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HEATING SYSTEM.

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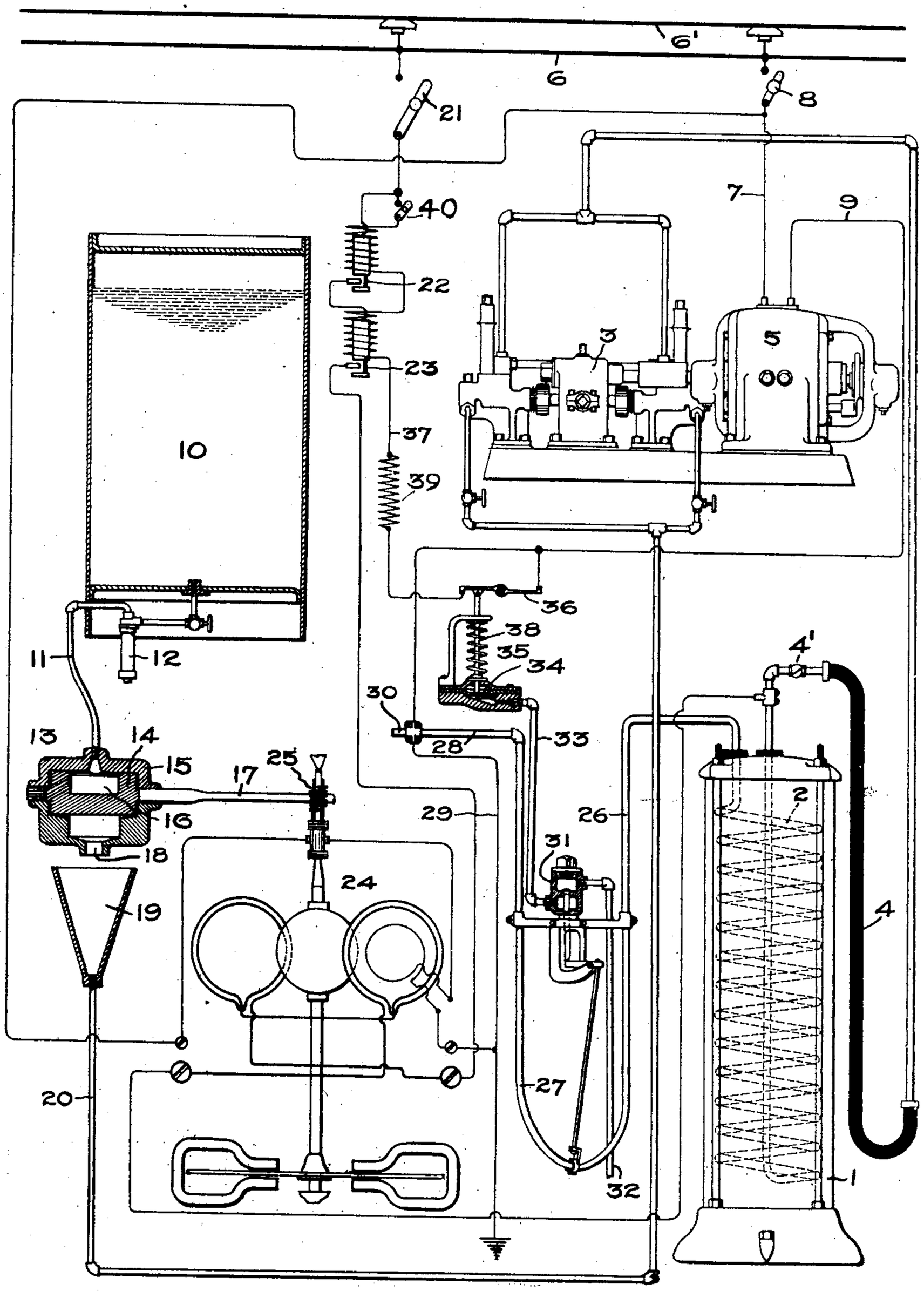

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UNITED STATES PATENT OFFICE.

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HEATING SYSTEM.

No. 919,365. Specification of Letters Patent. Patented April 27, 1909.

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To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Heating Systems, of which the following is a specification.

The present invention relates to heating systems for heating railway cars and the like by means of steam or hot water, where a source of electricity is available to supply heat and it is undesirable to have a fire as, for example, in tunnel service.

In the proposed system electricity flows through a heating unit in a suitable boiler or heater, or through the walls of the boiler or heater tube from end to end and the heat generated by the resistance of the walls to the flow of the current heats the water contained therein. The water is forced into the boiler or boiler tube by means of a pump driven by a suitable motor, such as an electric motor receiving electricity from the same source that supplies the heater. One of the difficulties to be overcome in such a system is that the line voltage varies between wide limits, as for example from 350 to 750 volts, and this variation tends to disturb the desired proportionate relation between the supply of heating energy or current and the supply of water to the heater. This is apparent from the fact that the heating effect of the current varies as the square of the electromotive force, while the speed of the motor, and therefore of the pump, varies in a manner substantially proportional to the electromotive force. In other words, a change in voltage from 500 to 400 volts decreases the heating effect in the ratio of 25 to 16, while the change in the speed of the pump is in the ratio of 5 to 4, or 25 to 20.

The object of my invention is to provide an improved means for regulating the supply of heating current and the supply of water to be vaporized in the boiler by said current, whereby the effects of changes in line voltage on the desired proportional relation of the heat and the water are reduced to a point where they can be disregarded.

The accompanying drawing shows in a somewhat diagrammatic manner one of the embodiments of my invention as arranged for use in connection with a railway system.

A boiler or heater 1 is provided in which the heating unit is composed of one or more coils 2 of relatively high resistance tubing arranged in any desired manner. A suitable pump 3 supplies water to the boiler and in the piping between the two is an insulating section, in this case comprising a piece of rubber hose 4 which prevents current flowing from the heating coil to the pump piping and connected parts. A check valve 4′ prevents the backward flow of the water. The pump is driven by an electric motor 5 receiving current from a conductor 6 through a conductor 7 controlled by a suitable switch 8. The conductor 6 is connected to a line conductor 6′ which may be the third rail of a railroad system and a conductor 9 leads from the motor to the ground on a return circuit.

The water supply flows from a tank 10 through a pipe 11 provided with a strainer 12, to a measuring and controlling valve or other suitable device 13. I have illustrated a rotary balanced valve or measuring device 14 mounted in a casing 15. The valve has a receiving cup or chamber 16, and a spindle or shaft 17 which projects outwardly from the casing. In the position shown, the chamber 16 would be filled with water from the tank and as the valve rotates or turns over, the chamber is emptied, the water passing through an outlet 18 in the casing 15 to a receiving funnel 19 on the end of the pump suction pipe 20. Obviously the rate of rotation of the valve 14 will determine the quantity of water delivered to the pump in a given time. The motor and the pump run all the time and are of sufficient capacity to handle the maximum quantity of water delivered to the pump.

A suitable switch 21 when closed connects the heating coil circuit with the main source of electricity 6′. In said circuit is a circuit-breaker comprising contactors 22, 23 operated by suitable relay magnets in the usual manner. The circuit 37 of the contactors is provided with a suitable resistance 39 for reducing the current to suit the conditions of the relay magnets. A switch 40 is also placed in the circuit 37 for breaking the circuit when it is desired to do any work upon it. This switch may also be used to open the heating coil circuit if the switch 21 is disabled. Two contactors are provided so that if one should be burned the other would operate to safeguard the apparatus, as described farther on. From the contactors the current flows to an electric metering device 24 which ro-

tates at a rate proportional to the energy supplied through it to the heater, although the impressed electromotive force of the circuit may vary between wide limits. The metering device 24 is connected by any suitable gearing 25 to the valve spindle 17 to rotate the latter. I have illustrated worm-gearing for this purpose but other forms of gearing can be used. The work to be performed by the device 24 is ordinarily very small but should it be desired to reduce the load on said device, any well-known form of gearing suitable for that purpose can be used as will be obvious to those skilled in the art. The heating current flows from the outlet end 26 of the coil 2 through the walls of a tubular thermostat 27 directly to a conductor 29 leading to the ground or on through a portion of the pipe 28 to said conductor. The vapor generated in the heater passes through the interior of the thermostat tube to the pipe 28, the outer end 30 of which is connected to the coils or radiators which heat the cars drawn by the locomotive. The thermostat 27 controls the operation of an insulated valve 31 which in turn controls the passage of compressed air from a train pipe 32 through a pipe 33 to the under side of a diaphragm 34 forming part of a regulator 35 which controls a switch 36 in the circuit 37 of the relay magnets of the contactors 22, 23. If the temperature rises to an abnormal value the thermostat expands sufficiently to open the valve 31. The air pressure on the diaphragm then raises it against the action of the spring 38 of the regulator and opens the switch 36, thereby deënergizing the relay magnets and opening the heating circuit to interrupt the supply of current to the heater until the temperature returns to its normal value. I can make the tubing of the coil 2 of nickel steel and the thermostat tube of German silver. Practice has proved these materials to be satisfactory but the invention is not to be construed as limited thereto.

As noted above, the metering device 24 rotates at a rate proportional to the supply of heating energy in the form of electricity delivered to the boiler, the current passing in series through it and said boiler. The valve or device 13 which controls the water supply for the boiler is controlled by the metering device in such a manner that it delivers water at a rate suitably proportioned to the supply of heating current during the normal operation of the system. Should the water tank become empty through carelessness or leakage, or the water supply to the boiler be interrupted due to any other cause while the current is on, the boiler tube might be overheated and damaged. To safeguard the system against such an action the thermostat 27 is provided to operate the circuit breaker and open the heating circuit when the temperature rises unduly. By arranging the thermostat and coil 2 so that the current flows in series through them the temperature of the thermostat will rise even though no steam be present in the system and operate the circuit breaker when its temperature rises above a safe limit.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a heating system, the combination of a boiler or heater having a heating unit, a source of electrical energy which supplies a heating current of electricity to said unit, means for supplying liquid to the heater, and a device actuated by the heating current for maintaining a proportional relation between the liquid and heat supplied to the boiler.

2. In a heating system, the combination of a boiler or heater having a heating coil, a source of electrical energy which supplies current to the coil, means for supplying liquid to the heater, and a metering device for the current which controls the operation of said means.

3. In a heating system, the combination of a boiler or heater having a heating coil, a source of electrical energy subject to fluctuations in voltage which supplies current to the coil, means supplying liquid to the boiler, a metering device for the heating current which is in series with the coil, and connections between the device and said means by which said device controls the supply of liquid and maintains a proportional relation between the liquid and the heat supplied to the boiler.

4. In a heating system, the combination of a boiler or heater having a heating coil, a source of electrical energy subject to fluctuations in voltage which supplies current to the coil, means for supplying liquid to the boiler, a rotary controlling device for said means, a metering mechanism through which and the coil the heating current flows in series, said mechanism rotating at a rate proportional to the energy supplied to the heater, and gearing between the metering mechanism and the controlling device by which said mechanism actuates said device and maintains a proportional relation between the liquid and the heat supplied to the boiler.

5. In a heating system, the combination of a source of electrical energy, a boiler or heater having tubing through the walls of which said source causes a current of electricity to flow to heat liquid within the tubing, means for supplying liquid to the in-

terior of the tubing, and means actuated by the heating current for automatically maintaining a proportional relation between the liquid and the heat supplied to the boiler.

6. In a heating system, the combination of a source of electrical energy, a boiler having a coil of tubing through the walls of which said source causes a current of electricity to flow to heat water within the coil, a pump for forcing water into the interior of the coil, means which regulates the supply of water to the pump suction, a metering device through which and the coil the heating current flows in series, and connections between said device and said means for actuating the latter to maintain a proportional relation between the heat and the water supplied to the boiler.

7. In a heating system, the combination of a source of electrical energy subject to fluctuations in voltage, a boiler having a coil of tubing through the walls of which said source causes a current of electricity to flow to heat water within the coil, a constantly operating pump for forcing water into the interior of the coil, a water tank, a rotating device which regulates the supply of water from the tank to the pump suction, a metering mechanism through which and the coil the heating current passes in series, said mechanism rotating at a rate proportional to the current supplied to the boiler, and gearing between the device and the metering mechanism by which said mechanism actuates the device and proportions the water supply to the heating current.

8. In a heating system, the combination of a source of electrical energy subject to fluctuations in voltage, a boiler having a coil of tubing through the walls of which said source causes a current of electricity to flow to heat water within the coil, a constantly operating pump for forcing water into the interior of the coil, a water tank, piping between the tank and the pump suction, a rotating valve or measuring device in said piping which controls the supply of water to the pump, a metering mechanism through which and coil the heating current passes in series, said mechanism rotating at a rate proportional to the current supplied to the boiler, and worm gearing between said mechanism and the valve for rotating the latter at a rate proportional to the supply of heating current.

9. In a heating system, the combination of a boiler or heater having a heating unit therein, a source of electrical energy which supplies a heating current of electricity to said unit, means for supplying liquid to the heater, a device actuated by the heating current for maintaining a proportional relation between the liquid and the heat supplied to the boiler, and means sensitive to a condition of the liquid being heated which interrupts the heating current when said condition becomes abnormal.

10. In a heating system, the combination of a boiler or heater having a heating coil, a source of electrical energy which supplies current to the coil, means for supplying liquid to the boiler, a metering device which controls the operation of said means, and means sensitive to a condition of the liquid being heated which interrupts the heating current and the supply of liquid to the heater when said condition becomes abnormal.

11. In a heating system, the combination of a boiler or heater having a heating coil, a source of electrical energy subject to fluctuations in voltage which supplies current to the coil, means for supplying liquid to the boiler, a metering device for the heating current which is in series with the coil, connections between the device and said means by which said device controls the supply of liquid and maintains a proportional relation between the liquid and the heat supplied to the boiler under normal conditions, and means responsive to the temperature of the liquid being heated which interrupts the heating current and the supply of liquid to the heater when said temperature becomes abnormal.

12. In a heating system, the combination of a source of electrical energy, a boiler having a coil of tubing through the walls of which said source causes a current of electricity to flow to heat liquid therein, a circuit breaker in circuit between the source and the coil, means supplying liquid to the interior of the coil, means actuated by the heating current for automatically maintaining a proportional relation between the liquid and the heat supplied to the boiler under normal conditions, and a thermostat through which and the coil the current flows in series, said thermostat operating the circuit breaker to interrupt the heating circuit when the temperature becomes abnormal.

13. In a heating system, the combination of a source of electrical energy subject to fluctuations in voltage, a boiler having a coil of tubing through the walls of which said source causes a current of electricity to flow to heat water therein, a rotary means which regulates the supply of water to the interior of the coil, a tubular thermostat through which steam passes on its way from the coil to the apparatus to be heated, a metering device through which and the coil and the thermostat the heating current flows in series, said device rotating at a rate proportional to the current supplied to the boiler, gearing between the device and said means by which said device actuates said means and proportions the water supply to the heating current, and a circuit breaker in the heating circuit which is operated by the thermostat to interrupt the heating current and

the supply of water to the boiler when the temperature becomes abnormal.

14. In a heating system, the combination of a source of electrical current which is subject to fluctuations in voltage, a boiler having a coil of relatively high resistance tubing through the walls of which said source causes a current of electricity to flow to heat water therein, means for forcing water into the interior of the coil, a rotating device which controls the supply of water to said means, a tubular thermostat through which steam passes on its way from the coil to the apparatus to be heated, a metering mechanism through which and the coil and the thermostat the heating current flows in series, said device rotating at a rate proportional to the current supplied to the boiler, gearing between the device and mechanism by which said mechanism actuates said device and proportions the water supply to the heating current, a circuit breaker in the heating circuit, a pressure controlled regulator for the circuit breaker, and means controlled by the thermostat which admits air under pressure from a suitable source to said regulator to operate the circuit breaker and interrupt the heating current and the supply of water to the boiler when the temperature of the thermostat becomes abnormal.

In witness whereof, I have hereunto set my hand this twenty ninth day of June, 1908.

HERMANN LEMP.

Witnesses:
JOHN A. MCMANUS, Jr.,
HENRY O. WESTENDARP.