(No Model.)

E. E. GOLD.

STEAM HEATING APPARATUS FOR RAILWAY CARS.

No. 557,265. Patented Mar. 31, 1896.

FIG. 1.

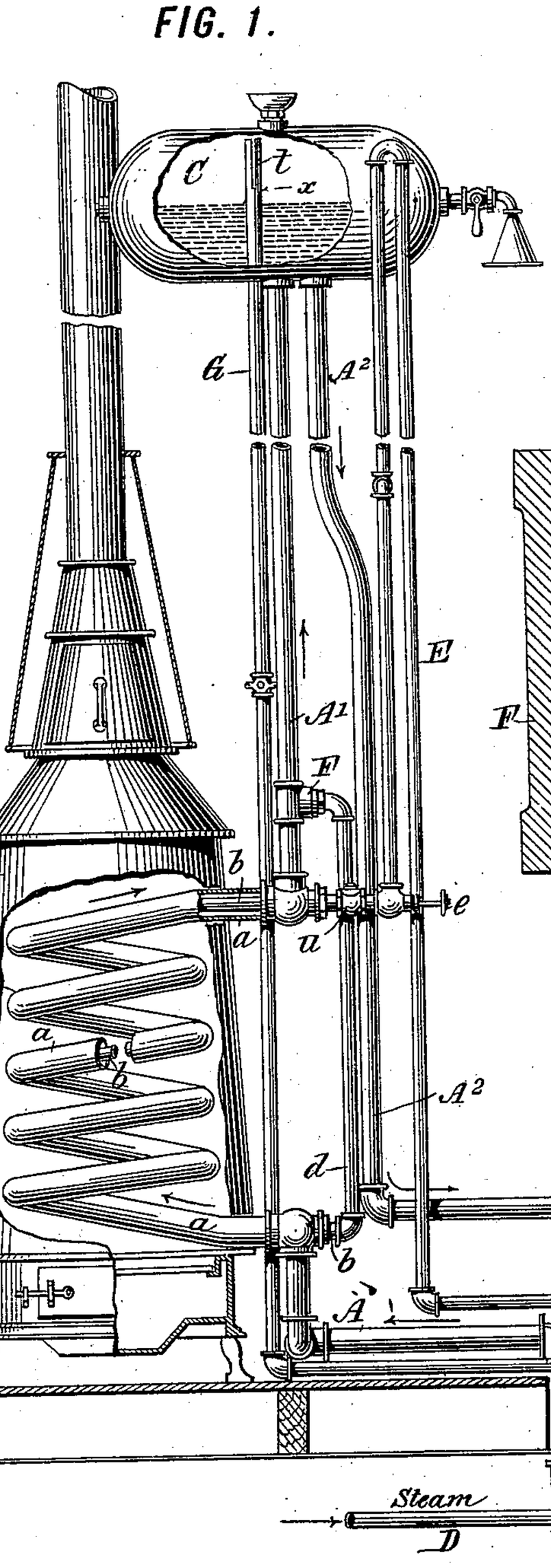

FIG. 2.

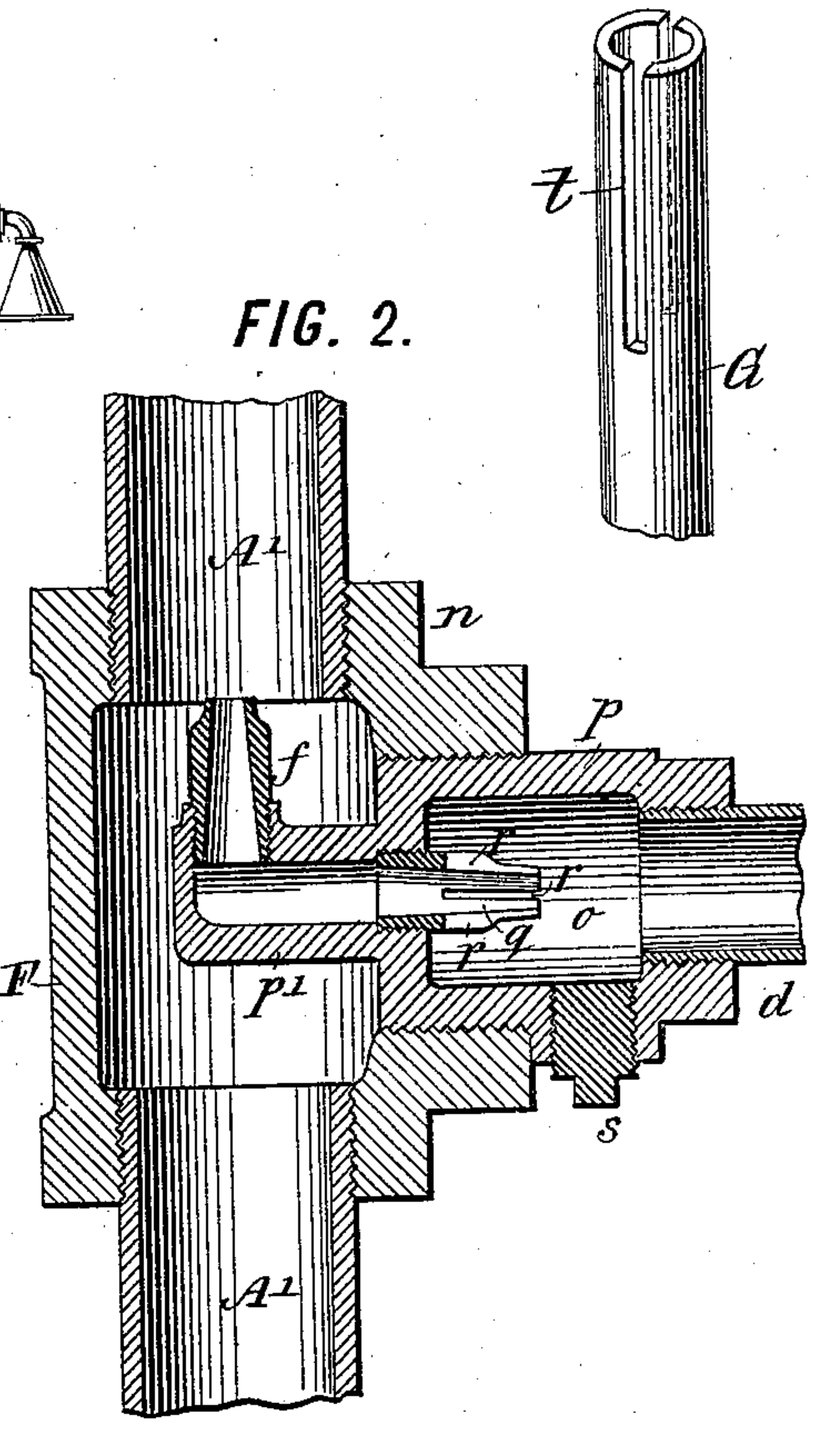

FIG. 3.

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STEAM HEATING APPARATUS FOR RAILWAY-CARS.

SPECIFICATION forming part of Letters Patent No. 557,265, dated March 31, 1896.

Application filed May 26, 1894. Serial No. 512,502. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. GOLD, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Steam Heating Apparatus for Railway-Cars, of which the following is a specification.

This invention relates to heating apparatus intended particularly for railway-cars, although adaptable also to the heating of buildings of that class wherein heat derived from steam is communicated to a liquid-circuit, which in turn radiates the heat to the car or apartment.

It particularly relates to apparatus in which the steam or condensed water from the steam is injected directly into the water in the liquid-circuit. An apparatus of this character is claimed in my Patent No. 508,132, dated November 7, 1893, and it is upon this apparatus that my present invention is most particularly an improvement.

Figure 1 of the accompanying drawings is a sectional elevation showing the apparatus provided by my present invention as adapted for heating railway-cars. Fig. 2 is an enlarged fragmentary sectional view showing the improved construction of the jet. Fig. 3 is a perspective of the upper part of the overflow-pipe.

Referring to the drawings, let A designate the pipes of an ordinary liquid heat-radiating circuit extending through the car, usually near the floor thereof, and arranged in any way known to the art.

B designates the steam-heater applied to the circuit, and consisting, essentially, of a liquid passage or space forming part of the water-circuit, and an adjoining steam passage or space arranged to impart the heat of the steam to the water. In the construction shown it consists of a double coil, a smaller pipe *b* being inserted within a larger or water pipe *a* and the two coiled together. The water-pipe is joined at its ends to the pipes of the water-circuit A, so as to form a part thereof, and the ends of the steam-pipe *b* pass outside of the water-pipe *a*. The water-circuit thus consists of radiating-pipes on the floor of the car; the pipe *a* of the water-coil, the ascending water-pipe A′ being an extension from the upper end of the coiled pipe *a* ascending to an expansion chamber or tank C, and a descending pipe A^2 leading down from this tank to or near the floor of the car, where it joins the radiating-pipes. It is customary to extend the radiating-pipes on both sides of the car by causing them to pass beneath the floor and extend as crossover-pipes to the opposite side, these crossover-pipes being shown in section at A^3. The water circulates upwardly through the spiral heater-coil and through the pipe A′ and downwardly through the pipe A^2, and thence through the going and returning radiating-pipes, as indicated by the arrows.

The pipe D is the main supply-pipe, extending from end to end of the car and fitted at its ends with couplings for uniting with the steam-pipes on the adjoining cars, in order that steam from the locomotive may be passed through the train. From the pipe D leads a branch pipe E for conducting steam to the heater B. This pipe is preferably carried first up above the water-level in the tank C, as shown, and then down to the steam-pipe *b* of the heater, being provided with a hand-valve *e* for controlling the flow of steam.

The precise construction and arrangement are not essential, it being only necessary that some means be provided for admitting steam to the heater B under control of the train-hands. The steam should be admitted at the upper end of the inner pipe *b*, so that it shall pass through the heater in the opposite direction to the water, being cooled in its descent through the coil, while the water as it ascends becomes hotter. The pipe *b* on its emergence from the lower end of the coil connects with the pipe *d*, which ascends, as shown in Fig. 1, to an injector F arranged in connection with the ascending water-pipe A′. The pipe *d* connects with the jet-nozzle *f* of this injector in the manner to be hereinafter described with reference to Fig. 2.

The steam in its passage through the heater-coil B will rapidly impart its heat to the water flowing past it in the annular space between the two pipes and will usually be wholly or almost wholly condensed by the time it reaches the bottom of the coil. The condensed water or spent steam, as the case may be, will then flow, by reason of the pressure of the steam behind it, through the pipe *d*

and be injected through the nozzle *f* into the ascending column of water in the pipe A′, thereby adding its heat to that of the water. Thus every portion of the heat of the steam is utilized in imparting heat to the water, and the force of the jet is utilized to reinforce the current in the pipe A′ induced by the action of the heater.

From the expansion-tank C an overflow-pipe G extends outside the car, preferably passing down through it and discharging beneath the floor. Any suitable trap may be applied to this pipe to discharge the overflow water.

I have shown the heater B as arranged within a car-stove M of the construction shown in my Patent No. 388,772, dated August 28, 1888, in order that when the car is disconnected from the source of steam it may be heated by building a fire in the stove.

So far as specifically described the apparatus is substantially the same as that shown in my Patent No. 508,132. I have, however, omitted the valves shown in that patent and lettered *g*, *m*, L, and J, and the trap K.

My present invention provides an improved construction of injector F, as shown in Fig. 2. In the construction of this injector an ordinary T-fitting *n* may be used, into the opposite openings of which the sections of pipe A′ are screwed, while to the branch opening is screwed a special fitting *p*. This latter fitting consists of a hollow plug having a tubular branch *p′* which projects into the axis of the pipes A′ and is turned upwardly therein, the jet-nozzle *f* being screwed into it so as to project upwardly and discharge into the axis of the pipe A′, as shown.

The spent-steam pipe *d* is screwed into the outer end of the plug *p*, so as to discharge the spent steam or condensed water into the hollow space or chamber *o* in this plug, and into the branch *p′* is screwed a reversed nozzle *q* projecting with its smaller end into the chamber *o*. Instead of these several connections being made by screwing the parts together they may of course be made in any other mechanically suitable way. The use of separate parts for the plug *p* and nozzles *f* and *q* is not essential, but is adopted as a mechanical convenience.

The spent steam or condensed water entering through the pipe *d* flows from the chamber *o* into the nozzle *q*, and thence through the bore in the branch *p′* and through the nozzle *f*, from which it issues in a jet into the column of water in the pipe A′. In case any particles of scale or other foreign matters which would be liable to lodge in the nozzle *f* are carried to the injector with the steam or condensed water, they will be deposited in the chamber *o*, since the nozzle *q* is as small as or smaller than the nozzle *f*, so that any foreign matter large enough to clog the nozzle *f* will be intercepted by the nozzle *q*. By the projection of the latter nozzle into the chamber *o* a space is afforded within this chamber around it for the reception of such foreign matters. To provide for the possibility of the orifice in the smaller end of the nozzle *q* being choked by some obstruction coming against it, the nozzle is sawed through to a sufficient depth to form longitudinal slots *r r*, through which the flow will be continued. Thus this construction of the nozzle *q* constitutes it in effect a strainer through which nothing can pass that would be large enough to fill or choke the nozzle *f*, so that anything which passes through the first nozzle will pass through the second. By the employment of the chamber *o* and the supplemental passages afforded by the saw-cuts *r* the stream of steam or water entering the nozzle is so spread out that its force is greatly reduced, and an opportunity is afforded for clogging particles or sediment to find a resting-place in the chamber *o* without being carried into the nozzle. In case of the accumulation of sufficient matter to choke the injector access may be obtained to the chamber *o* by unscrewing a plug *s*, so that by inserting a wire or other tool the clogging substances may be removed from within the chamber *o* and around the nozzle *q*, and this without the necessity of disconnecting any of the pipe connections.

A further improvement provided by my invention consists in the construction of the overflow-pipe G within the expansion-chamber C. This construction consists in extending the pipe G considerably above the overflow-level, which is indicated in Fig. 1 by *x*, and providing it with a slot or slots *t*, extending down from its upper end to the overflow-level. Instead of continuous slots or slits *t* a row or series of perforations might be used; but the slots are simpler, cheaper, and equally if not more effective.

To appreciate the advantage of this construction, it should be understood that the water discharged into the expansion-tank through the pipe A′ is apt to be in a violent state of ebullition, the principal purpose of the tank being to afford an opportunity for the bubbles of steam to separate themselves from the water and avoid their being carried down with the water through the descending pipe A². By reason of this ebullition the water in the tank is constantly agitated, the water being liable to boil or foam up at intervals, so that if the overflow-pipe G were to open at the desired overflow-level *x* water would overflow into it whenever the boiling up carried water above the overflow-level, so that in this way too great a quantity of water might be discharged. On the other hand, if to avoid this difficulty the pipe G were carried to a higher level and there opened the overflow would not be sufficient when the apparatus is working at a moderate rate and without violent ebullition, so that too great a quantity of water would accumulate in the tank. My

present invention avoids both defects by admitting of a limited overflow from x upward, so that in case of violent ebullition a little of the foaming water may escape through the slots t, but not sufficient ordinarily to materially reduce the quantity of water in the tank, whereas, on the contrary, in case the water accumulates without violent ebullition the area of overflow increases proportionately to the rising of the level of water above the normal overflow-level x. Foam, consisting chiefly of steam-bubbles, will pass slowly through the narrow slots t, since by the separation of the steam-bubbles but a small residue of water will descend the pipe, whereas when the water-level rises at a time when the water is moderately quiescent the water will flow out with sufficient rapidity through the contracted slots t to compensate for its rate of accumulation by the condensation of the steam.

The lower end of the pipe G is shown as being connected to a thermostatic trap T of suitable construction, which is adapted to open upon the cooling of the water to a sufficient degree, thereby discharging the overflow water as fast as it cools, but arresting its overflow as soon as hot water commences to pass. This means is found to discharge with sufficient promptness to prevent the accumulation of any inconvenient pressure in the expansion-tank.

I place a check-valve u in the steam-pipe E or b, in order to prevent any possible backflow of water into the steam-pipe. This check-valve might be used in lieu of extending the pipe E up above the water-level x.

I claim as my invention the following-defined novel features, substantially as hereinbefore set forth, namely:

1. In a steam heating apparatus of the character described wherein the spent or condensed steam is injected into the ascending column of water, the combination with the water and steam pipes of the injector F having an upturned jet-nozzle f, and constructed with a chamber o traversed by the steam on its way to said nozzle and a reversed nozzle q adapted to arrest any foreign matter which cannot pass said nozzle f, arranged to project into said chamber, and formed with slots $r\ r$ for continuing the flow of steam in case the main opening becomes choked.

2. In a steam heating apparatus of the character described, the combination with the water and steam pipes thereof and the expansion-tank C, of the overflow-pipe G projecting up into this tank and extending above the overflow-level, and formed with a slot t extending down to the overflow-level for permitting overflow of excess of water while restricting the overflow in case of foaming.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD E. GOLD.

Witnesses:
FRED WHITE,
GEORGE H. FRASER.