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(54) Control system for a boiler.

(57) A control system for a boiler (1) which prevents the water in the boiler from boiling, and thus noise due to such boiling is avoided. According to the invention control means (7) adjust thermostatic means controlling the maximum temperature of water leaving the boiler in response to signals received from temperature sensors (5,6) which sense the temperature of the water entering and leaving the boiler.

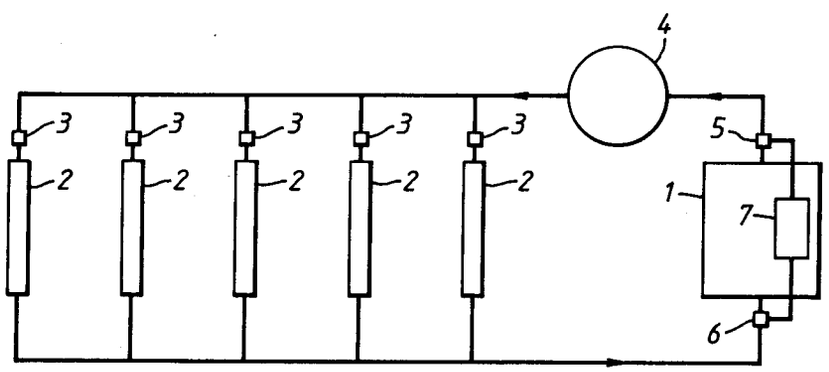

Fig.1

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This invention relates to the field of control systems for boilers, in particular lightweight gas boilers as commonly employed in domestic heating systems wherein water is circulated by a pump through a circuit including the boiler and several radiators connected between forward flow and return pipes leading from and to the boiler.

A demand for more compact and lightweight boilers has led to boilers being constructed with heat exchangers having high heat transfer concentrations in their water circulation tubes. To avoid noise in heat exchangers of this type, there must be adequate water flow through the exchanger at all times when the burner is firing.

A known form of boiler control senses the room temperature and switches off the boiler when the required temperature has been reached. With this arrangement there is no restriction of water flow through the boiler or other parts of the central heating system and, hence, no noise problems. The boiler is usually fitted with a fixed thermostat to limit the temperature of hot water flow from the boiler. Normally this temperature would not be reached as the room temperature control would intervene at a lower level. An alternative form of control arrangement allows individual control of room temperatures by employing thermostatic radiator valves (TRVs). These valves control the output of individual radiators in response to the room temperature by restricting the flow of water through the radiator. However, this control arrangement provides no feedback to the boiler to convey a reduced demand. If a large proportion of the radiators in the heating system are fitted with TRVs there can be marked reduction in the flow through the system and boiler when the heating demand is satisfied. This can result in noise generation in the heat exchanger of the boiler. A known method used to overcome this problem is to provide a by-pass pipe between the forward flow and return pipes of the system to provide a path allowing water to continue to flow through the boiler when the TRVs have closed the flow paths through the radiators. However, this is not an economical solution to the problem. Although the by-pass pipe maintains adequate flow through the boiler and heat exchanger, it absorbs a large proportion of the pump power. This power is therefore not available for the heating system. The by-pass pipe also leads to rapid cycling of the boiler as well as an unnecessary waste of energy.

The present invention aims at a control system suitable for lightweight domestic boilers, which avoids the problems of the prior art and in accordance with the invention there is provided a method of controlling a boiler having thermostatic means for controlling the maximum temperature of water leaving the boiler, characterised by adjusting the thermostatic means to vary said maximum temperature in response to the water temperature and flow rate through the boiler.

The preferred method comprises the steps of measuring the temperature differential between water leaving the boiler and water returning to the boiler and changing the maximum water temperature setting of the thermostatic means in accordance with the measured temperature differential. From the temperature differential between water leaving and returning to the boiler and the power output of the boiler which will be known it is possible to calculate the flow rate of the water flowing through the boiler and hence determine when noise is likely to be generated by the heat exchanger of the boiler. As noise generation is dependent upon temperature as well as water flow rate, the thermostatic means will be adjusted to reduce the maximum water temperature when the temperature differential indicates noise is likely to occur and thereby risk of noise generation is averted.

The present invention also provides a boiler comprising thermostatic means for controlling the maximum temperature of water leaving the boiler, and control means arranged to provide signals indicative of the water temperature and flow rate through the boiler and to adjust the thermostatic means to vary said maximum temperature in accordance with said signals.

To assist a clear understanding of the invention a more detailed description is given below with reference to the following drawing in which the single figure shows a schematic illustration of a central heating system including a boiler equipped with a control system embodying the invention.

The gas boiler 1 is connected in series with a plurality of space heaters or radiators 2 which are arranged in parallel to each other between forward flow and return water pipes of the central heating circuit. Each radiator is fitted with a thermostatic radiator valve 3. A pump 4 pumps the water around the circuit. The boiler 1 is provided with an adjustable thermostat to limit the output temperature of the water. This thermostat comprises a sensor 5 located to sense the outflow temperature. The sensor 5 provides a signal to the control unit of the boiler to shut off the burner when the set temperature of the water is reached. An additional sensor 6 is provided to sense the return temperature, i.e. the temperature of the water reentering the boiler having flowed around the circuit. The signals from the two temperature sensors 5 and 6 are supplied to a control device 7.

The thermostat for the output of the boiler 1 would typically be set at a temperature of 82°C. When the central heating system is operating water is pumped around the system and through the radiators. As the required room temperatures are

reached the TRV's close, restricting the flow of water through the respective radiators. The outflow and return temperatures are monitored by the sensors 5 and 6. The difference between the two temperatures and the known power output of the boiler, are used to calculate the water flow rate through the system. The temperature differential increases as the flow rate decreases, because less water is being heated in the heat exchanger.

The propensity to generate noise in the boiler is a function of the temperature of water in the boiler and the water flow rate. By monitoring the two temperatures, it can be estimated when noise is likely to be generated. When the temperature and flow conditions are such that noise is likely to occur, the control device 7 responds by adjusting the boiler thermostat i.e. lowering the outlet temperature at which the burner is shut off. Reducing the outlet temperature compensates for the low flow rate so that boiling in the pipes of the heat exchanger will not occur and the noise associated with such boiling is avoided.

It will be understood that the flow rate through the heating circuit is restricted when the TRVs are closed, that is when the heating load is satisfied. Consequently, lowering the outlet temperature of the boiler has no detrimental effect on the efficiency of the heating system.

In a particular embodiment the control system might be set up to lower the outlet temperature setting of the boiler when the flow rate is reduced to such a level that the temperature differential exceeds 15°C, and to progressively reduce the outlet temperature by approximately 5°C for every 2.5°C increase in the temperature differential. It will be understood that other values would be appropriate in different systems, for example, depending on the specific properties of the heat exchanger being used.

Claims

1. A method of controlling a boiler having thermostatic means for controlling the maximum temperature of water leaving the boiler, characterised by adjusting the thermostatic means to vary said maximum temperature in response to the water temperature and flow rate through the boiler.

2. A method according to claim 1, wherein, the difference in temperatures between the water leaving the boiler and water entering the boiler is sensed to provide a signal indicative of said flow rate.

3. A method according to claim 2, wherein the temperatures of the water leaving and entering the boiler are sensed by respective sensors, and the thermostatic means is adjusted in dependence upon the signals from said sensors.

4. A boiler (1) comprising thermostatic means for controlling the maximum temperature of water leaving the boiler, characterised in that control means (5-7) are arranged to provide signals indicative of the water temperature and flow rate through the boiler and to adjust the thermostatic means to vary said maximum temperature in accordance with said signals.

5. A boiler (1) according to claim 4, wherein the control means comprises respective sensors (5,6) for sensing the temperature of water entering and the temperature of water leaving the boiler, and a control unit (7) coupled to said sensors and to said thermostatic means.

6. A boiler (1) according to claim 4 or 5, wherein said thermostatic means controls a gas burner of the boiler to control the maximum temperature.

7. A central heating system comprising a plurality of space heaters (2) connected in parallel between forward flow and return flow pipes, thermostatic valves (3) for controlling flow through the respective space heaters, and a boiler (1) as claimed in claim 4,5 or 6 connected between the forward flows and return flows pipes.

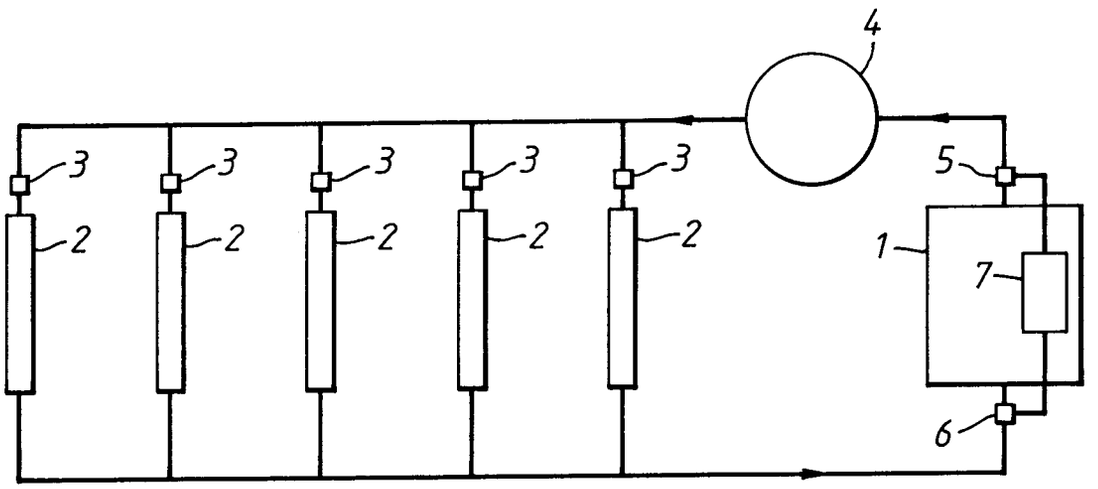

Fig.1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 9898

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.6)
A	EP-A-0 316 496 (COUSSEMENT BRUNO) 24 May 1989 * abstract *	1,5,7	F24D19/10 F23N1/08
A	GB-A-2 188 453 (BRITISH GAS PLC) 30 September 1987 * abstract *	1,5,7	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F24D
F23N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 April 1995	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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