Dec. 17, 1957 H. S. CLARK 2,816,652

SHIPPING CONTAINER FOR PARTICULATE SOLIDS

Filed Jan. 31, 1955

Fig. 1

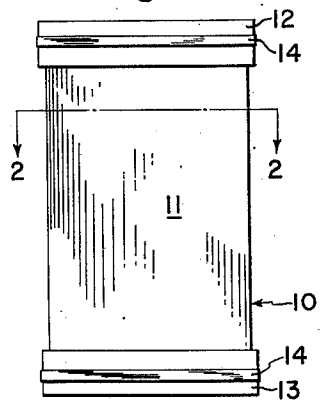


Fig. 2

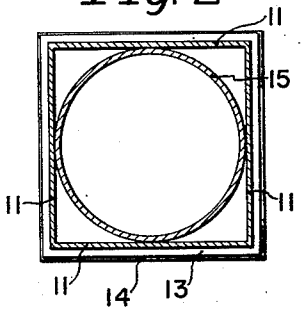


Fig. 3

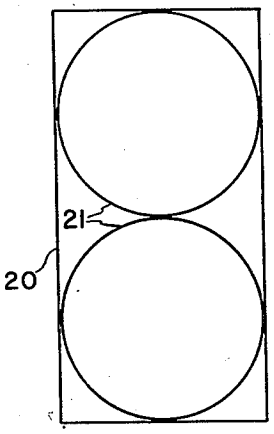


Fig. 4

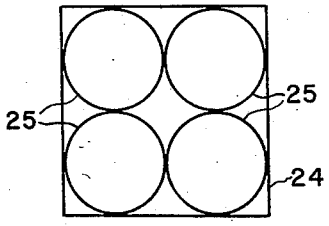


Fig. 5

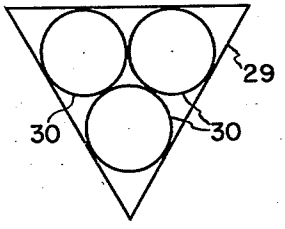


Fig. 6

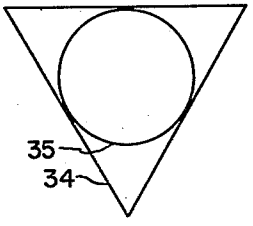


Fig. 7

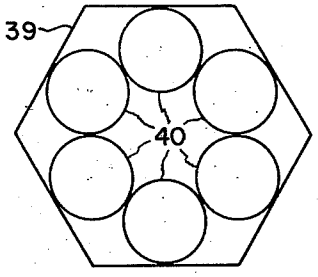
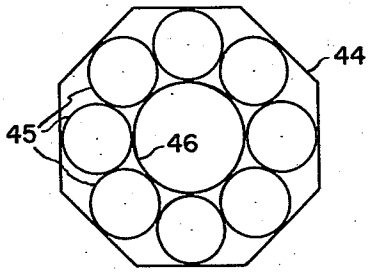


Fig. 8



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SHIPPING CONTAINER FOR PARTICULATE SOLIDS

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6 Claims. (Cl. 206—46)

This invention relates to a shipping container for particulate solids, and particularly to such a shipping container which is especially adapted to close packing adjacent other containers and also to tiering.

At the present time, industry is seeking to ship matetrials in containers of the largest size possible, since packaging, handling and discharging labor are thereby reduced and it is possible to load trucks, railroad cars and vessel holds more expeditiously, thereby reducing the idle time for the carrier. The construction of conventional containers limits the maximum size in which shipping packages may be economically fabricated, due to the fact that, as the unsupported wall expansion increases, there is a greater tendency to bulge, and this is not only unsightly but disturbs the stability of tiered piles as well as eventually opens the package at its weakest point, causing leakage and waste of product.

An object of this invention is to provide an improved shipping container which possesses greater strength and form stability under load than conventional containers of equal capacity. Another object of this invention is to provide a high strength shipping container which is more economical than conventional designs and which can be, in many instances, fabricated from such light materials as to be expendable. Yet another object of this invention is to provide a shipping container which is especially adapted to close packing adjacent neighboring containers on the same level, thus conferring mutual support between the several containers. Still another object of this invention is to provide a shipping container which is adapted to vertical tiering, thereby permitting more concentrated weight loading per unit area of storage space.

The manner in which these and other objects of this invention are obtained will become apparent from the detailed description and the following drawings, in which:

Fig. 1 is a side elevation view of a preferred embodiment of container according to this invention,

Fig. 2 is a section taken on line 2—2 of Fig. 1,

Fig. 3 is a schematic horizontal cross sectional view of another embodiment of this invention wherein the container box is rectangular in cross section with the long dimension in 2:1 ratio to the short dimension,

Fig. 4 is a schematic horizontal cross sectional view of still another embodiment of this invention wherein the container box is square and four inner sleeve elements are utilized,

Fig. 5 is yet another embodiment of this invention shown in schematic horizontal cross section wherein the container box has the shape of an equilateral triangle and wherein three inner sleeve elements are utilized,

Fig. 6 is yet another embodiment of this invention shown in schematic horizontal cross section wherein the container box has the shape of an equilateral triangle and a single inner sleeve element is utilized,

Fig. 7 is still another embodiment of this invention shown in schematic horizontal cross section wherein the container box has the shape of a regular hexagon and

six symmetrically arranged inner sleeve elements are utilized, and

Fig. 8 is a schematic horizontal cross sectional view of still another embodiment of this invention wherein the container box has the shape of a regular octagon and nine inner cylindrical sleeve elements are employed therewith.

Generally, the objects of this invention are achieved by providing a shipping container comprising a box open across its full transverse cross section having plane, relatively rigid side walls of equal lengths and widths differing not more than about 10% for boxes having an odd number of side walls and not more than about 10% from multiple relationship as regards a preselected pair of oppositely disposed side walls with respect to any other pair of oppositely disposed side walls for boxes having an even number of side walls, the ratio of length to width of the side walls not exceeding about 2:1, the box being provided with top and bottom closure members and having on the inside at least one unitary cylindrical sleeve disposed with outside periphery in proximity to at least one of the side walls of the box and also to the peripheries of any other adjacent sleeves disposed within the box in co-parallel relationship with the first-mentioned sleeve, the ends of the sleeves being disposed substantially abutting the inside surfaces of the closure members.

The container of this invention is adapted for use as a shipping container for particulate solids or any discrete solid objects which are sufficiently spheroidal in nature so that the weight of the mass is transmitted more or less equally radially of the sleeves. In use, it is intended that the containers be maintained in a position such that the longitudinal axes of the cylindrical sleeves are maintained substantially vertical at all times.

The term "cylindrical sleeve" as used herein is intended to include any cylindrical particulate solids-retaining elements internal of the container box which are open at both ends or closed at one or both ends, but substantially filled with the solids loading. Containers provided with open-ended sleeves can be produced at somewhat lower cost than when the sleeve is a conventional closed-end drum, however, the latter have the advantage of being commercially available and conferring increased stiffness to the assembly at top or bottom by the addition of the cylinder end closures.

A preferred embodiment of this invention is shown in Figs. 1 and 2, wherein the container box **10** consists of four side walls **11** folded and joined in any conventional manner to give the square cross section tube shown in Fig. 2. The top closure **12** and the bottom closure **13** are square in shape and designed to be interlocked with flaps on the outside periphery of the ends of box **10**, to which they are tightly secured by flexible steel banding straps **14**, or in other conventional manner, such as by banding, stapling or gluing, all as is well known to persons skilled in the art and therefore not described further herein.

The container box hereinbefore described is entirely conventional and my invention comprises combining the box with a unitary sleeve **15** which is circular in cross section, so that a substantial proportion of the weight of the contents of the box will be borne by the sleeve without transmission to the side walls of the container box. I have found that best results are achieved if the ratio of length to width of the narrowest side wall of the box is maintained below about 2:1, and boxes in this general range of proportions should thereforee be employed. Using a single cylindrical sleeve in conjunction with a square cross section container box, such as shown in Figs. 1 and 2, it will be apparent that 78.5% of the weight of the contents will be applied radially against the inside

periphery of sleeve **15**, thereby freeing side walls **11** from outward bulging stresses. It will be understood that the corner regions subtended by sleeve **15** are intended to be loaded with product material to utilize the full volume of the container, but this relatively small weight of product has no appreciable distorting effect on the side walls.

In the embodiments of my invention shown in Fig. 1 and the succeeding drawings, the inner sleeves are represented as being tangent to the side walls of the container box, and this arrangement is preferred because the sleeves are then self-spacing with respect to the container box. However, it will be particularly understood that tangency at the points of adjacency of the sleeves with the side walls, or with neighboring sleeves, is not necessary and that, in fact, with the usual type of load the sleeve may be disposed at a clearance up to about 1", or a distance equal to about eight times the diameter of maximum filling particle size, whichever is the smaller.

Another advantage of tangential disposition of the sleeves with respect to the side walls is that the sleeves can then be fixedly attached to the side wall, if desired, by adhesives in the case of paper board or plastics, or by spot welding in the case of metals, which increases the rigidity of the whole assembly to a substantial degree.

Filled containers made as hereinabove described, the contents of which have been well-packed by vibration or otherwise, have been found to be extremely strong when tiered one on another, the weight of overhead containers being apparently transmitted in the manner of an integral column axially through the product retained by the several sleeves **15** with the full load transmitted in turn to the supporting floor. The performance of containers made in accordance with this invention as regards packing adaptability on any one level and vertical tiering, has proved equal to, and in many cases superior over, that of much more expensive containers.

In a typical case, a square cross section shipping container fabricated according to this invention was made up with a container box measuring 36" on the side, with a length of 69". The material of the container box was double corrugated paperboard of a thickness of about ¼" and having a Mullen Test of 350 lbs. The inner cylindrical sleeve was an open-ended paper tube of 283 lbs. per 1,000 sq. ft. weight fiberboard, also 69" high. The bottom and top closures for the container box were of such dimensions as to fit snugly over the container box and to be sealed thereto with a locked seam, each closure being secured to the filled container by a single steel banding strap ¾" in width. This container proved sufficiently strong and stable in form against bulging for ordinary railroad transportation and plant handling of a unit load of 1500 lbs. of a granular polyethylene product having a particle size of ⅛" mesh.

I have found that it is possible with my construction to attain economies of the order of 25% or greater as regards the necessary paper weights to achieve equal strengths in service, in a typical case reducing individual container costs from $7 to $5.

While a square cross section container, such as that shown in Figs. 1 and 2, is especially preferred for use with this invention, since maximum economies as regards materials of construction are thereby realized due to the geometry, numerous other embodiments of this invention can be utilized with the achievement of substantial advantages over conventional container constructions.

Fig. 3 shows in cross section a rectangular container box **20** which is provided with two vertically disposed cylindrical sleeves **21** snugly nested within the container box. The sleeves **21** extend to points adjacent the closures, not shown, and are intended to be filled with product in the same manner as already described for the embodiment of Figs. 1 and 2, the regions outside of the sleeves, for this as well as all other embodiments of this invention, being also filled with product to utilize what would otherwise be dead space.

Another embodiment of this invention comprises a square cross section box **24**, such as that shown in Fig. 4, which is provided with four inner cylindrical sleeves **25**, which are disposed symmetrically with respect to each of the four corners of the container and each of which abuts two adjacent side walls as well as its two neighboring sleeves. Calculation reveals that the weight of contents within the several sleeves aggregate about 78½% of the total weight within the container; however, somewhat more material is required for the four sleeves of this embodiment than for the single sleeve of Figs. 1 and 2, and there is some additional labor in placing the plurality of sleeves, which makes the construction of Figs. 1 and 2 preferred.

The application of this invention to triangular cross section boxes is depicted in the embodiments of Figs. 5 and 6. Fig. 5 shows a container box **29** having the cross section of an equilateral triangle and provided with three equal diameter inner sleeves **30**, symmetrically disposed with respect to the container corners and in abutment one with another. In Fig. 6 the container box **34** has the cross section of an equilateral triangle but is provided with a single inner cylindrical sleeve **35**, the outside periphery of which is tangent to the inside surfaces of all three of the side walls.

My invention is also applicable to polygonal boxes such as the regular hexagonal box **39** shown in Fig. 7, which is provided with six equal diameter inner cylinders **40**, the outer peripheries of which are each tangent to a single side and in abutment with neighboring sleeves tangent to adjacent side walls. It will be understood that the design shown in Fig. 7 is in effect a composite of six of the assemblies of Fig. 6 arranged within a common enclosure. If desired, the central space of the container of Fig. 7 may be provided with yet another inner sleeve element, the outside periphery of which is in contact with each of the several sleeves abutting the several side walls. Where a multiplicity of sleeves are employed in conjunction with a single box they can, if desired, be attached together along their lines of mutual abutment as a convenience in assembly and, of course, individual sleeves can also be joined to adjacent side walls to give rigidity to the overall structure as has hereinbefore been explained.

Another polygonal arrangement is shown in Fig. 8, wherein the cross section of the container box has the shape of a regular octagon **44** and the interior of the container is provided with eight smaller diameter outer sleeves **45** surrounding a larger diameter inner sleeve **46**.

It will be noted that, in the embodiments of Figs. 7 and 8, the inner sleeves are shown adjacent only one side wall of the container box, and this arrangement is preferred because filling material outside of the sleeves is then retained in the relatively high-strength regions of the box defined by the corners. If desired, however, the sleeves may be disposed in the vertex regions, adjacent two adjoining side walls of the box, with some slight sacrifice in strength for the overall construction.

My invention can be applied to container boxes having either an odd or even number of side walls and, for either of these classes, a difference in side wall width between the widest and narrowest side walls of about 10% can be tolerated without sacrificing appreciable benefits. The embodiments of containers having an even number of side walls shown in Figs. 2, 4, 7, and 8 are represented as having side walls equal in length, and such a construction is preferred because snug fitting necessary to close packing is thereby facilitated. However, as represented by the embodiment of Fig. 3, containers with an even number of side walls cannot only have a 10% tolerance in side wall width but a pair of oppositely disposed side walls may vary within 10% from multiple relationship with respect to any other pair of oppositely disposed side walls while still realizing much of the advantage of my invention. Thus, as an example, an hexagonal box having one pair of

oppositely disposed side walls of an individual width x may have a second pair of oppositely disposed side walls with individual widths of $2x$ and a third pair of oppositely disposed side walls with individual widths of $4x$, and such construction is in full accordance with the teachings of my invention.

From the foregoing it will be understood that this invention is applicable to numerous shapes and designs of containers and that it may be modified in many respects without departure from the essential spirit, wherefor it is intended to be limited only by the scope of the following claims.

What is claimed is:

1. A shipping package of particulate solids adapted for the shipment of heavy contents weighing in the hundreds of pounds comprising in combination a box open across its full transverse cross section having plane, relatively rigid side walls of equal lengths and widths differing not more than about 10% for boxes having an odd number of side walls and not more than about 10% from multiple relationship as regards a preselected pair of oppositely disposed side walls with respect to any other pair of oppositely disposed side walls for boxes having an even number of side walls, the ratio of length to width of the narrowest of said side walls being below about 2:1, top and bottom closure members for said box, and at least one unitary cylindrical sleeve element disposed inside said box with the outside periphery of said sleeve element in proximity to at least one of said side walls of said box and in relatively close juxtaposition with the peripheries of any adjacent sleeve element disposed in co-parallel relationship with said first-mentioned sleeve element and with the ends of said sleeve element disposed substantially abutting the inside surfaces of said closure members, said particulate solids filling substantially the entire inside volume of said box and said sleeve element.

2. A shipping package of particulate solids according to claim 1 wherein the horizontal cross section of said box is in the shape of a rectangle with the long dimension an integral multiple of the short dimension.

3. A shipping package of particulate solids according to claim 1 wherein the horizontal cross section of said box is an equilateral triangle.

4. A shipping package of particulate solids according to claim 1 wherein the horizontal cross section of said box is a square.

5. A shipping package of particulate solids adapted for the shipment of heavy contents weighing in the hundreds of pounds comprising in combination a box open across its full transverse cross section having four plane, relatively rigid side walls of equal length disposed at right angles one to its adjacent neighbors, the wider opposed pair of said side walls differing not more than about 10% from multiple relationship with respect to the narrower opposed pair of said side walls and said side walls having a length to width ratio below about 2:1, top and bottom closure members for said box and a multiplicity of unitary cylindrical sleeve elements disposed in co-parallel relationship inside said box with the outside peripheries of said sleeves in proximity to the inside surfaces of at least two of said side walls and in proximity one to another in the neighboring regions of said sleeves, and with the ends of said sleeve elements disposed substantially abutting the inside surfaces of said closure members, said particulate solids filling substantially the entire inside volume of said box and said sleeve elements.

6. A shipping package of particulate solids adapted for the shipment of heavy contents weighing in the hundreds of pounds comprising in combination a box open across its full transverse cross section having four plane, relatively rigid side walls disposed at right angles one to its adjacent neighbors, which walls are substantially equal in width and length and have a length to width ratio below about 2:1, top and bottom closure members for said box, and a unitary cylindrical sleeve element disposed within said box in coaxial relationship therewith with the outside periphery of said sleeve element substantially tangent to the inside surfaces of said side walls and with the ends of said sleeve element disposed substantially abutting the inside surfaces of said closure members, said particulate solids filling substantially the entire inside volume of said box and said sleeve element.

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