

(No Model.)

J. W. GRAYDON.

METHOD OF AND APPARATUS FOR HEATING RAILROAD CARS.

No. 245,598.

Patented Aug. 9, 1881.

Fig. 1.

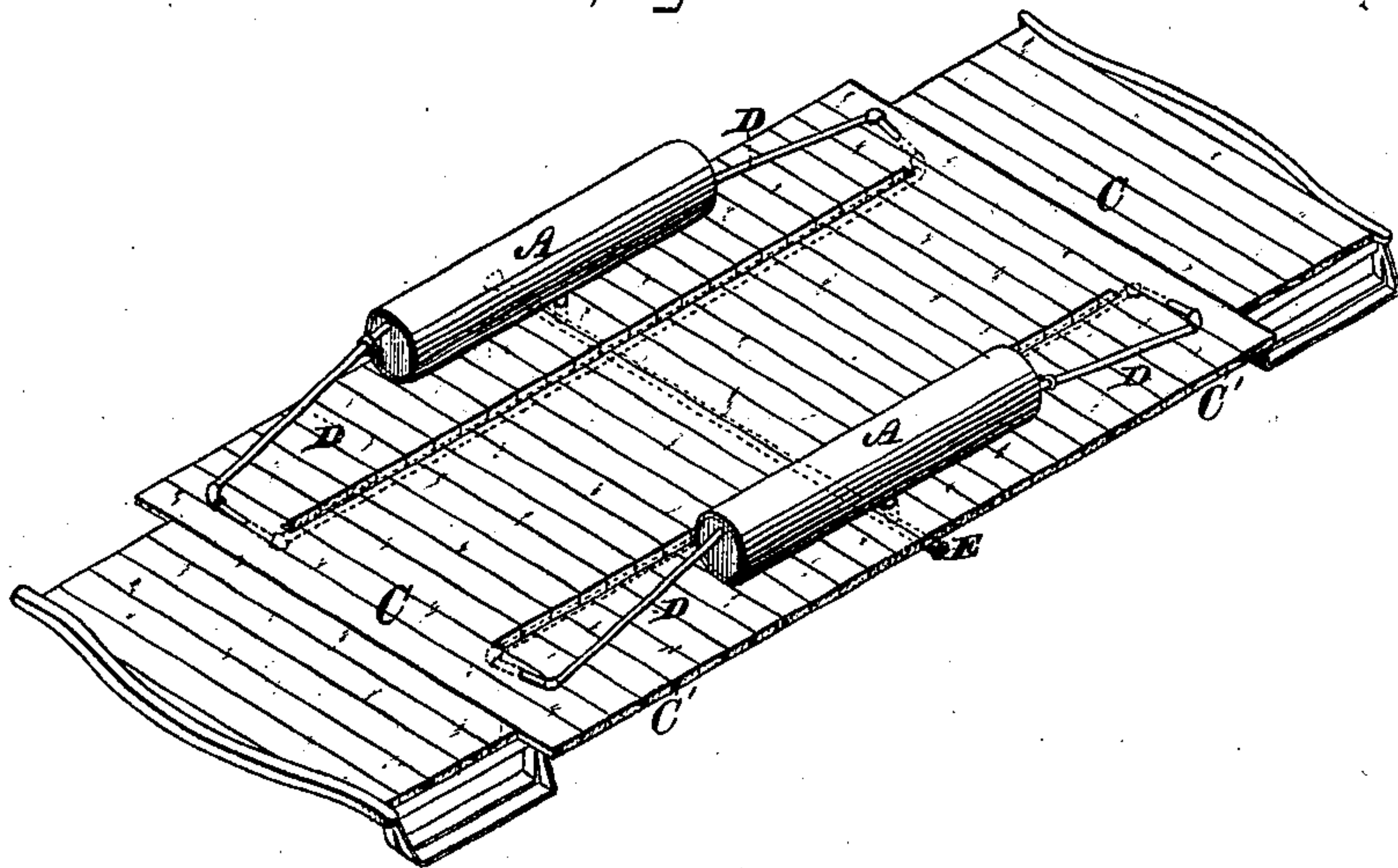


Fig. 2.

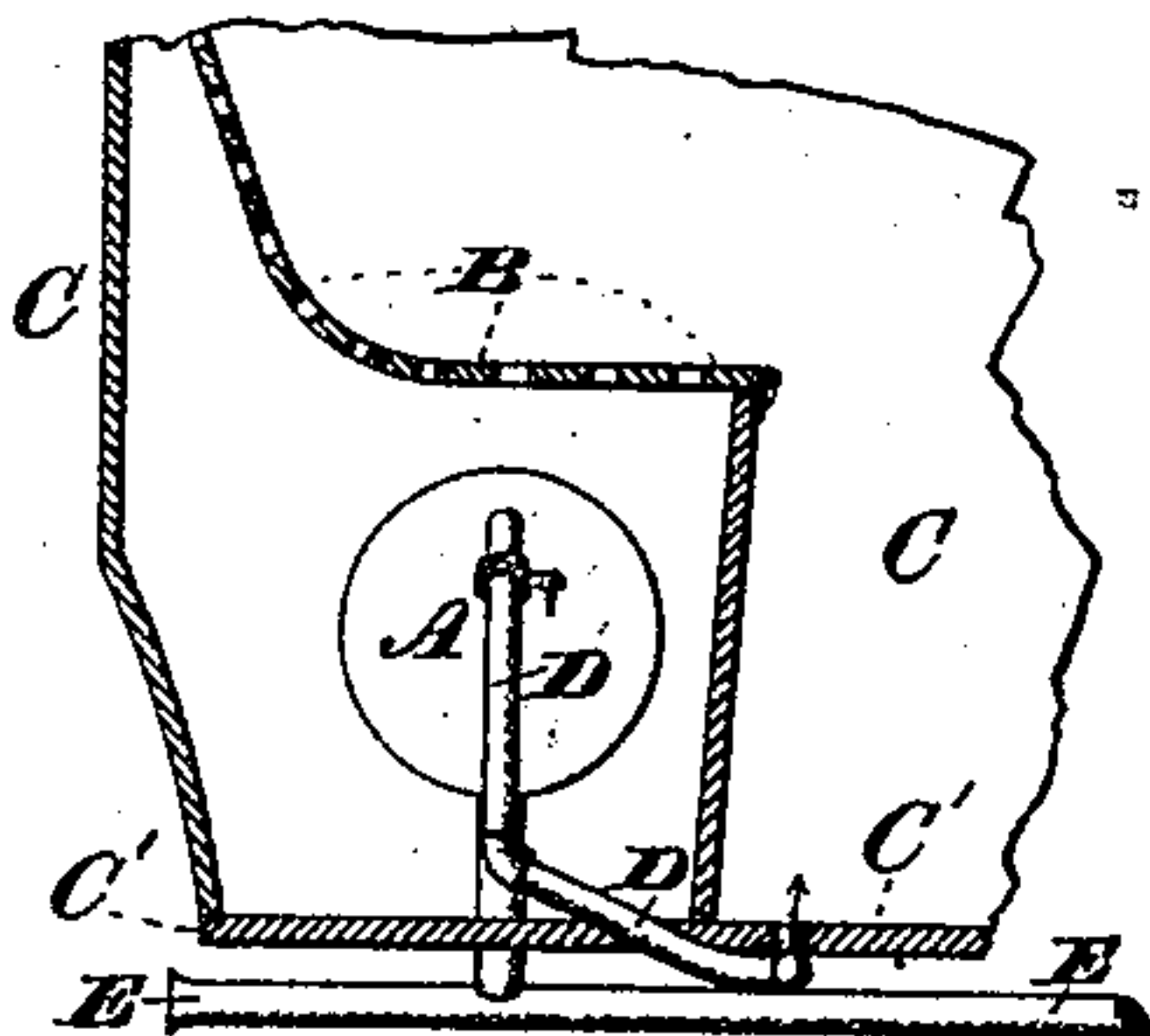
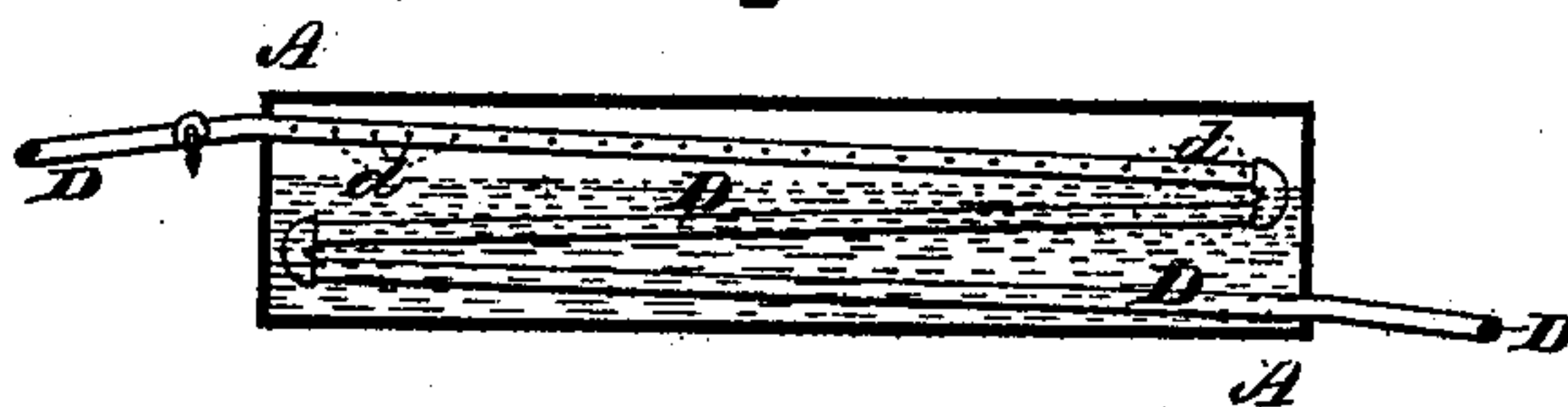


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## METHOD OF AND APPARATUS FOR HEATING RAILROAD-CARS.

SPECIFICATION forming part of Letters Patent No. 245,598, dated August 9, 1881.

Application filed February 5, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES W. GRAYDON, of the city of Washington, county of Washington, and District of Columbia, have invented certain new and useful Improvements in Methods of and Apparatus for Heating Railroad-Cars; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a perspective view of the floor of a car containing my improved heating mechanism. Fig. 2 is a broken cross-section of said car, showing the position of one of the reservoirs beneath the seat; and Fig. 3 is a central longitudinal section of said reservoir upon a vertical line.

Letters of like name and kind refer to like parts in each of the figures.

My invention is an improvement upon a similar device for which Letters Patent No. 209,166 were issued to me upon the 22d day of October, 1878, and has for its object the production, for any desired length of time, of an automatic circulation of steam within heating-pipes after the supply of caloric has been cut off; to which end it consists, principally, in the method of warming cars by means of a tank or reservoir adapted to be connected with and disconnected from a steam-generator connected with radiating circulation steam-pipes and partly filled with water, which water, by the introduction of steam having any desired pressure, is heated and caused to act as a magazine from whence steam is supplied to said radiating-pipes, while the temperature of said water is above the boiling-point, substantially as hereinafter specified.

It consists, further, in a car-warmer composed of a reservoir for containing steam and water provided with radiating circulation-pipes, which pass outward from the steam-space, and, returning, enter at or near the lower portion of the water-space and pass upward through the same to said steam-space, substantially as and for the purpose hereinafter shown.

In the annexed drawings, A represents a tank or reservoir, constructed of or from metal, in the form of a cylinder, and made steam-

tight and with sufficient strength to enable it to resist an internal pressure of several hundred pounds to the square inch. One of the reservoirs A is placed horizontally beneath each seat B of a car, C, and at its ends is connected with a pipe, D, which from each end of said reservoir passes beneath said seat into or near the adjacent end of said car; thence forward to a point in front of said seat, and thence to the opposite end of the car, where it connects with the pipe D from the opposite end of the reservoir. The pipe D in front of each seat B is horizontal, and is arranged within or below the floor C' of the car C, in convenient position to enable it to perform its office without interference with the feet of passengers, while of the portions of said pipe beneath said seat, that at one end enters the contiguous end of the reservoir A, at or near its bottom, while the pipe at the opposite end inclines upward and enters its end of said reservoir at or near the top. Within the reservoir A the pipe D, which enters at its lower side, continues upward in a zigzag or spiral form, and connects with the pipe that enters from the opposite end and upper side, the result being that said pipe is continuous or endless. A series of small openings, *d*, are provided within the upper portion of said pipe within said reservoir, through which communication is had between the interiors of the same.

The reservoirs A are connected with each other by means of a pipe, E, which passes transversely across the car C beneath the floor, and at each end projects through the side of said car, and is provided with means whereby a steam-supply pipe may be connected therewith.

In the use of my mechanism I avail myself of the well-known law which governs the production of steam from water—viz., that the boiling-point of water rises or falls as the pressure increases or diminishes, it being found that in an unconfined vessel steam is formed at a temperature of  $212^{\circ}$ , while a temperature of  $363^{\circ}$  is necessary for the production of steam when water is confined and subjected to a pressure of one hundred and twenty pounds per square inch, so that in case of water which has any temperature above  $212^{\circ}$  the lessening of pressure and the consequent



lowering of the boiling-point will cause the heat contained in water to convert a portion of the same into steam, which steam will increase the pressure within the vessel and arrest the further conversion, the pressure and temperature being thus caused to balance each other.

The application of these principles through or by means of my apparatus is as follows, viz: The reservoirs are first partly filled with water, and are then connected with a steam-generator and charged with superheated steam—having any desired pressure—until said water has attained a temperature substantially the same as that of the steam, after which said reservoir is disconnected from the steam-generator, and the car is ready for use. Steam from the upper portion of the reservoir A flows outward into the pipe D, which passes from the same, and as its temperature becomes lowered by radiation of heat its levity decreases and said steam naturally seeks the lowest portion of said pipe, while at the same time the temperature of the steam contained within that portion of said pipe within said reservoir is raised and its levity increased, so as to give to it an upward tendency, the result being a constant circulation of steam in the direction stated, so long as the temperature of the water is above  $212^{\circ}$ . From the point where the pipe D enters the lower portion of the reservoir A to the point of its exit therefrom it passes through highly-heated water or steam, whereby its contents become reheated and are caused to ascend, the result being a continuous flow of steam through said pipe. The radiation of heat from the pipe D causes the pressure within the reservoir A to constantly decrease, by which decrease in pressure the boiling-point of the water is lowered and said water caused to give off steam, said operation being continued until said water falls below a temperature of  $212^{\circ}$ , and all pressure has ceased.

The reservoir A, and all of the circulation-pipe D other than such as is utilized for heating purposes, is covered with a suitable non-conductor of heat, so as to prevent a loss of temperature from radiation, and by properly proportioning said reservoir to the radiating-surface of the said pipe a supply of heat may be stored therein sufficient for heating a car any desired length of time.

It is intended that each car shall have its reservoirs charged but twice each day; but such operation may be performed each trip, if necessary, the time required being but about one minute per car.

It has been found that by charging steam into reservoirs which are partially filled with

water, instead of charging said reservoirs directly with water having the desired temperature, a material saving is effected in time, a given quantity of heat being conveyed more rapidly by steam than by water.

For lines of railroad in which not more than twelve hours are required for a round trip it will be necessary to have a steam-generator at but one end of the route, and to charge the reservoirs of each car at the commencement of each round trip; but where a greater time is required, then it may be best to have a steam-generator at each end of the line.

My method of heating cars differs from those heretofore used in that, in connection with a reservoir which is adapted to be connected with and disconnected from a steam-generator, I employ steam as the heating agent and hot water as a magazine in which such steam is stored and from which it is liberated as required for use; and, further, I incase the reservoir and heat by radiating-pipes within which the steam is kept in constant circulation, while in mechanism heretofore used for heating purposes no circulation has been obtained, except when a direct connection was had with a generator to which heat was applied, and when the apparatus was disconnected from such generator the only diffusion of heat has been obtained through direct radiation from the reservoir.

Having thus fully set forth the nature and merits of my invention, what I claim as new is—

1. The hereinbefore-described method of warming cars by means of a tank or reservoir adapted to be connected with and disconnected from a steam-generator connected with radiating circulation steam-pipes and partly filled with water, which water, by the introduction of steam having any desired pressure, is heated and caused to act as a magazine from whence steam is supplied to said radiating-pipes while the temperature of said water is above the boiling-point, substantially as specified.

2. A car-warmer composed of a reservoir for containing steam and water, provided with radiating circulation-pipes which pass outward from the steam-space, and, returning, enter at or near the lower portion of the water-space and pass upward through the same to said steam-space, substantially as and for the purpose shown.

In testimony whereof I hereunto set my hand this 28th day of January, A. D. 1879.

JAMES W. GRAYDON.

Witnesses:

W. BURRIS,  
JNO. P. LOTHROP.