United States Patent

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[54] **ANTIFREEZE BOILER CIRCUIT**
4 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **219/280,** 122/504, 122/504.2, 219/208, 219/279, 219/309
[51] **Int. Cl.** **F22b 37/42**
[50] **Field of Search** 219/208, 279, 280, 332, 309; 122/504, 504.2

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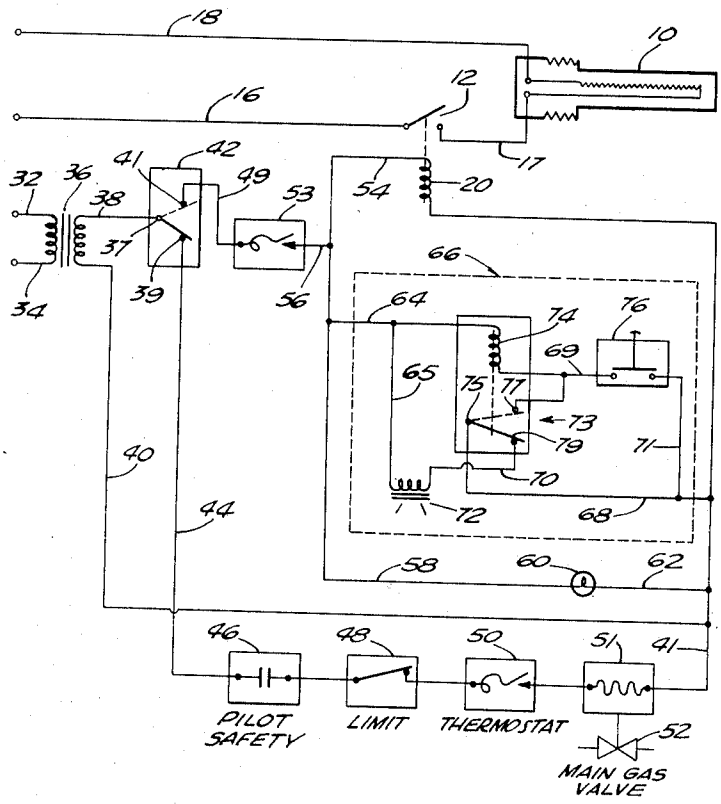
ABSTRACT: The invention is a system comprising an electric heating element installed in a boiler header and control circuitry therefor so as to protect a nonfunctioning boiler from damage caused by freezing of water therein if the boiler pump becomes inoperative and the ambient temperature drops below the freezing point.



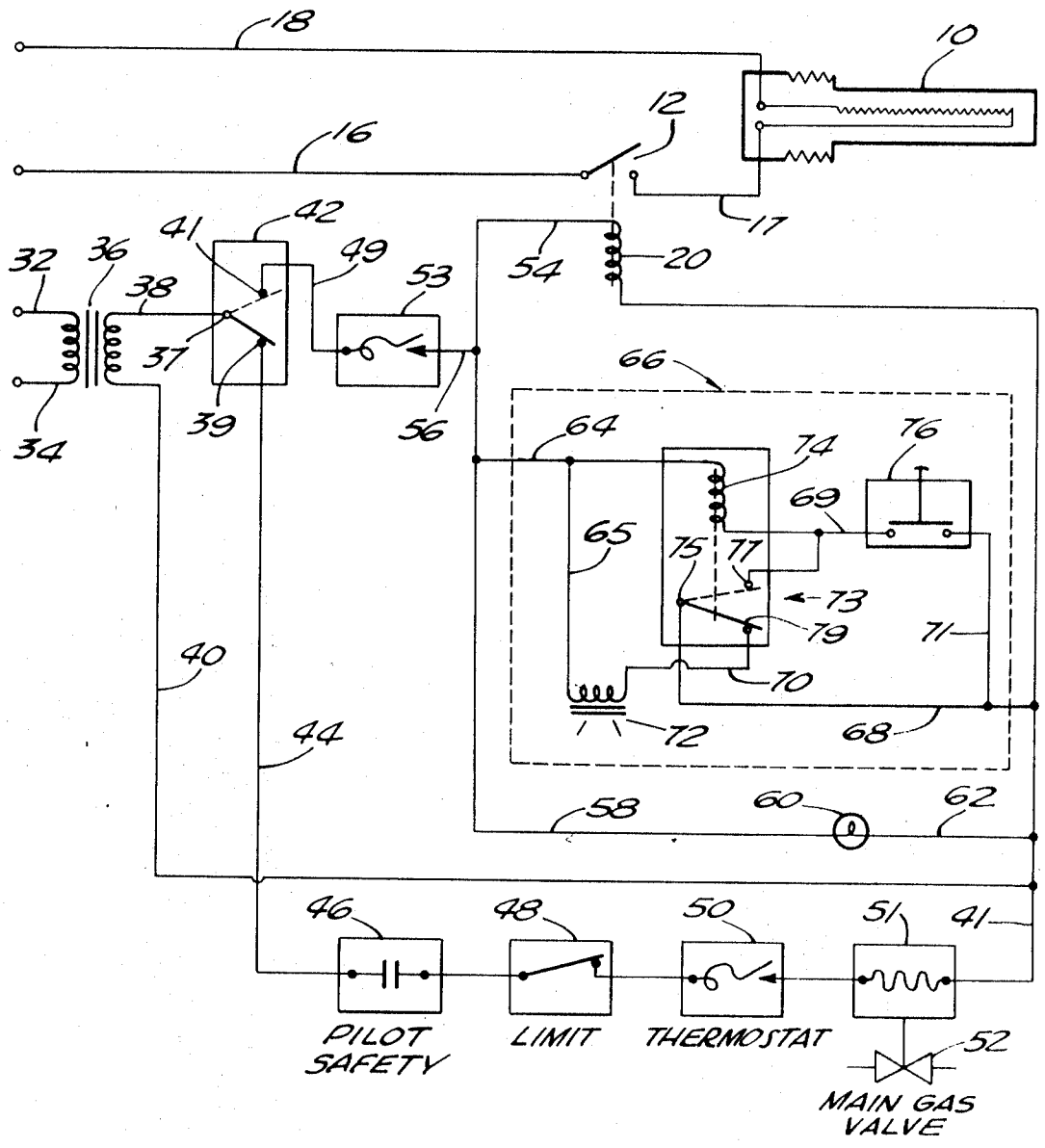


FIG. 1.

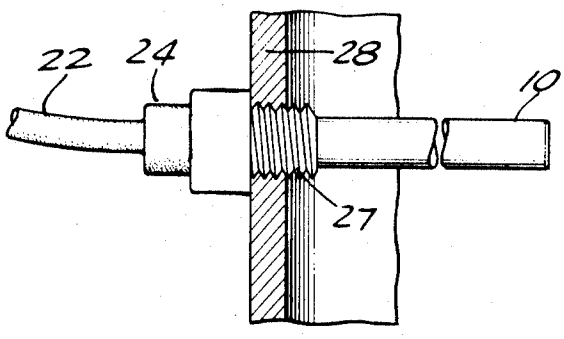


FIG. 2.

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ANTIFREEZE BOILER CIRCUIT

SUMMARY OF THE INVENTION

The invention relates to a system for prevention of freezing in a nonfunctioning or nonoperating boiler.

A boiler is the component in which water is heated and which consists generally of metal shells, headers and tubes that form the container for the steam and/or water under pressure. Boilers are generally placed in a boiler room which is in an isolated area in the building away from other activity but where adequate air is provided for combustion within the boiler and also for ventilation.

Large boilers require large openings or ducts between the boiler room and the outside of the building for the purposes of ventilation. In the event that the boiler ceases operation and there is no other source of heat, the ambient boiler room temperature will approach the outside air temperature which during certain times of the year may be below the freezing point of water. Since water expands upon freezing, damage to the boiler from freezing of the water therein can result in the form of burst tubes and headers.

In order to maintain water flow through the system, a pump is utilized. As long as the pump is operative and water is circulating through the system, there is little probability of freeze damage to the boiler. This is true even though it is known to be possible to freeze water in motion. When the pump is operative the water is actually heated by the work energy transferred from the pump and motor to the water. Therefore, the return water to the boiler will be at a relatively high temperature for an extended period of time.

However, it is evident that a dangerous condition may exist if there is no water flow through the boiler and the boiler room temperature is below the freezing point of water. In this event, there is no heat transfer from an operative pump to the water so as to heat the water and maintain it above freezing and thereby prevent damage to the boiler system in any manner.

To protect against the above two conditions, the present invention involves the addition of one or more electric heating elements to the header of the boiler to maintain the boiler water at a temperature above freezing. The heating element is energized when first, a flow switch indicates no flow of water through the boiler, and second, a boiler room thermostat indicates an ambient temperature below, for example, 35° F. Thus, in the event that for any reason the pump ceases to operate and it is during the time of year when temperatures are low, the heating element is energized to prevent the freezing of the water within the boiler.

Furthermore, an alarm circuit is utilized to indicate the undesirable condition. The alarm system can contain both audible and visual devices whereby the audible device can be manually turned off, but the visual device will stay on until the casualty condition is corrected.

In light of the foregoing the primary object of the invention is to provide improvements to prevent freeze damage to a boiler comprising a heating element and a control circuit for energizing the heater.

Another object of the invention is to provide heater control circuit as in the foregoing object responsive to absence of flow through the boiler.

Still another object is to provide a boiler heater control circuit as in the foregoing which is responsive to the ambient temperature of the boiler room.

Still another object is to provide a boiler heater control circuit as in the foregoing having an alarm arrangement indicating a dangerous condition.

Further objects and additional advantages of the invention will become apparent from the following detailed description and the annexed drawings, wherein:

FIG. 1 is a schematic circuit diagram of the system of the invention illustrating the principal components thereof; and

FIG. 2 is a view of the immersion heater mounted in a boiler header wall.

Referring now to the drawings, in FIG. 1, immersion heating element **10** is preferably positioned in the return header of the boiler. The immersion heater is energized by power supply leads **17** and **18** through relay switch **12** which is in between power supply leads **16** and **17**. Switch **12** is controlled by relay winding **20** which is energizable in a manner which will be explained below.

There may be a many heating elements as needed. For purposes of this description, however, one heating element will be shown.

In FIG. **2**, heating element **10** is shown mounted in a typical boiler header wall **28**. The element is attached to the wall by means of screw threads **27**. Cable **22** contains leads **17** and **18** and is a part of connector **24**. Immersion heating element **10** is of a typical heater construction but may have a built-in high limit to prevent excessive heating of the water in the boiler. Further it is feasible for this heating element to have a low-limit switch to prevent heating of the boiler water until it drOps to a predetermined temperature. By use of the heating element with a built-in high-limit switch or a low-limit switch, it is possible to insure heating of the boiler water only when it is necessary.

Heating element **10** may also be made of a special resistance heating wire that has a rapid increase in resistance corresponding to an increase in temperature. A heating element of this type would automatically reduce its current flow requirement as the boiler water increases in temperature and this would result in more economical operation compared to a standard heating element.

Turning now to a description of a normally operating boiler condition in which a gas burner, for example, is heating the flowing water, supply leads **32** and **34** provide voltage to step down transformer **36**, the output of which is represented by leads **38** and **40**. Flow switch **42** indicates the passage of water through the return header of the boiler and is a conventional single pole, double throw switch in which contact **37** normally engages contact **39** thereby connecting lead **38** to lead **44** to represent the normal operating condition of the boiler. As long as pilot safety switch **46**, limit switch **48**, and thermostat switch **50** are closed, voltage is provided to the operating coil **51** to control gas valve **52** to operate the boiler.

In the event that there is no waterflow in the return header of the boiler, the flow switch **42** will be switched to its other position and contact **37** will engage contact **41** thereby connecting supply lead **38** to the lead **49**. Due to the switching of flow switch **42** as a result of there being no waterflow through the return header of the boiler, the solenoid **51** is deenergized resulting in closing the main gas valve, thereby turning the gas burner off. Under these conditions the ambient boiler room temperature may approach the outside air temperature which may be at or near the freezing point of the water. The ambient boiler room temperature is sensed by thermostat switch **53** which may be designed to close at a temperature close to 32° F. and typically is set to close in a range between 35° F. and 40° F. In this event, when there is no waterflow through the return header of the boiler, flow switch **42** is in the no-flow condition and the ambient boiler room temperature has dropped below a danger point, the thermostat switch **53** closes thereby completing the circuit to relay **20** through leads **54** and **40** causing switch **12** to close, which in turn energizes immersion heating element **10**, thereby heating the water in the boiler and preventing freezing.

Thermostat switch **53** can be incorporated with heating element **10** in a manner previously described. In this instance, the thermostat **53** would be responsive to the temperature of the water rather than the ambient temperature of the boiler room. Otherwise, operation would be as described below.

Simultaneously with the energization of the heating element, an alarm device **66** is energized through leads **64** and **68**. Alarm **66** may be positioned in the boiler room or at a position remote to the boiler room to indicate that the immersion heating element **10** has been energized thereby communicating that the waterflow through the boiler is nonexistent

and that the boiler room temperature has reached a dangerous low level.

When the immersion heating element **10** has been energized due to the closing of switch **12** which is controlled by the energization of relay **20**, voltage is supplied to audible device **72** through leads **64**, **65**, **70**, and **68** and to indicating light **60** through leads **58** and **62**. Audible device **72** may typically be a loudspeaker, a horn, a bell or other attention-obtaining device. When it has been determined that the immersion heating element **10** is energized so as to avoid a water freezing condition and it is desired to shut off the audible device **72**, an alarm-silencing relay **73** is energized by the manual operation of silencing switch **76**. Relay coil **74** is thus energized through leads **64**, **69** and **71** and thereby causes contacts **75** and **79** to be disconnected so as to deenergize the audible device. With the switching of relay **73** to its other position, the relay coll **74** is held in an energized condition through contacts **75** and **77** by leads **64**, **73** and **68**. Switch **76** can immediately be released without alarm **72** being reenergized.

After immersion heating element **10** has heated the boiler water to a sufficient level and deenergizes itself or when the boiler has been turned on or the boiler room temperature has been increased, relay **74** is deenergized and resets the audible device **72** so that in the event that the immersion heating element **10** is energized at a subsequent time, the audible alarm will also be energized. Concurrently with the energization of relay **20**, indicating light **60** is energized through leads **56**, **58**, **62**, and **40**. Thus, there is a visual indication that the immersion heater has been energized. Light **60** is only turned off when the heating element is off.

From the foregoing, those skilled in the art will readily observe and understand the nature and construction of the invention and the manner in which it achieves and realizes all of the objects and advantages set forth in the foregoing as well as the many additional advantages that are apparent from the detailed description.

The term "boiler" as used herein is intended to mean any type of appliance in which water is heated and which is subject to possible freezing.

The foregoing disclosure is representative of a preferred form of the invention and is to be interpreted in an illustrative rather than a limiting sense, the invention to be accorded the full scope of the claims appended hereto.

What is claimed is:

1. A freeze damage prevention system comprising a fluid-circulating boiler for heating water and similar fluids, a heating element positioned to heat the boiler water when the boiler is not operating to prevent freezing of the water, and means responsive to absence of fluid flow as indicative of nonoperativeness of the boiler and a near-freezing temperature of the fluid for energizing said heating element.

2. A system as in claim **1**, further including an alarm circuit means whereby to indicate danger of freezing.

3. A circuit as in claim **2** including means for manually silencing the alarm.

4. A freeze damage prevention system comprising a fluid circulating boiler for heating water, a heating element positioned to heat the boiler water when the boiler is not operating to prevent freezing of the water, temperature-responsive means indicative of a near-freezing temperature to energize the element when danger of freezing occurs, flow-responsive means, an alarm circuit whereby to indicate danger of freezing, a relay energizable by said temperative-responsive means and flow-responsive means controlling the alarm circuit and having a holding circuit and means for manually silencing the alarm by interrupting the holding circuit.

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