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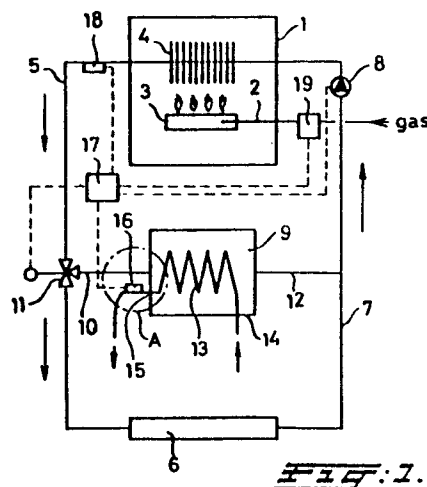
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(54) **Device for controlling a hot water supply.**

(57) A device for controlling a hot water supply, which consists of a boiler (1) with a burner (3) for heating a heating medium, and a continuous-flow heat exchanger (9) which contains a service water pipe (13) for tap water. The continuous-flow heat exchanger being connected to the boiler (1) on the one hand via a supply pipe (5, 10) and on the other hand via a return pipe (7). The heating medium circuit having a circulation pump (8) as well as a regulating device for keeping the tap water at a predetermined temperature. The regulating device consists of a single temperature transmitter (16) which is connected to the tap pipe (13) near the point (15) where the latter leaves the continuous-flow heat exchanger. The temperature transmitter being connected to a control element (17) which detects the temperature drop per unit time and if a predetermined value is exceeded sets the burner and circulation pump in operation. The control element being also capable to registrate the relationship between the temperature change of the heating medium and that of the tap water in order to detect if tap water is drawn off or not.



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Device for controlling a hot water supply.

5 The present invention relates to a device for controlling
a hot water supply, which consists of a boiler with a
burner for heating a heating medium, a continuous-flow
heat exchanger which contains a service water pipe for
tap water, which continuous-flow heat exchanger is
connected to the boiler, on the one hand, via a supply
pipe and, on the other hand, via a return pipe, a circulation
pump, a temperature transmitter for detecting the temperature
10 in the supply pipe, and also a regulating device for keeping
the tap water at temperature and for keeping the temperature
of the heating medium in the continuous-flow heat exchanger
within predetermined limits being incorporated in the
heating medium circuit.

15 Such a hot water supply, which is, for example, incorporated
in a central heating system, is known. In said known device
the regulating device for keeping the tap water at a
desired temperature consists of a first thermostat, the
sensor of which is incorporated in the service water pipe
and, in particular, inside the continuous-flow heat exchanger
20 at some distance from the point at which the service water

pipe enters the continuous-flow heat exchanger, and of a second thermostat, the sensor of which is situated inside the continuous-flow heat exchanger in the heating medium. The first thermostat, the sensor of which is situated in the service water pipe, detects by means of a drop in temperature in the service water pipe that tap water is being called for and switches over the distribution element and possibly switches the burner on so that heated medium flows towards the continuous-flow heat exchanger. The second thermostat serves to keep the tap water at the desired temperature during drawing-off by controlling the burner. The first thermostat has a two-fold function, namely, firstly to "detect" the fact that tap water is being drawn off, and secondly to keep the temperature of the heating medium inside the continuous-flow heating medium within predetermined limits if tap water is not being drawn off. The second thermostat therefore only serves to keep the temperature of the tap water at a desired set value during drawing-off by controlling the burner. Said known device is complicated and expensive by the use of two thermostats.

The object of the present invention is to simplify said known device, which is achieved according to the invention in that the regulating device consists of a single temperature transmitter which is connected to the tap pipe near the point where the latter leaves the continuous-flow heat exchanger, which temperature transmitter is connected to a control element which detects the temperature drop per unit time and if a predetermined value thereof is exceeded, sets the burner and the circulation pump in operation. In

this manner the control element, to which the single temperature transmitter is connected, has a three-fold function:

1. "detecting" the fact that tap water is being drawn off as a result of a drop in the temperature in the service water pipe;
2. keeping the temperature of the heating medium inside the continuous-flow heat exchanger within certain limiting values if no tap water is being drawn off;
3. regulation of the temperature of the tap water during drawing-off.

Because the temperature transmitter is fitted near the point where the service water pipe leaves the continuous-flow heat exchanger, said three functions can be carried out by one single temperature transmitter. A particularly fast regulation is obtained by detecting the temperature drop per unit time (i.e. the rate at which the temperature drops), since it is not necessary to wait until the temperature of the tap water has reached its minimum value at which the burner and the pump are switched on.

The control element thus distinguishes the slow cooling of the continuous-flow heat exchanger when no tap water is drawn off for a prolonged time and the rapid cooling of the temperature of the tap water as soon as some is drawn off. As a result it is possible to fit the temperature transmitter at the specified point without there being the risk that the contents of the continuous-flow heat exchanger cool down too much before the burner and the pump are switched on.

In a preferably used embodiment of the invention the temperature transmitter for detecting the temperature in the supply pipe is connected to the control element which determines the temperature rise of the heating medium per unit time and switches off the burner and the pump if the relationship between the temperature change of the heating medium and that of the tap water indicates that no heat is essentially being removed from the continuous-flow heat exchanger by the tap water.

While tap water is being drawn off, there is an arithmetical relationship between the temperature of the heating medium and the temperature of the tap water. If the drawing-off is stopped, no heat is removed by the tap water from the continuous-flow heat exchanger. This means that the temperature of the heating medium will rise rapidly and the temperature of the tap water will also increase. The control element detects the rapid rise of the temperature of the heating medium and relates said rise to the temperature change of the tap water. From the fact that said relationship deviates from that during the drawing-off, the control element "concludes" that nothing is being drawn off and consequently switches off the burner and the pump.

According to another embodiment of the invention the temperature transmitter connected to the service water pipe is fitted at some distance outside the continuous-flow heat exchanger and is connected by means of a metal strip to the supply pipe in a manner such that during the drawing-off the temperature of the tap water and, if there is no drawing-off, the temperature of the heating medium are registered.

In this manner the temperature transmitter can be fitted easily and cheaply. In addition, a thermal contact is produced between the heating medium and the tap water by the metal strip. By means of the temperature change which is detected by the temperature transmitter, it is possible to determine that no tap water is being drawn off so that the burner and the pump can be switched off.

Preferably, the burner control is modulated during the drawing-off on the basis of the set temperature of the tap water.

The device according to the invention can also be used if the hot water supply is incorporated in a central heating system with room heating elements which are connected, on the one hand, via a three-way valve to the supply pipe and, on the other hand, to the return pipe, in which case the control element, on switching on the burner and the circulation pump, also, resets the three-way valve from circulation through the room heating elements to circulation through the continuous-flow heat exchanger and which three-way valve is reset to circulation through the room heating elements when the burner is switched off.

The invention will now be explained in more detail on the basis of the drawing in which:

Figure 1 diagrammatically shows a heating system with a hot water supply which is equipped with a control device according to the present invention;

Figure 2 shows the detail A in Figure 1 of another embodiment of the control device on an enlarged scale.

As is evident from Figure 1, the central heating system consists of a boiler 1 with a burner 3 connected to a gas supply pipe 2, and a heat exchanger 4 for heating a heating medium. The heat exchanger 4 is connected via a pipe 5 to room heating elements 6 in order to convey heating medium to said room heating elements and is connected on the other hand, to a return pipe 7 which originates from the room heating elements 6 and in which a circulation pump 8 is incorporated. The heating system also contains a continuous-flow heat exchanger 9, which is connected, on the one hand, to the pipe 5 via a pipe 10 and a three-way valve 11 and, on the other hand, to the return pipe 7 via a pipe 12. Inside the continuous-flow heat exchanger 9 there is fitted a service water pipe 13 which enters with cold service water at 14 and leaves the heat exchanger 9 at 15 with hot tap water.

As is more clearly visible in Figure 2, a temperature transmitter 16, which is connected to a control element 17, is fitted on the service water pipe 13 near 15. In the exemplary embodiment shown the temperature transmitter 16 is fitted outside the continuous-flow heat exchanger 9 on the pipe 13.

The control element 17 is also in contact with the three-way valve 11, as well as with a gas regulator 19 incorporated in the gas supply pipe 2. The control element is further connected to the pump 8 to switch the latter on and/or off.

The control element 17 is equipped in a manner such that the temperature drop of the tap water per unit time is registered. If hot water is drawn off, a rapid drop of the

temperature in the service water pipe will be registered. The control element 17 responds to said rapid temperature drop by switching over the three-way valve 11, switching on the burner 3 and possibly the circulation pump 8. This has the advantage that it is not necessary to leave the switching over of the three-way valve 11 until the set minimum temperature of the tap water is reached, the switch-over being made from circulation through the room heating elements to circulation through the continuous-flow heat exchanger. If however no hot water is drawn off for a prolonged time, for example during the night, the continuous-flow heat exchanger will slowly cool down. During this slow cooling down, the control element will only respond if the said set minimum temperature is reached.

On the supply pipe 5 there is fitted a temperature sensor 18 which is also connected to the control element 17 and at the same time functions as a boiler thermostat.

While tap water is being drawn off, there is an arithmetical relationship between the temperature of the heating medium and temperature of the tap water. If tap water is no longer being drawn off, said relation changes. In particular the temperature of the heating medium increases rapidly and the temperature of the tap water will also rise. The control element 17 detects the rapid temperature rise of the heating medium and relates said rise to the temperature change of the tap water. If it follows from this relationship that no heat is being removed from the continuous-flow heat exchanger by the tap water, the control element switches the burner and the pump off and/or switches the three-way valve 11 over.

In this manner an exceptionally rapid and expedient control is obtained both when drawing-off is started and when it is stopped.

Figure 2 shows another embodiment of the invention.

5 In this case the temperature transmitter 16 is fitted outside the continuous-flow heat exchanger 9 on the pipe 13 for the tap water. The temperature transmitter 19 is connected to the pipe 10 for the heating medium by means of a metal strip 20 and, in particular, in a manner such
10 that the temperature transmitter detects the temperature of the tap water during the drawing-off and, when the drawing-off is terminated, detects the temperature of the heating medium as rapidly as possible. Here the relationship between temperature of the heating medium and of the tap water is
15 consequently generated by the strip 20 which provides a thermal connection between the two media. By means of said thermal connection it is possible to confirm rapidly that no heat is being removed from the continuous-flow heat exchanger by the tap water and that the three-way valve 11
20 has to be switched to circulation through the room heating elements 6. Said thermal connection thus assumes the position of the arithmetic relationship between the two temperatures as discussed on the basis of Figure 1.

The operation of the control device is as follows:

25 If no hot tap water is being called for, the three-way valve 11 is set to circulation of the heating medium through the room heating elements 6. The temperature transmitter 16 registers the temperature of the heating medium in the continuous-flow heat exchanger 9. If said temperature drops
30 below a minimum set value, a signal is transmitted via the

control element 17 to the three-way valve 11 which switches over from circulation through the room heating elements 6 to circulation through the continuous-flow heat exchanger 9. Then the burner 3 and the pump 8 are switched on by the control element. The contents of the continuous-flow heat exchanger 9 are consequently heated up until the maximum set temperature is reached, which temperature is registered by the temperature transmitter 16 and after which the three-way valve 11 is switched back to circulation through the room heating elements by means of the control element 17.

If, however, hot tap water is called for, the temperature in the service water pipe will exhibit a rapid drop, which is registered by the control element 17. The control element 17 thereupon switches the three-way valve 11 over, lights the burner and switches the pump on. During the drawing-off, the control element 17 provides modulating control for the burner 3 in order to keep the tap water at the desired temperature. The temperature transmitter 16 according to the invention consequently fulfils three tasks, namely, "detecting" that water is being drawn off, keeping the tap water at temperature during the drawing-off, and keeping the continuous-flow heat exchanger at temperature if no hot water is being drawn off. This three-fold function provides an exceptionally rapid and cheap control device, only one single temperature transmitter being necessary for measuring the temperature in the continuous-flow heat exchanger or of the water.

If the drawing-off of hot water is stopped, the three-way valve is reset to circulation of the heating medium through the room heating elements 6. The "detection" of the fact

5 that hot water is no longer being drawn off takes place because the relationship between the temperature of the heating medium and that of the tap water changes when drawing-off is stopped. This relationship may be of an arithmetic nature (Figure 1) or of a thermal nature (Figure 2).

10 It will be clear that, within the scope of the invention, a large number of variations will be possible. In the embodiment according to Figure 2 the temperature transmitter 16 could also be fitted inside the continuous-flow heat exchanger 9 in the service water pipe 13 and, in particular, near the point 15. In this case the thermal connection is formed by the heating medium itself and the metal strip 20 can be omitted.

CLAIMS

1. Device for controlling a hot water supply, which consists of a boiler (1) with a burner (3) for heating a heating medium, a continuous-flow heat exchanger (9) which contains a service water pipe (13) for tap water, which continuous-flow heat exchanger is connected to the boiler, on the one hand, via a supply pipe (5, 10) and, on the other hand, via a return pipe (7), a circulating pump (8), a temperature sensor (18) for detecting the temperature in the supply pipe, and also a regulating device (16, 17) for keeping the tap water at temperature and keeping the temperature of the heating medium in the continuous-flow heat exchanger within predetermined limits being incorporated in the heating medium circuit, characterized in that the regulating device consists of a single temperature transmitter (16) which is connected to the tap pipe (13) near the point (15) where the latter leaves the continuous-flow heat exchanger (9), which temperature transmitter is connected to a control element (17) which detects the temperature drop per unit time and if a predetermined value is exceeded, sets the burner (3) and circulation pump (8) in operation.

2. Device according to claim 1, characterized in that the temperature sensor (18) for detecting the temperature in the supply pipe (5) is connected to the control element which determines the temperature rise of the heating medium per unit time and switches off the burner and the pump if the relationship between the temperature change of the heating medium and that of the tap water indicates that no heat is essentially being removed from the continuous-flow

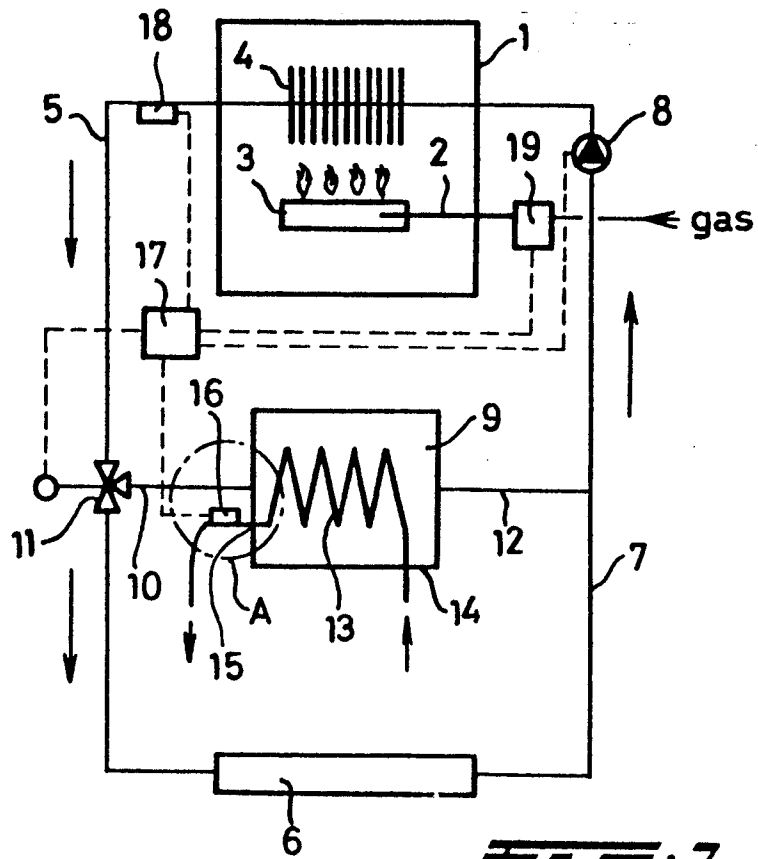
heat exchanger by the tap water.

5 3. Device according to claim 1, characterized in that the temperature transmitter (16) connected to the service water pipe is fitted at some distance outside the continuous-flow heat exchanger and is connected by means of a metal strip (20) to the supply pipe (10) in a manner such that, during the drawing-off, the temperature of the tap water, and if there is no drawing-off, the temperature of the heating medium are registered.

10 4. Device according to one of the preceding claims 1-3, characterized in that the burner control is modulated during drawing-off on the basis of the set temperature of the tap water.

15 5. Device according to one of the preceding claims 1-4, in which the hot water supply is incorporated in a central heating system with room heating elements (6) which are connected, on the one hand, via a three-way valve (11) to the supply pipe (5) and, on the other hand, to the return pipe (7), characterized in that the control element (17), on switching on the burner and the circulation pump, also resets the three-way valve from circulation through the room heating elements to circulation through the continuous-flow heat exchanger and which three-way valve is reset to circulation through the room heating elements when the
20
25 burner is switched off.

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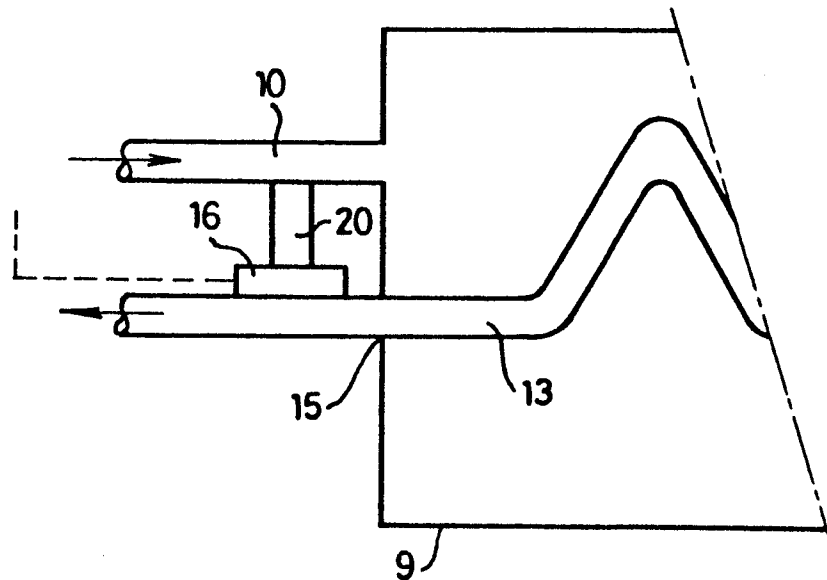


Fig: 2.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	EP-A-0 104 362 (VAILLANT) * Claim 1 *	1	F 24 D 19/10
A	DE-A-2 434 222 (VAILLANT) * Claim 1; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			F 24 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27-02-1987	Examiner VAN GESTEL H.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	