2 Sheets--Sheet 1.

D. BOYLE.

Ice-Machine.

No. 163,143. Patented May 11, 1875.

Fig 1.

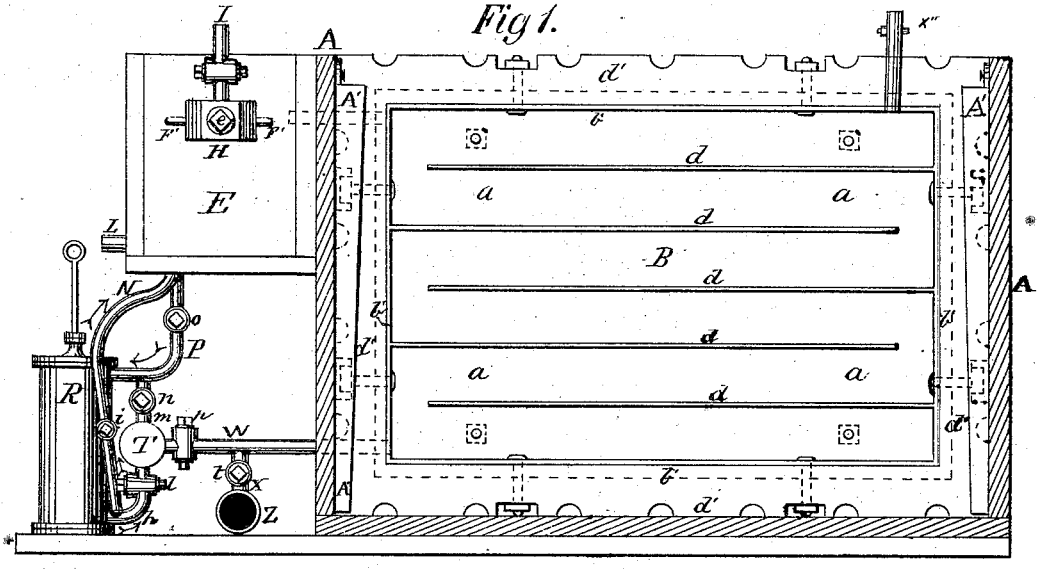
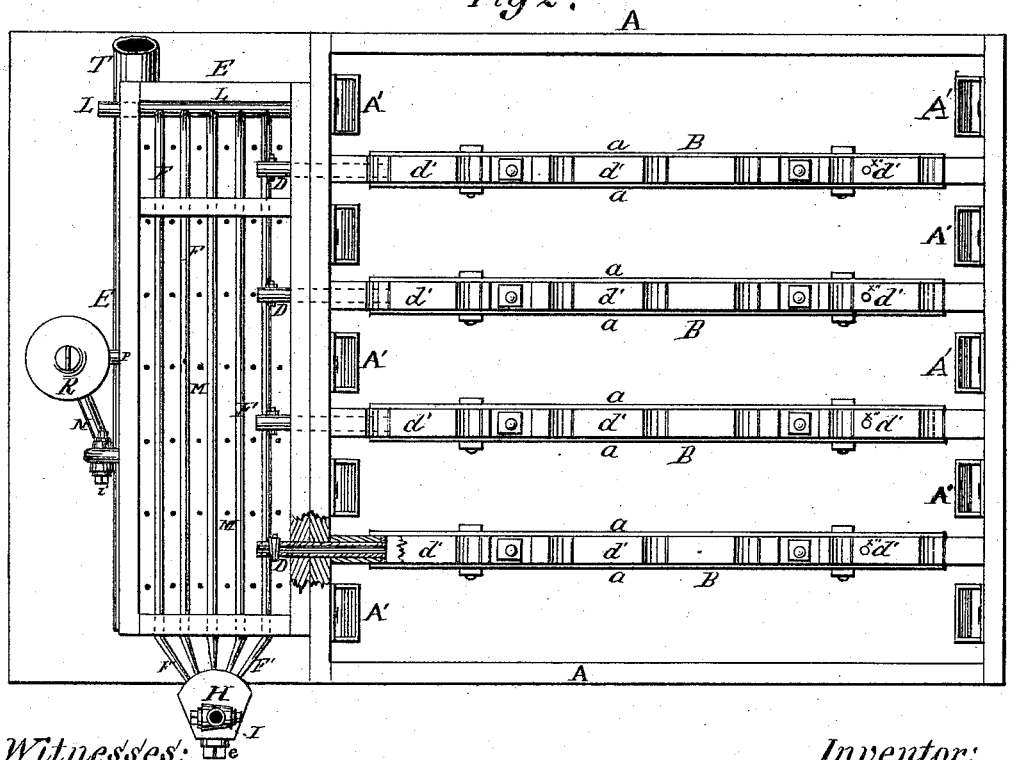


Fig 2.



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Chas. C. Gill

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2 Sheets--Sheet 2.

D. BOYLE.

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Fig 3.

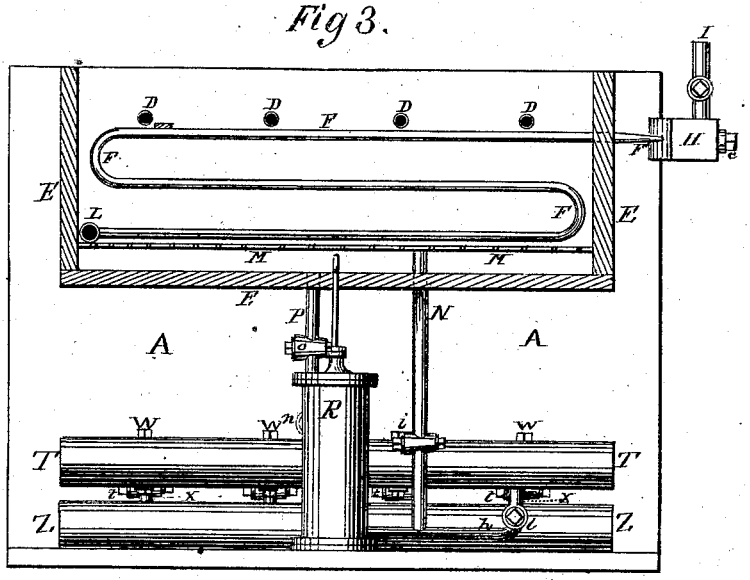


Fig 4.

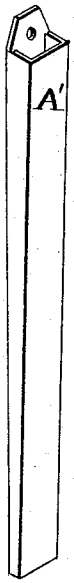
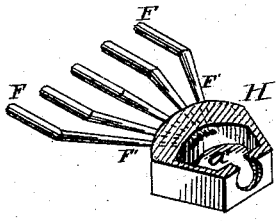


Fig 5.



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UNITED STATES PATENT OFFICE.

DAVID BOYLE, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN ICE-MACHINES.

Specification forming part of Letters Patent No. **163,143**, dated May 11, 1875; application filed October 24, 1874.

To all whom it may concern:

Be it known that I, DAVID BOYLE, of Washington, District of Columbia, have invented certain new and useful Improvements in Ice-Machines, of which the following is a specification, reference being had to the accompanying drawings.

The invention relates to an improvement in machines for the manufacture of ice; and consists in the devices, hereinafter described, for the even distribution of the freezing-fluid through compartments encompassed by a non-conducting frame, and formed of metallic plates having partitions, open at alternate ends, so as to produce a uniform temperature over the freezing surface or plates upon which the ice is formed; also, in an arrangement of pipes, cocks, conduit, and pump, by which the circulation of the freezing-fluid is produced, as desired, over the rears of the freezing-surfaces, and further affording a means of operating any one or more of the freezing-surfaces at will; also, in a wedge-shaped pocket, placed at the ends of the spaces wherein the ice is formed, to facilitate the removal of the ice when made.

The object of the invention is to provide a convenient machine for manufacturing ice.

Figure 1 is a side elevation of a device embodying the elements of the invention, certain parts removed to disclose the internal constructions. Fig. 2 is a top or plan view of same, certain parts broken out to disclose internal devices. Fig. 3 is an end view of same, with a side of the evaporator-tank removed. Fig. 5 is a detached view of the distributer H. Fig. 6 is a similar view of the pocket A′.

In the accompanying drawings, A is a tank, in which are placed, equidistantly, the hollow water-tight partitions B, composed of the metallic plates or freezing-surfaces *a*, secured in a water-tight manner to the metallic strip *b′*, the metallic strip *b′* being encompassed by the frame *d′*, of non-conducting material. The plates *a* are separated a proper distance, and provided with the partitions *d*, which fit in water-tight manner between the plates *a*, but are open at alternate ends. Spaces are provided on the outer sides of the frames *d′*, to permit the circulation of water through the tank. A pipe, D, provided with a cock, *x*, leads from each compartment between the plates *a* to the evaporator-tank E, situated at one side of the tank A, so that a fluid may pass through the pipe from or to the compartments. An air-vent, *x″*, provided with a cock, is inserted in each compartment, to admit air when the compartment is being emptied. The tank E is provided with a coil of pipe, F, forming the evaporator-coil, the upper ends of the pipes of which pass through the end of the tank E, are reduced in diameter to the pipes F′, and converge radially into a distributer, H, formed of a piece of metal shaped as shown, the ends of the pipes F′ terminating at a recess, *a′*, in the distributer, in which is placed the plug *e*, which being withdrawn the pipes F′ may easily be cleaned by a wire or other suitable appliance. A pipe, I, leads into the side of the distributer, through which the volatile liquid under pressure is fed to the coils F, which terminate in the conduit L, leading to an exhaust and compression pump, (not shown,) for the purpose of compressing and reliquefying the volatile matter into a condenser, whence the liquid is returned to the pipe I, through which it is thus fed continuously to the coil F, preserving a constant circulation, and cooling the fluid in the tank E. Near the bottom of the tank E is placed the false perforated bottom, M, which causes the distribution of the fluid uniformly about the coil as it flows upward or downward. From the bottom of the evaporator-tank E the pipes N and P descend, the former leading to the eduction, the latter to the induction, port of the pump R. The pipe N is provided with the cock *i*, and connected with the main pipe T by the pipe *h*, provided with the cock *l*. The pipe P is provided with the cock *o*, and connected with the pipe T by the pipe *m*, provided with the cock *n*.

The main pipe T is provided with the pipes W, leading to the base of the compartments, between the freezing-surfaces *a*, the pipes W being furnished with the cocks *p*, and connected by the pipes X, provided with the cocks *t*, with the conduit Z.

Midway between the plates *a*, at each end of the tank, are placed the metallic pockets A′, formed open above, but water-tight elsewhere, and tapering from top downward. The

purpose of these pockets is to prevent the ice freezing to the tank.

During the operation of freezing, the pockets A′ are empty, but when the ice is formed of the thickness desired, they are filled with water at a common temperature, which thaws the ice off, so that the pockets can be withdrawn, and the sheets of ice removed.

The pump R is for causing a circulation of the cooling medium through the compartments, pipes, and about the coil of the apparatus.

The operation is as follows: The tank A having been filled with water to the level of the upper edge of the plates *a*, and the tank E and hollow partitions B with some freezing-liquid, the volatile liquid or other cooling agent is introduced into the coil F, through the distributer H, becoming gaseous, chilling the coil, and extracting heat from the freezing-liquid in the tank E, emerging through the conduit L under the operation of an exhaust and compress pump, which returns it to a condenser, wherein it is liquified, and in that state returned to the pipe I, thence to the distributer, and so into the coil F continuously.

The cocks *p i n* being opened, and the cocks *t l o* closed, the pump R is operated, which draws the uncongealable liquid from the base of the compartments, thus causing the chilled fluid to pass from the tank E into the compartments, wherein it flows about the partitions *d*, thus evenly chilling the plates *a*, and finally emerging through the pipes W into the main pipe T, thence through pipes *m* and P, into the pump R, which redelivers it through the pipe N into the tank E.

By this operation, the water between the hollow partitions B is chilled and frozen from the surface downward, as the current of freezing-fluid descends through the compartments.

To freeze the water from below upward upon its being discovered that the ice is making too rapidly above, by closing the cocks *t i n*, and opening the cocks *p l o*, the current of freezing-fluid may be reversed, which will freeze the water between the partitions from below upward, as the freezing-fluid ascends. In the above operations it is presumed that the cock *x″* is open.

When the ice has been formed on the plates as thick as desired, the cocks *p* are closed, and the cocks *t*, *x*, and *x″* opened, which permits the freezing-fluid to escape through the pipes X into escape-conduit Z, thus emptying the compartments, when water at an ordinary temperature, being admitted through the pipes T and W to the compartments from a source higher than the tops of the plates *a*, fills the compartments, and thaws the ice off the plates *a*, so that it may be withdrawn.

It is obvious that the ice may be removed, as aforesaid, from any one or more of the plates *a* by opening the cock *x″* and the cock *t* leading to the selected compartment, when the ice may be removed from the particular plates by proceeding in respect to its compartment and the pipe *x*, as above specified, the operation of freezing continuing upon the other plates without interruption.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A freezing-plate, operated by a refrigerant, and encompassed by a non-conducting frame.

2. The combination of a freezing surface or a freezing-plate, encompassed by a non-conducting-frame, with a series of partitions open at their alternate ends, for the purpose of producing a uniform flow of the chilling-fluid and evenly chilling the plates.

3. The combination of a hollow partition, encompassed by a non-conductor, with an evaporator-tank, as stated.

4. The combination of the pump R with the pipe N having the cock *i*, *h* having the cock *l*, P having the cock *o*, T and *m* having the cock *n*, W having the cock *p*, substantially as set forth, for the purpose of directing the flow of the chilling agent in a circuit beginning and ending in the tank E, and including the hollow partitions B, and either upward or downward through the partitions, as described.

5. The wedge-shaped pocket R, in combination with the freezing-tank, for the uses stated.

In testimony that I claim the foregoing improvements in ice-machines, as above described, I have hereunto set my hand and seal this 21st day of October, 1874.

DAVID BOYLE. [L. S.]

Witnesses:

S. F. AUSTIN,

H. C. SPENCER.