May 11, 1937. P. C. McABEE 2,079,769

DRY ICE CONVERTER

Filed July 27, 1933

Fig. 1

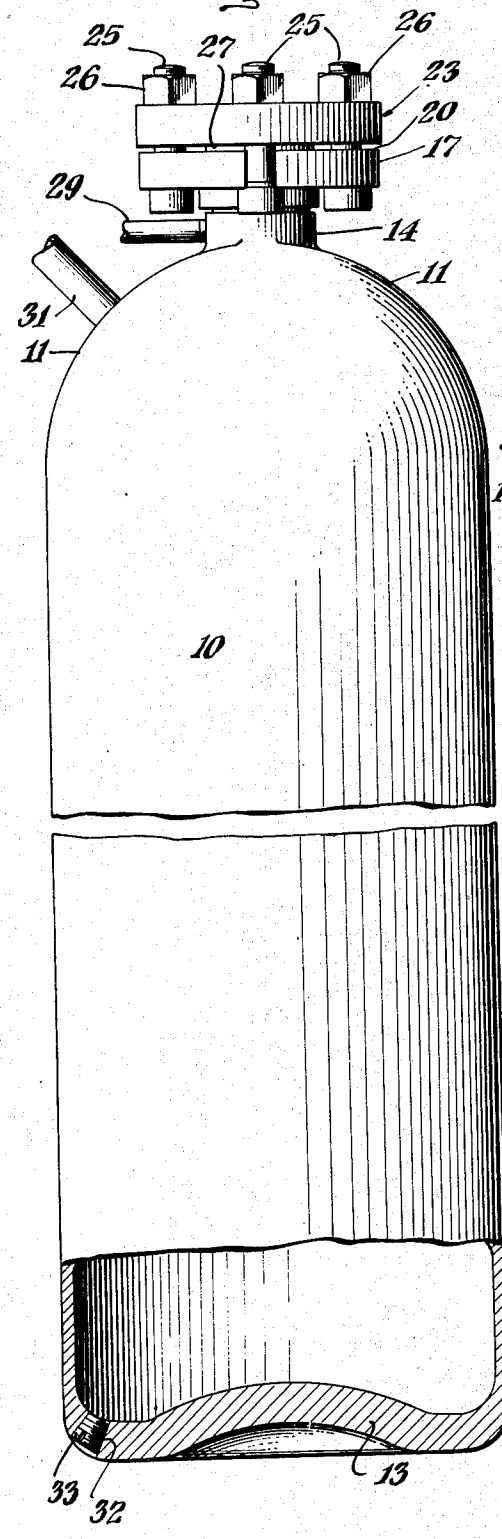
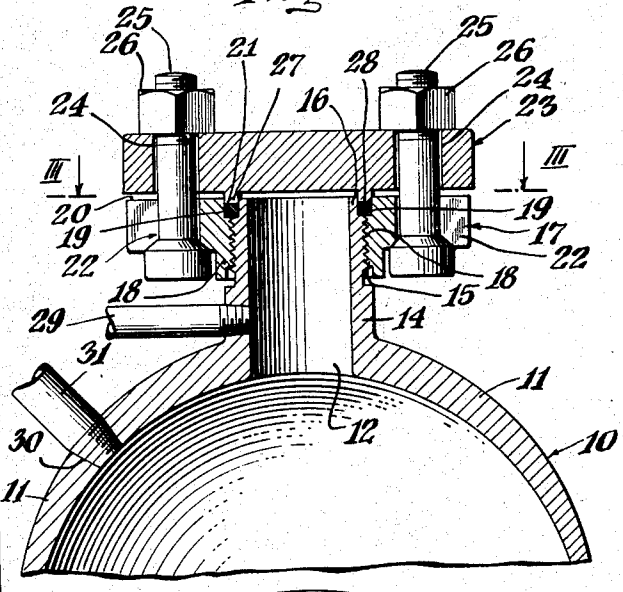


Fig. 2



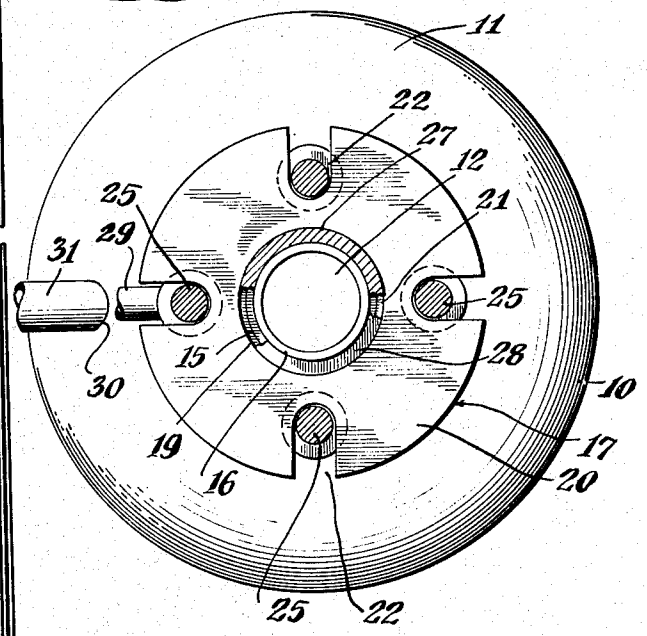


Fig. 3

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DRY ICE CONVERTER

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Application July 27, 1933, Serial No. 682,404

2 Claims. (Cl. 220—3)

This invention relates to containers for converting a solid into a liquid or a gas and more particularly to containers for converting solid carbon dioxide into liquid or gaseous form.

Containers heretofore used in connection with carbon dioxide have generally fallen into two classes. In one class, a solid forged container is closed at one end and is drawn at the other end to a small neck; and liquefied carbon dioxide is charged through this neck into the container. In containers of the second class there is little or no reduction in section at the open end in order that solid blocks of carbon dioxide may be charged into the cylinder; and accordingly a sizable cap must be fastened upon this opening to close the container. With containers of the first class it is practically impossible to employ carbon dioxide in the solid form and liquid carbon dioxide, which is more expensive, must be used. Containers of the second class require special provision for taking care of the exceedingly high pressures on the cap or closure because of the large area presented by the cap to the pressure within the container. According to the present invention the end of the container is reduced to a neck of sufficient size to permit insertion of suitable particles of solid carbon dioxide but of sufficiently small size to prevent great pressures upon the closure.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which

Figure 1 is an elevation of a container constructed in accordance with the invention, the lower part of the container being shown in section,

Figure 2 is a partial vertical section through the container illustrated in Figure 1, and

Figure 3 is a horizontal section on the line III—III of Figure 2.

In the following description and claims various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawing.

In the drawing accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now more particularly to the drawing, it will be seen that it shows a container 10 having a shoulder 11 at one end and an opening 12 in the shouldered end. The opening 12 is of sufficient size to permit insertion of solid particles of the material to be converted, for instance, carbon dioxide.

The container may be a forged cylinder, with a closed end 13, the cylinder being formed in the usual way, except for the construction at the opening 12. In other words, the cylinder may be constructed in substantially the same manner and have substantially the same dimensions as an ordinary liquid carbon dioxide flask. For example, an ordinary commercial liquid carbon dioxide flask, in one commercial size, is about fifty inches high and about eight inches in diameter.

It is preferred to make the opening 12 at least two inches in diameter in order that particles of the solid may be conveniently projected through it into the cylinder. However, it is not desired to limit the invention to any particular size of opening or other dimensions so long as the stated purpose is realized.

In order that the opening 12 in the cylinder 10 may be conveniently closed, it is preferred to extend the material of which the cylinder is formed into an integral nipple 14, which is externally threaded as at 15. An external annular contraction 16 is formed at the outer end of the nipple 14 beyond the threads, for a purpose which will later be described.

An internally threaded flange 17 is provided, the threads 18 thereon being of a size to permit screwing the flange 17 upon the nipple 14. An interior annular contraction 19 is formed beyond the threads 18 on the flange 17 contiguous with the face 20 of the flange. When the flange 17 is screwed upon the nipple 14, the annular contraction 19 thereof registers with the annular contraction 16 on the nipple 14, thereby providing an outer annular groove 21 on the container.

In addition to being screwed onto the threads 15 in the nipple 14, the flange 17 may be shrunk onto the nipple. The flange 17 is provided with bolt holes 22, which as here shown comprise recesses extending radially toward the center of the flange.

A cap or cover 23 is provided for closing the opening 12 at the end of the nipple 14. This cap has bolt boles 24 therein which are registerable

with the bolt holes 22 in the flange 17. Accordingly, bolts 25, passing through bolt holes 22 and 24 may be drawn tight by means of nuts 26 to press the cap 23 upon the flange 17 and the end of the nipple 14.

It is preferred to provide an annular projection 27 upon the face of the cap 23 which is positioned nearest the flange 17, this annular projection being of a size to fit into the annular groove 21. A ring-shaped gasket 28 is formed to fit into the annular groove 21, so that when the nuts 26 are tightened on the bolts 25 and the cap 23 is drawn toward the flange 17, the annular projection 27 will bear upon the gasket 28 forming a gas seal for the opening 12 at the end of the container.

While the nipple 14 may be made of sufficient length to provide a suitable area for tapping openings therein for the insertion of all outlets to the container, it is preferred to position only one outlet in the nipple 14, that is to say, a pipe 29 which may be connected to a gauge or safety valve (not shown). An opening 30 may be tapped in the shouldered end of the container into which a pipe 31 may be screwed for withdrawing gas from the upper part of the container. Furthermore, a second opening 32 may be tapped in the lower part or closed end 13 of the container for withdrawing liquid from the container. As here shown the opening 32 is closed by a plug 33 having a kerf therein for screwing the plug into or out of the container wall.

In order to use the container, the standard cake of the solid, for instance carbon dioxide, is broken up with a hammer or in any other convenient manner, into pieces which will pass through the opening 12 in the container. These pieces are then placed in the container, a funnel being inserted in the nipple end to facilitate the operation if necessary.

The size and capacity of the container being known and the size of the standard block, which is broken up, also being known, the proper amount of solid can easily be charged into the container. When the temperature of the solid pieces is raised within the container by absorption of heat from the atmosphere, the phase of the solid will be changed and where carbon dioxide is being used, both a liquid and a gas will be formed in the container. Obviously the liquid will occupy the lower end of the container, whereas the gas will fill the upper end. The liquid and the gas may be withdrawn from the container for use through the means already described. Clearly it will be possible to extend the pipe 31 to the lower part of the container and siphon liquid off through this pipe in a manner too well known to require illustration.

A container formed in accordance with the invention has marked advantages over other containers now known in the art, in that solid material such as carbon dioxide may be broken up and charged into the container with ease, while all of the advantages of a small opening may be realized. It is not necessary to place an entire block of commercial carbon dioxide in this container nor need the end of the container be of sufficient size to permit passage of the quarter block now commonly placed in such containers. On the other hand the opening is not of the small size which requires that the more expensive liquid carbon dioxide be charged into the container.

Furthermore it will be apparent that the converter comprehended by the invention may be made having all the desirable features of a standard liquid carbon dioxide cylinder. In addition I provide an opening sufficiently large for easy insertion of crystallized or solid carbon dioxide which may be closed by gas tight fittings without appreciable reduction in the safety factor.

Moreover, the additional features can be had at very small expense as the cylinder may be drawn from solid material in the usual manner and the regular patterns, forms, dies, hammers and other equipment now used in the manufacture of ordinary types of cylinders may be utilized.

The dome top of the cylinder may be drawn originally to a size having an opening sufficiently large for insertion of solid carbon dioxide or it may be drawn in the manner ordinarily followed in making the standard liquid carbon dioxide cylinder and then the opening enlarged. In either case my novel fittings may be adapted and are of such design as to add materially to the strength of the converter at those places where rupture may otherwise be expected.

Having made available such a converter the excessive costs entailed in transportation of heavy steel cylinders, as is commonly necessary where liquid carbon dioxide only is used, may be avoided.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A container for converting a solid into a liquid or a gas comprising a forged cylinder having a shoulder at one end thereof, an externally threaded nipple in integral continuation of the shoulder having an external annular contraction at its outer end, an internally threaded flange screwed on said nipple, said flange having bolt holes therein, said flange also having an interior annular contraction contiguous with one face thereof to register with the contraction in said nipple when said flange is screwed thereon, and a cap having bolt holes therein registerable with the bolt holes in said flange, said cap serving to close the outer end of said nipple, in combination with an annular projection on one face of said cap, constructed and arranged to fit into the annular space provided by the contraction on said nipple and the contraction on said flange, and a gasket in the annular space formed by the contractions on said nipple and said flange, against which said projection bears to form a gas seal.

2. A carbon dioxide converter comprising a forged cylinder having a reduced end merging into a nipple formed with external threads and having an opening communicating with the interior of the cylinder, a collar formed with internal threads and screwed onto said nipple, adjacent portions of said nipple and collar defining an annular recess adjacent the end of said threads, an annular washer seated in said recess, a cap, means for securing said cap in position closing said nipple, and an annular projection formed on said cap and entering said recess to compress said washer against the sides of said recess for sealing the joint between said cap and said cylinder.

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