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METHOD OF FORMING A CONTAINER FOR HIGH PRESSURE FLUID

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Fig. 1.

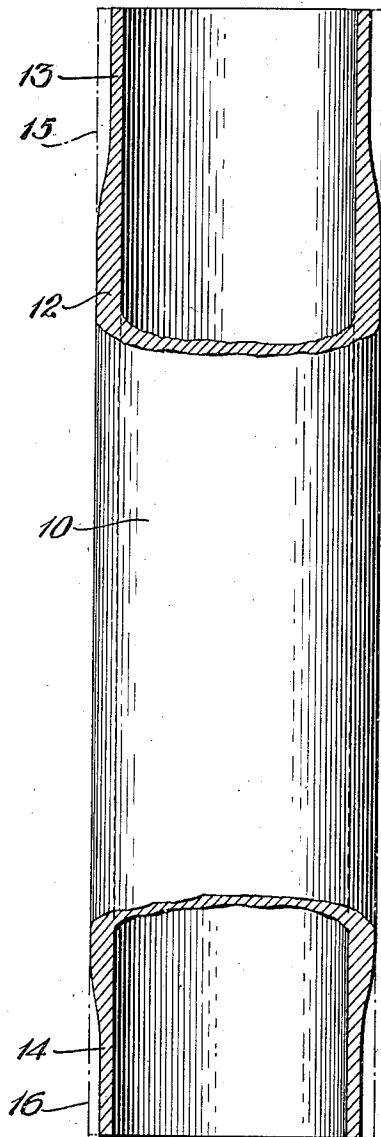
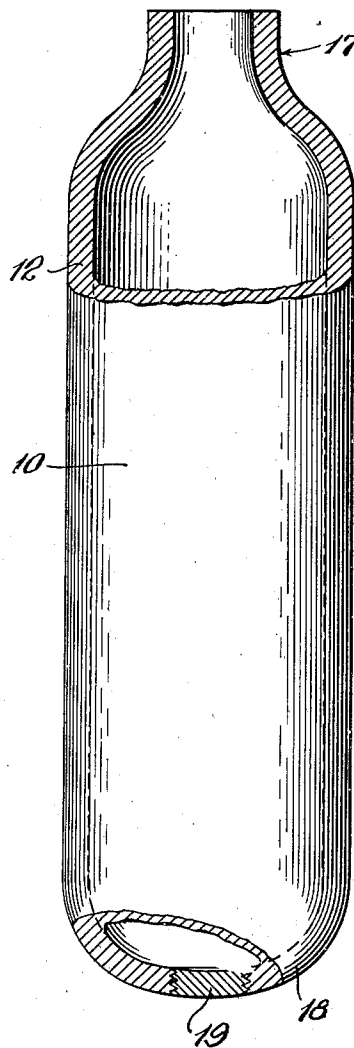


Fig. 2.



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METHOD OF FORMING A CONTAINER FOR
HIGH PRESSURE FLUIDScott E. Allen, Glen Ridge, N. J., assignor to C-O-
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4 Claims. (Cl. 29-148.2)

This invention relates to containers for high pressure fluids, such, for instance, as liquefied carbon dioxide, and has for an object to provide a novel method of making the same.

Containers for high pressure fluids are usually in the form of a metallic cylinder integrally closed at one end and provided at the other end with a constricted neck portion. Heretofore in the manufacture of such containers it has been the practice to form a hollow cup-like cylindrical blank of uniform internal and external diameters and then to constrict the open end portion of the cylindrical blank by a suitable necking-in method, so as to form a neck on the finished cylinder. The inflow of metal during the necking-in operation results in materially thickening the wall of the cylinder neck and the shoulder connecting the neck to the body of the cylinder. Such extra thickness of metal at the shoulder and the neck does not add useful strength to the cylinder. Actually, by reason of the reduced internal diameter of the shoulder and the neck, the total fluid pressure per unit of length acting expansively on the wall of the shoulder and the neck is materially less than that in any other zone in the body of the cylinder.

The principal object of this invention is to provide a method by which such surplusage accumulation of metal may be avoided so as to reduce the weight of the cylinder as a whole. Under certain conditions it is most desirable to keep the weight of the cylinder down to a minimum consistent with safety. Fire extinguishing apparatus employing carbon dioxide as the extinguishing medium is provided not only in fixed installations, but also in portable cylinders which may be readily carried by hand to the immediate vicinity of a fire. Obviously, it is desirable to keep the weight of such portable extinguishers down to a minimum, and even in large cylinders for fixed installation, reduction of weight makes for greater ease in handling. Carbon dioxide cylinders are also installed in airplanes not only to extinguish fire, but also for other purposes. For example, carbon dioxide or other highly compressed fluid is used in some planes to dilate floats, so as to support the plane if it should alight upon water. Manifestly, in airplanes saving of weight is of utmost importance.

I am aware that heretofore surplus metal has been removed from the shoulder and the neck portions of carbon dioxide cylinders by machining the shoulder and the neck internally and externally after the necking-in process. One object of this invention is to provide a method

whereby the removal of surplus metal is effected before the necking-in step, thereby materially reducing the work involved in forming the shoulder and the neck.

Cylinders may be made from open end tubing or from "drawn cups." When they are made from tubing it is necessary to close both ends of the tube in order to form a cylinder. This operation may be performed by spinning or other means common to the art. When cylinders are made from open end cups, it is necessary to close only one end of the cup in order to form a cylinder. It is the object of my invention to provide a method whereby metal, which would subsequently be surplus, in the closed end portions of the cylinder, may be removed before the ends of the tubing or cup are contracted and/or closed, as by spinning.

With these objects and advantages in view I shall now describe my invention in connection with the accompanying drawing which illustrates certain stages of the method, and thereafter the novelty and scope of the invention will be set forth in the claims.

In the drawing:

Figure 1 is an elevation, partly in section, of an open end tubing with the surplus metal removed; and

Fig. 2 is an elevation, partly in section, showing the finished cylinder.

The container or cylinder blank 10 consists of a tubing open at both ends. The internal diameter of this cylinder blank is substantially uniform throughout, and the wall 12 of the main body of the cylinder blank is of substantially uniform thickness. However, the wall thickness of the ends 13 and 14 is reduced, as indicated.

Preferably, I form the cylinder blank 10 from tubing of substantially uniform wall thickness throughout its length, as indicated by the broken lines 15 and 16. Those portions of the tubing which are to form the shoulder and the neck and closed end of the finished container or cylinder are then turned down in a lathe to provide the cylinder blank with ends 13 and 14 of reduced wall thickness. The portion of the reduced end 13 which when turned in forms the neck may be of the same reduced thickness throughout its length and the portion which forms the shoulder when turned in may be of different thickness reduced preferably in proportion to the amount of reduction effected in the cylinder diameter at this point. No special tools are required to reduce the thickness of the wall of the tubing, because the cut is made on the exterior of the

tubing and on a wall that is of cylindrical form.

The reduced end 13 thus formed is then subjected to a necking-in process so as to produce the shoulder and the constricted neck 17 of the finished product, Fig. 2. This may be done in any well known manner, as by swaging or preferably by spinning. As a result of such necking-in operation the final wall thickness of the shoulder and the neck 17 will be much greater than that of the reduced end 13. In fact it may be substantially equal to that of the main body of the cylinder, provided, of course, that the wall thickness of the end 13 in the blank has been properly proportioned to allow for the thickening produced by the necking-in step. If desired, the final wall thickness of the shoulder and the neck 17 may be even less than that of the main body of the cylinder. However, I prefer to obtain substantially the same wall thickness in the neck as in the body of the cylinder, because in cylinders of this type a closure fitting or discharge head is applied to the neck of the cylinder, usually by threading the same into the neck, and it is essential to provide sufficient metal in the neck wall to allow for such a threaded connection. Preferably, the wall of the end 13 is reduced in thickness to such an extent that the wall thickness of the finished neck 17 will at most be no thicker than that of the body portion.

In a similar manner the reduced end 14 is subjected to swaging or spinning to produce the rounded closed end 18 of the finished product, Fig. 2. This spinning operation may be continued until the end 18 is substantially closed which may then be reamed and threaded and closed by a threaded plug 19. If desired, however, the spinning operation may be continued and this end of the cylinder may be entirely closed by fusion spinning or by welding. The amount of metal removed from the end 14 is such that when this end is turned in by spinning or the like the wall of the closed end 18 will be substantially of the same thickness throughout as the wall 12 of the main body of the container.

It is obvious, of course, that the cylinder blank may be produced by other methods than the method herein described, as the reduced ends may be produced by rolling or any other method, and such blanks may be cut from long pieces of tubing reduced at spaced intervals. It is also obvious that the reduction of the wall thickness of the ends may be effected by cutting away metal on the interior of the tubing, though I prefer to remove the surplus metal by making the cut on the exterior as disclosed. It is to be understood that I reserve the right to all such changes as fall within the principle of my invention and the scope of the appended claims.

Having thus described my invention what I claim as new and desire to protect by Letters Patent, is as follows:

1. The method of making a cylindrical metal container of substantially minimum wall thickness to withstand a predetermined high pressure which comprises providing a tubular blank having a central portion of uniform substantially

minimum wall thickness to withstand such pressure and end portions of less or smaller wall thickness and tapering wall portions adjoining the central and end portions, and necking in the thin and tapered portions of one end of said blank to provide a shoulder and neck having a smooth wall portion of substantially the same thickness as the central portion of the blank and reshaping the thin and tapered portions of the other end of the blank to form at least a part of the closed end of the container having a smooth wall portion of substantially the same thickness as the central portion of the blank.

2. The method of making a cylindrical metal container of substantially minimum wall thickness to withstand a predetermined high pressure which comprises providing a tubular blank of the same interior diameter throughout its length and having a central portion of uniform substantially minimum wall thickness to withstand such pressure and end portions of less or smaller wall thickness and tapering wall portions adjoining the central and end portions, and necking in the thin and tapered portions of one end of said blank to provide a shoulder and neck having a smooth wall portion of substantially the same thickness as the central portion of the blank and reshaping the thin and tapered portions of the other end of the blank to form at least a part of the closed end of the container having a smooth wall portion of substantially the same thickness as the central portion of the blank.

3. The method of making an end of a cylindrical metal container having a body and end of substantially minimum wall thickness to withstand a predetermined high pressure which comprises providing a tubular blank having a body portion of uniform substantially minimum wall thickness to withstand such pressure with an end portion of less or smaller wall thickness and a tapering wall portion adjoining the body and end portions and reducing the diameters and increasing the wall thicknesses of the thin and tapered portions of the blank to form at least a part of an end of the container having a smooth wall portion of substantially the same thickness as the body portion of the blank.

4. The method of making an end of a cylindrical metal container having a body and end of substantially minimum wall thickness to withstand a predetermined high pressure which comprises providing a tubular blank having a body portion of uniform substantially minimum wall thickness to withstand such pressure with an end portion of less or smaller wall thickness and a tapering wall portion adjoining the body and end portions all of the same interior diameters, and reducing the diameters and increasing the wall thicknesses of the thin and tapered portions of the blank to form at least a part of the end of the container having a smooth wall portion of substantially the same thickness as the body portion of the blank.

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