

Feb. 13, 1940.

E. S. CORNELL, JR

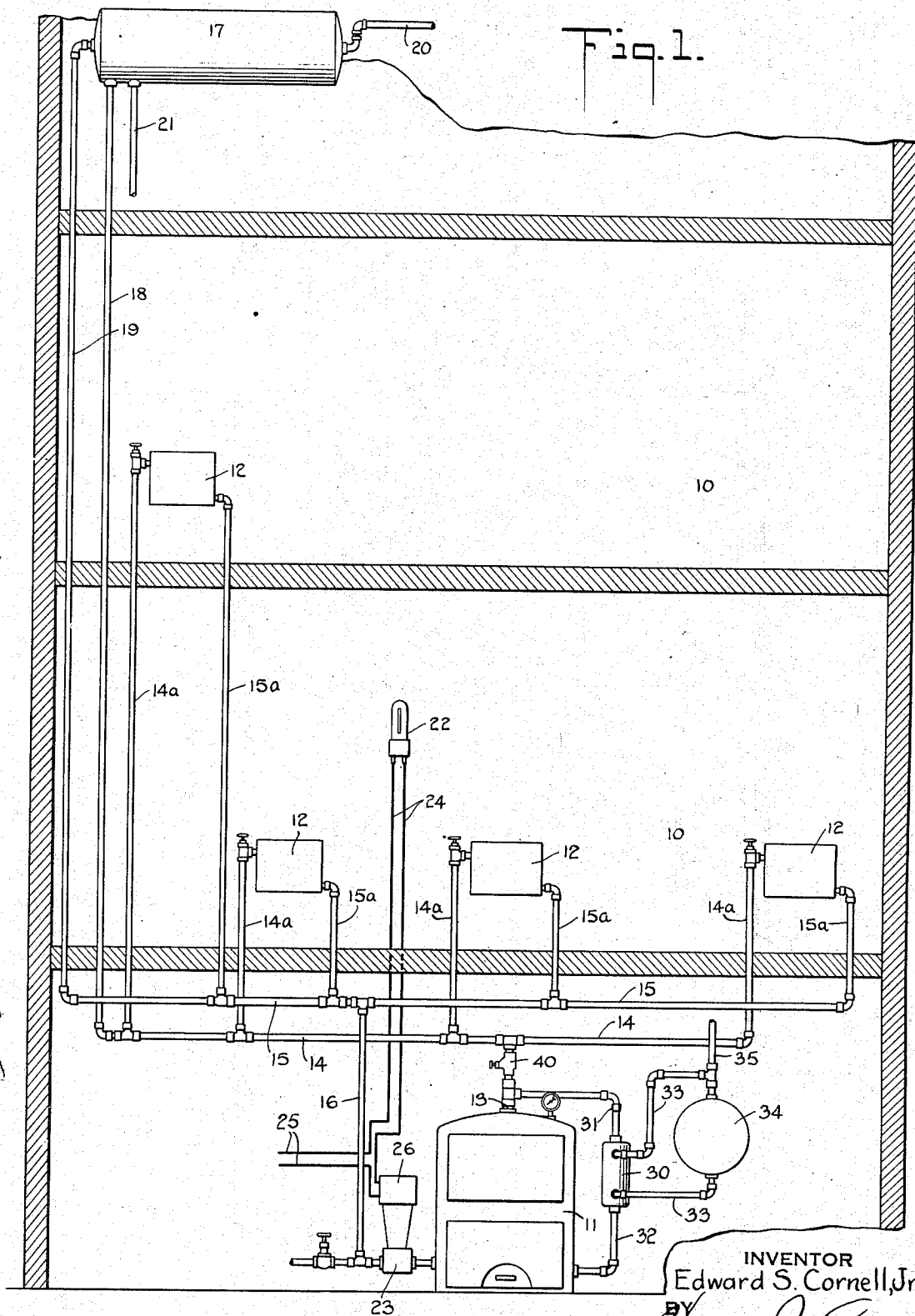
2,189,941

OPEN TANK HEATING SYSTEM WITH FLOW CONTROL

Filed Sept. 2, 1938

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Fig. 1.



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Fig. 2.

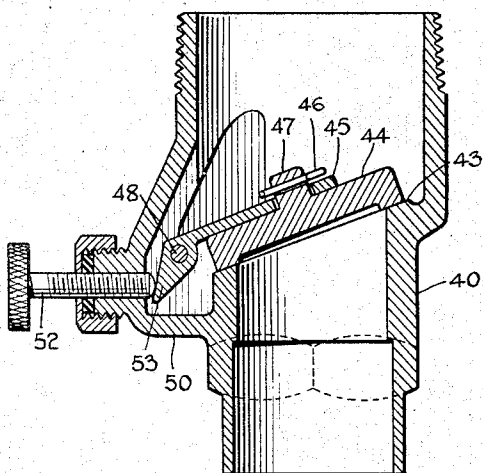


Fig. 3.

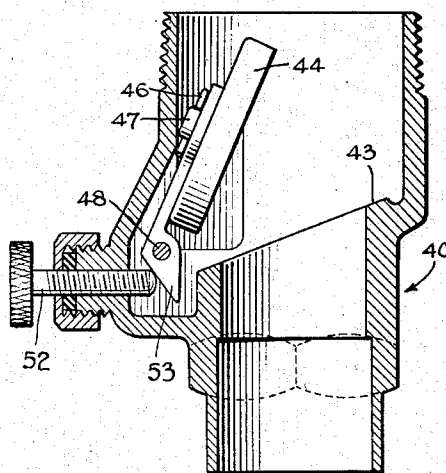


Fig. 4.

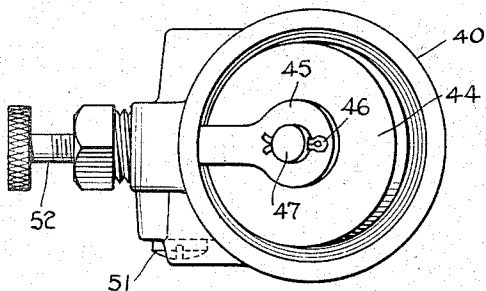
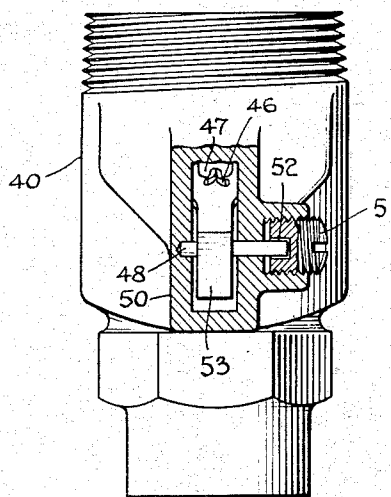


Fig. 5.



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OPEN TANK HEATING SYSTEM WITH FLOW CONTROL

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by mesne assignments, to American Radiator &
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Application September 2, 1938, Serial No. 228,087

1 Claim. (Cl. 237—63)

This invention relates to heating systems.

In particular, the invention relates to open tank type hot water heating systems which, according to conventional practice, may include a boiler or other hot water generating means, piping for affording a circulation of the hot water to and from radiators serving to heat the building or other enclosure, and a correlated water circulatory system embodying the common boiler and a heat exchanger for generating hot water for domestic use.

It is an object of the invention to provide a hot water heating system whereby during such periods when the heating effect of the radiators is not desired, the common boiler may be used to provide a continuous supply of hot water for domestic or other purposes.

A further object of the invention is to provide a heating system automatically operable to preclude flow of hot water from the boiler to the radiators during such periods, while permitting free flow of hot water from the boiler and to and through the domestic water supply generation means.

The invention is applicable to any type of boiler or other heat generator, and with any arrangement of radiator piping. Desirably, the system incorporates, as an element of the radiator piping system, a power driven pump or equivalent means for enforcing circulation to and from the radiators. Such pump may be driven by an electric motor, the periods of operation and quiescence of such motor being under the control of a room thermostat embodying a thermostatically operated make and break switch in the electric power line serving such pump motor.

In the heating system forming the subject matter of the present invention, flow control valve means are provided whereby during the stage of enforced water circulation, such stage being controlled, as aforesaid, by the operation of the room thermostat, free flow of water to and from the radiators is afforded, and circulation of water from the boiler to and from the domestic water supply heat exchanger is maintained in full operative status. The stated flow valve means is automatically operable, during such periods of quiescence of the water circulating pump, to preclude flow of hot water to and from the radiators, while permitting free flow of hot water from the boiler to the domestic hot water supply heat exchanger.

Such flow control means may be of the gravity bias valve type, described and claimed in my presently co-pending application Serial No. 228,086,

filed Sept. 2, 1938, entitled Improved gravity biased flow valve. Such flow valve is desirably located in a boiler outflow main leading directly from the boiler to the radiator supply main, and in particular, the flow control valve is located intermediate such point of connection of the boiler outflow main with the radiator supply main and a point of connection of the stated boiler outflow main with the domestic water supply heat exchange unit. With such arrangement or equivalent, it will be obvious that the automatic closing of the flow control valve during periods of quiescence of the circulator does not affect, in any degree, the circulation of hot water to and from the domestic water supply heat exchange unit.

The circulating pump is desirably of a type offering minimum resistance to flow there-through when in inoperative, i. e., non-pumping, status. A reverse thermo-syphonic flow from the boiler to the radiators, the tendency to such flow resulting from an elevated water temperature condition at the boiler, is precluded by reason of the "check valve" action of the flow control valve.

As above stated, the heating system is of the open tank type. Such open tank, in accordance with conventional practice, has a connection with the radiator circulatory system, thus accommodating the expansion of water within the system. Suitable overflow means prevents the generation of excessive pressures within the heating system.

Other features and advantages will herein-after appear.

In the accompanying drawings—

Fig. 1 is a diagrammatic representation of a heating system embodying the present invention;

Fig. 2 is a sectional elevation of a form of flow control valve applicable to the present invention, said valve being illustrated in closed position;

Fig. 3 is an elevation similar to Fig. 2, illustrating the valve maintained in open position, through the agency of suitable valve adjustment means;

Fig. 4 is a plan view of the valve, illustrating the valve in closed position; and

Fig. 5 is an elevation of the valve, partly in section, detailing the valve disk pivot means and the adjustment therefor.

Referring to Fig. 1, a heating system, applicable for heating a plurality of rooms 10, comprises any conventional type of boiler or other heat generator 11, and one or more radiators 12, said radiators being a part of a water cir-

culating system including a boiler outflow main 13, radiator supply mains 14, radiator return mains 15, and a boiler return connection 16.

In accordance with conventional practice, branch risers 14a and return branches 15a connect each radiator to the respective supply and return mains.

The heating system further includes an expansion or overflow tank 17, said expansion tank desirably having a piping connection 18, 19, respectively with the supply main 14 and the return main 15; however, piping connection 18 or 19 may be eliminated, if desired. The overflow tank has connected thereto a suitable overflow pipe 20, which may lead to an external discharge point or to any other convenient means for accommodating the overflow of water from said tank. When the overflow tank is of the automatic refill type, a cold water supply line 21 may be connected to the domestic water supply line of the building served by the heating system.

For maintaining a desired temperature condition within the building, there is provided a suitable thermostat 22, located, in accordance with accepted practice, in a room or enclosure of which the temperature may be considered as "typical" of the temperatures desired in other rooms of the building. By suitable proportioning of the heat output of the radiators 12, the maintenance of a desired temperature within the room in which the thermostat is located may maintain an equivalent desired temperature in other rooms containing radiators 12.

The positive circulation of heated water from the boiler to and from the radiators 12 is attained by a circulating pump 23. Such pump is desirably electric motor driven, and the room thermostat 22 may constitute a thermally operated make and break switch interposed in series electrical connection in an electrical circuit comprising the leads 24 and power line 25, the latter representing a suitable power supply line, such as the domestic lighting supply. Thus, the motor 26 of the circulator 23 will be electrically energized during periods in which the thermostat 22 is "calling" for heat; in other words, during periods in which the temperature in the room 10 is below the minimal temperature setting of the thermostat 22. Upon the attainment of the maximal thermostat setting, the breaking of the electric circuit halts the operation of the motor 26, and halts the enforced circulation of hot water to the radiators 12.

The heating system may further include a correlated circulatory system, a function of which may be the generation of hot water for domestic water supply. As illustrated in Fig. 1 such correlated system may include the heat exchanger 30, of any conventional design, and supplied with a continuous flow of hot water from the boiler 11 through the supply connection 31 and the return connection 32. The heat exchanger 30 effects an interchange of heat with the domestic water supply, said water supply heat exchange system including the circulatory piping 33, 33, and any suitable storage reservoir or tank 34. The pipe line 35 diagrammatically represents the connection between the tank 34 and the hot water line of the domestic water supply system.

It is a feature of the present invention that the boiler 11 may be employed for continuously heating domestic hot water regardless of room temperature conditions, during winter or summer

months, which make it undesirable to have hot water flow to any of the radiators 12.

To effect such correlated and yet independent operation of the building heating system and the domestic hot water supply generation system, there is employed a flow control valve 40, illustrated in detail in Figs. 2 and 3, and desirably installed in the boiler outflow main 13 intermediate the connection of such main 13 with the radiator supply mains 14 and the point of connection of the heat exchanger supply pipe 31 with the boiler outflow main or equivalent location affording continuous water flow to the heat exchanger 30.

Referring to Fig. 2, the flow control valve 40 includes a suitable valve body of desired size, the ends of which are arranged for suitable connection with the radiator supply mains 14 and with the boiler outlet line 13. Desirably, the valve body is of brass, copper, or similar metal adaptable for a sweat jointed, i. e., soldered, connection with a copper boiler outlet main 13 and supply main 14; obviously, one or both ends may be screw threaded.

A suitable valve seat 43 is provided substantially intermediate the valve body. Such valve seat may be integral with the valve body, as illustrated in Fig. 2, or may be of the removable type shown in one embodiment of my stated presently co-pending application Serial No. 228,086, filed Sept. 2, 1939. The valve seat 43 is preferably inclined in the direction of flow of water, as illustrated in Fig. 2. Such inclination is preferably of the order of 20 degrees.

For cooperation with the valve seat 43 in controlling the flow of water through the valve 40, there is employed a valve disk 44, desirably of integral metal of substantial weight. Such valve disk is arranged for swinging, i. e., pivotal, mounting by means of a pivoted supporting tongue 45 which may be secured to the valve disk by the cotter-pin 46 and a neck 47 formed in the valve disk 44. Such tongue 45 is pivotally secured to the valve body by means of a pin 48, said pin being inserted into suitable openings in walls of a housing 50 of the valve body. To secure the said pin 48 in a manner precluding leakage of water from the valve 40, there may be employed a suitable packing screw 51 having an elongated body formed with a relatively fine screw thread. As illustrated, such screw 51 may have a central aperture 52 into which an end of the pin 48 may extend. Such central aperture provides for the extended threading of the screw 51 while permitting, also, an elongation of the pin 48, to facilitate the grasping of the pin during the removal or insertion thereof.

The weight of the valve disk 44 is such that it will remain closed, under all conditions of water temperature in the boiler, when the pump 23 is not operating to produce a velocity of water flow through the system suitable to overcome the gravity bias of the valve disk and move the disk into open position. Obviously, the weight of the valve disk should be such as will permit the disk to close, upon cessation of pump operation, against the thermo-syphonic circulation of the water in the system, and the resistance to closing afforded by friction in the pivot pin 48. Thus, immediately upon cessation of pump operation, further flow of water to the radiators 12 is halted, whereas hot water may uninterruptedly flow from the boiler 11 to and through the heat exchanger 30.

I have found that an upward inclination of

the valve seat 43 of the order of 20 degrees provides satisfactory operation of the valve disk under the above stated conditions. Such inclination of the valve disk appreciably lessens the resistance to water flow during the first stages of operation of the pump, by minimizing the abruptness of change of direction of water flow through the valve during such stages of partial valve opening. Such valve seat inclination, also, lessens the degree of angular movement of the valve disk requisite for affording full flow capacity through the valve 40.

The pivoted valve disk 44 comprises, with its supporting tongue 45, a lever of the second order. Therefore, considering the center of mass of the valve disk 44 to be the load on the lever, the greater the distance from said center of mass to the fulcrum 48, the greater kinetic energy of the flowing water is required to overcome the resistance to rotation of the lever upwardly about its fulcrum. The relative position of the center of mass with respect to its fulcrum 48 afforded by an inclination of the valve disk of the order of 20 degrees represents a most efficient relation of "weight arm" to "force arm" consonant with the advantages derived from minimum resistance to water flow and minimum change of water flow direction through the valve body.

In accordance with conventional practice, the expansion tank 17 is located at a high point of the heating system. In the piping arrangement illustrated in Fig. 1, the provision for circulation from the supply main 14 to the tank 17 and thence to the return main 16 creates a thermo-syphonic leg which serves to expedite thermo-syphonic flow through the heating system. Such piping arrangement is particularly effective in the event that power failure or other abnormal condition prevents the operation of the pump 23. Although the pump 23 is desirably of such design that it presents minimum resistance to the free flow of water therethrough, it is obvious that resistance is present, and the inducement to thermo-syphonic circulation afforded by the stated expansion tank piping arrangement insures adequate circulation through the heating system.

To render the flow control valve inoperative during such instances where thermo-syphonic circulation is necessary, there is provided a suitable adjustment screw 52, the stated screw being disposed in operative relationship to a depending lug 53 formed as a part of the valve disk mounting tongue 45. As indicated in Fig. 3, suitable positioning of the adjustment screw 52 serves to maintain the valve disk 44 in full open status, or in any position of partial opening.

The boiler 11 may be of any type, that is, may be of the solid fuel combusting type or of the automatic oil or gas combusting type. In accordance with conventional practice, suitable known means may be provided whereby the water

temperature within the boiler may be maintained at any desired point consistent with the water pressure resulting from the elevation of the tank 17. In a conventional residence system where such tank elevation may be of the order of 15 feet above the highest radiator, the water temperature afforded by the resultant water pressure will be of the order of 225 degrees F.

The maintenance of an elevated water temperature condition within the boiler 11 results in a strong natural tendency toward thermo-syphonic circulation through the system. The weight of the valve disk 44 prevents an upward thermo-syphonic flow of water through the valve, whereas the "check valve" action of the valve 40 prohibits a reverse syphonic circulation.

In initiating the operation of the system, flow valve 40 may be held in open position by operation of the screw 52, to permit entrained or dissolved air to be driven through the system into the expansion tank 17 and into the various radiators 12, whence it may be removed by operation of conventional air release cocks. After such air removal, normal operation may begin.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

A heating system, comprising a boiler for generating hot water, a water circulation system operatively associated with said boiler and including a vertically disposed boiler outflow main, a supply main served by said outflow main for conducting heated water to radiator means, and a return main for conducting cooled water from said radiator means to said boiler; an open expansion tank in operative association with said circulation system and disposed at a high point of said heating system; normally closed valve means disposed in said vertically arranged outflow main to afford a substantially rectilinear path of upward flow of water through said outflow main and said valve, said valve means including valve seat means inclined upwardly in the direction of water flow and disposed transversely of said upward flow of water through said valve and freely swingable weighted valve disc means pivotally mounted adjacent a low point of said valve seat means; pump means operatively associated with said water circulation system for positively moving said valve disc means from its normally closed position to a substantially fully open position substantially parallel to the path of water flow through said valve; and thermostat means responsive to heat emission from said radiator means for controlling the periods of operation of said pump means.

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