

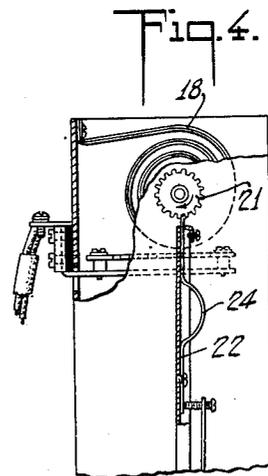
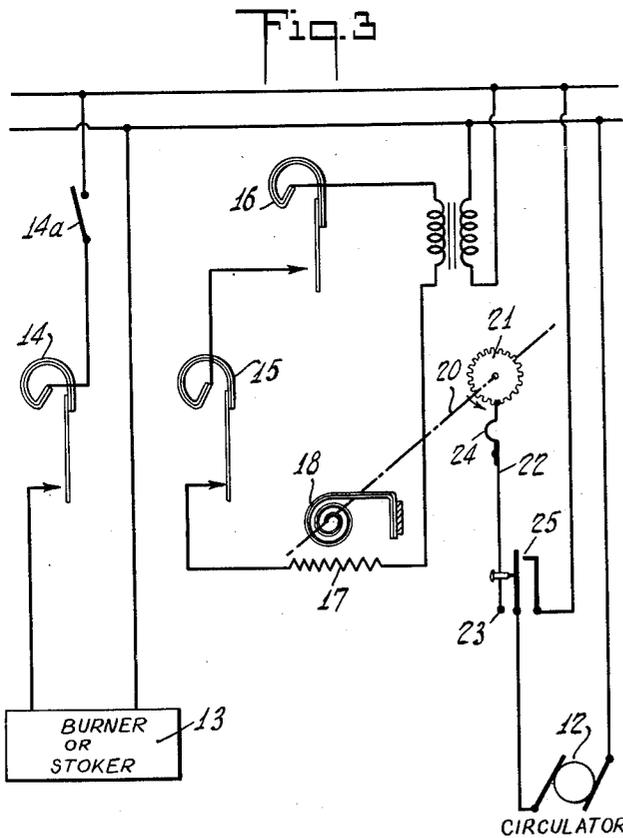
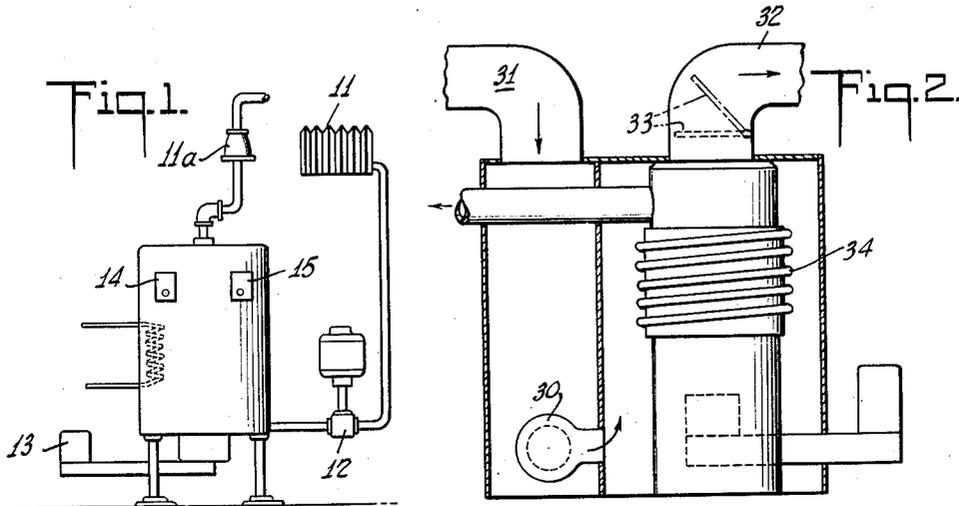
Aug. 24, 1948.

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2,447,901

HEATING SYSTEM

Filed May 14, 1942



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2,447,901

HEATING SYSTEM

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Application May 14, 1942, Serial No. 442,943

5 Claims. (Cl. 236-9)

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The present invention relates to heating systems.

It is customary to provide hot water furnaces with circulating pumps under the control of the room thermostat to secure forced circulation of hot water in the radiators. In such systems the boiler itself is automatically maintained at a convenient high temperature for supplying domestic hot water and maintaining a storage of hot water ready to be moved into the radiators by the circulator, flow of water through the system when heat is not required being prevented by a flow control valve. In systems such as just referred to, the circulator operates while the room thermostat is calling for heat, and experience has shown that the circulator operation is prolonged so as to place more hot water in the radiators than the minimum required to satisfy the room thermostat resulting in temperature rise above that for which the thermostat was set. This overrun is at the expense of the boiler which chills to a comparatively low temperature so that a longer run of the burner is necessary to restore the boiler to the normal operating temperature.

According to the present invention the circulator is operated (when heat is required) to force water from the boiler to heat the radiators and cool the boiler to a substantial amount yet within the range suitable for room heating by hot water heating and the heating of domestic hot water, and the circulation is stopped until the boiler temperature has been restored to a temperature substantially above the lowest temperature reached, and substantially below the high temperature to attain which the boiler is fired.

The present invention contemplates automatic operation of the hot water heating system according to which the circulator is under the dual control of a room thermostat, preferably of the low voltage type, and a second piece of thermostatic apparatus, such as an aquastat, is placed in the boiler and adjusted to be closed at normal boiler operating temperature and to open at a predetermined temperature somewhat below the normal high temperature at which the boiler is maintained. Thus the stopping of the circulator may be made to depend upon the return to the boiler an amount of water sufficient to so reduce the boiler temperature. In order to avoid the intermittent operation of the circulator, which could be brought about (while the room thermostat is still calling for heat) by the opening and closing of the aquastat which controls it, it is preferable according to the present invention to control the circulator through a switch under the

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delayed action of a thermal motor operated by a heater in series with the room thermostat and the aquastat. Such a control makes it possible to operate the circulator long enough to reduce the boiler water temperature in an amount substantially below the aquastat setting and to also delay the restarting of the circulating motor for a period of time sufficient to permit the boiler to store up a reserve of hot water so that on the next operation of the circulator this reserve of hot water may be forced into the radiators. This avoids overheating the rooms and undercooling the boiler, and subsequent lag in reheating the room.

The present invention is also applicable in the control of hot air heating systems.

Other and further objects will hereinafter appear as the description proceeds.

The accompanying drawings show, for purposes of illustrating the present invention, embodiments in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In these drawings:

Figure 1 is a diagrammatic view illustrating a hot water heating system without wiring;

Figure 2 is a similar view of a hot air heating system;

Figure 3 is a wiring diagram; and

Figure 4 illustrates a timer switch.

A conventional hot water boiler 10 is connected to radiators 11 through the usual flow control valve 11a and a motor operated circulator 12 so that the hot water can be circulated through the boiler and radiators. The boiler may be fired by a stoker or oil burner indicated at 13, or by hand firing with suitable automatic draft controls, and may supply domestic hot water as usual.

Where the stoker or oil burner is employed it will be under the control of a thermostatic switch or aquastat 14 and limit switch 14a both in the boiler. This switch may be of any common type for the purpose and either operating on high tension current, as indicated in Figure 3, or may operate on a low tension circuit, its purpose being to control the firing of the boiler so that water is kept at a predetermined high temperature, for example, at 190° F. Such controls are common.

The boiler is provided with a second thermostatic switch or aquastat 15 adjusted to be closed whenever the temperature is above some predetermined lower temperature, for example, 180° F., whereby a 10° F. differential in temperature may be allowed for. In the drawings the aquastat 15

is shown as a low voltage device and is in series with a low voltage room thermostat 16 adapted to close whenever heating is required. The thermostats 15 and 16 are in series with a heater coil 17. This heater coil is placed adjacent, preferably below, a bimetallic element 18 anchored at one end 19 and coupled at the other end to a shaft indicated at 20. The heating of this bimetallic element will cause the shaft 20 to turn in the direction indicated by the arrow. The shaft 20 carries a gear or other suitable device 21 adapted to operate an arm 22 pivoted at 23. This arm includes a bowed spring 24 which prevents binding between the gear teeth and end of the spring. The arm operates a normally open switch indicated at 25 in the circuit of the circulator 12. The gear arrangement makes it possible to have the end of the spring 24 between two teeth and movable with little movement of the gear yet maintaining the same circuit condition so long as the gear turns in the same direction.

When the room thermostat calls for heat the heater 17 will in a short period of time, for example, 30 to 60 seconds, operate the thermal motor to close the switch 25 and start the circulator. This, of course, will force the cooled water from the radiators back into the boiler, lowering the boiler temperature, whereupon the burner or stoker would normally be put into operation. The circulator capacity is generally sufficient to cool off the boiler at a rate higher than it can be heated by the burner, and this will soon effect a cooling of the boiler an amount sufficient to cause the thermostat 15 to open. Instead of immediately shutting down the circulator, as would be the case if a simple relay were employed in the circuit of parts 15 and 16 to operate the circulator motor switch, the motor continues to operate for a short interval of time, for example, one and one-half to two minutes, after the opening of the thermostat 15 (or room thermostat 16). The length of time that the circulator operates, the quantity of water pumped and the drop in temperature of the boiler may all be under the control of the thermal motor, so that an actual drop in boiler temperature of much more than the differential between the aquastats results, for example, 30° F. The cooling of the thermal motor 18 and its reheating, when the thermostat 15 is reclosed may occupy a considerable interval, and this makes it possible for the hot water in the radiators to warm up the space to be heated, and, if this has satisfied the room thermostat, the circulator is not restarted.

With this system it is possible to transfer hot water into the radiators in comparatively small amounts so that the effect of this amount of water may be made available without operating the circulator to force more hot water into the radiators than is necessary to satisfy the heating demand. Very even room temperature may be maintained. It also makes it possible to avoid cooling the boiler more than it is really necessary for the heat demanded. The boiler is also kept hot for domestic hot water.

Figure 2 shows a hot air heater having a circulating fan or blower 30 which draws in cold air at 31 and exhausts it at 32 past a damper 33 adapted to close when the blower stops. This closed damper makes it possible to keep the furnace hot without heating the rooms and with a furnace kept hot it is possible to obtain domestic hot water by a coil 34 in the heating space. With such an installation the thermostatic switches 14

and 15 of Figure 3 will be airstats in the furnace casing.

It is obvious that the invention may be embodied in many forms and constructions within the scope of the claims and I wish it to be understood that the particular forms shown are but a few of the many forms. Various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. A hot water heating system including a hot water boiler, radiators, a motor operated circulator for securing forced circulation of water, means to fire the boiler when it is below a predetermined high temperature to maintain it at substantially said high temperature, and means to control the operation of the circulator comprising a thermostat in the space to be heated by the radiators, a normally closed thermostat in the boiler independent of the first mentioned means and in series with the first thermostat and adapted to open when the boiler temperature is below a predetermined lower temperature, and a thermal motor having a heater in series with the thermostats, and effective to provide a predetermined delay in starting the circulator after the thermostats close the circuit and in stopping the circulator after the circuit has been opened by one of the thermostats.

2. A hot air heating system including a hot air furnace, a motor operated blower for securing forced circulation of heating medium, means to fire the furnace when it is below a predetermined high temperature to maintain it at substantially said high temperature, and means to control the operation of the blower comprising a thermostat in the space to be heated, a normally closed thermostat in the furnace independent of the first mentioned means and in series with the first thermostat and adapted to open when the furnace temperature is below a predetermined lower temperature, and a thermal motor having a heater in series with the thermostats, and effective to provide a predetermined delay in starting the circulator after the thermostats close the circuit and in stopping the circulator after the circuit has been opened by one of the thermostats.

3. A heating system including a furnace, a motor operated circulator for securing forced circulation of heating medium, means to fire the furnace when it is below a predetermined high temperature to maintain it at substantially said high temperature, and means to control the operation of the circulator comprising a thermostat in the space to be heated, a normally closed thermostat in the furnace independent of the first mentioned means and in series with the first thermostat and adapted to open when the furnace temperature is below a predetermined lower temperature, and a thermal motor having a heater in series with the thermostats and effective to provide a predetermined delay in starting the circulator after the thermostats close the circuit and in stopping the circulator after the circuit has been opened by one of the thermostats.

4. A hot water heating system such as claimed in claim 1 wherein the thermal switch is also effective to provide a delay in the restarting of the circulator for a predetermined interval after satisfaction of the thermostat in the boiler so that the boiler is heated substantially above said lower temperature.

5. A hot air heating system such as claimed in claim 2, wherein the thermal motor is also effective to provide a delay in the restarting of the

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circulator for a predetermined interval after satisfaction of the furnace-temperature-responsive thermostatic switch so that the furnace is heated substantially above said lowered temperature.

RALPH W. DE LANCEY. 5

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