April 28, 1936. F. C. BRODERICK 2,038,982

COMBINED WATER HEATER AND CIRCULATING UNIT

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Fig. 1

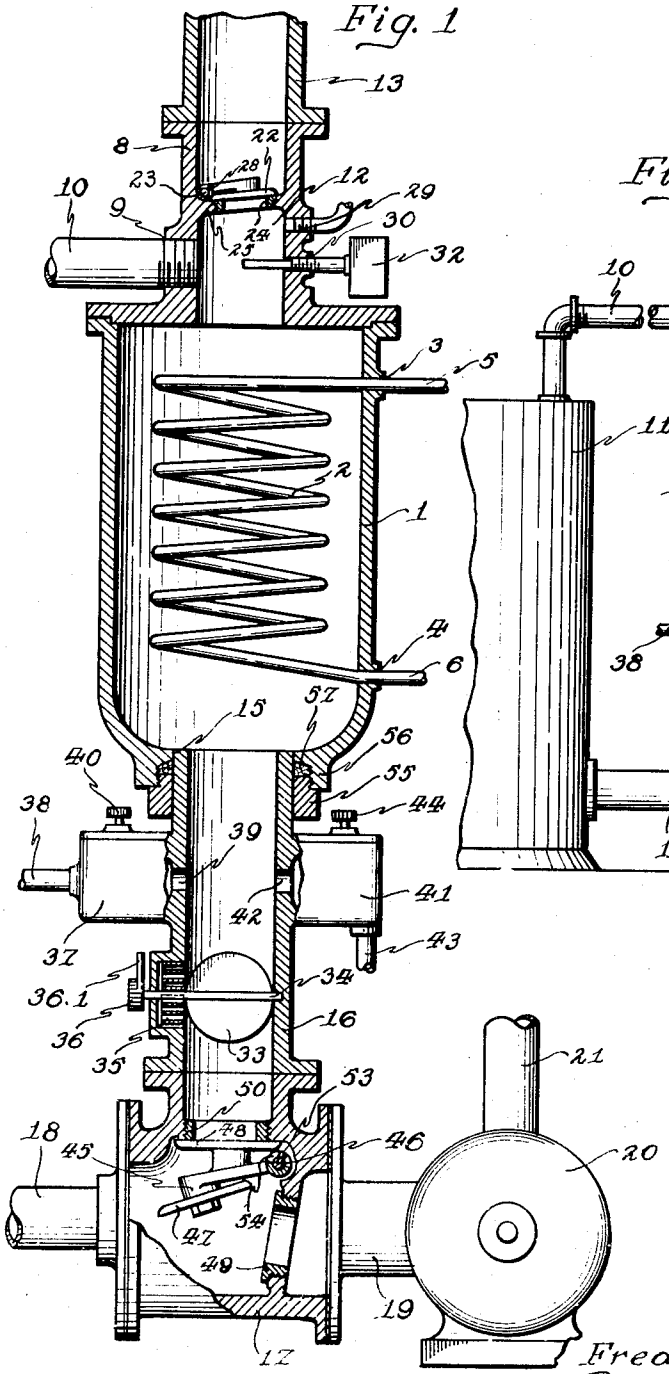
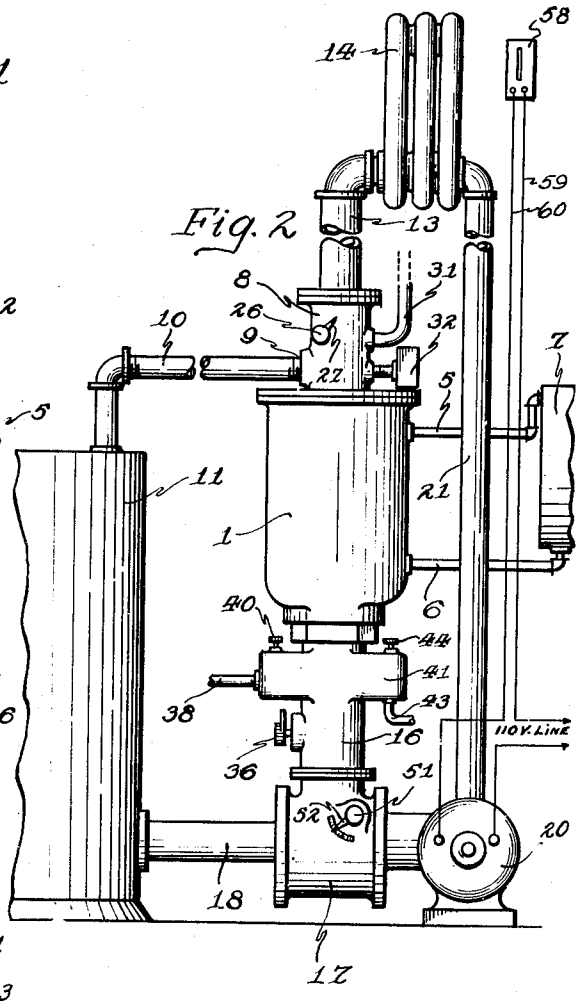


Fig. 2



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COMBINED WATER HEATER AND CIRCULATING UNIT

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8 Claims. (Cl. 237—19)

This invention relates to hot water heating systems and particularly to unitary fittings or devices which have the dual function of circulating hot boiler water throughout a premises heating system and providing a separate supply of hot water for domestic or other use.

The main objects of this invention are to provide as an article of manufacture an improved device or fitting embodying in a single unitary structure a domestic hot water heater together with all the elements necessary for complete control of boiler water circulation to and from a premises heating system; to provide such a device that can be completely produced and assembled at the factory and shipped as a single package to the user ready for simple connection into existing or new premises heating systems; to provide such a device having a telescoping construction to readily accommodate variations in the vertical spacing of the boiler supply and return connections and minimize expensive and time-consuming pipe cutting and fitting; and to provide such a device having means to positively control circulation of boiler water in the production of domestic hot water as well as circulation through the premises heating devices.

A specific embodiment of this invention is shown in the accompanying drawing in which:

Figure 1 is a sectional view showing an improved heating and circulating unit in elevation, and

Fig. 2 is a view of the same in elevation showing the several operative connections.

My improved heating and circulating device comprises mainly a unitary mechanical structure in the form of an indirect water heater having suitable fittings for direct connection with the usual supply and return connections of a boiler and including a supply connection for the premises heating devices and a circulating pump having provision for connection with the return conduit of the premises heating devices. Also the unit is arranged so that the water heater serves as a by-pass between the boiler supply and return connections and includes valve means which automatically direct the flow of boiler water either through the premises heating devices or through the water heater, according to whether or not there is a demand for heat from the premises heating devices, together with means which regulate the flow of boiler water through the water heater automatically according to the temperature of the boiler water.

In the form shown in the drawing, my improved unit comprises an indirect water heater shell or casing 1 enclosing a domestic water heating coil 2, the ends of which extend through ports 3 and 4 in the shell 1 and are connected by conduits 5 and 6 to a domestic hot water storage tank 7. At the top of the shell 1 is a hollow fitting 8 which serves as a closure for the shell and which is provided with a lateral port 9 arranged for connection with the main supply riser 10 of a boiler 11. The fitting 8 provides a passageway 12 which communicates at one end with the interior of the shell 1 and is connected at the other end with the main riser 13 leading to a premises heating device or radiator 14.

The lower end of the shell 1 terminates in an opening 15 in which is connected a tubular connecting member or fitting 16 which leads directly to a T-shaped two-way valve structure 17. One side of the valve or valve structure 17 is directly connected to the boiler return conduit 18 and the other side is connected directly to the discharge member 19 of a motor driven pump or circulator 20. The intake side of the pump 20 is directly connected with the return conduit 21 which leads from the radiator 14.

The pump or circulator 20 is not shown herein in detail but is more or less diagrammatically indicated since many forms of pumps might be used. However, the pump must be of a type that will pass water when not in operation, for a purpose that will be hereafter explained, and is preferably of the centrifugal type.

As shown in the drawing, the fitting 8 is provided with a swing check valve 22 positioned between the intake port 9 and the connection with the conduit 13. The check valve 22 is pivotally journaled on a shaft 23 so as to be freely swingable and is weighted to normally close, gravitationally, against a renewable bronze seat 24 screwed into an annular collar 25 formed in the passageway 12. One end of the shaft 23 extends through the wall of the fitting 8, through a suitable gland, not shown, and terminates in a knob 26 which is provided with a pointer 27 to indicate the position of a pin or lug 28 which is fixed to the shaft and which rides in a semicircular slot formed in the hub of the valve arm. Suitable means, not shown, are provided to prevent turning of the shaft 23 other than by means of the knob 26 and the slot in the valve arm is arranged so that the position of the pin or lug 28 may either determine the amount the valve will swing open or prevent the valve from closing.

The fitting 8 is also provided with two ports 29 and 30 below the entering side of the valve 22. The port 29 is arranged for connection by suitable

piping 31 to an expansion tank, not shown, which serves the additional purpose of receiving gases released or generated in the boiler water as the same is heated and preventing these gases from lifting the valve 22 and thus allowing a transfer of heat to the premises radiators when the valve 22 is intended to be closed.

The port 30, which is preferably disposed directly opposite the port 9, is arranged to receive an aquastat 32, or similar thermostatic control device, which is subject to boiler water temperatures and may be employed, in a manner not shown, to control a combustion device, not shown, for heating the boiler 11.

Fitting 16 serves mainly the purpose of connecting the shell 1 with the valve structure 17. However, use is made of this fitting for the incorporation of certain features necessary to carry out the intention of providing a complete unitary structure. One of these features is a valve arrangement 33 which is thermostatically controlled to close the passage through the fitting 16 when the water passing therethrough reaches a predetermined maximum temperature.

The valve 33 is of the butterfly type and is mounted on a shaft 34 extending transversely of the fitting 16 and projecting outwardly from one side thereof. A coiled thermostatic element 35, housed in an enlargement in the side wall of the fitting 16 and disposed so as to be responsive to the temperature of the water passing the said fitting, is provided to actuate the valve 33.

The element 35 is coiled around the shaft 34 and is arranged to rotate the shaft directly in response to a coiling or an uncoiling movement of the element under thermostatic influence; thus temperature changes in the water passing through the fitting will cause the thermostatic element 35 to expand or contract and in this way cause the valve 33 to shift to either an open or closed position.

On the end of the shaft 34, projecting from the fitting 16, is a knob 36 having a pointer 36.1 by means of which the valve and the thermostatic element might be adjusted for a predetermined temperature range within which it is desired to operate. The construction of the thermostatic element 35, together with the associated mechanisms for its adjustment, is not shown in detail for the reason that such constructions are old and well known in the art and any of the several well-known arrangements might be readily employed.

The other devices which are mounted on the fitting 16 comprise a pressure reducing valve 37 which is connected by means of a pipe 38 with the city water lines and which communicates with the passageway in the fitting 16 through a port 39 for the purpose of supplying fresh water to the heating system to make up for any losses from the system that might in any way occur.

The pressure reducing valve 37 is not shown in detail since such constructions are well known in the art but it is understood that the device is one which, having been set for a predetermined water pressure by means of an adjusting screw 40, will, upon a drop of pressure within the system below the predetermined point, admit fresh water from the city lines into the system by way of the port 39.

As shown in Fig. 1, a pressure relief valve 41 is also mounted on the fitting 16 and communicates with the interior thereof through a port 42 for the purpose of relieving water from the system in the event that the pressure therein goes beyond a predetermined maximum point. The pressure relief valve 41 is also not shown in detail for the reason that such constructions are well known. However, as shown, the relief valve 41 is provided with a drain connection 43 which preferably leads to a sewer to care for any water that is relieved from the system; and is also provided with an adjusting screw 44 by which the pressure relief mechanism is set for the predetermined relieving pressure.

The valve mechanism 17 comprises a T-shaped housing arranged with its center opening connected directly to the fitting 16. The lateral openings are flanged as shown in Figure 1 and are connected respectively with the discharge portion 19 of the circulator or pump 20 and the return conduit 18 leading directly to the boiler.

As shown, the valve structure 17 is provided with a two-way valve mechanism comprising an arm 45 pivotally mounted on a shaft 46 and carrying a pair of oppositely disposed valve discs 47 and 48. This valve mechanism is weighted so as to normally and gravitationally seat the valve disc 47 against a bronze seat 49 removably mounted in the lateral opening of the valve structure 17 which is connected with the discharge portion of the pump 20. The arm 47 is so positioned that upon swinging vertically, the valve disc 48 will seat against a bronze seat 50 removably mounted in the center opening of the valve structure. Thus upon a velocity flow of water being created by the pump or circulator 20 the valve disc 47 is unseated and the valve mechanism is swung upwardly so that the valve disc 48 seats itself to close the passageway through the fitting 16 and the tank or shell 1.

The shaft 46 is arranged to extend through one side of the valve structure 17 and project outwardly therefrom where it carries a knob 51 having a pointer 52.

The arm 45 is journaled on the shaft 46 so as to be freely swingable on the shaft axis and the shaft 46 is provided with a fixed pin or lug 53 which rides in a semicircular slot or groove 54 formed in the hub of the arm 45. Thus upon rotation of the shaft 46 by means of the knob 51, the pin 53 can be positioned so as to either hold the valve 48 against the seat 50 or the valve 47 against the seat 49 or limit the amount of movement of the valve arm 45 toward or away from either of the seats 49 or 50, through engagement of the pin with the ends of the semicircular slots 54, the pointer 52 indicating the position of the pin 53.

It will now be seen that the completely assembled unit comprises all of the several devices that are necessary for complete control of the flow of boiler water either through the premises heating circuit or through the domestic hot water heating circuit; as well as providing means for supplying fresh water to the system or relieving water from the system upon the occurrence of an excess pressure therein and connections for thermostatic control of the boiler heating unit together with the necessary connection for an expansion tank. Thus, in one simple unit which may be completely assembled at the factory and shipped as a single package to the user, a device is provided which may be readily connected with an existing or new heating system and in which all necessary plumbing connections are brought to one common location. In this way the necessity of installing many separate devices distributed over various parts of

the heating plant is obviated, greatly reducing the cost of the installation in both labor and materials.

As shown in Fig. 1, the unit is particularly designed to facilitate connections with the boiler supply and return mains through the provision of a telescoping connection between the fitting 16 and the shell 1. Such a connection is had by slidably inserting the upper end of the fitting 16 into the aperture 15 in the bottom of the shell 1 and locking the fitting to the shell 1 by means of a nut 55 which surrounds the upper end of the fitting 16 and screws into an internally threaded collar 56 on the bottom of the shell 1.

An annular friction packing member 57 is provided within the collar 56 and is arranged to be compressed by the nut 55 so as to frictionally grip the end of the fitting 16 to hold the same and securely seal the joint.

At the time of manufacture, the fitting 16 is made of such length as to provide the maximum distance between the supply connection 10 and the return connection 18 that might be required in installation. During installation should the distance between the supply connection 10 and the return connection 18 be less than that provided by the length of the fitting, it is only necessary to cut off a portion of the fitting 16 or slidably telescope the same into the shell 1 until the distance between the connections 10 and 18 is such as to fit the particular boiler with which the unit is to be associated. Thus the unit not only contains in one structure all of the many devices that ordinarily are separately installed in a heating system, but is also arranged so as to fit any particular boiler specifications without the necessity of time-consuming and expensive pipe cutting and fitting; the vertical distance between connections 10 and 18 on the unit being adjusted on the job to exactly fit the distance between the supply and return connections of the boiler.

In operation of my improved water heating and circulating unit, after the necessary connections have been made with the respective boiler and radiator supply and return lines, the hot water storage tank, the fresh water supply line, the relief water drain and the electrical control circuits of both the aquastat and the circulating pump, the check valves 22 and 47 are normally seated to close the passage to the radiator through the conduit 13 and from the radiator on the pump side of the valve 17. Thus the boiler water is free to circulate gravitationally from the boiler through the conduit 10 to the heater shell or tank 1 and thence by way of the connection 16, the valve 17 and the return conduit 18 back to the boiler, heating the coil 2 while so circulating. Heat transferred to the coil 2 is transmitted to water for domestic use, circulating therethrough gravitationally from the tank 7 and is stored in the said tank.

If during such gravitational circulation through the heater shell 1, the boiler water should reach a predetermined maximum temperature, the valve 33 will be automatically actuated by the thermostatic element 35 and close the passage through the fitting 16; thus stopping circulation over the coils 2 and preventing the domestic water being heated beyond a maximum predetermined temperature.

Upon a demand for heat on the part of the room thermostat 58, which is positioned to be affected by the radiator 14, the thermostat 58 will close a circuit through the leads 59 and 60 energizing the motor of pump or circulator 20 and causing the pump to force circulation of boiler water to and from the radiator 14.

Operation of the pump 20 will unseat the valve 47, due to velocity of the water flow, and cause the arm 45 to swing upwardly and seat the valve 46, closing the passage through the fitting 16. Also the valve 22 will be opened by the forced flow of water through the radiator 14 and then the boiler water will be caused to circulate from the boiler 11 through the conduit 10, the fitting 8, the radiator supply conduit 13, through the radiator 14 and return line 21 to the pump 20 and thence, through the valve structure 17 and boiler return connection 18 back to the boiler 11. Such circulation will continue until the thermostat 58 is satisfied and then the thermostat will break the circuit between the leads 59 and 60 and cause the pump 20 to stop. As soon as the pump 20 is stopped, the valves 22 and 47 will seat themselves in their normal positions closing off the circuit to and from the radiator 14 and then the boiler water will again be free to circulate gravitationally from the boiler through the heater shell 1 and back to the boiler to heat water for domestic use.

It will now be readily seen that when the pump is stopped and the valves 22 and 47 are adjusted to be normally seated, there is no possibility of heat being transferred to the radiator 14 when it is undesired, either through the supply line or the return line of the radiator. Thus, in summer operation, when the boiler is serving to heat water for domestic use, no heat will be passed to the radiator 14 since the thermostat 58 will maintain an open circuit between the leads 59 and 60 preventing operation of the pump 20.

During winter-time operation of a hot water heating system, it is sometimes desirable to provide for a minimum flow of hot boiler water to and from the premises heating radiators, even though there is no call for heat on the part of the room thermostat, in order to obviate a condition in the premises known as a "cold 70°". Such a condition exists when the room temperature at the level of the room thermostat is at approximately 70° F. and is characterized by the fact that the temperature adjacent the floor is at a point sufficiently below 70° F. to cause drafts and discomfort to occupants of the premises. This condition is caused when there is no circulation to the radiators and when the radiators are cold; and is obviated by maintaining a predetermined minimum circulation of boiler water to the radiators in order to keep them warm, so as to heat the room air adjacent the floor.

In the hereindescribed apparatus and when a minimum circulation of heating medium to the radiators is desired, the valves 22 and 47 in the supply and return lines respectively of the radiator are adjusted so that they will remain partially open even though the circulator 20 is not in operation, such adjustment being had by means of the knobs 26 and 51 on the valve pivots or shafts 23 and 46 respectively, wherein the fixed pins or lugs carried by the shafts are positioned so as to prevent the valves from completely closing. Since the pump or circulator 20 is of a type that will pass water even though not operating, it will be readily seen that a minimum circulation to and from the radiators will thus be had through thermal gravitational action of the heating medium.

Also in the event that the circulator or pump should, for any reason, become disabled, a ther-

mal-gravitational circulation of heating medium to and from the radiators for general premises heating purposes can be had by adjusting the valve knobs 26 and 51 so that the valves will be entirely open. However, in such a case the knob 51 on the shaft 46 would preferably be so adjusted that the valve 48 would not be entirely seated so that some of the heating medium coming from the boiler through the supply conduit 10 may be by-passed through the heater shell 1 and the fitting 16 in order to maintain a supply of domestic hot water.

A particular advantage of my improved heating and circulating unit is the fact that the construction is such as to require a minimum of head room in the basement where the installation is usually made, the unit being so arranged that the boiler supply connection is at its top and boiler return connection at its bottom; thereby permitting an installation wherein the heating and circulating unit need extend above the boiler only a very short distance, if at all.

Another advantage of my improved unit is its telescoping construction whereby its length or distance between the supply and return conduit connections can be adjusted to suit any particular boiler specifications; thus simplifying the procedure of connecting the unit to the boiler and requiring only a minimum of pipe cutting and fitting in order to make the installation.

Another advantage of my unitary water heating and circulating construction is the arrangement wherein short-circuiting of the radiator return water through the heater and back to the radiator supply pipe is completely obviated, the construction being such that the circuit of circulating heating medium can only be that which is desired.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that numerous details may be altered or omitted without departing from the spirit of the invention, as defined by the following claims.

I claim:

1. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port in its upper portion for connection with a boiler supply conduit and a second port adjacent the first port for connection with a radiator supply conduit, said ports communicating with each other, a check valve adjacent said second port arranged to normally close the passage therethrough and to be shiftable by a forced flow of water toward said radiator to open said second port, an outlet port in the lower portion of said water heater, a two-way check valve having an opening connected to said outlet port, said two-way valve having a second opening for connection with a circulator and a third opening for connection with a boiler return conduit, and valve means in said two-way valve arranged to normally close said second opening and to be shiftable by a forced flow of water from the circulator to open said second opening and close the opening connected to said water heater outlet port.

2. As an article of manufacture, a device of the class described comprising a hollow shell, a heat transfer coil disposed within said shell and having inlet and outlet connections extending through the wall thereof, a port in the upper portion of said shell for connection with a boiler supply conduit, a second port in the upper portion of said shell for connection with a radiator supply conduit, said ports being in communication with each other and the interior of said shell, a check valve disposed adjacent said second port and arranged to normally close the passage therethrough, said check valve being shiftable under a forced flow of water toward the radiator to open said second port, a two-way check valve connected to the lower portion of said shell and having an opening in communication therewith, said two-way valve having a second opening for connection with a boiler return conduit and a third opening for connection with a circulator, and a valve means in said two-way valve arranged to normally close the said third opening and to be shiftable under a forced flow of water from the circulator to open said third opening and close communication with said shell.

3. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port in its upper portion for connection with a boiler supply conduit and a second port adjacent the first port for connection with a radiator supply conduit, said ports communicating with each other, a check valve adjacent said second port arranged to normally close the passage therethrough and to be shiftable by a forced flow of water toward said radiator to open said second port, an outlet port in the lower portion of said water heater, a two-way check valve having an opening connected to said outlet port, said two-way valve having a second opening for connection with a circulator and a third opening for connection with a boiler return conduit, valve means in said two-way valve arranged to normally close said second opening and to be shiftable by a forced flow of water from the circulator to open said second opening and close the opening connected to said water heater outlet port, and means connecting said two-way valve with said heater outlet port arranged to permit adjustment of said two-way valve toward and away from said heater.

4. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port at its upper portion for connection with a boiler supply conduit and an outlet port at its lower portion, a connection at the upper portion of said heater for a radiator supply conduit, said connection communicating with said inlet port, a check valve in said connection arranged to normally close the passage therethrough and to be shiftable by a forced flow of water toward said radiator to open said passage, a two-way check valve having connection with said outlet port. said two-way check valve having an opening for connection with a boiler return conduit and another opening for connection with the discharge side of a circulator, valve means in said two-way valve arranged to normally close the opening thereof connected with the circulator and to be shiftable by a forced flow of water from said circulator to close the connection with said heater outlet port, and a thermostatically actuated valve arranged to close communication between said heater outlet port and said two-way valve in response to a predetermined maximum temperature of boiler water passing through said heater.

5. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port at its upper portion for connection with a boiler supply conduit and an outlet port at its lower portion, a connection at the upper portion of said heater for a radiator

supply conduit, said connection communicating with said inlet port, a check valve in said connection arranged to normally close the passage therethrough and to be shiftable by a forced flow of water toward said radiator to open said passage, a two-way check valve having connection with said outlet port, said two-way check valve having an opening for connection with a boiler return conduit and another opening for connection with the discharge side of a circulator, valve means in said two-way valve arranged to normally close the opening thereof for connection with the circulator and to be shiftable by a forced flow of water from said circulator to close the connection with said heater outlet port, and a fitting connecting said two-way valve with said heater outlet port and providing a passage therebetween, said fitting having a telescopingly adjustable connection with said outlet port.

6. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port at its upper portion for connection with a boiler supply conduit and an outlet port at its lower portion, a connection at the upper portion of said heater for a radiator supply conduit, said connection communicating with said inlet port, a check valve in said connection arranged to normally close the passage therethrough and to be shiftable by a forced flow of water towards said radiator to open said passage, a two-way check valve having an inlet opening connected with said outlet port, said two-way check valve having a second inlet opening and an outlet opening for connection with a boiler return conduit, a circulator having its discharge portion connected to said second inlet opening of said two-way valve, and valve means in said two-way valve arranged to normally close the second inlet opening thereof and to be shiftable by a forced flow of water from said circulator to close the first inlet opening of said two-way valve.

7. As an article of manufacture, a device of the class described comprising an indirect water heater having an inlet port at its upper portion for connection with a boiler supply conduit and an outlet port at its lower portion, a connection at the upper portion of said heater for a radiator supply conduit, said connection communicating with said inlet port, a check valve in said connection arranged to normally close the passage therethrough and to be shiftable by a forced flow of water toward said radiator to open said passage, means associated with said check valve arranged to be manually adjustable to prevent closing of said valve, a two-way check valve having an inlet opening connected with said outlet port, said two-way check valve having a second inlet opening and an outlet opening for connection with a boiler return conduit, valve means in said two-way valve arranged to normally close the second inlet opening thereof and to be shiftable by a forced flow of water through said second inlet opening to close the first inlet opening of said two-way valve, and means associated with said valve means arranged to be manually adjustable to prevent said valve means from closing said second inlet opening of said two-way valve.

8. A device of the class described comprising an indirect water heater having an inlet port at its upper portion for connection with a boiler supply conduit and an outlet port at its lower portion, a two-way check valve having an inlet opening communicating with said outlet port and an outlet opening for connection with a boiler return conduit, said two-way valve having a second inlet opening for connection with a circulator, valve means in said two-way valve arranged to normally close said second inlet opening thereof and to be shiftable under a forced flow of water into said second inlet opening to close the first inlet opening of said two-way valve, and a fitting connecting said two-way valve with said heater outlet port, said fitting having an adjustable telescoping connection with said heater outlet port.

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