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H. ETZELT ET AL

2,538,964

HEATING SYSTEM

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Fig. 1

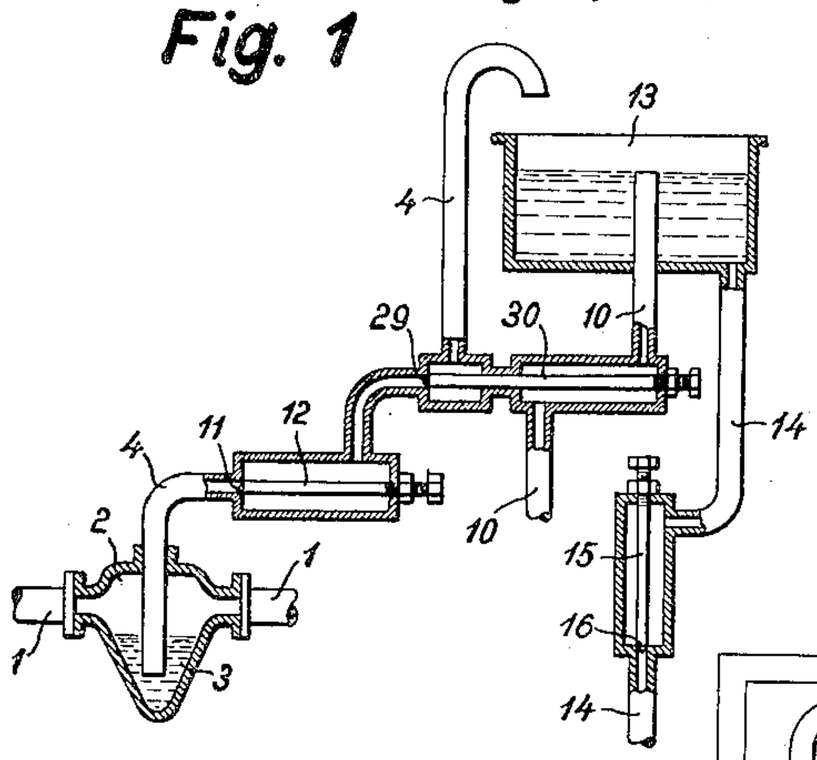


Fig. 2

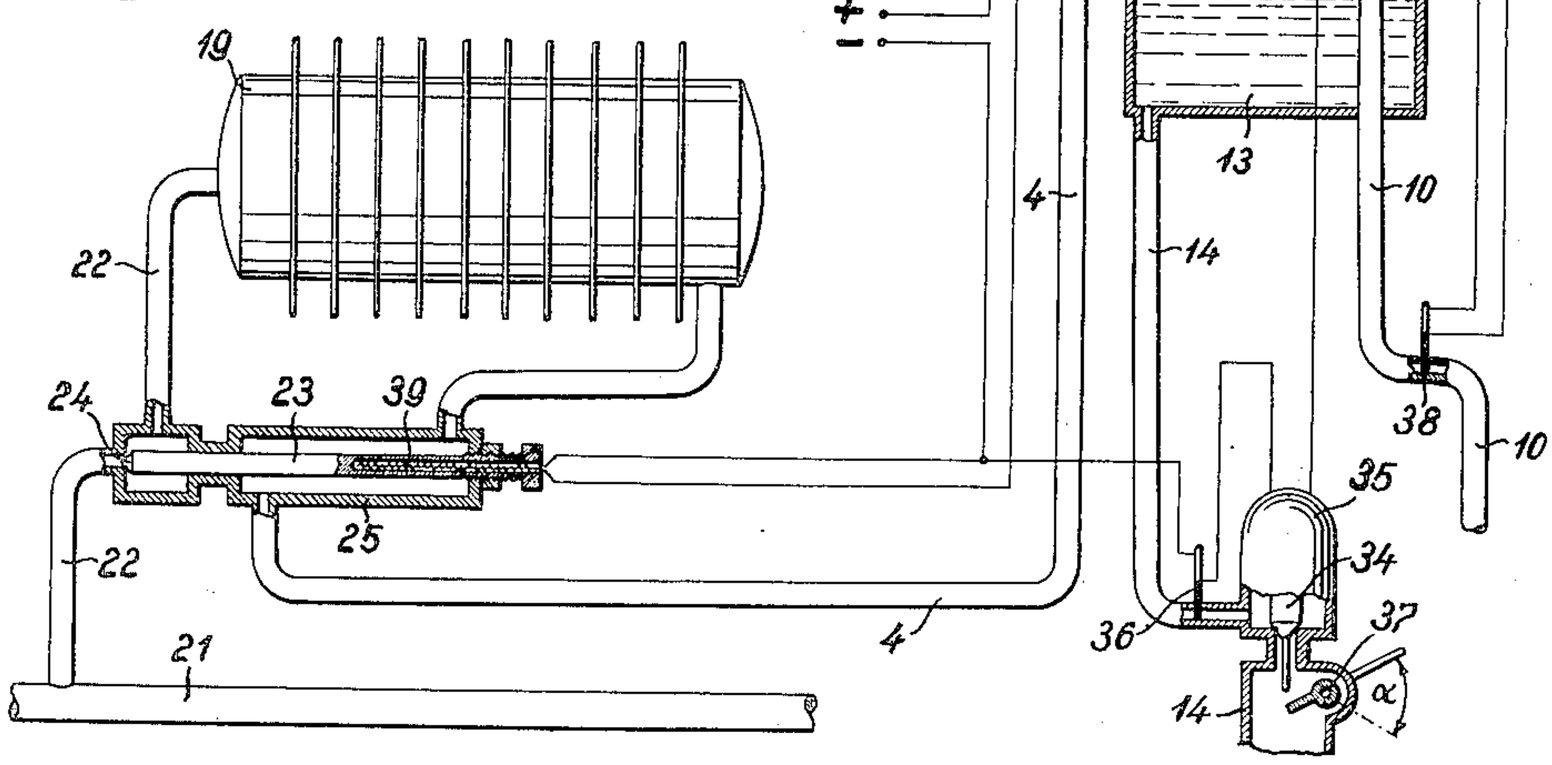
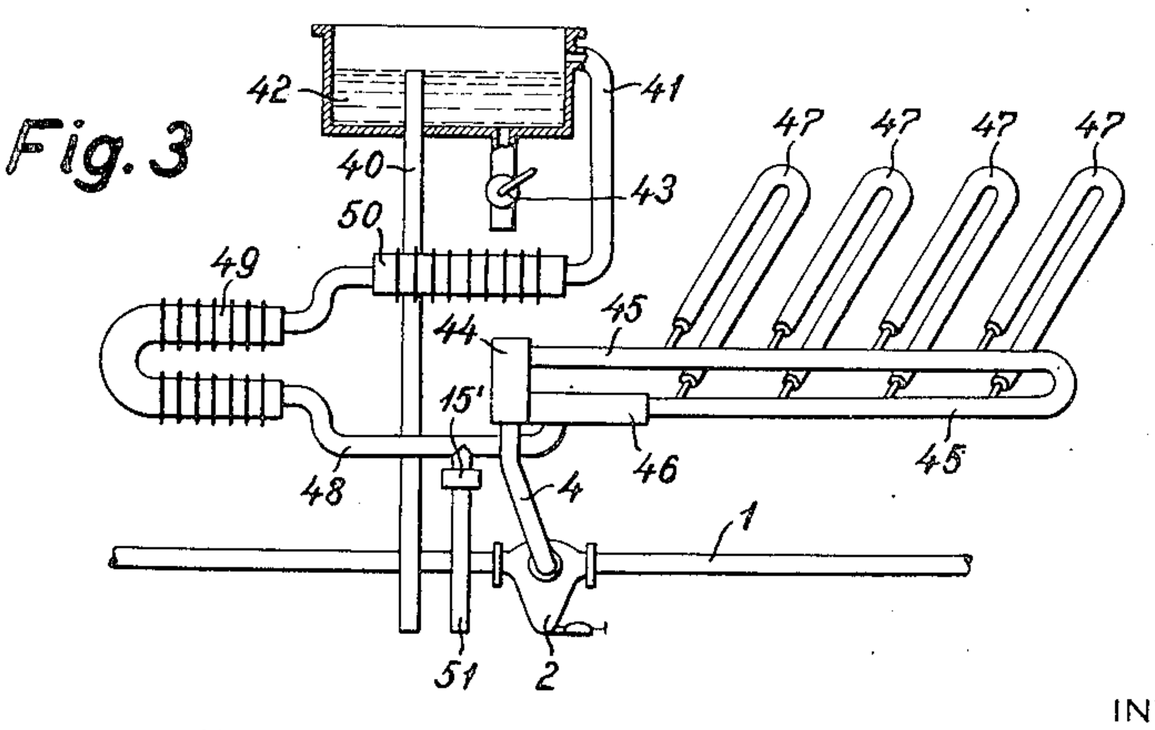


Fig. 3



INVENTORS:
HEINRICH ETZELT AND GUSTAV NEMETZ, DECEASED,
BY VALERIE NEMETZ, ADMINISTRATRIX
BY
K. A. Mayr
ATTORNEY

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HEATING SYSTEM

Heinrich Etzelt, Vienna, Austria, and Gustav Nemetz, deceased, late of Vienna, Austria, by Valerie Nemetz, administratrix, Vienna, Austria, assignors to Alex. Friedmann, Kommandit-Gesellschaft, Vienna, Austria

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9 Claims. (Cl. 237—5)

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The invention relates to a process and a device for utilizing the condensate of steam heating plants, in particular in railway carriages.

It is known to partly regain the heat contained in the condensate of steam heating systems, or the like by supplying it to a low pressure steam heating system by way of a reducing valve whereby it is reevaporated and, if desired, used in combination with the live steam. The remaining condensate and that forming in the low pressure heating system is, however, usually discharged into the open and wasted. Return of the condensate to the steam generating plant by means of pumps is very expensive.

The invention has for its object to recuperate, particularly in railway carriages, the water of condensation of a steam heating plant to a very high degree by new and simple means, by delivering it to a hot water tank by the pressure of the steam in the system whereby an excess of water is discharged by way of overflow from the tank. The condensate may be taken from the steam main which is usually underneath the railway car or from the radiator system inside the car.

In railway carriages the condensate may be used to fill the service water containers of the washing installations and the lavatories during the cold season. The condensate is very soft and neither scale nor incrustations are deposited, and the fittings are well preserved. Furthermore, the condensate may be used to feed a hot water heating system in the railway carriages.

According to the invention the condensate is forced from the steam heating plant by the steam pressure acting on it into the hot water tank from the lower part of the steam plant. However, the delivery may be also effected by an injector operated with live steam and sucking the condensate from the lower part of the steam heating plant and conveying it, mixed with the injector steam, through a delivery conduit to the hot water tank.

In order to prevent feeding of undesirably hot water or steam, the latter after exhaustion of the condensate collecting in the lower part of the steam heating plant, into the hot water tank, the delivery conduit is, according to the invention, closed by a control device exposed to the medium to be delivered, as soon as steam is delivered instead of condensate. According to the adjustment of the temperature responsive device, steam or excessively hot condensate is prevented from flowing into the delivery line. The temperature sensitive device may consist of an expansion

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member exposed to the medium flowing in the delivery line and mechanically connected to a closing device. Alternatively, in the delivery line, a thermostat operated switch may be provided for closing an electric circuit for an electromagnetic control device for a shut off valve. The latter case presents the advantage of a greater constructive freedom.

The valve controlled by the temperature sensitive device which is exposed to the temperature prevailing in the delivery line, will, in general, directly close the delivery line so as to interrupt delivery itself. According to the invention, however, the delivery of the condensate may also be interrupted by preventing the supply of steam to the steam heating plant, the condensate of which is to be utilized, whereby the closing device is arranged at the inlet at the heating plant and the temperature sensitive device at the outlet thereof. The temperature of the heating surfaces can, in this simple manner, be regulated in dependence on the temperature of the condensate, whereby at the same time the delivery of the water to the hot water tank is also suitably regulated. The regulation may be adjusted in such a manner that only water of a temperature below a predetermined value is forced by the steam pressure of the steam heating installation into the hot water tank. Upon exhaustion of the condensate in the heating system the temperature responsive device will close the steam inlet valve until a sufficient quantity of water of condensation of adequate temperature will again have been formed and supply of water to the hot water tank may be resumed.

If hot water consumption is small hot water may overflow from the hot water tank, whereby it is not impossible that the water be urgently required at another point of the train. For avoiding losses of this kind the invention provides for interruption of supply of the surplus water in dependence on the temperature of the water flowing over from the hot water tank. In this case a valve is interposed in the conduit between the lower part of the steam heating plant and the hot water tank which valve is controlled by a device depending on the temperature of the overflow water which device may be an expansion body or a contact thermometer adapted to close the valve when a specified temperature limit below the steam temperature is exceeded.

If the conduit connecting the lower part of the steam installation and the hot water tank is already provided with an electro-magnetically controlled valve, it suffices to control the current by

a second contact thermometer connected in parallel to the contact thermometer which is exposed to the temperature of the water in said connecting conduit. This second contact thermometer is exposed to the temperature of the overflow water and is so adjusted as to close the valve in said conduit at a lower temperature than does the contact thermometer exposed to the water in the conduit. The two contact thermometers controlling the current in the electromagnetically operated valve will prevent in a most simple manner supply of excessively hot water or steam to the hot water tank. On the other hand this arrangement also prevents overflow of hot water from the tank.

This result may also be attained by an expansion member exposed to the temperature of the water delivery line to the tank or to that of the lower part of the steam heating plant. According to the invention said expansion member may be provided with an electric heating device connected with a contact thermometer exposed to the temperature of the overflow water whereby the expansion member is electrically heated.

In order to prevent excessive cooling of the water in the full hot water tank because the hot water supplied to it is instantly discharged by way of the overflow, or because the feed valve in the supply line to the tank remains closed, according to the invention, a shut off valve is provided in the drain pipe of the hot water tank, and controlled by a device responsive to the water temperature in the overflow pipe, e. g. by an expansion member. This valve will be opened when the temperature in the drain pipe drops below a predetermined value and cold water is discharged into the open until a water of sufficient temperature will again reach the expansion member and cause it to close the valve.

As it is necessary for safety reasons to provide in each hot water tank means to empty the plant, according to the invention a mechanical device may be added for manually opening the overflow valve.

If the water of condensation is supplied to a service water plant or a service water container it is desirable that the temperature of the water be not too high. The temperature of the water of the service water plant in railway carriages used for washing and operating the toilets should not exceed 30–40° C. According to the invention condensate may be supplied to the service water tank from the steam heating plant by way of an installation utilizing heat, especially a hot water heating system. In this case the water of condensation is fed into the service water container already at the correct temperature. In the hot water conduit between the steam heating installation and the service water container, one or more hot water radiators may be inserted. These may be used for heating the auxiliary rooms of the railway carriage, for example the corridor or the toilet, and may be dimensioned in such a manner that from the water of condensation delivered from the steam heating system to the service water container, such a quantity of heat is removed that it arrives at the service water system cooled down to a suitable temperature.

In the drawing the invention is diagrammatically represented by way of examples showing embodiments used in connection with railway carriages.

Fig. 1 illustrates, diagrammatically, a system according to the invention in which the condensate of the main steam conduit is delivered in to a service water container.

Fig. 2 diagrammatically illustrates a system according to the invention in which the condensate of a steam heating installation is delivered into a service water container.

Fig. 3 shows, diagrammatically, a system in which the water of condensation is supplied to a service water container by way of a number of hot water radiators.

Referring more particularly to Fig. 1 a main steam conduit 1 conducts steam from the locomotive through the whole train. Conduit 1 is fitted with a trap 2 having a lower part 3 in which the condensate collects. The steam pressure in the trap 2 forces the condensate through conduit 4 to tank 13.

A valve 11 controlled by an expansion member 12 is inserted in the conduit 4. The water flowing through the connecting line 4 heats the expansion member which is so adjusted as to close the valve 11 at the desired temperature. This temperature will be lower than the temperature of the steam which, after the exhaustion of the water in the lower part 3 of the vessel 2, may penetrate from the line 1 into the line 4. Therefore, only water of a predetermined temperature can be forced from the lower part 3 of trap 2 to the service water container 13.

In order to prevent the hot water in the full tank 13 from cooling down too much considering that the hot water is instantly discharged through the overflow 10 the tank may be provided with a drain 14 provided with a valve 16 which is controlled by an expansion member 15. Said expansion body 15 is adjusted in such a manner that it opens the valve 16 when the temperature in conduit 14 drops to a predetermined value which is considerably lower than the temperature which closes valve 11. If the temperature in the drain pipe 14 and consequently that of the expansion member 15 drops below that value, the water of the service water container 13, which is too cold, flows into the open by way of the valve 16, until the hot water following will have reheated the expansion body 15, and will have closed the valve 16. By suitably adjusting the expansion member 12 the temperature of the water supplied to the service water container 13 can be limited, whereas by adjusting the expansion member 15 the temperature of the water in the container 13 can be prevented from dropping below a predetermined value.

For preventing water losses due to overflow a valve 29 is inserted in conduit 4 and controlled by an expansion member 30 which is exposed to the temperature of the water in the overflow line 10, and is so adjusted that it will close the passage through conduit 4 at a predetermined temperature which is lower than the temperature at which the expansion member 12 closes valve 11. With this arrangement water is withdrawn from the steam installation only till the tank 13 is completely filled. Instead of two valves, 11 and 29, one electrically controlled valve only may be installed and the elements 12 and 30 may be replaced by thermostats which actuate switches arranged in parallel in the circuit for operating the single valve, similarly to the arrangement of thermostats 36 and 38 in the embodiment of the invention illustrated in Fig. 2 which will be described hereafter.

A modification of the invention is shown in Fig. 2. In this case the steam plant is repre-

sented by a radiator 19 which is supplied with steam from the high pressure steam conduit 21 by way of a steam inlet valve 24 controlled by an expansion member 23. Said expansion member 23 is exposed to the temperature of the water of condensation in cylinder 25 disposed below the steam heating system 19, and prevents, by an adequate control of the valve 24, water of too high a temperature or even steam from flowing into the hot water tank 13 by way of the connecting conduit 4 in which cylinder 25 is inserted.

The passage of water through the drain pipe 14 of the hot water tank 13 is governed by a valve 34 which is automatically opened by an electro-magnet 35 when the contact thermometer 36, exposed to the temperature of the drain pipe 14, closes the control circuit to the electro-magnet 35. This contact thermometer 36 is adjusted in such a manner that the electro-magnet 35 is excited and the valve 34 is opened when the temperature of the water in the drain pipe 14 drops below a predetermined value.

Besides, a mechanical hand adjusting device, i. e. a lever 37 is additionally provided for the electro-magnetically controlled valve 34 so as to make it possible to empty the hot water tank 13 at any moment. By turning the lever 37 by hand through the angle α the valve 34 is opened.

For preventing hot water losses by overflow from the hot water tank 13 a second contact thermometer 38 is connected to a source of electric current in parallel to the contact thermometer 36. The contact thermometer 38 is exposed to the water temperature in the overflow pipe 10, and controls a circuit containing a heating coil 39 located in the expansion member 23 of the steam inlet valve 24 of the heating system 19. If hot water flows through the overflow pipe 10, the contact thermometer 38 will, when it reaches the temperature to which it is adjusted, switch-on the heating coil 39 which heats the expansion member 23 to close the steam inlet valve 24 whereby supply of water to the tank 13 is interrupted.

According to the embodiment shown in Fig. 3 the invention is applied to the low pressure steam heating system of a railway carriage which is supplied with high pressure steam from the main line 1 located below the carriage by way of a water separating trap 2 and conduit 4. The high pressure steam enters the low pressure steam heating system through a conventional regulator head 44 which contains a conventional throttle valve of a type controlled by an expansion member. After the steam pressure is reduced the steam passes through a looped conduit 45 and returns to the regulator head 44 through a cylinder 46 in which an expansion element is located which controls the steam valve in the same maner as devices 23, 24 in Fig. 2. The live steam entering the heating system through the head 44 circulates continuously through the radiators 47 connected to the loop 45.

Cylinder 46 is disposed at the lowest point of the system where condensate collects. Therefrom a pipe line 48 conducts the water first to a hot water radiator 49 heating the corridor of the carriage, whence it is conducted to the radiator 50, for example heating the toilet. Therefrom the water, cooled down to a suitable temperature, enters the service water container 42 by way of pipe 41. From container 42 the water may be withdrawn by means of a cock 43 where-

as excess water is discharged through overflow pipe 40.

The delivery of the condensate from the cylinder 46 to the service water container 42 is effected by the pressure of the steam in the low pressure steam heating system. From the lowest point of the steam water conduit 48 a branch conduit 51 leads into the open which conduit is controlled by a conventional automatic drain valve 15' which opens when, after the separation of the carriage from the train, the water in the pipe 48 has cooled down to a predetermined minimum temperature for avoiding damages by frost.

What we claim is:

1. An apparatus for utilizing the condensate of the steam heating system of a railway car, comprising a general utility water storage tank disposed at a higher elevation than said heating system, and a conduit connected with said heating system and terminating in said storage tank for conducting condensate from said heating system by means of the steam pressure in said system to said storage tank.

2. An apparatus as defined in claim 1, comprising a thermostat responsive to the temperature of the condensate in said conduit, a valve connected to and actuated by said thermostat and interposed in said conduit for controlling the flow of condensate through said conduit into said storage tank in dependence on the temperature of said thermostat.

3. An apparatus as set forth in claim 2, comprising a hot water heating system interposed in said conduit for conducting the condensate therethrough before it is discharged into said storage tank.

4. An apparatus as defined in claim 1, comprising a discharge conduit connected with the lowest point of said tank, a thermostat responsive to the temperature of the condensate in said discharge conduit, and a discharge valve disposed in said discharge conduit and connected with said thermostat to be opened when the temperature of the condensate in said conduit falls below a predetermined value.

5. An apparatus as set forth in claim 4, comprising manipulating means connected with said discharge valve for opening same by hand.

6. An apparatus for utilizing the condensate of the steam heating system of a railway car, comprising hot water service conduit means connected with said heating system and adapted to receive condensate therefrom, and a service water storage tank interposed in said conduit means and disposed at an elevation above that of said heating system.

7. An apparatus as set forth in claim 6, comprising an overflow conduit connected with said tank, a thermostat responsive to the temperature of the condensate in said overflow conduit, and valve means interposed in said conduit means and connected with said thermostat for interrupting flow of condensate to said tank at a predetermined temperature of the condensate in said overflow conduit.

8. An apparatus as set forth in claim 6, said conduit means having a portion interconnecting said heating system and said tank for condensate flow, a thermostat responsive to the temperature of the condensate in said portion, an overflow conduit connected with said tank, a thermostat responsive to the temperature of the condensate in said overflow conduit, and a valve disposed in said portion and connected with both said thermostats for interrupting con-

densate flow through said portion at a predetermined temperature of said thermostats.

9. An apparatus as set forth in claim 6, said conduit means having a portion interconnecting said heating system and said tank for condensate flow, a thermostat responsive to the temperature of the condensate in said portion, an overflow conduit connected with said tank, a thermostat responsive to the temperature of the condensate in said overflow conduit, and a valve disposed in said portion and forming part of said first thermostat and adapted to interrupt condensate flow through said portion at a predetermined temperature of said first thermostat, an electric heating coil connected with said first thermostat, a switch interposed in the circuit of said heating coil and connected with said second thermostat for closing the circuit and heating said first thermostat and closing said valve at a

predetermined temperature of said second thermostat.

HEINRICH ETZELT.
VALERIE NEMETZ,
Administratrix of Estate of Gustav Nemetz, deceased.

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