Aug. 4, 1970 M. L. HOLCOMB ET AL 3,522,647

METHOD OF MAKING A SPHERICAL CONTAINER

Filed Feb. 19, 1968 2 Sheets-Sheet 1

Fig. 1

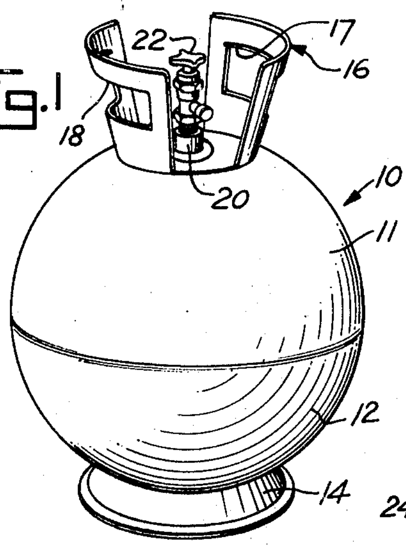

Fig. 2

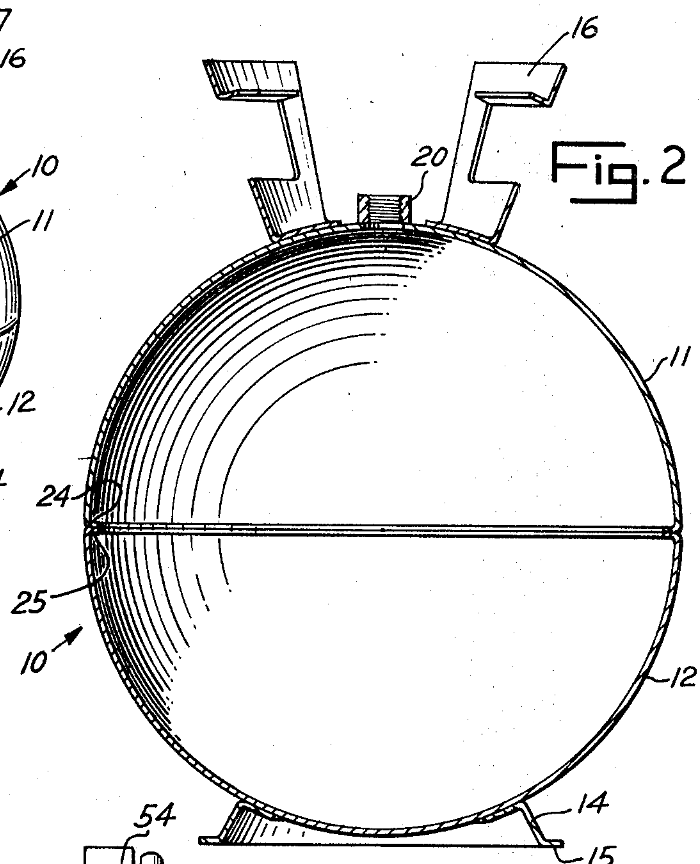

Fig. 3

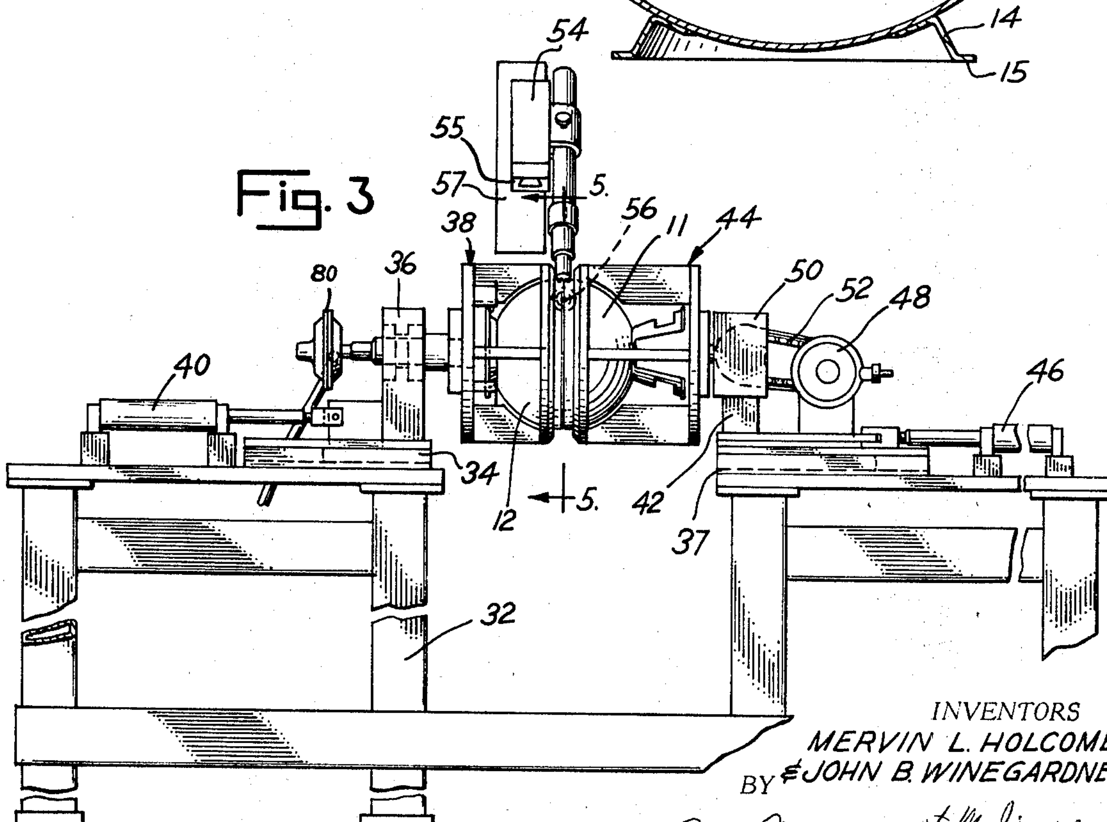

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Fig 4

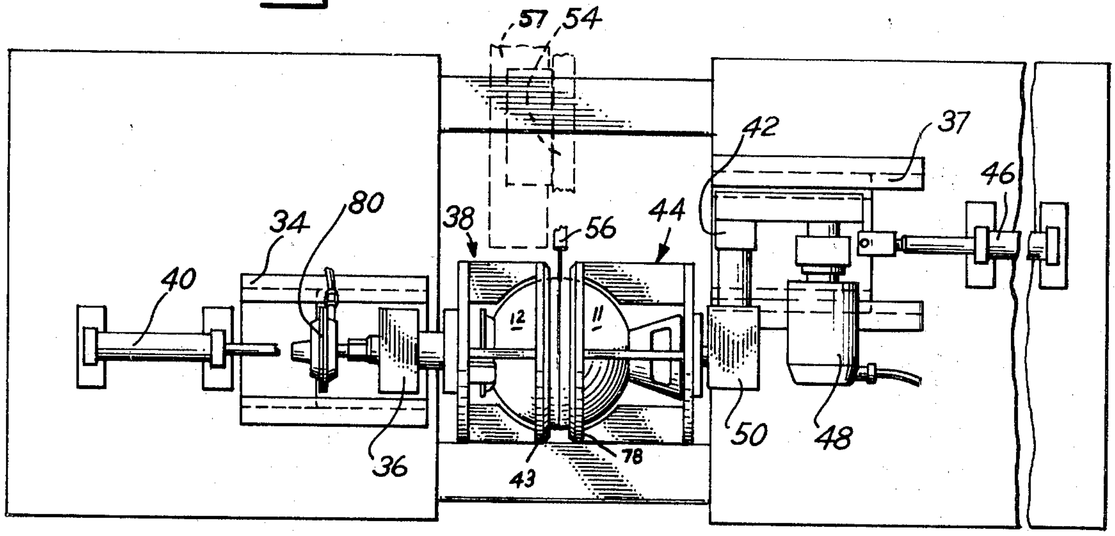


Fig. 6

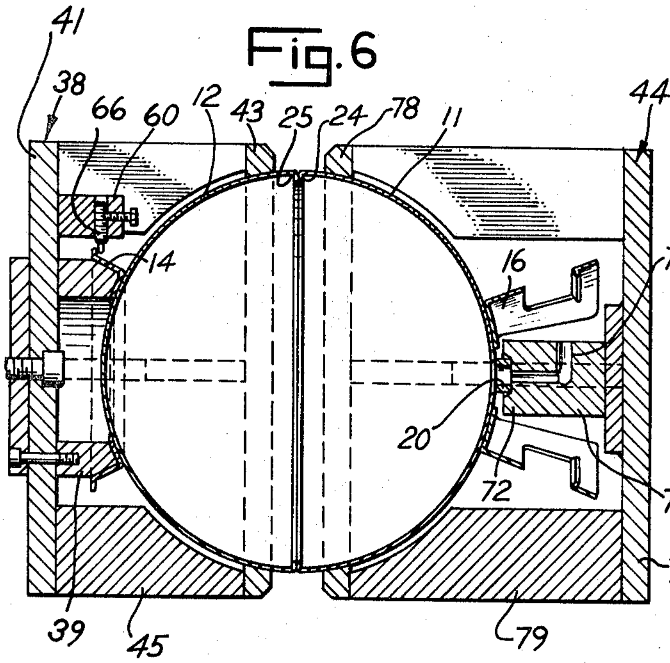
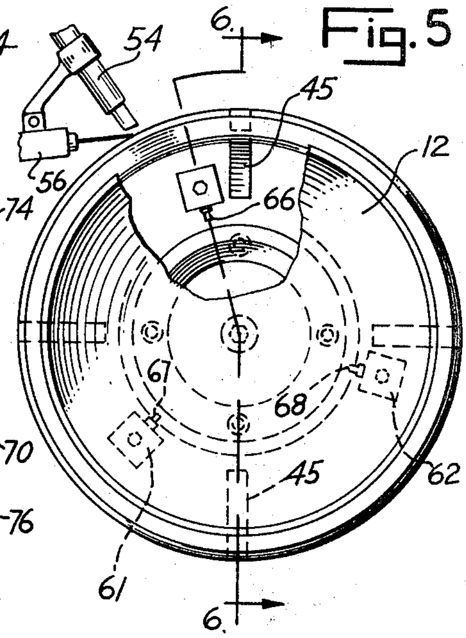


Fig. 5



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METHOD OF MAKING A SPHERICAL CONTAINER

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Int. Cl. B21d 39/02
U.S. Cl. 29—463 3 Claims

ABSTRACT OF THE DISCLOSURE

A method of forming a spherical container comprising two like hemispherical sections, each having inwardly turned annular flanges at the open end lying in the plane of the open end. The hemispherical sections are maintained in precise aligned manner with the annular flanges in abutting relation and the hemispherical sections are rotated to apply a weld seam line of joinder between the two hemispherical sections.

BACKGROUND OF THE INVENTION

The invention relates to a spherical container and, more particularly, to a method of making a spherical container from thin gauge metal.

Spherical containers are advantageous for storing and shipping liquified gases, for example, refrigerant. Such containers weigh less for an equivalent capacity than cylindrical containers. Normally after use, a refrigerant container is returned to the manufacturer for reuse. Because of weight, it is desired that the containers be made cheaply in that they can be disposed of after use, rather than returned to the manufacturer.

One form of spherical container is shown in Pat. 3,050,207, granted Aug. 21, 1962. However, to applicant's knowledge, the device disclosed in said Pat. 3,050,207 has never been sold commercially.

The known methods of making spherical containers are not entirely satisfactory. Heavy gauge metal can be formed in sections and then butt-welded along abutting edges to form a spherical container, as in Pat. 2,118,388, granted May 24, 1938. The method is slow, expensive and would be unsuitable where thin gauge metal is to be used for relatively high volume production of spherical containers.

Pat. 2,113,060, granted Apr. 5, 1938, suggests a method of forming spherical receiver containers from thin gauge metal, wherein hemispherical receiver containers from thin gauge metal, wherein hemispherical male and female sections are provided having open ends formed with telescopically engaging portions. The open ends are joined and then brazed to one another. The male and female sections must be formed by separate dies, thereby increasing fabrication costs. Difficulties would be encountered in fitting the telescoping portions to one another and in maintaining desired roundness and fit in order to assure a good brazed joint and maintenance of relatively high pressure by the completed cotainer.

The interior of the completed spherical container must be free from foreign materials. Since there is only a small opening in the spud to permit access to the interior of the container, it must be kept free from foreign materials during manufacture.

An object of the present invention is to provide an improved method of fabricating spherical containers from this gauge metal, wherein the disadvantages and deficiencies of prior constructions are obviated.

Another object of the present invention is to provide an improved method of manufacturing a spherical container from thin gauge metal comprising forming like hemispherical sections with inturned flanges at the open ends, abutting the inturned flanges at the open ends of the

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hemispherical sections and welding the sections together. Other objects and advantages of the present invention will be made more apparent hereinafter.

BRIEF DESCRIPTION OF THE DRAWING

A preferred embodiment of the present invention is shown in the drawing, wherein:

FIG. 1 is a perspective view of a spherical pressure cylinder made in accordance with the method of the present invention;

FIG. 2 is a cross-sectional view of the spherical pressure cylinder of FIG. 1, but with the control valve omitted;

FIG. 3 is an elevation view of the apparatus for making the spherical pressure cylinder;

FIG. 4 is a plan view of the apparatus of FIG. 3;

FIG. 5 is a view of one chuck of the apparatus of FIGS. 3 and 4 taken generally along line 5—5 of FIG. 3 and illustrating the relationship of the guide means to the welding head; and

FIG. 6 is a cross-sectional view of the chucks of the apparatus of FIGS. 3 and 4, with a spherical pressure cylinder being illustrated in position for assembly, taken generally along line 6—6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2 of the drawing, there is illustrated a spherical container **10** made in accordance with the present invention. The spherical container **10** is of the lightweight disposable type, which is adapted to be disposed after use. The container is particularly adapted for containing material under pressure, for example, liquified gas, refrigerant or the like. Essentially, the cylinder **10** comprises a pair of like hemispherical sections **11** and **12**, joined to one another. Affixed to the hemispherical section **12** is a footring **14** which may be formed or stamped from a thin gauge sheet material and then spot welded, or otherwise secured to the hemispherical section **12**. The handle portion **16** may be suitably stamped or formed from thin gauge sheet material to provide the openings **17** and **19** therein, and then formed to shape. The formed handle **16** is then spot welded, or otherwise suitably secured to the hemispherical section **11**. A spud or fitting **20** is secured to an opening in the top portion of the hemispherical section **11** and a suitable control valve **22** is secured within the spud **20**. The valve **22** controls the discharge of refrigerant from within the container in either liquid or vapor form and if desired, the valve **22** may include a spring loaded relief device.

With reference to FIG. 2, it is noted that the two hemispherical sections **11** and **12** are each provided with an inturned annular flange **24** and **25**, respectively. The flanges **24** and **25** are formed such that the exterior surface of each lies generally in the plane of the open end. The footring **14** is secured to the hemispherical section **12**, such that a plane containing the exterior surface of flange **15** of the footring **14** would be substantially parallel to the plane of the exterior surface of the inwardly turned flange **25**. The spud **20** is secured to the hemispherical section **11** at substantially right angles to the plane of the exterior surface of the inwardly turned flange **24**. The handle **16** is affixed to the hemispherical section **11** concentric to the spud **20**.

The spherical container **10** is manufactured from relatively thin gauge metal stock, for example, steel or aluminum, though steel is presently preferred because of its cheaper cost. The hemispherical sections **11** and **12** are identical and are formed from thin gauge sheet material on the order of .030" thick. During trimming or cutting to size of the sheet stock, half of the stock may have a hole formed therein, which will provide opening for the reception of a spud at a later time. The hemispherical sections 11 and 12 may be then drawn to form and the inwardly turned flanges 24 and 25 may be provided by a separate stamping or forming operation. It is preferred that the inwardly turned flanges lie substantially in the plane of the open ends of the hemispherical sections, that is, the exterior surface of the annular inturned flange of each hemispherical section should lie in a plane. This arrangement provides planar abutting contact between the inwardly turned flanges 24 and 25 during subsequent fabrication and assembly to form the spherical container. The inwardly turned flanges appear to rigidify the hemispherical section and minimize "egging" or out of round distortion of the hemispherical sections before joinder to one another.

After the hemispherical sections 11 and 12 have been formed, and the inwardly turned flanges 24 and 25 properly completed, the hemispherical sections are separately processed. The footring 14 is connected to the hemispherical section 12, as by spot welding, in such manner that a plane through the bottom of the footring as viewed in FIG. 2 is parallel to a plane through the outer surfaces of the internal flange 25.

The spud 20 is inserted into the opening in the hemispherical section 11 and secured thereto, with the axis of the spud at right angles to the plane of the inwardly turned flange 24. The spud 20 subsequently serves as a locator for the handle 16, which is concentrically disposed about the spud 20 and joined to the top of the hemispherical section 11, as, for example, by spot welding.

With reference to FIGS. 3–6, there is shown apparatus for joining the hemispherical sections to one another. The apparatus 30 comprises a suitable framework 32 having a first track means or guideway 34 and a second track means or guideway 36 formed thereon. Slidably supported on the first trackway 34 is a support head 36, which rotatably journals a chuck 38. Power drive means 40 are provided to reciprocate the support head 36 in trackway 34. The power drive means 40 may comprise a power ram and cylinder operatively connected to a source of power, for example, a source of pressurized air. It will be understood that hydraulic source may be substituted for the pneumatic source, if desired.

Slidably carried on the trackway 37 is a support 42 for a second chuck 44. The support 42 is adapted to be reciprocated in the trackway 37 by power drive means 46, which may include a power ram and cylinder operatively connected to a pneumatic or hydraulic power source. Carried on the support 42 is a drive means 48, which is operatively connected to a variable speed gear reduction mechanism 50 for rotating the chuck 44 at a predetermined rate of speed. As illustrated, the electric motor 48 is connected to the reduction mechanism 50 by means of a chain drive 52.

Operatively disposed between the cooperating chucks 38 and 44 is a welding mechanism 54, which is adapted to be moved toward and away from the work held within the chucks 38 and 44. The welding mechanism 54 may be of a conventional type, for example, a metal inert gas type, and may include a wire feed mechanism. A feature of the apparatus is the provision of a guide finger or guide mechanism 56 on the welding head, for guiding the welding head along the plane of joinder between the abutting hemispherical sections of a spherical container. The welding mechanism 54 is slidable in a trackway 55 supported on plate 57 that is suitably secured to the framework 32. Trackway 55 guides the welding mechanism for movement toward and away from the work to be welded. As seen in FIG. 5, the guide 56 is operatively associated with the welding head 54, so as to cause tracking of the welding head along the joinder line between the hemispherical sections 11 and 12 both laterally of a true joinder plane, as well as toward and away from the work. Though variations are small, they can be important in adversely affecting the quality of the weld. The guide means 56 assumes a superior, uniform weld during rotation of the chucks 38, 44 and work (hemispherical sections 11 and 12 to be joined) carried therewith.

The hemispherical section 12 is disposed within the chuck 38, such that the footring 14 is over the adaptor 39 secured to the back-up plate 41 of chuck 38 and the planar flange 15 on the footring 14 is carried by the three spring loaded detent mechanisms 60, 61 and 62 on the back-up plate 41 of the chuck 38. The detent mechanisms 60, 61 and 62 are spaced uniformly in a circle about the axis of the chuck 38 and each includes a plunger mechanism 66, 67 and 68, which is spring loaded to permit detachable connection and retention of the hemispherical section 12 within the chuck or holder means 38. The hemispherical section 12 is retained in such manner that the plane of the internal flange 24 is perpendicular to the axis of rotation of the chuck 38, with the retainer ring 43 of the chuck 38 adjacent to but spaced from the flange 25. The retainer ring 43 is secured to the back-up plate 41 by means of ribs 45.

The hemispherical section 11 is disposed within the chuck 44 and retained therein with the flange 25 in abutting relationship with the inwardly turned flange 24 of the hemispherical section 11. The chuck 44 is provided with an adaptor 70 which has a recess 72 in the forward end thereof for receiving the spud 20. The adaptor 70 receives the spud so as to center the section 11 within chuck 44 and to orient the section with the plane of the open end at right angles to the axis of rotation of the chuck 44. The adaptor 70 includes a passage 74 therein communicating with the opening in the spud 20 for venting the interior of the spherical container 10 to the atmosphere during fabrication. Adaptor 70 is secured to back-up plate 76 of chuck 44. The retainer ring 78 is secured to the back-up plate 76 by ribs 79. The retainer ring 76 is constructed and arranged to engage a hemispherical section 11 adjacent to but spaced from the flange 24. The chucks 38 and 44 are separated. A rotary grounding means 80 is operatively secured to the chuck 38 for grounding the welding mechanism 54 in use.

To fabricate a container, operator positions a hemispherical section 12 in chuck 38. A hemispherical section 11 is positioned with a chuck 44 with the spud 20 in engagement with the recess 72 in the adaptor 70. The power drives 40 and 46 are then actuated to move the chucks 38 and 44 toward one another, so as to move the internal flanges 24 and 25 of the respective sections 11 and 12 into abutting relationship with one another.

The operator then actuates a suitable control to move the welding mechanism 54 toward the chucks so as to move the guide 56 into contact with the plane of joinder between the two hemispherical sections 11 and 12. The rotary drive 48 is actuated to rotate the chuck 44. Because of the frictional contact between the cooperating hemispherical sections, the chuck 38 will also be rotated. The guide 56 will guide or track for the welding head, so as to maintain the disposition of welding head with respect to the work, so as to produce uniform weld. It has been found that by virtue of the cooperation of welding head with the two inwardly turned flanges 24 and 25, a uniform weld will be formed at the surface of the spherical container, and no portion of the inwardly turned flanges will be broken off and fall into the container. An important consideration in fabrication of the spherical container is that the interior of the containers 10 be free from foreign material, as the only opening in the finished container is that in the spud 20. Such opening is relatively small and it is, therefore, difficult to effect cleaning of the interior of the container. Therefore, it is most important that no contaminants or foreign materials enter the interior of the spherical container during fabrication.

After fabrication of the spherical container as viewed in FIG. 2, the container is air cleaned and pressure tested. Those units satisfactorily passing the pressure test are then dried, painted, and a valve is applied to each. The containers are then ready for filling.

The spherical container resulting from application of the present invention is made from thin gauge sheet metal, and can be readily produced at high volume and at relatively low cost. The completed spherical container is of high quality. Such container is lightweight, readily handled whether full or empty, and may be disposed after use.

By virtue of performing the welding of the hemispherical sections and at the same time venting the interior of the container through the opening in the spud to the atmosphere, there is no undesirable pressure build-up within the spherical container. The inwardly turned flanges cooperate with one another to provide a uniform weld without any burn-off or sputtering of welding material into the interior of the container during fabrication. Thus, the interior of the finished container is essentially free from foreign materials.

While we have described a presently preferred embodiment of our invention, it will be understood that the invention is not limited thereto, and it can be embodied within the scope of the following claims.

We claim:

1. A method of manufacturing a spherical container from thin gauge metal comprising the steps of forming hemispherical sections, each having an inturned annular flange at the open end thereof, with an opening in one of said hemispherical sections, the axis of said opening lying perpendicular to the plane of the open end of said one hemispherical section, affixing a spud in said opening such that the axis thereof is perpendicular to the plane of the open end of said one hemispherical section, securing a handle ring to said one hemispherical section concentric to the spud, securing a footring to the other hemispherical section in a plane parallel to the plane of the open end of said other hemispherical section, abutting the inturned annular flanges at the open ends of the hemispherical sections, centering said other hemispherical section prior to joinder by means of the footring and centering said one section prior to joinder by means of the spud, whereby the inturned flanges abut one another substantially about the entire peripheries thereof, and joining the hemispherical sections to form a spherical container open to the atmosphere only through the spud.

2. The method of claim **1** including the steps of forming the internal flanges such that the exterior surfaces thereof lie in the plane of the open end and abutting the hemispherical sections with the exterior surfaces of the internal flanges being in engagement substantially about the entire peripheries thereof.

3. The method of claim **2** including the step of welding the hemispherical sections in the region of abutment of the hemispherical sections while venting the interior of the spherical container through the spud to permit release of pressure from within the spherical container.

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U.S. Cl. X.R.

29—471.1; 113—120