ELECTRICALLY WELDED HIGH PRESSURE GAS CONTAINER

Filed Jan. 15, 1930

FIG. 1.

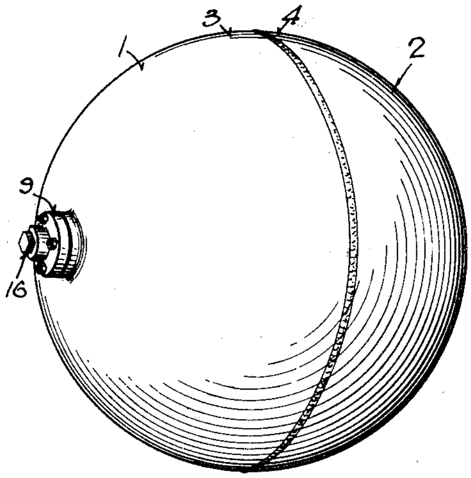


FIG. 2.

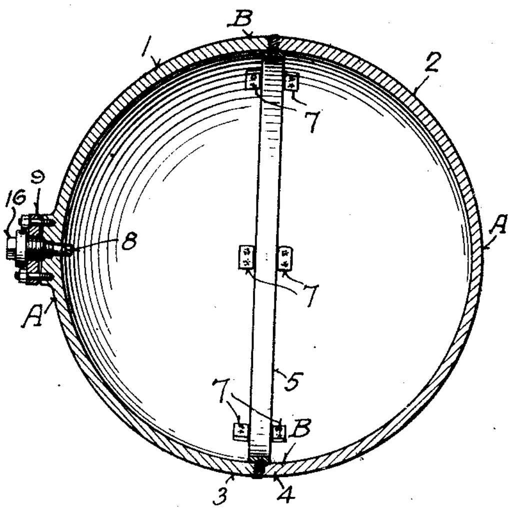


FIG. 3.

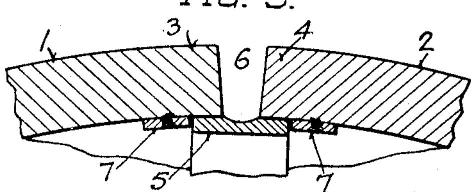


FIG. 4.

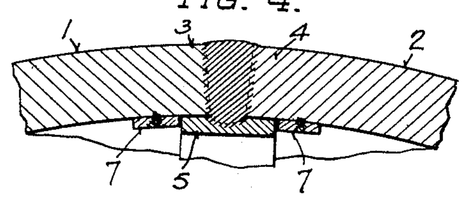
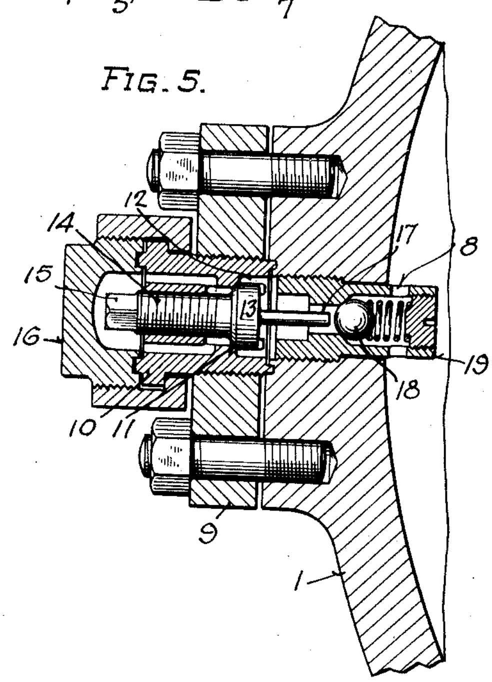


FIG. 5.



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Patented July 10, 1934 1,966,241

UNITED STATES PATENT OFFICE

1,966,241

ELECTRICALLY WELDED HIGH PRESSURE GAS CONTAINER

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Application January 15, 1930, Serial No. 421,012

5 Claims. (Cl. 220—3)

This invention relates to an electrically welded high pressure gas container.

The container is particularly adapted for the transportation, under high pressures, of relatively light gases such as helium, as set forth in my copending application, Serial No. 374,713.

The object of the invention is to provide a container which will withstand the high pressures required more safely.

Another object is to provide a high pressure gas container which has a greater capacity per unit weight of metal, giving consideration to the increased capacity due to greater gas pressures employed, and which is simple in construction and more economical to manufacture.

According to the invention, the container is an integral metal sphere formed from two hemispheres welded together at their meeting circumferential edges, the hemispheres having a wall thickness which gradually increases from the centers or common axis to the outer peripheral welded edges of the hemispheres.

The invention may be more readily understood in its various features by reference to the accompanying drawing in which:

Figure 1 is a perspective view of a container embodying the invention.

Fig. 2 is a vertical central section through the container.

Fig. 3 is an enlarged detail transverse section of the parts arranged for welding.

Fig. 4 is a similar section showing the finished weld.

Fig. 5 is an enlarged section of the valve and connections for the container.

The container is substantially spherical and is preferably constructed of a high tensile strength steel, such as chrome vanadium alloy steel, which will provide a more economical manufacture, having consideration for the required strength, capacity and weight of the tank.

The container is particularly adapted to the storage and transportation of light gases, such as helium, under relatively high pressures, as 2,000 or more pounds per square inch. When constructed for use on tank cars such as that illustrated in my copending application above referred to, the containers are approximately seven feet in diameter and have a minimum wall thickness approximating one and one-half inches.

Heretofore, containers for high pressure transportation of gases have been forged from a single steel ingot into cylindrical shaped vessels. However, the great wall thickness required in the cylindrical shaped vessels in order to withstand the high pressures employed makes the use of such forged vessels expensive and almost prohibitive in the case of transporting light gases, such as helium.

The present invention adapts the spherical tank construction to the transportation of helium under high pressure and thereby provides an economical and safe transportation for this and other valuable gases. The invention of course may be employed in the transportation of other gases and for other purposes.

In the manufacture of the container, two flat plates of metal having a thickness approximating that of the minimum required thickness of the vessel, for example, one and one-half inches, are spun or otherwise pressed into complemental hemispherical shape. The hemispheres 1 and 2 thus formed have a wall thickness approximating that of the original plate at their centers and a gradually increasing wall thickness towards the peripheral edges thereof. Thus where a plate approximating one and one-half inches in thickness is employed, the hemispheres approximate one and one-half inches in thickness at their centers, marked "A" in the drawing, Fig. 2, and approximate about two inches in thickness at the peripheral edges thereof, marked "B" in Fig. 2. This gradual increase in thickness may be readily obtained in the spinning or pressing operation.

The peripheral edges 3 and 4 of the respective hemispheres are then milled or planed so that when the hemispheres are arranged in assembled relation, as shown in Fig. 3, the edges will be in slight angular relationship.

The hemispheres are assembled in such manner that the edges 3 and 4 are in spaced relation and, together with a chill or backing ring 5, form a welding groove 6. The backing ring 5 is preferably provided with a circumferential groove which forms the base of the welding groove and provides a groove of greater depth than the wall thickness of the hemispheres. In order to properly position the chill ring 5 within the sphere and space the edges of the two hemispheres uniformly, it has been found desirable to provide locating lugs 7 on the interior surface of the hemispheres. The locating lugs may be secured to the interior surface in any suitable manner such as by spot welding.

After assembling the hemispheres in the manner above indicated, the edges are welded together preferably by electric arc welding wherein a fusible electrode is employed. The electrode is preferably of a composition such that the weld metal deposited has substantially the same composition as that of the hemispheres.

The welding metal is deposited in layers and the first layer penetrates into the backing or chill ring 5 and integrally unites the same with the edges being welded. The subsequent layers are interfused and substantially fill the welding groove 6. The weld thus produced is substantially 25 to 30% thicker than the required minimum thickness of the vessel and thereby provides a greater margin of safety.

The gradual increase in wall thickness of the hemispheres from the center or pole towards the welded edges and from the minimum required thickness of the vessel to the thickness of the weld provides a more uniform stress condition in the container than would be the case were the weld metal substantially thicker than the metal of the edges of the hemispheres. This is particularly important in the use of these spherical containers on tank cars, such as that shown in my above mentioned copending application, for railway transportation, as it is essential to provide a container having greater safety in case of railway wrecks. On the other hand, it is important from the standpoint of economical transportation of helium to provide a container which has a minimum weight per unit capacity.

The container is provided with a valve controlled inlet and outlet 8, as shown in Fig. 5. The control valve comprises a cap 9 bolted to the sphere and having a screw plug 10. The screw plug 10 has a conical valve seat 11, and a central passage 12 for receiving the valve 13 and valve stem 14. The valve stem 14 is threaded into the plug 10 and is provided with a squared head 15 at its outer end.

A cover 16 normally encloses the outer end of the valve stem 14. During charging or discharging of the fluid contents of the sphere, the cover 16 is removed and a pipe connection having a valve control mechanism, which engages the head 15 of the valve stem, is secured to the plug 10.

The valve 13 has a central pin 17 projecting inwardly therefrom for the purpose of engaging and opening a ball check valve 18 at the time the control valve 13 is opened. This check valve 18 is located in a plug 19 secured in the spherical tank wall and serves as a safety valve in case of injury to the outer control valve mechanism. Thus in a railway wreck the outer control valve mechanism may be entirely broken away from the sphere without allowing the escape of the valuable fluid contents of the sphere, due to the check valve 15 which functions independently of the outer valve to seal the tank outlet.

Various modifications of the invention may be employed within the scope of the following claims.

I claim:

1. A high pressure gas container comprising a metal sphere made up of two hemispheres joined at their circumferential meeting edges by weld metal and having a wall thickness increasing gradually from the minimum required wall thickness at their centers to an excess thickness for welding at their meeting edges.

2. In a high pressure storage tank, in combination, two thick walled hemispherical shells, the walls of the shells being of a predetermined thickness at the apexes sufficient to stand the maximum pressure to be applied and gradually increasing in thickness from the apexes to the bases, and a weld uniting the thick edges of the bases of the hemispherical shells to form a spherical tank.

3. A high pressure storage tank comprising two thick walled hemispherical shells, the walls of the shells being of a predetermined thickness at the apexes sufficient to stand the maximum pressure to be applied and gradually increasing in thickness from the apexes to the bases, a weld uniting the thick edges of the bases of the hemispherical shells to form a spherical tank, one of said shells having an opening at the apex, and a safety valve mounted in said opening.

4. A high pressure storage tank comprising two thick walled hemispherical shells, the walls of the shells being of a predetermined thickness at the apexes sufficient to stand the maximum pressure to be applied and gradually increasing in thickness from the apexes to the bases, a weld uniting the thick edges of the bases of the hemispherical shells to form a spherical container, and a boss formed on one of the shells, said boss having an opening therethrough leading to the interior of the container and a valve mounted in said opening and attached to said boss.

5. A high pressure storage tank comprising two thick walled hemispherical shells, the walls of the shells being of a predetermined thickness at the apexes sufficient to stand the maximum pressure to be applied and gradually increasing in thickness from the apexes to the bases and a weld uniting the thick edges of the bases of the hemispherical shells, a boss formed on one of the shells, the boss having a threaded opening extending therethrough to the interior of the container, and threaded holes extending into it at a distance from said opening, a valve threaded into said opening, and studs engaged in said threaded holes cooperative to retain the valve in position in the threaded opening.

RUDOLPH FURRER.