(No Model.)

S. D. LOUNT.

MANUFACTURE OF ICE.

No. 259,697. Patented June 20, 1882.

Fig. 1

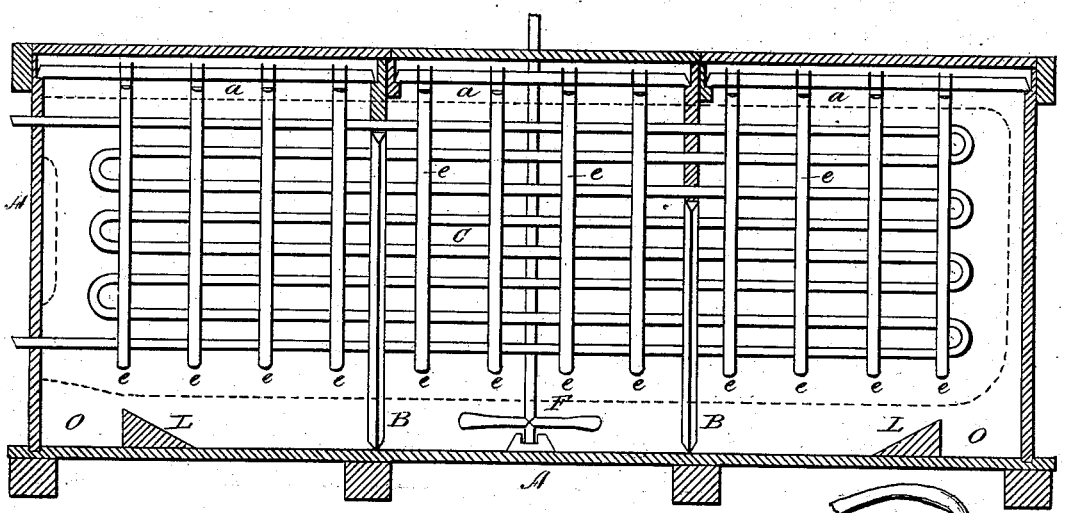


Fig. 2.

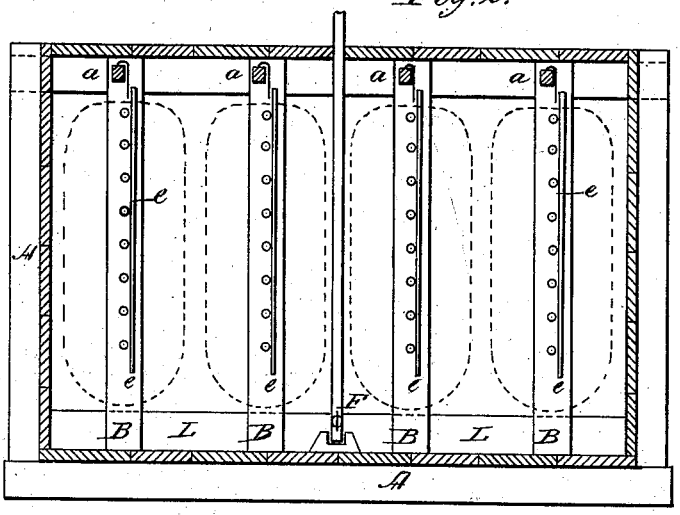
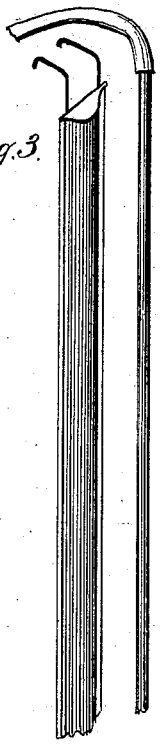


Fig. 3.



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MANUFACTURE OF ICE.

SPECIFICATION forming part of Letters Patent No. 259,697, dated June 20, 1882.

Application filed December 19, 1881. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. LOUNT, of Phœnix, in Maricopa county, and Territory of Arizona, have invented new and useful Improvements in the Manufacture of Ice, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal and Fig. 2 a cross section of my freezing-tank and congealer; and Fig. 3, an enlarged view of one of the parting-tubes used to separate the ice from the congealer, and also of the pipe used for introducing a stream of water into the parting-tubes.

Similar letters refer to similar parts in all the drawings.

A A is a freezing-tank, which should be inclosed in a building with non-conducting walls. This tank contains the water to be frozen, and within it is placed the congealer C. This congealer is simply one or more flat coils of pipe through which the refrigerant is circulated, and which are supported in a vertical position by the posts B B, which posts rest on the bottom of the tank A, their upper ends being attached to joist which run across the top of the tank.

F is an agitator placed in the bottom of the freezing-tank below the congealer, and also below the blocks of ice which are formed upon it. This agitator is operated by an upright shaft which passes through the top of tank A.

L L are low partitions, extending across the bottom of tank A near each end, thus forming receptacles O O for catching the solid impurities which are suspended in the water to be frozen.

e e e e are sheet-metal tubes, closed at the lower end, which are suspended across the congealer-pipes by hooks attached to the upper end. The points of these hooks are bent down and rest on the top of the removable bars *a a a a*. These bars are over the coils of the congealer and parallel with them, and the tubes *e e e e* are supported by them in such manner that one side of each tube is in contact with a coil or row of pipes in the congealer.

One object of my invention is the construction of a congealer consisting of one or more rows or flat coils of pipe, which are placed in an upright position in the water to be frozen and supported upon posts, or their equivalent, in such manner that the sides—top and bottom edges—and one end of the blocks of ice which are formed upon the congealer are not in contact with any solid substance.

Another object of my invention is the combination, with the congealer of an ice-machine which is immersed in the water to be frozen, of an agitator placed in the water and below the congealer, where it can be operated efficiently, and will also permit free access at all times to the congealer or blocks of ice above it.

A further object of my invention is a process for detaching the ice from the congealer without having to first loosen the same by heat, which process consists in freezing tubes closed at one end into the block of ice along the line of the congealer-pipes, removing the tubes after the block of ice has attained sufficient thickness, and then splitting the ice through the line of holes thus formed; and, also, a method for loosening the above-mentioned parting-tubes, previous to drawing them out from the ice, by means of a stream of water above the freezing temperature, which is introduced into these parting-tubes, near their closed ends, through a smaller tube, which is attached to a hose and thrust inside the parting-tube, said stream of water flowing through the parting-tube outside the above-mentioned inside tube and out at the open end of the parting-tube; and, also, a process for removing ice from the congealer of an ice-machine, which consists in making a line of holes in the ice along the line of the congealer and then splitting the block of ice through this line of holes.

My invention further consists in constructing the parting-tubes above mentioned with one flat side between two sharp edges and placing the flat sides in contact with the congealer; also, in the means employed to secure contact between the parting-tubes and congealer-pipes, when placed across said pipes—viz., by suspending the parting-tubes from one side of their center of gravity; also, in the employment of removable supports for the purpose of keeping the parting-tubes in proper position

until they are frozen fast to the congealer-pipes.

A further object of my invention is the combination, with the tank of an ice-machine which contains the water to be frozen and an agitator for keeping the water in motion, of suitable receptacles for the solid impurities which are suspended in the water, said receptacles being placed in the eddies caused by the circulation of the water.

The freezing-tank A should be covered with plank while in use, as shown by the drawings, and the joist across the top of the tank not only keep it from spreading, but afford a rest for the top planks, thus allowing them to be cut into short pieces, by which means access can be had to any part of the tank by removing only a small portion of the covering.

The ends of the congealer-coils C pass through one end of the tank, and are connected on the outside of it with any apparatus used for the purpose of circulating a refrigerant through the congealer. As the refrigerant is circulated the ice forms around the pipes until the adjacent rolls freeze together, when it will form solid blocks, with the congealer-coils inclosed in the center. The dotted lines in the drawings show the outside of these blocks of ice when fully formed.

The water in the tank should be kept above the upper lines of pipe in the congealer, and the lower lines of pipe must be placed a sufficient distance from the bottom and the return-bends from the ends of the tank to prevent the ice-blocks, when of full size, from coming in contact with either the ends or bottom of the tank. Of course the ice will form around the top and bottom lines of the coils where they pass through the tank and freeze fast to it; but if the subdivision of the blocks is commenced at the opposite end, (which should not be allowed to form within a few inches of the end of the tank,) the pieces can be easily removed, as they are separated from the main block, and these attachments will readily break loose when these last pieces are removed.

In practice there are several coils of pipe in one congealer, all in the same tank, (the annexed drawings show four of such coils,) and the ends of these coils are so connected by means of three-way cocks placed outside the tank that either one or more of them can be instantly thrown out of circuit, while the refrigerant is still allowed to circulate freely through the other coils.

When a coil is thrown out of circuit the ice can be taken off from it at any time without interfering with the formation of ice on the coils which are still in circuit, although it should stand a few hours before it is broken into, in order that the surrounding water may equalize the temperature, when it will be less brittle.

It is neither necessary nor desirable that all the ice should be removed from a coil at one time, for the fully-formed blocks weigh one or more tons each, and as they are surrounded at all times by ice-water, there is less melted by taking the ice from the block only as it is sold than there would be by removing the whole block at once and storing it. After one block of ice is all disposed of the coil from which it was taken is again turned into circuit and another block which has been previously thrown out of circuit is broken into.

The weighing-scales, hooks, &c., can be kept on top of the tank, for, as before mentioned, the cover of the tank is divided into several sections, and there is always room enough to handle and weigh the ice on the closed portion of the cover.

Water is drawn into the tank from time to time as the ice is taken out, and it will be seen that the operations of making and selling ice from the same tank can be carried on simultaneously and continuously.

If the ice is frozen faster than it is disposed of, it is only necessary to stop the engine which circulates the refrigerant when there is a surplus of ice in the tank, and, as the amount on hand can at any time be quickly ascertained, the engine can be started up again when necessary.

It will be observed by reference to the drawings that the posts B B, which support the congealer, are beveled from where the congealer-pipes pass through them to the center of each side, and they are not placed directly under the joist to which they are attached, but on one side.

When the ice is taken from the congealer the block is first divided crosswise from top to bottom over the post B, which is next to the free end of the block. This division can be made with a saw, or by means of one of the parting-tubes *e*, suspended from the cross-joist, and a wedge. After making this cross-division the tubes *e e e e*, which are between the post and the end of the tank, are removed from the block of ice, after being loosened by means of a stream of water introduced near their lower ends through the pipe *f*, which can be connected by means of a hose with the tank above the freezing-tank containing water direct from the well or other source of supply. Water at 60° or 70° Fahrenheit, when applied in this manner, will loosen one of the parting-tubes in a few seconds, and as it flows from the open end of the parting-tube into the freezing-tank, there to be frozen into ice, there is no ice wasted while thawing the tubes loose. After removing the parting-tubes long wedges are inserted in the holes which they leave, and a few blows on each wedge will split the section of ice which is over the wedges off from the main block on a line with one side of the coil or row of congealer-pipes on which it was formed. If there is left, as above specified, a few inches of space between the free ends of the blocks of ice and the end of the tank, there will be sufficient room between the cross-joist and end of the tank for the detached section

of ice to pass through, and it can be readily lifted from the water to the top of the tank with ordinary ice-hooks. After this section is disposed of the middle section on the same side of the block can be split off in the same manner and pushed along to the end of the tank and taken out from the same opening through which the first section was passed. The last section on the same side can then be taken out in the same manner, as it will readily break off where it is frozen to the end of the tank when the wedges are driven. The line of bars *a a a*, which is above the coil of pipe from which the ice is being taken, should now be removed and the ice taken from the other side of the coil by sections, commencing, as before, at the free end of the block. The ice on this side of the coil is clinched between the congealer-pipes; but a wedge or two is easily driven through the ice next to the line of pipes, and the clinchers break loose without much waste, and the few chips which are broken off remain in the tank and help to cool the feed-water as it is drawn into it. Occasionally the first side of the block does not split close to the line of the congealer-pipes. This seldom happens; but when it does it is not safe to take off the other side by driving wedges through the solid ice next to the pipes; but in this case holes for the wedges can be bored through the block of ice next to the pipes by simply placing the open end of the pipe *f*, while the water is running through it, over the place where the hole is wanted, and pushing it through the block as the stream of water melts the ice before it. With a quarter-inch gas-pipe a hole which will average about one and one-half inch in diameter can be bored through three feet of ice in about three minutes with water at 70° Fahrenheit, when applied as above mentioned. Holes can be bored in the same way for inserting the wedges used for splitting off the first side of the block, in case some of the parting-tubes have not been placed across the pipes before the block of ice has been formed; but as there will be no sharp angles in the holes next to the congealer-pipes, as there is when the tubes have been employed, the line of cleavage will not be apt to follow so closely the line of the pipes.

One-inch gas-pipe is probably the best size for the congealer, and the posts B B, for supporting it, should not be over four or five feet apart. Therefore, if the congealer-coils are over fifteen feet long, more than two posts, as are shown in the drawings, will be required for each coil.

If the parting-tubes are constructed as shown in the drawings and average two and one-fourth inches wide on the flat side, it will not be necessary to place them nearer than one foot from each other along the line of congealer-pipes.

It is a well-known fact among ice-manufacturers that rapid freezing in still water will cause the ice so formed to be white and porous; but if the surface of a block of ice while freezing is in contact with water in motion, the minute bubbles of air or gas which are constantly liberated from the freezing water cannot adhere to the surface of the ice, and consequently ice so formed will be solid and clear; and it makes no difference whether the motion of the water over the surface of the ice is reciprocating or always in one direction, the only thing necessary being to prevent these minute air or gas bubbles from adhering to one place on the surface of the forming ice until a film of water freezes over them.

The beneficial effect of keeping the water in motion while freezing has been long known, and agitators have been proposed in various forms to be immersed in the water to be frozen, the water being in a tank containing the congealers; but, so far as I know, they have heretofore been placed between the congealers, and also between the blocks of ice which were formed upon the congealers. In fact, congealers of this class, or the frames around them, usually extend to the bottom of the tank. In practical use agitators so placed are liable to be frozen into the adjacent blocks of ice, and, besides, they interfere materially with the operation of removing the ice from the congealer and tank. Their motion must be stopped, and it is usually necessary to remove each set of them from the tank when the adjacent ice is taken from the congealer.

One object of my invention, as before stated, is to secure a thorough agitation by means of an agitator which is immersed in the water to be frozen and placed entirely below the congealer and the blocks of ice which are formed upon it. When so situated it can be operated at all times without interfering with the removal of the ice from the congealer and tank, and, besides, only one agitator is needed for each tank, no matter how many blocks of ice are formed in it; and I do not claim broadly an agitator placed in a tank containing the congealer and the water to be frozen, but only when it is used in combination with a congealer which does not extend to the bottom of the tank, and it is placed below the congealer, as above described.

This agitator can be constructed and operated in various ways and have either a rotary or reciprocating motion; but I prefer simple revolving blades attached to a perpendicular shaft, as is shown in the drawings, on account of efficiency, convenience, and economy, both in construction and the power required to operate it.

I am aware that it has been proposed to subdivide large blocks of ice by freezing flat tubes into them, closed at the lower end, and afterward loosening these tubes by filling them with water above freezing temperature, removing them, and finally splitting the block through the holes thus formed; but, so far as I know, it has always been proposed to divide the block by means of such tubes in a direction perpen-

dicular to the surface of the congealer, and not along the line of the congealer, as is above described. Neither is it practicable in all cases to fill such tubes with water while in practical use without some special arrangement for introducing it, for water often gets into these parting-tubes from the freezing-tank while the ice is forming, either through the open top or by leakage, the result being that the lower ends of the tubes become filled with ice to a greater or less depth, and it is evident that boiling water even would not melt this ice if it were simply poured into the top of the tubes; but if an inside tube is employed, in the manner herein specified, they can be melted loose from the ice in which they are inclosed by means of water which is but little above freezing temperature, even if they are entirely filled with ice.

I am also aware that it has been proposed to form ice in a congealer consisting of a naked coil of pipe supported upon posts and immersed in the water to be frozen, and to remove the ice thus formed from the congealer by means of a series of wedges which are frozen into the block between the congealer-pipes and parallel with them; but it is not practicable to remove the ice from this form of congealer by the means proposed, for, in the first place, the lower edge of the block is attached to a solid support, which will interfere with the separation of the two portions of the block after it is divided; and, secondly, as the wedges are frozen fast in the ice on all sides, they are practically only a portion of the mass, and when power is applied to force them ahead the ice will not split into two parts, but will break in every direction.

Solid ice has a grain running perpendicular to the surface from which it has been frozen, and therefore with congealers having a flat surface it would be difficult to separate the ice from the congealer by employing wedges, unless it was first loosened by heat, for the whole block would have to be divided across the grain. If, however, the congealer is composed of pipes only, without any metallic connection between them, that portion of the block of ice which is between the pipes has the grain running with the line of pipes, and therefore if a line of holes is made along the line of a congealer composed of a row or coil of pipes only, and wedges are driven into these holes, the line of cleavage will practically follow the line of the congealer, whether the holes are made and the wedges driven between and parallel with the pipes or across and in contact with the sides of the pipes, even if the holes are considerably farther apart than the thickness of the ice over the wedges.

When a congealer of the above-mentioned construction is immersed in the water to be frozen it will readily be seen that the most efficient and economical manner of arranging the congealer and parting-tubes for forming a line of holes is the one which is shown in the annexed drawings and herein described—viz., horizontal congealer-pipes in vertical rows or coils, with the parting-tubes suspended vertically across and in contact with the rows or coils of congealer-pipes.

The parting-tubes *e* can be made in various forms; but to insure the division of the ice-block close to the line of congealer-pipes on which it is formed they should be made, as above specified, with a flat side between two sharp edges, the flat side being placed next to the line of the congealer-pipes. The best manner for constructing these flat-sided tubes is by joining a flat piece of sheet metal the length and breadth of the tube to an arc-shaped piece of the same length by means of flat seams along the edges, as is shown in Fig. 3. Both the flat and arc-shaped pieces should be cut tapering, so as to make the tubes smaller at the closed than at the open end. When these parting-tubes are placed in position across a row of congealer-pipes they are suspended from one side of their center of gravity, as before described, by which means the weight of the tubes will keep them in position until fastened by ice formed on the congealer-pipes.

While placing a row of parting-tubes in position, and until they are fastened, as above mentioned, it will be necessary to stop the motion of the agitator; otherwise the motion of the water in the tank would throw the tubes out of place. The time consumed, however, for one man to place a row of parting-tubes across a row of congealer-pipes twelve to eighteen feet long, turn the congealer-pipes in circuit, and have sufficient ice formed to fasten the tubes in position need not be over fifteen or twenty minutes, and during that time there will be little or no white ice deposited upon the other blocks which are forming in the same tank. Of course the parting-tubes can be rigidly attached to the supporting-bars, if required, and the agitator kept constantly in motion; but I prefer supporting them in the manner above described.

As the supporting-bars *a a a* would interfere with removing the ice, they should be attached to the tank by means of recesses in the joist and ends of the tank, as shown in the drawings, or by any other means which will allow them to be removed after the parting-tubes are withdrawn.

As nearly all the water which can be obtained for making ice contains lime, and sometimes salt and other solid matter, both in solution and suspension, which matter is not taken up by the ice, means must be employed to prevent the water which remains in the tank from becoming too highly charged with these impurities. This object can be attained by occasionally emptying and cleaning out the tank; but this would interfere with continuous operation, and therefore it is preferable to draw off once in two or three days, or oftener, a small portion of the water from the tank and fill up with fresh water. This will

get rid of the soluble impurities, and the solid matter which is held in suspension will be caught in the receptacles O O, these receptacles being situated across the bottom of the ends of the tank, or in any other position where they will be in the eddies caused by the circulation of the water in the tank.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A congealer for an ice-machine, consisting of one or more flat coils or rows of pipe attached to and supported by posts and placed in an upright position in a tank containing the water to be frozen, when so constructed and arranged that the blocks of ice which are formed upon it will be held in position by the posts which support the congealer, and will not come in contact with the tank or any other support, except at one end of the blocks, substantially as and for the purpose set forth.

2. The combination, with the congealer of an ice-machine which is placed in a tank containing the water to be frozen, but does not extend to the bottom of said tank, of an agitator placed within the tank and below the congealer, and also below the blocks of ice formed upon it, substantially as described.

3. The process herein described for detaching the ice from the congealer, which consists in freezing tubes closed at one end in the blocks of ice along the line of the congealer, removing the tubes after the ice has attained sufficient thickness, and finally splitting the blocks of ice along the line of holes left by said tubes.

4. The method herein described for loosening the parting-tubes previous to drawing them from the ice, which consists in pushing a smaller tube inside the same and introducing a stream of water which is above the freezing temperature through this inside tube into the parting-tube near the closed end, substantially as and for the purpose set forth.

5. The process of removing the ice from the congealer of an ice-machine which consists in making a line of holes in the block of ice along the line of the congealer, and then splitting the block of ice through this line of holes.

6. In combination with the congealer of an ice-machine, the parting-tube *e*, made with one flat side between two sharp edges, the flat side being in contact with the congealer.

7. The method herein described for securing contact between the parting-tubes and congealer, which consists in suspending the parting-tubes from a point on one side of the center of gravity.

8. In combination with the congealer of an ice-machine and a row of parting-tubes placed along the line of said congealer, removable supports for the parting-tubes, substantially as herein described.

9. The combination, with the tank of an ice-machine which contains the water to be frozen and an agitator for keeping the water in motion, of suitable receptacles for catching the solid impurities which are suspended in the water, substantially as described.

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