FLUID HEATING AND STORAGE

The invention relates to a fluid heating and storage apparatus, for heating and storing a fluid, and a method for controlling fluid heating and storage.

Background to the invention

In domestic and industrial water heating systems, it is known to heat water using a heater, such as boiler. A heat exchanger is used to transfer heat from this water, to water in a storage vessel. When required, appliances can draw hot water from the storage vessel, or another heat exchanger may enable transfer of heat from the storage vessel water to a separate water supply, such as a mains-pressure water supply.

As time passes, or if storage vessel water is used to heat appliances, the temperature of the storage vessel water will decrease. Re-heating requires the simultaneous circulation of the storage vessel water and the boiler water through the heat exchanger. Typically, the storage vessel is stratified such that the hotter water is maintained at the upper end of the vessel. During heating, the storage vessel water is circulated from the lower end of the vessel, which is cooler, heated in the heat exchanger and delivered to the upper end of the vessel, which is hotter.

Conventional systems work on the assumption that hot boiler water will be available immediately. However, there is typically a delay as boilers require some time to heat the water up to the desired temperature. During the delay, boiler water is delivered to the heat exchanger at a lower temperature, which, in turn, results in cooler water being circulated from the lower end to the upper end of the storage vessel, without being adequately heated in the heat exchanger. In many systems, the delay until the boiler produces sufficiently hot water may not be long (usually less than a minute). This does not cause significant problems, as only a small quantity of cooler water enters the top of the storage vessel, from the heat exchanger, which can mix with the hot water already in the storage vessel and the cooling effect is minimal.

However, a problem arises if the delay increases. If cooler water is circulated over an extended period, it has a significant cooling effect on the hotter water already stored. The cooling of the storage vessel water would then affect the temperature of water supplied to taps or other appliances. The inventor has appreciated that such problems arise most severely when using boilers with a large thermal mass, as they take a long time to heat up to full temperature.

The inventor has also recognised that there are also problems in systems where a number of storage vessels are connected to a central boiler, such as in blocks of flats or apartments. In such systems, there is a delay in bringing water in the distribution pipe work up to the required temperature, as there may be some distance between the boiler and the hot storage vessels. The conventional approach to overcome the delay is to keep the boiler water constantly circulating at high temperatures ready for a demand. This can adversely affect boiler efficiency, and can increase heat loss from distribution pipe work, often resulting in overheating in public spaces where the pipe work is situated. It may also waste significant amounts of energy, which is detrimental to the environment.

To increase efficiency, a boiler can be a weather compensation boiler. Weather compensation boilers may take into account an external temperature and reduce boiler output accordingly.

The colder the external temperature, the more heat is lost from a building and the more heat is required from the boiler to heat the inside of the building. Weather compensation boilers match boiler output with heat loss from the building. For example, a warmer outside temperature would require a lower boiler output, and the boiler can automatically adjust rapidly, thus maximising fuel efficiency.

However, the inventor has appreciated problems that can occur in some hot water systems. For example, some heating systems operate using a central boiler plant with one set of boiler flow (or output) and return pipes. The central boiler plant may provide heat for central heating and for heating mains-pressure water.

To satisfy mains-pressure hot water demands, the boiler output needs to be at or above 65°C (typically 75°C) in order to heat mains-pressure hot water to 60°C. This can mean that the boiler continually works at higher temperatures and can be energy inefficient. If a weather compensation boiler is introduced, boiler temperatures may be reduced, to increase efficiency, and may provide sufficient heat for central heating. However, at lower operating temperatures, the boiler cannot provide the necessary heat for mains-pressure hot water.

Summary of the invention

This invention provides a fluid heating and storage apparatus, a method for controlling fluid heating, and kits, as defined in the appended independent claims to which reference should now be made. Advantageous or preferred features are set forth in dependent claims.

Thus, the invention may provide a fluid heating and storage apparatus, or system, comprising a fluid heater for heating (or arranged to heat) a first fluid; a fluid store for storing (or arranged to store) a second fluid; and a heat exchanger through which the first and second fluids can flow, to transfer heat from the first fluid to the second fluid.

Thus, in use, the fluid heater may heat the first fluid, the fluid store may store the second fluid, and the first and second fluids may flow through the heat exchanger to transfer heat from the first fluid to the second fluid.

The fluid heater may have a variable heat output and so may be able to heat the first fluid up to varying temperatures, the output being dependent on a particular parameter, such as an environmental condition. For example, the heater may have a variable heat output in response to an air temperature. Thus, the heater may take into account an air temperature, such as an external air temperature and the heater output may be varied accordingly. The fluid heater may be a weather compensation fluid heater. The heater may have a variable output that is dependent on, or at least partially controlled by, an air temperature.

The apparatus may thus comprise an air temperature sensor, or thermometer, that can measure an air temperature. Preferably, the thermometer is arranged to measure an external, or outside, air temperature. An output from the thermometer may control or influence heat output from the water heater.

Alternatively, rather than obtaining an indication of temperature from a temperature sensor or a thermometer, the apparatus may be arranged to obtain an indication of temperature from another source. For example, the apparatus may comprise, or be in communication with, a computer. The computer may receive information indicative of a local air temperature from an internet source. An output signal from the computer may control water heater output.

The fluid heater may operate in a first mode (which may be a weather compensation mode) in which the first fluid is heated to a temperature that is below a pre-determined, temperature. The pre-determined temperature may be at least 60°C, 65°C, 70°C or 75°C. The pre-determined temperature may be a temperature within the range 60-80°C or 65-75°C. In the first mode, the water heater may heat the first fluid so that it is sufficient for providing central heating but is not sufficient to heat mains-pressure water adequately.

For example, a relatively mild external air temperature may mean that the fluid heater only has to heat the first fluid up to a temperature of about 40-50°C, to provide adequate warmth for central heating. This would not be sufficient to heat mains-pressure water up to about 60°C.

This apparent conflict of interest may be resolved by the present invention.

The fluid heater may operate in a second mode (which may be a non-weather compensation mode) in which the first fluid is heated to a temperature at or above the pre-determined temperature. For example, there may be an override control or a timer which means that in certain circumstances, or at certain times, the boiler operates in the second mode. This may occur at regular intervals during the day or at times of peak mains-pressure demand. It may be

initiated manually. At these times, the first fluid may be hot enough to heat the second fluid in the fluid store up the required temperature. This may allow replenishment of hot fluid in the fluid store so that the second fluid in the fluid store can be used to heat mains-pressure water, even if the water heater switches to operating in the first mode. Demands for mains-pressure water may be met whilst the water heater is not required to operate at a high output constantly.

The apparatus may thus comprise a controller or control system for, in use, controlling, or varying (or that is arranged to control or vary), flow of the second fluid through the heat exchanger depending on, or in response to, the output or heating capability of the fluid heater. Flow of the second fluid through the heat exchanger may only occur, for example, when the water heater is operating in the second mode.

For example, the apparatus is controlled, or comprises a controller or control system such that the flow and/or a flow rate of the second fluid through the heat exchanger may be controlled in response to a temperature of the first fluid flowing from the fluid heater to the heat exchanger.

In a particularly preferred embodiment, described in more detail below, the control system comprises a thermostat arranged to measure a temperature of the first fluid, and a means for enabling or restricting flow of the second fluid, such as a pump.

Alternatively, rather than reacting to a temperature of the first fluid, the apparatus may be arranged such that circulation of the second fluid through the heat exchanger is controlled by another means. For example it may be controlled directly in response to an air temperature. A thermometer output may control flow of the second fluid through the heat exchanger. It is also envisaged that the water heater itself may provide an electrical output that affects flow of the second fluid through the heat exchanger. For example, the water heater may emit a signal indicative of its output.

The flow of the second fluid through the heat exchanger may be controlled such that delivery of the second fluid to the fluid store does not cause a temperature of the second fluid in the fluid store to decrease below a desirable or pre-determined value. The pre-determined value may vary depending on a number of factors such as the type of appliance the second fluid is being used to heat. Typically, the predetermined value is at least 60°C, at least 65°C, at least 70°C or at least 75°C. Preferably, delivery of the second fluid to the fluid store does not cause a substantial decrease in the temperature of the second fluid already contained in the fluid store, and in particular at or near the top of the fluid store. Preferably, the second fluid delivered to the fluid store maintains or increases the temperature of the fluid already in (at the top of) the store.

The control of the flow of the second fluid through the heat exchanger may be such that a temperature of the second fluid delivered to the fluid store is above a pre-determined value. The predetermined value may be at least 60°C, at least 65°C, at least 70°C or at least 75°C.

The temperature of the second fluid delivered to the fluid store may be greater than or equal to a maximum temperature of the second fluid contained within the store.

Thus, the apparatus may be particularly advantageous when there is a delay in the fluid heater heating the first fluid up to a sufficiently high temperature or if it is operating in a weather compensation mode.

Preferably, the first fluid and/or second fluid is water.

The fluid heater may be any suitable heater capable of heating a fluid. This includes a boiler such as a gas boiler. It also includes a wood burner and solar panels. The water heater may be part of a combined-heat-and-power (CHP) system.

The fluid store may be any means capable of storing the second fluid such that the second fluid can maintain its heat for an extended period. Fluid stores are generally insulated such that hot fluid can be stored for an extended period,

without losing its heat. The fluid store may be a water cylinder. The fluid store may be vented or pressurised. The fluid store may be a thermal store, in which, for example, domestic or mains-pressure water is not stored and where heat is transferred to mains-pressure water using a heat exchanger. The fluid store preferably has outlets or connections for supplying the second fluid to appliances or other heat exchangers.

Preferably, the second fluid in the fluid store is exclusively for heating mains-pressure water. Preferably the fluid store is not used for heating or providing central heating fluid. The central heating fluid may be heated directly by the first fluid using, for example, a second, or distinct, heat exchanger. There may be an alternative fluid store used for heating central heating water.

Preferably, the heat exchanger is outside the fluid store, but it could be inside the fluid store. The heat exchanger is preferably a plate heat exchanger and may be a tube-in-tube heat exchanger.

Preferably, the first fluid is circulated through the heat exchanger, such that following delivery to the heat exchanger, the first fluid returns back to the boiler.

The apparatus may comprise a first-fluid pump for pumping the first fluid through the heat exchanger.

Preferably, the second fluid is circulated through the heat exchanger. Typically, the second fluid flows from a lower part of the fluid store to a higher part of the fluid store. Preferably, the second fluid flows from the bottom of the fluid store, through an outlet, through the heat exchanger and returns to the top of the fluid store through an inlet. The second fluid may flow from the bottom half, bottom third or bottom quarter of the fluid store, with reference to the internal height or length of the fluid store. The second fluid may flow to the top half, top third or top quarter of the fluid store. This may help to keep a temperature differential within the fluid store, with hotter water being at the top and cooler water being at the bottom. However, the second fluid may be supplied to the fluid store

from a cold fluid feeding tank, possibly placed above the fluid store, such that the fluid may flow under the influence of gravity.

Preferably, the apparatus comprises a means for enabling or restricting the flow of the second fluid through the heat exchanger in response to the temperature of the first fluid. The preferred means is a pump. However, other means may be suitable, such as a valve. The means may be responsive or programmed to be responsive to a signal from a thermostat or other type of temperature sensor.

The apparatus preferably comprises a temperature sensor arranged to measure the temperature of the first fluid flowing between the fluid heater and the heat exchanger, such as the temperature of the first fluid flowing from the water heater to the heat exchanger. The sensor may be in the form of a thermostat, which, in response to a measured temperature, may provide a signal to affect flow of the second fluid through the heat exchanger. This may include providing a signal or output to the pump or valve, or modifying or preventing a signal being sent to the pump or valve.

In a particularly preferred embodiment, the apparatus is arranged such that if the temperature of the first fluid, as measured by the temperature sensor, is above a predetermined value, the second fluid can flow through the heat exchanger and if the temperature of the first fluid is below the pre-determined value, the second fluid cannot flow through the heat exchanger. This means that only when the first fluid is hot enough, the second fluid can flow through the heat exchanger. The first fluid then transfers heat to the second fluid at the heat exchanger, and the heated second fluid is delivered to the fluid store. As a result, the second fluid entering the store does not decrease the temperature of the second fluid in the store. The predetermined temperature may be at least 60°C, at least 65°C, at least 70°C or at least 75°C. However, the value would depend on the intended use of the heating apparatus and the appliances heated by the second fluid.

The apparatus may comprise a pump for pumping the second fluid through the heat exchanger. In a preferred embodiment, the pump affects the flow of the

second fluid in response to the temperature of the first fluid. For example, if the temperature of the first fluid is below the predetermined value, the pump may be prevented from pumping the second fluid through the heat exchanger.

In a preferred example, the control system may be implemented such that the thermostat measuring a temperature of the first fluid may prevent a run signal from reaching the pump or such that the thermostat may prevent electrical power from reaching the pump. Typically, the pump may receive a run signal (from a conventional controller) if a separate thermostat positioned in the fluid store indicates that the temperature of the second fluid within the fluid store is too low. The pump may also receive conventional run signals from a timer or may receive a run signal initiated manually by a user, such as an override signal. If the thermostat measuring the temperature of the first fluid detects a temperature below the predetermined value, then it may prevent these run signals from reaching the pump. If the temperature of the first fluid is greater than the predetermined temperature, the thermostat will not prevent the run signal or electrical power from reaching the pump and the pump will operate.

Alternatively, if the temperature of the first fluid is above the predetermined value, the thermostat may provide a run signal to the pump. The pump may activated in response to the run signal from the thermostat or it may be initiated in response to the run signal from the thermostat in addition to one or more other run signals. If the temperature of the first fluid is below the predetermined value, then the thermostat may not provide a run signal to the pump.

In another embodiment, the control system may comprise a valve for affecting the flow of the second fluid through the heat exchanger in response to the temperature of the first fluid. The valve may thus be a thermostatic control valve. For example, if the thermostat measures a first fluid temperature that is below the pre-determined value, the valve may close to prevent or restrict the flow of the second fluid through the heat exchanger.

In an alternative embodiment, the apparatus may permit the second fluid to flow through the heat exchanger even when the first fluid is below an ideal, optimum or maximum temperature, such as the predetermined temperature.

For example, the apparatus may be configured such that when the temperature of the first fluid is below the optimum or maximum temperature, the second fluid may be able to flow through the heat exchanger, but at a reduced rate compared to if the first fluid is at the optimum or maximum temperature. The apparatus could permit delivery of the cooler second fluid into the fluid store, but because it has a lower rate of delivery, it will not cause an unacceptable reduction in the temperature of the second fluid contained within the fluid store. There may be a small reduction in the temperature of the second fluid contained within the fluid store, but this may be within acceptable limits.

In one example, the second fluid may be controlled to have a variable flow rate. As the temperature of the first fluid decreases, the flow rate of the second fluid through the heat exchanger may also decrease. Configuration of the apparatus may be such that when the first fluid is at or above the predetermined temperature, the flow rate of the second fluid through the heat exchanger is at a maximum. When the temperature is below the predetermined temperature, the flow rate of the second fluid may reduce. The flow rate may reduce in relation to, or in proportion to, the temperature of the first fluid. For example, if the temperature of the first fluid is only slightly below the predetermined temperature, the flow rate of the second fluid may be slightly less than maximum. If the temperature is significantly lower than the predetermined temperature then the flow rate may reduce to a level significantly lower than maximum.

The relationship between the flow rate of the second fluid and the temperature of the first fluid may be configurable such that influx of the second fluid into the fluid store from the heat exchanger does not cause the temperature of the second fluid within the fluid store to drop below the predetermined or desired temperature. A user may take into account, for example, the size of the fluid store, the size of the fluid heater and the distance between the fluid heater and the fluid store when configuring the relationship.

There may be provided a method for controlling fluid heating and storage, comprising: sensing a temperature of a first fluid flowing to a heat exchanger

from a fluid heater; and controlling a flow of a second fluid through the heat exchanger to a fluid store.

Preferably, the fluid heater has an output responsive to an air temperature. The fluid heater may thus be a weather compensation fluid heater. The flow of the second fluid may be controlled depending on the heat output of the fluid heater. For example, flow of the second fluid may be controlled in response to a temperature of the first fluid.

Preferably, controlling the flow of the second fluid occurs such that the second fluid entering the fluid store does not cause a temperature of the second fluid in the fluid store to decrease below a predetermined level.

In a preferred embodiment, the method comprises preventing the flow of the second fluid through the heat exchanger if the temperature of the first fluid is less than a predetermined value and permitting the flow of the second fluid through the heat exchanger if the temperature of the first fluid is greater than the predetermined value.

The invention may also provide a kit for, or specifically adapted for, assembling an apparatus as described in any form above. The kit may comprise a fluid heater for heating a first fluid; a fluid store for storing a second fluid; a heat exchanger through which, in use, the first and second fluids can flow, to transfer heat from the first fluid to the second fluid.

The kit may comprise a controller or control system that, in use, controls flow of the second fluid through the heat exchanger, depending on the output of the fluid heater. This may comprise a thermostat for measuring a temperature of the first fluid flowing from the fluid heater to the heat exchanger; and a means for enabling or restricting the flow of the second fluid through the heat exchanger in response to the temperature measured by the thermostat, such as a pump or a valve.

The kit may also comprise a set of instructions for installing or configuring the kit into an apparatus, in which the flow of the second fluid through the heat exchanger is controlled in response to the temperature of the first fluid.

Alternatively, the invention may provide a kit for, or specifically adapted for, assembling an apparatus as defined in any form above. The kit may comprise a controller or control system that, in use, controls flow of a second fluid through a heat exchanger, depending on the output of a fluid heater. For example, the kit may comprise a thermostat for measuring a temperature of a first fluid flowing from a fluid heater to a heat exchanger. The kit may comprise a means for enabling or restricting the flow of the second fluid through the heat exchanger.

The kit may comprise instructions for installing and configuring the control system into an apparatus or arrangement comprising a fluid heater for heating a first fluid; a fluid store for storing a second fluid; and a heat exchanger through which, in use, the first and second fluids can flow to transfer heat from the first fluid to the second fluid, such that the control system controls flow of a second fluid through the heat exchanger, depending on the output of the fluid heater. The instructions may be for installing and/or configuring the thermostat and/or the controller in order to control the flow of the second fluid through the heat exchanger to the fluid store in response to a temperature of the first fluid.

The kit may also comprise one or more of the following: a fluid heater for heating a first fluid; a fluid store for storing a second fluid; a heat exchanger through which, in use, the first and second fluids can flow to transfer heat from the first fluid to the second fluid.

Description of specific embodiment

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram of a fluid heating and storage system according to an embodiment of the invention;

Figure 2 is a schematic diagram of a fluid heating and storage system according to another embodiment of the invention.

A fluid heating and storage system 1 as shown in Figure 1 comprises a fluid store 3, in the form of a hot water cylinder. The cylinder contains storage water 15, stratified into layers according to its temperature. Hot water 19, typically at 60-65°C, is at the top and cool water 17, typically below 30°C, is at the bottom. A layer of water 20 at an intermediate temperature is between the hot water and cool water.

A storage water circuit or pipe 13 extends between a storage water outlet 21 at the bottom of the cylinder and a storage water inlet 23 at the top of the cylinder. The storage water circuit passes through a plate heat exchanger 5 positioned outside the cylinder. The storage water circuit also incorporates a pump 7 between the fluid store outlet and the heat exchanger.

The system has a boiler (not shown) and a boiler water circuit or pipe 11 runs between a boiler outlet and a boiler inlet (both not shown). The boiler water circuit passes through the heat exchanger 5 and has a thermostat positioned between the boiler outlet and the heat exchanger, adjacent to the heat exchanger. The boiler water circuit also has a pump (not shown).

In use, the boiler heats the boiler water to a temperature of typically 70°C or above. The pump in the boiler water circuit 11 pumps the boiler water from the boiler water outlet and through the heat exchanger 5. Consequently, the hot boiler water is delivered to the heat exchanger where it is available to transfer heat to storage water. Colder boiler water is returned to the boiler through the boiler water inlet once the transfer has taken place.

The pump 7 in the storage water circuit pumps cool storage water 17 from the storage water outlet 21, through the heat exchanger. As the storage water flows through the heat exchanger, the boiler water heats the storage water up to a temperature typically above 60°C. The heated storage water then enters

the water cylinder 3 at the top through the storage water inlet 23, adding to the layer of hot water 19.

Hot storage water is then available for other applications when required, such as heating mains-pressure water, in a known manner.

The thermostat 9 senses the temperature of the boiler water entering the heat exchanger 5 from the boiler. Depending on this temperature, the thermostat influences the operation of the pump 7 in the storage water circuit. The thermostat is programmed such that if the temperature of the boiler water entering the heat exchanger is at least 60°C or above, it does not prevent the pump from running. However, if the temperature of the boiler water is below 60°C, the thermostat prevents the pump from running, and storage water cannot flow through the heat exchanger.

Although not described in detail, the pump may receive signals from a number of different sources, as in a conventional system, instructing it to run. This may include signals from a timer or signal from a thermostat in the water cylinder 3. If the temperature of the boiler water entering the heat exchanger is below 60°C, the thermostat prevents such run signals from reaching the pump.

As a result, storage water flows through the heat exchanger 5 only if the boiler water is sufficiently hot to heat the storage water. This prevents cooler storage water entering the top of the water cylinder 3 and cooling the hot water 19. Consequently, the hot water 19 at the top of the fluid store is maintained at the desired temperature.

An alternative fluid heating and storage system 1 is shown in Figure 2. Similar features to those in Figure 1 have been assigned like reference numerals.

The system 1 is substantially the same as described above, in relation to Figure 1. However, the system has a weather compensation boiler 31. The weather compensation boiler is in electrical connection with a temperature sensor or thermometer 33 that is positioned to measure an external air

temperature. The boiler is connected to the heat exchanger 5 by the boiler water circuit or pipe 11.

In use, the water heater 31 has a variable heat output depending on the external air temperature sensed by the temperature sensor 33. If the external temperature is mild, then the water heater output is reduced to save energy and fuel consumption. If the external temperature is cold, then the water heater output is increased to ensure that the central heating is at an adequate temperature to heat the inside of the building. The central heating circuit is not shown in Figure 2.

If the external air temperature is mild, and the water heater output is reduced, the boiler flow i.e. the boiler water circulating in the boiler water circuit 11 is less than 65°C. The temperature of the boiler water is detected by the thermostat 9 and the pump 7 is prevented from running. So, cooler water is prevented from entering the top of the fluid store 3. This preserves any hot water 19 at about 60-65°C that is at the top of the store, which is available for heating mains-pressure water to about 60°C. The mains-pressure water circuit is not shown in Figure 2. The hot water at the top of the store can be delivered to a heat exchanger, such as a plate heat exchanger, where transfer of heat to the mains-pressure water in the mains-pressure water circuit can occur.

If storage water is permitted to flow through the storage water circuit or pipe 13 by the pump 7 when the boiler water is below 65°C, then it may cause the temperature of the storage water in the fluid store to decrease. In such a situation, the system could not meet demands for the provision of hot mains-pressure water.

At regular intervals during the day (and, for example, at times of peak hot water demand), or if the external air temperature is particularly cold, the boiler output is increased. If the boiler output is increased such that the temperature of the boiler fluid reaches 65°C or above, the thermostat 9 will permit operation of the pump 7 in the storage water circuit 13 such that storage water 15 can be heated to about 60-65°C and delivered to the top of the fluid store 3.

Claims

1. A fluid heating and storage apparatus, comprising:

a fluid heater arranged to heat a first fluid, that has an output responsive to an air temperature;

a fluid store arranged to store a second fluid;

a heat exchanger through which, in use, the first and second fluids flow, to transfer heat from the first fluid to the second fluid; and

a control system that, in use, controls flow of the second fluid through the heat exchanger, depending on the output of the fluid heater.

2. An apparatus according to claim 1, in which flow of the second fluid through the heat exchanger is only permitted when the fluid heater output is sufficient to heat the second fluid to a pre-determined temperature.

3. An apparatus according to claim 1 or claim 2, in which the control system controls the flow of the second fluid through the heat exchanger in response to a temperature of the first fluid flowing between the fluid heater and the heat exchanger.

4. An apparatus according to any preceding claim, in which the water heater operates in a first, weather compensation mode in which the second fluid is heated to a temperature that is below a pre-determined temperature, and a second, non-weather compensated mode in which the first fluid is heated to a temperature that is at or above the pre-determined temperature, and in which the flow of the second fluid through the heat exchanger is prevented or reduced in the first mode and is permitted or increased in the second mode.

5. An apparatus according to claim 4, in which the predetermined temperature value of the first fluid is at least 60°C, at least 65°C, at least 70°C or at least 75°C.

6. An apparatus according to any preceding claim, in which the control system is arranged such that the second fluid entering the fluid store from the heat exchanger does not cause a temperature of the second fluid in the fluid store to decrease below a pre-determined value.

7. An apparatus according to any preceding claim, in which the control system comprises a thermostat arranged to sense or measure the temperature of the first fluid flowing between the fluid heater and the heat exchanger, and controls the flow of the second fluid through the heat exchanger in response to the sensed or measured temperature.

8. An apparatus according to any preceding claim, in which the control system comprises a means for enabling or restricting the flow of the second fluid through the heat exchanger in response to the temperature of the first fluid.

9. An apparatus according to claim 7, in which the means for enabling or restricting the flow of the second fluid is a pump.

10. An apparatus according to claim 9, in which the pump is controlled such that if the temperature of the first fluid is below the predetermined value, the pump cannot pump the second fluid through the heat exchanger and if the temperature of the first fluid is above the predetermined value, the pump can pump the second fluid through the heat exchanger.

11. An apparatus according to claim 10, in which a run signal is prevented from reaching the pump unless the temperature of the first fluid is above the pre-determined value.

12. An apparatus according to claim 10 or claim 11, in which electrical power is prevented from reaching the pump unless the temperature of the first fluid is above the pre-determined value.

13. An apparatus according to any preceding claim, arranged such that the first fluid can circulate between the fluid heater and the heat exchanger.

14. An apparatus according to any preceding clam, arranged such that the second fluid can circulate between the fluid store and the heat exchanger.

15. An apparatus according to any preceding claim, comprising a temperature sensor arranged to measure an air temperature, preferably an external air temperature and a controller or means for controlling water heater output in response to the air temperature.

16. A method for controlling fluid heating and storage, comprising:

sensing a temperature of a first fluid flowing between a heat exchanger and a fluid heater with an output responsive to an air temperature; and

controlling flow of a second fluid through the heat exchanger to a fluid store depending on the output of the fluid heater.

17. A method according to claim 16, comprising controlling the flow of the second fluid through the heat exchanger in response to a temperature of the first fluid.

18. A method according to claim 16 or claim 17, in which the controlling the flow of the second fluid occurs such that the second fluid entering the fluid store does not cause a temperature of the second fluid in the fluid store to decrease below a predetermined level.

19. A method according to any of claims 16 to 18, comprising preventing or restricting the flow of the second fluid through the heat exchanger if the temperature of the first fluid is less than a predetermined value and permitting the flow of the second fluid through the heat exchanger if the temperature of the first fluid is greater than the predetermined value.

20. A kit specifically adapted for assembling an apparatus according to any of claims 1 to 15, comprising:

a fluid heater for heating a first fluid, with an output responsive to an air temperature;

a fluid store for storing a second fluid;

a heat exchanger through which, in use, the first and second fluids can flow, to transfer heat from the first fluid to the second fluid; and

a control system that, in use, controls flow of the second fluid through the heat exchanger, depending on the output of the fluid heater.

21. A kit according to claim 1, in which the control system comprises:

a thermostat for measuring a temperature of the first fluid flowing between the fluid heater and the heat exchanger; and

a means for enabling or restricting or preventing the flow of the second fluid through the heat exchanger in response to the temperature measured by the thermostat.

22. A kit specifically adapted for assembling an apparatus according to any of claims 1 to 15, comprising:

a control system that, in use, controls flow of a second fluid through a heat exchanger, depending on the output of the fluid heater; and

instructions to install and/or configure the control system in an arrangement having a fluid heater for heating a first fluid, a fluid store for storing a second fluid, and a heat exchanger through which, in use, the first and second fluids can flow to transfer heat from the first fluid to the second fluid, so as to control the flow of the second fluid through the heat exchanger to the fluid store in response to output of the fluid heater.

23. A kit according to claim 22, comprising:

a thermostat for measuring a temperature of the first fluid flowing between the fluid heater and the heat exchanger; and

a means for enabling or restricting the flow of the second fluid through the heat exchanger,

instructions to install and/or configure the thermostat and means for enabling or restricting the flow of the second fluid through the heat exchanger so as to control the flow of the second fluid through the heat exchanger in response to the temperature of the first fluid.

24. An apparatus substantially as hereinbefore described with reference to the accompanying drawing.

25. A method substantially as hereinbefore described with reference to the accompanying drawing.

26. A kit substantially as hereinbefore described, with reference to the accompanying drawing.

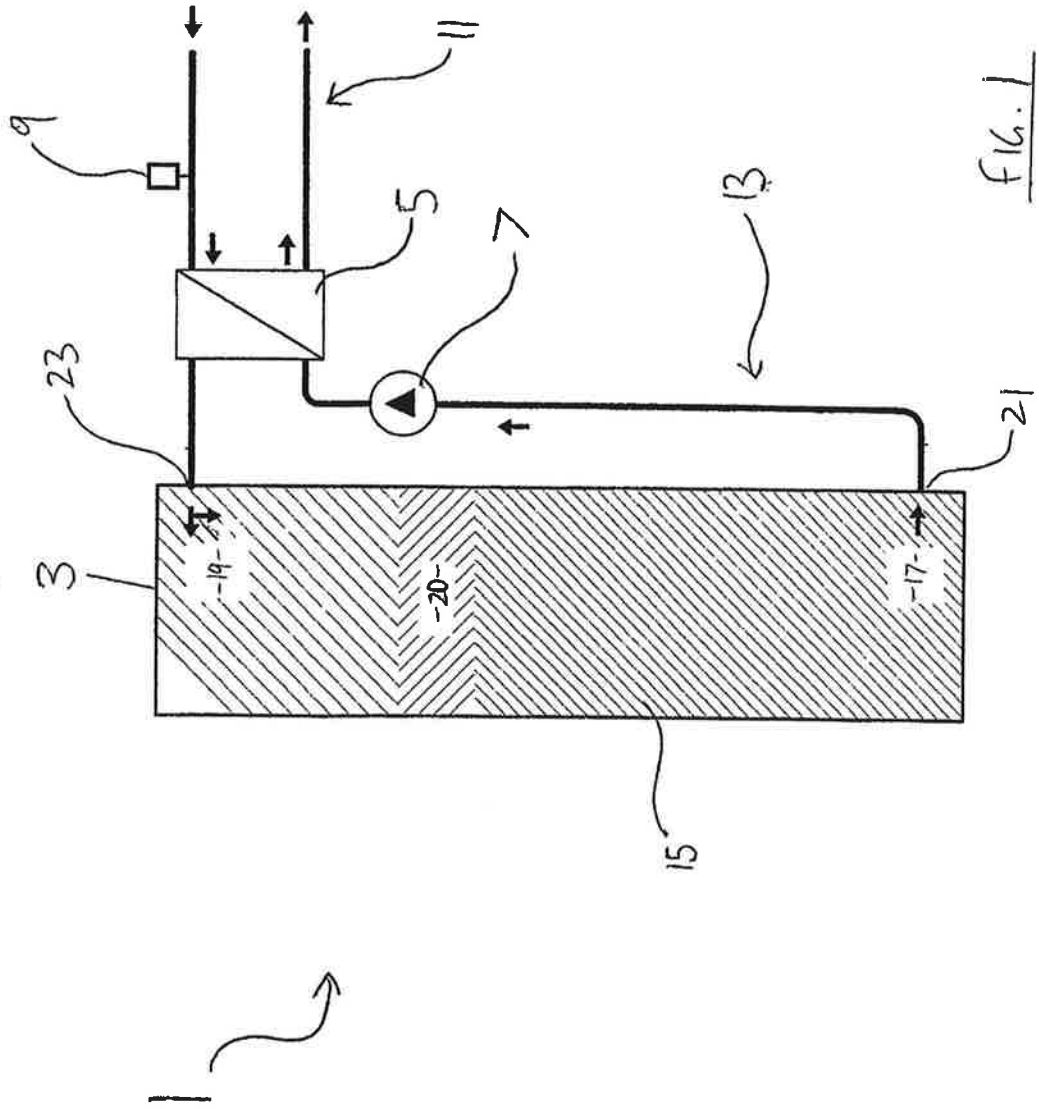


FIG. 1

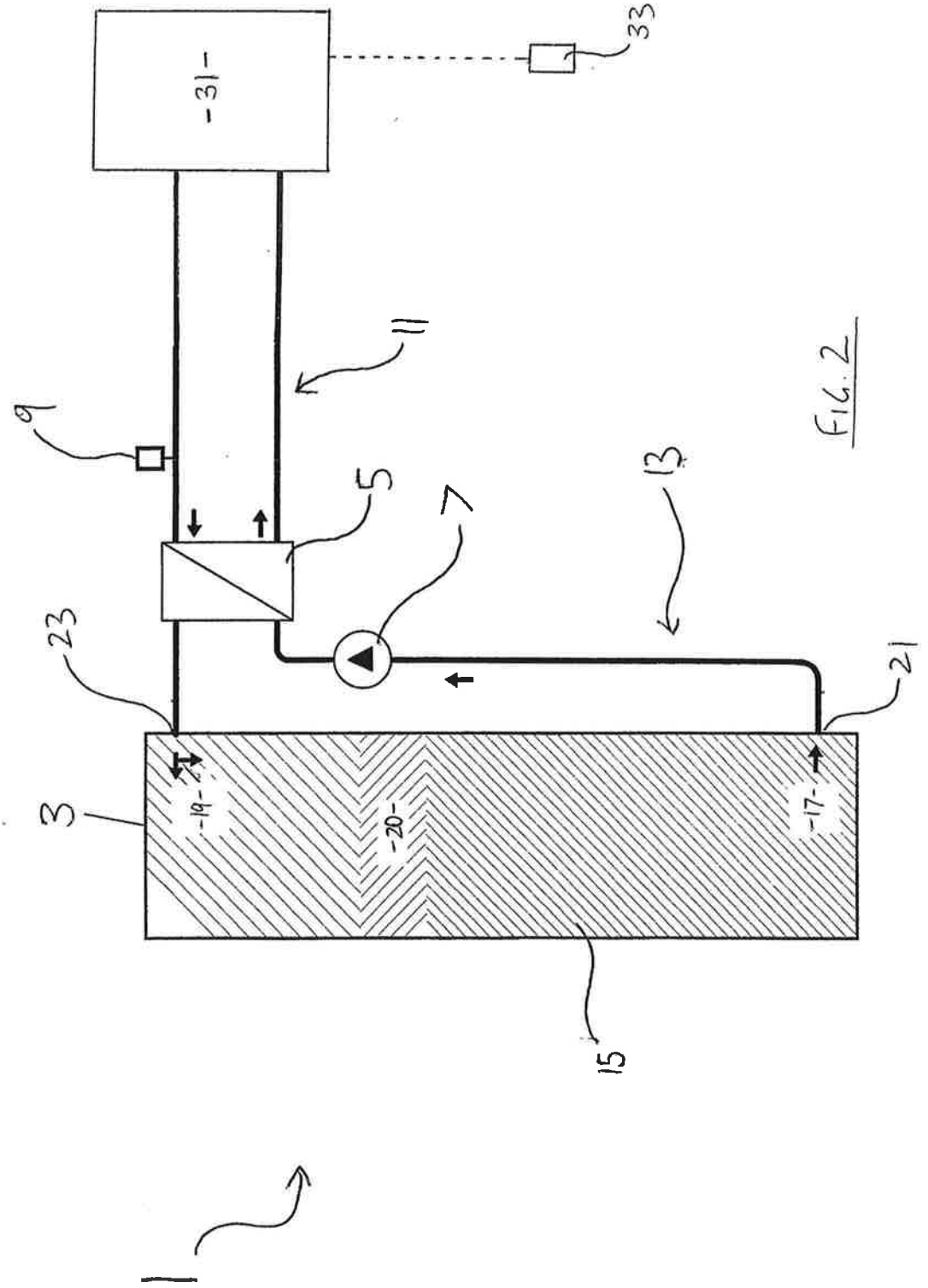


FIG. 2