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METHOD OF FORMING SPHERICAL CONTAINERS

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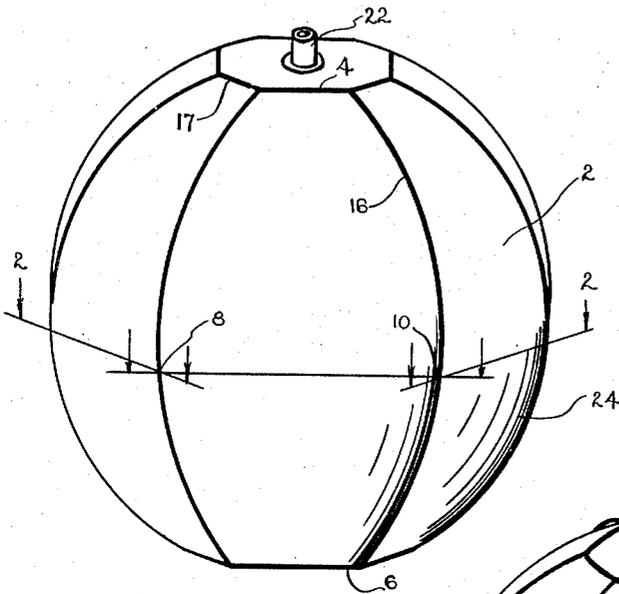


FIG. 1

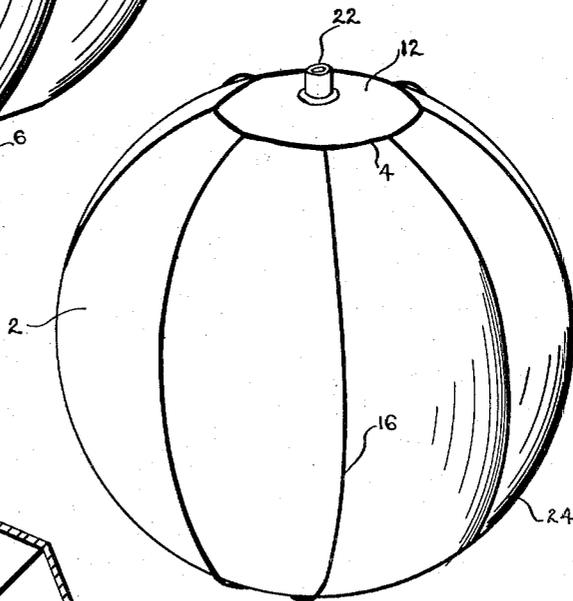


FIG. 3

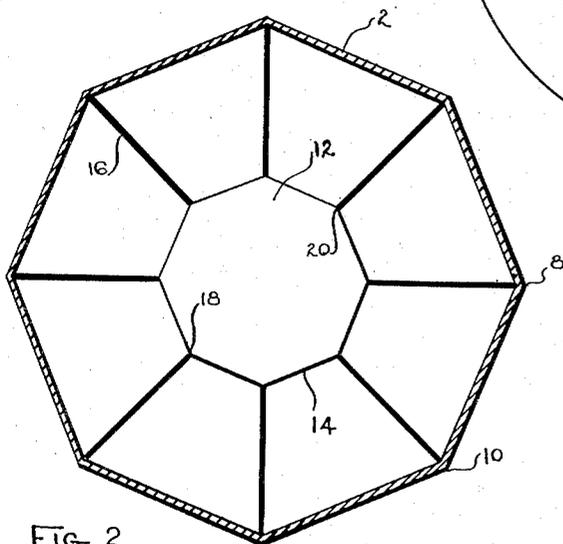


FIG. 2

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## METHOD OF FORMING SPHERICAL CONTAINERS

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2 Claims. (Cl. 29—148.2)

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This invention relates to spherical containers, and more particularly but not limited thereto, to the method of forming spherical tanks adapted to be used in the storage and transportation of fluids under pressure, such as liquified petroleum gases and volatile liquids. The present invention is similar and relates in subject matter to applicant's co-pending application, Serial Number 739,789, filed April 7, 1947, now Patent No. 2,503,190.

This invention differs from the conventional method of forming spheroids or spherical tanks that normally utilize dies and die machinery, and is concerned with the method or process of forming a spherical body by the hydraulic application of a fluid, such as oil or water, to a closed body of particular configuration and in such a manner that the body is bulged by the hydraulic pressure to form a substantially symmetrical spheroid body. The hydraulic method employing oil or water to create bulging has many advantages, particularly in that all or the greater part of the metal may be uniformly stretched to maintain a uniform thickness throughout the body in the reshaping to a substantially spherical configuration.

The present invention differs from the aforementioned application mainly in that the process can be utilized for forming larger vessels with a saving of material. Furthermore, considerable material displacement is prevented.

It is an important object of this invention to provide a novel method of forming a high pressure vessel of substantially spherical shape without the use of dies, molds or the like.

And still another object of this invention is to provide a method of forming spherical bodies by hydraulic expansion.

And another object of this invention is to form a spherical body by the application of hydraulic pressure in such a manner that the finished spherical vessel is assured of a safety factor to prevent bursting within the confines of the A. S. M. E. code.

And still another object of this invention is to form a spherical container from a pre-formed body of substantially polygonal shape in cross-section by employing hydraulic pressure to bulge or reshape the polygonal shaped body into a substantially symmetrical spheroid.

Other objects and advantages of the invention will be evident from the following detailed description, read in conjunction with the accompanying drawings, which illustrate my invention.

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In the drawings:

Figure 1 is a front elevational view of the body prior to the reshaping thereof.

Figure 2 is a cross-section of Figure 1 taken on lines 2—2 thereof.

Figure 3 is an elevational view of the body expanded or shaped into a spheroid.

Referring to the drawings in detail and more particularly Figures 1 and 2, the novel method utilized herein comprising forming a polygonal shaped shell (such as an octagon) comprising a plurality of individual segments 2. Each of the segments 2 are formed by cutting or forming a flat plate having pre-determined dimensions wherein the dimension at the opposite ends 4 and 6 are substantially equal. The dimensions at the center or widest portion of the plate is substantially greater, particularly between the points 8 and 10, as shown in Figure 1, as will be hereinafter set forth. The flat plates of the preformed dimensions are rolled on a forming roll (not shown) into a curvature providing a longitudinal radius. However, it will be apparent from Figure 2, that in cross-section each of the curved segments 2 are substantially flat or straight, as shown. A substantially flat plate 12 is formed with multiple circumferential edge portions 14 of pre-determined dimensions to form an octagonal or polygonal body or end plate 12.

A plurality of the individual segments 2, are required to form a composite octagonal body connected by welding 16 at the longitudinal edges thereof, as clearly shown in Figures 1 and 2. The octagonal shaped end plate 12 is then secured to the opposite ends of the combined segments 2 by welding as at 17. It will be apparent that the edges 14 of the end plates are of substantially the same dimensions as the outer edge portions 4 and 6 of the plurality of segments 2. It is to be understood that although the invention discloses an octagonal shaped body, it is not limited thereto.

To assure uniform expansion of the pre-formed body, the distance at the center portion of a segment 2, for example between the points 8 and 10 as shown in Figure 1, is substantially equal in dimensions to the widest portion of a polygonal shaped end plate 12, or the distance between the points 18 and 20, as shown in Figure 2, thereby providing a pre-determined ratio between the dimensions of the individual segments 2 and the end closure plates 12.

With the plurality of segments 2, and the head plates 12 secured by welding to form an enclosed composite body or container 24, as

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shown in Figure 1, the body is then provided with a coupling member 22 welded to one of the end plates 12 in order to provide communication with the interior of the vessel or container 24. The coupling 22 permits input of the hydraulic medium, such as oil and water, from pumping equipment (not shown), similar to that disclosed in applicant's aforementioned co-pending application. The closed vessel is filled with fluid to build up the pressure and continued discharge of fluid with an increase of pressure into the vessel 24 will cause a bulging thereof. Continued increase and application of the hydraulic pressure will increase the bulging or expansion of the welded and curved segments 2 from a substantially flat contour, as shown in cross-section in Figure 2, so that the longitudinally curved segments 2 will be bulged or shaped transversely with a transverse radius or curvature substantially on the segment of a sphere. Simultaneous with the bulging or expansion of the segments 2, the end plates 4 and 12 will be bulged outwardly to expand the body into a substantially spherical configuration, as clearly shown in Figure 3. The present method utilizes a hydraulic medium to form a spherical vessel from a pre-formed substantially polygonal shaped body and particularly without the use of any dies to assist in the shaping of the material during the formation period. The material utilized in constructing the polygonal shaped body is the same as any other material for pressure vessels of this type. It will be apparent that the stretching or elongation of the polygonal shaped body shown in Figure 2 will cause considerable saving in material from the conventional die method of pre-forming segments for forming spherical bodies normally utilized today. However, the welding footage is substantially equal.

Under practical tests the welds 16 will remain substantially stationary permitting the transverse elongation of the segments 2 of the pre-formed polygonal body.

The present method in addition to bulging or expanding a pre-formed polygonal body into a substantially spherical shape, also functions to provide a simultaneous testing operation for the safety factor in pressure vessels of this type in order to comply with the A. S. M. E. code requirements of the theoretical bursting pressure. The present method does not need any external shaping dies; however if desired, dies or other means (not shown) may be utilized for applying a compression or external shaping to assist in the formation of the spherical bodies. The spheroid (as shown in Figure 3) is possessed of all the favorable mechanical properties and characteristics of a sphere.

From the foregoing it will be apparent that the present invention provides a novel method of reshaping a polygonal configured body into a

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spheroid which is economical and simple in its operation. Furthermore, the method forms a spherical container with considerable economy in both the labor and material saved, at the same time functioning as a test for the expanded spherical factors tested in compliance with the A. S. M. E. code. The novel method of forming spheroid containers is as particularly adaptable for containers of larger diameters permitting stretching or elongation of the material without any substantially material displacement or distortion of the welds during the expansion or bulging operation.

Changes may be made in the specifications and drawings without departing from the spirit of the invention within the scope of the following claims, as set forth.

What I claim is:

1. The method of forming a spherical container which consists of constructing a closed body from a plurality of longitudinally curved welded segments of a substantially flat transverse contour, closing the opposite ends of the welded segments with a polygonal shaped plate having the largest diametrical dimension thereof of substantially equal to the largest transverse dimension of the said segments to form a closed body of polygonal shape in cross section, and expanding the closed polygonal body with internal hydraulic pressure to reshape the body into a spherical configuration.

2. The method of forming a spherical container which consists of constructing a closed body of substantially octagonal shape in cross section by a plurality of longitudinally curved welded segments, welding an octagonal shaped plate at the open ends of the welded segments having a substantially equal dimensional ratio between the largest diametrical portion thereof and the largest transverse portion of the segments, and a substantially equal dimensional ratio between the peripheral edges thereof and the edges of the segments, and expanding the closed polygonal body with internal hydraulic pressure to reshape the body into a substantially spherical configuration.

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