E. H. GOLD.

HEATING SYSTEM.

APPLICATION FILED AUG. 7, 1907.

**929,126.**

Patented July 27, 1909.

4 SHEETS—SHEET 1.

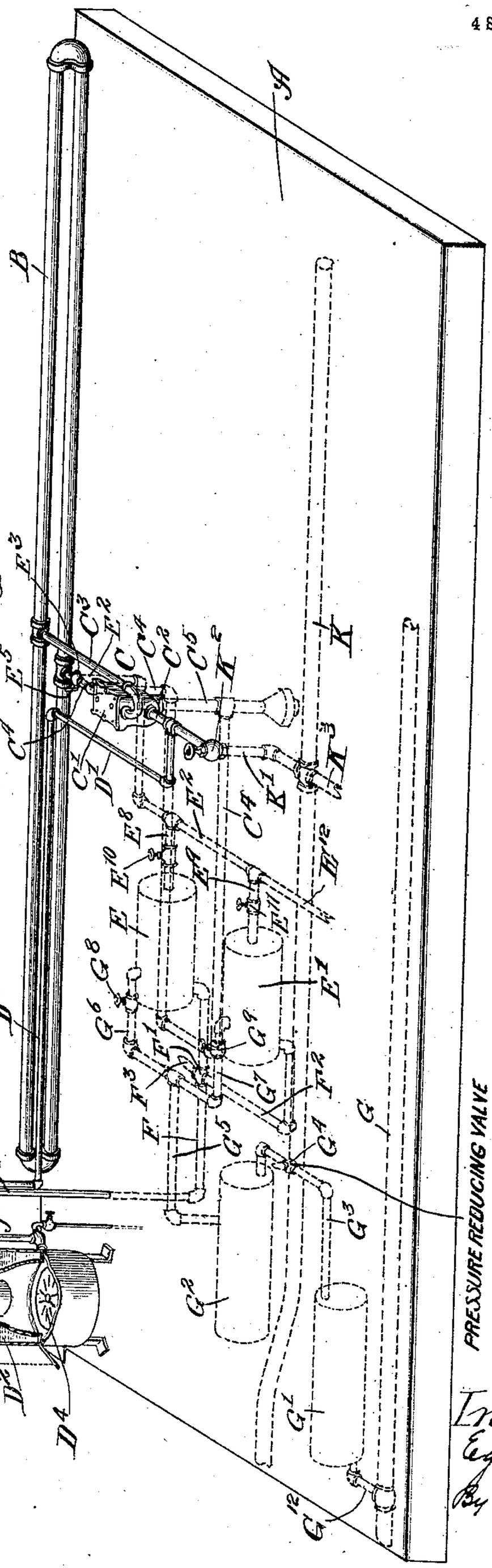


Fig. 1.

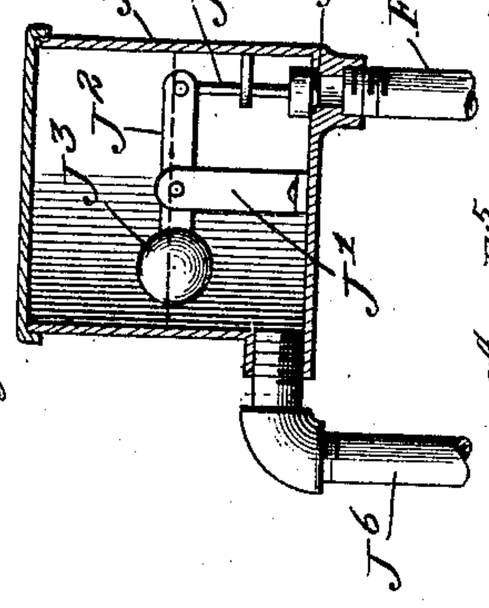


Fig. 2.

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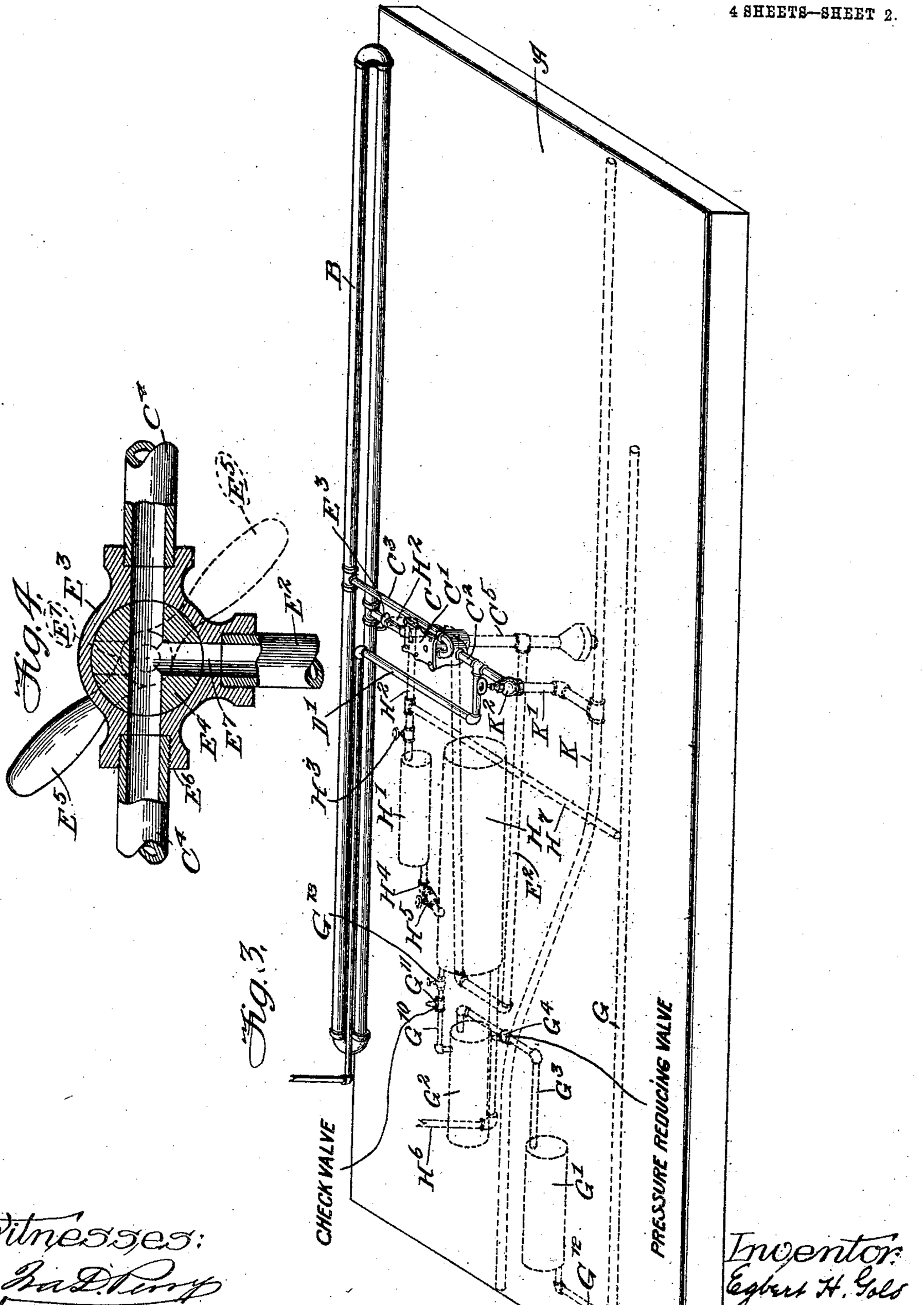


Fig. 4.

Fig. 3.

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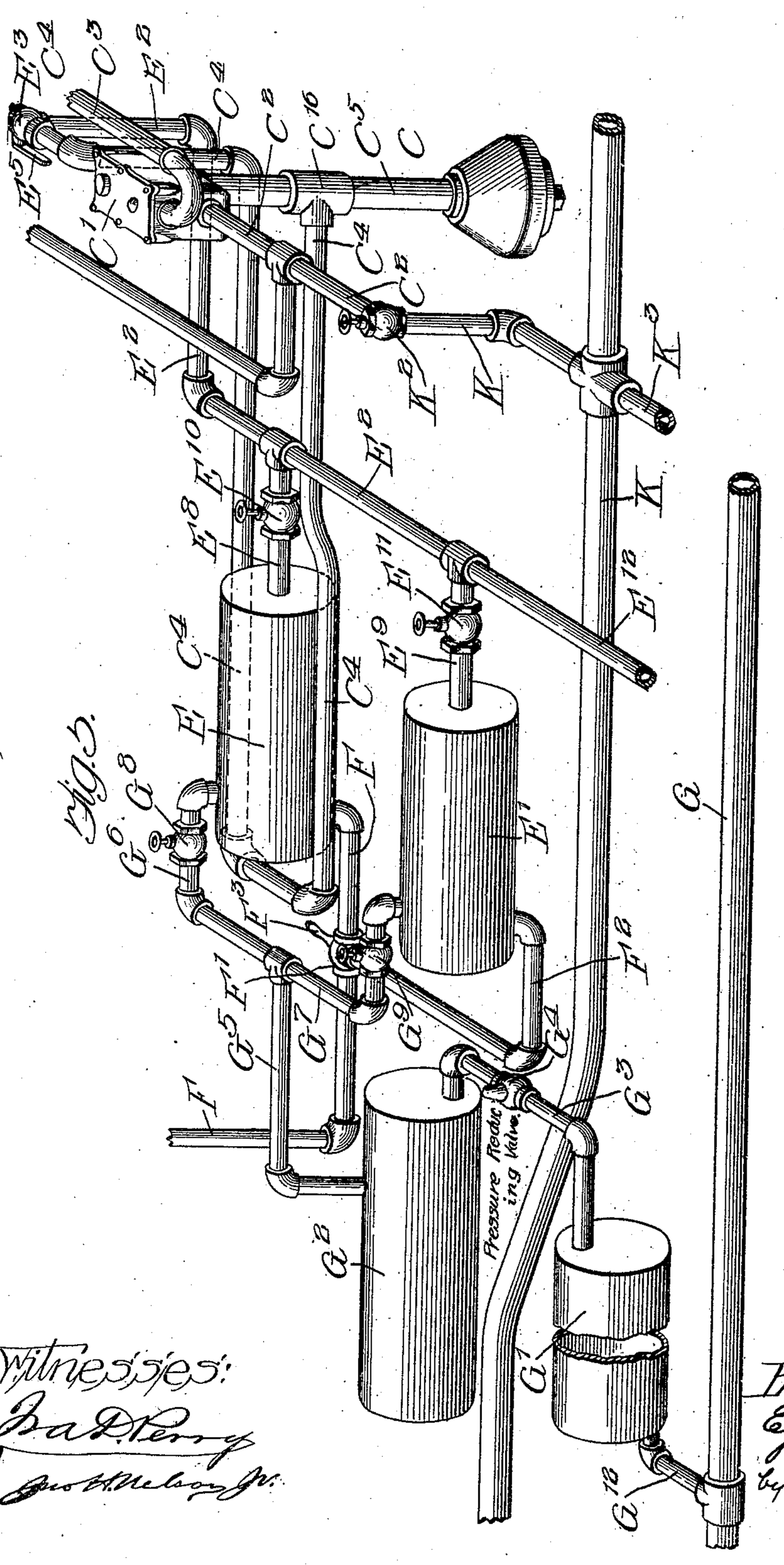

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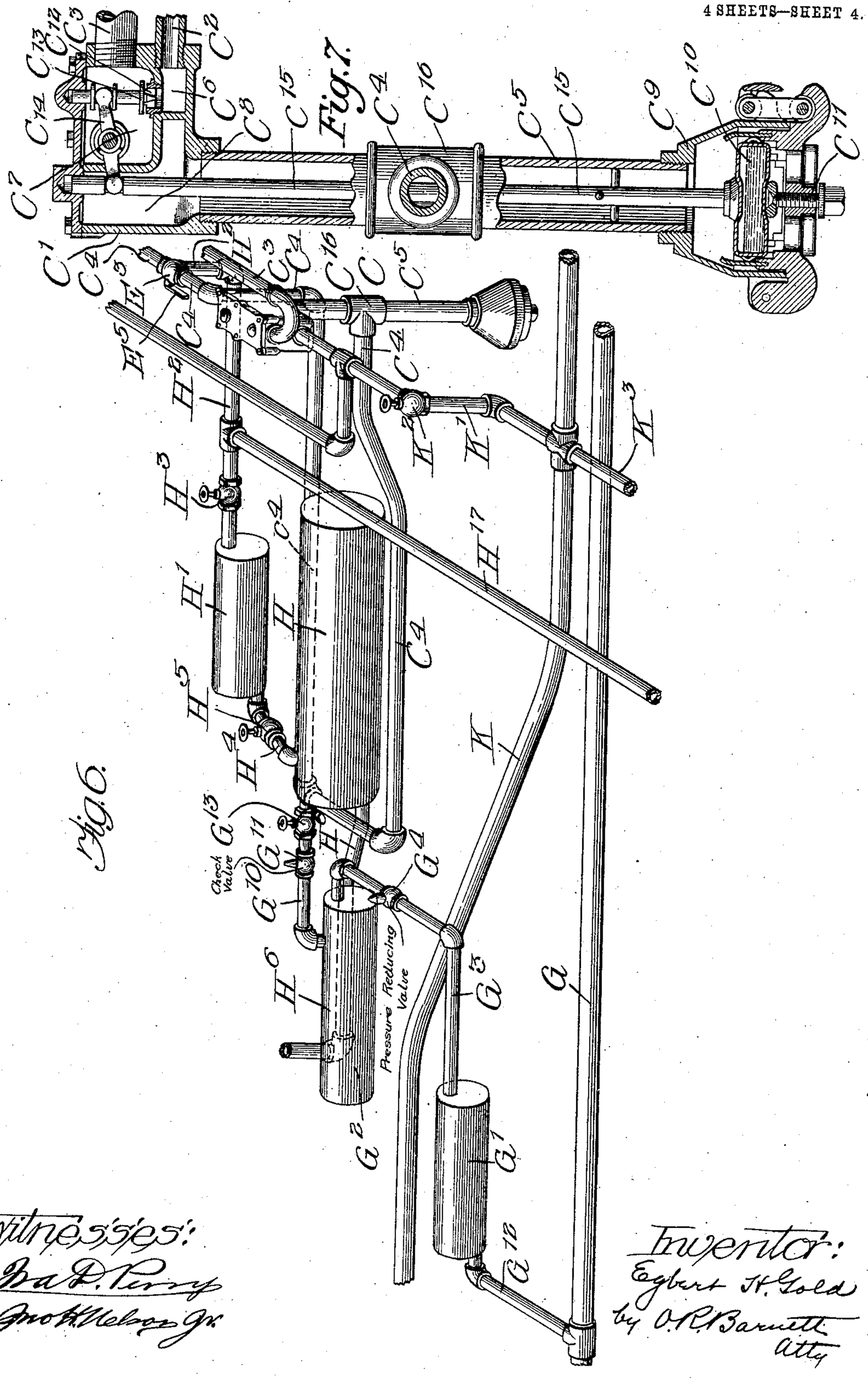
4 SHEETS—SHEET 4.

Fig. 6.

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# UNITED STATES PATENT OFFICE.

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## HEATING SYSTEM.

No. 929,126. Specification of Letters Patent. Patented July 27, 1909.

Application filed August 7, 1907. Serial No. 387,550.

*To all whom it may concern:*

Be it known that I, EGBERT H. GOLD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Heating Systems, of which the following is a specification.

My invention relates to a steam heating system and has for a principal object to provide means for trapping and storing water of condensation from the radiating pipes and causing the same to be delivered for use at any desired place.

The invention is particularly suitable for use in connection with heating systems for railway cars and will be shown and described as an amplification and improvement upon the type of car heating system shown in my co-pending application Serial No. 384,804, filed July 20, 1907; but it will be obvious that the invention may be used with different car heating systems from the one referred to, or in other connections or for other purposes where similar conditions prevail.

The car heating system referred to comprises a set of radiating pipes normally connected with the steam train pipe through a thermostatically operated pressure reducing controller, together with an auxiliary steam generator adapted to be used to supply the steam when the train pipe supply is not available, for example, when the car is cut off from the engine. This auxiliary heater is used only occasionally and should, of course, be as small and compact as possible. For this reason, its boiler must be necessarily small; and this is desirable also so that a supply of steam may be obtained quickly. The condensation taking place in a system of pipes sufficient to keep a large railway car warm in cold weather is very considerable. It is, therefore, necessary, and one of the serious problems involved in the use of the system above referred to, to provide some convenient means for keeping up the supply of water in the boiler of the auxiliary generator during use. It would not be practical to use reservoirs kept full all the time, as that would involve carrying about all the time a considerable supply of water which would be used but rarely.

My present invention contemplates trapping the water of condensation, storing it and, when the auxiliary generator is used, forcing the same back into the boiler, preferably by means of compressed air, a supply of the latter being available on all passenger cars. Preferably the water is supplied to the boiler by an automatic feed, the whole system of water supply operating without the necessity of care. It is obvious that the water of condensation, so trapped and stored, might be used for other purposes than feeding the generator; and that the tanks used for water might, if desired, be filled from other sources than the radiating pipes.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating one application of my invention. Fig. 2 is a detail section of the automatic feed. Fig. 3 is a view similar to Fig. 1 of a modified arrangement. Fig. 4 is a detail cross section of the valve in the return pipe of the radiating system. Fig. 5 is an enlarged view in perspective of the pipes, tanks and controller shown in Fig. 1. Fig. 6 is a similar view of the arrangements shown in Fig. 3; and Fig. 7 is a vertical, sectional elevation of the controller or the vapor regulator.

Like characters of reference indicate like parts in the several figures of the drawings.

A represents the flooring of the car; B a radiator or system of radiating pipes represented more or less conventionally; K the steam train pipe which ordinarily runs the length of the train and receives steam from the locomotive; G the air train pipe which also runs the length of the train and supplies compressed air for operating the air brakes on the several cars; C the controller or vapor regulator, which in this case is shown as a common form of vapor regulator regulating the inflow of steam to the radiator in accordance with thermostatic conditions at the discharge end of the radiator; and D an auxiliary steam generator.

When the car is connected up with the engine under ordinary conditions, steam will be supplied to the radiator B from train pipe K through a branch pipe K′, provided with a hand valve of ordinary construction $K^2$. The supply of steam from the train pipe, in which the pressure is usually very considerable but variable, to the radiator is controlled by controller C, the construction of which is shown in Fig. 7.

C′ is a casing divided into an inlet chamber $C^6$, an outlet chamber $C^7$ and a chamber $C^8$, the latter being in communication with a

discharge pipe $C^5$, which is tapped into the casing. At the end of pipe $C^5$ is a thermostat casing $C^9$, in which is located thermostat $C^{10}$, consisting of a receptacle filled with a volatile fluid, the thermostat being adjusted by the ordinary adjusting screw $C^{11}$. A port $C^{12}$ puts chamber $C^6$ in communication with $C^7$ and this port is controlled by a valve $C^{13}$, the stem of which is engaged by a lever $C^{14}$, the other end of which engages an operating rod $C^{15}$, which seats upon the thermostat $C^{10}$.

$C^2$ is a pipe leading from valve $K^2$ to chamber $C^6$; $C^3$ a pipe leading from chamber $C^7$ to radiator B; $C^4$ is a pipe leading from the point of exhaust of radiator B to pipe $C^5$, where it is tapped into a tee $C^{16}$ in said pipe.

I have illustrated in the drawings the radiator and control device on one side of the car only. Ordinarily there will be another radiator with a similar control device on the other side of the car, this radiator being fed from the train pipe K by the branch pipe $K^3$. With valve $K^2$ open and pipe K′ filled with steam from the locomotive, just enough steam is admitted to the radiator B to maintain the same full of steam at atmospheric pressure. An excess of steam at the discharge end of the radiating pipes causes the thermostat $C^{10}$ to expand and valve $C^{13}$ to close or throttle the port between chambers $C^6$ and $C^7$. A steam heating system of this sort has become known as the "vapor system." Ordinarily the water of condensation coming from the radiator flows out through the discharge pipe 5 of the controller and is wasted.

It is one of the objects of my invention to provide means for trapping this water of condensation, without interfering with the flow of steam from the point of exhaust of the radiator to the controller, and causing such water of condensation to be stored upon the car and to be delivered at any point on the car where it is desirable to use it. For example, the heating system which I have shown involves the provision of an auxiliary steam generator adapted to supply the radiating pipes with steam when the car is cut off from the locomotive or when, for any other reason, the system cannot be fed from the train pipe K; and in such a system the water of condensation is trapped, stored in suitable receptacles, and fed to the boiler of the auxiliary generator in amounts sufficient to keep the water in the generator at the desired level. Any sort of steam generator might be used in this connection. I have shown a generator D of familiar construction, which consists of a casing $D^3$ in the lower part of which is the grate $D^4$, and above the same an annular boiler $D^2$. A steam pipe D′ leads from the boiler $D^2$ to the pipe $C^2$ leading into the inlet chamber of the controller. If desired, a branch pipe $D^5$ may be employed to conduct steam to the radiator on the opposite side of the car (not shown). Pipes D′ and $D^5$ are provided with valves $D^6$ and $D^7$, respectively.

When steam is not available from the train pipe K, a fire may be lighted on grate $D^4$ of the auxiliary generator and steam generated in boiler $D^2$, which, when valve $D^6$ is opened and valve $K^2$ closed, passes into the radiator B through the controlling device C. The admission of the steam to the radiator will be controlled in accordance with thermostatic conditions at or near the point of discharge of the radiator, the same as if the radiator were being fed from the train pipe.

The auxiliary generator will only be used occasionally and obviously, if the radiating pipes are of considerable length, the generator will require a good deal of water in order to maintain the radiating pipes full of steam at atmospheric pressure. It will be possible to carry a supply of water on the car for such an emergency, but this would necessitate the use of large tanks which, for the greater part of the time, would be useless and which would be likely, through inattention, not to be filled at the time when they were needed. By trapping the water of condensation and storing the same in receptacles which are constantly being replenished so long as there is any call for steam in the radiating pipes, it is possible to very considerably diminish the amount of water kept on hand for occasional use in the auxiliary generator. I have shown two arrangements of tanks having this purpose in view together with means for utilizing compressed air taken from the air train pipe for forcing the water thus trapped and stored into the boiler of the generator when the same is put in operation. One of these arrangements is shown in Figs. 1 and 5, the other in Figs. 3 and 6. A different arrangement of tanks and pipes might, of course, be devised, these two forms being given merely as illustrating the principle of my invention.

Referring first to Figs. 1, 2, 4 and 5, E, E′ represent two water tanks. A pipe $E^2$ leads from valve casing $E^3$ in pipe $C^4$ between the radiator B and the drip pipe $C^5$ and is provided with branches $E^8$, $E^9$, having, respectively, valves $E^{10}$, $E^{11}$, which branches lead into tanks E, E′, respectively. Within the valve case $E^3$ is a valve piece $E^4$ operated by a handle $E^5$ and which has the passageway $E^6$, which can be alined with the pipe $C^4$, and the branch passageway $E^7$ leading to pipe $E^2$, as shown in full lines in Fig. 4. By giving $E^5$ a half rotation, pipe $E^2$ may be closed without interfering with the passage of steam through $C^4$. G′ is a principal air tank connected with the air train pipe G by branch pipe $G^{12}$; and $G^2$ an auxiliary air tank constituting the source of air supply for the system connected with G′ by pipe $G^3$, in which is the pressure reducing valve $G^4$. A

pipe $G^5$ leads from the tank $G^2$ and has the two branches $G^6$, $G^7$ provided with the hand valves $G^8$, $G^9$, respectively, which branches respectively communicate with tanks E, E′. F is a pipe leading from tank E to an automatic water feed device J which is interposed between the water tanks and the boiler of the generator, as will be described. $F^2$ is a branch of this pipe communicating with E′, and F′ a valve of any ordinary construction located at the intersection of F, $F^2$ and arranged to open and close alternately communication between tanks E, E′ and the water feed device J, this valve being operated by the handle $F^3$. The automatic water feed device consists of a casing J in which is a standard J′ having pivoted thereto a lever $J^2$ carrying a float $J^3$, and the valve stem $J^4$ of a valve $J^5$ to control the opening of pipe F. The pipe $J^6$ leads from the casing J to the boiler $D^2$ of the generator.

The operation of these parts will be as follows: Suppose steam is not available from train pipe K, valve $K^2$ is closed, valve $D^6$ opened and a fire lighted on the grate of the generator. Tanks E, E′ are used alternately, one to collect the water of condensation, the other being connected up with the compressed air and with the automatic feed device J, so that it supplies the generator with water. When the radiator is receiving steam from the train pipe, valve $E^4$ may be turned, if desired, so as to allow the water of condensation to escape through the controller. When the generator is used, the valve is turned so that passageway $E^7$ registers with the pipe $E^2$. The water of condensation is, therefore, free to pass from the radiator down into pipe $E^2$ and from there into tank E or E′, according to whether valve $E^{10}$ or valve $E^{11}$ is open. If valve $E^{10}$ is open and $E^{11}$ closed (tank E′ being supposed to have been previously filled with water), valve $G^8$ will be closed and $G^9$ open. Water will, therefore, be forced by air pressure in tank $G^2$ through branch pipe $F^2$ and pipe F into the casing J, the valve at the junction of pipes F and $F^2$ being in position to shut off communication with tank E. The water flows through casing J and pipe $J^6$ into boiler $D^2$. When the proper level has been reached in the boiler, the water in casing J, being at the same level, closes valve $J^5$ by means of the float $J^3$. The supply of water to the generator is, therefore, automatic and in accordance with its needs. When tank E′ is empty, tank E will by this time have been filled. Water of condensation may then be caused to pass to tank E′ and tank E connected up with the air supply and water feed device by reversing the position of valves $E^{10}$, $E^{11}$, $G^8$, $G^9$ and $F^3$. If desired, the radiator on the opposite side of the car may drain into tanks E, E′ through an extension $E^{12}$ of pipe $E^2$.

The general arrangements are the same in the modification shown in Figs. 3 and 6, except that in this case a main water tank is provided from which the water is forced to the generator, a collecting tank being provided which can be emptied into the main tank at intervals. The main tank is indicated at H, the collecting tank at H′, the latter being connected to the pipe $C^4$ by a pipe $H^2$ corresponding to pipe $E^2$ of the other arrangement, this pipe having a hand valve $H^3$. The tanks are connected by a pipe $H^4$ having a hand valve $H^5$. A pipe $H^6$ leads from the tank H to the generator (not shown) or to any other desired place where the water is to be utilized. A branch pipe $H^7$ leads to a radiator on the opposite side of the car (not shown). A pipe $G^{10}$ having a check valve $G^{11}$ and a hand valve $G^{13}$ leads from the auxiliary air tank $G^2$ into tank H. The water of condensation, valve $H^3$ being open and valve $H^5$ closed, flows into H′, tank H being supposed to be filled or partially filled. Air pressure from $G^2$ forces the water from tank H through the pipe $H^6$. When tank H′ is filled, valves $H^3$ and $G^{13}$ may be temporarily closed and valve $H^5$ opened. The water from H′ will flow into H, from which the pressure has been taken by closing valve 13.

I claim:

1. The combination with a radiating system, a source of supply of steam at high but variable pressure, and means for taking steam from said source of supply and circulating it through the radiating system at substantially atmospheric pressure, of means for receiving and storing the water of condensation from the radiating system, a source of supply of compressed air, and valved connections between the radiating system, the receiving means and between the receiving means and the air supply, whereby the water of condensation may be at will drained into and forced from the receiving means.

2. The combination with a radiating system, a source of supply of steam at high but variable pressure, and means for taking steam from said source of supply and circulating it through the radiating system at substantially atmospheric pressure, of means for receiving and storing the water of condensation from the radiating system comprising two receptacles having a valved connection between them, a source of supply of compressed air, and valved connections between the radiating system, receiving means and air supply, whereby the water of condensation may be simultaneously drained into and forced from the receiving means.

3. The combination with a radiating system, a source of supply of steam at high but variable pressure, and means for taking steam from said source of supply and circulating it

through the radiating system at substantially atmospheric pressure, of receiving means for the water of condensation from the radiating system comprising a plurality of receptacles having valved connections between the same, a source of supply of compressed air, and means whereby the water of condensation may be alternately drained into one of said receptacles and forced by pressure of air from the other receptacle.

4. The combination with a radiating system, a source of supply of steam at high but variable pressure, and means for taking steam from said source of supply and circulating it through the radiating system at substantially atmospheric pressure, of two receptacles, a source of supply of compressed air, means for connecting one of the receptacles with the radiating system, means for connecting the other of said receptacles with the source of supply of compressed air, and a valved connection between the receptacles, whereby the water of condensation may be drained into one of the same and forced from the other.

5. The combination with a radiating system, means for supplying the same with steam, and a controller under the influence of temperature conditions in the radiating system; of receiving means to receive the water of condensation, a source of supply of compressed air, and valved connections between the radiating system, the receiving means and the air supply, whereby steam is permitted to pass out from the radiating system to the controller while the water of condensation is drained into and forced from the receiving means.

6. The combination with a radiating system, means for supplying the same with steam, a controller under the influence of temperature conditions at the discharge end of the radiating system, and a connection between the radiating system and such controller; of receiving means for the water of condensation, a drain pipe from the connection between the radiating system and the controller to said receiving means, a source of supply of compressed air, connections between the same and the receiving means, and valves in said connections and in the train pipe, whereby steam from the radiating system is permitted to pass into the controller while water of condensation is caused to pass into and is forced from the receiving means.

7. The combination with a radiating system, means for supplying the same with steam, and a controller under the influence of temperature conditions in said system; of receiving means for water of condensation comprising two receptacles, a valved connection between one of said receptacles and the radiating system, a valved connection between said receptacles, and means for forcing the water out of the other of said receptacles.

8. The combination with a radiating system, means for supplying the same with steam, a controller, and a connection from the discharge end of the radiating system to the controller; of receiving means for water of condensation comprising two receptacles, a drain pipe leading from the connection between the radiating system and the controller to one of said receptacles, a source of supply of compressed air, a connection between the receptacles, means for shutting off communication between the receptacles, and means for opening communication between the source of air supply and one of said receptacles.

9. The combination with a radiating system, of a steam generator, a controller to control the steam in said radiating system in accordance with temperature conditions in said system, receiving means for the water of condensation, a source of supply of compressed air, and valved connections between the radiating system, controller, receiving means, air supply and generator, whereby steam is permitted to pass from the radiating system to the controller and water of condensation is conducted from the radiating system through receiving means to said steam generator.

10. The combination with a radiating system, of a steam generator, a controller whereby the steam is circulated through the radiator at substantially atmospheric pressure, a source of supply of compressed air, and means for withdrawing water of condensation from the radiating system and forcing it into the steam generator by air pressure.

11. The combination with a radiating system, of a steam generator, a controller whereby the steam is circulated through the radiator at substantially atmospheric pressure, a source of supply of air under pressure, and means operated by the air supply whereby the water of condensation is withdrawn from the radiating system and fed to the steam generator so as automatically to maintain the water in the boiler thereof at a desired level.

12. The combination with a radiating system having a vent for the exhaust steam, with a steam generator, means for withdrawing the water of condensation from the radiating system without closing the vent for the exhaust steam, a controller operated by such exhaust steam and adapted to regulate the amount of steam maintained in the radiating system, and means for introducing the water of condensation into the boiler of the generator so as automatically to maintain the water therein at a given level.

13. The combination with a radiating system having a vent for the exhaust steam,

with a steam generator, means for withdrawing the water of condensation from the radiating system without closing the vent for the exhaust steam, a controller operated by such exhaust steam and adapted to regulate the amount of steam maintained in the radiating system, a source of supply of air under pressure, and means operated thereby for introducing the water of condensation into the boiler of the generator so as automatically to maintain the water therein at a given level.

14. The combination with a railway car, of a source of supply of compressed air, a radiator, a steam generator, a controlling device for controlling the flow of steam from the generator to the radiator comprising a thermostat located adjacent to the discharge end of the radiator, receiving means for water of condensation comprising two receptacles, means for connecting one of said receptacles with the radiator without preventing the flow of steam to said thermostat, and means for connecting the other of said receptacles with the source of compressed air and with the generator.

15. The combination with a railway car, of a source of supply of steam at high pressure, a source of supply of compressed air, a radiator, a supply pipe leading from the source of supply of steam to the radiator, a pressure reducing valve in the supply pipe, a thermostatic device in operative communication with the discharge pipe from the radiator to operate the pressure reducing valve, an auxiliary steam generator, a steam pipe leading from the generator to the supply pipe of the radiator at a point in advance of the pressure reducing valve, receiving means for water of condensation comprising two receptacles, and a valved connecting pipe from one to the other, a pipe having a valve connecting one of said receptacles with the discharge end of the radiator, and means for connecting the other of said receptacles with the source of supply of compressed air and with the steam generator.

16. The combination with a railway car, of a source of supply of steam at high pressure, a source of supply of compressed air, a radiator, controlling means for controlling the flow of steam from the source of supply to the radiator in accordance with thermostatic conditions in said radiator, an auxiliary steam generator, pipe connections between the same and the radiator, whereby the flow of steam from the generator, when used, is controlled by the same controlling device employed when steam is taken from said first-mentioned source of supply of steam, receiving means for the water of condensation from the radiator, a valved connecting pipe between the radiator and the receiving means, a pipe between the receiving means and the generator and a valved pipe between the supply of compressed air and the receiving means so that the steam generator is fed with water of condensation from the radiator.

17. The combination with a railway car, of a radiator, a steam generator, a compressed air train pipe, two air tanks, a pipe connecting them, provided with a pressure reducing valve, a receptacle for feed water for the generator, means connecting one of said tanks with the air train pipe, means for connecting the other of the air tanks with the water receptacle, means for connecting the latter with the steam generator, and an automatic regulating device between the water receptacle and the generator comprising a float tank, an inlet valve for the same, and a float to operate said inlet valve for automatically maintaining the water in the generator at a desired level.

18. The combination with a railway car, of a steam train pipe carrying steam at a high but variable pressure, an air train pipe, a radiator in said car, controlling means under the influence of steam at the outlet of said radiator for introducing steam into the radiator from said train pipe, and maintaining the steam in the radiator at substantially atmospheric pressure, means for withdrawing water of condensation from said radiator without interfering with the flow of steam to the outlet thereof, an auxiliary steam generator adapted to be connected with the radiator when steam from said train pipe is not available, an air tank connected with said air train pipe, and means for maintaining the pressure in said tank substantially uniform, receiving means for the water of condensation, and valved connections from the air tank to said water receiving means, and from said water receiving means to the generator, whereby water of condensation from the radiator may be used to feed the generator.

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