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(54) **METHOD AND SYSTEM FOR LIMITING WATER BOILER HEAT INPUT**

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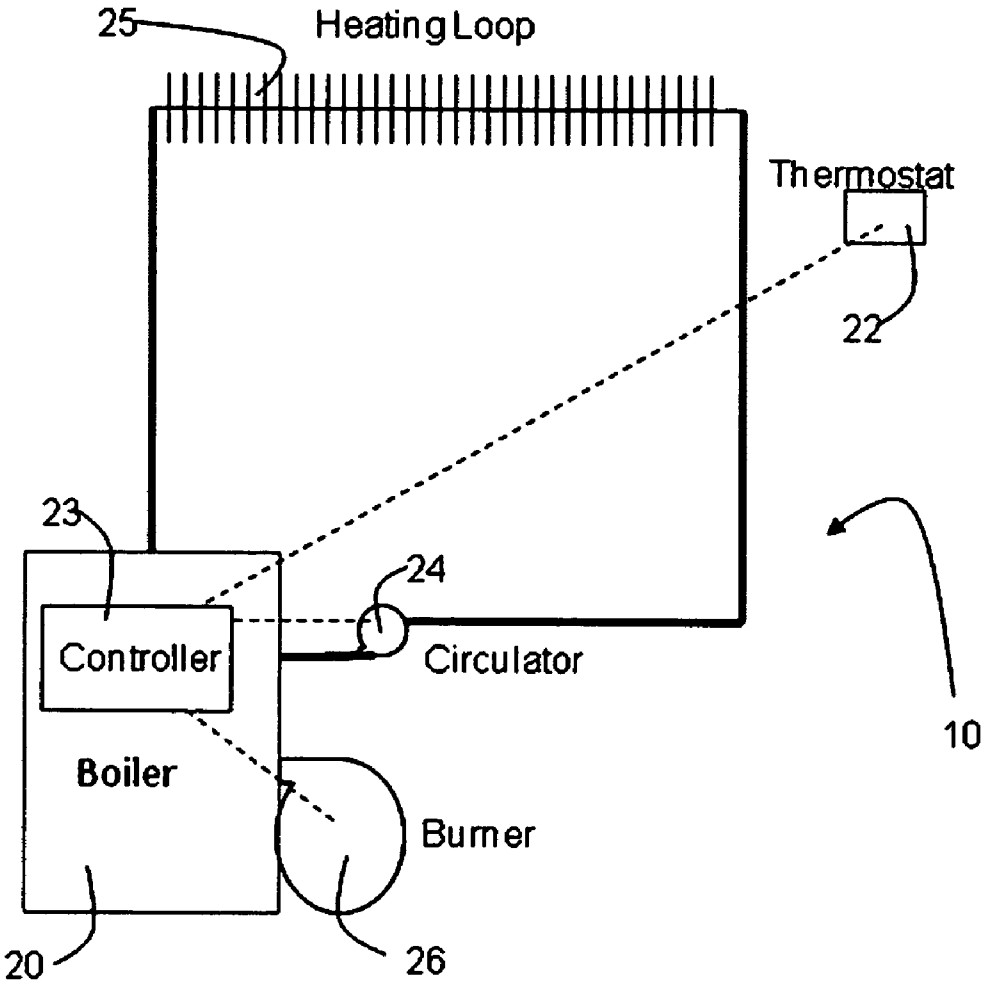
(57) **ABSTRACT**

A method to control the heat input into a boiler utilizing the boiler return temperature to minimize the heat input and maximize the efficiency of the boiler.



Typical Single Zone Heating System

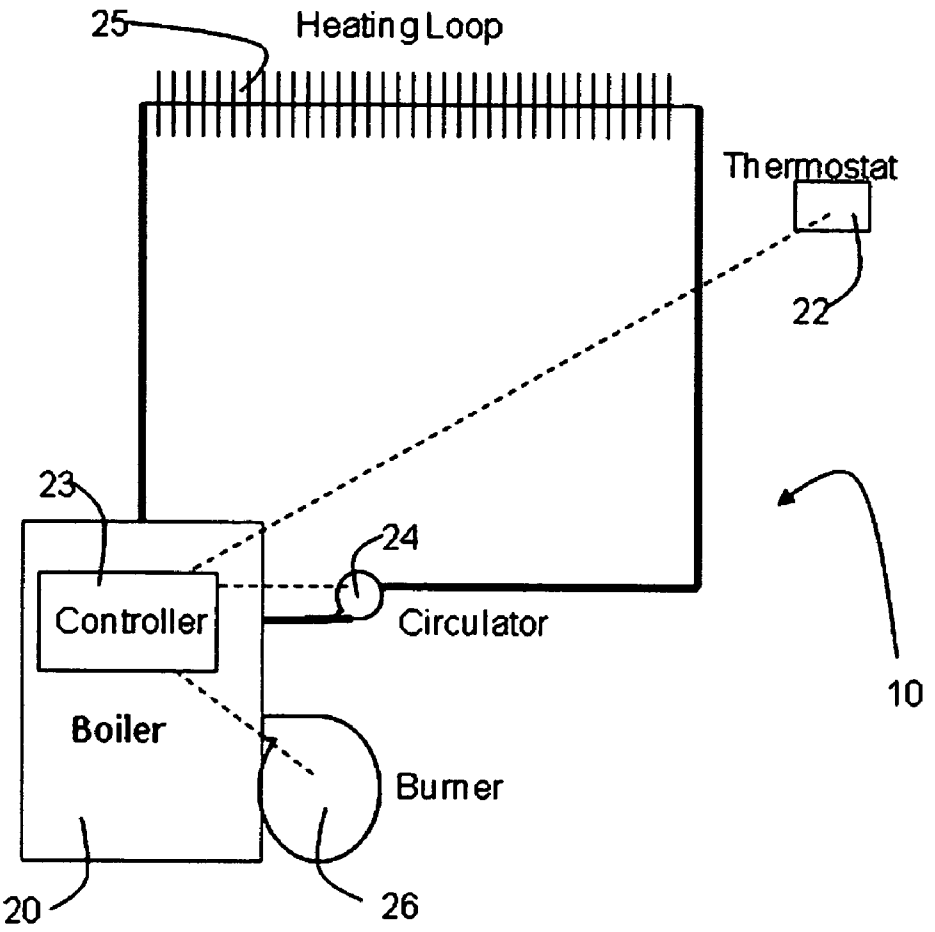


Figure 1 – Typical Single Zone Heating System

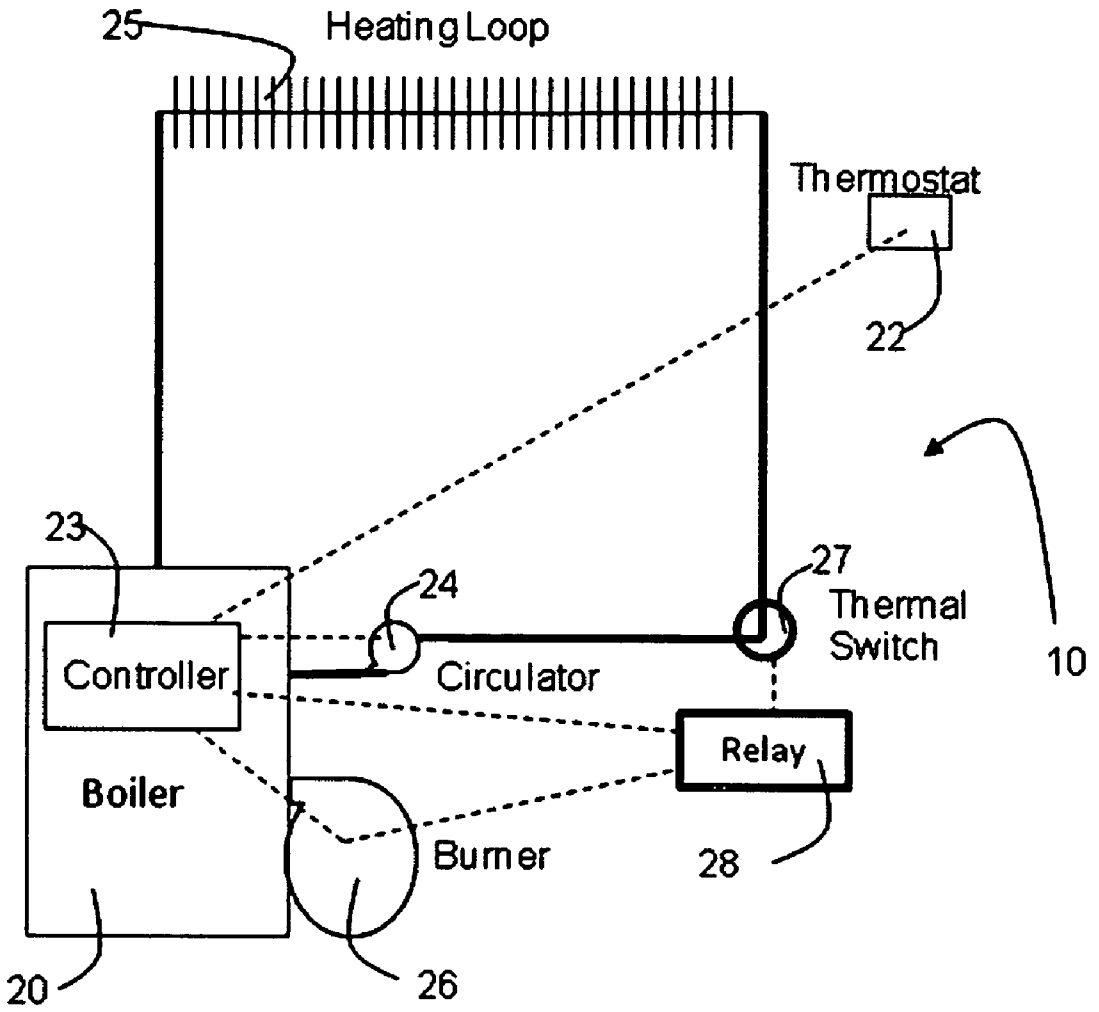


Figure 2 – New Single Zone Heating System

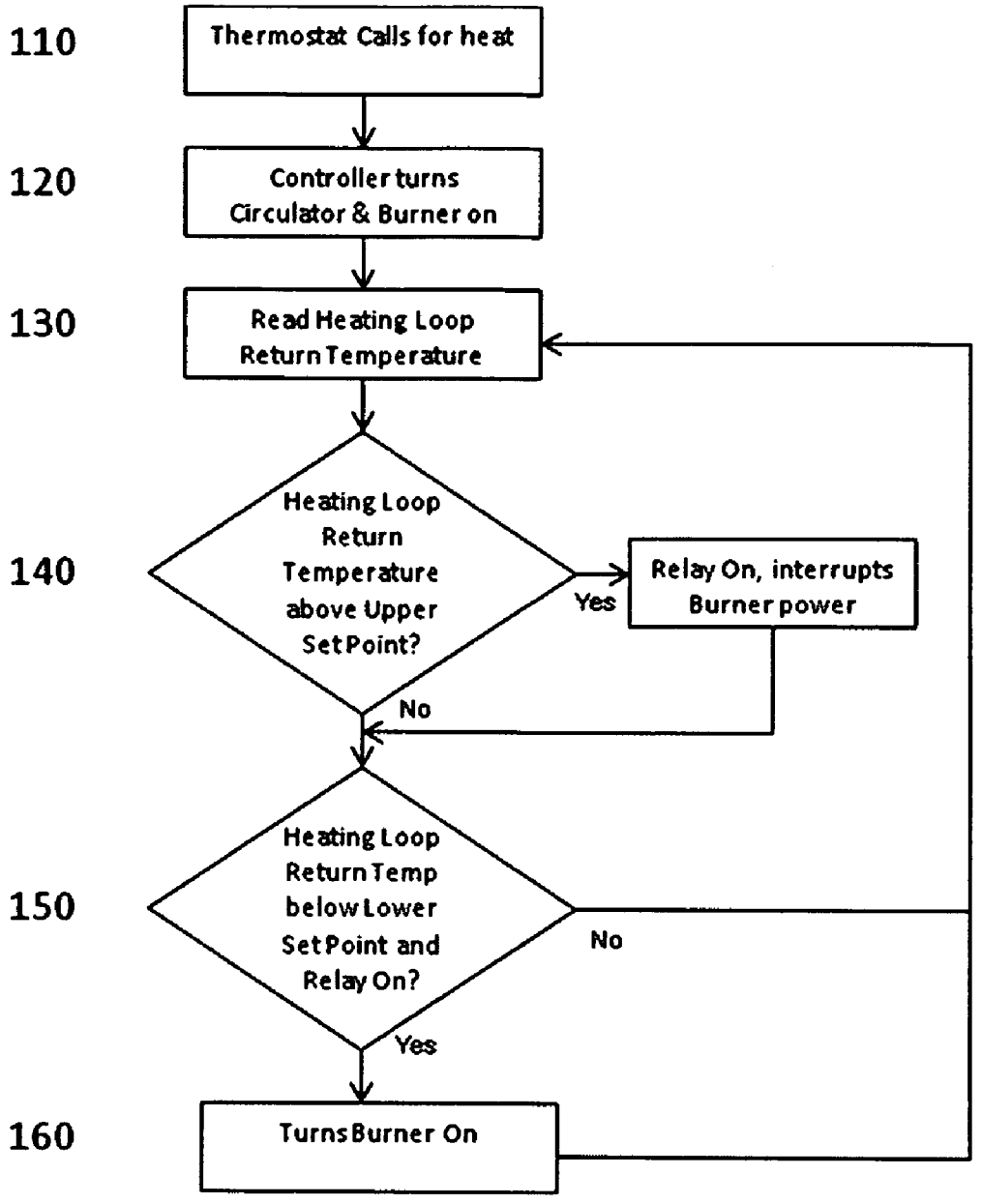


Figure 3– Control Logic

METHOD AND SYSTEM FOR LIMITING WATER BOILER HEAT INPUT

BACKGROUND

[0001] 1. Technical Field

[0002] The disclosed subject matter generally relates to a method and system for controlling and minimizing the heat input into a water boiler, while maintaining the same heat output. Particularly, the disclosed subject matter relates to a method and system that improves the overall thermal efficiency of a water boiler.

[0003] Heat Input relates to the amount of fuel oil, natural gas, electricity, or other energy that is needed to produce a given amount of Heat Input, commonly measure in BTUs.

[0004] Heat Output refers to the usable heat produced, by a device such as a water boiler, from this Heat Input, also measure in BTUs.

[0005] Minimizing the Heat Input while maintaining a given Heat Output improves the efficiency of the water boiler.

SUMMARY

[0006] In one aspect this invention provides a method to improve the efficiency of a water boiler. The method allows the system to limit the heat input of the water boiler while maintaining the same heat output of the boiler. The method accomplishes this by monitoring the return temperature of the heating loop to limit the heat input based on the return temperature.

[0007] In another aspect this invention provides a method to adjust the efficiency based on the heat demand required.

[0008] These aspects, as well as others, are described in more detail herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** depicts a Typical Single Zone Heating System; and

[0010] FIG. **2** depicts a New Single Zone Heating System according to one embodiment disclosed herein; and

[0011] FIG. **3** is a flowchart illustrating the Control Logic to maximize the efficiency of the boiler.

DETAILED DESCRIPTION

[0012] Although the disclosed subject matter has been shown and described with respect to the detailed embodiments thereof, it will be understood by those of skill in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the disclosed subject matter. In addition, modifications may be made to adapt a particular situation or material to the teachings of the subject matter without departing from the essential scope thereof. Therefore, it is intended that the disclosed subject matter not be limited to the particular embodiments disclosed in the above detailed description, but that the disclosed subject matter will include all embodiments falling within the scope of the disclosure.

[0013] FIG. **1** illustrates a Typical Single Zone Heating System (**10**). A boiler (**20**) converts heat input to heat output. The thermostat (**22**) in the heated area turns on to indicate a heat demand. Through the furnace controller (**23**), the circulator (**24**) activates and circulates water through the heating loop (**25**). When the circulator is active, the burner (**26**) activates to heat the water. The boiler temperature is maintained with the controller (**23**) on the boiler. This controller turns the burner (**26**) on when the circulator (**24**) is on, and will remain on unless an adjustable high temperature set point is reached or the circulator turns off. If the high temperature is reached the burner remains off until the water temperature drops to specific lower temperature set point, an un-adjustable difference from the high temperature set point. The current method allows the water temperature to continue to rise even if the Heat Loop (**25**) is at a high temperature and the heat demand is about to be satisfied.

[0014] Some water boilers integrate domestic hot water (tap water), where the water boiler maintains a temperature range constantly for the heat exchanger in the water boiler; these boilers have both a high and low settable temperature limit.

[0015] FIG. **2** illustrates the New Single Zone Heating system (**10**). This system has the same components as shown in FIG. **1**, with the addition of an adjustable temperature switch (**27**), and a relay (**28**). This system monitors the return temperature of the loop with an adjustable temperature switch (**27**), with a relay (**28**) to limit the burner's on time, based on the return temperature. This allows the Heat Loop's (**25**) return water temperature to rise and the relay to shut off the burner based on the return temperature. Enabling the water in the heating loop to cool to a lower temperature as the heat demand is satisfied. The lower the water temperature when the heat demand is satisfied, the more efficient the heating cycle becomes.

[0016] By adjusting the maximum return temperature an effective cycle can be maintained. This can be applied to single zone or multiple zone systems, and water boilers with and without domestic hot water heat exchangers.

[0017] In a multiple zone system, if another zone activates during the cooling portion of the cycle, the cool water from the activated zone decreases the return temperature and the burner reactivates until the maximum is reached.

[0018] This method requires the addition thermal switch (**27**, FIG. **2**) or thermal sensor and a relay (**28**, FIG. **2**) to turn off the burner, no changes beyond the boiler are required. This makes retrofit of existing boilers easy as well as addition to new installations.

[0019] FIG. **3** defines the Control Logic of the new system. When the thermostat in the heated area calls for heat (**110**) it signals the controller to turn on the circulator to turn on (**120**). As the water flows through the Heating loop, the return temperature is monitored (**130**) by the thermal switch (**27**, FIG. **2**). If the return temperature is below the set temperature, the relay (**28**, FIG. **2**) remains in its' normally closed position. Once the water temperature reaches the set temperature the relay (**28**, FIG. **2**) is energized to its' open state (**140**) and the burner shuts off. The burner will remain off until the heat demand is satisfied (the thermostat shuts off the circulator), or the return temperature falls below the set temperature (**150**).

[0020] As the heat output required to satisfy the heat demand changes, due to external temperature, the set points may be increased for colder weather, or decreased for warmer weather.

[0021] For unusual heat demands, an extreme cold day, a timer can be added to keep the burner on when long cycles are encountered. This bypasses the thermal switch.

[0022] This method may be applied to multiple zone system.

[0023] In a multiple zone system, if an additional zone is activated while the relay is in the open position, the cooler

water from the activated zone decreases the return temperature and returns the relay (**28**) shown in FIG. **2**, to the closed (burner on) position (**160**).

What is claimed is:

1. This method reduces the heat input into a water boiler and increases the thermal efficiency of the water boiler.

2. This method reduces the fuel consumption of the water boiler.

3. This method allows adjustment of the boiler to maintain the thermal efficiency as the heat demand changes due to external temperature.

4. This method reduces the average maximum temperature of the water boiler.

5. This method reduces the maintenance and repair cost of the boiler due to less burner time and lower Maximum Temperature.

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