H. J. WEST.

Apparatus for the Refrigeration or Freezing of Liquids.

No. 213,794. **Patented April 1, 1879.**

FIG. 1.

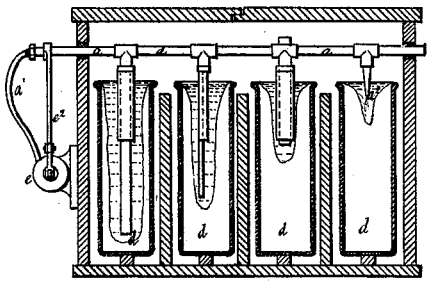


FIG. 2.

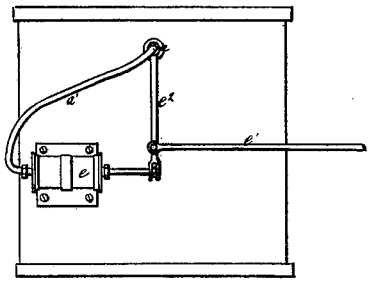


FIG. 3.

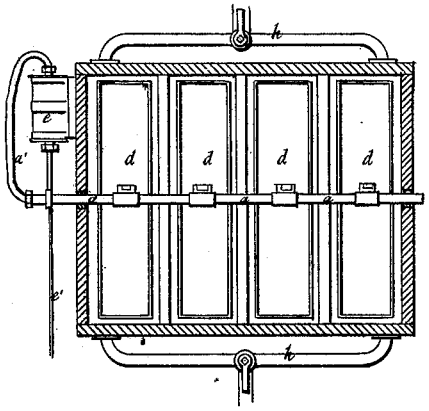


FIG. 6.

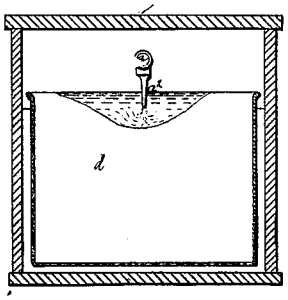


FIG. 4.

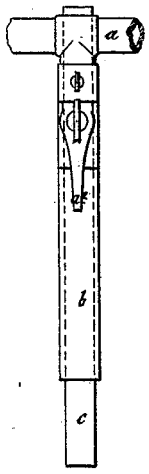
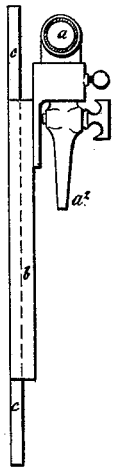


FIG. 5.



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UNITED STATES PATENT OFFICE.

HENRY J. WEST, OF GREAT SUFFOLK STREET, SURREY COUNTY, ENGLAND.

IMPROVEMENT IN APPARATUS FOR THE REFRIGERATION OR FREEZING OF LIQUIDS.

Specification forming part of Letters Patent No. **213,794**, dated April 1, 1879; application filed October 2, 1878.

To all whom it may concern:

Be it known that I, HENRY JOSEPH WEST, of Great Suffolk Street, in the county of Surrey and Kingdom of England, engineer, have invented Improvements in Apparatus for the Refrigeration or Freezing of Liquids, of which the following is a specification:

My invention relates to an apparatus for the refrigeration or freezing of liquids wherein cold is produced by the evaporation of a volatile liquid, or by other known means, such cold being used to cool brine, glycerine, or other freezing-liquid, which in its turn is employed to freeze or refrigerate water or other liquids.

My present improvements relate to the apparatus wherein the ice is produced. I employ for this purpose open vessels of thin metal, containing the water to be frozen, and suspended or resting in compartments in a casing, through which cooled brine is made to circulate, the brine being introduced in the compartment at one end of the casing, and circulating in a zigzag direction through all the compartments to the other end. I arrange across this casing a spindle carrying a number of blades, one of which is suspended in each of the said vessels, and has an oscillating motion imparted to it by means of the spindle, so as to keep the water in the vessels in a state of agitation while the operation of freezing is going on, by which means perfectly transparent ice may be obtained.

I do not claim the use of reciprocating agitators, as I am aware that such are well known; but as the space in which these agitators move becomes gradually more and more restricted, owing to the formation of the ice on the sides, ends, and bottom of the vessel, whereby the motion of the agitators would be restricted, I make these agitators according to my invention of a sliding or telescopic form, so that as the lower end thereof comes in contact with the ice at the bottom and ends it will slide up over, within, or against the upper part or through the rocking shaft or spindle, and thus allow the agitator to continue its motion until only a small quantity of unfrozen water is left in the center of the vessel, the agitator being removed when its further motion is impeded. The shortening of this agitator may be either automatic or effected by hand or by any convenient mechanical arrangement.

In order to maintain the agitation of the small remaining quantity of water in the middle, and to insure its transparency when it is frozen, I construct the spindle carrying the agitators hollow, and at the points where the agitators are connected to it I provide small nozzles of sufficient length to dip into the water to be frozen. The one end of the spindle is connected to a small pump of any suitable construction, whereby water is alternately drawn from and forced into the hollow spindle. By this means a portion of the water is continually drawn up from the freezing-vessels through the nozzles, and is then forced back into them again, thus effecting the required agitation of the water.

The before-described agitators are in this arrangement provided with a jaw at their upper ends, embracing a collar on the nozzles and secured by a screw, so that when the agitators are prevented from further motion they can readily be detached.

In some cases the agitating-blades may be entirely dispensed with, and the necessary agitation may be effected entirely by the stream of water from the nozzles, as above described, in which case the hollow spindle may or may not have the before-described rocking motion imparted to it.

In the casing for producing ice, as above described, compartments may be advantageously formed wherein to place vessels for making ices or bottles containing water to be frozen.

I sometimes provide in the ice-box a tank or receptacle, from which cold water is continually drawn and forced through the beforementioned hollow spindle, or through a pipe with nozzles into each of the ice-vessels, thus maintaining the agitation of the water in these, while the surplus water is made to flow back into the tank, the top flanges of the ice-vessels being made to fit practically water-tight upon the tops of the brine-cells, so as to prevent any of the cold water from leaking down into the latter; or the agitation may be partially effected by this means, and partially by alternately drawing water from and forcing it back

into each ice-vessel, as first described, the supply of water in either case being regulated by means of small taps on the nozzles.

In the first-described arrangement of ice-boxes it is sometimes desirable, in order to effect the uniform freezing of the ice and cause it to be of the same thickness in all the ice-vessels, to reverse the current of brine at intervals. To effect this I construct the inlet and the outlet pipes for the brine each with two branches communicating with each end of the ice-box, and at the junction of the branches I provide a three-way cock, so that, according to the position into which these cocks are turned, the brine may be made to flow in either at the one or the other end of the box, the cock on the outlet being turned so as to cause the brine to flow off from the opposite end.

In the drawings forming part of this specification, Figure 1 represents a longitudinal vertical section, Fig. 2 an end view, and Fig. 3 a plan, of an ice-box provided with the peculiar means, according to my invention, of agitating the water which undergoes congelation therein. Figs. 4 and 5 are front and side views, on an enlarged scale, of my combined jet-nozzle and telescopic or adjustable agitator; and Fig. 6, a transverse section.

a is a tubular rocking spindle, on which the agitators are fixed by a screw and nut. Each of these consists of a back piece, *b*, in which a blade, *c*, is fitted to slide vertically, so that as the ice forms at the lower part of the ice-mold *d* the blade *c*, meeting the ice, is gradually pushed upward, and the length and stroke of the agitators are thereby diminished. The tubular spindle *a* is connected by a flexible tube, a^1, to a small pump, *e*, worked by the connecting-rod e^1 from any suitable motor. (As this pump is employed merely for displacing, it requires no valves.) This connecting-rod, engaging with an arm, e^2, on the spindle *a*, causes it to rock as the pump is worked; or the pump may be disengaged therefrom, the arm e^2 in that case working the agitator only.

When the pump *e* is in action a portion of the water undergoing congelation is drawn out of the ice-molds *d* and forced back into them at every stroke of the pump through the tubes $a^1 a$ and nozzles a^2, as shown in the transverse section, Fig. 6, and also in the last compartment of Fig. 1.

The agitation produced by the in and out streams of the water caused by the pump is in some cases sufficient without other agitators, and the rocking of the spindle *a* may then be dispensed with, a pipe with nozzles being substituted, each nozzle having a cock, by which the stream may be varied; or the telescopic agitators *c* may be used separately, if preferred. I prefer, however, to combine the pipe and nozzle with the telescopic agitator, so that either may be used at pleasure; and for this purpose I construct the agitators so that they can be secured on the nozzles by a pinching-screw, as shown in my drawings.

The ice-molds *d* are made of thin metal, immersed in the brine or other congealing-liquid, which is caused to circulate in zigzag direction through the successive compartments of the ice-box.

Compartments of the ice-box may, if desired, be used for forming table-ices or for freezing water in bottles; but I lay no claim to such a combination.

The congealing-liquid flows to and from the ice-box by branch pipes *h h'*, provided with three-way cocks, so that the direction of the current in the boxes may be reversed at pleasure.

The flanges of the ice-molds *d* may be bedded on caoutchouc or other soft packing, forming a practically water-tight joint, and in that case the water for congelation may flow freely over the flanges of the molds from one to the other. When this arrangement is employed, the ice-box is made with a supply-compartment at one end, separated from the congealing-liquid by a non-conducting partition, which may be of wood.

Having thus described the nature of my invention, and in what manner the same is to be performed, I claim, in respect of apparatus for the refrigeration or freezing of liquids, as means of agitating water undergoing congelation—

1. The combination, with the water-receptacle of a refrigerating apparatus, of a movable agitator provided with a vertically-sliding blade, substantially as set forth.

2. The combination, with the water-receptacles of a refrigerating-machine, of nozzles communicating with a pump, whereby the liquid is alternately withdrawn from the receptacle and returned, substantially as specified.

3. The combination of the hollow rock-shaft *a*, its nozzles a^2, agitating-blades, and arm e^2, and the pump having its rod connected to said arm, and communicating through a pipe, a^1, with the hollow shaft, for the purpose specified.

In witness whereof I have signed my name in the presence of two subscribing witnesses.

H. J. WEST.

Witnesses:

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