(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 749 819 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.07.2014 Bulletin 2014/27

(51) Int Cl.:
F24D 3/08 *(2006.01)* ***F28D 21/00*** *(2006.01)*

(21) Application number: **13197862.9**

(22) Date of filing: **17.12.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **28.12.2012 GB 201223481**

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(54) A system and method for heating fluids, and an adapter for use with a boiler

(57) A fluid heating system, comprising: a heater having an inlet and an outlet; a storage vessel; a fluid mixer having a first inlet for receiving fluid stored in or passing through the storage vessel, a second inlet for receiving fluid from a cold fluid supply, and an outlet for supplying fluid to the heater inlet; wherein in a first mode the heater is operable to heat fluid in the storage vessel, and in a second mode the fluid mixer is mixes fluid from or passing through the storage vessel with fluid from the cold fluid supply at a predefined volumetric ratio to provide mixed fluid to the inlet of the heater to be heated further to an output temperature.

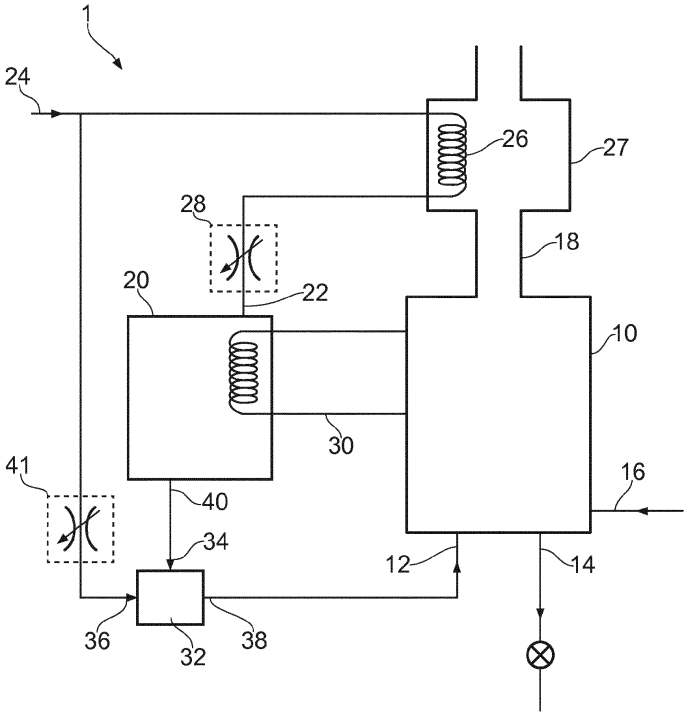


FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the delivery of hot water and in particular delivery of hot water in heating systems, and an adapter for use with a boiler.

BACKGROUND TO THE INVENTION

[0002] Hot water demand in domestic heating systems varies considerably during the day. At peak times, for example during mornings and evenings when domestic users require showers and baths, present day heating systems which have been reduced in power output as dwellings have become more highly insulated can struggle to accommodate high demand.

[0003] In order to serve peak hot water demand, two alternative approaches are often provided in hot water systems. The first involves having a large tank of water heated via a heat exchanger by a relatively low capacity boiler to an acceptably high temperature. Hot water is then drawn off the top of the tank as and when hot water is required by a user, while cold water is provided to the bottom of the tank to replenish it. Whilst having a large hot water tank provides the benefit of having a plentiful supply of hot water once the tank is hot, after depletion of hot water from the tank, the tank takes a considerable time to heat back up to the required temperature.

[0004] An alternative approach, dispensing with the hot water tank altogether, is the use of a combination boiler. Cold water from the cold water main is provided to the boiler and heated in real-time to an output temperature, as required by the user. The combination boiler can provide instantaneous hot water, but the output flow rate is typically restricted compared to that of hot water tank systems. This is partly because the thermal output of a combination boiler is typically matched to the space heating requirements of the dwelling or area it services, and as insulation standards have been improved, the space heating requirement and hence boiler output power has reduced.

SUMMARY OF THE INVENTION

[0005] According to a first aspect of the invention there is provided a fluid heating system, comprising: a heater having an inlet and an outlet; a storage vessel; a fluid mixer having a first inlet for receiving fluid stored in or passing through the storage vessel, a second inlet for receiving fluid from a cold fluid supply, and an outlet for supplying fluid to the heater inlet; wherein in a first mode the heater is operable to heat fluid in the storage vessel, and in a second mode the fluid mixer is mixes fluid from or passing through the storage vessel with fluid from the cold fluid supply at a predefined volumetric ratio to provide mixed fluid to the inlet of the heater to be heated further to an output temperature.

[0006] Mixing warmed fluid, such as water, from the storage vessel with fluid from a cold fluid supply provides several advantages over present day systems. Firstly, in contrast to prior art combination heating systems, since the temperature of water provided to the heater is higher than that of the cold water supply, flow rate through the heater can be increased whilst providing water to the heater outlet at the same output temperature. Secondly, in contrast to prior art hot water tank systems, because hot water from the storage vessel is mixed with the cold water supply, stored hot water is depleted less quickly, thus having the effect of increasing the quantity of hot water available at any one time without increasing the size of the hot water storage reservoir. For a heating system with the same sized heater, the size of the storage vessel can be reduced, thereby reducing cost and valuable space taken up by the heating system.

[0007] The fluid mixer may be a simple tee fitting, or alternatively could comprise a venturi arrangement.

[0008] The first and second inlets of the fluid mixer may have different cross-sectional areas, the effect of which may be reflected in the relative flow rates through the first and second inlets. Thus, the relative volumetric mix between the first and second inlets may be defined a function of the cross-sectional areas of the two inlets.

[0009] In addition, or as an alternative, to the contrasting cross-sectional areas of the first and second inlets, a flow restrictor may be provided to further control the relative flow rates of fluid at the first and second inlets. The flow restrictor(s) may be arranged to restrict the flow of fluid provided to one or more of the first and second inlets. The flow restrictors may be variable or fixed and may be factory configured or calibrated during installation of the heating system. Other devices for setting and controlling relative volumetric flow rates known in the art may also be applied the present system. Thus a flow restrictor may be used to vary the pressure difference acting at the first and second inlets.

[0010] The heater may be a combustion heater, and preferably a combination boiler. The storage vessel heating means may recover heat from the flue gases produced during combustion of fuel within the boiler. Thus heat which would otherwise have been lost to the atmosphere can be used to preheat water from a cold water main prior to entry of such water into the heater for further heating. The boiler may be connected to the storage vessel such that in the first mode it receives fluid from the storage vessel, warms it and delivers warmed fluid, such as warm water back to the storage vessel. Alternatively the boiler or heater may be connectable to heat exchanger within the storage vessel to warm the fluid contained in the storage vessel.

[0011] Additional storage vessel heating means may further comprise one or more secondary heat exchangers, recovering heat from solar energy, ground source or other such sources. Heat may also be recovered by the one or more secondary heat exchangers from condensate drained from the heater during periods of idle oper-

ation of the heater. The storage vessel may be heated further by way of means such as electric heaters, or from the heater.

[0012] According to a second aspect of the present invention, there is provided an adapter comprising: a support; at least first and second boiler ports supported by the support; at least first and second plumbing ports supported by the support, the first plumbing port in fluid flow communication with the first boiler port, and the second plumbing port in fluid flow communication with the second boiler port, wherein the first and second boiler ports are arranged to align with corresponding ports on a boiler, and at least one of the plumbing ports is out of alignment with the corresponding boiler port.

[0013] Thus the adapter allows a replacement boiler to be installed at the same location as that in which a previous boiler was installed where the previous boiler had a different arrangement of fluid and fuel ports to those of the replacement boiler.

[0014] The adapter may comprise one or more additional boiler ports connectable to the boiler and in fluid communication with one or more corresponding additional plumbing ports. The additional boiler and corresponding plumbing ports may be inline or out of line, depending on the requirement and configuration of the boiler and plumbing pipes to be connected. Thus multiple ports can be re-routed to accommodate for differences in inlet/outlet configuration of an old boiler compared to that of a replacement boiler to be installed at the same location. Thus out of line ports can be brought into fluid communication to maintain connectivity without having to re-route previously installed plumbing in a building or structure.

[0015] The boiler ports preferably comprise connectors to enable the boiler ports to be sealingly connected to corresponding ports on the boiler. Similarly the plumbing ports preferably comprise connectors to allow the plumbing ports to be sealingly connected to plumbing pipes preinstalled in a building, or to pipes which are to be installed.

[0016] The adapter may further comprise a fluid mixer having first and second inputs and a mixer output, the fluid mixer arranged to mix fluid from the first input with fluid from the second input and supply mixed fluid to the mixer output. Thus the adapter can be used to join a set of ports on a boiler with a preinstalled plumbing system and to retrofit a fluid mixer for use with the boiler.

[0017] Advantageously, the fluid mixer mixes fluid from the first input with fluid from the second input at a predefined volumetric ratio. Thus, for example, assuming the pressure in the storage vessel is substantially the same as the pressure in the cold main, as is the case when the cold main is connected to the storage vessel to replenish it, then the water from the storage vessel may mix with water from the cold main at a ratio of say 1:3. This ratio does not change with temperature of water from the storage vessel. The ratio may be fixed between say 1:1 and 1:7, although these are only example ranges and are not to be taken as being limiting.

[0018] Preferably, either the first or second inlet is in fluid communication with a plumbing port and the mixer output is in fluid communication with one of the boiler ports. Thus fluid from the cold water main can be provided to the fluid mixer via the adapter and then to a cold water input of the boiler.

[0019] The adapter may be combined with any of the features of the fluid heating system according to the first aspect of the invention.

[0020] According to a third aspect of the invention there is provided a method of operating a fluid heating system, the heating system comprising: a heater having an inlet and an outlet; a storage vessel; and a fluid mixer having a first inlet for receiving fluid from a cold fluid supply, a second inlet for receiving fluid stored in or passing through the storage vessel and an output for supplying fluid to the heater inlet; the method comprising operating the heating system in a first mode where the heater is used to warm the fluid stored in the storage vessel, and in a second mode where the fluid mixer mixes, fluid from the first inlet with fluid from the second inlet at a predetermined volumetric ratio and supplies mixed fluid to the heater to be heated further to an output temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Embodiments of the present invention shall now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of a fluid heating system;

Figure 2 is a schematic diagram of a fluid heating system which is a variation of the embodiment shown in Figure 1;

Figure 3 is a schematic diagram of a further variation of the fluid heating system shown in Figure 1;

Figure 4 is a schematic diagram of a further variation of the system of Figure 1;

Figure 5 shows a further variation on the arrangement shown in Figure 1;

Figures 6a to 6c are cross-sectional illustrations of variations of the fluid mixer shown in the fluid heating systems shown in Figures 1 to 5;

Figure 7 is a cross-sectional view of a boiler adapter; and

Figure 8 is a schematic illustration of a fluid heating system comprising a boiler adapter.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0022] Figure 1 shows a fluid heating system 1. The heating system comprises a heater 10, typically a combination boiler for heating water, having a cold water inlet 12 and a hot water outlet 14. The heater 10 further comprises a fuel inlet 16 for providing fuel such as gas for combustion, and a flue 18 through which combustion gases can escape to the atmosphere. The heater 10 comprises components typically found in a boiler that provides hot water for washing and hot water for a space heating circuit. Thus the boiler may comprise a combustion chamber, a primary heat exchanger for transferring heat to water in the primary heat exchanger, a secondary heat exchanger, such as a plate heat exchanger, for transferring heat from the warmed water from the primary heat exchanger to portable water received from the cold water inlet, a pump and a controller. In other embodiments, combustion heater 10 could be replaced with an electric heater, or other type of known heater.

[0023] In addition to the heater 10, a storage vessel 20 is provided. Water is supplied to a vessel inlet 22 of the storage vessel 20 from a cold water main 24, optionally via a heat exchanger 26. When provided, the heat exchanger 26 is placed in the path of a flue 18 and arranged to recover heat from the hot flue gases produced by combustion in the boiler 10. The heat exchanger 26 may be provided as part of a flue heat transfer means 27 which may further comprise heat storage means (not shown) for storing heat recovered from hot flue gases emitted from the boiler 10 during combustion of fuel. In which case, the heat transfer means 27 can provide heat to the storage vessel 20 even when fuel is not being combusted in the boiler 10.

[0024] In the embodiment shown in Figure 1, water from the cold main 24 forms the fluid inside the storage vessel 20. However, in alternative embodiments, for example the embodiment shown in Figure 2, water may pass through the storage vessel 20 via a conduit 25 that forms a heat exchanger passing through the storage vessel 20 and such that water passing through the conduit 25 may receive heat from warm fluid stored in the storage vessel 20. In which case, the storage vessel 20 may be filled and/or topped up with water from the cold water main 24 via a separate inlet (not shown), connected to the space heating circuit or may be filled with another suitable fluid with a high specific heat capacity and other suitable characteristics for heat storage and transfer.

[0025] In both of the embodiments shown in Figures 1 and 2, an optional flow restrictor 28 may be provided in the fluid path upstream of the vessel inlet 22 or downstream of outlet 40 to control the flow rate of fluid supplied to or through the storage vessel 20 and, indirectly, the boiler 10, as will described in more detail below. The flow restrictor 28 may be a fixed or variable flow restrictor, and may be set manually during installation or maintenance or may alternatively be under periodic or constant control by way of a controller (not shown). Instead of being placed directly upstream of the vessel input 22, the flow restrictor 28 may be located at any suitable location within the fluid network whilst still providing a restrictive effect on the flow rate of fluid supplied to or via the storage vessel 20.

[0026] Water in the storage vessel 20 may be heated by a secondary heat exchanger 30 connected to the boiler 10. Optionally, heat may also be recovered from condensate drained from the boiler 10 as described in GB2459879, the heat transferred to the storage vessel 20 via one or more further secondary heat exchangers.

[0027] In an alternative arrangement, as shown in Figure 3, the fluid heating system does not include the heat exchanger 26 or the heat transfer means 27. The storage vessel 20 is heated by way of the heat exchanger 30.

[0028] In a further arrangement, shown in Figure 4, the cold water main 24 connects directly to the storage vessel 20 and the heat exchanger 26 is configured such that it delivers heat to the storage vessel 20. In the embodiment shown, heat is provided to the water in the storage vessel via a further heat exchanger 42 in combination with heat exchanger 26, thus creating a closed heating loop 43. Fluid flow within the loop is driven by a pump 44. Optionally, the pump 44 speed is variable and may depend upon the temperature of the fluid within the loop 43. The closed heating loop 43 may be connected to an optional expansion chamber 46 and pressure relief valve 48 so as to prevent pressure build up within the loop 43 due to temperature variations therein. Alternatively, a degree of elasticity can be built into the system to accommodate for pressure changes. This may be achieved, for example, with the use of corrugated pipe or other methods known in the art. In the configuration shown in Figure 4, heat can be delivered to the storage vessel at any time by combustion of fuel within the boiler 10. Also, because the heat exchangers 26, 42 form a closed loop 43, the heat transfer medium does not need to be limited to water. Any suitable heat transfer fluid can be used.

[0029] In each embodiment, the heating system 1 further comprises a fluid mixer 32 having first and second inputs 34, 36 and a mixer output 38. An output 40 of the storage vessel 20 is provided to the first input 34 of the fluid mixer 32. The second input 36 of the fluid mixer 32 is connected to the cold water main 24. The output 38 of the fluid mixer is provided to the cold water inlet 12 of the boiler 10. An optional flow restrictor 41 may be provided in the fluid path between the cold water main 24 and the second input 36. As with flow restrictor 28, the flow restrictor 41 may be preset manually during installation or maintenance or may alternatively be under periodic or constant control by way of a controller (not shown).

[0030] In the embodiments shown in Figures 1 to 4, the second input 36 of the fluid mixer 32 is fed by the same cold water supply 24 as that supplying the heat exchanger 26 and vessel inlet 22 of the storage vessel. However, in an alternative embodiment as shown in Figure 5, cold water is supplied to each of the flue heat ex-

changer 26 and the second inlet 36 of the fluid mixer by two separate cold water feeds 24a, 24b. As is known in the art, check valves 48a, 48b may be provided at the cold water supply feeds 24a, 24b to prevent back flow of water into the cold main. In which case, an expansion chamber 50 and pressure relief valve 52 may be provided in communication with the flue heat exchanger 26 to prevent pressure build up due to temperature variations within the pipe between the check valve 48a and the vessel inlet 22. Where backflow into a cold main is allowable and legal, the check valves 48a, 48b may be omitted. The above arrangement is particularly applicable in circumstances where the flue heat transfer means 27 and the fluid mixer 32 are a substantial distance apart, thus needing to be connected to separate cold water supplies.

[0031] The fluid mixer 32 volumetrically mixes cold water from the cold water main 24 with hot water stored in or passing through the storage vessel 20 before being admitted to the input 12 of the boiler 10 where it can be heated further. In other words, water from the cold water main 24 is mixed by volume with water stored in or running through the storage vessel 20 at a predetermined ratio. This ratio may be arbitrary or set by an installation or maintenance engineer. Volumetric mixing of water from the cold water main 24 with water stored in or passing through the storage vessel 20 has the effect of increasing the quantity of water available at a temperature elevated from the cold water main temperature, thus providing several advantages over present day systems. Firstly, in contrast to some prior art combination boiler systems, since the temperature of fluid provided to the boiler is higher than that of the cold water main, flow rate through the boiler 10 can be increased whilst providing water to the boiler outlet 14 at the same output temperature. Secondly, in contrast to prior art hot water tank systems, because hot water from the storage vessel 20 is mixed with the cold water main, stored hot water is depleted less quickly, thus having the effect of increasing the quantity of hot water available at any one time without increasing the size of the hot water storage reservoir. For a heating system with the same sized boiler, the size of the storage vessel can be greatly reduced, thereby reducing cost and valuable space taken up by the heating system.

[0032] Operation of the heating system described herein will now be explained by way of non-limiting example. Suppose water is required at 40°C at the output of a heating system, and the temperature of the water in a storage vessel is also 40°C or higher. In prior art tank systems, water would be drained directly from the storage vessel, thereby depleting the hot water source at the rate at which water is tapped off at the output. In prior art combination boiler systems with no hot water tank, water might be heated directly from the cold water main substantially instantaneously, but the output flow rate would be comparably low. In the arrangement described herein however, if the water in the storage vessel is at 40°C, it will be mixed down in to an intermediate temperature lower than 40°C before being heated back up to the required 40°C in the boiler. The immediate temperature is not predefined and varies with cold main temperature and the temperature of the water in the store 20. Thus, water from the storage vessel is used less quickly, thereby increasing the amount of continuous water that is able to be delivered to the output. Furthermore, because less water is depleted from the storage vessel, the storage vessel can be made smaller. Smaller tanks are more efficient, as they lose less heat and have a reduced recovery time since there is less water in the tank to be heated, once depleted.

[0033] An invention based on similar principles is described in EP1809949, in which a thermostatic blending valve operates to blend water from a hot water storage vessel with water from a cold water main down to a specific target temperature which is then provided to the inlet of a condensing boiler for heating to a higher temperature. Thus, EP1809949 provides a very efficient method of providing water at a temperature above that of the cold water main to the inlet of a boiler. In this configuration, fluid is provided to the inlet of a boiler at an accurately controlled temperature. However, such systems require thermostatic mixing valves which add cost to the system.

[0034] The inventor has realised that similar, but not as good, performance can be delivered by a less complex and inexpensive system which provides the functionality described herein. The fluid mixer 32 of the present invention provides simple volumetric mixing of hot water from a storage vessel with cold water from a cold water main to be provided to a boiler, using simple components and requiring no sensory control. Accordingly, a robust, inexpensive and efficient apparatus for obtaining high flow rate hot water for extended periods at peak times is provided.

[0035] Embodiments of the fluid mixer 32 of the present invention are illustrated in Figures 6a, 6b and 6c. Figure 6a shows a tee mixer configuration 32a in which hot water from the storage vessel 20 is added at input 34a to cold water flowing from the second input 36a towards the mixer output 38a. Figure 6b shows a venturi mixer configuration 32b. Hot water from the storage vessel 20 is provided via input 34b to the centre of a stream of cold water from the cold main. The narrowing throat 54 in the pipe causes cold water to accelerate through the narrow point, thereby reducing pressure at the point at which hot water is added from the first input 34b to the cold water stream. This draws hot fluid from the first input 34b into the flow of cold water and promotes mixing of the hot and cold fluids. Figure 6c shows a further embodiment of the fluid mixer 32 comprising a venturi mixer 32c of simplified construction. Hot water from the first input 34c is provided to the mixer through a hooded entrance 56, masked from the flow of cold water received at the second input 36c. The hood 56 provides the added function of reducing the diameter of the mixer pipe at the point at which the hot water is added, thus again promoting mixing of the two input fluids.

[0036] Whilst embodiments of the present invention have been described in respect of single heater systems, the invention may also be used in multi-boiler installations where, while hot water is available from the storage vessel, it may be blended with cold water and used by two or more boilers to supply hot water. However, once the store of warmed water in the vessel 20 is depleted, one or more of the boilers may be tasked with re-warming it whilst the other boiler services the hot water draw in a conventional manner.

[0037] Domestic boilers, such as the boiler 10 shown in Figures 1 to 5, typically comprise a plurality of fuel and fluid inlets/outlets. On installation into a building or structure, these inlets/outlets are connected to a series of rigid pipes. Currently, no standard exists for the configuration of such ports on domestic boilers. Accordingly, boiler manufacturers tend to design their boilers such that the location of fuel inlets and water inlets and outlets differ from those of rival companies. Thus when a domestic boiler needs to be replaced due to failure, upgrade or otherwise, the proprietor of an old boiler is minded to purchase a replacement boiler from the same company in order to preclude the requirement and associated cost of re-routing pipes and connectors associated with the boiler plumbing. Equally, boiler manufacturers occasionally change the configuration of inlet/outlet ports on new models of boilers to account for technological improvements. Users purchasing new boilers are thus required to implement changes in their plumbing systems in order to account for these new designs.

[0038] Figure 7 shows an adapter 60 for a boiler. The adapter 60 is designed to allow a replacement boiler to be installed at the same location as that in which a previous boiler was installed having a different arrangement of fluid and fuel ports to those of the replacement boiler. The adapter comprises a rigid body 62 having a plurality of boiler ports 64a, 64b, 64c, 64d, 64e situated on its upper surface and a plurality of plumbing ports 66a, 66b, 66c, 66d, 66e situated on its lower surface. The boiler ports 66a to 66e are arranged on the rigid body 62 so as to align with the fuel and fluid inlet/outlet ports 68a, 68b, 68c, 68d, 68e on a particular model of boiler 10. The boiler 10 in Figure 7 has been designated the same reference numeral as the boiler illustrated in Figures 1 to 5. However it will be appreciated that the adapter may be designed such that the boiler ports 64a to 64e align with the ports 68a to 68e of any known boiler.

[0039] In addition to the cold water inlet 68a, hot potable water outlet 68b, and fuel inlet 68c shown in the boilers illustrated in Figures 1 to 5, the boiler 10 may additionally comprise a hot water outlet 68d and return 68e to feed a central heating system comprising one or more space heaters (not shown).

[0040] Each of the boiler ports 64a to 64e of the adapter 60 preferably comprises connection means such as a threaded pipe or a compression connector, appropriate for sealingly connecting each boiler port 64a to 64e to a corresponding fluid/fuel port 68a to 64e of the boiler 10. Plumbing ports 66a to 66e are preferably arranged on the lower surface of the rigid body 62 to match the configuration of ports on a boiler previously installed at a particular location, thus aligning with previously installed plumbing pipes 70a, 70b, 70c, 70d, 70e, supplying fuel and cold water to the boiler, and for supplying hot water from the boiler to taps, space heaters and other devices distributed about the building.

[0041] Such that each pipe 70a to 70e is in fluid connection with the correct associated boiler inlet/outlet port 68a to 68e (e.g. 68a-70c, 68b-70a, 68c-70b 68d-70e, 68e-70d) a network of connection pipes 72a, 72b, 72c, 72d, 72e is provided within the rigid body 62 of the adapter 60 which provide the relevant fluid connection between each boiler port 64a to 64e and associated plumbing port 66a to 66e.

[0042] The adapter 60 described with reference to Figure 7 may optionally be modified to incorporate the mixing valve 32 shown in Figures 1 to 6. Furthermore, the adapter 60 may be incorporated into fluid heating system according to embodiments of the present invention, as described with reference to Figures 1 to 6 or retrofitted into state of the art heating systems. Figure 8 shows a fluid heating system 80 according to an embodiment of the present invention. The heating system 80 comprises a heater 10, equivalent to the heater shown in Figures 1 to 5, having a fluid inlet 12, a fluid outlet 14 and a fuel inlet 16.

[0043] In addition to the heater 10, a storage vessel 20 is provided, having an inlet 22 fed by a cold water main 24 which may pass through a heat exchanger 26 disposed in the flue gas path of the boiler 10.

[0044] The heating system further comprises an adapter 82, shown having been fitted to the base of the boiler 10, having boiler ports 84a, 84b, 84c, 84d, 84e and plumbing ports 86a, 86b, 86c, 86d, 86e equivalent to those boiler ports and plumbing ports of the adapter 60 shown in Figure 7. However, in addition, the adapter 82 includes the fluid mixer 32 described with referenced to Figures 1 to 6. The first input 34 of the fluid mixer 32 is connected to the outlet 40 of the storage vessel 20 and the second input 36 is connected via a connecting pipe 88a internal to the adapter 82 to a plumbing port 86c aligning with the cold water main (not shown). The output 38 of the fluid mixer then connects via a further connecting pipe 88b to the fluid inlet 12 of the boiler 10.

[0045] Thus, the adapter 82 provides an elegant solution for retrofitting of the fluid mixer 32 and storage vessel 20 of the fluid heating system described herein to known boilers, whilst providing all of the advantages associated with the adapter 60 shown in Figure 7.

[0046] Although the storage vessel configuration shown in Figure 8 is the same as the embodiment shown in Figure 1, The adapter 82 could equally be integrated into fluid heating systems shown in any of Figures 2 to 5.

[0047] Although the invention has been described in the context of heat water, it is equally applicable for heating other fluids, such as food, oils, chemicals and so on.

Claims

1. A fluid heating system, comprising:

   a heater (10) having an inlet (12)and an outlet (14);
   a storage vessel (20);
   a fluid mixer (32) having a first inlet (34) for receiving fluid stored in or passing through the storage vessel (20), a second inlet (36) for receiving fluid from a cold fluid supply, and an outlet (38) for supplying fluid to the heater inlet (12);
   wherein in a first mode the heater (10) is operable to heat fluid in the storage vessel, and in a second mode the fluid mixer (32) mixes fluid from or passing through the storage vessel with fluid from the cold fluid supply at a predefined volumetric ratio to provide mixed fluid to the inlet of the heater (10) to be heated further to an output temperature.

2. A fluid heating system as claimed in claim 1, wherein the fluid mixer (32) is a venturi arrangement or a tee.

3. A fluid heating system as claimed in claim 1 or 2, wherein the first and second inlets of the fluid mixer (32) have different cross-sectional areas.

4. A fluid system as claimed in any preceding claim, further comprising a flow restrictor (41, 28) arranged to restrict the flow of fluid provided to one or both of the first and second inlets of the fluid mixer.

5. A fluid system as claimed in any preceding claim, wherein the volume of fluid mixed from the first inlet relative to the second inlet by the fluid mixer is fixed or is user variable.

6. A fluid system as claimed in any preceding claim, wherein the heater is a combustion heater and a flue heat transfer heating means recovers heat from the flue gases of the combustion heater for delivery to fluid in the storage vessel.

7. A fluid system as claimed in any preceding claim, further comprising one or more of a combustion heater, an electric heater or a solar heater for heating fluid in the storage vessel.

8. A fluid heating system as claimed in any preceding claim, further comprising an adapter, comprising:

   a support;
   at least first and second boiler ports supported by the support;
   at least first and second plumbing ports supported by the support, the first plumbing port in fluid flow communication with the first boiler port, and the second plumbing port in fluid flow communication with the second boiler port, wherein the first and second boiler ports are arranged to align with corresponding ports on a boiler, and at least one of the plumbing ports is out of alignment with the corresponding boiler port.

9. A fluid heating system as claimed in claim 8, wherein one of the first inlet and the second inlet are in fluid communication with the plumbing ports and the mixer output is in fluid communication with one of the boiler ports.

10. An adapter for a boiler, comprising:

    a support,
    at least first and second boiler ports supported by the support;
    at least first and second plumbing ports supported by the support, the first plumbing port in fluid flow communication with the first boiler port, and the second plumbing port in fluid flow communication with the second boiler port, wherein the first and second boiler ports are arranged to align with corresponding ports on a boiler, and at least one of the plumbing ports is out of alignment with the corresponding boiler port.

11. An adapter as claimed in claim 10, further comprising one or more additional boiler ports in fluid communication with one or more corresponding additional plumbing ports.

12. An adapter as claimed in claim 11, wherein the one or each of the additional boiler ports are out of line with the corresponding additional plumbing port.

13. An adapter as claimed in any of claims 10 to 12, wherein the boiler ports comprises boiler connection means to sealingly connect the boiler ports to the corresponding ports on the boiler.

14. An adapter as claimed in any of claims 10 to 13, wherein the plumbing ports comprise plumbing connection means to sealingly connect the plumbing port to a corresponding plumbed inlet/outlet.

15. An adapter as claimed in any of claims 10 to 14, further comprising a fluid mixer having first and second inputs and a mixer output, the fluid mixer adapted to mix fluid from a first input with fluid from a second input and supply mixed fluid to a mixer output.

16. An adapter as claimed in claim 15, wherein the fluid mixer mixes fluid from the first input with fluid from the second input at a predefined volumetric ratio.

17. An adapter as claimed in claims 15 or 16, wherein

one of the first inlet and the second inlet are in fluid communication with plumbing ports and the mixer output is in fluid communication with one of the boiler ports.

18. A method of operating a fluid heating system, the heating system comprising:

a heater having an inlet and an outlet;
a storage vessel; and
a fluid mixer having a first inlet for receiving fluid from a cold fluid supply, a second inlet for receiving fluid stored in or passing through the storage vessel and an output for supplying fluid to the heater inlet,
the method comprising, operating the heating system in a first mode where the heater is used to warm fluid stored in the storage vessel, and in a second mode where the fluid mixer mixes fluid from the first inlet with fluid from the second inlet at a predetermined volumetric ratio and supplying mixed fluid to the heater to be heated further to an output temperature.

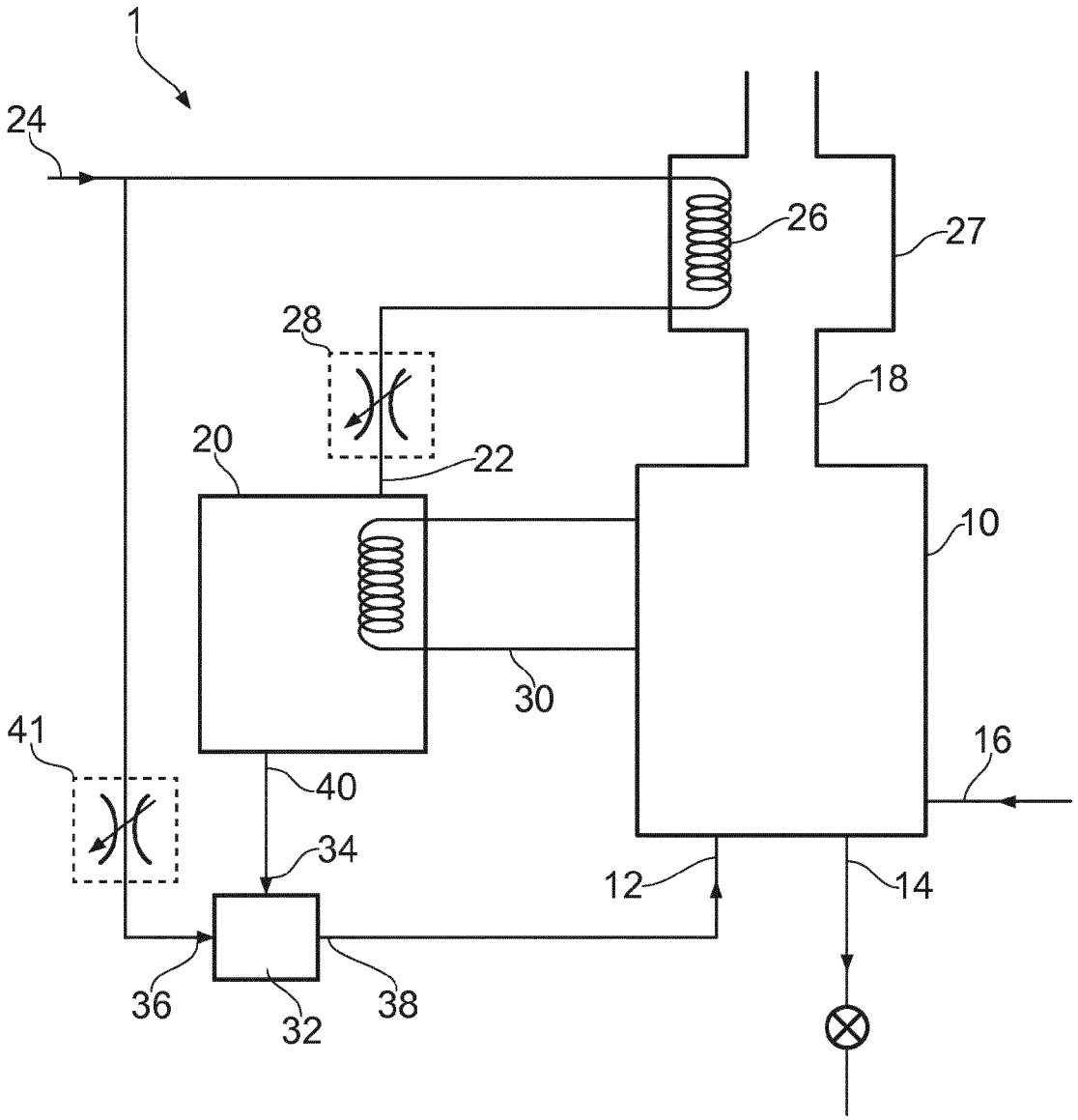


FIG. 1

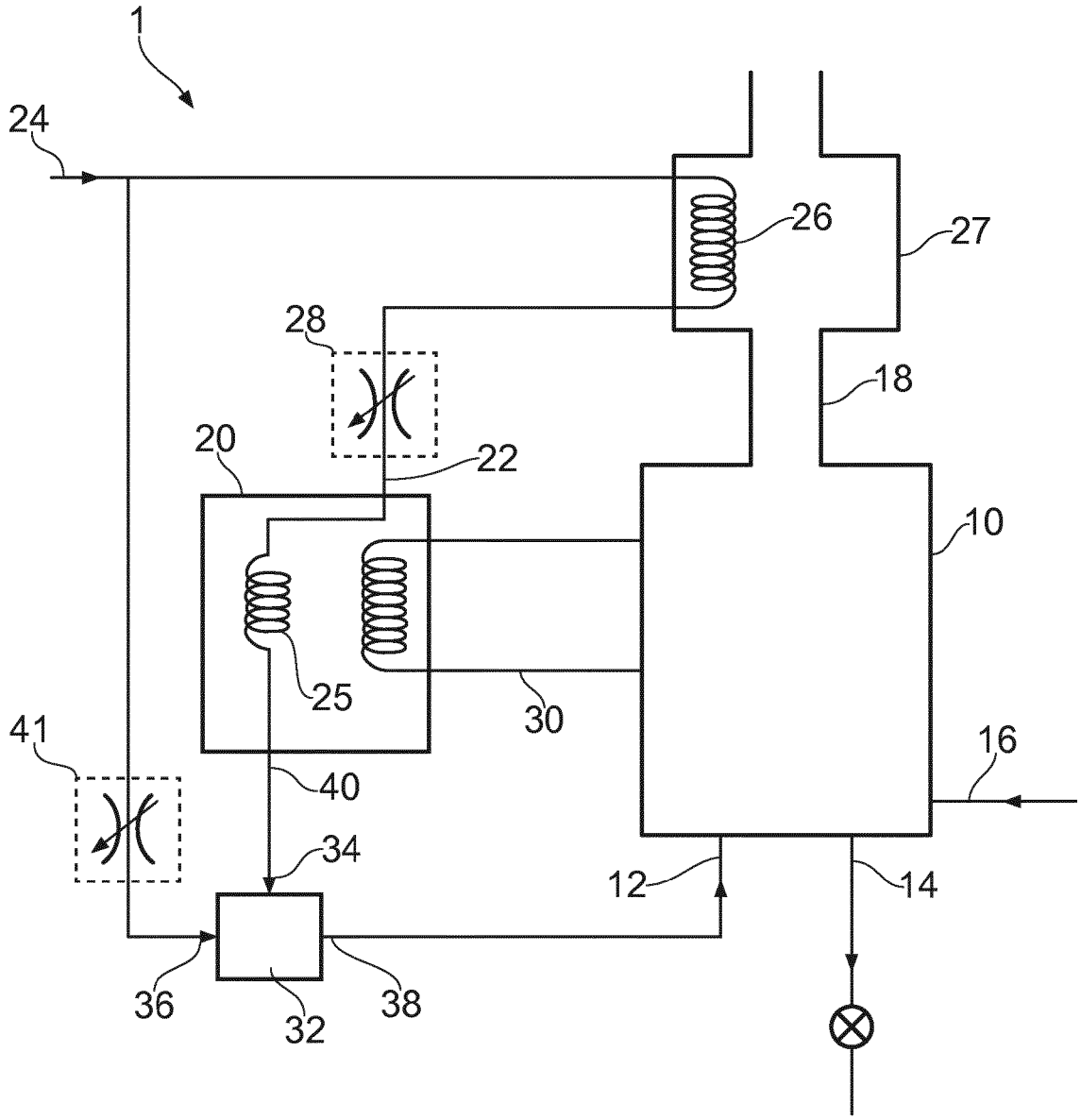


FIG. 2

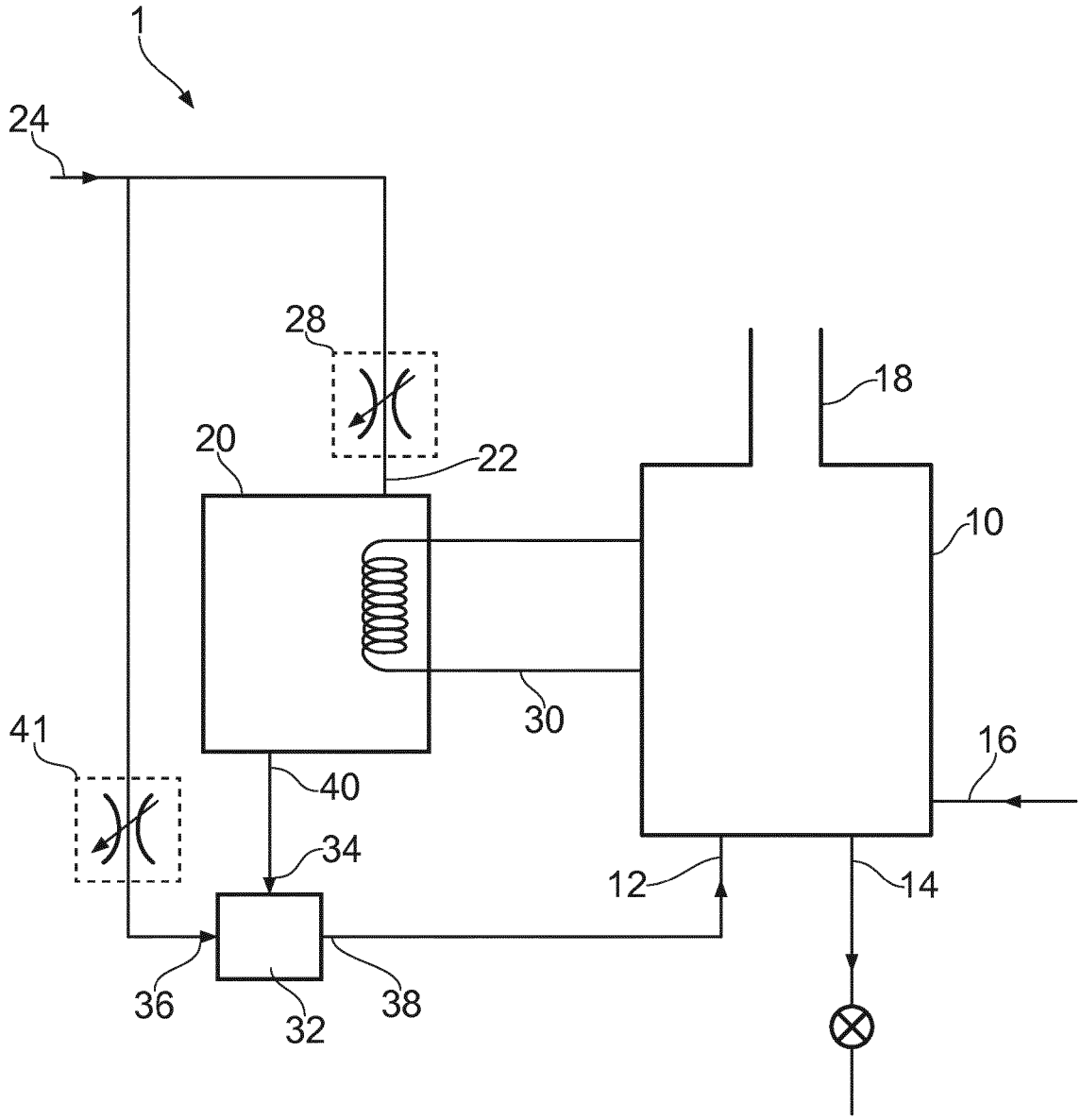


FIG. 3

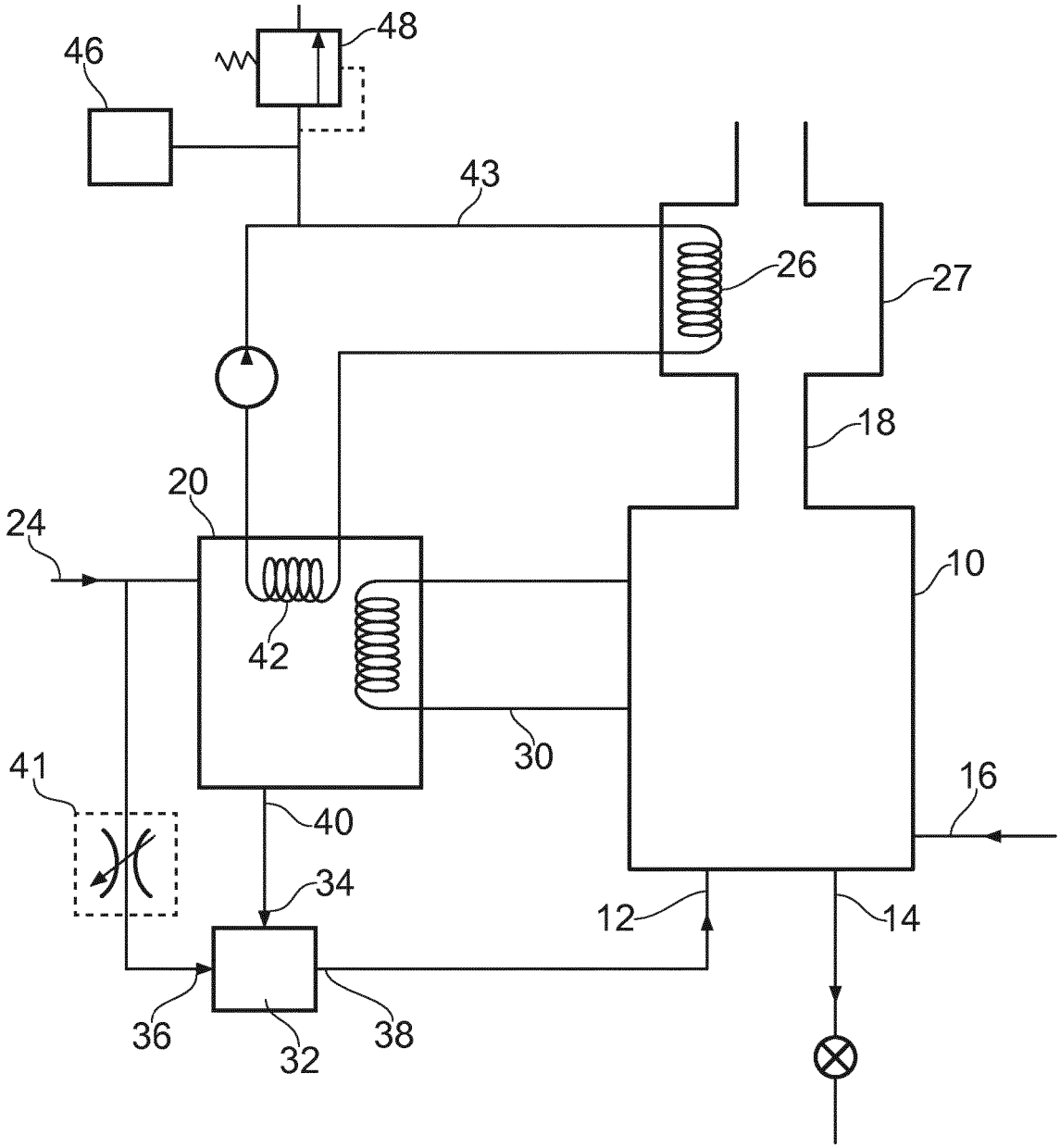


FIG. 4

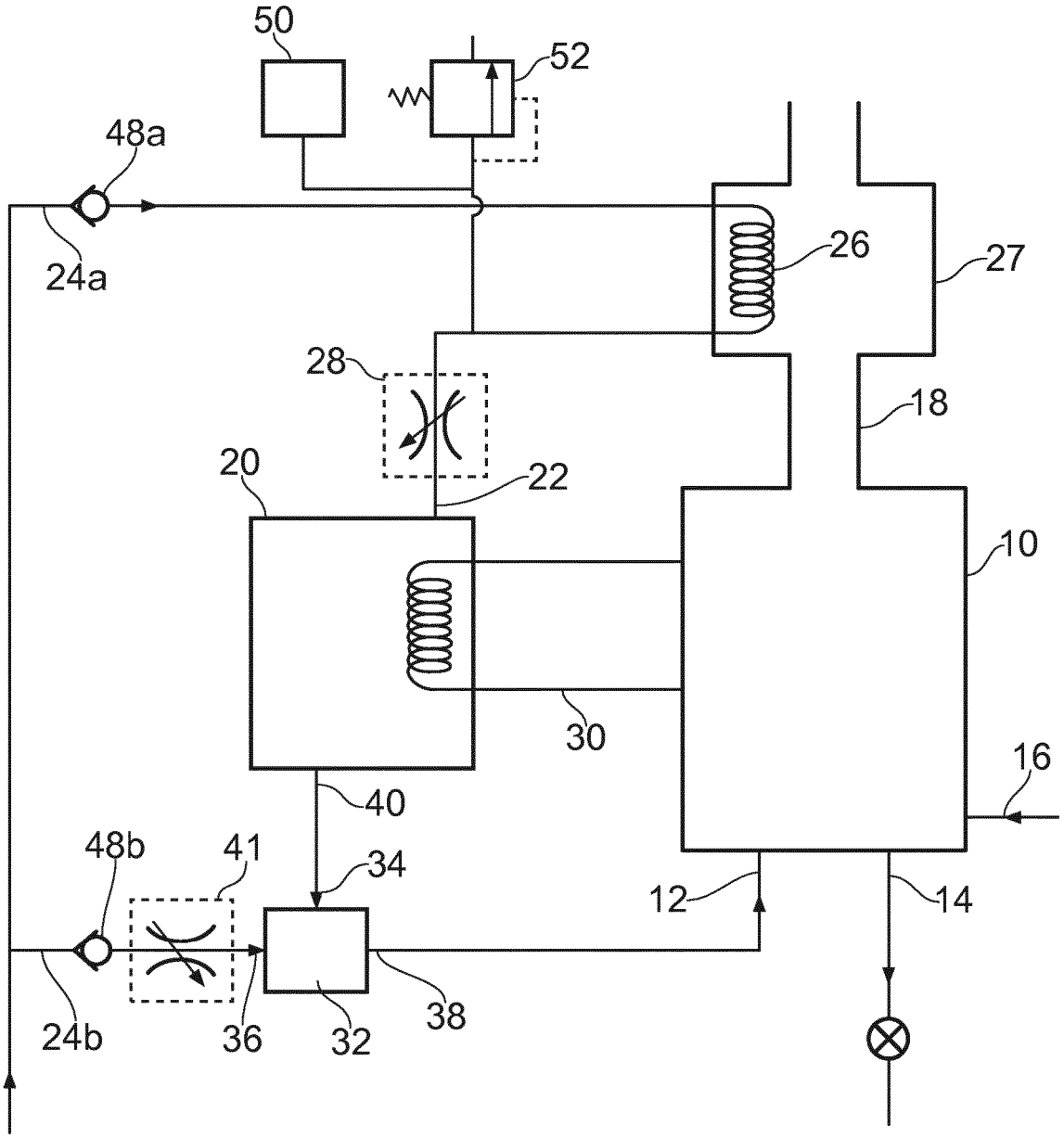

50
52
48a
24a
26
27
28
18
20
22
10
30
16
40
48b
41
34
12
14
24b
36
32
38

FIG. 5

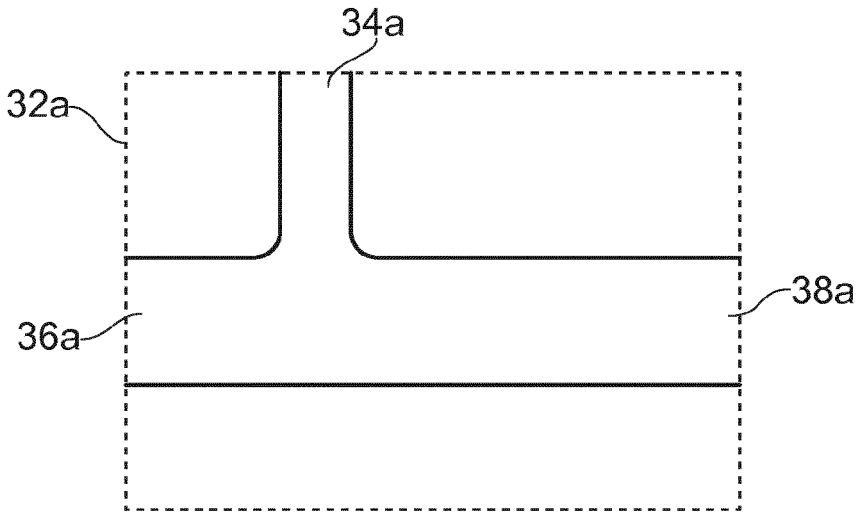


FIG. 6a

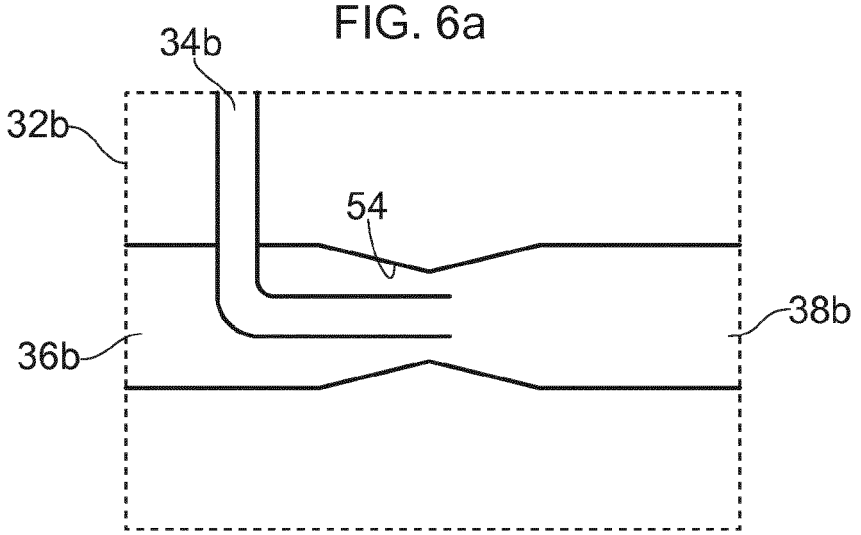


FIG. 6b

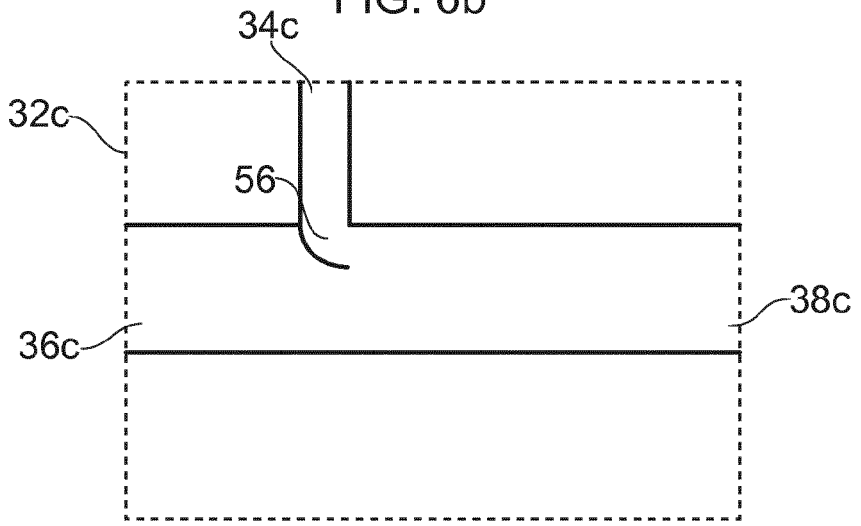


FIG. 6c

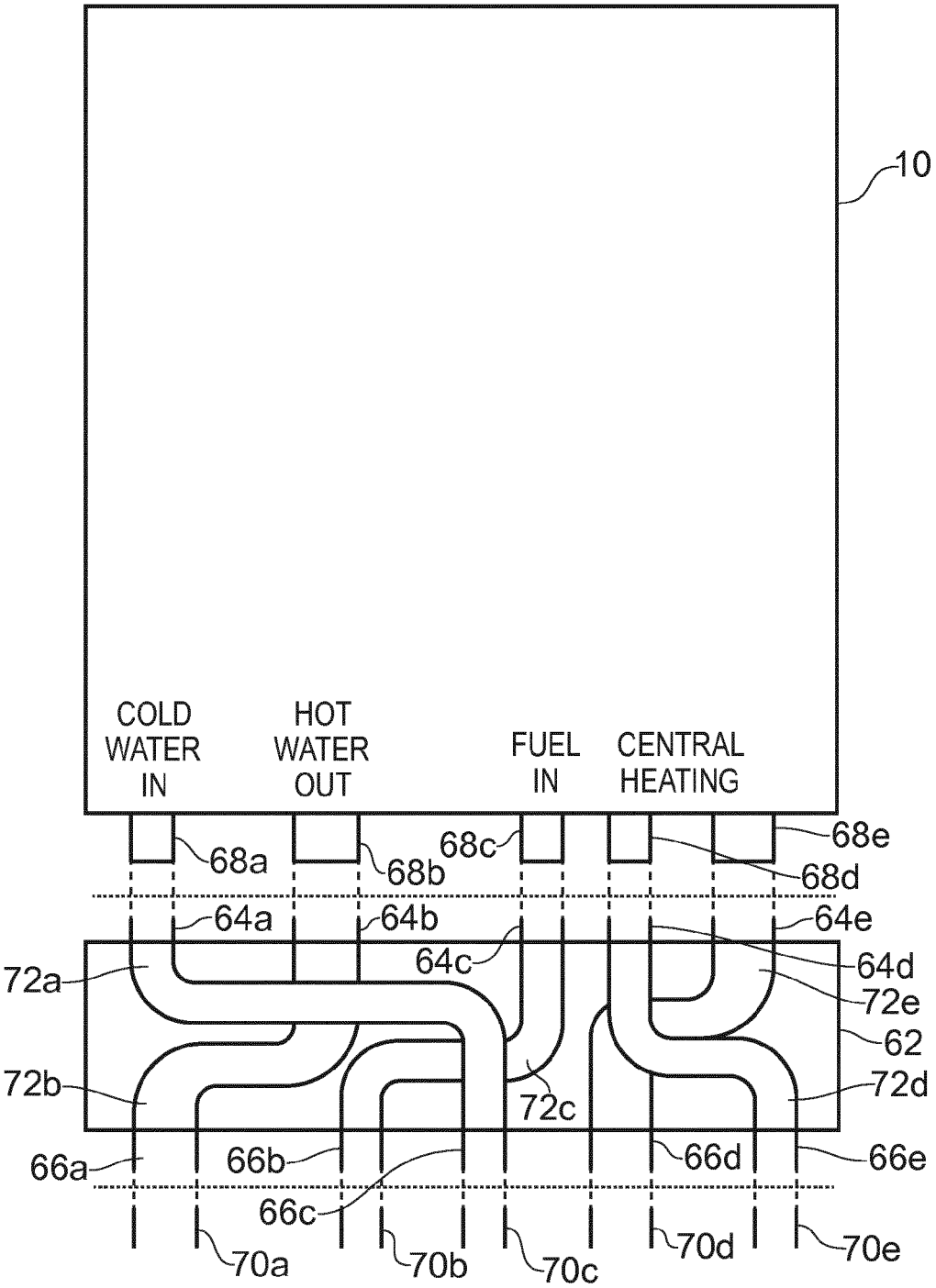

10
COLD WATER IN
HOT WATER OUT
FUEL IN
CENTRAL HEATING
68a
68b
68c
68d
68e
64a
64b
64c
64d
64e
72a
72b
72c
72d
72e
62
66a
66b
66c
66d
66e
70a
70b
70c
70d
70e

FIG. 7

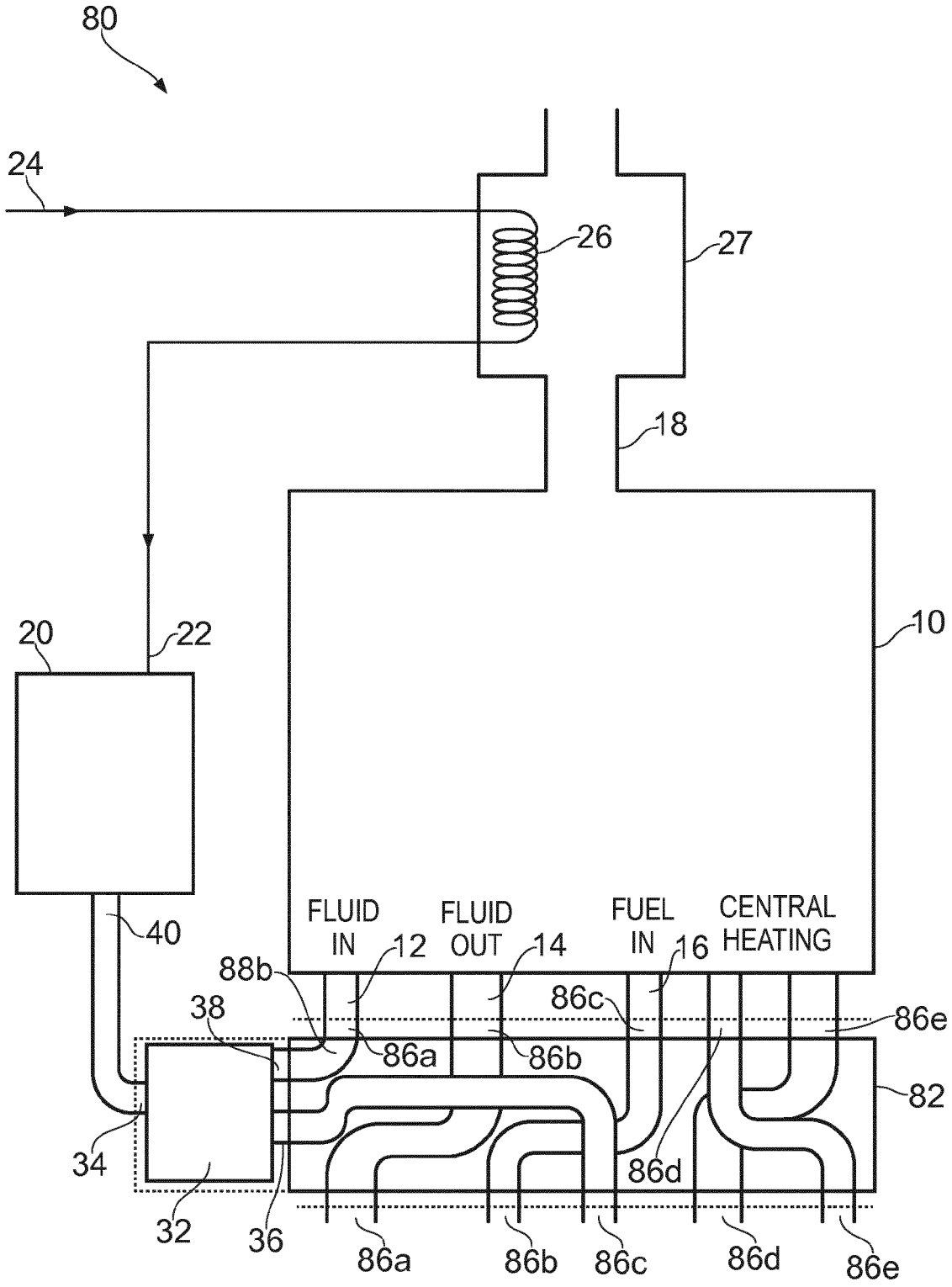

80
24
26
27
18
10
20
22
40
FLUID IN
12
FLUID OUT
14
FUEL IN
16
CENTRAL HEATING
88b
38
86a
86b
86c
86e
82
34
86d
32
36
86a
86b
86c
86d
86e

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2459879 A **[0026]**
- EP 1809949 A **[0033]**