(No Model.) 3 Sheets—Sheet 1.

E. E. GOLD.

CAR HEATING APPARATUS.

No. 572,254. Patented Dec. 1, 1896.

FIG. 1.

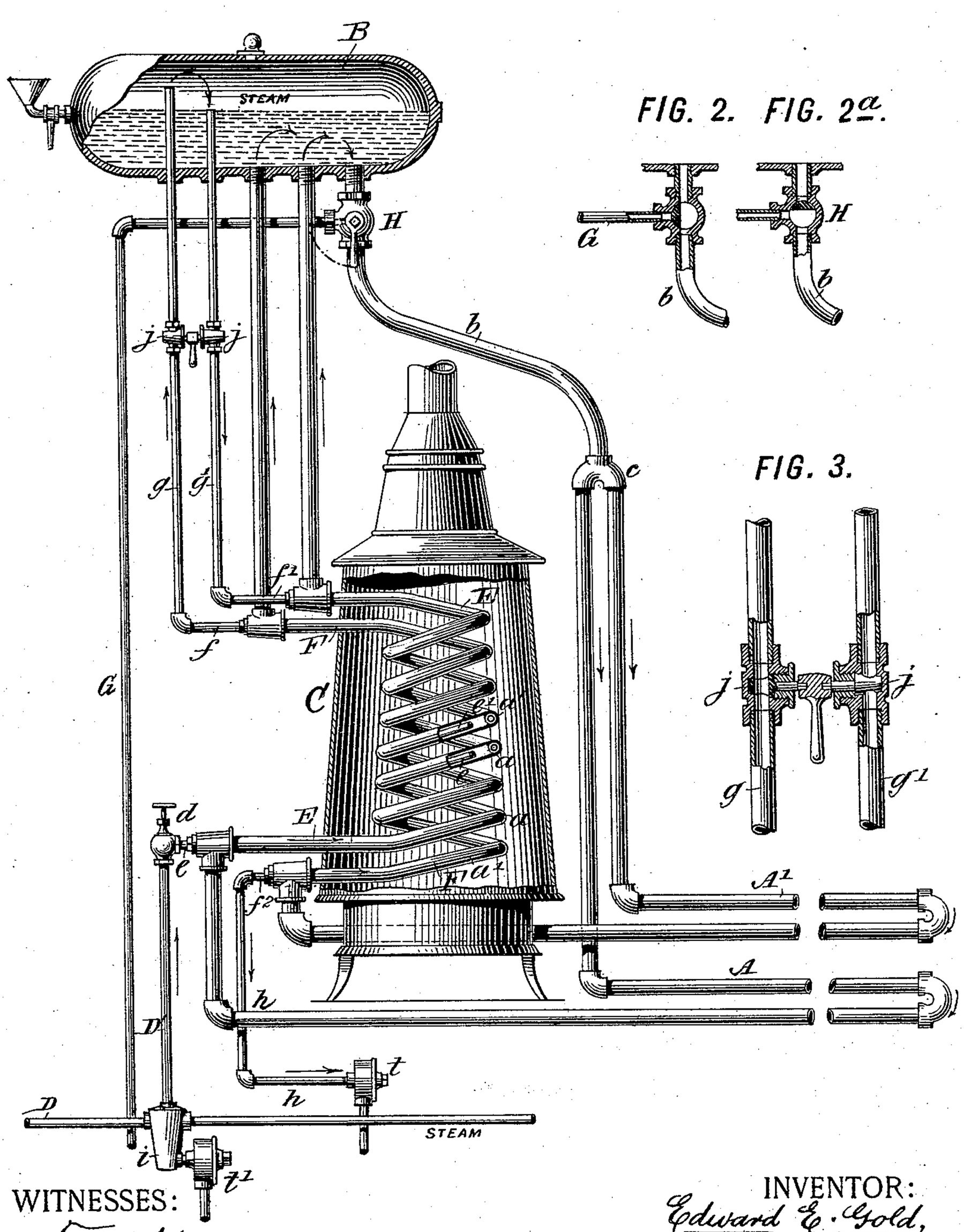

FIG. 2. FIG. 2a.

FIG. 3.

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FIG. 4

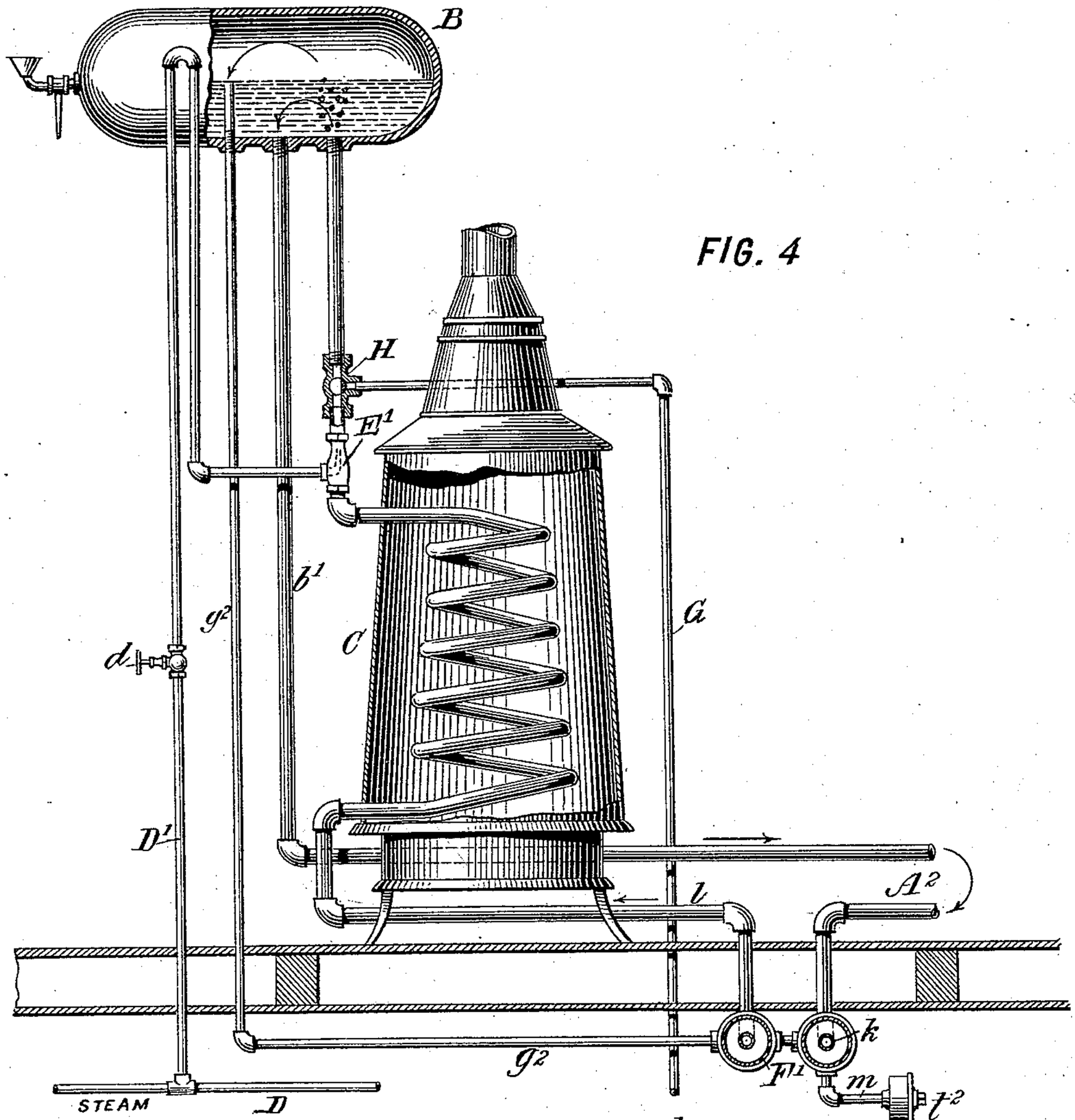
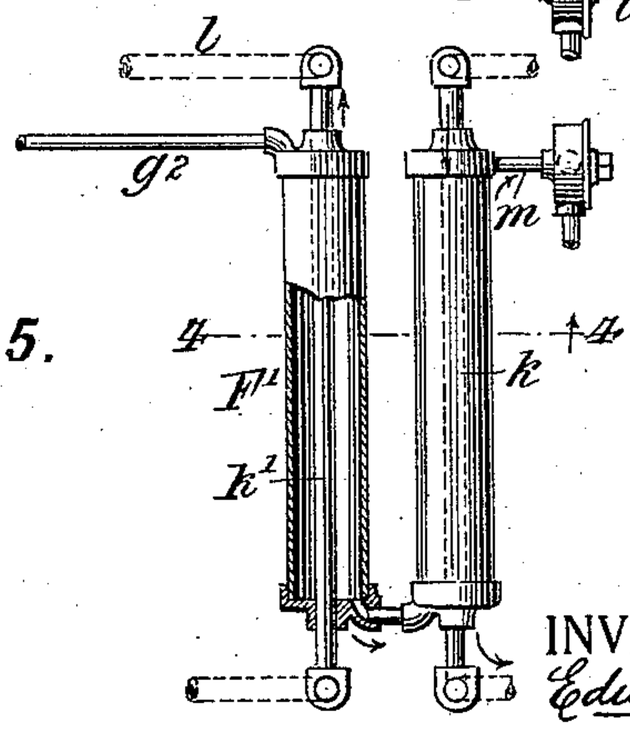


FIG. 5.



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CAR HEATING APPARATUS.

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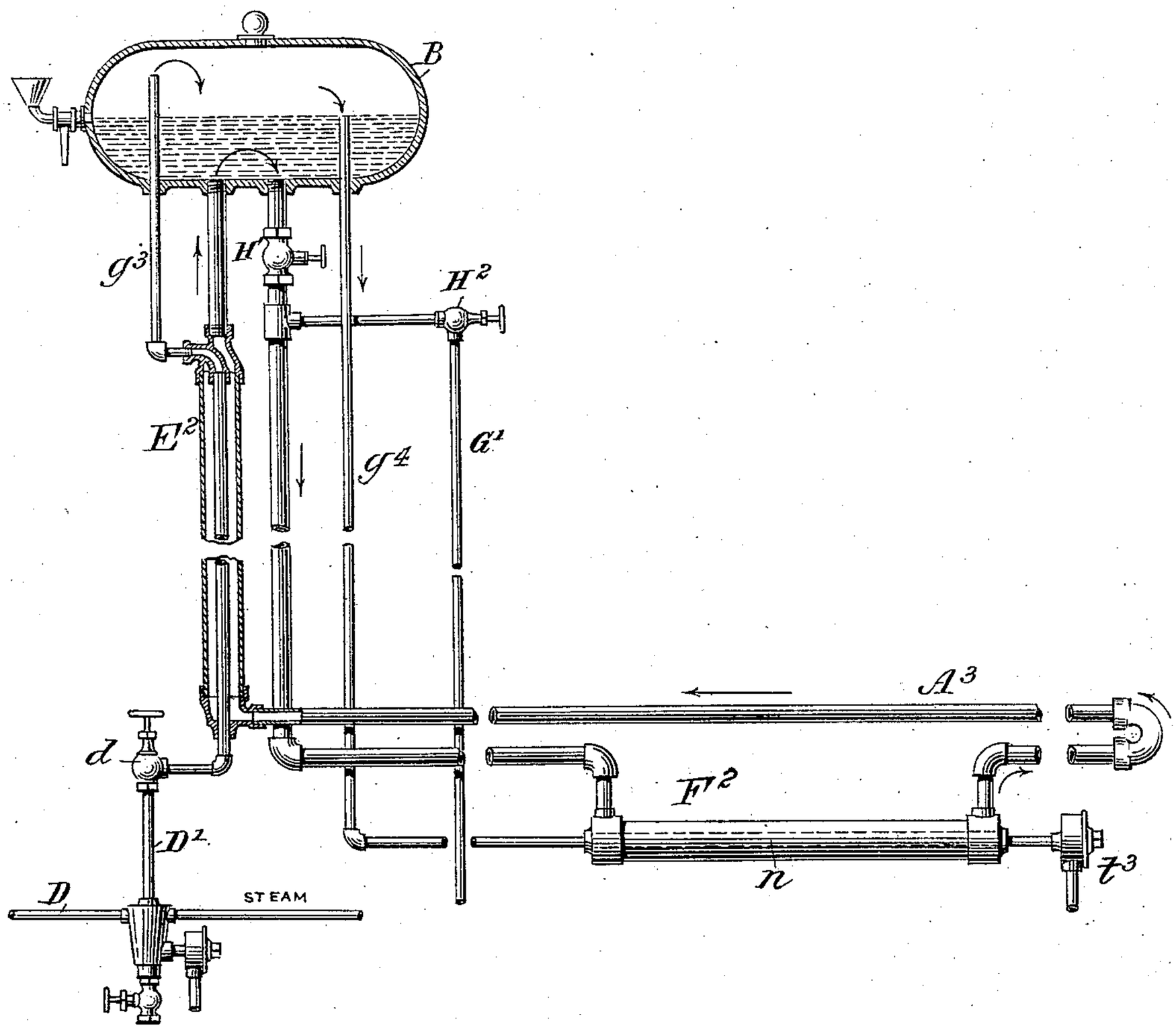
FIG. 6.



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UNITED STATES PATENT OFFICE.

EDWARD E. GOLD, OF NEW YORK, N. Y.

CAR-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 572,254, dated December 1, 1896.

Application filed November 18, 1893. Serial No. 491,309. (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 Car-Heating Apparatus, of which the following is a specification.

This invention relates to heating apparatus specially adapted for heating railway-cars, and of that class wherein one or more liquid-circuits are employed from which the heat is radiated throughout the car, and which are heated by steam derived from the locomotive-boiler or other source.

One object of my invention is to provide for a more thorough and effective utilization of the heat from the steam which is admitted to the car.

Another object is to provide by a simple construction for the automatic discharge from the circuit of any excess of water, while utilizing the overflow for heating purposes.

A further object is to facilitate the simultaneous heating of two radiating liquid-circuits for heating opposite sides of the car or different portions thereof, an arrangement that is frequently used.

A further object is to facilitate the filling up of the liquid-circuit with water by providing means for preventing the formation of an air-trap in the pipes, and enabling all air contained in the circuit to be expelled with certainty by blowing it out under the pressure of steam.

Figure 1 of the accompanying drawings is an elevation, partly in vertical section, of the heating apparatus embodying my invention as applied to a railway-car having two distinct heat-radiating liquid-circuits. Fig. 2 is a fragmentary section thereof, showing the normal position of the valve for closing the liquid-circuit, while Fig. 2ª shows this valve in its position when turned for expelling air. Fig. 3 is a fragmentary section showing the valves for closing the steam-pipes when the system is to be heated by a fire in the stove. Fig. 4 is an elevation, partly in section, showing a modification of my invention; and Fig. 5 is a fragmentary plan, partly in section, showing a portion of Fig. 4. Fig. 6 is an elevation, partly in section, showing a further modification embodying my invention.

Referring to Fig. 1, let A and A′ designate two heat-radiating liquid-circuits which are extended through different portions of a railway-car, and which are carried up to an elevated expansion-tank B. In the course of their ascent they pass through a heating-stove C, commonly known as the "Baker heater," the portions passing through this stove consisting of coils or worms *a a′* of pipe, which are arranged in the stove so as to be exposed to the direct heat of a fire therein. The two circuits A A′ may be wholly distinct, except that both communicate with the same expansion-tank B, or they may, as shown, be united for a short distance by a pipe *b*, common to both and extending down from the tank B to a Y-fitting *c*, by which the single pipe is branched to the two pipes constituting the two separate circuits. The two circuits being filled with water or other liquid, which also partly fills the expansion-tank, as shown, if heat is applied to the ascending portions of the circuits, as by making a fire in the stove C, the liquid in the coils *a a′* is heated and boiled, and its specific gravity being thus reduced an upward circulation is instituted, so that the heated liquid is caused to circulate through the whole length of both circuits, and also circulating to give out its heat to warm the car.

Steam is admitted from the locomotive-boiler or other source to a steam-pipe extending through the train and connected from car to car by couplings, a fragment of this pipe being shown at D. From this pipe a branch pipe D′ leads into the car and is provided with a valve *d* for controlling the admission of steam. Two steam-heaters are provided for communicating the heat of the admitted steam to the liquid-circuits. Of these the first heater, which I will letter E, consists in the construction shown of a steam-pipe *e*, carried through the liquid-pipe, within the coil *a* thereof, as shown, where the two pipes are broken away within the stove. This pipe *e* emerges at *f* from the inclosing liquid-pipe and is extended upwardly by a pipe *g*, which opens into the upper part of the expansion-tank B, as shown. From within the tank B there extends downwardly another pipe *g′*, which at *f′* enters within the liquid-pipe of the other coil *a′*, and extends within it, as shown, the portion of pipe thus inclosed being lettered *e′* and constituting with its inclosing pipe the second steam-heater, which as a whole is lettered F. The inclosed pipe

emerges from this heater at f^2, and from this point is extended down by a pipe (lettered h) which passes down through the floor of the car and terminates in a trap t for draining off any water of condensation or overflow water that may accumulate as fast as it shall cool, the trap employed for this purpose being any suitable or known construction of thermostatic trap adapted to open and admit the flow of a cold fluid, and to be expanded and close the flow as soon as the fluid that is passing becomes hot.

The operation of the apparatus as thus described is as follows: When steam is turned on at the valve d, it flows through the inner pipe e of the heater E, ascends through the pipe g into the drum B, descends through the pipe g' into the inner pipe e' of the second heater F, and thence descends through the pipe h to the trap t, and in blowing out through the trap it heats up and closes the trap, so that a pressure of confined steam is maintained in the several pipes and in the heaters. The steam in the inner pipes of the two heaters gives up its heat, which is conducted through these pipes and imparts heat to the liquid in the annular spaces between the inner and outer pipes of the two heaters, so that the liquid is heated and boiled, and consequently caused to ascend through the heaters, thereby instituting a circulation in the liquid-circuits A A', which is maintained as long as the heat is supplied from the steam. As the steam condenses in the inner pipes of the two heaters its reduced volume enables more steam to flow in from the main steam-pipe, so that as the condensation occurs it is accompanied by a current of steam through the heaters, which current is spirally upward through the first heater and spirally downward through the second heater, but is more rapid in the first heater than in the second. This current in the first heater will ordinarily blow the water of condensation up through the pipes e and g into the expansion-tank B, but if it is insufficient to do this the water of condensation will flow down through the pipe D' and enter the main steam-pipe, from which it can be trapped off in any of the ways known in the art, preferably by introducing at one or more points a sediment-well i, forming a pocket into which the water may run, and having a trap t' for letting the water escape as often as it cools.

Whenever by the condensation occuring either in the first heater, and which is blown up into the expansion-tank, or by that occurring in the steam-space of the tank the water-level in the tank is raised above the normal water-level, the excess of water overflows from the tank down through the pipe g', the upper end of which opens at the level desired for the normal water-level, so that this pipe g' constitutes not only a steam-pipe, but also an overflow-pipe for preventing the accumulation of too much water in the liquid circuits and tank. The water thus discharged having been highly heated by the steam is very hot, and as it flows down through the inner pipe e' of the second heater its heat and that of any steam in this pipe is given up to the liquid-circuit, and the overflow-water, together with any water of condensation, flows down through the pipe h and is discharged from time to time through the trap t. Thus the heat, not only of the steam and water of condensation from the first heater, but also of any overflow-water from the expansion-tank, is fully utilized in the second heater by being communicated to the water in the pipe a' thereof.

Where the first and second heaters are employed for heating two distinct circuits, and when it is desired to maintain a substantially uniform temperature in both circuits and a uniform rate of circulation, the action of the two heaters is rendered substantially equal by arranging the second heater as a "reverse-flow" heater, so that the steam or hot water in the inner pipe traverses in the contrary direction to the liquid being heated, while in the primary heater the steam in ascending through the inner pipe traverses in the same direction with the liquid that is being heated, and consequently its temperature cannot be reduced below that of the emerging and consequently hottest liquid in the outer pipe, so that the first heater is somewhat less efficient than the second heater, in which latter every available portion of the heat in the descending current of steam or water is utilized, since as it descends and gives up its heat it continually encounters a cooler portion of the column of liquid to be heated, so that it is useful for heating purposes until its temperature has been reduced to that of the coolest or incoming portion of the water column.

One important feature of my invention is the provision it affords for preventing excessive pressures within the liquid-circuit and expansion-tank. The upper part of the expansion-tank being made a portion of the steam communication between the first and second heaters, it is obvious that the pressure in the liquid-circuit cannot exceed the pressure of the steam, that is, the pressure which is admitted past the valve d, and which will ordinarily be a low pressure, being continually reduced by the frequent discharge of the cool water of condensation through the trap t.

In order to shut off the steam-pipes from communication with the drum when the system is to be heated by a fire in the stove, I provide the pipes $g\,g'$ with stop-cocks $j\,j$, connected together so as to be turned by a common handle, which may conveniently be accomplished by the construction shown in Fig. 3. When a fire is started in the stove, these stop-cocks should be closed by their handle to shut off the steam-pipes, and when the car is to be heated again by steam from the locomotive these cocks should be opened.

In the modification shown in Figs. 4 and 5

the first steam-heater (here lettered E′) consists of a jet for injecting steam directly into the ascending column of water in the liquid-circuit. The steam is thus in part condensed and gives up its heat to the water. That portion of the steam which is not condensed rises in the tank and descends through the pipe g^2 to the second heater, (here lettered F′,) which is placed beneath the floor of the car to heat the crossover-pipes of the liquid-circuit. Only a single liquid-circuit is here shown, the stove C being shown for heating this circuit by a fire when steam is not available. From the coil in this stove the circuit passes by the usual ascending pipe to the expansion-tank B, thence by a descending pipe b' to near the floor, thence to the opposite end of the car and back, forming a radiating-circuit A^2, then down beneath the floor and across the car as the crossover-pipe k, (shown in plan in Fig. 5,) from which the radiating pipes extend on the opposite side of the car and again cross over by a crossover-pipe k', which joins the return-pipe l, leading back to the lower end of the heater-coil. The second heater F′ consists in the construction shown of a casing or casings inclosing the crossover-pipes k k', to which casings the steam is admitted from the pipe g^2, so that these crossover-pipes are enveloped in hot steam or water of condensation held in these casings. The water of condensation as it accumulates and cools is drained off by a pipe m and a trap t^2. In this modification the first and second heaters are employed to heat different portions of the one liquid-circuit instead of heating two separate liquid-circuits.

In the modification shown in Fig. 6 the first and second heaters (here lettered E^2 and F^2, respectively) are both applied to the same liquid-radiating circuit A^3. The first heater E^2 consists simply of a steam-pipe extended up through the ascending pipe of the liquid-circuit in order to heat the ascending liquid and boil it to cause it to circulate. The steam after traversing this heater passes up through a pipe g^3 into the expansion-tank, and thence down by a pipe g^4 to the second heater F^2. This heater consists also of a steam-pipe passing through a pipe or casing forming part of the liquid-circuit, the inner pipe n receiving the spent steam or water of condensation, or hot overflow-water from the expansion-tank, and serving to conduct the heat thereof to the column of water flowing through the outer pipe or casing. As the water of condensation cools it is discharged by a trap t^3.

My invention provides means for readily discharging the water from the pipes of the liquid-circuit when a car is to be laid out of service, in order to prevent the bursting of the pipes by freezing and for facilitating the filling of the pipes again with water when the heating apparatus is required to be again used. To this end I apply on any of the pipes of the liquid circuit or circuits and at any convenient point a valve or cock for closing off the pipe or pipes, and adjacent thereto I connect with the pipe or pipes a blow-off pipe, which extends thence beneath the car or to any other suitable point for effecting the discharge. In order to empty water out of the pipes, this valve is turned so as to close the pipe of the liquid-circuit and open communication to the blow-off pipe, whereupon by turning on a pressure of steam the entire column of water in the pipes of the liquid-circuit is blown out through the blow-off pipe and discharged outside the car. This means of clearing the pipes is much more satisfactory than that now practiced, namely, by opening a drainage-cock at the lowest point of the circuit, since by the present method considerable water is liable to be held pocketed in the pipes, and particularly in the crossover-pipes, by reason of the numerous bends commonly existing in the liquid-circuit. The principal advantage, however, of this feature of my invention consists in the facility it affords for refilling the pipes with liquid. This operation is ordinarily difficult because of the pipes being filled with air, which becomes trapped in the bends of the pipes, rendering it almost impossible to dislodge it.

By the use of my invention it is only necessary to turn on the steam and permit it to blow through the entire system of circulating-pipes and out through the blow-out pipe, so that the steam in making the circuit forces all air contained in the pipes ahead of it, expelling it through the blow-off pipe. The pipes of the circuit then become filled with steam, the heat of which is useful to warm up the car, the blow-off valve being closed, and as the steam condenses the pipes become filled with water of condensation, provided that the connection with the source of steam is maintained. If this connection cannot be maintained, then it is only necessary to couple on a hose while the pipes still remain filled with steam, and as the steam condenses the vacuum thus occasioned will draw water into the pipes, or if a suitable water-pressure is provided the water will be forced in and will take the place of the steam as rapidly as the latter is condensed.

Referring to Fig. 1, let G be the blow-off pipe, and H the valve or cock for closing the pipe of the liquid-circuit. As in this figure there are two liquid-circuits, this valve is preferably applied to the pipe b, which is common to both circuits, as otherwise two valves would be required, one for each circuit. In the preferred construction the valve H has a three-way cock of the kind shown in Figs. 2 and 2^a, so that it serves not only to close or open the water-pipe b, but also by the same movement which closes the water-pipe to open communication into the blow-off pipe, as shown in Fig. 2^a. Fig. 2 shows the normal position of the valve when the heating apparatus is in use. On turning the valve to

this position and introducing steam the entire column of liquid in the radiating-circuit of pipes will be blown off through the blow-off pipe. To refill the pipes with liquid, it is only necessary in order to expel the air to turn on the steam, which will blow through from the expansion-tank into the pipes of the liquid-circuit, forcing the air out of these pipes through the valve H and blow-off pipe G, whereupon by closing the valve H to the position shown in Fig. 2 the pipes may be filled with the liquid. The same valve H and blow-off pipe G are shown in Fig. 4.

In Fig. 6 is shown a slight modification, wherein instead of employing a single three-way valve at the junction of the two pipes a stop-cock H′ is applied for closing off the liquid-circulating pipe and a separate stop-cock or valve H^2 is applied to the blow-off pipe G′, which requires the operating of two valves instead of one. In either case it is preferable to apply the valve H or H′ and to connect the blow-off pipe G or G′ closely adjacent to the point wherein steam is admitted to the circuit, which in the construction shown is at the expansion-tank B, so that in these constructions the connections referred to are made closely adjacent to the expansion-tank, the reason for this being that the steam that is admitted can force the water or air which is contained in the radiating-pipes out of almost the entire circuit of pipes, excepting only the insignificant portion intervening between the valve H or H′ and the expansion-tank; but by applying a three-way cock such as is shown in Figs. 2 and 2^a to any point in the circuit the entire circuit may be emptied by turning it first to the position shown in Fig. 2^a for emptying that portion of the circuit beneath the cock and then to the reverse position, so as to empty that portion of the circuit on the opposite side of the cock.

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

1. The combination with a liquid-radiating circuit and an elevated expansion-tank, of two steam-heaters below said tank, a pipe for admitting steam to the first heater, the first heater discharging into the expansion-tank, and an overflow-pipe for admitting steam or hot overflow-water from the expansion-tank to the second heater, whereby the steam is first admitted to the first heater, then to the tank wherein by condensation it maintains the full volume of water in the circulating system, and finally the remaining steam with any excess of water passes to the second heater, where its remaining heat is utilized.

2. The combination with a liquid-radiating circuit and an elevated expansion-tank, of two steam-heaters below said tank, the first arranged to be traversed upwardly by the steam and upwardly by the water being heated, and the second a reverse-flow heater to be traversed downwardly by the steam and upwardly by the water being heated, a pipe admitting steam to the lower part of the first heater, a pipe for discharging from said heater into the expansion-tank, a pipe for admitting steam or hot water from the expansion-tank to the second heater, and a pipe leading from the lower part of the second heater to a trap or discharge, whereby the two heaters, which receive steam at different temperatures are rendered of approximately equal heating efficiency.

3. The combination with two liquid-radiating circuits and an elevated expansion-tank communicating with both, of two steam-heaters in operative contact with the respective circuits, a pipe for admitting steam to the first heater, a pipe for discharging therefrom into the expansion-tank, and a pipe for admitting steam or hot water from the expansion-tank to the second heater.

4. The combination with a liquid-radiating circuit, an elevated expansion-tank, and a local heater or stove for heating said circuit, of two steam-heaters below said tank, a pipe for admitting steam to the first heater, an ascending pipe for discharging therefrom into the expansion-tank, a descending pipe from said tank for admitting steam or hot water from the expansion-tank to the second heater, and valves for simultaneously closing said ascending and descending pipes to admit of the circuit being heated by said local heater.

5. The combination with a liquid-radiating circuit, an elevated expansion-tank, a heater beneath said tank, of a steam-pipe communicating through said heater with said tank for admitting steam thereto, a valve in said circuit for closing communication through it, and a blow-off pipe leading from said circuit adjacent to said valve, whereby by closing said valve and turning steam into said circuit, the contained air or liquid is forced through said circuit and expelled to said blow-off pipe, and the pocketing of the air or liquid in the circuit is prevented.

6. The combination with a liquid-radiating circuit and expansion-tank, of a steam-pipe communicating with said tank for admitting steam to the tank and circuit, a valve in said circuit adjacent to said tank, and a blow-off pipe leading from said circuit, and arranged to communicate when said valve is closed with the portion of the circuit beneath the valve, whereby on admitting steam to the tank the air or liquid contained in the circuit is forced around through it to said valve and expelled through said blow-off pipe.

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

EDWARD E. GOLD.

Witnesses:
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THOMAS F. WALLACE.