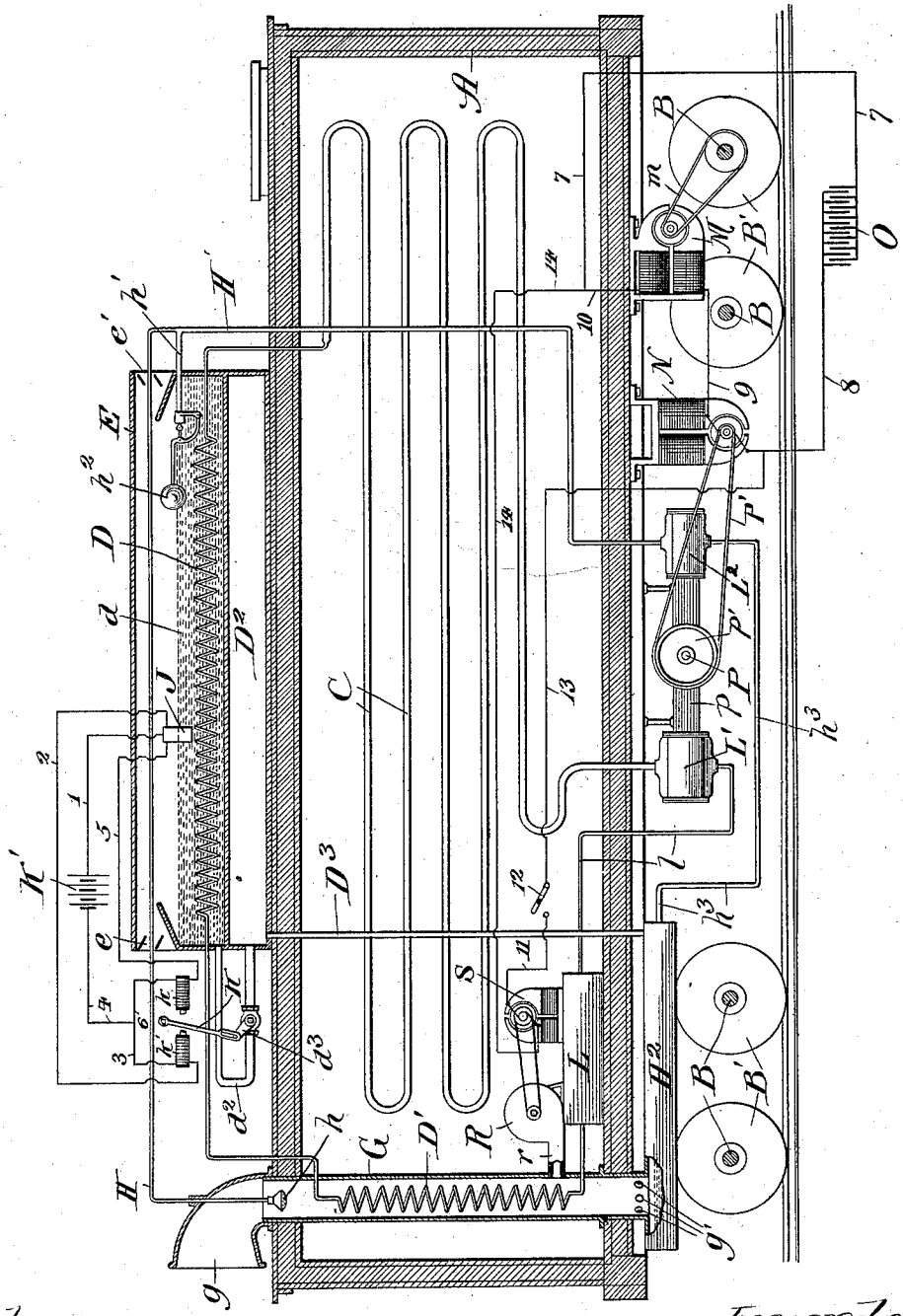
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M. E. SCHMIDT & T. J. RYAN.

REFRIGERATOR CAR.

(Application filed Nov. 26, 1898. Renewed May 16, 1901.)

(No Model.)



Witnesses:
Chas. E. Gaylord.
Lutie S. Fitler.

Inventors,
Max E. Schmidt,
Thomas J. Ryan,
By Banning & Banning & Sheridan,
Attys.

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UNITED STATES PATENT OFFICE.

MAX E. SCHMIDT, OF PRINCETON, NEW JERSEY, AND THOMAS J. RYAN, OF CHICAGO, ILLINOIS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO AUGUSTUS TREADWELL, JR., OF NEW YORK, N. Y.

REFRIGERATOR-CAR.

SPECIFICATION forming part of Letters Patent No. 687,344, dated November 26, 1901.

Application filed November 26, 1898. Renewed May 16, 1901. Serial No. 60,614. (No model.)

To all whom it may concern:

Be it known that we, MAX E. SCHMIDT, of Princeton, Mercer county, New Jersey, and THOMAS J. RYAN, of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Refrigerator-Cars, of which the following is a specification.

Our invention relates to that class of railway-cars which are used for carrying freight, vegetables, and dressed meats and which are commonly known in the art as "refrigerator-cars," and particularly to the means by which the temperature in the car is maintained at a predetermined or desired point.

The object of the invention is to provide a simple, economical, and efficient refrigerator-car; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawing the figure represents a longitudinal sectional elevation of a car constructed in accordance with our improvements and which for the sake of clearness is shown in diagrammatic form.

In the art to which this invention relates it is well known that there are upward of eighty thousand refrigerator-cars in use in the United States, which consume when the cars are in use a great many tons of ice per day. It will be seen, therefore, that the use of ice alone in these cars entails an enormous outlay of money. The labor of loading and unloading the ice also entails an enormous expense, as well as long periods of delay. For instance, in transit from California to Chicago the cars have to be iced several times, so that they are side-tracked at these icing or replenishing stations and delayed from one to twenty-four hours. The loss of time, therefore, when considered alone, aggregates a considerable expense, and when taken in connection with the labor involved means a large financial outlay.

The object of our improvement, therefore, is to remove these objections and provide means to keep the atmosphere of the car at a low temperature and prevent putrefaction of the goods stored in the car. To accomplish this purpose, we provide a refrigerating apparatus adapted to be operated primarily by the movement of the car and to store up sufficient surplus energy when the car is in motion to operate it at any time, all of which will more fully hereinafter appear.

In constructing a car in accordance with our improvements we use a body portion A of the desired size, shape, and strength to hold the various mechanisms in position. This body portion is insulated in any of the usual manners, so as to prevent the temperature of the air inside the car from being affected by the outside thermal conditions. The car is supported, as is usual, on trucks arranged at each end and which are provided with the usual axles B and car-wheels B′.

In order to provide for refrigeration in the car during its movements and use the movements of the car to accomplish such purposes, we provide a series of pipes or conduits C of suitable diameter and length to confine and guide the gas of an ammoniacal liquor or similar material while in its extended condition through the body of the car. The reactions caused by the expansion and circulation of this gas are so well known in the art of refrigeration that we do not consider it necessary or advisable to describe the same here. To cool and condense the gases into an ammoniacal liquor after they have circulated through the car and absorbed a quantity of heat, we provide such pipes with a primary cooling or condensing coil D and arrange it preferably in a cooling-tank E in the roof of the car. This tank is adapted to hold a body of liquid water *d*, so that as the ammoniacal liquor is passed through the same it is condensed and cooled. To further assist in cooling and condensing the ammoniacal liquor we provide one end of the car with a vertical pipe or cylinder G, which is provided with a funnel *g* at its upper end arranged to be turned in the direction in which the car is moving and scoop in the atmospheric air and with perforations *g′* to provide means for promoting the circulation thereof. The circulating-pipe is provided with a second cooling or condensing coil D′, arranged in the vertical cylinder and in the path of the inrushing air, so that as the ammoniacal liquor circulates through the same the air contacts it and

assists in cooling any liquor that may be contained therein. To assist in further cooling the ammoniacal liquor, a water-supply pipe H is provided, the end of which has a sprinkler *h* arranged in the vertical cylinder, so that water in a finely-divided condition may be spread on the condensing-pipes of the refrigerating medium to saturate the same. The inrushing air tends to evaporate this water on the condensing-pipes and cool the refrigerating medium.

The cooling-tank E, above described, which is arranged in the roof of the car, is adapted to contain a body of water *d* and is preferably open at both ends and provided with lattice or screen work *e* and *e'*, so that as the car rushes along the air enters the tank, passes over the body of water or exposed coil, as the case may be, and assists in keeping the same in a cooled condition. To supply water to this cooling-tank and to the sprayer in the vertical cylindrical pipe, a force-pump L^2 is provided, which has a delivery-pipe H' leading to the cooling-tank on the roof. This supply-pipe has two branch pipes *h'* and the pipe H, above alluded to. The branch pipe *h'* has its outlet arranged in the water-receptacle of the cooling-tank and is provided with a ball-valve h^2, so that when the water in such tank is at a low level a fresh supply may be obtained, and when the water in the tank rises to the level shown in the drawing the ball is raised and the further supply of water shut off. At the same time, however, a supply of water passes through the pipe H and is forced through the sprinkler *h*. As the water passes from the sprinkler and down through the vertical pipe it is caught in a waste-pan H^2, from which it may be withdrawn to the force-pump by means of the pipe h^3.

At times the water in the cooling-tank on the roof of the car will be raised to a temperature where it can no longer perform its functions, owing to the heat absorbed from the ammoniacal liquor, so that it becomes necessary to discharge such body of water and obtain a fresh supply. In order to accomplish this result, the water-receptacle in the cooling-tank is provided with a thermostat J, arranged in the tank so as to be affected by the temperature of the liquid. The tank is provided with a waste-chamber D^3, arranged thereunder, while a pipe d^2 connects the same. This pipe is provided with a valve d^3, arranged to open and close the connection between the water-receptacle and waste-chamber. This valve is also arranged to be operated by means of the electromagnetic mechanism, which is arranged as follows: An armature-lever K is provided and pivotally mounted between two electromagnets *k* and *k'*. These electromagnets are electrically connected by means of wires with the thermostat and with an electric battery K', so that when the water is sufficiently cooled current flows from the battery through wire 1, through the thermostat J, wire 2, through electromagnet *k*, energizing the same and drawing the armature over to the position shown in the drawing, thence through wires 3 and 4 back to the battery. As will be seen from an inspection of the drawing, when the current flows in the direction above indicated the armature-lever is operated so as to close the valve d^3, and thereby the communication between the water-chamber and the waste-chamber. When the temperature of the water is raised, so as to impair its efficiency as a cooling agent, the thermostat is operated so that the current flows from battery K and through wire 1 to the thermostat, thence through wire 5, through electromagnet *k*, and thence through wires 6 and 4 back to the battery. This operation deënergizes the electromagnet *k'* and energizes the electromagnet *k*, so that the armature-lever is drawn to its opposite position and into contact with the electromagnet *k* to open the valve d^3. The water in the water-receptacle is then allowed to discharge into the waste-chamber, from which it is in turn discharged through the pipe D^3 to the waste-receptacle H^2, from whence it can be pumped over again. The discharge of the water in the water-receptacle permits the ball-valve H^2 to drop and as a consequence opens the outlet in the branch pipe *h'* and furnishes the water-chamber with a fresh supply of water. When the ammoniacal liquor has become cooled, it enters the condenser L, from which it is withdrawn by the action of the pump L' through the pipe *l*. The ammoniacal pump being operated forces the ammoniacal liquor into the large pipes, which permits it to expand into a vaporized or gaseous state, and thus expand and lower the temperature to the desired or predetermined point.

It is essential and necessary that economical means be provided for operating the pumps with which the water and ammoniacal liquor are kept in circulation. This means must be simple in construction and of a light weight in order that it may be carried by the car and not occupy too much space therein and interfere as little as possible with the cost of running the same. To accomplish this result and provide means for operating this pump, as well as the other mechanism hereinafter described, when the car is in motion or during a standstill at stations or other points, an electric generator M is provided and arranged at some convenient point, so that its armature-shaft may be driven by means of a belt or other gearing *n* direct from one of the axles B of the car. This means of generating electric power is a decided advantage in that it does away with the necessity of having a prime mover operated by the steam energy of the locomotive, which is not only expensive, but involves intricate mechanisms and connecting mediums. Arranged, preferably, adjacent to this generator of electric current is an electric motor N, electrically connected with the poles of the generator. During the running of the

car the electric generator develops sufficient current to operate the motor; but when the car is at a standstill the generator no longer performs this function, thereby permitting the contents of the car to be destroyed or their value impaired.

In order to provide for the stopping of the car in transit, a secondary battery O is provided and interposed between the generator of electric current and the motor, so that the current as fast as it is formed is fed to this set of batteries to energize the same, or, in other words, transform the material composing the elements in such batteries from an inactive to an active material, so that the potential differences of the elements may be taken advantage of to generate current and operate the motor. In fact, this set of batteries furnishes the energy for the driving of the motor in that all the energy must first pass into the batteries from which the motor will draw the necessary quantity, while the surplus is stored for emergencies. The batteries, dynamos, and motor are connected together by means of the wires 7, 8, 9, and 10. The armature of the motor is connected with a crank-shaft P on a suitable frame p by means of the pulley p' and the belt P'. The crank-shaft is connected with movable pistons in pumps L' and L^2, so as to operate such pumps whenever desirable or necessary.

When the car is stationary, it is highly desirable to have a quantity of air forced into the vertical tubular pipe G, so as to assist in evaporating the water on the surface of the condensing-coil D'. In order to accomplish this result, a blower R is provided, which has its outlet-pipe r connected with the vertical tubular pipe at any desired point, so that during the operation of the blower air is furnished such pipe and may pass out through the upper opening g or the openings g' at the bottom thereof. To operate this blower, an electric motor S is provided and electrically connected with the battery by means of the wire 11, switch 12, wires 13 and 8, thence with the battery O, wires 7 and 14 to the motor. The current therefore when the switch is closed may travel from the battery through the wires 7 14, through the motor S, back by wires 11, 12, 13, and 14 to the battery, which will cause the motor to operate and furnish the desired quantity of air.

While we have described our invention with more or less minuteness as regards details and as being embodied in certain precise forms, yet we do not desire to be limited thereto unduly or any more than is pointed out in the claims.

We claim—

1. In a car of the class described, the combination of a car provided with an insulated body portion, a pipe or pipes for conveying and guiding the cooling medium through the car, a coil of pipes or similar element arranged outside of the car-body and connected with the guiding-pipes for the purpose of cooling or condensing the cooling medium, a second coil of pipes arranged to be contacted by water and atmospheric air to assist in further cooling the cooling medium, a force-pump for circulating the cooling medium through its circulating-pipe and coils, and means for furnishing a supply of water to the second coil, substantially as described.

2. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank or similar receptacle arranged on the roof of the car lengthwise thereof and provided with openings at each end thereof through which air may circulate, pipes for conveying and guiding the cooling medium through the car, a cooling or condensing pipe or pipes arranged in the cooling-tank on the top of the car and connected with the pipes for confining and guiding the cooling medium, a force-pump for circulating the cooling medium through the confining and guiding pipes and cooling-coil, and means for operating the force-pump, substantially as described.

3. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the outside of and on the roof of the car extending longitudinally therewith and provided with openings at each end thereof to permit the air to circulate through the same, a vertical pipe or tube arranged in the car and provided with an opening to receive air by the movements of and while the car is in motion, a pipe or pipes for confining and guiding a cooling medium through the car, a condensing or cooling coil arranged in the cooling-tank on the outside of the car and connected with the guiding-pipes, a second condensing-coil arranged in the vertical tubes and connected with the first-named coil, a force-pump arranged to circulate the cooling medium through the confining and guiding pipes and the condensing or cooling coils, and means for operating such force-pump, substantially as described.

4. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the outside of and extending longitudinally with the roof of the car and provided with a water-chamber having openings at each end thereof through which air may pass as the car is moved, a pipe or pipes for confining and guiding a cooling medium through the car, a condensing or cooling coil arranged in the water-chamber connected with the confining and guiding pipes, a force-pump for circulating a cooling medium through the confining and guiding pipes, means for operating such pump, and means for furnishing a supply of water to the water-chamber of the cooling-tank, substantially as described.

5. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the

roof of the car longitudinal therewith and provided with a water-chamber having openings at each end thereof to permit a circulation of air therethrough when the car is in motion, a waste-chamber arranged under the water-chamber, means for supplying the water-chamber with a supply of water, means for draining the water in the water-chamber into the waste-chamber, a pipe or pipes for conveying and guiding a cooling medium through the car, a condensing or cooling coil arranged in the water-chamber of the cooling-tank and connected with the confining and guiding pipes, a force-pump connected with such confining and guiding pipes and with the cooling-coil for circulating the cooling medium therethrough, means for operating such pump, and means for supplying water to the water-chamber, substantially as described.

6. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the roof of the car longitudinally therewith and provided with water and waste chambers and with openings at each end thereof, a pipe or pipes for confining and guiding a cooling medium through the car, a cooling-coil arranged in the water-chamber of the cooling-tank and connected with the conveying and guiding pipes, a force-pump connected with the confining and guiding pipes for circulating a cooling medium therethrough, a second pump for furnishing a supply of water to the water-chamber, valve mechanism for closing and opening the connections between the water and waste chambers, a thermostat arranged in the water-chamber to operate such valve and open and close the same, and means for operating the above-named pumps, substantially as described.

7. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the roof thereof longitudinally therewith and provided with a water-chamber having openings at each end thereof, a pipe or pipes for confining and guiding a cooling medium through the car, a cooling or condensing coil arranged in the water-chamber of the cooling-tank and connected with the confining and guiding pipes and with a force-pump, a force-pump connected with the cooling or condensing coil and with the confining and guiding pipes for circulating the cooling medium therethrough, a pump for furnishing a supply of water to the water-chamber of the cooling-tank, a supply-pipe connecting such pump with the cooling-tank, an outlet-valve on such supply-pipe adapted to be operated by the level of the water in the water-chamber, and means for operating the above-named pumps, substantially as described.

8. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the roof thereof and provided with a water-chamber, a vertical tube or chamber arranged in the car and provided with an opening at the upper end through which air may be inducted or exhausted, a pipe or pipes for confining and guiding the cooling medium through the car, a primary cooling or condensing coil arranged in the water-chamber of the cooling-tank and connected with the confining and guiding pipes, a second cooling or condensing pipe arranged in the vertical chamber and connected with the first-named cooling-coil, a force-pump connected with the cooling-pipes and with the pipes for confining and guiding the cooling medium for circulating such medium therethrough, a pump for furnishing a water-supply to the water-tank, a branch water-supply pipe connecting with the pump and leading to the water-supply chamber in the cooling-tank and provided with an outlet therein, a branch pipe connected with the vertical pipe and connected with the water-supply pump for forcing water on the second cooling or condensing pipe, a waste-chamber for the water connected with the water-pump, and means for operating the above-named pumps, substantially as described.

9. In a car of the class described, the combination of a car provided with an insulated body portion, pipes for conveying and guiding the cooling medium through the car, a cooling or condensing pipe connected with the confining-pipe, an air-blower arranged with its outlet in position to furnish a supply of air to the cooling or condensing pipe when such blower is in motion, an electric motor to operate such blower, a force-pump connected with and arranged to circulate the cooling medium through the above-named pipes, a motor for operating such force-pump, and a secondary battery connected with the motor of the force-pump and the motor of the air-blower to operate the same, substantially as described.

10. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the roof thereof and longitudinal therewith, a vertical receptacle arranged at or near one end of the car and provided with a funnel at the upper portion thereof to furnish a supply of air when the car is in motion, a pipe or pipes for confining and guiding a cooling medium through the car, a cooling or condensing pipe or pipes in the cooling-tank connected with the confining and guiding pipes, a second cooling or condensing pipe or pipes in the vertical receptacle connected with the first-named cooling-pipes and with a force-pump, a force-pump for circulating a cooling medium through the above-named pipes, an electric motor for operating such pump, an air-blower connected with and arranged to furnish a current of air to the vertical receptacle, an electric motor for operating such

blower, and means for furnishing a supply of electric current to such motors, substantially as described.

11. In a car of the class described, the combination of a car provided with an insulated body portion, a cooling-tank arranged on the roof thereof and provided with a water-chamber, a vertical tube or chamber arranged in the car and provided with an opening at or near either end through which air may be inducted or exhausted, a pipe or pipes for confining and guiding a cooling medium through the car, a primary cooling or condensing coil arranged in the water-chamber of the cooling-tank and connected with the confining and guiding pipes, a second cooling or condensing pipe arranged in the vertical chamber and connected with the first-named cooling-coil, a force-pump connected with the cooling-pipes and the pipes for confining and guiding the cooling medium for circulating such medium therethrough, a pump for furnishing water-supply to the water-tank, a branch water-supply pipe connecting with the pump and leading to the water-supply chamber in the cooling-tank and provided with an outlet therein, a branch pipe connected with the vertical pipe and with a water-supply pump for forcing water on the second cooling or condensing pipe, a waste-chamber for the water connected with the water-pump, and means for operating the above-named pumps, substantially as described.

MAX E. SCHMIDT.
THOMAS J. RYAN.

Witnesses to the signature of Max E. Schmidt:

HUTCHINSON SOUTHGATE,
A. M. WILSON.

Witnesses to the signature of Thomas J. Ryan:

THOMAS F. SHERIDAN,
THOMAS A. BANNING.