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LOW-PRESSURE STEAM HEATING PLANT PARTICULARLY ADAPTED FOR RAILWAY VEHICLES
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Fig. 1

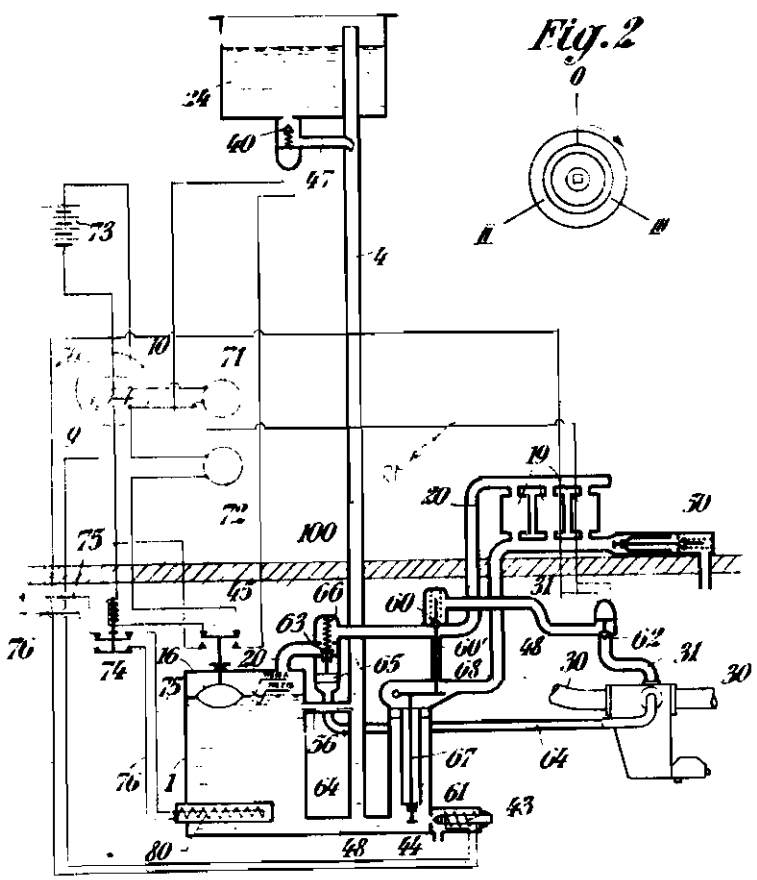

Fig. 2

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LOW-PRESSURE STEAM HEATING PLANT PARTICULARLY ADAPTED FOR RAILWAY VEHICLES

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The present invention relates to a low-pressure steam heating provided with a pressure-controlled steam generator plant particularly adapted for railway vehicles. The steam heating plant consists of a heated boiler and an automatically operating device for maintaining the boiler pressure of uniform height within certain limited of regulation. The radiators connected to the boiler are, by means of a distributing pipe, in communication with the steam space of the boiler, so that the same steam pressure prevails in all the radiators as in the boiler, whereby by maintaining the steam pressure uniform simultaneously also the temperature of the heating surfaces of the radiators is controlled. The pressure-controlled steam generating plant on the vehicle, therefore, forms the regulator for the temperature of the heating surfaces of the radiators.

Now, all low-pressure steam heatings of railway vehicles require to be so constructed that they may be operated with steam of a source of high-pressure, preferably steam of a locomotive boiler. Arrangements allowing such an operation are known already.

The known arrangements, however, are not adapted to be used for low-pressure steam heatings of the above described kind, because in such a case high-pressure steam would reach the radiators and the sealing joints would begin to blow. Moreover, the danger of tearing of the radiators would exist. Besides this, the temperature of the heating surfaces of the radiators filled with high-pressure steam would fluctuate in accordance with the steam pressure which would result in an unequal heating of the inner rooms of railway vehicles and, moreover, in a heating plant, operating with a low-pressure boiler provided with a stand-pipe discharging into the atmosphere, the high-pressure steam also would reach the boiler and discharge into the atmosphere by way of the stand-pipe.

Now, the object of the present invention is to so construct the above described low-pressure steam heating that the radiators may be supplied with controlled low-pressure steam from a source of high-pressure steam which is not provided on the vehicle.

According to the invention a thermostatically controlled throttle valve is provided for this purpose in the connecting pipe between the high-pressure steam pipe and the distributing pipe supplying the pressure-controlled steam from the low-pressure steam boiler to the radiators. The thermostat of this throttle valve being influenced by the temperature of the heating medium flowing out of the radiators. If now the low-pressure steam heating is connected to the high-pressure steam pipe, then the high-pressure steam must flow through this automatically operating throttle valve. In accordance with the setting of the thermostat the high-pressure steam is changed to low-pressure steam of quite a definite pressure and now fills the radiators maintaining uniform the temperature of the heating surfaces of same. When heating with steam of a source of high-pressure steam the same working condition of the radiators results as when the heating plant is operated with steam produced in the own pressure-controlled low-pressure steam generator plant.

In the connecting pipe between the high-pressure steam pipe and the above mentioned thermostatically controlled throttle valve an other control member preferably is arranged which by mechanical or electrical means is kept closed as long as the low-pressure steam generator plant operates. Without a special manipulation being required, on starting of the low-pressure steam generator plant simultaneously the connection between the high-pressure steam pipe and the low-pressure steam pipe is directly or indirectly interrupted, so that the radiators are supplied with steam from the pressure-controlled low-pressure steam generator plant only.

In connection with heating plants it is usual to open and close a step member, mounted in the steam supply pipe leading to the radiators, by a temperature feeler subjected to the temperature of the heated room and to so control the temperature of the room. In accordance with the invention the above mentioned control member is used for this purpose in the heating plant previously described when heating with steam of a source of high-pressure steam. To this end the control member is constructed as a magnetic valve and the hand setting device, serving to disconnect the low-pressure steam generator, is used to place in circuit a contact thermometer subjected to the temperature of the heated space which thermometer on reaching a predetermined limit of temperature effects closure of the magnetic valve and stops the supply of steam derived from the source of high-pressure steam.

As during heating with high-pressure steam from the distributing pipe, supplying the throttled steam to the radiators, a portion of the steam, without flowing through the radiators, reaches the low-pressure boiler and the thermostat of the above mentioned throttle valve and may influence the operation of the latter, it is preferable to

arrange in the distributing pipe of the heating plant, between the discharge point of the connecting pipe, supplying the heating plant by way of the throttle valve with controlled steam, and between the low-pressure steam boiler, a stop member which is influenced to be closed by the pressure of the high-pressure steam. If high-pressure steam is supplied to the heating plant, this stop member cuts off the way leading to the low-pressure steam boiler and an undesired admission of steam to the thermostat of the above mentioned throttle valve is rendered impossible.

It is also of advantage to connect the throttle valve and the control member, controlled electromagnetically in most cases and also if used, the last mentioned pressure controlled stop member in a heat conducting manner, so as to have a mutual thawing up effect by heat conduction and heat radiation. As is well known, during frost all such constructional members of the steam generator plant always freeze in. Each of these constructional members, therefore, always is so formed that on being supplied with steam it thaws up again and is rendered capable of operation.

If now all such constructional members present are in a heat conducting manner connected to each other, each contructional member supplied with steam safely thaws up. Hereby the heat also is transmitted to the other constructional members, so that these without steam being supplied to them also thaw up and are rendered capable of operation.

In the accompanying drawing a heating plant according to the invention is diagrammatically shown by way of example.

In this drawing:

Fig. 1 is a diagrammatic view of the entire plant, and

Fig. 2 is a detail view of a change-over switch.

From the zone of the lowest water level of the low-pressure steam boiler 1 of the heating plant according to Fig. 1 the stand-pipe 4, connected to the branch pipe 56, leads upwardly beyond the water level of a highly located tank 24. The boiler 1 is heated by the electric heating element 50. Its pressure is determined by the water column in the stand-pipe 4 which column is controlled by the float 16 in the following manner.

The float 16 influences a change-over switch 45 arranged in the circuit of the magnetic coil of a valve 40 arranged in the water filling pipe system 47, 4 in such a manner that the valve 40 closes as soon as the highest admissible water level in the boiler 1 is reached. From this point of time flowing off of water from the tank 24 by way of the pipe 47 and the standpipe 4 to the boiler 1 is interrupted until the boiler water level has dropped to an admissible lowest height, whereupon the change-over switch 45 is adjusted and the re-filling valve 40 is opened again, so as to allow water to flow to the boiler 1 again by way of the pipe 47 and stand-pipe 4. If the boiler water level has been raised again to the highest admissible height, the change-over switch 45 is again adjusted, so that the magnetic valve 40 closes again, whereupon the operation described is repeated.

In this manner the steam pressure in the boiler 1 as well as in the radiators 10, connected to the boiler 1 by means of the distributing pipe 20, is controlled. The condense water returns from the radiators 19 to the boiler 1 by way of a pipe 46. To aerate the heating plant, a thermostatically controlled valve 50 is provided which is closed as soon as on heating the air in the plant is displaced by the steam and the latter has heated the thermostat of this valve 50.

To assist the described pressure control in the boiler 1, a relay switch 74 is provided in the circuit 75 and 76 of the heating coil 80. The relay coil is arranged in a circuit so controlled by the float 16, that the heating current of the heating element 80 is interrupted as soon as the float 16 has reached the admissible lowest boiler water level, whereas the heating current is cut in again, if after the re-filling operation the water level of the boiler is raised again to the admissible highest level. Therefore, during the re-filling operation the boiler heating is disconnected to faster obtain the re-filling. The boiler heating operates as long only as the water level in the boiler is within the permissible limits.

As mentioned already, the radiators 19 and the steam space of the boiler are always filled with steam of the same pressure and the temperature of the heating surfaces of the radiators is always maintained on the same height. In order to allow the operation of such a heating plant with controlled steam derived from a source of high-pressure steam, preferably steam from a locomotive boiler, as is required in connection with railway vehicles, the main steam pipe 30, extending below the vehicle and carrying the high-pressure steam, is, in accordance with the present invention, connected to the distributing pipe 20 of the low-pressure steam generator plant by way of a connecting pipe 31 in which a throttle valve 60 is arranged. The latter is controlled by a thermostat 81 subjected to the temperature of the heating medium leaving the radiators 10 by way of the pipe 40, whereby the extensions by heat of the thermostat are transmitted by way of a rod 67, the lever 60 and the extension rod 60' to the valve 60 in such a manner that by way of the pipe 20 always as much steam only flows to the radiators 10, that a predetermined pressure is maintained in these radiators and, therefore, also the temperature of the heating surfaces of said radiators is maintained uniform. If, therefore, the pipe 30 is supplied with high-pressure steam, the radiators 19 are, by means of the steam supplied to them from the source of high-pressure steam, heated in exactly the same controlled manner as by the pressure-controlled steam admitted to them after connecting the low-pressure steam boiler 1.

In the connecting pipe 31 between the thermostatic throttle valve 60 and the high-pressure steam pipe 30 a control member 62, in the example shown a magnetic valve, is arranged, so that after connecting the low-pressure steam boiler 1 the controlled steam supply of the radiators 16 which is then to be effected exclusively from the boiler 1 is not subjected to a disturbance due to steam flowing off into the pipe 30 in which at this point of time no steam is present. In the control circuit of the magnetic valve a switch 70 is arranged which also serves for switching in the control circuit for the boiler filling valve 40. As shown in Fig. 2 this switch has three positions and serves to connect and disconnect the low-pressure steam heating plant. In the O-position all the contacts 9 and 10 are open and the plant is out of service On changing-over into the position I, the contact 9 is closed which cuts in a circuit by way of a blowing out or discharge valve 44 of the boiler 1, so that the heating coil 43 heats the thermostat of the valve 44 and closes the latter so that the boiler 1 may

be filled with water. In the position II the contacts 10 also are closed which by way of the magnetic coil switch in the control-circuit of the re-filling valve 40, so that the latter is opened and allows water to flow from the tank 24 into the boiler 1 until the highest water level is reached and the valve 40 is closed again. By way of the relay switch 74 simultaneously the heating current for the heating element 80 is switched in and the development of steam in the boiler 1 starts. Moreover, the magnetic valve 62 is closed so that the connecting pipe 31 is closed towards the high-pressure steam pipe 30.

With regard to its pressure and the temperature of its heating surfaces, the heating plant now operates in a controlled manner as has been described above.

Putting out of service of the heating plant is effected by turning the switch 70 into the position O. If the heating plant is to be operated with high-pressure steam derived from the pipe 30, the switch 70 is brought into the position I which at first has the purpose only to close the blow out or drain valve 44 so that the condense water flowing by way of the pipe 48 from the radiators 19 to the boiler 1 collects in the latter for the later main operation of the low-pressure steam generator plant.

The magnetic valve 62 is not yet supplied with current and by way of this valve and the connecting pipe 31 the high-pressure steam flows to the throttle valve 60 which reduces the pressure of the high-pressure steam to the desired low-pressure and admits this steam to the radiators 19 by way of the distributing pipe 20. To prevent a portion of the pressure-reduced steam to flow into the boiler 1 and from the latter either to escape by way of the stand-pipe 4 or to advance into the pipe 48 and to heat the thermostat 61 of the throttle valve 60, thereby disturbing the desired throttle operation, a stop member 63 is provided in the distributing pipe 20 between the discharge point of the connecting pipe 31 and the boiler 1.

The stop member 63 is influenced in an opening sense by a spring and is closed by the piston 65, if high-pressure steam is admitted to the latter from the pipe 30 by way of the pipe 64. In this case the radiators 19 are supplied with throttled steam by way of the throttle valve 60 maintaining uniform the temperature of the heating surfaces of the radiators 19.

For the purpose of regulating the room temperature when the heating plant is operated with high-pressure steam derived from the pipe 30, a contact thermometer 71 is provided in the control circuit of the magnetic valve 62 and this thermometer causes the closure of the magnetic valve 62 as soon as the room temperature exceeds the setting temperature of the contact thermometer 71. By an alternate closing and opening of the magnetic valve 62, maintaining uniform height of the room temperature is ensured.

If the heating plant is operated with steam derived from the low-pressure boiler 1 the switch 70 occupies the position II. Hereby the contact thermometer 71 is short-circuited but a contact thermometer 72 is switched in in the circuit containing the change-over switch 45 and the relay coil of the relay switch 74. The contact thermometer 72 also is subjected to the temperature of the heated room and controls the temperature of this room by an alternate opening and closing of the heating circuit 75, 76 of the heating element 80. The current required for all these control operations is supplied by a battery 73, preferably the light battery of the vehicle.

It may easily be seen that the constructional members i. e. the throttle valve 60, the magnetic valve 62 and the stop member 63 may be arranged in a common casing or may otherwise be connected to each other as desired in a heat conducting manner. If after putting the vehicle out of service, all these constructional elements are frozen in and if for instance high-pressure steam is admitted through the pipe 30, the magnetic valve 62 is supplied with steam and thaws up. The heat, however, also is transmitted to the other constructional member 60 and 63 so that these also thaw up and are rendered capable of operation. Putting in service of the low-pressure steam boiler 1 has the same effect but then steam is admitted to the stop member 63 which thaws up, whereupon the heat is transmitted to the constructional members 60 and 62 by conduction and radiation.

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