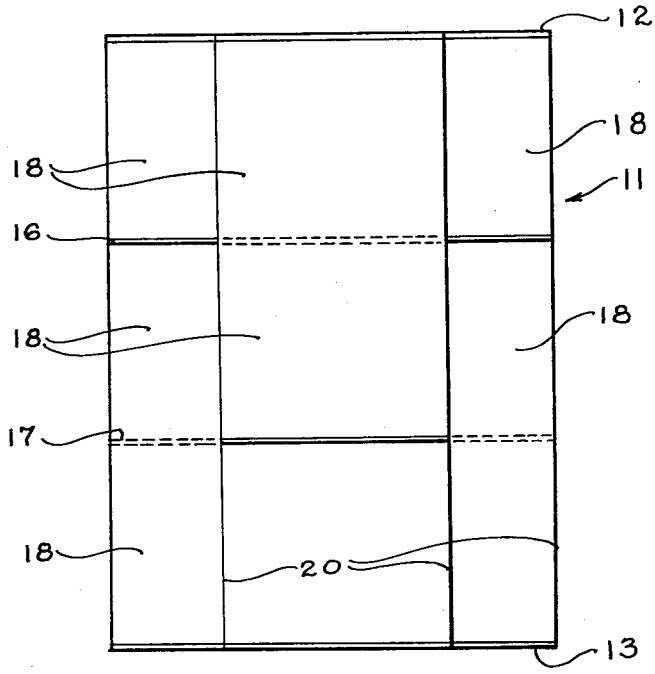
March 14, 1961 O. J. VAN LEER 2,974,841

SHIPPING CONTAINER

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Fig. 1



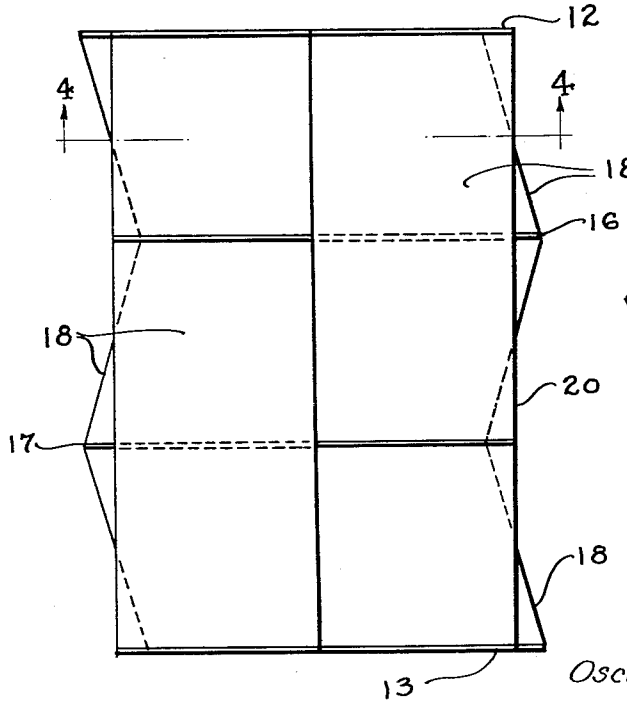


Fig. 2

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Fig. 6

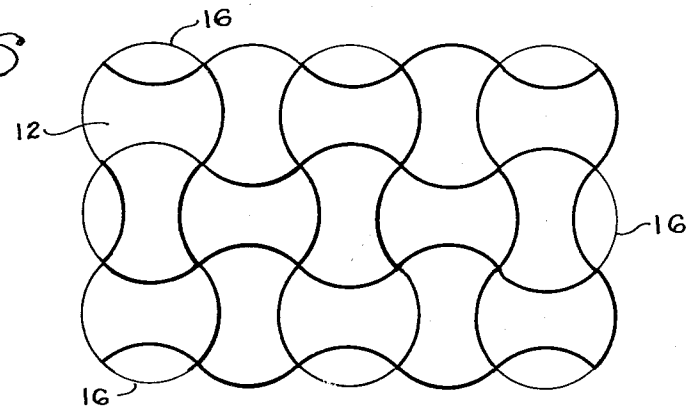


Fig. 5

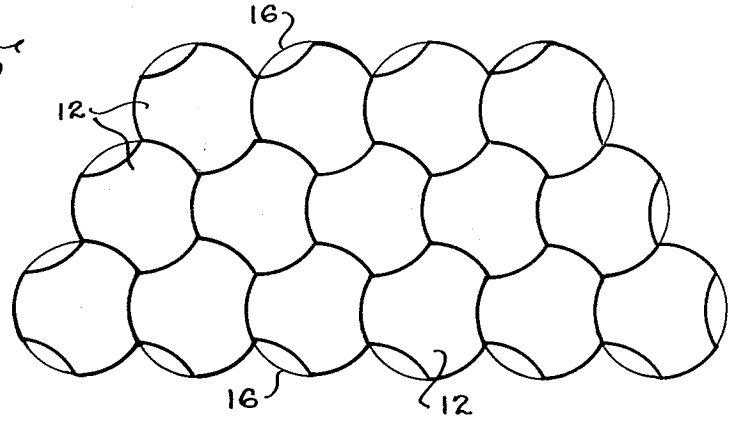


Fig. 3

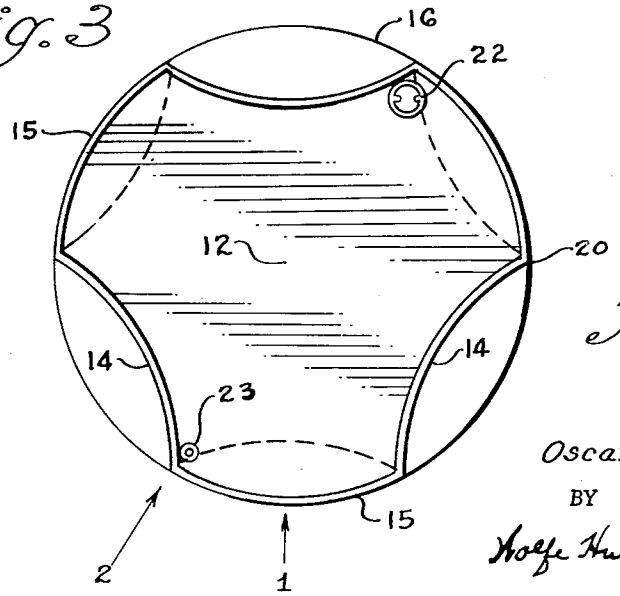




Fig. 4

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SHIPPING CONTAINER

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Filed Apr. 20, 1959, Ser. No. 807,435

Claims priority, application Netherlands Aug. 26, 1958

6 Claims. (Cl. 229—1.5)

The invention relates to a shipping container capable of being nested with other similar containers for the saving of shipping space.

Shipping containers for oil, dairy products or the like usually are cylindrical with a circular cross-section which has the advantage of relative great strength for a given wall thickness and the possibility of the container being rolled. However, a disadvantage is that these containers are wasteful of space.

Drums and boxes have been proposed having a cross-section in the form of an equilateral triangle, square or hexagon. It is true that with containers of such a shape the available space may be completely filled up but they have the drawback that they cannot be rolled and that they are not as strong as a cylinder for a given wall thickness.

It is an object of the invention to provide a shipping container having a novel shape which utilizes the available space more efficiently than a cylinder but which like a cylinder can be smoothly rolled along the ground. It is a more specific object to provide a shipping container which is capable of nesting with other similar containers stacked either horizontally or vertically with substantially complete utilization of space. It is another object to provide a container as above which is inherently stronger than a cylindrical container of the same wall thickness and which may be economically manufactured.

Other objects and advantages of the invention will be apparent from the attached detailed description and from a drawing in which:

Fig. 1 is a side elevation of a container according to the invention in a preferred embodiment, and viewed according to the arrow I in Fig. 3.

Fig. 2 is a side elevation of the same container viewed according to the arrow II in Fig. 3.

Fig. 3 is a top view of this container.

Fig. 4 shows the manner in which the facets of the body of this container are generated.

Fig. 5 is a diagrammatic top view of a plurality of containers in the embodiment shown in Figures 1–3 placed side by side.

Fig. 6 is a diagrammatic top view of a plurality of containers in another embodiment of the invention, also placed in side by side relationship.

Referring to Figures 1–3 the container has a body **11**, a top end wall **12** and a bottom end wall **13**. The end walls have the shape of a hexagon with alternating concave sides **14** and convex sides **15** in the form of circular arc having mutually equal radii of curvature, so that a convex side of the end wall of one container snugly fits in the concave side of the end wall of another similar container. The end walls are twisted through 60° relatively to one another so that a convex side **15** of the top end wall is in alignment with a concave side **14** of the bottom end wall. Thus, the convex sides of both end walls link up and together they constitute a complete circle, inasmuch as the center of all arcs forming

the convex sides are positioned in the axis of the container body.

At one third of the height of the container from the top end wall, the body has a similar hexagonal cross-section **16** which, however, is twisted through an angle of 60° i.e., one step relatively to the top end wall **12**, while at one third of the height from the bottom end wall the body has a cross-section **17** also similarly shaped, but again twisted through an angle of 60°. Therefore, the top end wall **12** and the cross-section **17** are in the same phase position and the position of the bottom end wall **13** corresponds to that of the cross-section **16**. The convex sides of the cross-section **16** also are in alignment with the concave sides of the cross-section **17** so they too, together, constitute a complete circle.

Due to the presence of the two uninterrupted circles the container can be rolled smoothly along the ground without bumping or tipping from side to side. When being rolled the container rests on a convex side of the end wall **12** and on a convex side of the cross-section **17** and, alternatively, on a convex side of the end wall **13** and a convex side of the cross-section **16**. Thus spaced-apart circles of support are provided around the entire periphery. Between alined sides of adjacent hexagons there is a smooth transition of the wall material and forming what may be called a "facet" **18** of the wall surface. The result is to produce a generally cylindrical surface made up of a large number of these facets bearing a shallow angle with respect to one another. More specifically, each facet is generated by successively connecting the points on the concave arc with the points equidistantly spaced apart from the corner on the convex arc of the subsequent cross-section by means of substantially straight lines. These lines **19** (Fig. 4) are in a vertical position in the corners of the hexagon, forming six straight ribs **20** in the container body. Progressing along the arcs the lines swing about the axis X—X via intermediate positions, two of which have been represented by dotted lines in Fig. 4, to an extreme position indicated by **21** which is reached in the middle of the arcs; thereafter they swing back again into the vertical position. Since each facet can be generated by movement of a straight line, it follows that the dies for producing the surface can be formed by a series of straight cuts, thereby making it economical to produce the necessary dies.

Adjacent facets both in circumferential and in axial direction thus constitute one another's complements so that, if the containers are placed in a row in side by side relationship as diagrammatically illustrated in Fig. 5, not only do the endwalls **12** and **13** and the similarly shaped cross-sections **16** and **17** interfit, but moreover the facets **18** of one container engage the facets **18** of the adjacent container. The entire volume occupied by the stacked containers is useful volume occupied by material being shipped and without substantial intervening air spaces. When the containers are stacked in a rectangular space the only lost space is the slight amount corresponding to the notches or dimples in the peripheral containers.

Because of the area contact between adjacent containers, the container bodies support each other which gives them a greater resistance to damage during transport, for instance in consequence of large accelerations or decelerations up to and including that experienced in a parachute drop.

The particular container shape according to the invention affords still other important advantages. Thus if one wants to stack containers of circular cylindrical shape in a horizontal position, the end containers of the bottom row must be blocked against rolling sideways which would cause the entire stack to collapse. Moreover, a

stack of cylindrical containers exerts a large horizontally directed force on the blocking means. The present containers by contrast lock together. Note that if Fig. 5 is considered to represent a side elevation of a correspondingly formed stack of containers according to the invention, the containers interfit so that the containers at the ends of the bottom row cannot roll away in a sideways direction being held by the containers on top or on one side.

The peculiar shape of the present container not only facilitates horizontal stacking, as above, but also stacking vertically, end to end. When cylindrical containers are stacked end to end the end seams should register with one another for stable support. However in practice the adjacent drums are offset so that one teeters on the other with only two points of support, i.e., where the seams intersect. Containers of the embodiment of the invention as shown in Figures 1–3, however, even after lateral displacement and/or twist relatively to one another keep resting one on top of the other at six points thereby insuring a stable condition, making stacking easier, and considerably reducing the risk of toppling or damage.

In one end wall of the container shown in Figures 1–3 a filling and pouring hole which may be closed by a conventional bung **22** is provided and positioned as close to the corner as possible. The reason for this is that, at that point one of the ribs **20** forms a continuous chute or drain permitting the container to be completely drained. A diametrically opposed vent hole which may also be closed by a bung **23** is provided.

Various alternatives and modifications may be conceived without departing from the spirit and scope of the invention. For instance, it is not necessary for the particularly shaped cross-sections to be located at the end wall or walls in order to practice the invention. The container shown in Figures 1–3 might, for instance, be extended at both ends by one half of the height of a facet. At the axis X—X of the facets the container body has a cross-section in the shape of a true equilateral hexagon with straight sides, and a container extended in the way described would therefore have end walls of this shape.

Moreover, it is not required that the container body have only four of the particular cross-sections. The container may have any even number, for example, six or eight, thus forming three or four rolling hoops respectively.

In the embodiment shown in the drawings the centers of the arcs forming the convex sides of the cross-sections are all located in the axis of the container body, thus together constituting a true complete circle and thereby permitting smooth rolling of the container. However, the arcs might have a somewhat larger radius without departing from the invention. In such a case the advantage of complete filling up of the space is preserved; however, rolling will be somewhat bumpy.

Preferably, the particularly shaped cross-sections are positioned in phase as shown in Figures 1–3, that is, each subsequent cross-section is twisted with respect to the preceding one through the prescribed angle. In this way a container lying horizontally is always supported along lines axially spaced over two thirds of its length regardless of the portion of the periphery in contact with the ground. However, as an alternative, the cross-sections at the end walls **12** and **13** could be placed in the same phase position, and the cross-sections **16** and **17** could also have the same position relative to one another but twisted through an angle of 60° relative to the end walls **12** and **13**. When being rolled the container would then rest alternatively on the two outer rolling hoops at the end walls and on the two inner rolling hoops at the cross-sections **16** and **17**. Or, if desired, it will be apparent to one skilled in the art that the cross-section at the end wall **12** and the cross-section **16** might be phased the same but twisted relatively to the cross-section **17** and end wall **13** which are also phased the same. When being rolled the container would then rest alternatively on its left hand and on its right hand portion. Obviously, these embodiments although falling within the scope of the invention are less to be preferred than the embodiment hereinbefore described and illustrated.

The polygon forming thefoundation for the particularly shaped cross-sections need not be a hexagon. As is shown by the diagrammatic illustration of Fig. 6, all the above advantages forming the objects of the present invention can also be obtained if the particularly shaped cross-section is built up from a quadrangle, i.e., a four sided figure having alternately convex and concave sides. In such event the cross sections are twisted 90° rather than 60°. However, a container with a four-sided shape as the foundation for its cross-sections is inherently not quite as economical of material, with wall thickness and other factors determining the strength of the container being assumed to be equal. Also the manufacture is somewhat less simple.

Only when a quadrangle or a hexagon forms the foundation for the particularly shaped cross-sections can all the objects of the invention be achieved. When using an octagon as the primitive form for the cross-sections, the ideal of complete utilization of the available space cannot be attained but it may be approached whereas the possibility of obtaining shockless rolling remains, so that such an embodiment also should be regarded as falling within the scope of the invention.

The above discussion, and the drawings as well, have been directed toward a geometrically idealized construction having sharply defined facets. Such a structure can be closely approached using the forming machinery disclosed in copending U.S. application Ser. No. 753,934, filed August 8, 1958 and depending upon the forming pressures employed. However, it has been found that the invention can be utilized to a large extent even where the shape is not quite as sharply defined as has been illustrated in the drawings. Let it be assumed, for example, that an outer die is provided having the geometric shape illustrated in the drawings. Let it further be assumed that a cylindrical metal blank is used which is acted upon by internal expanding means tending to cause the blank to be expanded outwardly against the die. Using only moderate pressure, the blank will largely take the form of the die; however, the edges (see **16** and **17** in Fig. 2) will be somewhat rounded rather than sharp. Also the break points between adjacent regions of convex and concave contour will not be as sharp as shown in Fig. 3. Thus, the resulting drums will fit together but not quite as compactly as if they were shaped with geometric precision. Nevertheless, I consider that such a close approximation of the preferred shape enables one to make substantially full use of the advantages of the invention and falls within the scope of the invention.

While the invention has particular utility in metal shipping drums, particularly the standard 55-gallon "oil drums," the invention is not limited thereto and any sheet material such as paper, plastic material or the like may be employed. The invention is not limited as to size, and is fully applicable to individual paper containers in the pint and quart sizes by way of example.

I claim as my invention:

1. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the side wall being characterized by the fact that in at least four transverse sections substantially equidistant from one another the wall forms a hexagon consisting of convex arcs centered on the container axis alternating with concave arcs of substantially the same radius of curvature, at least two of the cross sections being twisted through an angle of 60° and with a smooth transition of the wall between alined sides of adjacent hexagons.

2. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the end walls being formed of a polygon having an equal number of sides consisting of arcs with equal radii of curvature with the concave and convex sides alternating, the side walls being so shaped as to define an even number of equidistant cross-sections of similar shape with the end walls and cross-sections being twisted one step out of phase from one to the next thereby to define circles of rolling support.

3. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the side wall being characterized by the fact that in at least four transverse sections substantially equidistant from one another the wall forms a polygon having an equal number of sides consisting of arcs with equal radii of curvature with the concave and convex sides alternating, at least two of the cross sections being twisted through an angle of 360° divided by the number of sides of the polygon and with a smooth transition of the wall between alined sides of adjacent polygons.

4. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the side wall being characterized by the fact that in at least four transverse sections substantially equidistant from one another the wall forms a polygon having an equal number of sides consisting of convex arcs centered on the container axis alternating with concave arcs having the same radius of curvature, at least two of the cross sections being twisted through an angle of 360° divided by the number of sides of the polygon and with a smooth transition of the wall between alined sides of adjacent polygons.

5. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the side wall being characterized by the fact that in at least four transverse sections substantially equidistant from one another the wall forms a polygon having an equal number of sides consisting of convex arcs substantially centered on the container axis alternating with concave arcs having the same radius of curvature, adjacent polygonal sections being twisted through an angle of 360° divided by the number of sides of the polygon and with a smooth transition of the wall between alined sides of adjacent polygons.

6. A shipping container having end walls and a generally cylindrical side wall capable of nesting side-by-side with similar containers without loss of space in between, the side wall being characterized by the fact that in at least four transverse sections substantially equidistant from one another the wall forms a polygon having an equal number of sides consisting of arcs with equal radii of curvature with the concave and convex sides alternating, at least two of the cross sections being twisted through an angle of 360° divided by the number of sides of the polygon and with a smooth transition of the wall between alined sides of adjacent polygons, at least one of said end walls having a filler opening in an extreme corner position to facilitate draining of the container when the same is on its side.

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