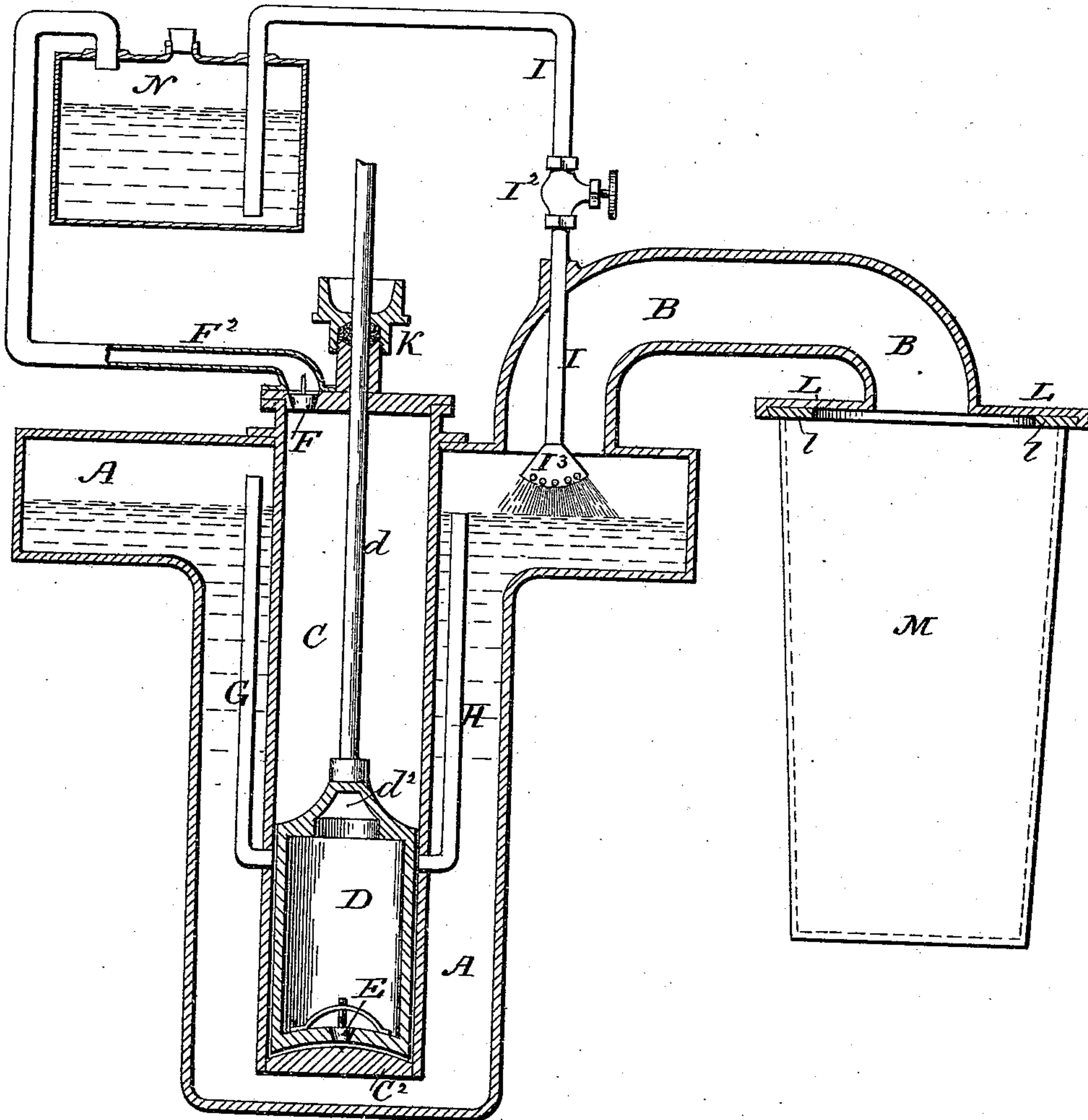


(No Model.)

E. J. HARDY.
ICE MACHINE.

No. 446,205.

Patented Feb. 10, 1891.



Witnesses:

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UNITED STATES PATENT OFFICE.

EDWARD J. HARDY, OF BROOKLYN, NEW YORK.

ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 446,205, dated February 10, 1891.

Application filed September 12, 1890. Serial No. 364,727. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. HARDY, a citizen of Great Britain, residing at Brooklyn, in the county of Kings, State of New York, have invented certain new and useful Improvements in Ice-Machines, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to the method of producing refrigeration and to refrigerating or ice-making machines in which water is evaporated in vacuum and its vapor brought in contact with sulphuric acid or other absorbent, and in which pumps and various means have been used to raise and agitate said acid to expose new surfaces to the aqueous vapor.

The objects of my invention are to produce the necessary vacuum and absorption of aqueous vapor by simple means and the pumping of the air and acid in an apparatus of simple and compact form in which the pump may be inclosed in the acid used. I attain these objects and the operation of the method by the construction illustrated in the accompanying drawing, in which the apparatus is represented in vertical section.

In said drawing, A represents a closed vessel containing sulphuric acid or other well-known absorbent of aqueous vapors. Said vessel has in the top a bent pipe B for a communication between it and the water-freezing receptacle M. Into the closed top of the vessel A there is inserted, preferably, the whole of a pump-cylinder C, having a closed bottom C², and within said cylinder is fitted a hollow piston D, having in its bottom a valve E, capable of being lifted upwardly to open a passage in said bottom. Said piston has attached to its top a piston-rod *d*, which is to be reciprocated by a crank-shaft or other suitable operating means. The top of the hollow piston has perforations *d*² therein to allow the upward passage of air and acid therethrough. In the top of the cylinder, but on one side of its center, there is an opening into which is fitted an air and acid discharge valve F, capable of being lifted upwardly, and over said valve the lower end of pipe F² is secured to the top of the pump-cylinder, and the upper end of said pipe leads into a carboy N or other acid-holding receptacle.

In the side of the pump-cylinder is inserted

the lower end of a pipe G, that has its upper end extending above the surface of the acid in the vessel A, and is to lead the air and aqueous vapors from above said surface to a point under the piston when the latter is ascending to the top of its course. In the side of the pump-cylinder is also inserted the lower end of a pipe H, that has its upper end on a level with the surface of the acid. The internal area of the pipe H is such as to quickly admit the acid into the pump-cylinder in proper quantities to maintain the surface of the acid in the vessel A at a constant level.

The form of the pipe H should preferably be crescent-shaped in cross-section and the lower end made to enter a horizontal groove in the side of the cylinder to obtain the desired large delivery without increasing the vertical width of the groove or pipe opening into the cylinder.

In the elbow of the pipe B is inserted an acid-inlet pipe I, which is provided with a valve I² to regulate the admission of the acid. This valve may be controlled by a speed-governor of any well-known form, so that the acid will be admitted only when the machine is in operation, and thus the flooding of the machine with acid be prevented when said machine is stopped under vacuum.

The pipe B has its lower end provided with a perforated rose or sprayer I³ to admit the acid in the form of spray or rain into the vessel A above the surface of the acid therein. The top of the pump-cylinder is provided with an acid-tight stuffing-box K of suitable form. The pipe I conducts the sulphuric acid from the carboy or receptacle N into the top of the vessel A. The whole apparatus is formed of suitable acid-resisting materials or of metal suitably glazed.

To operate the machine, the vessel A is charged with acid to the level of the top of the pipe H, and an open-top water-freezing vessel, as M, containing some water, is attached to or applied against the rubber gasket *l* on the under side of the disk L, so as to form an air-tight joint. The pump is then started and the valve I² so opened as to admit the proper quantity of acid into the vessel A. The piston D on its upstroke ascends above the openings leading from the pipes G and H, and permits a charge of air and acid to enter the

pump-cylinder below the piston, and the latter in its downstroke again covers the lower openings of the pipes G and H and forces said charge of air and acid up through the opening
 5 closed by the valve E in the lower end of the piston, and thoroughly mixes and shakes together said air and the aqueous vapors taken with it and the acid, and on the upward stroke of the piston it expels the air and acid
 10 through the discharge-valve F. A portion of the pump-cylinder above the piston D being filled with acid, said valve F and the openings of the pipes G and H into the cylinder are liquid-sealed.

15 After a few strokes of the piston the air is exhausted from the chamber A and the vessel M, and water being added to the latter by well-known means the production of ice can be carried on rapidly and continuously. The
 20 flow of acid through the pipe I is so regulated as to supply enough acid in the form of spray for absorbing the aqueous vapor and change to ice the water placed or introduced into the vessel M, and the area of the pipe H is
 25 such as to admit the acid into the pump-cylinder and maintain the acid in the vessel A at a constant level. The pipe F leads the acid and the aqueous vapor from the pump-cylinder into the carboy or acid-receptacle N,
 30 and the latter can be left partly open for the escape of surplus air brought therein by the pump.

By this construction the use of a separate vacuum-pump is dispensed with, as well as
 35 of a vacuum-pump in which oil is used, which oil is liable to be affected by change of temperature and by gases from the sulphuric acid. If the pumping device consists of two pump cylinders and pistons operated from
 40 opposite cranks upon the shaft, they need not have top valves, as F; but the pistons under vacuum will balance each other.

Having now fully described my invention, I claim—

45 1. In a refrigerating-machine, the combination of a pipe connected with the vessel

containing liquid to be frozen, a receptacle connected to said pipe and containing absorbent liquid acting as a seal, and a pump exhausting the freezing-vessel and drawing
 50 the liquid from the absorbent-vessel.

2. In a refrigerating-machine, the combination of a pipe connected with the vessel containing liquid to be frozen, a sprayer in
 said pipe, a receptacle connected to said pipe
 55 and containing absorbent liquid, and a pump drawing watery vapor from the freezing-vessel and liquid from the absorbent-receptacle and delivering the liquid to the sprayer.

3. In a refrigerating-machine, the combination of a pipe connected with the vessel containing liquid to be frozen, a receptacle
 for absorbent liquid, as sulphuric acid, connected to said pipe, and a pump in said liquid,
 60 drawing from the receptacle and the water-freezing vessel.

4. In a refrigerating-machine operated by vacuum and an acid absorber of watery vapor, the combination of an acid-vessel, a pump
 partly inclosed in said vessel, and pipes
 70 inclosed within said vessel and having one end entering into the pump, whereby air and acid are led simultaneously into the pump, substantially as described.

5. In a refrigerating-machine, the combination of a receiving-vessel having attached
 thereto pipes to lead therein air, watery vapors, and an absorbent acid for said vapors,
 80 with a pump-cylinder having pipes entering its sides to lead therein the air, watery vapors, and the acid from the receiving-vessel, an exit-pipe, an acid-holding vessel or carboy, and a piston within the cylinder, whereby the acid used as a vapor absorbent is also
 85 used to liquid-seal the valves and piston of the pump.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD J. HARDY.

Witnesses:

N. R. COTTMAN,
 D. B. BRITTON.