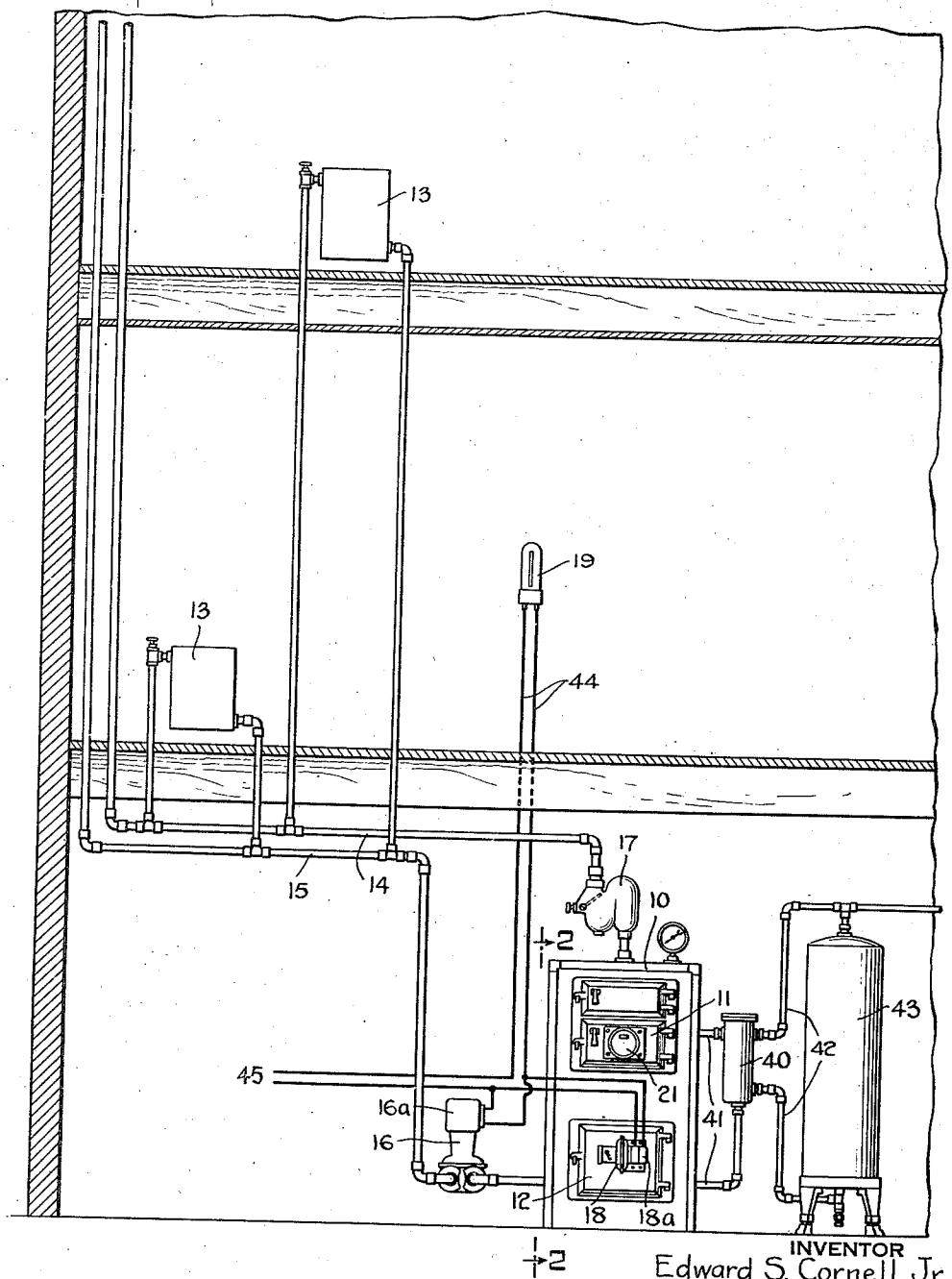
March 26, 1940. E. S. CORNELL, JR 2,194,691

HEATING SYSTEM

Filed July 1, 1938 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

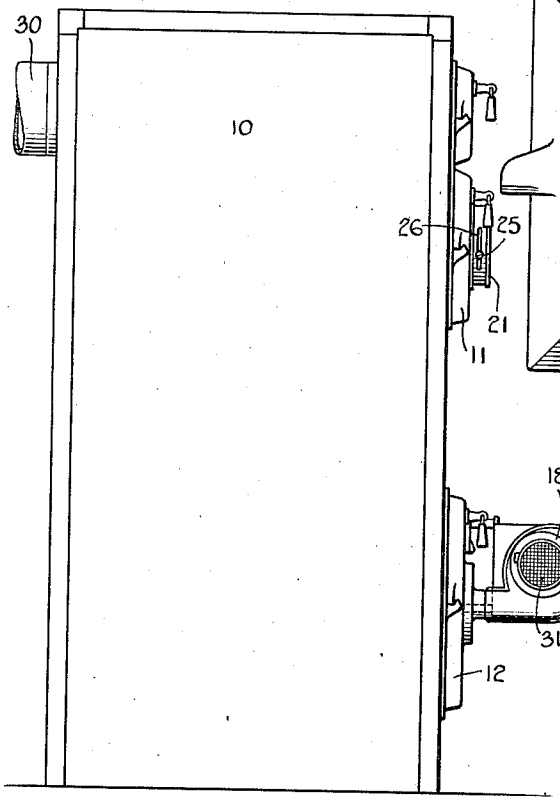


Fig. 3.

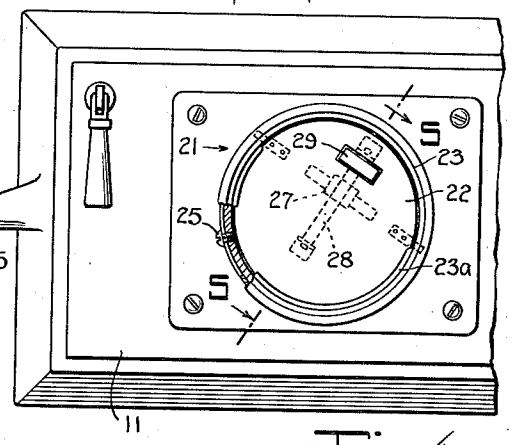


Fig. 4.

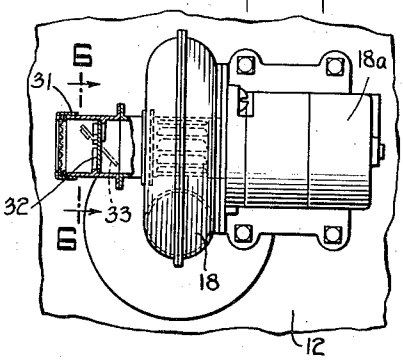


Fig. 5.

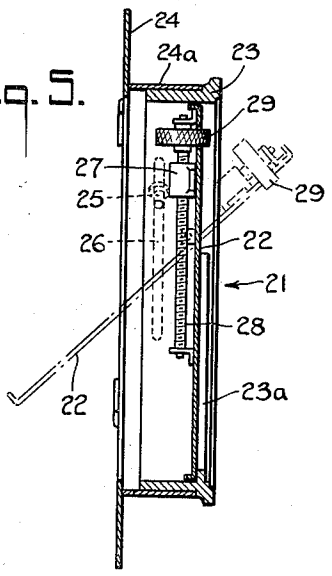
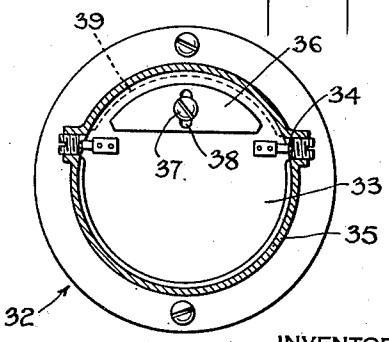


Fig. 6.



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Patented Mar. 26, 1940 2,194,691

UNITED STATES PATENT OFFICE

2,194,691

HEATING SYSTEM

Edward S. Cornell, Jr., Larchmont, N. Y., assignor, by mesne assignments, to American Radiator & Standard Sanitary Corporation, New York, N. Y., a corporation of Delaware

Application July 1, 1938, Serial No. 217,007

6 Claims. (Cl. 237—8)

My present invention is directed to improved heating systems.

More particularly, my invention is directed to heating systems embodying a boiler utilizing solid or equivalent fuel to form a fire bed through which air may be forced to promote combustion.

My invention is particularly applicable to all types of hot water heating systems.

In carrying out my invention, a boiler, say of the coal burning type, is connected by suitable piping with the one or more radiators of the heating system. Desirably, the heating system is controlled by a thermostat, which is conveniently located in a room or other space of the building or other enclosure served by the radiators, such room or other space being selected pursuant to accepted thermal practice well known to those skilled in the art. Desirably, also, I provide a water circulator directly or indirectly controlled by such thermostat. That is to say, under the stage of requirement of heat, the circulator is actuated to positively cause the flow of water through the piping and therewith through the respective radiators, the cooled water being returned to the boiler.

In the riser, i. e. the length of pipe connecting the heated water sections of the boiler with the piping system, I provide a suitable type of flow-control, the characteristics of which are, that under the stage of non-operation of the circulator, the valve of the flow-control is in closed position, in which latter status thermal-siphoning of the water through the piping and radiators is substantially prevented; further, during the stage of operation of the circulator the flow-control valve is in its open position, effected either positively under control of the thermostat or by the pressure of the water imposed thereon by the circulator.

A preferred form of flow control valve is set forth and claimed in my co-pending application Serial No. 171,540, filed October 28, 1937, entitled Air cushion fitting for thermal systems. My stated preferred flow control valve is also set forth and claimed in combination with another embodiment of thermal system in my co-pending application Serial No. 171,539, filed October 28, 1937, entitled Closed thermal system.

Coordinated with the aforesaid instrumentalities, I provide suitable means for the forced and controlled feed of air to the fire bed from the bottom thereof upwardly through the same. Preferably, such forced air feed means, e. g. a blower, is regulatable with respect to the quantity of air positively fed.

In the more preferred embodiments of my invention, I further provide suitable means, e. g. a fire-check, for affording supply of air from the outer atmosphere to the combustion chamber of the boiler, above the fire bed, during the stage of non-supply of forced air, and operative to exclude the entry of air from the outer atmosphere during the stage of supply of forced air. Such means is, therefore, effective for dampening the fire at periods of non-supply of forced air.

Preferably, control of forced feed of air below the fire bed, control of admission of atmospheric air above the fire bed, and control of forced circulation of water through the boiler and piping of the system is accomplished simultaneously through the medium of thermostat means, dampening of the fire being effected as a protection to the thermal sections of the boiler when the circulator is rendered non-operative.

My invention is also applicable for conjoint heating of hot water for domestic utilization purposes, whereby the heating of the domestic water supply takes place independently of the stages of operation and non-operation of the water pump.

In the drawings:

Fig. 1 illustrates a preferred embodiment of heating system pursuant to the present invention.

Fig. 2 represents a left-side elevation of the heating boiler of Fig. 1.

Fig. 3 represents an enlarged fragmentary detail view, in front elevation, of a preferred embodiment of fire-check disposed in the fire-door of the boiler of Fig. 2.

Fig. 4 represents a detail view in front elevation, and partly in vertical section, of a preferred type of blower functioning as the means for effecting forced feed of air beneath the fire bed of of the boiler.

Fig. 5 represents a vertical section taken on the line 5—5 of Fig. 3, on a somewhat enlarged scale.

Fig. 6 represents a section taken on the line 6—6, Fig. 4, on an enlarged scale.

Referring to the drawings: the illustrated heating system is of the hot water type, being either a closed system or one provided with an expansion tank according to well known practice. The system embodies a hot water boiler of the type provided with suitable grates for the support of solid fuel, such as coal, in the establishment of a fire bed below a combustion chamber. The combustion chamber, as is usual, is defined, at least in part, by water conducting sections for the heat-

ing of water circulated through the heating system.

The boiler 10 is provided with a fire door 11, usual in hand-fired types of boilers, serving to close the feed opening which communicates directly with the combustion chamber above the grates. An ash compartment of the usual type is provided below the grates, entrance thereto being had through an ash door 12, as is usual in boilers of this type.

The heating system comprises one or more (here shown as two) heat transfer devices, such as the usual type of radiator 13, communicating with the boiler by supply piping, indicated at 14, and return piping, indicated at 15.

A water circulator 16 is included in the system for effecting forced circulation of water through the water conducting sections of the boiler, through the heat exchangers, and through the interconnecting piping. Preferably, the water circulator is disposed in the return piping 15 at a location adjacent the boiler 10.

A flow-control 17 is disposed in the supply piping 14, preferably at a location adjacent the boiler 10, as a safeguard against thermal-syphoning of the water through the system when the circulator 16 is non-operative.

Efficient combustion of the coal, or other solid fuel employed for the formation of a fire bed on the grates of the boiler, is obtained by the provision of means for the forced supply of air below the fire bed. Such means advantageously takes the form of a blower 18, communicating with the ash pit of the boiler through the ash door 12. Because of the provision for forced supply of air, the cheaper grades of coal, such as pea and buckwheat, may be employed as fuel for the boiler.

Control of operation of the water circulator 16 and the blower 18 is preferably had simultaneously by means of a thermostat 19, common to both. Accordingly, upon actuation of the water circulator 17, the blower 18 will also be actuated to effect forced combustion of the fuel in the fire bed of the boiler coincidentally with forced circulation of water through the water conducting sections of the boiler and the piping of the system.

When the air of the enclosure served by the heating system has reached the desired temperature, as determined by the setting of the thermostat, both the forced feed of air to the fire bed of the boiler and the forced circulation of water throughout the system will be halted. Because the fire bed usually comprises a certain proportion of unconsumed fuel which prolongs actual combustion, and because continued application of heat to the water sections of the boiler after circulation of water therethrough has ceased, is likely to cause damage, it is preferred that means be provided for dampening the fire at the stage of non-operation of circulator and blower.

The dampening means may take the form of a fire-check device installed in the fire door 11, and constructed for automatic operation correlated with operation of the blower 18.

A satisfactory form of fire-check device is indicated at 21, the same being illustrated in detail in Figs. 3 and 5. It comprises a counterweighted circular damper 22 pivoted for opening and closing movement within a supporting ring 23. The supporting ring 23 is adjustably mounted within a ring formation 24a which extends from the outer face of a plate 24 secured to the fire door 11 of the boiler by suitable means as for instance screws. The ring formation 24a is concentric with ring 23, and fits about the latter as a sleeve. Limited adjustment of ring 23 and its supported damper about the axis of ring 24a is afforded by set screw 25 cooperating with the slot 26 formed in ring 23.

The counterweight of the damper 22 is preferably adjustable, and, accordingly, is provided with a traveler nut 27 mounted on a rotatable threaded shaft 28, the shaft 28 being radially placed with respect to the damper 22 and rotatable by means of the knurled disk 29.

Damper 22 is anti-frictionally pivoted in supporting ring 23, preferably well above its central horizontal axis, the line of pivot being adjustable with respect to the horizontal by set screw 25 operative in slot 26, see Fig. 3. A partial inwardly extending rim 23a formed about the lower portion of supporting ring 23 serves as a stop to limit outward swing of damper 22.

The balance of counterweighted damper 22 is adjusted in every instance so that the damper will remain closed during operation of the forced draft of blower 18, but will open by reason of the ordinary chimney draft when the blower is not in operation.

The blower 18, as illustrated in Fig. 4, may be equipped with an intake device 31 embodying a counterweighted check 32 operative to close the air intake port of the blower when the latter is idle. Thus passage of air through the fire bed by reason of natural draft is effectively prevented at the stage of non-operation of the blower.

The check device 32 is illustrated in detail in Fig. 6, and preferably comprises a counterweighted damper 33 anti-frictionally pivoted, as at 34, in supporting ring 35 at a location above the horizontal axis of the damper. The counterweight is advantageously provided by an auxiliary weight 36 adjustably secured to the upper part of damper 33 as by means of the set screw 37 cooperating with a vertical slot 38. A stop 39 may be formed about the upper portion of supporting ring 35, extending inwardly, to limit the movement of damper 33.

Accordingly, upon actuation of water circulator 16 and of forced draft blower 18 by thermostat 19, damper 33 of check device 32 will open to permit the inflow of air for forced passage through the fire bed of the boiler, while damper 22 of fire-check 21 will close precluding entry of atmospheric air to the combustion chamber above the fire bed. When, in response to thermostat 19, water circulator 16 and forced draft blower 18 become idle, damper 33 of check device 31 will close, precluding entry of air to the ash pit of the boiler and thus through the fire bed, while damper 22 of fire-check 21 will swing open by force of the natural draft, admitting atmospheric air to the combustion chamber of the fire bed for effectively dampening the fire.

Suitable additional control devices may be incorporated in the system to positively actuate water circulator 16 whenever forced draft blower 18 is in operation, thus safeguarding the water conducting sections of the boiler from excessive heat when there is no circulation of water therethrough.

Means for heating water for domestic supply may be embodied in the system, as for example, by employing a heat exchange device 40 connected by piping 41 with the heated water sections of the boiler 10, and connected by piping 42 with the interior of the storage tank 43.

The thermostat 19 is preferably of electrical

type, and the blower 18 or other positive air feeding means and the circular 16 actuated by electric motors. As shown in Fig. 1, the terminals of the thermostat 19 are suitably connected by the wiring 44 with the electric motor 16a of the circulator 16 and the electric motor 18a of the blower 18, which motors 16a and 18a are preferably connected in multiple. The electrical source is indicated at 45.

From the above, it is apparent that I have provided, in general, an efficient heating system employing solid fuel for the formation of a fire bed, a circulator for effecting forced circulation of thermal medium through the thermal piping of the system, means for the forced supply of air to the fire bed for promoting combustion thereof during the stage of forced circulation of the thermal medium, and a fire-check device for regulating the admission of atmospheric air to the combustion chamber of the fire bed to dampen the fire when the means for the forced supply of air to the fire bed is in non-operative status.

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:

1. The combination with a boiler provided with grate means adapted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relation with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, thermostat means responsive to the temperature of air served by said radiator or radiators, circulator means controlled by said thermostat means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, means for positively feeding air to said grate means for promoting combustion of fuel, means for supplying air to the combustion chamber of the boiler during the stage of non-operation of said positive air feeding means to thereby dampen the combustion of the fuel and for substantially precluding the supply of air during the stage of operation of said positive air feeding means to thereby promote the combustion of the fuel, and means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

2. The combination with a boiler provided with grate means adapted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relation with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, thermostat means responsive to the temperature of air served by said radiator or radiators, circulator means controlled by said thermostat means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, means for positively feeding air to said grate means for promoting combustion of fuel, means responsive to the operation of said positive air feeding means for substantially precluding the supply of air to said combustion chamber and responsive to the non-operation of said positive air feeding means to supply air to said combustion chamber, and means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

3. The combination with a boiler provided with grate means adapted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relation with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, thermostat means responsive to the temperature of air served by said radiator or radiators, circulator means controlled by said thermostat means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, means for positively feeding air to said grate means for promoting combustion of fuel, adjustable means controlled by said positive air feeding means for regulating the supply of air to the combustion chamber of the boiler during the stage of non-operation of said positive air feeding means to thereby dampen the combustion of the fuel and for substantially precluding the supply of air during the stage of operation of said positive air feeding means to thereby promote the combustion of the fuel, and means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

4. The combination with a boiler provided with grate means adopted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relations with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, electrical thermostat means responsive to the temperature of air served by said radiator or radiators, electrically actuated circulator means controlled by said thermostat means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping

arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, electrically actuated means for positively feeding air to said grate means for promoting combustion of fuel, means controlled by said electrically actuated positive air feeding means for supplying air to the combustion chamber of the boiler during the stage of non-operation of said positive air feeding means to thereby dampen the combustion of the fuel and for substantially precluding the supply of air during the stage of operation of said positive air feeding means to thereby promote the combustion of the fuel, and electrical means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

5. The combination with a boiler provided with grate means adapted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relation with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, thermostat means responsive to the temperature of air served by said radiator or radiators, circulator controlled by said thermostat means, means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, means for positively feeding air to said grate means for promoting combustion of fuel, adjustable means controlled by said positive air feeding means for regulating the supply of air to said combustion chamber responsive to the non-operation of said positive air feeding means and for substantially precluding the supply of air to said combustion chamber responsive to the operation of said positive air feeding means, and means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

6. The combination with a boiler provided with grate means adapted to combust solid or equivalent fuel, said boiler including a combustion chamber in heat exchange relation with hollow means arranged to contain a thermal medium, of one or more radiators, piping interconnecting said radiator or radiators with said hollow means of the boiler, electrical thermostat means responsive to the temperature of air served by said radiator or radiators, electrically actuated circulator means controlled by said thermostat means suitably connected with said piping for positively effecting the flow of the thermal medium through said piping and said radiator or radiators, flow control valve means controlled by said circulator means located in said piping arranged to afford flow of the thermal medium during the stage of operation of said circulator means and to preclude substantial flow of the thermal medium during the stage of non-operation of said circulator means, electrically actuated means for positively feeding air to said grate means for promoting combustion of fuel, means controlled by said positive air feeding means responsive to the operation of said positive air feeding means for substantially precluding the supply of air to said combustion chamber and responsive to the non-operation of said positive air feeding means to supply air to said combustion chamber, and electrical means interconnecting said thermostat means with said circulator and said positive air feeding means to effect stages of concurrent operation of said circulator and of said positive air feeding means and concurrent non-operation of said circulator and of said positive air feeding means.

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