April 19, 1927. 1,625,712

V. CREMIEU

APPARATUS FOR COOLING BY THE EXPANSION OF GASES

Filed Jan. 9, 1926

Fig. 1

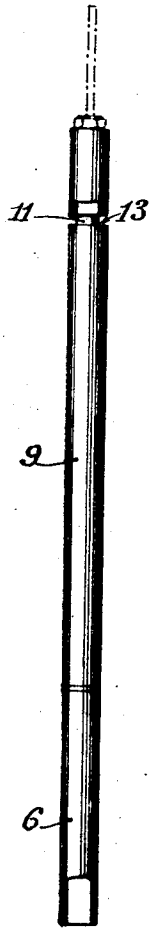


Fig. 2

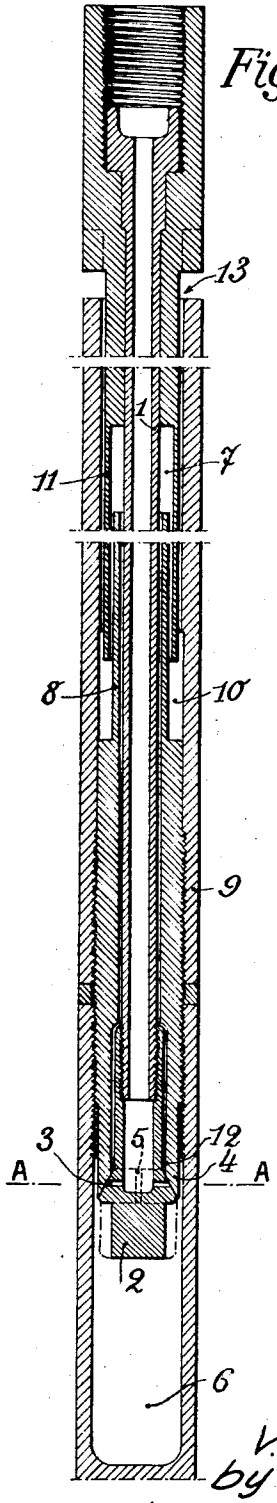
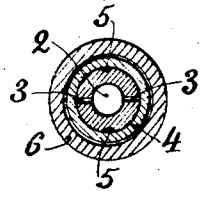


Fig. 3



Inventor
V. Cremieu
by Lanpher, Parry, Hard & Lanpher
Attys

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VICTOR CREMIEU, OF COLOMBIERES-SUR-ORB, FRANCE.

APPARATUS FOR COOLING BY THE EXPANSION OF GASES.

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The present invention has for its object an apparatus for producing the expansion of compressed or liquified gases in the midst of a liquid, whereby all the heat in the operation will be withdrawn from the said liquid, and the latter will be thus cooled.

In all the known devices which are based upon the use of carbonic acid snow, the compressed CO_2 must be supplied in the liquid state to the apparatus in which the snow is produced, so that the tubes containing the liquefied gas must be placed in the horizontal position or must be fitted with immerged tubes. Furthermore, their use is attended with a very low efficiency in countries in which the ordinary temperature exceeds the critical temperature of CO_2 or 31 degrees centigrade.

My said apparatus serves to raise the temperature of the compressed gas to a point near the critical point of the gas, before the latter is allowed to expand.

Numerous gases may be employed for this purpose, but in practice, and chiefly when the question relates to the cooling of food products, it is preferable as a rule to employ either pure carbonic anhydride in the case in which the room temperature exceeds 31 degrees C. which is the critical temperature of the gas, or suitably proportioned mixtures of carbonic anhydride and air, in the case in which the room temperature is below 31 degrees C. The proportion of air may attain 20 per cent of the volume of CO_2.

The critical temperature of such mixtures is in fact from 16 to 28 degrees C. Furthermore, when these mixtures are compressed they will depart sufficiently from the law of Boyle and Mariotte, in order that one may compress in the usual gas cylinders—tested to 250 atmospheres—suitable quantities of gas which when expanded will produce quantities of cold which equal or even exceed the quantities corresponding to the weight of the pure liquefied CO_2 usually contained in such cylinders. On the other hand, the pressure in said cylinders does not exceed 120 atmospheres, so that it remains within the proper limits of safety.

A form of construction of the expansion and cold-producing apparatus according to the invention is shown by way of example in the appended drawings.

Fig. 1 is an elevational view of the apparatus, and

Fig. 2 is a lengthwise section of the same on a larger scale.

Fig. 3 is a cross section on the line A—A of Fig. 2.

The said apparatus comprises a tube 1 which is connected with a compressed gas recipient, not shown, and has at the end the tapered seating 2, having formed therein the holes 3.

The said holes communicate with the very narrow space between the male tapered seating 2 and a female seating 4 having a like angle.

The female seating 4 is formed in a tube comprising a lower expansion chamber 6 which communicates through the narrow grooves 5 in the seating 2 (Fig. 3) with the upper part of the said tube which consists of the two concentric cylinders 8 and 9.

Upon the tube 1 is fitted a cylindrical member 11 which is engaged between the two cylinders 8 and 9.

The tubes 8 and 9 are slidable without friction, but with a very small play, upon the member 11. The apparatus is suspended from the tube 1, so that the tube portion 6, 8, 9 is allowed to rise, the weight of the latter serves to maintain the seating 4 upon the stationary seating 2.

For the operation of the said apparatus, it is immersed in the liquid to be cooled, and the cock or valve (not shown) of the gas cylinder is opened.

A certain amount of gas will at once enter the chamber 6, and a high pressure is thus produced, this being below the pressure in the gas recipient but sufficient to press the female seating 4 strongly against the male seating 2, so that the space next the holes 3 will allow but a very small quantity of gas to escape.

As concerns the gas in the chamber 6, it is discharged into the chamber 7 and into the atmosphere, thus passing through the grooves 5 and proceeding through 12—7—10—13.

The apparatus will operate as long as the valve of the gas vessel remains open. The liquid is strongly cooled, and ice will soon form upon the walls of the tube 6—9.

It is preferable to agitate the apparatus in the liquid so that the ice will be melted as fast as it is formed.

In fact, should a homogeneous layer of ice be allowed to accumulate, this will form a sheet-protecting layer between the liquid

to be cooled and the interior of the cooling apparatus, thus acting against the cooling effect and reducing the cooling efficiency of the expanded gas.

The said apparatus will also operate when the compressed gas is at a few degrees below the critical temperature, but it now acts by successive impulses, each impulse corresponding to the ebullition—in the holes 3—of the quantity of gas which has liquefied at the lower part of the supply tube 1. This liquefaction is due to the fact that during the first few moments of the expansion, there is a very intense cooling of the end of the tube 1, which is sufficient to cause the condensation of the gas, the latter being near its critical temperature.

Having thus described my process and apparatus, what I claim as new therein, and my own invention, is:

1. An apparatus for the production of cold by the expansion of compressed gas, comprising a stationary supply tube adapted for connection with a source of compressed gas, a tapered seating provided at the end of said tube, a stationary tube surrounding the said supply tube upon a portion of its length and a slidable element comprising an internal tube which is slidable with a slight play in the space between the two stationary tubes, said internal tube having a tapered seating cooperating with the said seating of the first-mentioned stationary tube, a closed chamber surrounding this last-mentioned seating, and an external tube slidable with a slight play upon the second stationary tube, narrow channels being formed through the wall of the said seating of the first-mentioned stationary tube, other narrow channels being formed upon the tapered surface of the said seating, said channels serving for the flow of the gas contained in the first-mentioned stationary tube into the space between said tube and the internal tube of the said movable element.

2. An apparatus for the production of cold by the expansion of compressed gas, comprising a stationary element consisting of two vertical and concentric stationary tubes which are connected together at the upper part, the internal tube being longer than the external tube and having a stationary tapered enlarged part, narrow channels being formed in the said enlarged part for the flow of gas and a movable element consisting of two vertical concentric tubes which are secured together at the lower part, the internal tube being slidable with a slight play between the said stationary tubes, the external tube slidable with a slight play upon the external stationary tube, the said internal movable tube having at the lower end a seating adapted to fit upon the said stationary enlarged part, and a closed chamber surrounding the said enlarged part, the said apparatus being adapted for immersion in a liquid to be cooled and for connection by means of its stationary elements to a source of compressed gas.

In testimony whereof I have hereunto affixed my signature.

VICTOR CREMIEU.