for example, be threaded into a fluidtight sealed engagement with the container means to maintain the latter closed when the plugs 8 and 9 are in position as well as to discharge and fill the container, respectively, when the plugs 8 and 9 are removed. If desired, these plugs 8 and 9 can be removably connected with the end framework portions of the supporting framework 1.

In order to fix the silo compartment means 2 in the support means 1 in a condition where it is capable of absorbing forces which extend along the central axis 3, a multipartite ring 10 is provided. This ring 10 is preferably made of two parts (FIG. 8) which coact to form a complete ring surrounding the upper portion of the compartment means 2 in the position thereof shown in FIG. 2. This ring 10 is directly connected with the compartment 2 and through a releasable fixing structure 11 is releasably fixed with the upper end portion of the supporting framework 1. Thus, as is schematically indicated in FIGS. 2 and 8, elements 11 may be in the form of angle irons which may be releasably screwed to bars of the framework 1 and which are pivotally connected with lugs which are fixed to and extend from the parts which make up the ring 10. The sheet material which forms compartment 2 may have fixed thereto flexible sheet extensions 14 formed with eyelets 16, for example, which receive the ring 10 so that in this way the compartment means 2 may be removably suspended from the ring 10. As a result of this construction not only is the silo compartment means 2 reliably supported buy in addition it can easily be removed from the supporting framework 1 and is thus capable of being shipped in a collapsed, folded condition of nonuse.

In addition, the support means 1 itself is collapsible. For example, the various open framework walls and the floor shown in FIG. 1 may be hingedly connected to each other so that the opposite end framework portions, for example, can be swung down to a position of nonuse after which the opposed sidewalls and the upper longitudinal wall shown in FIG. 1 can be collapsed to a flattened condition, whereupon the end walls can then be swung over the sidewalls which are in the flattened condition. Of course it is also possible to provide a releasable connection between a pair of the sidewalls for any suitable matching holes in angle irons of the framework and bolts removably placed therein. When the sidewalls are set up to surround the compartment means 2, the end walls may be swung to their upright conditions shown in FIG. 1 and coacting with the sidewalls to maintain them in their operative condition extending around the container means 2. In this case also removable bolt-and-nut assemblies may be used to releasably maintain the structure in its expanded position of use. Therefore, it is a simple matter to ship the supporting framework 1 also in a collapsed condition where it occupies only a small volume when it is empty and thus in a condition of nonuse.

In the upright position of the structure illustrated in FIG. 2, the silo compartment means 2 hangs from the multipartite ring 10 and the lugs 6 and loops 7 have no operative influence at this time. The filling and emptying of the compartment means 2 takes place with the axis 3 in the upright position of FIG. 2.

In FIG. 3 there is illustrated in a more detailed manner the fastening of the lugs 6 to the floor of the supporting framework by suitable screws, as also shown in FIG. 10, as well as the manner in which the flexible loop or sleeve components 7, which are fixed to the container means 2, extend around rods 12 (see also FIG. 9) which are fixed to the elongated upper bars 13 of the framework 1, so that in this way the loops 7 are suspended and hung from the supporting framework 1 while extending longitudinally in the direction of the axis 3. These rods 12 on which the loops 7 and thus the container means 2 are directly suspended in the position shown in FIG. 3 are themselves removably connected with the supporting framework as by being removably received in suitable brackets carried by the framework.

FIG. 4 illustrates how the structure of the invention can be used for many different purposes, such as for transporting articles 4 which may take the form of individual smaller packages which can be situated within the framework 1 on the floor thereof. Thus, when the compartment means 2 is empty it may be folded to the collapsed condition indicated at the upper part of FIG. 4 with the compartment means maintained in this collapsed position through any suitable flexible bands or the like. This provides beneath the collapsed compartment means 2 a free space in which piece goods 4 may be situated. Thus, when structure of the invention is shipped to a location where the compartment means 2 will receive a flowable material, the structure may be used to ship other articles 4 so that economic use can be made of the structure in travelling to and from a given location.

FIG. 5 schematically illustrates the structure of the invention during filling thereof. This filling takes place with the axis 3 in its upright position so that when the plug 9 is removed a flowable material can be introduced into the compartment means 2. Such flowable materials may take the form, for example, of synthetic fertilizers, cement, seed goods, fuels, or oil. The compartment means 2 can be completely filled with such flowable materials, and the plug 9 is replaced after the filling operations are completed.

The entire structure can then be mounted on a vehicle such as the truck schematically indicated in FIG. 6. In this condition the axis 3 extends substantially horizontally so that the entire structure can conveniently be transported. Of course, instead of an automotive truck it is possible to transport the structure on a railroad car or by ship. In this easy and convenient manner it is possible to transport the materials over great distances.

When the destination is reached, the structure is set up with the axis 3 in its upright position so that the materials can be stored in the very same structure until the compartment means 2 is completely emptied. As is schematically indicated in FIG. 7 for this purpose the compartment means 2 and the support means 1 are set up on a suitable stand providing beneath the structure a space to which the flowable materials can be discharged upon removal of the plug 8.

Thus, it will be seen that with the structure of the invention special large storage units at the place where the material is to be consumed, are not required, such units requiring, for example, special storage sheds, because the structure used to transport the flowable materials at the same time is used to store the flowable materials. When the compartment means is fully emptied, it is possible for the entire structure to be shipped back to its original location in an empty condition with the entire structure collapsed to occupy only a small volume. Also, it is possible to provide an arrangement as shown in FIG. 4 where other articles are transported during return of the structure of the invention.

The primary advantages which are achieved by the structure of the invention are as follows:

1. The materials which are transported need only be filled once into a container in which the materials are transported and stored, so that only the one filling operation is required until the materials are to be discharged for use.

2. In order to bring about transportation of the materials it is not essential to provide a special vehicle structure having, for example, special tanks. No manipulations are required in connection with filling or emptying of such tanks and thus a special emptying device is not required. A conventional automotive truck with a hydraulic lifting assembly will be sufficient for the purposes of transportation.

3. The setting up of the compartment means when it reaches its final destination takes place directly at the location where the materials are to be used and with the assistance of the hydraulic lifting assembly of the transporting truck it is possible to set the structure of the invention up in its condition of use in a few minutes.

4. During emptying of the silo compartment means of the invention it is not possible for any bridging of solid particulate material within the compartment means to take place. Thus, in rigid containers a powdery material can form bridges during partial caking of the powdery material, inhibiting flow of such materials out of such rigid containers. However, since with the structure of the invention the compartment means is in the form of a flexible sheet structure which is preferably elastic, it is a simple matter to easily deform the walls of the compartment means to prevent such caking and bridging of the materials when the latter are in the form of a solid, particulate, flowable material.

5. The structure of the invention is easily collapsed so that it will occupy only a small space during return of the structure when it is not possible to ship other articles in the manner illustrated in FIG. 4 and described above.

6. The silo compartment means of the invention can easily be exchanged for another silo compartment means, so that different silo compartment means can be used for different materials.

7. The weight of the entire structure is significantly less than steel containers of corresponding volume.

8. The cost of the multipurpose transporting and storing structure of the invention is substantially less than comparable steel containers.

What is claimed is:

1. In a structure for transporting and storing flowable materials, silo compartment means, having a central axis, for receiving and discharging flowable materials when said axis is upright, said silo compartment means being composed of a flexible sheet material which can be folded when the silo compartment means is empty for collapsing the latter to a condition of nonuse, and support means extending around and operatively connected with said silo compartment means for supporting the latter with said central axis thereof upright, said support means including an outer framework extending around said compartment means and a multipartite ring removably carried by said framework and from which said compartment means is suspended when the axis thereof is upright, said compartment means having extensions extending up to and connected with said ring for suspending said compartment means therefrom.

2. The combination of claim 1 and wherein said support means has, when said silo compartment means is folded in its collapsed condition, a substantial interior space for receiving articles which may be transported within said support means.

3. The combination of claim 1 and wherein said support means is in the form of a framework which is collapsible to occupy a substantially small volume when in a condition of nonuse.

4. The combination of claim 1 and wherein said silo compartment means is of a cylindrical configuration and has opposed ends of tapered, frustoconical configuration.

5. The combination of claim 1 and wherein said compartment means and support means are transportable with said axis in a horizontal position and wherein lugs are fixed to said compartment means and engage said support means and loops are fixed to said compartment means and operatively connected with said support means so that kinetic and static forces will be transmitted to said support means through said lugs and loops.

* * * * *