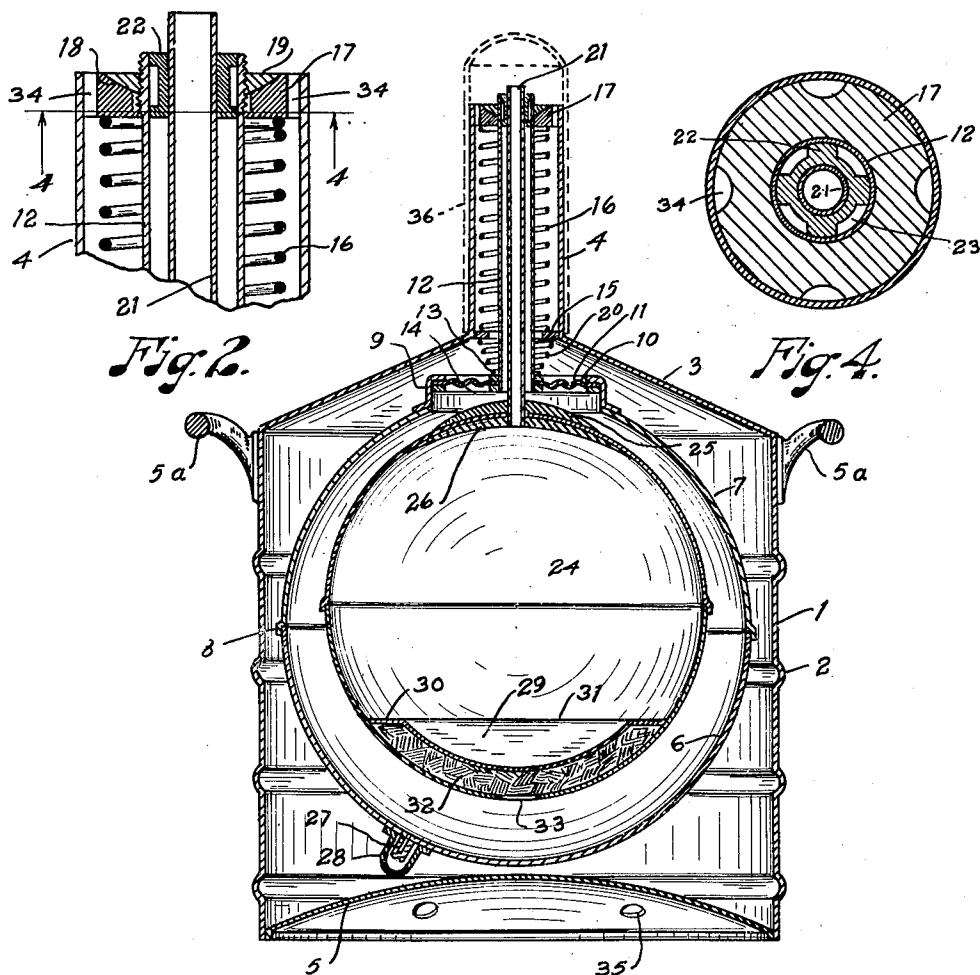
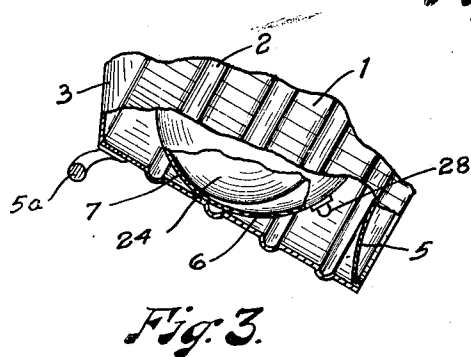


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C. MOTT ET AL
LIQUID OXYGEN CONTAINER
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UNITED STATES PATENT OFFICE.

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MESNE ASSIGNMENTS, TO PUROX COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

LIQUID-OXYGEN CONTAINER.

Application filed January 28, 1924. Serial No. 688,972.

To all whom it may concern:

Be it known that we, CHESTER MOTT and WILLIAM H. MARSHALL, citizens of the United States, residing at Denver, in the
5 county of Denver and State of Colorado, have invented certain new and useful Improvements in Liquid-Oxygen Containers; and we do declare the following to be a full, clear, and exact description of the invention,
10 such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a
15 part of this specification.

This invention relates to improvements in containers for storing and transporting liquid oxygen.

In our co-pending application, Serial No. 667,297, filed October 8, 1922, we have described and claimed a container of the type
20 above referred to. We have found, however, that several minor changes in construction are necessary for the best results and this application is therefore in the nature of an improvement on the construction described
25 and claimed in the application referred to.

Our invention can be best described and will be most readily understood when reference is had to the accompanying drawing in
30 which the preferred embodiment thereof is shown, and in which:

Fig. 1 is a vertical diametrical section of our improved container;

35 Fig. 2 is an enlarged sectional view of the upper end of the neck of the container;

Fig. 3 is a fragmentary view showing the position of the parts while pouring the liquid; and

40 Fig. 4 is a section taken on line 4—4, Fig. 2.

Our container consists of an enclosing casing 1, preferably of cylindrical shape and reinforced by means of circumferential beads
45 or corrugations 2. The top 3 of the casing is conical and has an upwardly extending central neck portion 4. The bottom 5 is preferably upwardly convex, as shown in the drawing. Near the upper end of the
50 cylindrical portion we provide handles 5'. Within the casing, which has been just described, the double walled evacuated container is suspended. This container consists of a spherical outer container formed

from two semispherical portions 6 and 7
55 secured together along an equatorial line 8. The upper portion of part 7 has an opening to which is soldered the ring 9. This ring has its upper edge spun inwardly to form a flange 10, to the underside of which the cor-
60 rugated flexible diaphragm 11 is secured. This diaphragm has a central opening for the reception of the tubular member 12, which is soldered thereto and held in place by rings 13 and 14. A washerlike member
65 15 is secured to the inside of the tubular neck 4 near its junction with the conical top 3. A helical spring 16 has its lower end resting on the upper side of ring 15 and supports a ring 17 which is slidable
70 within member 4 and has a spherically curved inclined portion 18, which supports and cooperates with a similarly curved member 19 that is threadedly connected to the upper end of tube 12. Since the cooperating
75 surfaces of members 17 and 19 are spherical, they are adapted to move relative to each other in any direction so that the outer spherical container may swing in any direction within the casing 1. A conical coil
80 spring 20 extends from the lower surface of ring 15 to the upper surface of member 13. The function of spring 20 is to prevent the upward throw of the parts, which will sometimes happen if the weight of the
85 suspended parts alone are depended upon to hold them down. We consider this is a distinct and valuable improvement over the structure shown in our prior application, where this spring is not present. Secured
90 to the inside of member 12 is a smaller tubular member or pipe 21. This pipe is held in concentric parallel relation with pipe 12 by means of a ferrule or spoollike member
95 22. The lower flange of this member is notched as indicated by numerals 23 in Fig. 4, while the upper flange is soldered to pipe 12. This arrangement holds the two members 12 and 21 in concentric parallel relation. Pipe 21 extends a short distance above
100 the top of member 4 and below the diaphragm 11. To the lower end of pipe 21 the spherical container 24 is secured and held in place by washerlike members 25 and 26, which are sweated to the container and
105 to the pipe. Attention is called to the fact that member 26 is concave on its lower side so as to facilitate draining the liquid from

the container. When the parts are assembled as shown and all joints are properly soldered or sweated, the space between container 24 and the outer container, can be evacuated to a high degree of vacuum. For the purpose of evacuating the space between the walls of the double container, we have provided the outer container with a nipple 27, to which the vacuum pump can be attached. After the vacuum has been formed, the nipple is fused by a suitable flame and forms a seal. The sealed nipple is enclosed in a thimblelike protector 28. It is evident that when the space between the two containers has been evacuated, the pressure of the atmosphere will tend to collapse the outer container and in order to make it as strong as possible to withstand this collapsing pressure, it is made as nearly spherical as possible, as this form offers the greatest resistance to collapsing. The fact that the upper side is cut away and has the ring 9 secured thereto, does not weaken the structure. The inner spherical container is merely subjected to a disruptive strain which merely puts the material under tension and is only subjected to a pressure that tends to collapse it when for any reason the vacuum fails while the inner container contains liquid oxygen. In this case the liquid oxygen will soon evaporate and the air between the walls of the containers will increase in temperature from that of the liquid oxygen to that of the circumambient air. This increase in temperature will produce a corresponding change in volume and this change will take place so fast that the air will not have time to escape through the small leak, with the result that a high pressure is set up between the walls of the two containers. Unless this pressure is relieved, it will either burst the outer container or else collapse the inner one and as the latter causes the smaller damage, the inner container has been so constructed that it will collapse before the outer one bursts.

It is necessary to provide a carbon pocket that communicates with the evacuated space in order to obtain the degree of vacuum desired. This pocket is filled with coconut charcoal which is heated when the space is evacuated so that the occluded gases will be driven off. When the inner container is filled with liquid oxygen, the low temperature causes the charcoal to become a very efficient absorbent of gases, with the result that the vacuum is maintained at a high degree of efficiency.

In the present construction the carbon pocket is placed on the inside of the inner container and is formed by means of a member 29 which has a portion thereof concentric with the container. A flange 30 extends outwardly to the container walls and is soldered thereto along the edge as indi-

cated by numeral 31. This forms a pocket between the outer surface of the patch 29 and the inner surface of the container and this pocket is filled with charcoal 32. An opening 33 is provided in the bottom of the spherical container and this permits the charcoal to be introduced thereto. This opening is covered with wire screen. Other openings may be provided if desired. It is evident that the placing of the carbon pocket on the inside of the inner container does not materially weaken it against internal pressure, as this very seldom exceeds atmospheric pressure, but it does materially weaken it against an outer pressure which tends to collapse it. As a result of this, if a leak should occur and a high pressure should be generated in what is normally the evacuated space, the lower semi-spherical portion of the inner container will collapse, thus preventing serious injury to the other parts.

When liquid oxygen is transported, the inner container 24 will be heavy and will cause the parts to swing about the bearing surface 18 to such an extent that the tubular neck 21 will always hang vertically. The outer container being comparatively light and held in a predetermined relation to the inner container by means of the spool 22 and diaphragm 9, will assume the same period of oscillation as the inner heavy container, with the result that they will never come into contact during shipment or when subjected to the vibrations of ordinary transportation. Since the pipe 21, which forms the neck of the liquid container, is of small diameter, it is evident that liquid will flow out only very slowly, if at all, unless some internal pressure is generated. When it is desired to pour liquid out of the container, the casing 1 is tilted in the manner shown in Fig. 3. When the outer container strikes the inner walls of the casing it will, of course, stop, but the inside container 24 will continue to move as the diaphragm 11 permits the outer container to move relative to the inner one. When the containers come into contact, there will be a rapid transfer of heat and the liquid oxygen will start boiling, thereby producing a pressure that will force the liquid out through the neck in a steady stream. It will be noted that I have provided member 17 with a number of holes 34 and that openings 35 have been provided in the bottom 5. The purpose of these holes is that when the cap 36, shown dotted in Fig. 1, is in place any evaporated oxygen will pass down through the holes 34 and out through holes 35, thereby filling the space about the double container with low temperature gas that increases the thermal efficiency of the container.

In the drawing the inner spherical con-

tainer is shown suspended in a slightly eccentric position with respect to the outer container. This is not an essential feature of the construction and the two spherical containers may be mounted so as to be concentric.

Having now described our invention, what we claim as new is:

1. A vessel for storing and shipping liquefied gases comprising, in combination, an inner container having a long, narrow neck rigidly attached thereto, an outer container surrounding said inner container, said outer container having an opening, a flexible diaphragm secured in said opening, said diaphragm having an opening, a tubular member extending through said diaphragm and rigidly secured thereto, the neck of the inner container extending through the tubular member, a ferrule spacing the tubular member from the neck, said ferrule being connected to said member and neck by an airtight joint, a casing surrounding said containers, said casing having a cylindrical neck portion for the reception of the tubular members secured to the outer containers, a universal joint between said cylindrical neck and the tubular member, resilient means for supporting said universal joint, said means comprising a helical spring, and resilient means comprising a conical shaped coil spring for producing a force tending to move the parts downwardly against the supporting spring.

2. A vessel for storing and shipping liquefied gases comprising, in combination, an inner container having a long, narrow neck rigidly attached thereto, an outer container surrounding said inner container, said outer container having an opening, a flexible diaphragm secured in said opening, said diaphragm having an opening, a tubular member extending through said diaphragm and rigidly secured thereto, the neck of the inner container extending through the tubular

member; a ferrule spacing the tubular member from the neck, said ferrule being connected to said member and neck by an airtight joint, a casing surrounding said containers, said casing having a cylindrical neck portion for the reception of the tubular members secured to the outer containers, a universal joint between said cylindrical neck and the tubular member, resilient means for supporting said universal joint, said means comprising a helical spring, and resilient means comprising a conical shaped coil spring for producing a force tending to move the parts downwardly against the supporting spring.

3. A vessel for storing and shipping liquid oxygen, comprising a casing having an upwardly extending cylindrical neck portion, an inwardly projecting annular flange near the bottom of the neck, a helical coil spring resting on the upper surface of said flange, a doubled-walled evacuated container within said casing, said container having a neck portion extending through the spring, a supporting member resting on the upper end of the spring and slidable within the cylindrical neck of the casing, said supporting member having a spherically curved surface, a ringlike member secured to the upper end of the neck of the container, said last-named member having a spherical surface adapted to cooperate with the corresponding surface of the supporting member to form a universal joint, and a spring surrounding the neck of the container, said last-named spring abutting its upper end against the lower surface of said flange and its lower end against the container.

In testimony whereof we affix our signatures.

CHESTER MOTT.
WILLIAM H. MARSHALL.