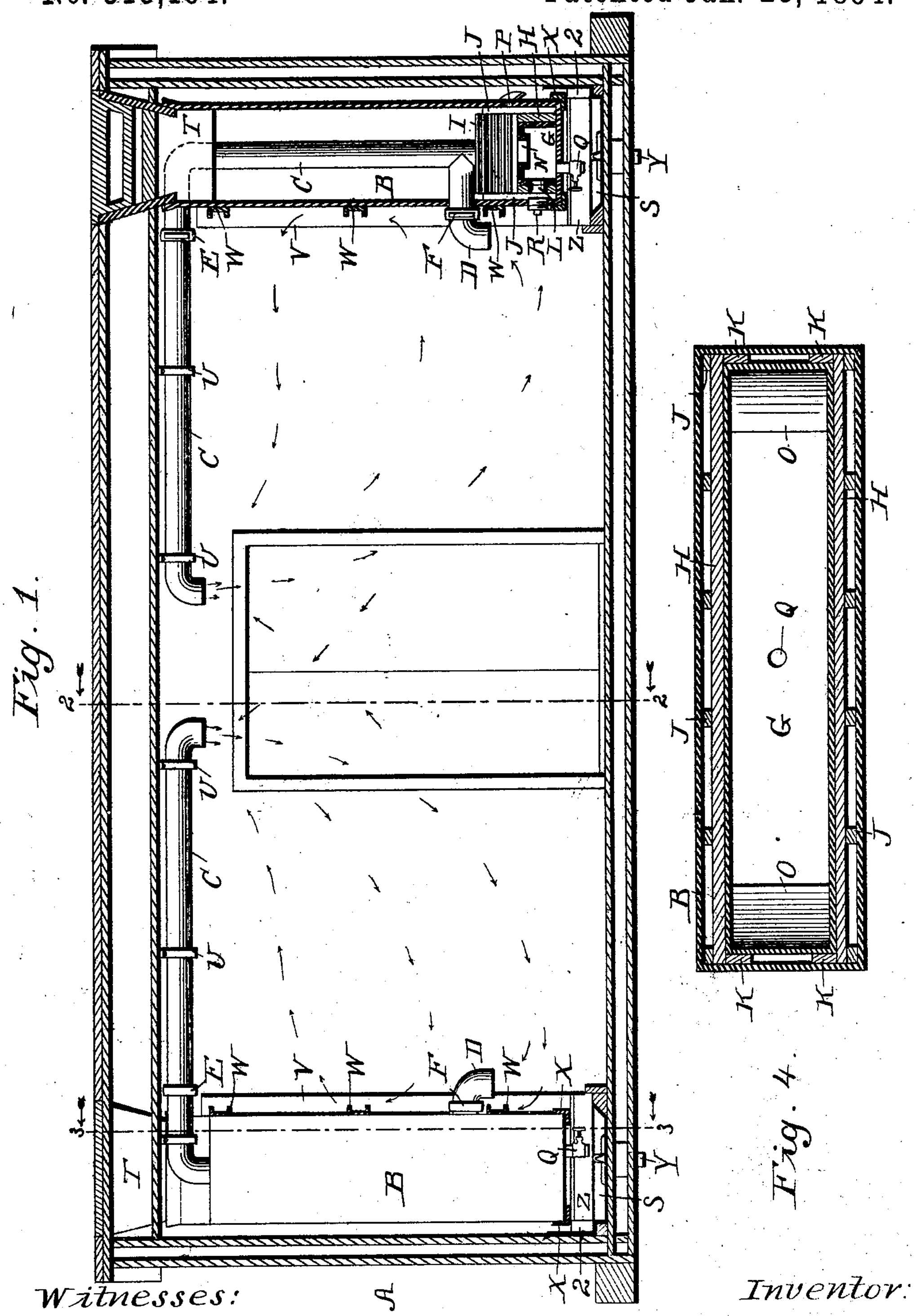
(No Model.) 2 Sheets—Sheet 1.

M. S. MILLARD.

REFRIGERATOR CAR.

No. 513,194. Patented Jan. 23, 1894.



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THE NATIONAL LITHOGRAPHING COMPANY, WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

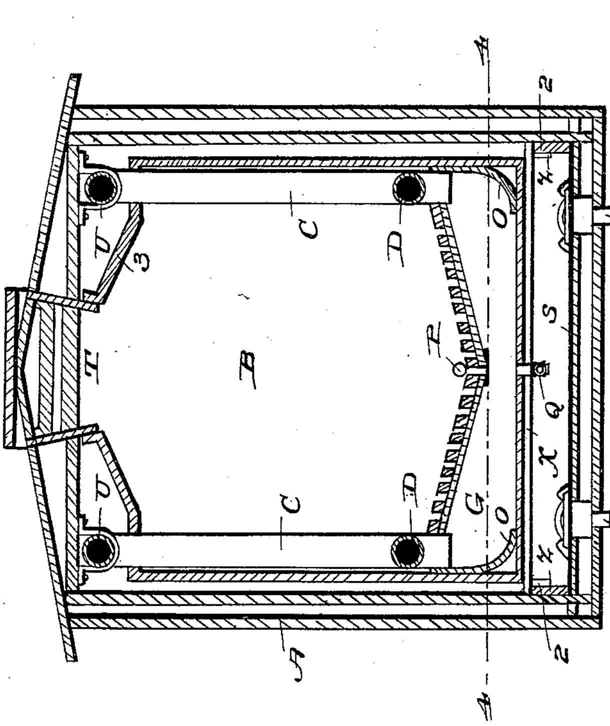


Fig. 6.

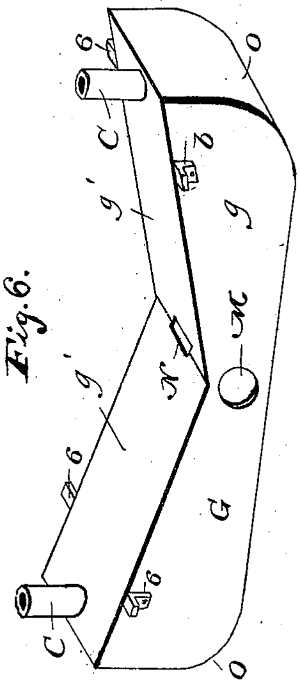


Fig. 2.

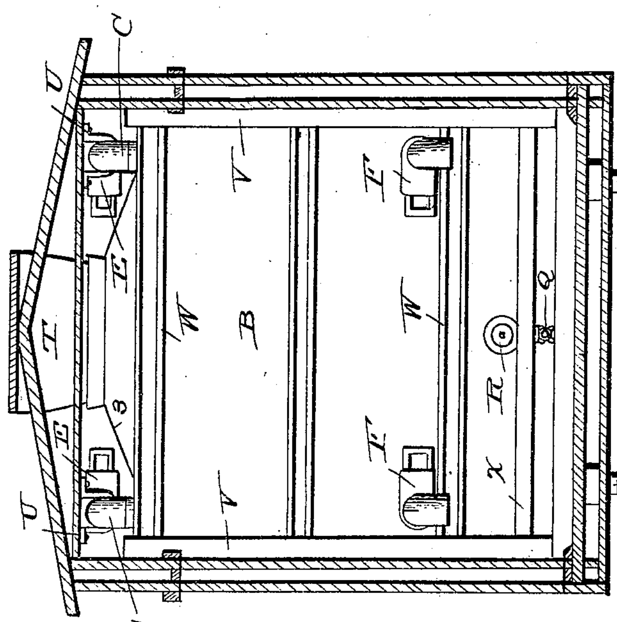
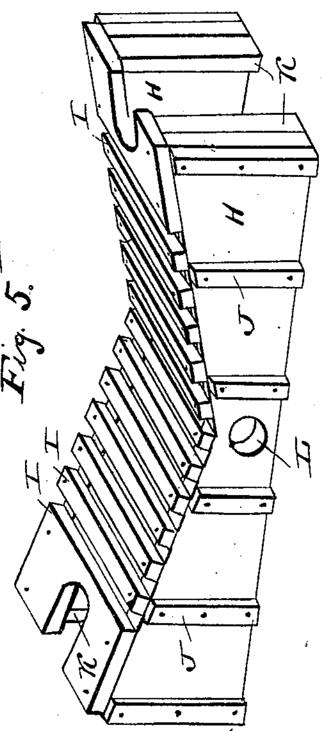


Fig. 5.



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UNITED STATES PATENT OFFICE.

MARTIN S. MILLARD, OF KANSAS CITY, MISSOURI.

REFRIGERATOR-CAR.

SPECIFICATION forming part of Letters Patent No. 513,194, dated January 23, 1894.

Application filed May 29, 1893. Serial No. 475,894. (No model.)

To all whom it may concern:

Be it known that I, MARTIN S. MILLARD, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Refrigerator-Cars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in refrigerator cars in which are provided devices for insuring a positive circulation of air within the car body when the car is in motion and which also provides for the circulation of air, by conduction, when the car is at rest, so that a continuous circulation of air is insured through the car at all times, (both when in motion and at rest,) to maintain the temperature at practically the same points in all parts of the car. In my apparatus, the rocking or swaying motion of the car is utilized to draw the warm air from the body of the car into the refrigerating apparatus and force the cold air from the latter into the chamber of the car, thus maintaining the positive circulation of air throughout the car when it is in motion.

My apparatus is simple, cheap and durable in construction, and it can be readily removed from the car when it is necessary to repair or refit the car.

With these ends in view, and such others as pertain to my invention, it consists of the peculiar construction and arrangement of parts, and in the novel combination of devices, which will be hereinafter fully described and particularly pointed out in the claims.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a vertical longitudinal sectional view through a refrigerator car, with the tanks at both ends of the car, one of the tanks being shown in vertical section and the other tank by side elevation. Fig. 2 is a vertical transverse sectional view through the car, on the plane indicated by the dotted lines 2—2 of Fig. 1, illustrating one of the end tanks in front elevation. Fig. 3 is a vertical transverse sectional view through the car and one of the end tanks, the plane of section being indicated by the dotted line 3—3 of Fig. 1. Fig. 4 is a transverse horizontal sectional view through the lower part of the tank and the air forcing chamber therein, the plane of section being indicated by the dotted line 4—4 of Fig. 3. Fig. 5 is a detail perspective view of the removable ice tray or rack designed to be placed over the air forcing chamber in the bottom of the refrigerant tank. Fig. 6 is a detail perspective view of the removable shell forming the air forcing chamber in the bottom of the refrigerant tank.

Like letters and numerals of reference denote corresponding parts in all the figures of the drawings, referring to which—

A is the car which is of the usual or any preferred construction, having the double walls at its sides and ends, bottom and top, but this construction is optional.

At each end of the car I provide the tanks B, B, which preferably extend the width of the car, but the arrangement of the tanks at opposite ends is not essential as the tanks can be situated in the middle of the car and the doors provided at the ends of the car. Hence I do not limit myself to the position of the tanks shown in the drawings. Below the tanks are provided the drip pans S, S, one to each tank, and on the upper edges of the drip pans are fitted the supporting bars Z, Z, which are arranged at right angles across the drip pans, preferably at the ends thereof. On the upper edges of these transverse supporting bars Z, Z, are placed the angle bars X, X, which are at right angles to the bars Z, Z, and which extend longitudinally of the drip pan and along the bottom of the tank B. The tank rests upon and is supported by these angle bars X, X, the lower corners of the tank being fitted in the angle bars; and said angle bars and the bars Z, Z, are removable from beneath the tank so that the latter can be detached from the supporting devices to permit of its ready removal and replacement. These supporting bars X, Z, also elevate the tank above the drip pan and the floor of the car so that a space is provided between the bottom of the tank and the drip pan for the free circulation of air beneath the tank for cooling or condensing the air in the car; and the back and sides of the tank are arranged out of contact with the side and end walls of the car to permit the air to circulate freely around the entire tank, which is very desirable, especially when the car is at rest, as a circulation of air, by conduction, is thus insured within the car, thereby contributing materially to the efficiency of the apparatus.

The tank is preferably constructed of metal, with imperforate bottom, side and top walls; and the top of the tank is inclined at 3, 3, shown more clearly in Fig. 3, to form the open throat T through which the refrigerant can be introduced into the tank. The throat T is near the top of the car, or it can be extended into or through the ceiling, and it is adapted to be securely closed by means of the cover T′ that can be removed from the outside of the car, at the top thereof.

To prevent the ice or refrigerant in the tank from bulging or forcing out the vertical walls of the tank, I provide the stay bars W, W, preferably made of angle iron. The stay bars W, W, are arranged in direct contact with the wall of the tank, at suitable intervals thereon, and extend from side to side thereof; and these bars are confined or held in place by means of vertical bars V, V, which are arranged to bear against the stay bars W, W, and which are fastened in any suitable manner to the side walls of the car, as for instance by bolts.

To remove the tank from the car, it is necessary to first detach the bars V, the stay bars W, then take out the front angle bar X, allowing the tank to tilt forward, and finally remove the rear bar X, whereby the tank can descend into the drip pan from whence it can be easily removed. It will thus be seen that the tank can be removed and replaced at will, and that the tank is sustained in position within the car by devices which rigidly and securely hold it in place and at the same time provide for the desired circulation of air wholly around the tank, to cause the air to be cooled and condensed by contact with the metallic walls of the tank.

In the bottom of each of the tanks B, B, I provide a sub-chamber G which I term, and will hereinafter designate, as the air forcing chamber for the reason that it serves to receive the body of liquid which is adapted to be oscillated within the chamber G by the rocking motion of the car; and this oscillation of the body of liquid in the chamber effects the suction and expulsion of the warm and cold air respectively, to insure a positive circulation of air, thus maintaining the temperature at practically the same point throughout the entire car.

The air forcing chamber G is formed by a shell or casing, the preferred form of which is illustrated in Fig. 6 of the drawings. The shell or casing consists of the side walls, g, the inclined top g', g', and the curved ends O, O, all of which are suitably constructed of metal, preferably, although this particular material is not essential. In the preferred embodiment of my invention the shell is open at its bottom and is placed directly within the lower part of the tank B, to rest upon the bottom thereof, so that the bottom of the tank forms the bottom of the chamber G. The top parts g', g', are inclined reversely to each other from the middle toward the ends of the shell and thus has its top depressed at the middle thereof; and in this central depression is formed an opening N through which the cold water from the tank B can pass into the chamber G. The end walls O O of the shell are curved or inclined from the top to the bottom of the shell, as shown by Fig. 3, and the lower edges of the curved walls rest upon the bottom of the tank, as shown. The shell is made somewhat smaller than the bottom of the tank, and over this shell and between the walls of the tank is placed the protective crate or tray H which serves to sustain the weight of the refrigerant in the tank and prevent it from bending or crushing the shell forming the chamber G. This crate or tray encompasses the shell on all sides except the bottom, and it is made open so that the cold water can circulate or pass through the crate and around all sides of the shell. Said crate consists of the side pieces which conform to the shape of the sides g of the shell, the horizontal spaced bars I fastened to the upper edges of the side pieces, the vertical side cleats J fastened to the upper edges of the side pieces, the vertical side cleats J fastened to the sides of the crate, and the vertical end cleats K, K, fastened to the ends of the side pieces, all as shown more clearly in Fig. 5. This crate is fitted over the shell and removable therefrom; and the side cleats J lie between the sides of the tank and the shell while the cleats K are between the end walls O of the shell and the ends of the tank, whereby a space is left all around the shell and tank to receive the cold water.

The tank B is provided with an overflow opening P which may discharge to a spout, as shown by Fig. 1; said opening P being situated at a point just above the central depressed part of the top of the shell forming the chamber G so that cold water will fill the chamber up to the line of the opening P; but as this chamber G is enlarged in depth from the middle toward the ends thereof and as the depth of the chamber at the ends thereof is greater than the distance between the bottom of the tank and the overflow P it will be seen that the chamber G is not entirely filled with water but that an air space is provided at each enlarged end of the chamber above the line of the cold water therein.

C, C, are the air pipes which serve to conduct warm air from the car to the forcing chamber G and to conduct cold air from said chamber G to the car as the car rocks or oscillates to influence the body of cold water in the chamber G. These pipes C, C, are provided near the sides of the car, and said pipes extend vertically through the sides of the tank down to the chamber G and then extend horizontally through the upper part of the car from the tank substantially to the middle of the car, the ends of the pipes C opening into the car to discharge cold air therein and to draw warm air therefrom. The lower ends of the pipes C, C, are connected to the enlarged end parts to the shell G to communicate with the air spaces in the enlarged ends of the chamber, as shown by Fig. 3; and these pipes C are designed to receive and discharge air into the upper part of the car, but they are provided with branches D, D, which connect with the pipes at points just above the chamber G and which extend through the tank B so as to draw in and discharge air into the bottom of the car. The volume of air passing through the pipes C can be regulated by means of valves E which are preferably of the slide or gate variety as they are fitted in horizontal guides, see Fig. 2, and the pipes D are likewise provided with the regulating valves F similarly guided by horizontal slides. These gate valves E, F, are designed to be adjusted by hand, but if desired, I may employ free movable automatic valves in the pipes C, D, to control the direction of the flow of air through the pipes.

The automatic valves are not essential and I have not deemed it necessary to illustrate them, as I prefer to employ the valves E, F, as they are cheap, simple and not liable to get out of order.

The pipes C, C, are sustained in place on the ceiling of the car by means of the hangers or clips U which embrace the pipes and are suitably fastened to the ceiling of the car.

To prevent the crate and the weight of the ice from wearing out the bottom of the tank, the crate and shell forming the chamber G are connected by means of the clips 6, 6, which are fastened to the sides of the shell and are adapted to engage with the sides of the crate; and in the sides of the shell and crate are provided the coincident hand holes L, M, respectively, by which the bottom of the tank and chamber can be cleaned.

The water from the tank can be discharged through a valved pipe Q which depends from the bottom of the tank B into the drip pan S, and said tank has a hand hole in one side thereof, which is normally closed by the screw cap R, said hand hole in the side of the tank being in line with the openings L, M, in the crate and shell. See Fig. 1. The drip resulting from condensation by the warm air coming in contact with the cold walls of the metallic tank is collected in the drip pan S, and it is discharged therefrom through the traps Y that extend through the bottom of the car.

This being the construction of my apparatus, the operation may be described as follows: Each tank B is filled with crushed ice and with the necessary quantity of salt. Water from the melted ice fills the chamber G to the center line, at about the line of the openings N or P, and the surplus water will escape from the tank through the overflow P. When the car is in motion, the body of cold water therein is oscillated or moved up and down alternately in each enlarged end of the air forcing chamber G therein, and thus the air is drawn into the chamber through one of the pipes C while it is forced out of said chamber through the other pipe C, which effect is produced by the oscillation of the body of the cold water in the tank. The air forcing chamber G thus acts as a pump to draw in and force out the air alternately in opposite ends of the chamber when the car is in motion, and the volume of air passing through the pipes C, C, and D, D, can be governed or controlled by adjusting the valve or gates E, F. The warm air is drawn from the top and middle portion of the car through the pipes C, C, as indicated by the course of arrows in Fig. 1, and passes through the pipes into the tank and the chamber G, so that its temperature is greatly reduced by contact with the cold metallic surfaces of the pipes *s;* and as the body of water rises in the chamber G the air in its cooled condition is forced out through the same pipes downward into the middle of the car, thus agitating the air below the ends of the pipes at the center of the car and causing the warm air therein to ascend and pass through the pipes at the next movement or pulsation of the cold water in the chamber G. As the rocking of the car is quite frequent when in motion, it is obvious that the body of cold water will pulsate back and forth quite rapidly in the chamber G, and thus the air is constantly agitated and caused to positively circulate throughout the car. The pipes D, D, at the bottoms or lower ends of the pipes C, C, also operate to draw in warm air when the body of cold water recedes in one end of the chamber, and to expel cold air to the bottom of the car when the body of cold water rises in the chamber G; and the cold air is thus uniformly and mechanically distributed throughout the car by devices which are operated or influenced solely by the rocking or swaying motion of the car. The warm air that is not drawn in by the pipes C, D, is caused to circulate toward the tanks B, B, at the ends of the car, and this warm air is cooled or condensed by contact with the cold surfaces of the metallic refrigerant tanks; and as said tanks are accessible on all sides, the air is free to circulate around the tanks on its sides and bottom. The air is thus caused to circulate both positively and by conduction, and the temperature of the air is equalized so that it is practically at one and the same temperature in all parts of the car. When the car is at rest, the temperature of the air therein is lowered by conduction, that is to say, the warm air in the car is displaced by the cold air in the zone influenced by the cold metallic surfaces of the tanks B,

B. The air in contact with the cold tanks B, B, is cooled, condensed and precipitated to the bottom part of the car, displacing the warm air, which is caused to flow toward the tanks and in turn to be cooled by contact therewith, whereby conducting currents of air are produced from the warmer middle portions of the car toward the refrigerant tanks. At the same time, the air from the top middle portion of the car is free to pass through the pipes C, C, down through the tanks B into the chamber G, and the cooled air passes through the pipes D, D, into the bottom of the car.

I do not strictly confine myself to the bottomless shell forming the chamber G in the bottom of the tank B as I may use a shell closed on all sides in connection with an elevated refrigerant tank, to which the air forcing chamber is connected by pipes; nor do I limit myself to the exact details of construction and form and proportion of parts herein shown and described as an embodiment of my invention, as I am aware that changes and alterations can be made therein without departing from the spirit or sacrificing the advantages of my invention.

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

1. In a refrigerator car, the combination with a refrigerant tank, of an air-forcing chamber having an inlet by which water is supplied to said chamber from said tank and provided with enlarged ends whose cross sectional area is greater than the middle part of the chamber, to form air spaces above the mean water level in the chamber, and the air pipes connected to said air-forcing chamber, substantially as and for the purposes described.

2. In a refrigerator car, the combination with a refrigerant tank, of an air-forcing chamber situated in the bottom of said tank to receive water therefrom and constructed with the enlarged ends to contain a liquid which is caused to pulsate therein by the swaying motion of a car, and air pipes passing through said tank and communicating with the enlarged ends of the air-forcing chamber above the mean-water level therein, for the purposes described, substantially as and for the purposes set forth.

3. In a refrigerator car, the combination of a refrigerant tank having an overflow near its lower end, an air forcing chamber G situated in the tank below the overflow thereof and having the enlarged ends, and the air-pipes extending through the tank and connected to the enlarged portions of the air-forcing chamber above the mean water level therein, substantially as described.

4. The combination with a car, of a refrigerant tank sustained therein out of contact with the walls of the car to provide air circulating spaces between the car and tank, an air-forcing chamber G situated within the tank to communicate therewith and having the enlarged ends to provide air spaces above the mean water level of the pulsating body of water in said air forcing chamber, and the air pipes connected to the enlarged ends of the air forcing chamber above the mean water level therein and extending through the tank into the car, for the purposes described, as set forth.

5. In a refrigerator car, the combination with a refrigerant tank, of a removable shell fitted in said tank and forming an air forcing chamber at the bottom thereof, the pipes connected with said chamber, and a crate which incloses said shell and constructed to sustain the weight of the refrigerant in the tank, substantially as described.

6. In a refrigerator car, the combination with a tank, of the shell fitted within the tank and forming an air-forming chamber which communicates with the tank and is adapted to contain a pulsating body of liquid, the pipes connected to said chamber, and a removable crate having the cleats fitted between the shell and the walls of the tank, for the purpose described, substantially as set forth.

7. In a refrigerator car, the combination of a drip pan, the removable supporting bars fitted thereon, the angle bars removably supported by said transverse bars, and a tank seated on and supported by the angle bars, whereby the tank can be readily removed and replaced and it is elevated above the drip pan to provide for circulation of air beneath the tank, substantially as described.

8. In a refrigerator car, the combination with a drip pan, of the removable angle bars sustained thereon and extending longitudinally of the drip-pan, the tank seated at its corners in said angle bars, the stay bars fitted against the sides of the tank, and the fixed bars for holding the stay bars in position, substantially as described.

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

MARTIN S. MILLARD.

Witnesses:
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R. L. MASON.