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METHOD AND APPARATUS FOR PRODUCING CARBON DIOXIDE SNOW

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Fig. 1.

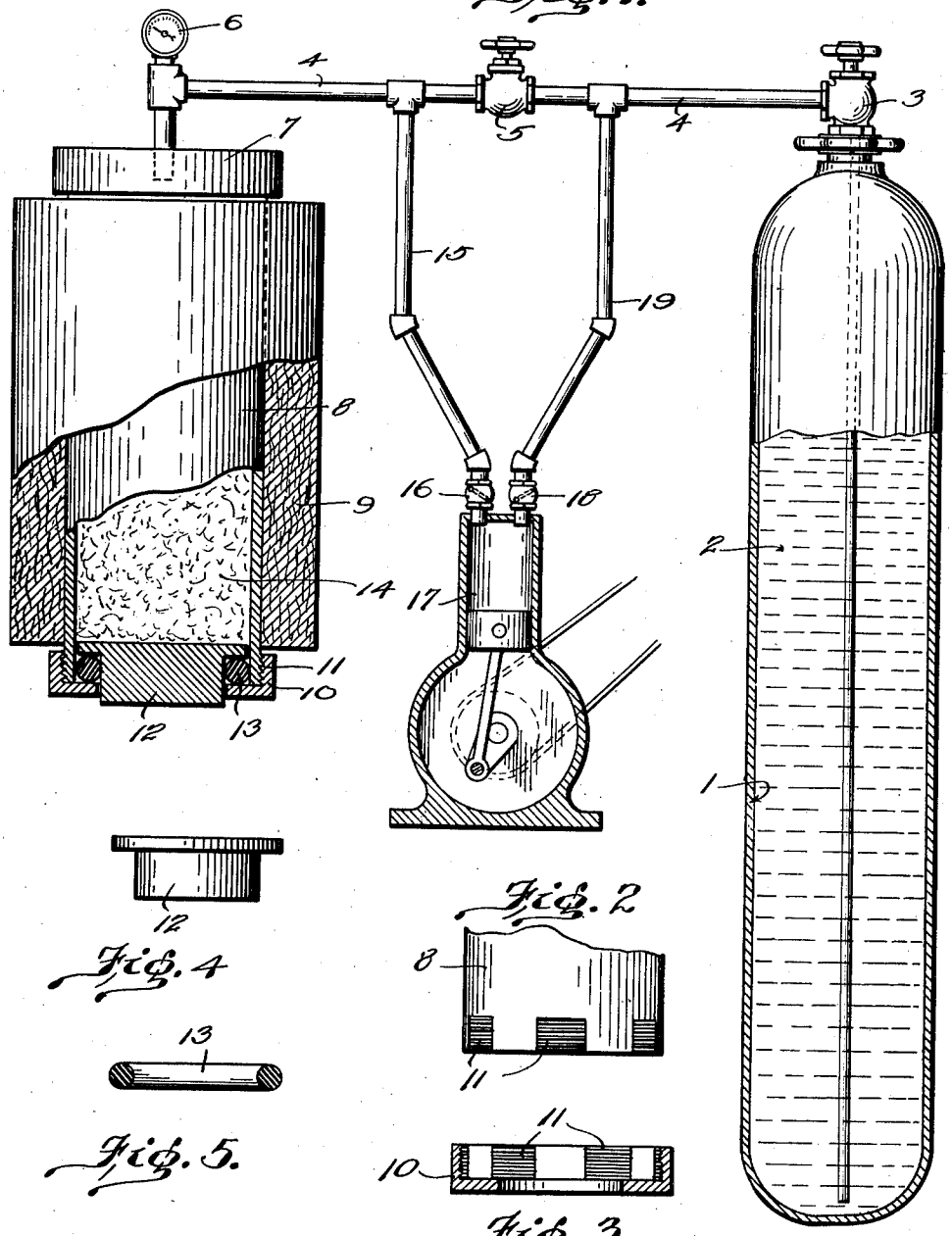


Fig. 4.

Fig. 5.

Fig. 2.

Fig. 3.

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METHOD AND APPARATUS FOR PRODUCING CARBON DIOXIDE SNOW.

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To all whom it may concern:

Be it known that I, THOMAS B. SLATE, a citizen of the United States, residing in New York city, in the county of New York and State of New York, have invented a new and useful Method and Apparatus for Producing Carbon Dioxide Snow, of which the following is a specification.

This application is a division of my copending application, Serial No. 685,482, filed January 10, 1924. My object is to produce carbon dioxide snow for refrigeration and other purposes by a novel method, and to provide suitable and novel apparatus for carrying out the invention. One form of suitable apparatus is illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view, partly in elevation and partly in section, of my apparatus for producing carbon dioxide snow;

Fig. 2 is a detailed side elevation of the lower end of the refrigerator shell 8;

Fig. 3 is a detailed sectional view of removable cap 10;

Fig. 4 is a detailed side elevation of plug 12; and

Fig. 5 is a detailed sectional view of resilient ring 13.

Like characters of reference indicate like parts throughout the several views.

Referring to the accompanying drawings, I provide a conventional tank or container 1 of liquid carbon dioxide 2 under high pressure, the container 1 being provided with the conventional release valve 3. The element 1 is to be understood as representing any suitable source of supply of liquid carbon dioxide and not merely a particular form of container. Element 1 may, for example, consist of a manufacturing plant by means of which liquid carbon dioxide is produced. Such a manufacturing plant will include a suitable conventional heat exchanger to condense the surplus carbon dioxide gas, which has not been refrigerated to snow, to a liquid for delivery again through my pipe 4 to the converting chamber. The heat exchanger referred to is a machine of conventional type and is not illustrated or claimed as novel.

Opening out of valve 3, I provide a pipe 4 in communication with the source of supply 1, leading through valve 5 and discharging through top 7 into refrigerator shell 8, which at its lower end is provided with a closure plug 12, quick-detachable cap 10, and interposed resilient ring 13. Cap 10 and shell 8 are threaded in a similar manner, preferably at spaced portions, permitting of quick application or removal of cap 10 and plug 12.

I provide a compressor 17, with a suction pipe 15, leading from supply pipe 4 on the discharge side of valve 5, through check valve 16 to compressor 17 and out through check valve 18 and pipe 19 to supply pipe 4 on the supply side of valve 5.

To operate my invention, compressor 17 is started and valve 5 opened. This allows a complete circuit through suction pipe 15, check valve 16, compressor 17, check valve 18, discharge pipe 19, and through valve 5 back to pipe 15. The valve is then opened, allowing the pressure of liquid carbon dioxide from the source of supply 1 to cause the liquid carbon dioxide to flow through pipe 4 into refrigerator chamber 8. When the pressure gauge 6 registers a pressure that would indicate liquid in chamber 8 at the temperature of the chamber, the valve 5 is closed. The closing of valve 5 starts the compressor to pumping from chamber 8 back to the source of supply, through pipe 15, check valve 16, compressor 17, check valve 18, and pipe 19, to pipe 4 on the supply side, which is cut off from chamber 8 by means of valve 5. The carbon dioxide gas thus returned to the source of supply 1, when that source of supply is a manufacturing plant, is condensed to a liquid by a suitable heat exchanger. The operation above described is repeated and the walls of chamber 8 become so cold from the previous filling and refrigeration that any gas that may enter the chamber is liquefied. As soon as the gauge 6 registers atmospheric pressure, the liquid carbon dioxide in chamber 8 has vaporized until the latent heat of vaporization has turned a portion of the liquid to ice or snow. As it turns to snow, the pressure may be completely removed and the carbon dioxide will remain a solid to be handled and used as the operator may choose. The carbon dioxide snow, as it thus comes from the refrigerating chamber, is porous and light, but is then compressed by any suitable apparatus into dense cakes of any convenient size to fit the requirements of the trade.

The terms, "carbon dioxide snow" or

"snow" are to be construed as referring to the product, whether in its porous or in its compressed form.

What I claim is:

1. The method of making carbon dioxide snow, consisting in conducting liquid carbon dioxide into a chamber while maintaining the pressure on the liquid, reducing the pressure in the chamber and withdrawing the free gas from said chamber, whereby to convert a portion of the liquid carbon dioxide into carbon dioxide snow.

2. In a method of making carbon dioxide snow, the process of conducting liquid carbon dioxide into a chamber while maintaining the pressure on the liquid, reducing the pressure in the chamber and withdrawing the free gas therefrom, and successively repeating the aforesaid steps and thereby applying the low temperature of each refrigeration to the succeeding refrigeration to cause the carbon dioxide to remain liquid at low pressure.

3. In an apparatus for making carbon dioxide snow, the combination of a closed pressure chamber, a source of supply of liquid carbon dioxide under pressure, means for supplying liquid carbon dioxide to said closed chamber, and valve-controlled means for reducing the pressure in said chamber and withdrawing the free gas therefrom while retaining the snow in the closed chamber.

4. In an apparatus for making carbon dioxide snow, the combination of a closed pressure chamber, means for filling said chamber with liquid carbon dioxide, valve-controlled means for the release of pressure and for withdrawing free gas from said chamber, and a compressor in operative communication with the last-named means to return the gas to the source of supply.

5. In an apparatus of the class described, the combination of a source of supply of liquid carbon dioxide, an insulated container, a conduit extending from the source of supply of liquid carbon dioxide to the insulated container, a valve in said conduit, a compressor, a second conduit communicating between the first-named conduit at the container side of said valve and the compressor and affording a passage to the compressor, a third conduit extending from the compressor to the first named conduit at the supply side of said valve, and check valves in each of said conduits.

6. In combination with the apparatus described in claim 5, the insulated container having an open end, and detachable closure means for the open end of said container adapted to tightly seal the container and withstand the high pressure from within the container necessary to retain liquid carbon dioxide in its liquid state.

7. In combination with the apparatus described in claim 5, the insulated container having an open end, said end having spaced threaded portions, a cap having correspondingly threaded portions correspondingly spaced to permit of quick removal and replacement on the end of the insulated container, a plug slidably seatable in the open end of the insulated container, and a resilient ring interposed between the plug and the cap member for effecting an airtight joint when pressure is exerted on the plug from within the container.

THOMAS B. SLATE.