(No Model.) 2 Sheets—Sheet 1.

A. W. ZIMMERMAN.

REFRIGERATOR CAR OR CHAMBER.

No. 417,801. Patented Dec. 24, 1889.

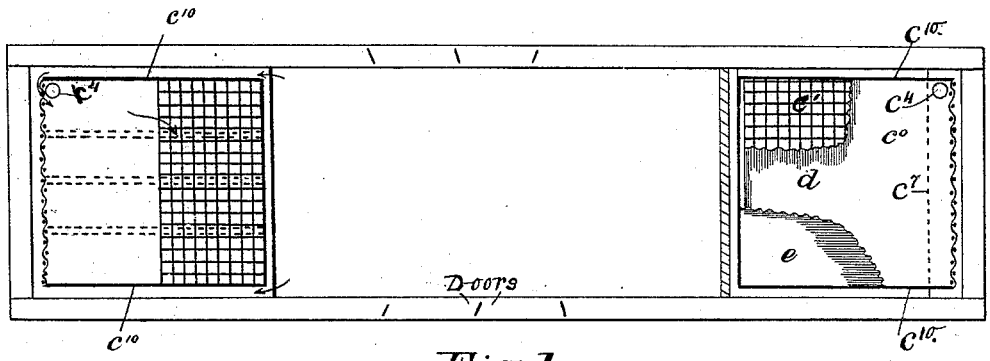

Fig. 1

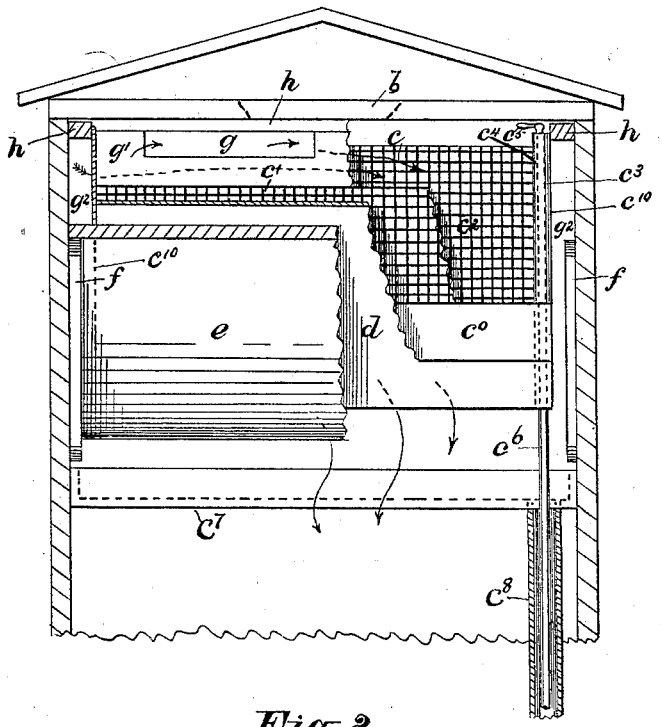

Fig. 2

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(No Model.) 2 Sheets—Sheet 2.

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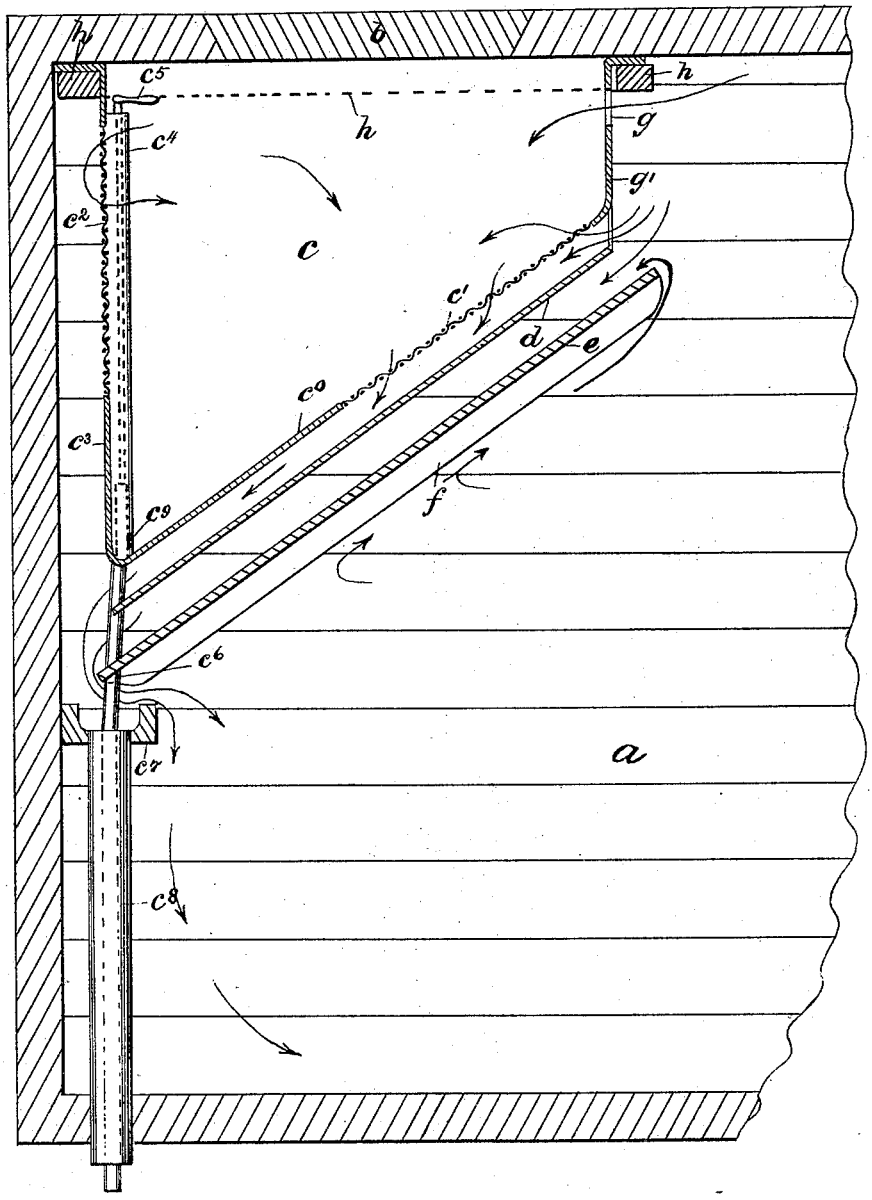
Fig. 3



Witnesses;
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UNITED STATES PATENT OFFICE.

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REFRIGERATOR CAR AND CHAMBER.

SPECIFICATION forming part of Letters Patent No. 417,801, dated December 24, 1889.

Application filed January 26, 1888. Serial No. 261,981. (No model.)

To all whom it may concern:

Be it known that I, ARNOLD W. ZIMMERMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Refrigerator Cars and Chambers, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a plan view of my improved refrigerator-car, having its top removed so as to show the interior of the ice-chambers. Fig. 2 is an end view of one of the ice-chambers as seen from the center of the car, the various parts being broken away so as to show one part behind the other and the air circulation, as indicated by the arrows. Fig. 3 is a side elevation, in vertical section, of one end of a car on a plane taken at any point between the wall nearest the observer and the center of the car, and in it are also shown the opposite walls and air-flues and air circulation, as indicated by the arrows.

Like letters refer to like parts.

The object of my invention is to produce a refrigerator car or chamber in which higher refrigeration may be obtained by means of ice and salt or like frigorific compound than has heretofore been found practicable, owing to the fact that the difficulties which are encountered in refrigeration by means of ice or refrigerating-mixtures placed in tanks are mainly due to the impossibility under ordinary circumstances of securing a sufficient circulation of air in the chamber to be cooled, and to the fact that the moisture condenses upon the cold surfaces of the tank containing the refrigerating-mixture in a thick layer of frost or snow, so that no matter what degree of cold may be produced within the tank the air within the chamber to be cooled is only brought in contact with a surface having the temperature of melting snow.

It is the object of my invention to remedy both these objections by creating sufficiently strong currents of air in the chamber and by preventing the deposition of snow or frost upon the heat-absorbing surfaces.

The general principles of construction involved in my invention are the following: I construct an ice-tank of any suitable form, which has an inclined bottom. The upper portion of that bottom is perforated, the lower portion imperforate. Beneath and parallel or approximately parallel to this inclined bottom I arrange an apron of any suitable material which is a good conductor of heat—say sheet-iron. This apron neither at the upper end nor at the lower end is connected with the ice-tank in any way such as to interfere with the passage of air, and is placed at a suitable distance from the said bottom, such as will leave an air duct or channel between the bottom of the tank and this apron, open at both the upper and the lower end. Below and parallel or approximately parallel to this apron of conducting material I place a second apron of some material which is a non-conductor of heat, such as wood. This is placed at a suitable distance from the first apron so as to leave a second air duct or channel between the two, also open at top and bottom. As a result of this construction the air which is in the air ducts or channels is rapidly cooled and flows down and out at the lower end, thus setting up a current and a circulation of air. This current is materially accelerated by the water and brine—if salt is used on the ice—which drops through the upper portion of the bottom which is perforated, and falling on the metallic apron runs down the same and drops off the lower edge into a drip-trough. The water, also, which collects in the bottom of the tank and rises to a level with the lower edge of the perforated portion pours through these openings down upon the apron, and thus acts to accelerate the current of air. When the tank is in a refrigerator-car, the uneven motion of the car causes this action to occur intermittently, and the water swashes over in considerable quantities at a time, which has a beneficial influence in producing the desired air-currents. As a consequence, the current of air through the ducts or channels is of a sufficient rapidity to prevent the deposition of moisture upon the bottom of the tank or the metallic apron, and the latter are kept in the most efficient condition for absorbing heat

from the air-currents. Moreover, this arrangement presents a large amount of cooling-surface to the air-currents. The metallic apron is kept at a low temperature by its proximity to the ice-tank, and especially by the constant dripping upon it of the brine, and the air has access to both sides of the apron. Thus is produced a double current of air, which is rapidly cooled and delivered in a united stream from the lower mouths of the air ducts or channels and flows out into the chamber which is to be refrigerated.

I will now specifically describe a construction which shall embody the principles and accomplish the objects above set out.

At each end of the room or car a, I suspend under the roof, on beams h, or cleats, or other like device, an ice-tank c, having a short front wall g' and a long back wall c^2 c^3 of which the upper part c^2 is formed of open wire-cloth or perforated sheet metal, and the lower part c^3 of galvanized sheet-iron. To the said front and back walls and sides of the tank is attached a slanting bottom, of which the lower part c^0 is formed of sheet metal and the upper part c' of wire-cloth meshes or perforated sheet metal. The sides c^{10} are preferably solid sheet metal throughout, but their upper parts may also be made of open-work, if so desired, down to on about a line with the lower end of the wire-cloth c^2, and through said openings, when employed, a free-air circulation may be obtained from the storage-chamber directly upon the ice, whereby said air is deprived of all its acquired moisture, and is, at the same time, cooled down to the lowest possible point attainable from the refrigerating agent.

The lower ends of the sides c^{10} and the back c^3 and the bottom c^0 form a water-tight tank, which has an outlet c^9, placed in one corner near or at the lowest point of the bottom to let out the water. Said outlet is opened and closed by means of a cock c^5 passing through the corner tube c^4.

The water derived from the ice may be drained out through an opening c^9, closed by the cock c^5, into the pipe c^6, and said pipe c^6 passes through the drip-pipe c^8, which latter passes through the bottom of and thereby serves to discharge the water from the drip-trough c^7. By this construction the drain and drip pipes are placed in the most efficient position, and at the same time are the most effectually out of the way from injury, and by the one passing through the other they each give support and strength to the other, and are strengthened by the parts to which they are attached.

A short distance (one to several inches) below the bottom c^0 c', and about parallel with it, is a sheet-metal apron d, extending about as far as the side walls c^{10} on the sides, and from the back wall c^3 to the front wall g', which is preferably suspended from the ice-tank; and at about a like distance below said apron d is supported an apron e, of wood or other non-conducting material, also about parallel with the apron d and bottom c^0 c'. Said apron e extends back to about over and some distance above the center of the drip-trough c^7, which is placed against or near the end wall of the room, and at the front it extends to or somewhat beyond the wall g', and fits closely against the side walls of the car, where it rests on cleats f. The drip-trough c^7 is made wide and deep and inclined to one side of the room, and in its lower end is placed a discharge-pipe c^8, leaving an annular space between it and the pipe c^6 to let out the water caught on the aprons d and e, and discharged into the said trough.

By providing two aprons d and e, and making the outer one of wood or other non-conducting material, all condensation and therefore dripping from the outer or under side of said apron d into the storage-room is prevented.

The apron e acts as a roof to catch and discharge all dripping water into the drip-trough, and said apron e, by reason of its being both a non-conductor and fitting to the side walls of the storage-room and closely to the drip-trough at its lower edge, and the upper edge thereof extending high up and to near the top of the storage-room, between temperatures of wide difference, gives excellent inducement for strong currents of air circulation moving as shown by the arrows. One or more holes g may also be cut in the top of the front wall g' so as to allow a circulation of air through them directly upon the ice.

Around the outside of the side walls c^{10} and back wall c^2 c^3 there is an air-space for the free circulation of air around and into the ice-tank, as indicated by the arrows, which, after cooling to the full capacity of the refrigerating agent, descends through said air-spaces, and thereby aids and increases the current formed and directed by the apron e. It is not necessary, however, for the operation of my invention that there should be such openings as these, since the unaided action of the air ducts or channels, as previously described, is sufficient to set up a circulation of air in the chamber or car and bring all of it in contact with the refrigerating-surfaces.

In practice the ice-tank is filled from the top through the opening b. When a greater degree of cold is desired than can be obtained from melting ice alone, salt or other frigorific substances may be used upon the ice. As the ice melts, the water therefrom fills the lower and water-tight part of the tank and overflows it through the lower openings in c', which are placed a little lower than the lower edge of the wire-cloth c^2 in the back wall of the tank, so as to cause the cold liquid to splash upon the apron d, and thereby flow over a large surface, and also to thereby at the same time agitate the air, both by its motion in the tank and its flow on the apron, and thereby, further, both by its cold temperature and motion, cause and augment

the cold-air circulation due to the construction herein shown. The air-space between the tank-bottom c^0 and apron d would soon fill up with ice formed from the moisture, as before mentioned, but for the rapidity of the currents produced and the fact that by the overflow of the brine or liquid over the upper edge of the bottom c^0, the said space is kept clear and the air-currents uninterrupted.

It is a well-known fact that the moisture condensing, and thus forming thick frost on the outside of a closed sheet-metal ice-tank, forms such a good non-conductor that no greater degree of cold can be secured in the storage-room than that of melting ice, no matter how powerful the frigorific agent within it may be, as the force of the greater degree of cold is expended in forming the frost on outside of the tank obtained from the moisture in the refrigerating-chamber; but by the construction herein shown and described the air has direct access to the bare frigorific substance at all times, which the circulating air is bound to find and to the water or brine flowing through the perforations in the bottom of the ice-tank and dripping on the metallic apron, so that by this construction and generation of air-currents the storage-room can be quickly and permanently cooled to the full temperature of any frigorific agent, which may be very far below the freezing-point. The water running from the melting ice which rests on the meshes of the bottom c' forms icicles between the said bottom and the apron d, which said icicles together form a very large area of ice-surface, against which the warm-air currents from above impinge in their downward passage and are divided into numerous small currents, which are thus quickly and completely cooled and deprived of their moisture, and which then pass on uninterrupted through the aforesaid clear space under the bottom c^0 and out into the storage-room.

What I claim is—

1. In a refrigerator-car, an ice-tank suspended from the ceiling in such a manner as to leave between said ice-tank and chamber-walls a free air-space on each side of said tank extending to the ceiling, said ice-tank being provided with a short front wall and a long back wall, which, together with the side walls, are connected by an inclined bottom, which latter is perforated in its upper part, while its lower part, together with the back and side walls of the tank, forms a water-tight receptacle, a metal apron suspended below and parallel to said tank-bottom, and a second apron of wood or other non-conducting material arranged below and parallel to said apron, said second apron being fitted to and supported in the side walls of the apartment, and a drip-trough under its lower edge, substantially as specified.

2. In a refrigerator-car, an ice-tank suspended from the ceiling in such a manner as to leave between said ice-tank and chamber-walls a free air-space on each side of said tank extending to the ceiling, said ice-tank being provided with a short front wall and a long back wall, which, together with the side walls, are connected by an inclined bottom, which latter is perforated in its upper part, while its lower part, together with the back and side walls of the tank, forms a water-tight receptacle, a metal apron suspended below and parallel to said tank-bottom, a second apron of wood or other non-conducting material arranged below and parallel to said apron, said second apron being fitted to and supported in the walls of the chamber, a drip-trough under its lower edge, and a drain-pipe from said ice-tank provided with a cock, said drain-pipe being passed through a drip-pipe of said drip-trough, substantially as specified.

3. The combination of an ice-tank having an inclined bottom imperforate at its lower portion and foraminous at its upper portion with a duct beneath it into and through which the drip from the interior of the ice-tank and air from the refrigerating-chamber pass, substantially as and for the purpose set forth.

4. In a refrigerating apparatus, the combination of an ice-tank which has an inclined bottom imperforate below and foraminous above, an apron of conducting material arranged beneath and parallel or approximately parallel to the bottom of taid tank, and a second apron of non-conducting material arranged below and parallel or approximately parallel to the first apron, so that there shall be air-ducts between these aprons and between the first apron and the bottom of the ice-tank, all substantially as described.

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Witnesses:

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