S. B. MARTIN & J. M. BEATH.

Ice-Manufacture and Machine.

No. 161,976. Patented April 13, 1875.

Fig. 1.

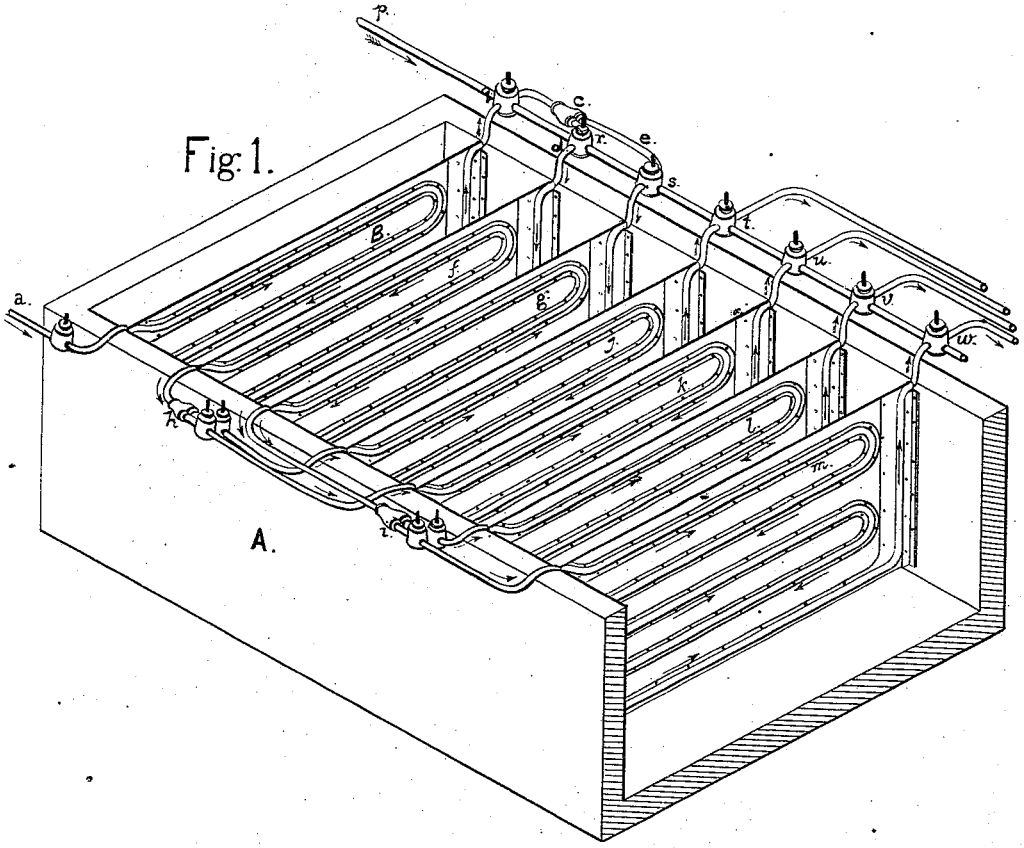

Fig. 2.

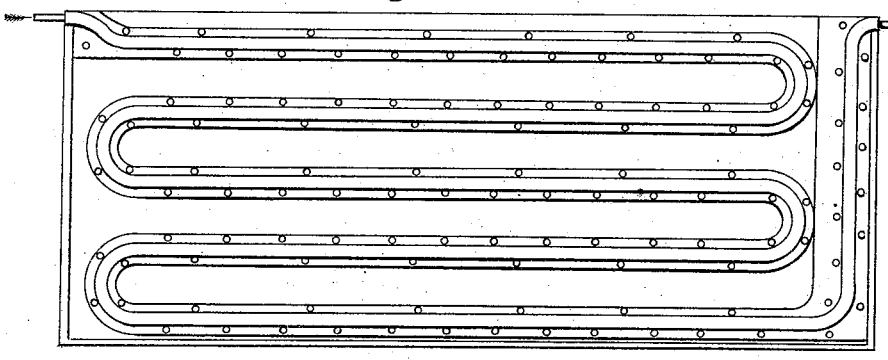

Fig. 3.

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UNITED STATES PATENT OFFICE.

SAMUEL B. MARTIN AND JOHN M. BEATH, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN ICE MANUFACTURES AND MACHINES.

Specification forming part of Letters Patent No. **161,976**, dated April 13, 1875; application filed July 8, 1873.

To all whom it may concern:

Be it known that we, SAMUEL B. MARTIN and JOHN M. BEATH, of the city and county of San Francisco, State of California, have invented an Improvement in the Manufacture of Ice and Refrigerating-Machines; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings and letters marked thereon.

The subject-matter of our invention contained in this specification relates to a system or method of distribution of the cold-producing agent, and its embodiment in the channeled plates of the congealer, which was patented by us May 28, 1872, and reissued July 16, 1872.

The nature of our invention consists essentially in increasing the number or sectional area of the channels or pipes in which the cold-producing fluid flows through our congealer, in such a manner as to distribute equally both liquid and vapor as the said fluid increases in volume.

We have discovered that when volatile liquids are vaporized in their passage through long channels or pipes of small sectional area, the fluid remains a homogeneous mass—that is to say, the liquid particles become completely and uniformly mixed with the vapor, are carried along with it without reference to the grade of the pipe, be it either up or down, and when, by reason of the great expansion caused by the absorption of heat the velocity becomes as high as desirable, the stream of mixed vapor and liquid may be equally divided by simply forking or branching the pipe, and each one of these branches may, after a further expansion by heat, be again divided, and thus the subdivisions may be carried to any number and length of pipe desired, each pipe always carrying its due proportion of liquid and gas, and producing a uniform degree of cold throughout the whole system of pipes, by simply adjusting the pressure in the pipes, so that the vaporization of the liquid is not entirely complete before it reaches the outlet.

Our congealer, constructed so as to embody this principle of action, consists of the before-mentioned channeled plates, each plate being traversed by a branch or division of this system of pipes.

The construction and form of the plates may be varied to suit the size of the machine desired by the maker.

The whole system may be embodied in a single plate, which may be put in the form of a scroll, with the necessary space between the parts of the scroll for the formation of ice on both sides of every part of it. In this form it may be lodged in a tub of cylindrical shape for holding the water, or each division of the pipe may be inclosed in a single plate of plain surface, as is shown in the drawings. All the divisions may be of equal length and the plates equal in size.

In the annexed drawings, which form a part of this specification, Figure 1 is a perspective view of our congealer. Fig. 2 is a side view of one of the channeled plates composing the congealer. Fig. 3 is a vertical section of one of these plates.

As a means of security against leakage, when we use ammonia as a freezing-agent we make our system of pipes, in which it is expanded into vapor, of lead, making the parts which form the lining of the channels much lighter than that which is exposed outside and has to resist the pressure. Each channel is formed by two pieces of plate rolled longitudinally, with semi-tubular depressions to receive the pipe. These are riveted on each side of the pipe, closing between them the edge of the plate which fills the space between the parallel channels. The whole, being thus firmly riveted together, forms one plate with the lead-lined channels before described, and as is shown in Figs. 2 and 3.

In Fig. 1 seven of these plates are placed in a tank, A, and are fastened to it by bolts or screws passing through the flanges on each end of the plates. We make the space or distance between the plates sufficient, so that when sheets of ice are formed on them of the thickness required, a few inches of water will remain. The water-space allows the ice to be removed from the plate when loosened, and it is also a receptacle for air and impurities held in suspension and rejected or thrown out by the freezing.

The tank A containing these plates is made non-conducting, to keep out the external heat, and the plates are raised from the bottom of the tank to allow a free circulation of water under them, and prevent the ice from freezing or becoming attached to the bottom of the tank.

The freezing-liquid is introduced at *a*, which, after passing back and forth through the plate B, as is shown by the arrows, makes its exit at *c*. By the time the fluid has reached *c* it has become so much expanded by the heat absorbed from the freezing water surrounding the plate that its velocity has become greatly increased, so that it may be equally divided into two streams by the fork *c*, from which it passes, by the pipes *d e*, into the plates *f g*. By the time it has passed through those plates its velocity has again been brought up to a point which requires it to be again divided at *h i*. The four divisions thus formed pass through the plates *j k l m*.

An important advantage of this method of distribution is that all danger of clogging is avoided, as no divisions are made until the volume of the fluid is brought up to a point which permits it to be made without diminishing the size of the pipe or channel in which it flows. The gasified liquid is conveyed from the congealer to the liquefying apparatus. This liquefying apparatus may consist of any of the known methods or apparatus used for liquefying the different gases in ice-making machines. Any means by which the cold-producing fluid is continuously withdrawn from the congealer in the gaseous form, and conti ously returned in the liquid form, may be used. The quantity of liquid received and gas withdrawn is a measure of the quantity of ice produced.

The ice first commences forming on the plates around the channels; but when the thickness of the ice is equal to the distance between its channels it presents a smooth external surface. Therefore we make the distance between the channels equal to the thickness of ice required. We find the quantity of ice formed for each lineal foot of chan nel should not be greater than five or six cubic inches per hour on each side of the plate. By observing these rules we construct channel-plates for making transparent and compact ice as much as twelve inches in thickness, if desired.

The construction of our congealer is such that the ice will not be detached from the plates by allowing the gas or vapor from the condenser or liquefying apparatus to flow into it, as practiced heretofore. In our experiments we have found that the accumulation of condensed liquid in the pipes would obstruct the flow of gas, so that portions of the plate would not be affected by it. We have therefore devised special means for more effectually accomplishing this object, and also means by which the ice is detached and taken from one or more of the plates without interrupting or checking the formation of ice on the other plates of the congealer.

The pipe *p* is connected with the pipe leading to the condenser and with each one of the congealer-plates by the two-way cocks *q r s t u v w*. These cocks are so constructed that they may be set to open a free passage from one plate to the other as the liquid flows in freezing; and by turning them ninety degrees this passage is closed, and the passage from the pipe *p* is opened. Then, to detach the ice from any plate, it is only necessary to turn the two-way cock connected with that plate to open a passage for the gas from the condenser, while the cock on the opposite side of the plate is opened sufficiently to allow the condensed liquid produced by the rapid condensation of the gas rushing into the plate under the high pressure of the condenser to pass out.

In constructing these plates we make the thickness of the plate and diameter of pipe proportionate to the size of the plate. For plates, say, six feet in depth, we make the plate of No. 10 (Birmingham gage) rolled iron, and the pipes three-fourths of an inch in inside diameter. To facilitate the removal of the ice in large machines we usually make the length of the plates less than the width of the tank by a distance equal to about the depth of the plate, and place one end of the plate against one side of the tank, leaving a water-space the whole length of the tank on the opposite side. As the ice is detached from the plate it is split vertically into square blocks, which are floated into the open space, where they turn on their sides, and may be easily drawn on an incline fixed at any point required on the side of the tank.

The top edges of the plates, especially the end which does not reach the side of the tank, should be stayed by pieces running across from plate to plate, at a height sufficient to allow the ice to float on its edge under them.

In the place of each one of the two-way cocks described, two single cocks may be used, so placed as to force the gas from the condenser into any one of the plates for the purpose of loosening the ice from the plate, as described.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The described method of distributing the fluid through the congealer—that is, by branching or doubling the pipe as the vapor increases in volume—for the purpose of preventing the pipes from clogging, as described.

2. The combination, with the pipe *p*, of the two-way cocks *q r s t u v w*, as and for the purpose described.

In testimony whereof we have hereunto set our hands and seals.

SAML. B. MARTIN. [L. S.]
JOHN M. BEATH. [L. S.]

Witnesses:
C. W. M. SMITH,
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