

(No Model.)

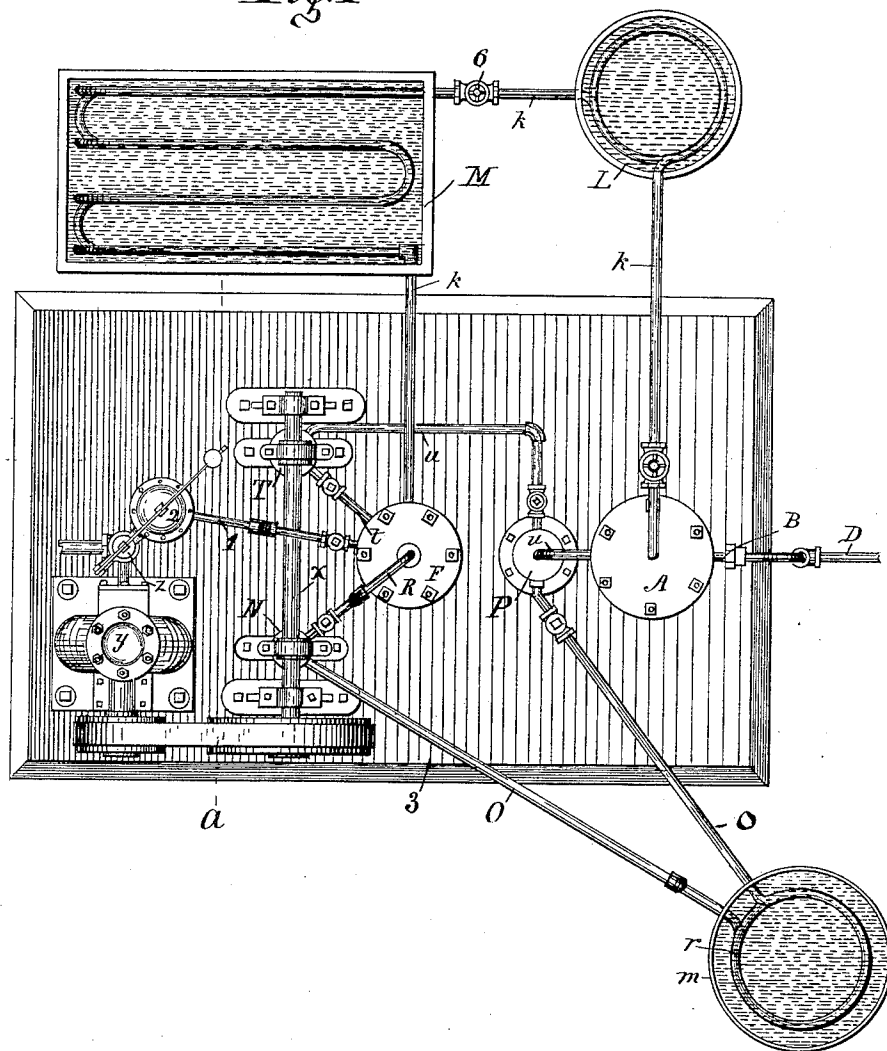
4 Sheets—Sheet 1.

O. H. CASTLE.
ICE MACHINE.

No. 462,689.

Patented Nov. 10, 1891.

Fig. 1



Witnesses
V. M. Hood
A. M. Hood.

Inventor
Oliver H. Castle:
By His Attorney
H. P. Hood

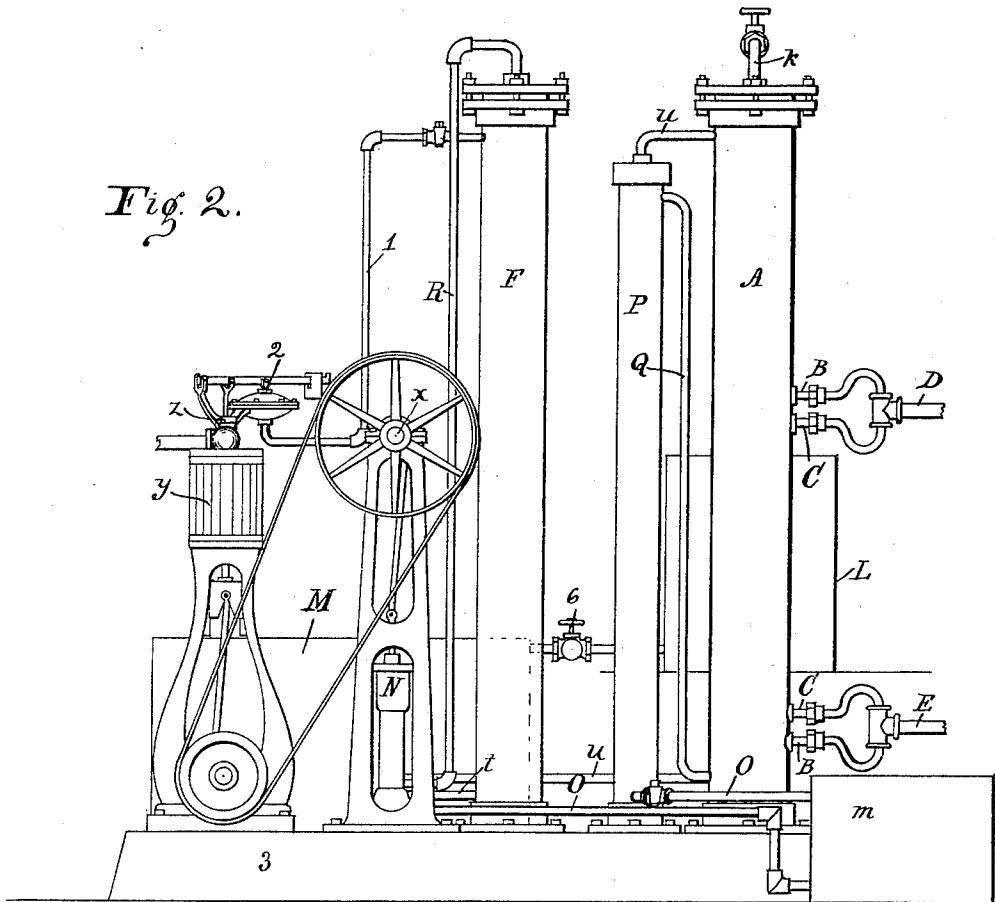
(No Model.)

4 Sheets—Sheet 2.

O. H. CASTLE.
ICE MACHINE.

No. 462,689.

Patented Nov. 10, 1891.



Witnesses
V. M. Hood,
A. M. Hood,

Inventor:
Oliver H. Castle.
By His Attorney
H. P. Hood

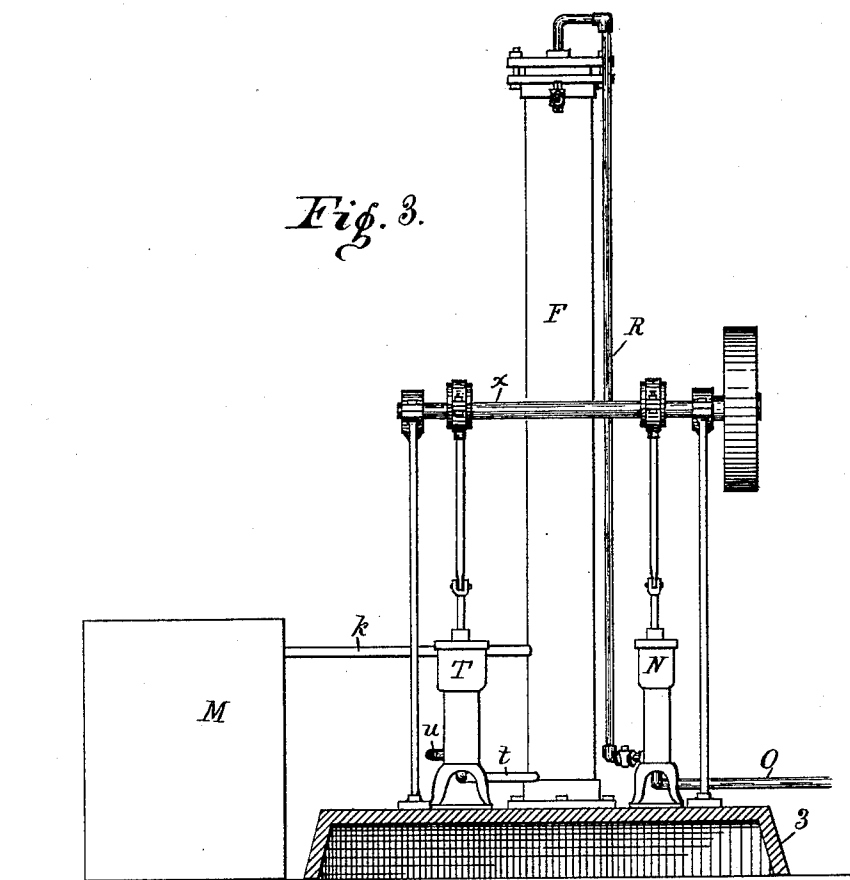
(No Model.)

4 Sheets—Sheet 3

O. H. CASTLE.
ICE MACHINE.

No. 462,689.

Patented Nov. 10, 1891.



Witnesses

V. M. Hood,
A. M. Hood.

Inventor,

Oliver H. Castle,

By his Attorney

H. P. Hood.

(No Model.)

4 Sheets—Sheet 4.

O. H. CASTLE.
ICE MACHINE.

No. 462,689.

Patented Nov. 10, 1891.

Fig. 4.

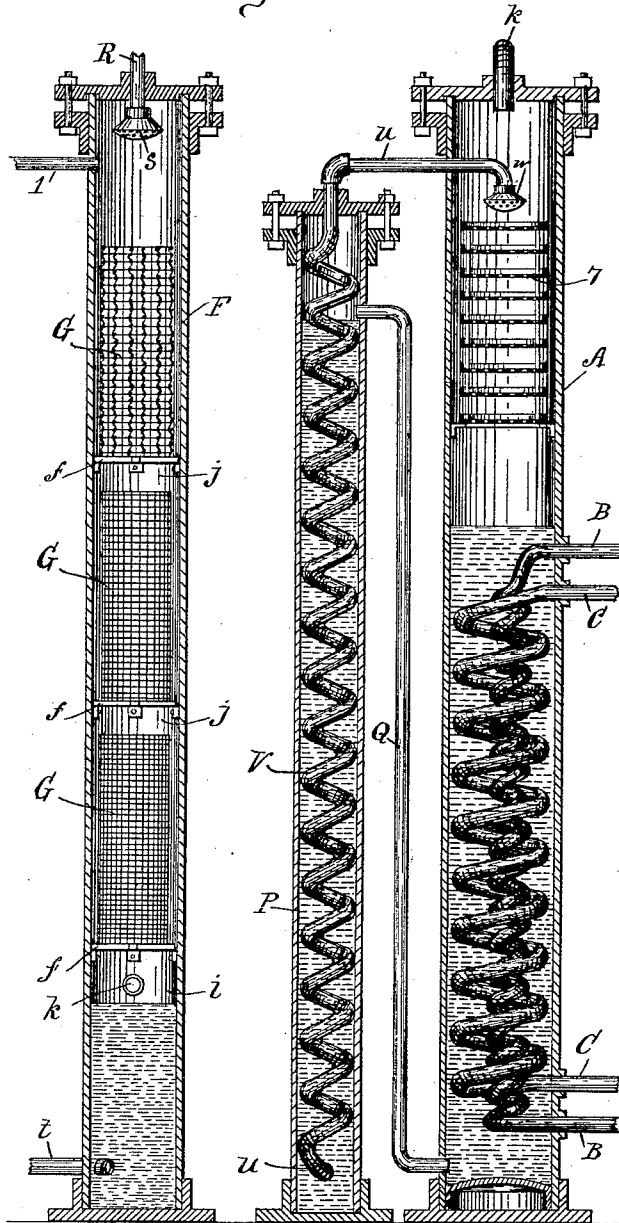
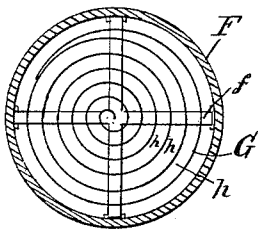


Fig. 5.



Witnesses
T. M. Hood.
A. H. Hood.

Inventor
Oliver H. Castle
By His Attorney
H. P. Hood.

UNITED STATES PATENT OFFICE.

OLIVER H. CASTLE, OF INDIANAPOLIS, INDIANA.

ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 462,689, dated November 10, 1891.

Application filed August 4, 1890. Serial No. 360,900. (No model.)

To all whom it may concern:

Be it known that I, OLIVER H. CASTLE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Improvement in Ice-Machines, of which the following is a specification.

My invention relates to an improved ice-machine of that class in which the necessary temperature of the freezing-liquid is obtained by the use of aqua-ammonia by the well-known "absorption" method. By this method the strong aqua-ammonia is heated by means of steam-coils in a suitable retort, and the ammonia thus separated from the water in the form of gas is conveyed through pipe-coils, which are surrounded by water, where its temperature is reduced to such a degree that the pressure behind it causes it to liquefy. This liquid is then conducted to the refrigerating-coils, where, the pressure being relieved, the liquid again assumes the form of gas, and in so doing absorbs sufficient heat from the surrounding brine to form ice in the ice-molds. The gas after passing from the refrigerating-coils is conducted to the absorption-chamber, into which the water or weak liquor left in the retort is also conducted, having previously been cooled to a moderate temperature. The cool weak liquor, when brought in the form of a spray into the presence of the ammonia-gas, quickly absorbs it and the resulting rich liquor or strong aqua-ammonia is pumped into the retort, and this cycle of operations is repeated indefinitely.

It has been found difficult in practice heretofore to control the relative proportions of gas and weak liquor in the absorber, so as to avoid excessive pressure of gas on the one hand and an oversupply of weak liquor on the other. The objects of my improvement are, therefore, in part, first, to provide improved means for exposing a large surface of weak liquor to the action of the gas in the absorber, to the end that the gas may be rapidly absorbed.

The accompanying drawings illustrate my invention.

Figure 1 represents a plan of the entire machine and necessary tanks. Fig. 2 represents a side elevation of the same. Fig. 3

represents an end elevation at *a*, Fig. 1. Fig. 4 represents on a larger scale longitudinal sectional views of the retort, the heat exchanger, and the absorption-chamber. Fig. 5 represents an enlarged transverse section of the absorption-chamber.

In the drawings, A is the retort in which the strong aqua-ammonia is placed.

B and C are two steam-coils, arranged one within the other in the lower part of the retort. The ends of coils B and C project through the side of the retort and are connected at their upper ends with the steam-supply pipe D, and at their lower ends with the discharge-pipe E. By this construction a free flow of steam through both coils is insured and there are no joints in or between the coils within the retort.

F is the absorption-chamber, which consists of a closed cylindrical vessel having arranged on suitable open transverse supports *f* a series of water-distributing coils G G G, the upper one being shown in section. Coils G consist, preferably, of wire-cloth rolled into a loose cylindrical coil, so as to leave narrow annular spaces between the successive layers, as at *h*, Fig. 5. These coils are of less diameter than the interior of the absorption-chamber, and are arranged centrally on the supports *f*, so as to leave a narrow annular space between the outside of the coils and the walls of the chamber. Supports *f* are arranged so as to leave a clear space *i* at the bottom of the chamber and clear spaces *j j* between the ends of the coils, the object being to permit a free circulation of the gas through and about the coils from the bottom upward. Coils G may be made of perforated sheet metal or of other material which will present a large surface, over which the weak liquor may be distributed, as hereinafter explained. Chamber F, at a point just below the lowermost coil G, is connected with a retort A by a pipe K, which first passes through the condensing-tank L and the freezing-tank M.

N is a force-pump which is connected with the lower part of retort A by a supply-pipe O, stand-pipe P, and pipe Q, and is connected by discharge-pipe R with the upper part of the absorption-chamber F, the pipe terminating within the absorption-chamber in a spray.

ing-nozzles. Pipe O forms between the pump N and the stand-pipe a condensing-coil *r*, which is arranged in a cooling-tank *m*.

T is a force-pump of greater capacity than pump N. Pump T is connected by a supply-pipe *t* with the lower part of the absorption-chamber and is connected by a discharge-pipe *u* with the upper part of retort A, the pipe forming a coil V, which traverses the stand-pipe P and terminating within the retort in a spraying-nozzle *w*. Pumps N and T are both connected to a counter-shaft *x*, which is driven by the steam-engine *y*. Steam is admitted to engine *y* through a throttle-valve *z*, which is controlled by the pressure of the gas in the absorption-chamber, acting through the pipe 1, and the well-known form of pressure-regulator 2, the arrangement being such that when the pressure increases in the absorption-chamber the valve is opened and the speed of the motor is increased, and when the pressure in the chamber decreases the valve is closed and the speed of the motor is decreased.

For the purpose of keeping the engine, the pumps, the absorption-chamber, the retort, and their several connections in true relation with each other they are all rigidly secured to a cast-iron base 3.

The operation of my apparatus is as follows: A quantity of strong aqua-ammonia sufficient to cover the steam-coils B and C is placed in the retort A. Tanks L and *m* are filled with cold water and tank M with brine or other fluid which may be reduced in temperature to the freezing-point of water without congealing. Steam being admitted to pipes B and C, the ammonia separates in the form of gas from the water and passes from the retort to the cooling-tank L, where the gas, by the reason of the reduction of its temperature and the pressure from the retort, is condensed to a liquid, which on passing the valve 6 into the expansion-coils in the refrigerating-tank L again assumes the gaseous form, and in so doing abstracts heat from the refrigerating-fluid and whatever may be placed therein. The gas passes from tank L through pipe *k* into the absorption-chamber F at a point below the lowermost coil G. The operation of the gas thus far is common and well known. The weak liquor left in retort A, from which the ammonia has been mostly expelled, is forced by the pressure in the retort through pipe Q into the stand-pipe P, and passes from thence through the condensing-coil *r* and pipe O to the pump N. The hot weak liquor in passing through stand-pipe P parts with a portion of its heat, which is taken up by the weak liquor passing through coil V, as hereinafter explained, and is still further cooled by its passage through coil *r*, so that when it reaches the pump N it is of a proper temperature to reabsorb the ammonia. The operation of the weak liquor thus far is common and well known.

Heretofore it has been usual in ice-machines

of this class to convey the cold weak liquor by a pipe leading from the boiler, so that it enters the absorption-chamber under the boiler-pressure. By this plan the amount of weak liquor entering the absorption-chamber varies with the boiler-pressure, thus exposing unequal volumes of weak liquor to varying volumes of the expanded gas and making the operation of the machine irregular and uncertain. In my machine the flow of weak liquor is controlled by the pump N, which is driven by the engine *y*, whose speed is regulated by the pressure of gas in the absorption-chamber, operating through the pipe 1 and pressure-regulator 2 to control the throttle-valve *z*. By this means as the pressure of the gas increases in the absorption-chamber the speed of the pump N and the consequent supply of weak liquor is correspondingly increased, thus maintaining a proper relation in the absorption-chamber between the supply of gas and weak liquor thereto. The weak liquor is discharged at the top of the absorption-chamber through the spraying-nozzle *s* and, falling upon the distributing-coils G, forms in the meshes thereof thin films of weak liquor, to which the ammonia-gas passing upward through and between the coils has free access on both sides, thus causing a free and active absorption of the gas. The rich liquor thus formed falls to the bottom of the absorption-chamber and is drawn from thence by pump T through the supply-pipe *t* and passes from the pump through the discharge-pipe *u* through the coil V to the spraying-nozzle *w* in the upper part of retort A, whence it is discharged and falls to the lower part of the retort through suitable distributing-pans 7. It will be observed that pumps N and T are both driven from the same shaft *x* and must always move at the same speed. It will also be observed that pump T is of slightly-greater capacity than pump N. By this construction all possibility of flooding the absorption-chamber with weak liquor is avoided and a regular continuous operation of the machine is attained.

I claim as my invention—

1. In an ice-machine, the combination, with the absorption-chamber and a weak-liquor-supply pipe arranged to enter the upper part of said chamber, of a weak-liquor distributor consisting of a coil of wire-cloth or like perforated material supported in said chamber above its bottom and below said weak-liquor-supply pipe, whereby the weak liquor is distributed in thin films, as and for the purpose set forth.

2. In an ice-machine, the combination, with the absorption-chamber and a weak-liquor-supply pipe arranged to enter the upper part of said chamber, of a weak-liquor distributor consisting of a series of coils of wire-cloth or like perforated material, said coils being supported in said chamber above its bottom and below said weak-liquor-supply pipe, said coils each forming a series of vertical passages and

arranged with a transverse open space between adjacent coils, substantially as set forth.

3. In an ice-machine, the combination, with an absorption-chamber, of a weak-liquor distributor consisting of an open coil of sheet material set on edge within the absorber and arranged to receive the weak liquor and form-

ing a series of vertical passages through which the ammonia-gas may circulate, substantially as set forth.

OLIVER H. CASTLE.

Witnesses:

H. P. HOOD,

A. M. HOOD.