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HEATING SYSTEM DEVICE

1,952,823

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Fig. 1.

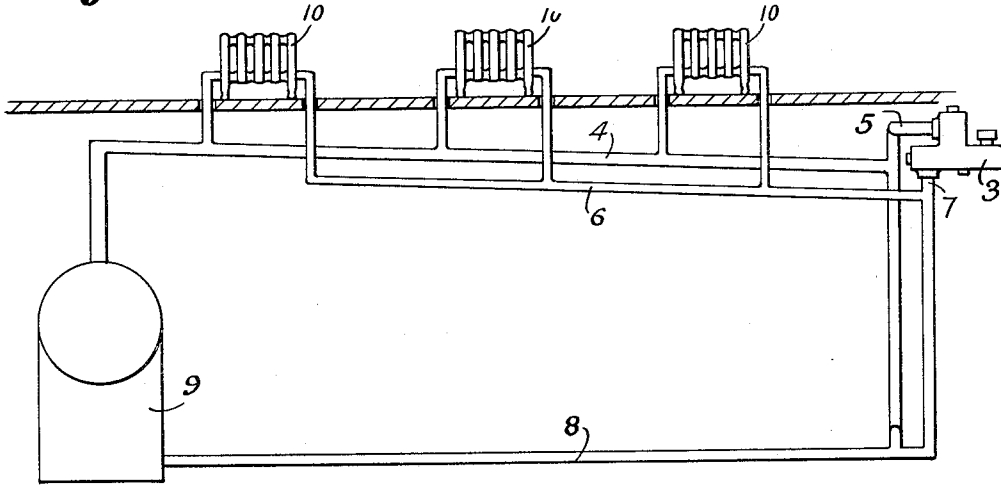
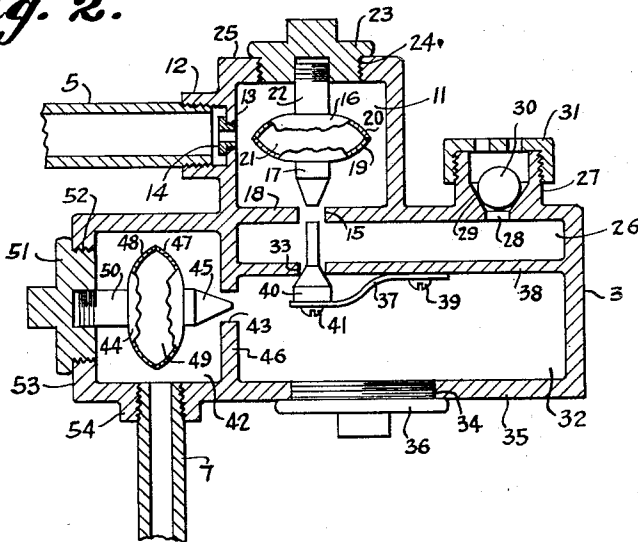


Fig. 2.



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1,952,823

HEATING SYSTEM DEVICE

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8 Claims. (Cl. 237-68)

My invention relates to heating system devices and the like and has among its other objects the production of devices of the kind described which are compact, convenient, durable and satisfactory for use wherever found applicable.

My invention is particularly adapted to be used in combination with steam heating systems such as are employed to heat dwellings but it is to be understood that the invention is limited to this use only to the extent indicated in the appended claims.

A particular object of the invention is to provide an improved means whereby all radiators in the system are supplied with steam uniformly.

Another particular object of the invention is to provide an improved means whereby air is expelled from supply and return mains substantially without loss of steam.

A still further object of the invention is to provide a means whereby air cannot enter the system through the device even though subatmospheric pressures may exist therein.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

To this end my invention consists in the novel construction, arrangement and combination of parts herein shown and more particularly pointed out in the claims.

In the drawing, wherein like reference characters indicate like or corresponding parts:

Figure 1 shows diagrammatically the application of the device to a steam heating system, and

Figure 2 is an enlarged sectional elevation of the device shown in Figure 1, showing the construction details thereof.

Referring to the drawing, the reference character 3 designates generally the device which is preferably connected to the end of the supply and return mains of a heating system. As shown in Figure 1, the device is operatively connected to a supply main 4 of a heating system by means of pipe 5 and to a return main 6 by pipe 7, a wet return main 8, steam boiler 9 and radiators 10, 10, 10 being connected and shown at the usual position in the system. In the illustrated embodiment of the invention, Figure 2, the pipe 5 is provided for operatively connecting the tank 11 to the end of a supply main, the pipe 5 being screw-threaded into a boss 12 which is preferably formed integral with the tank 11. Within boss 12 is preferably provided partition 13 into which is screw-threaded orifice 14 through which pipe 5 communicates with tank 11. Tank 11 com-

municates with tank 26 through aperture 15. The aperture 15 is preferably controlled by a thermostatic device which is designated generally by the reference character 16 and preferably comprises a valve member 17 adapted to engage the partition 18 to close the aperture 15. The valve member 17 is carried by a diaphragm 19 which cooperates with a diaphragm 20 to form a chamber 21, the chamber 21 being preferably filled with a fluid which is responsive to variations in temperature. Rigidly secured to diaphragm 20 is a post 22 which is screw-threaded into a plug 23, the plug 23 being screw-threaded into aperture 24 provided in the wall 25 of tank 11.

Adjacent to tank 11 is a tank 26, in one side of which is provided a check valve for operatively discharging air accumulated in tank 26. The check valve comprises preferably a boss 27 which is formed integral with the tank 26 having a passage 28 whereby the tank 26 may communicate with the exterior of the tank. Formed in passage 28 is valve seat 29 engageable by a light-weight metal ball 30. Screw-threaded to integral boss 27 is a perforate retainer cap 31. Adjacent to tank 26 is a tank 32 which may communicate with tank 26 through aperture 33. To permit access to tank 32 I preferably provide an aperture 34 in wall 35 of tank 32 into which is screw-threaded plug 36. A spring means 37 preferably attached at one end to partition 38 by a screw 39 and at the other end to valve member 40 by a screw 41 is normally constrained to close aperture 33 by causing valve member 40 to engage partition 38. Valve member 40 extends through tank 26 to aperture 15 substantially as shown, being of sufficient length so as to project into the operating range of valve member 17 of thermostatic device 16 so that when thermostatic device 16 operates to engage partition 18 and close aperture 15, valve member 17 engages valve member 40 to open aperture 33 in partition 38 as hereinafter described. Adjacent to tank 32 is a tank 42 communicating with tank 32 through aperture 43. Aperture 43 is preferably controlled by a thermostatic device which is designated generally by the reference character 44 and preferably comprises a valve member 45 adapted to engage partition 46 to close aperture 43. The valve member 45 is carried by a diaphragm 47 which cooperates with a diaphragm 48 to form a chamber 49, the chamber 49 being preferably filled with a fluid which is responsive to variations in temperature. Rigidly secured to diaphragm 48 is a post 50 which is screw-threaded into a plug 51, the plug 51 being screw-threaded into aperture 52 provided in wall 53 of tank 42.

A pipe 7 is provided for operatively connecting the tank 42 to the end of a return main, the pipe 7 being screw-threaded into a boss 54 which is preferably formed integral with the tank 42 so that pipe 7 may communicate with the interior of tank 42.

The operation of the above described apparatus is substantially as follows: Assuming that the device is connected to a heating system substantially as shown in Figure 1, it is obvious that as steam is generated in the boiler 9, steam will flow into supply main 4 and advance to pipe 5 at the end of the main, expelling air from the supply main as it advances through device 3. As is evident in Figure 2, any fluid flow into tank 11 from pipe 5 must pass through orifice 14. Since the diameter of orifice 14 is less than the diameter of pipe 5 it serves as a restriction to fluid flow into the device, the amount or rate of flow depending substantially upon the pressure at the orifice and the diameter thereof. The reason for installing the orifice will be stated hereinafter. When the system is cold, air normally fills the system above the boiler water line level. This air within the piping and radiators is at room temperature and consequently, when steam generated within the boiler expands and fills the system, the air is expelled through device 3 and being at room temperature does not affect thermostatic device 16 in entering tank 11 but passes through aperture 15 into tank 26. The steam pressure upon the air caused by the steam being generated and expanding to fill the system, raises the ball check 30 off of seat 29 thus permitting air discharge to the exterior of tank 26 through passage 28. The retainer cap 31 prevents the loss of ball check 30, the ball check 30 returning to seat 29 by gravity after all air is expelled. Eventually all air contained in supply main 4 is expelled and steam enters tank 11 through pipe 5 and orifice 14 and while it is obvious that some of the steam will escape at first into tank 26, the thermostatic device 16 is so constructed that when it is subjected to the relatively high temperature of the steam, the fluid in the chamber 21 expands and causes the valve member 17 to close the aperture 15. However, before valve member 17 can completely close aperture 15 it engages valve member 40 and as valve member 17 continues to advance to engage partition 18 to close aperture 15 it overcomes the pressure that spring 37 exerts on valve member 40 to close aperture 33 and disengages valve member 40 from partition 38, thus opening aperture 33. Subsequently valve member 17 advances and engages partition 18 closing aperture 15. Now since aperture 15 is closed and aperture 33 is open it is obvious that fluid flow from the supply main is stopped and that fluid flow through device 3 can take place only from return main 6, through pipe 7 into tank 42, through aperture 43 into tank 32, thence through aperture 33 into tank 26 where it is discharged to the exterior of tank 26 through passage 28 as described above. It is further obvious, since flow from return main 6 into device 3 can now take place, that steam from supply main 4 will flow into radiators 10, 10, 10 substantially at the same time, forcing air from the radiators into return main 6 from which it flows through pipe 7 into device 3 to be expelled as previously explained. Eventually all air contained in radiators 10, 10, 10 and return main 6 is expelled and steam enters tank 42 through pipe 7 and while it is obvious that some of the steam will escape at first into tank 32 the thermostatic device 44 is so constructed

that when it is subjected to the relatively high temperature of the steam, the fluid in the chamber 49 expands and causes the valve member 45 to close the aperture 43.

The heating system shown in Figure 1 shows but one pair of supply and return mains. Actually, in practice, a multiplicity of pairs of branch supply and return mains might exist in a heating system, depending upon conditions involved. In such cases, I contemplate the application of the device to the ends of each pair of branch mains. The length of each pair of branch mains may differ so that the total pipe friction, or resistance to steam flow, from boiler to each device will vary accordingly. In order to make the flow of steam to all radiators uniform, in systems having a multiplicity of pairs of branch mains, an orifice 14 is inserted in each device to regulate the rate of fluid flow into each device, said orifices restricting the fluid flow as previously explained. The diameter of orifice 14, of each device, is sized to equalize the resistance to steam flow in each branch supply main from source of steam supply into tank 11. Since tank 11 of each device receives steam at substantially the same time, thermostatic device 16 operates to close aperture 15 and open aperture 33, of each device, accordingly. It is obvious, therefore, since aperture 33 of each device opens at substantially the same time, and permits venting of return mains, that steam will flow to all radiators at substantially the same time.

With both apertures 15 and 43 closed, fluid flow through device 3 is stopped and ball check 30 restfully engages seat 29. If steam condenses in the radiators and piping faster than it is being generated in the boiler sub-atmospheric pressures may exist within the system and the usual benefit gained therefrom, for, although the steam temperature resulting from sub-atmospheric steam pressures may be insufficient to cause the fluid within the chambers 21 and 49, of thermostatic devices 16 and 44, to continue to respond and maintain apertures 15 and 43 closed, air cannot enter the system through device 3 since ball check 30 engages seat 29. Obviously, the greater the difference between atmospheric pressure and sub-atmospheric pressure within the system the more intensely does ball check 30 engage seat 29, thus preventing air from entering through passage 28.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of the invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement or combination of parts herein shown and described, or uses mentioned:

What I claim as new and desire to secure by Letters Patent is:

1. In a heating system device having an upper tank, said upper tank having a fluid inlet adapted for connection with a steam supply main and a fluid outlet, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a tank ad-

5 adjacent to said lower tank, and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank adapted for connection with a return main.

10 2. A heating system device comprising four communicating tanks, a first tank having a fluid inlet for operatively connecting to a steam supply main and a fluid outlet, said fluid outlet communicating with a second tank, an accessible valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said second tank having a fluid discharge valve communicating with the exterior of the second tank and a fluid inlet communicating with a third tank, an accessible valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a fourth tank having a fluid outlet communicating with the third tank, and an accessible valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said fourth tank for operatively connecting to a return main.

15 3. In a steam heating system, the combination of a device for venting a steam supply main and a steam return main at a point posterior to points of their connection with heat exchange devices, said device comprising a plurality of communicating tanks, an upper tank having a fluid inlet connected with the end of a steam supply main and a fluid outlet, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank connected with the end of a steam return main.

20 4. A heating system device comprising four communicating tanks, an upper tank having a fluid inlet adapted for connection with the end of a steam supply main and a fluid outlet, a removably positioned orifice within said fluid inlet, said fluid outlet communicating with an intermediate tank, a valve controlling said outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank adapted for connection with the end of a return main.

25 5. In a heating system the combination of a source of steam, a system of piping and a plurality of heat exchange devices, a device for in-

itiating fluid flow uniformly to all heat exchange devices, said device consisting of four communicating tanks, an upper tank having a fluid inlet connected with a supply main posterior to points of connection with the heat exchange devices, and a fluid outlet, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank connected with a return main posterior to points of connection with the heat exchange devices.

30 6. In a heating system the combination of a source of steam, a system of piping and a plurality of heat exchange devices, a device for establishing uniform fluid flow to all heat exchange devices, said device comprising four communicating tanks, an upper tank having a fluid inlet connected with the end of a supply main and a fluid outlet, a removably positioned orifice within said fluid inlet, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet arranged to close its inlet when the first mentioned valve is open, and to open upon closing of the first mentioned valve, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and a fluid inlet to said adjacent tank connected with the end of a return main of system piping, a removably positioned orifice within fluid inlet, a fluid outlet and a valve controlling fluid outlet, a second tank having a fluid inlet from end of system piping, a fluid outlet and a valve controlling fluid outlet, a third tank having an inlet from second tank and an outlet, a valve operatively controlling said outlet extendable through a fourth tank and engageable with valve of first tank and yieldable means normally constrained to close valve, said valve being opened by valve of first tank after valve of first tank has partially closed, said fourth tank having a fluid inlet from first tank, a fluid outlet and a valve controlling fluid outlet.

35 7. In a heating system device having an upper tank, said upper tank having a fluid inlet adapted for connection with a steam supply main and a fluid outlet, and having an orifice within said fluid inlet for establishing the rate of fluid flow into said upper tank, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last men-

tioned inlet arranged to close its inlet when the first mentioned valve is open, and to open as the first mentioned valve is closing, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank adapted for connection with a return main.

8. A heating system device having an upper tank, said upper tank having an orificed fluid inlet adapted for connection with the end of a steam supply main and a fluid outlet, said fluid outlet communicating with an intermediate tank, a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, said intermediate tank having a fluid discharge valve communicating with the exterior of the intermediate tank and a fluid inlet communicating with a lower tank, a valve in the last mentioned inlet and yieldable means to maintain it closed when the first mentioned valve is open, said last mentioned valve being arranged to open when the first mentioned valve is substantially closed, a tank adjacent to said lower tank and having a fluid outlet communicating with the lower tank, and a valve controlling said fluid outlet, said valve allowing the passage of air but preventing the passage of steam, and an inlet to said adjacent tank adapted for connection with the end of a return main.

CLIFFORD J. SCHLAFMAN.

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