

Description

[0001] The present invention relates to combined hot water and heating systems.

[0002] Combined hot water and heating systems are commonly provided in homes. Such systems allow provision of hot water for use in radiators, to heat the home, and for heating water for use in other domestic applications, for example washing, from the same hot water supply.

[0003] A conventional combined hot water and heating system has a boiler, which takes in cold water via an inlet and supplies hot water via an outlet, and a pump for pumping hot water from the boiler around the combined hot water and heating system.

[0004] A combined hot water and heating system may have several water circuits. A typical system has two circuits. The first, a heating circuit, allows water from the boiler to circulate through a series of radiators. Control of the supply of hot water passing through the heating circuit allows controlled heating of the house.

[0005] The second circuit is a hot water circuit. A portion of the hot water circuit passes through a hot water tank. This portion of the hot water circuit is usually coiled to provide a better thermal coupling between water in the hot water circuit and water to be heated in the hot water tank. By controlling the flow of hot water through the hot water circuit it is possible to control the temperature of water in the hot water tank.

[0006] US 4,671,457 discloses a thermostat which is arranged to control the timing and intensity of operation of a burner in order to regulate temperature of a heated space. The system selects the duration and intensity of heating of by the burner to provide a roughly constant temperature. This system has a disadvantage in that directly pulsing the burner may cause increased wear of the burner components.

[0007] It is an object of the present invention to provide an alternative combined hot water and heating system.

[0008] According to a first aspect of the present invention there is provided a combined hot water and heating system comprising a hot water supply means and a pump for pumping water from the hot water supply means to a first water circuit and a second water circuit, wherein supply of hot water from the hot water supply means to the first and second water circuits is regulated by at least one valve means, the system comprising control means, which comprises a timer operable to set predetermined heating periods and predetermined heat dissipation periods, said control means operable when the hot water supply means is in operation and during the heat dissipation periods to cause the at least one valve to prevent supply of hot water from the hot water supply means to at least one of said first and second water circuits.

[0009] Hot water may only be supplied to the water circuits during the predetermined heating periods. This

results in a pulsing of the supply of hot water to the water circuits when hot water is needed. The applicant has found that pulsed supply of hot water to water circuits of a combined hot water and heating system results in greater energy efficiency.

[0010] The at least one valve means may comprise a valve for each water circuit.

[0011] Each water circuit may have an associated thermostat and supply of hot water to each water circuit by the at least one valve means may be controlled in dependence on the output of the thermostat associated with that water circuit.

[0012] The combined hot water and heating system may be a domestic hot water and heating system, the first circuit being associated with provision of hot water for domestic use and the second water circuit being associated with space heating and wherein the thermostat associated with the first water circuit is a hot water thermostat and the thermostat associated with the second water circuit is a room thermostat.

[0013] The duration of the predetermined heating periods and the duration of the predetermined cooling periods may be user selectable.

[0014] The duration of the predetermined periods may be user selectable between 2 minutes and 30 minutes. Preferably, the predetermined periods may be user selectable between 5 minutes and 10 minutes.

[0015] The combined hot water and heating system may be arranged to allow user selection of a continuous heating mode. When operating in the continuous heating mode the combined hot water and heating system would act as a conventional combined hot water and heating system, providing hot water to the water circuits continuously.

[0016] According to a second aspect of the present invention there is provided a control means for a combined hot water and heating system comprising a hot water supply means and a pump for pumping water from the hot water supply means to a first water circuit and a second water circuit, wherein supply of hot water from the hot water supply means to the first and second water circuits is regulated by at least one valve means, the control means comprising a timer operable to set predetermined heating periods and predetermined heat dissipation periods, said control means being operable when the hot water supply means is in operation and during the heat dissipation periods to cause the at least one valve means to prevent supply of hot water from the hot water supply means to at least one of said first and second water circuits.

[0017] The control means may be provided as a stand-alone unit for retro-fitting to existing combined hot water and heating systems. The control unit may be arranged to cause a combined hot water and heating system to operate in a manner as described above with reference to the first aspect of the present invention.

[0018] Throughout this specification the word "comprise", or variations such as "comprises" or "compris-

ing", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

[0019] A combined hot water and heating system which embodies this invention is described now, by way of example only, with reference to the accompanying drawings of which:

Figure 1 is a diagram which shows schematically the structure of a combined hot water and heating system;

Figure 2 is a flow diagram illustrating the operation of the boiler of the hot water and heating system shown in Figure 1;

Figure 3 is a flow diagram illustrating the operation of the pump of the hot water and heating system shown in Figure 1;

Figure 4 is a flow diagram illustrating the operation of the hot water zone valve of the hot water and heating system of Figure 1;

Figure 5 is a flow diagram illustrating the operation of the heating zone valve of the hot water and heating system shown in Figure 1; and

Figure 6 is a diagram which schematically shows the structure of an electronic control system connected to a pre-existing combined hot water and heating system.

[0020] Figure 1 shows a combined hot water and heating system 1 in a house comprising a hot water supply means in the form of a boiler 10 and a pump 11. The pump 11 is connected to the boiler 10 and arranged to pump hot water from the boiler 10 around the system 1.

[0021] The system 1 comprises a heating circuit 2 and a hot water circuit 3. The circuits 2 and 3 form a common portion passing through the boiler 10 and the pump 11.

[0022] Supply of water from the boiler 10 to the circuits 2 and 3 is controlled by a pair of zone valves H and HW located at one end of the common portion of the two water circuits 2 and 3. Zone valve H controls supply of hot water to the heating circuit 2. Zone valve HW controls hot water supply to the hot water circuit 3.

[0023] The heating comprises three radiators 21 arranged in the heating circuit. Each radiator 21 is provided with an inlet attached to a first half of the heating circuit 2 and with an outlet attached to a second half of the heating circuit 2. When hot water from the boiler 10 is pumped around the heating circuit 2 it has to pass through an inlet and an outlet of a radiator 21. This ensures that all the hot water pumped around the heating circuit 2 passes through a radiator 21 and is used to heat the house.

[0024] The hot water circuit 3 comprises a coiled portion of pipe 31. This coiled portion of pipe is arranged inside a hot water tank 4 which is arranged to supply hot water to the house. The hot water tank 4 is supplied at its lower end with cold water from a cold water tank 5. Hot water may be extracted from the hot water tank to supply taps 6.

[0025] The combined hot water and heating system 1 also has an expansion tank 7 which is arranged to supply water to the heating and hot water circuits 2 and 3 as necessary. The expansion tank compensates for any loss of water from the water circuits 2 and 3 due to leaks and reduces the accumulation of air in the circuits. An expansion pipe (not shown) runs from the hot water tank to above the expansion tank, allowing water to be discharged into the expansion tank 7. The expansion pipe allows for expansion of water in the hot water tank. A second expansion pipe (not shown) runs from the water circuits 2 and 3 to above the expansion tank, allowing water to be discharged into the expansion tank 7. The second expansion pipe allows for expansion of water in the water circuits 2 and 3.

[0026] The cold water tank 5 and expansion tank 7 are shown schematically in Figure 6. Both of these tanks are usually located above the remainder of the combined hot water and heating system 1.

[0027] The system 1 also comprises three thermostats which are used in controlling the operation of the system. A hot water thermostat A is provided in the hot water tank 4 to monitor the temperature of the water in the hot water tank. A boiler thermostat B is provided in the boiler 10 to monitor the temperature of water in the boiler. A room thermostat C is provided in an appropriate room of the house to monitor the temperature of the house.

[0028] The Zone valves H and HW, the boiler 10 and the pump 11 are controlled by an electronic control system 8. The electronic control system 8 comprises a timer which measures heating on periods and heating off periods.

[0029] Operation of the system 1 will now be explained with reference to Figures 2 to 5.

[0030] Control of operation of the boiler 10 is illustrated in Figure 2. When the system 1 is operational the temperature of water in the boiler 10 is monitored by the boiler thermostat B. It is important that the water in the boiler 10 is not overheated as boiling of water in the boiler may cause damage to the system 1.

[0031] If the temperature of water in the boiler 10 is below a predetermined desired temperature, the control system 8 causes the boiler 10 to heat the water. If the water in the boiler 10 is above the predetermined desired temperature, the control system 8 switches the boiler 10 off and allows the water in the boiler to cool.

[0032] Figure 3 illustrates control of the operation of the pump 11. Passage of water around the water circuits 2 and 3 is determined by the zone valves H and HW. If both of these valves are closed then there is no where

for water to go beyond the pump 11. Accordingly, the pump 11 operates to pump water around the system 1 whilst one of the two zone valves H and HW is open. If both zone valves H and HW are closed the control system 8 switches the pump 11 off.

[0033] Figure 4 illustrates control of zone valve HW. When the system 1 is operational the hot water thermostat A monitors temperature of water in the hot water tank 4. At the same time the control system 8 is measuring heating on and heating off periods each of a predetermined duration. If the temperature of water in the hot water tank 4 is below a predetermined desired temperature and the control system 8 is measuring a heating on period, the zone valve HW is opened and hot water passes around the hot water circuit 3. If either the temperature in the hot water tank 4 is above the predetermined desired temperature or the control system 8 is measuring a heating off period the zone valve HW is closed.

[0034] In this manner, when the water in the hot water tank 4 needs heating the control system 8 provides hot water to the hot water circuit 3 in a pulsed manner.

[0035] Figure 5 illustrates control of the zone valve H. When the system 1 is operational the room thermostat C monitors the temperature of an appropriate room in the house. If the temperature of room is below a predetermined desired temperature and the control system 8 is measuring a heating on period, the zone valve H is opened and hot water passes around the heating circuit 2. If either the temperature in the room is above the predetermined desired temperature or the control system 8 is measuring a heating off period the zone valve H is closed. In this manner, when the room is below the predetermined desired temperature and needs heating, the control system 8 supplies hot water to the radiators 21 in a pulsed manner in order to heat the room.

[0036] Figure 6 is a diagram schematically shows the structure of an electronic control system 8 connected to a heating system 40 incorporating the present invention.

[0037] The pre-existing heating system 40 is of the same type described with reference to Figure 1. Corresponding features shown in the two figures are indicated with corresponding reference numerals. Description of these features is omitted for the sake of brevity.

[0038] The Pump 11 and zone valves H and HW are arranged as previously described. However, a connector block 41 (not shown in Figure 1) is provided to supply 240 V electricity to the pump 11 and the zone valves H and HW.

[0039] The electronic control system 8, indicated in a box, is supplied with power from a 240 V AC supply 90. Electricity from the power supply 90 is converted to 120 V and rectified in the electronic control system 8 to supply an electronics control unit 81. The electronics control unit 81 has two inputs 82 and 83 for receiving information from a user. The input 82 allows a user to set the heating on period for use in the operation of the system as described above with reference to Figures 2 to 5. The

input 83 allows a user to set the heating off period.

[0040] The electronics control unit 81 is connected to a relay 84, which controls a pair of switches 85 and 86. The switches 85 and 86 are connected between the pre-existing heating system between the power supply from the connector block 41 and the zone valves H and HW. The switches 85 and 86 may be opened and closed to control power supply from the connector block 41 to the zone valves H and HW. Over-ride switches 87 and 88 are provided to allow power supplied from the connector block 41 to by-pass switches 85 and 86 respectively to reach zone valves H and HW.

[0041] Although not shown in Figure 6, inputs from the hot water thermostat A and Room thermostat C are connected to the electronic control system 8.

[0042] In operation, the control unit 81 sends signals to the relay 84 causing the relay 84 to open and close the switches 85 and 86 thereby controlling operation of zone valves H and HW. The control unit 81 causes the switches 85 and 86 to open and close supplying power to the zone valves H and HW so that the pre-existing central heating system operates as described with reference to Figures 4 and 5.

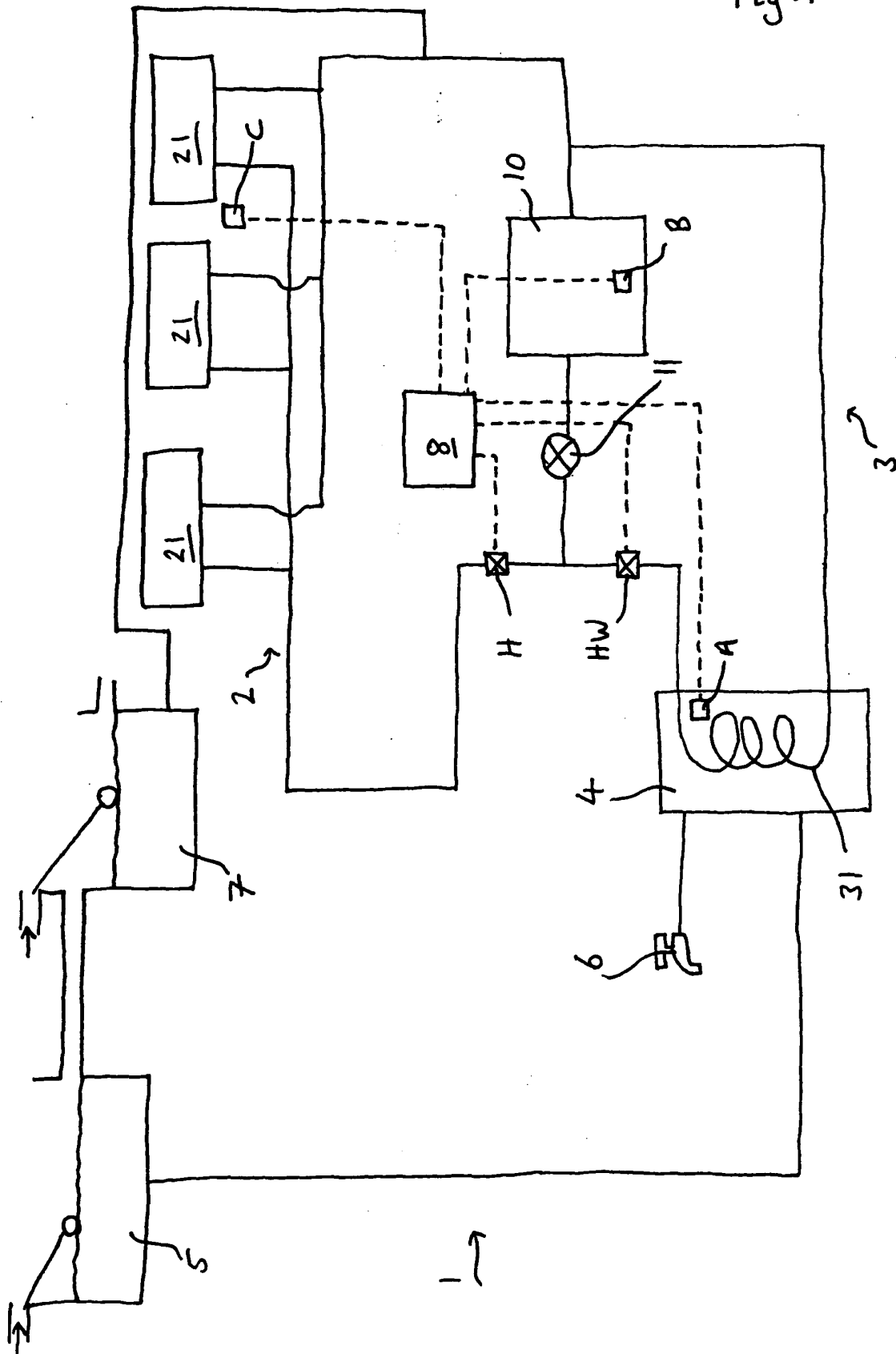
[0043] The control system 8 allows retro-fitting of existing combined hot water and heating systems. In the embodiment described above the control system takes advantage of existing electronics in the heating system to control the pump 11. When zone valves H and HW are both closed, the existing electronics shut off the pump 11. Otherwise, when at least one zone valve is open, the pump 11 is operational. The control unit 8 may be adapted to take advantage of the electronics pre-existing in a particular combined hot water and heating system to which it is to be fitted.

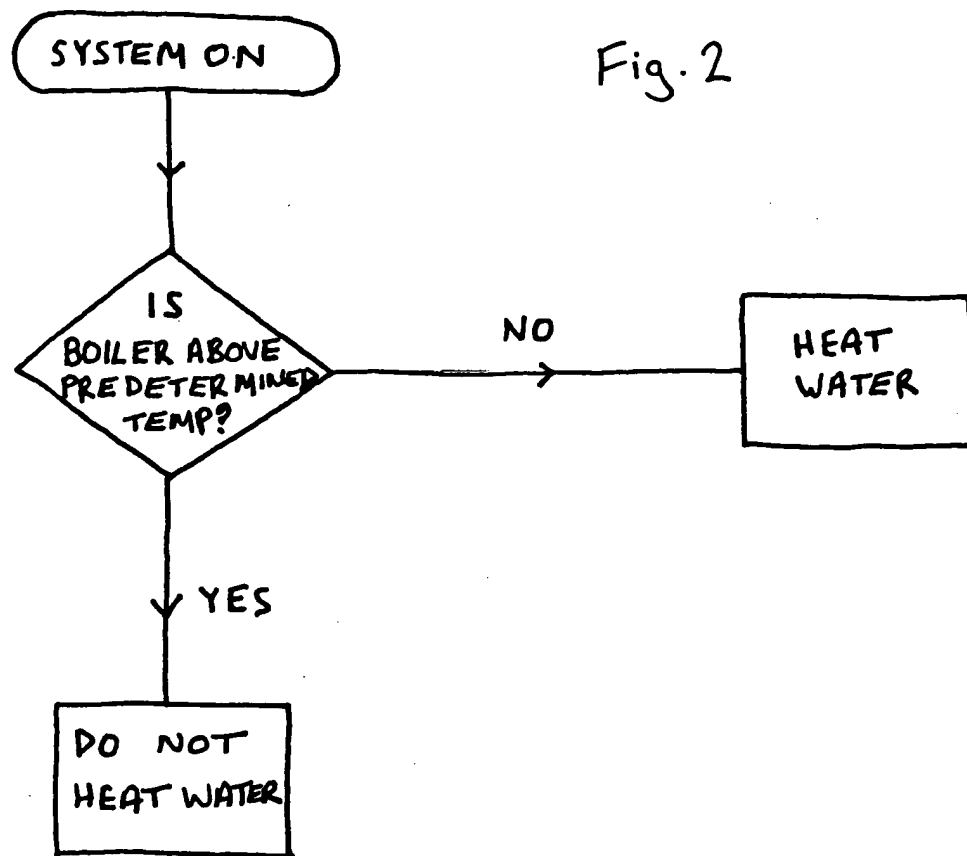
Claims

1. A combined hot water and heating system comprising a hot water supply means and a pump for pumping water from the hot water supply means to a first water circuit and a second water circuit, wherein supply of hot water from the hot water supply means to the first and second water circuits is regulated by at least one valve means, the system comprising control means, which comprises a timer operable to set predetermined heating periods and predetermined heat dissipation periods, said control means operable when the hot water supply means is in operation and during the heat dissipation periods to cause the at least one valve to prevent supply of hot water from the hot water supply means to at least one of said first and second water circuits.
2. A combined hot water and heating system according to claim 1 wherein the at least one valve means comprises a valve for each water circuit of the system.

3. A combined hot water and heating system according to claim 1 or claim 2 wherein each water circuit has an associated thermostat that controls the supply of hot water to each water circuit by operating the at least one valve means in dependence on the output of the thermostat associated with that water circuit during the heating periods. 5
4. A combined hot water and heating system according to claim 3 wherein the hot water and heating system is a domestic hot water and heating system, the first water circuit provides hot water for domestic use and the second water circuit provides space heating and wherein the thermostat associated with the first water circuit is a hot water thermostat and the thermostat associated with the second water circuit is a room thermostat. 10
5. A combined hot water and heating system according to any preceding claim wherein the duration of the predetermined heating periods and the duration of the predetermined cooling periods is user selectable. 15
6. A combined hot water and heating system according to claim 5 wherein the duration of the predetermined periods may be selected to be between 2 minutes and 30 minutes. 20
7. A combined hot water and heating system according to claim 5 wherein the duration of the predetermined periods may be selected to be between 5 minutes and 10 minutes. 25
8. A control means for a combined hot water and heating system comprising a hot water supply means and a pump for pumping water from the hot water supply means to a first water circuit and a second water circuit, wherein supply of hot water from the hot water supply means to the first and second water circuits is regulated by at least one valve means, the control means comprising a timer operable to set predetermined heating periods and predetermined heat dissipation periods, said control means being operable when the hot water supply means is in operation and during the heat dissipation periods to cause the at least one valve means to prevent supply of hot water from the hot water supply means to at least one of said first and second water circuits. 30 35 40 45 50
9. A control means according to claim 8 wherein the control means is arranged for control of the at least one valve means in dependence on the output of at least one thermostat associated with a water circuit. 55
10. A control means according to claim 9 for use in a domestic hot water and heating system having a first water circuit for the provision of hot water for domestic use and a second water circuit being for the provision of space heating, the control means being arranged for control of at least one valve means in dependence on the output of a hot water thermostat associated with the first water circuit and a room thermostat associated with the second water circuit.
11. A control means according to any preceding claim wherein the duration of the predetermined heating periods and the duration of the predetermined cooling periods is user selectable.
12. A control means according to claim 11 wherein the duration of the predetermined periods may be selected to be between 2 minutes and 30 minutes.
13. A control means according to claim 11 wherein the duration of the predetermined periods may be selected to be between 5 minutes and 10 minutes.

Fig. 1





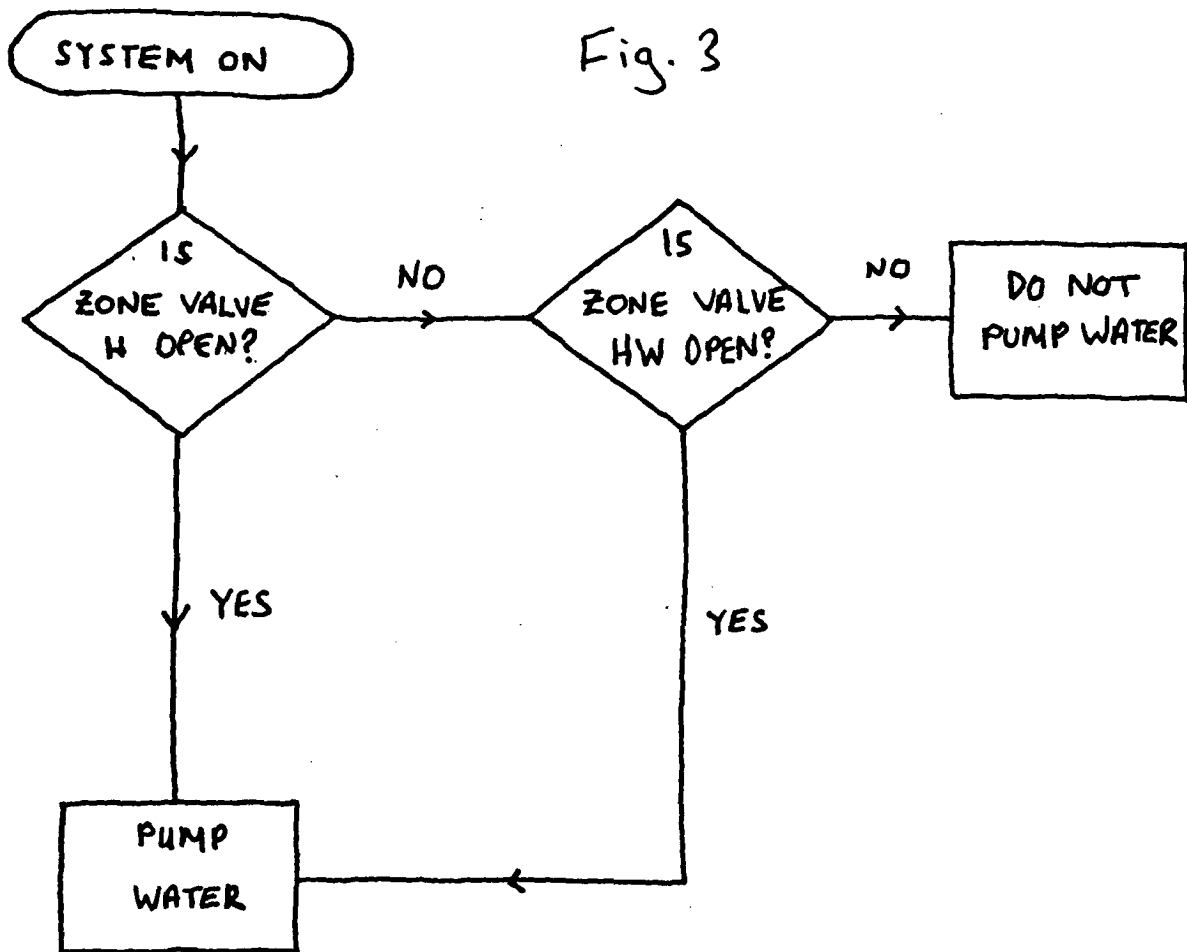


Fig. 4

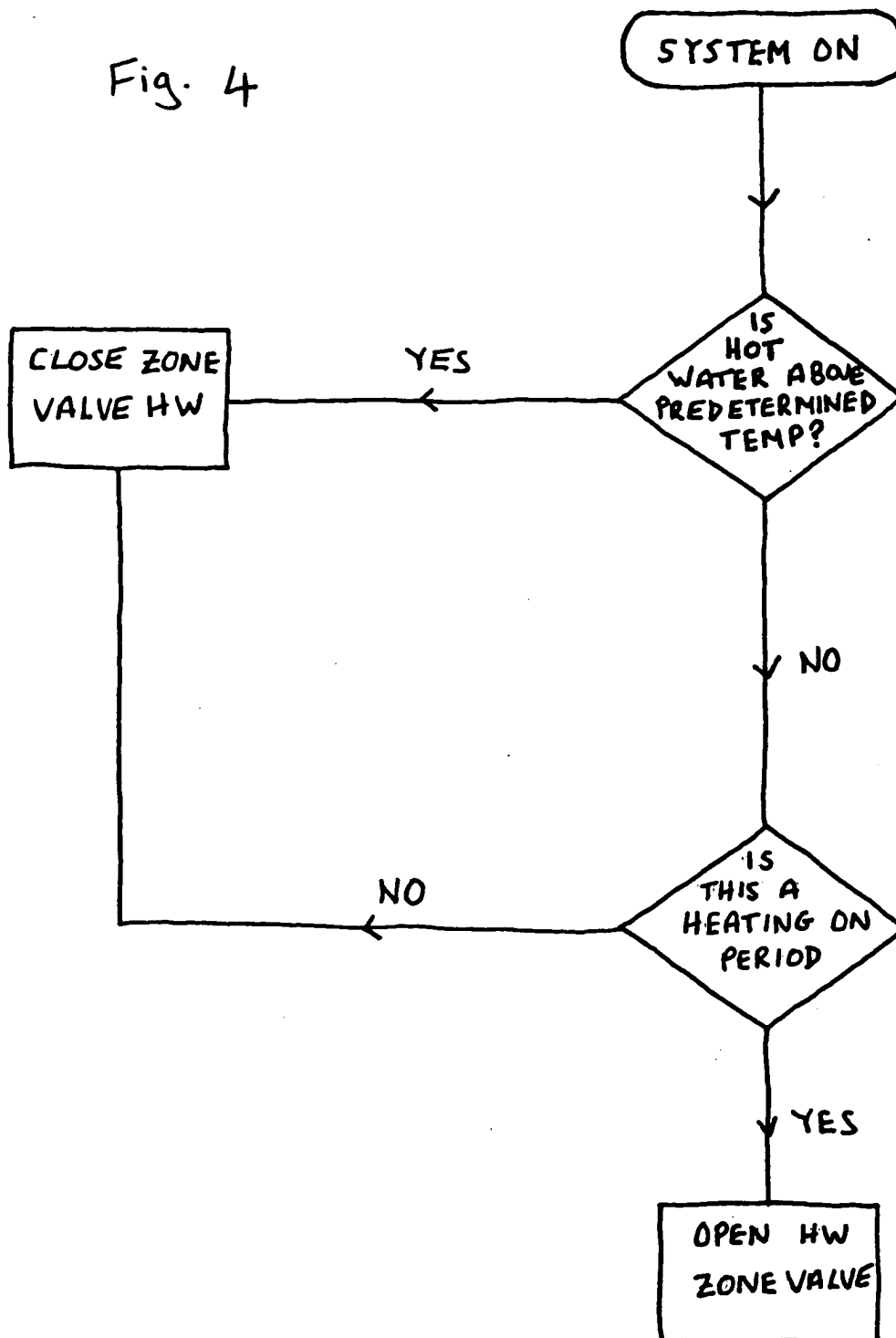


Fig. 5

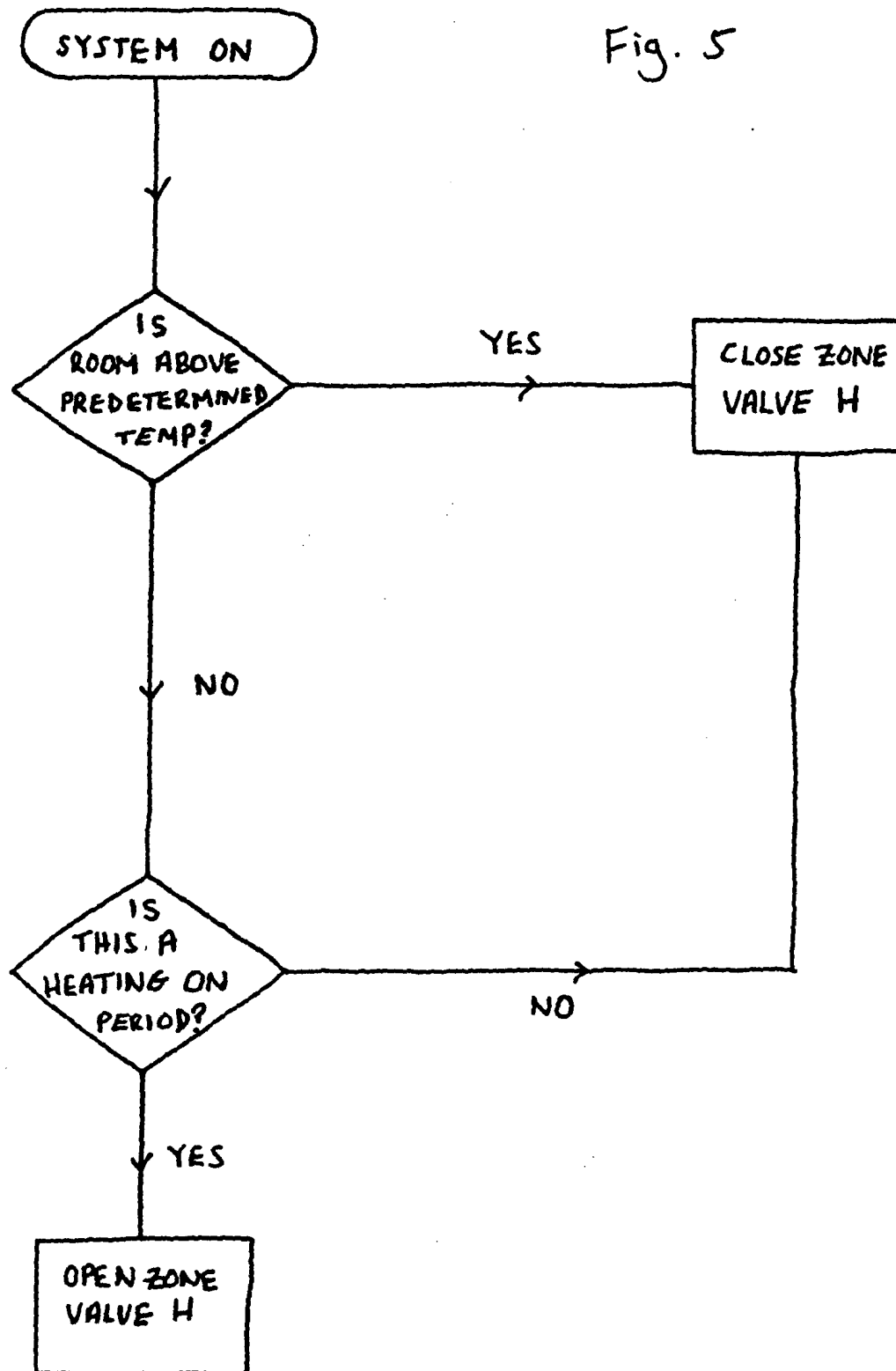
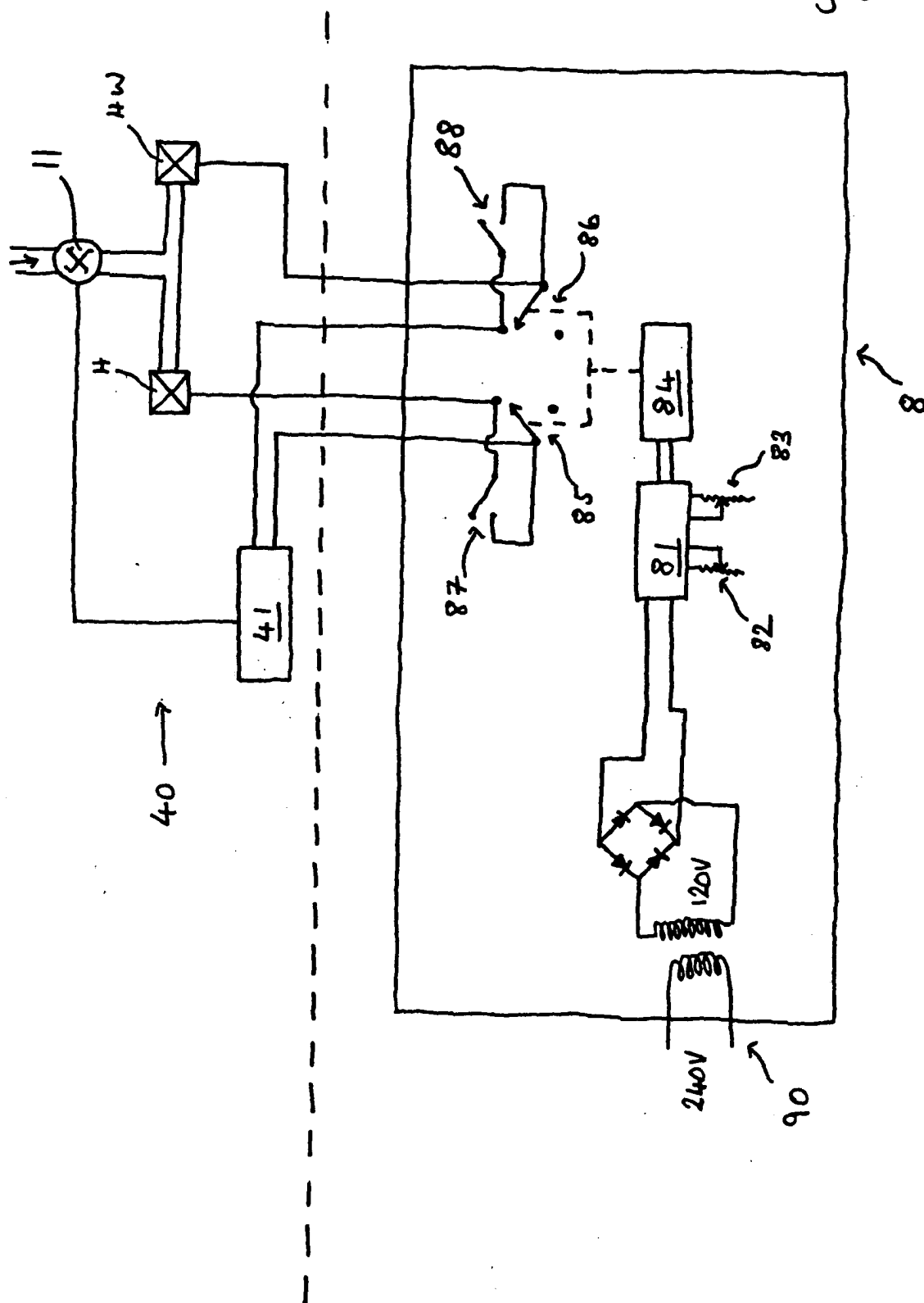


Fig. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 3103

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 15 September 2004	Examiner García Moncayo, O
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 25 3103

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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15-09-2004

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