(No Model.) 2 Sheets—Sheet 1.

J. BOUCHARD.

ICE MACHINE.

No. 319,551. Patented June 9, 1885.

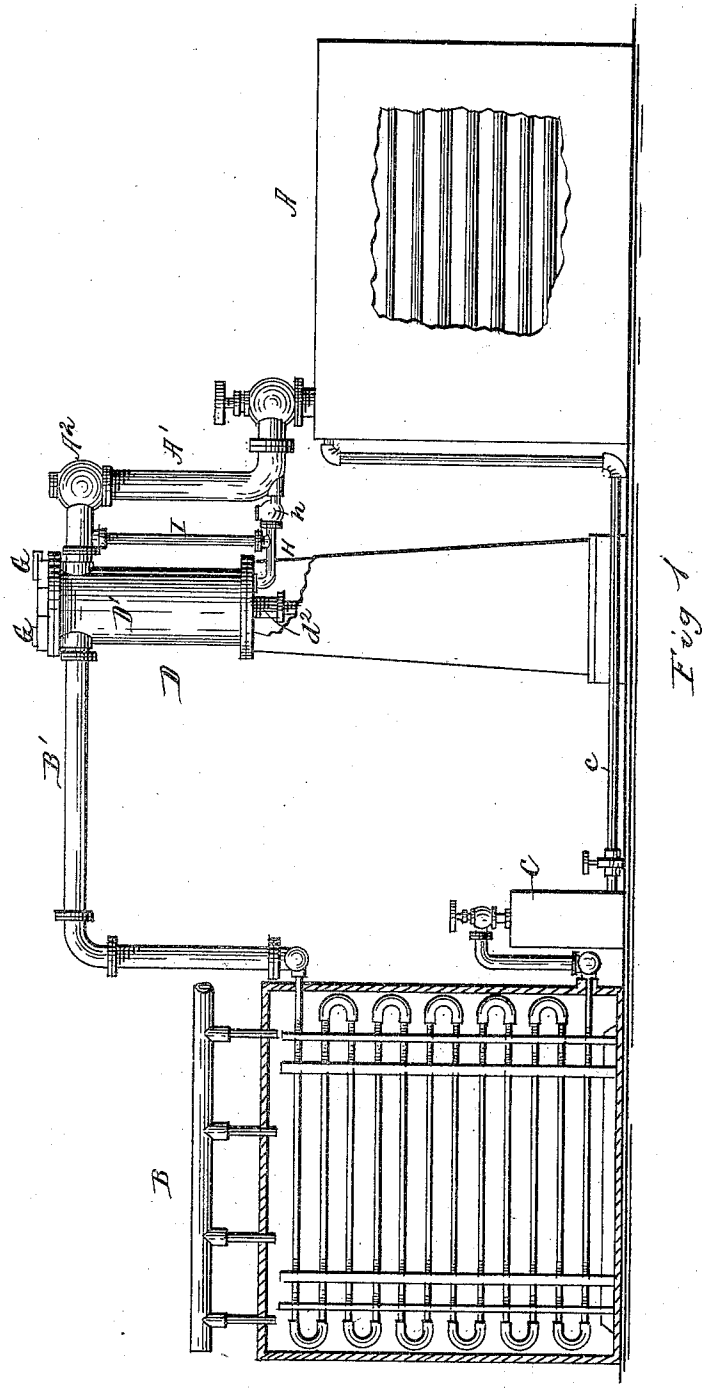


Fig. 1.

Witnesses
W. C. Coales
P. E. Remann.

Inventor
John Bouchard
By Coburn & Thacher
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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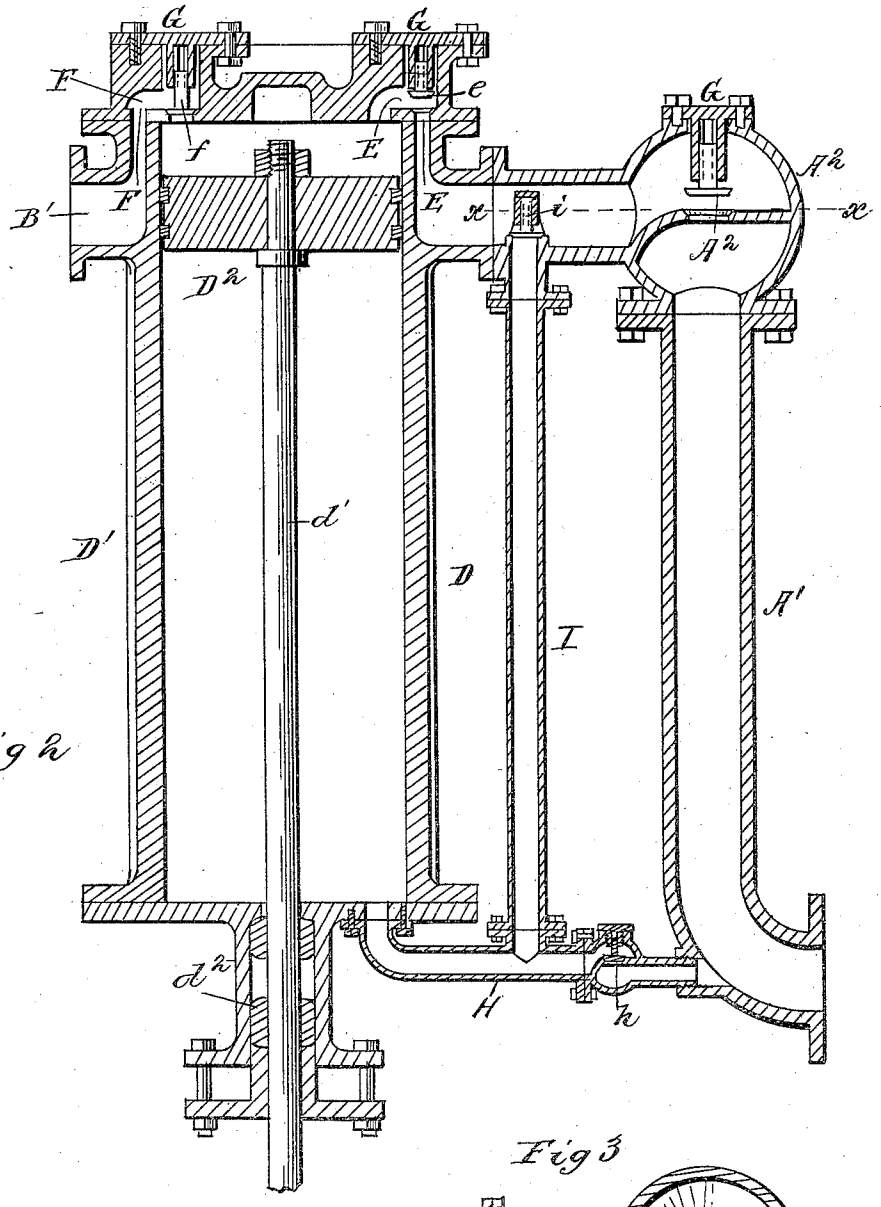


Fig 2

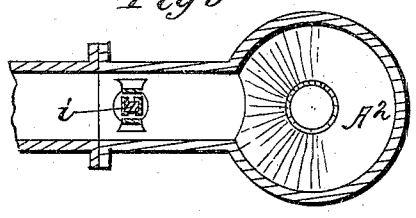


Fig 3

Witnesses
W. C. Corlies
P. E. Remsen.

Inventor
John Bouchard
By Coburn & Thacher
Attorneys

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JOHN BOUCHARD, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO GEORGE H. WEBSTER, OF SAME PLACE.

ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 319,551, dated June 9, 1885.

Application filed January 5, 1885. (No model.)

To all whom it may concern:

Be it known that I, JOHN BOUCHARD, a citizen of the United States, and residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Ice and Cold-Air Machines, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of an ice and cold-air machine embodying my invention. Fig. 2 is a vertical transverse sectional view of the pump, and Fig. 3 a detail sectional view of the same taken on the line *x x* of Fig. 2. Figs. 2 and 3 are on an enlarged scale, but on the same scale with respect to each other.

Like letters refer to like parts in all the figures of the drawings.

My invention relates to machines for producing artificial ice or cold air, generally known as "refrigerating-machines," and more particularly to the pump used for compressing the ammonia gas or other volatile liquid employed, its object being to increase the volume of gas compressed, to diminish leakage, and to otherwise improve the construction and operation of the pump; and to these ends it consists in certain novel features which I will now proceed to describe, and then specifically point out in the claims.

In Fig. 1 of the drawings I have shown a general view of a refrigerating-machine of the character to which my pump is adapted to be applied, in which A represents the refrigerating or freezing tank; B, the condenser; C, the receiver, and D the pump, to which latter my present invention relates, the remaining parts being of any approved construction. The general operation of the machine is as usual, the ammonia gas being liquefied by compression in the condenser B, the pipes of which are cooled to deprive the gas of its heat by means of a stream of water continually flowing over them. The liquefied ammonia passes from the condenser B into the receiver C, and thence through pipes *c* into the refrigerating-chamber A, where a vacuum is maintained by means of the pump D, as hereinafter described, and in which the liquefied ammonia expands very rapidly into a gas, absorbing the heat in the refrigerating-chamber and reducing the temperature thereby. The expanded gas is aspirated by the pump D from the refrigerating-chamber A and forced into the condenser B again, and this process is continued as long as desired. The receiver C, pipe *c*, and the pipe A′, which connects the refrigerating-chamber A with the pump D, are provided with the usual valves for controlling the flow of the ammonia.

In Figs. 2 and 3 of the drawings I have shown in detail my improved pump, which is in the nature of a single-acting pump, connected by the pipe A′ with the refrigerating-chamber and by the pipe B′ with the condenser. This pump consists of a vertically-arranged cylinder, D′, containing a piston, D^2, fitting tightly therein and operated by a piston-rod, d', passing through a suitable stuffing-box, d^2, at the lower end of the cylinder, and actuated by any suitable mechanism. At the upper end of the cylinder D′, which is the compression end thereof, are formed an inlet-port, E, and an outlet-port, F, the former communicating with the pipe A′ and being closed by a suitable valve, *e*, while the latter communicates with the pipe B′, and is adapted to be closed by a valve, *f*, these valves being arranged, as ordinarily, so that the former will be raised and the latter closed during the descent of the piston, and the former closed and the latter raised during its ascent. It will be observed that these valves are shown with their square stems sliding in U-shaped guides attached to plates G, which are removably bolted to the top of the cylinder-head, so that the said plates and valves may be readily taken out and inspected or cleaned, if necessary; but although I deem this form of valve preferable, any approved form may be employed.

In the pipe A′, at a suitable point, preferably near the cylinder D′, as shown, is arranged a valve, A^2, of suitable construction, preferably that shown.

H indicates a suction-pipe connecting at one end with the pipe A′ at a point between the valve A^2 and the refrigerating-chamber, and opening at the other end into the lower end of the cylinder, as shown.

The connecting-pipe I extends from the pipe H to the pipe A′, communicating with the latter at a point between the valve A^2 and the cylinder D′, the connection between the two being controlled by a valve, *i*, as shown, while the pipe H is also provided with a suitable valve, *h*, arranged at a point between its connection with the pipe A′ and with the pipe I, and adapted to be closed by the descent of the piston.

The operation of my device is as follows: The piston, in its ascent having forced the gas from the upper or compression end of the cylinder into the condenser through the port F, begins to descend, thereby closing the valve *f* and opening the valves *e* and A^2, as shown. During the ascent of the piston the valve *i* has been closed and the valve *h* opened, so that the space below the piston in the cylinder has become filled with the gas which has been drawn in through the suction-pipe H and pipe A′ during this ascent. Upon the descent of the piston, the valves *e* and A^2 being opened, as above stated, the gas is drawn into the upper end of the cylinder through the pipe A′ in an obvious manner; but at the same time the pressure of the gas below the piston closes the valve *h* and opens the valve *i*, so that the said gas is forced through the pipes H and I into the pipe A′, and thence into the upper end of the cylinder. This increase in the volume of gas in the upper end of the cylinder and in that portion of the pipe A′ between the cylinder and the valve A^2 over and above the volume which would naturally be drawn in by the mere suction of the piston in the cylinder will finally produce a pressure sufficient to close the valve A^2, and thereby prevent this compressed volume of gas above the piston from flowing back through the said valve and the pipe A′ into the refrigerating-chamber, so that when the piston once more begins to ascend it will find the space above it filled by a volume of gas already somewhat compressed, and considerably greater than the volume which the piston would have drawn into the said space by its suction alone. It will be seen from this that my improved pump compresses at each stroke a much larger volume of the ammonia gas than the ordinary pump, thereby greatly increasing its efficiency, while at the same time, since the upper end of the pump, through which the piston-rod does not pass, is employed as the compression end of the pump, the leakage around said piston-rod, which would prevent the best action of the pump for its purposes, is entirely obviated.

It is obvious that various mechanical modifications may be made in the construction and application of my device without departing from the principle of my invention.

Although I have shown my improved pump as applied to one particular kind of refrigerating-machine for purposes of illustration, I do not wish to be understood as limiting myself to this particular application thereof, as the same may be used in conjunction with various other devices for the purpose. Neither do I wish to be understood as limiting myself to the precise details of construction herein before described, and shown in the drawings, and I reserve the right to make such alterations therein as may fairly come within the scope of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a pump-cylinder and piston, the said cylinder being provided at one end with an inlet and an outlet port controlled by suitable valves, of the pipe A′, connected to the said inlet-port and provided with a valve, A^2, and the suction-pipe connecting the said pipe A′ with the other end of the cylinder beyond the said valve A^2, said suction-pipe being itself provided with a suitable check-valve and connected to the pipe A′ between the valve A^2 and the cylinder, substantially as and for the purposes specified.

2. The combination, with the pump-cylinder having its inlet and outlet valves arranged at one end, of the inlet-pipe provided with a suitable valve, and a suction-pipe connecting the portion of the inlet-pipe beyond the said valve with the other end of the cylinder, the said suction-pipe being connected to the inlet-pipe between its valve and the cylinder by a suitable connecting-pipe provided with a valve at its junction with the inlet-pipe, and the said suction-pipe being also provided with a valve arranged between the connecting-pipe and the inlet-pipe, substantially as and for the purposes specified.

3. The combination, with the pump-cylinder D′, of the inlet-pipe A′, connected therewith at one end through an inlet-port, E, controlled by a valve, *e*, said inlet-pipe being provided with a valve, A^2, the suction-pipe H, connecting the said inlet-pipe beyond the valve A^2 with the other end of the cylinder, and having a valve, *h*, and pipe I, connecting the pipes H and A′ on that side of their valves nearest the pump-cylinder, and provided itself with a valve, *i*, substantially as and for the purposes specified.

4. The combination, with the pump proper, of the inlet-pipe connected thereto at both ends, a pipe connecting the pipes which connect the inlet-pipe to the two ends of the cylinder, and valves, arranged substantially as described, to control the flow of the gas through the said pipes, substantially as and for the purposes specified.

JOHN BOUCHARD.

Witnesses:
IRVINE MILLER,
C. E. LITTLE.