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

(11) EP 1 486 735 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
13.10.2010 Bulletin 2010/41

(51) Int Cl.:
F24D 19/10 *(2006.01)* ***G05D 23/19*** *(2006.01)*
F24D 3/08 *(2006.01)*

(21) Application number: **04253103.8**

(22) Date of filing: **26.05.2004**

(54) **Combined hot water and heating system**

Kombinierte Anlage für Heizung und Brauchwasserbereitung

Systeme combiné de chauffage d'eau et de chauffage central

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR

(30) Priority: **10.06.2003 GB 0313350**
26.04.2004 GB 0409238

(43) Date of publication of application:
15.12.2004 Bulletin 2004/51

(73) Proprietor: **Eco-Pulse Limited**
Phoenix Green
Hampshire RG27 8HY (GB)

(72) Inventor: **Hunter, Roy Walter**
Phoenix Green, Hampshire RG27 8HY (GB)

(74) Representative: **Faulkner, Thomas John et al**
Cleveland
40-43 Chancery Lane
London WC2A 1JQ (GB)

(56) References cited:
DE-A- 3 538 934
DE-A- 3 539 328
FR-A- 1 392 333
FR-A- 2 465 164
GB-A- 2 320 108

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 486 735 B1

Printed by Jouve, 75001 PARIS (FR)

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] A combined hot water and heating system according to the preamble of claim 1 is known from the document GB2320108. According to this document, a boiler is shut down when a thermostat supplies a shut down signal. Once the boiler is shut down, a certain time interval must then elapse between the turning off and the refiring of the boiler.

[0007] DE3538934 (and related document DE3539328) relates to a central heating system with a variable thermostat threshold setting. A boiler and pump are operated independently in dependence on the measured temperature relative to the thermostat threshold, and in dependence on anticipated changes in the thermostat threshold.

[0008] FR2465164 relates to a heating installation having a three ways valve between a radiator circuit, heat exchanger, and a boiler.

[0009] 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.

[0010] It is an object of the present invention to provide an alternative combined hot water and heating system.

[0011] 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 (H, HW), the system comprising control means, which comprises a timer operable to set predetermined heating periods and predetermined heat dissipation periods, **characterized in that** said control means 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 when the hot water supply means is in operation and during the heat dissipation periods.

[0012] 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.

[0013] The at least one valve means may comprise a valve for each water circuit.

[0014] 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.

[0015] 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.

[0016] The duration of the predetermined heating periods and the duration of the predetermined cooling periods may be user selectable.

[0017] 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.

[0018] 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.

[0019] Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] The combined hot water and heating system 1 also has a 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.

[0027] 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.

[0028] 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.

[0029] 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 sets heating on periods and heating off periods.

[0030] Operation of the system 1 will now be explained with reference to Figures 2 to 5.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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.

[0044] 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 (10) and a pump (11) for pumping water from the hot water supply means to a first water circuit (2) and a second water circuit (3), and at least one valve means (H, HW) wherein supply of hot water from the hot water supply means to the first and second water circuits is regulated by the at least one valve means (H,HW), the system comprising control means (8), which comprises a timer operable to set predetermined heating periods and predetermined heat dissipation periods, **characterized in that**
said control means (8) cause the at least one valve means to prevent supply of hot water from the hot water supply means (10) to at least one of said first (2) and second (3) water circuits when the hot water supply means (10) is in operation in order to heat water and during the heat dissipation periods.

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.

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.

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.

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.

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.

Patentansprüche

1. Ein kombiniertes Warmwasser- und Heizsystem, umfassend ein Warmwasserversorgungsmittel (10) und eine Pumpe (11) zum Pumpen von Wasser von dem Warmwasserversorgungsmittel zu einem ersten Wasserkreislauf (2) und einem zweiten Wasserkreislauf (3) sowie mindestens ein Ventilmittel (H, HW), während eine Warmwasserversorgung von dem Warmwasserversorgungsmittel zu dem ersten und dem zweiten Wasserkreislauf durch das mindestens eine Ventilmittel (H, HW) gesteuert ist, wobei das System ein Steuermittel (8) umfasst, das eine Zeitschaltuhr aufweist, die betriebsfähig ist, um vorbestimmte FTeizperioden und vorbestimmte Wärmeabfuhrperioden zu setzen, **dadurch gekennzeichnet, dass**
das Steuermittel (8) es bewirkt, dass das mindestens eine Ventilmittel eine Warmwasserversorgung von dem Warmwasserversorgungsmittel (10) zu mindestens einem von dem ersten (2) und dem zweiten (3) Wasserkreislauf verhindert, wenn das Warmwasservarsorgungsmittel (10) in Betrieb ist, um Wasser zu erwärmen, sowie während den Wärmeabfuhrperioden.

2. Ein kombiniertes Warmwasser- und Heizsystem gemäß Anspruch 1, während das mindestens eine Ventilmittel ein Ventil für jeden Wasserkreislauf des Systems umfasst.

3. Ein kombiniertes Warmwasser- und Heizsystem gemäß Anspruch 1 oder Anspruch 2, während jeder Wasserkreislauf ein zugehöriges Thermostat aufweist, das die Warmwasserversorgung zu jedem Wasserkreislauf mittels Betreiben des mindestens einen Ventilmittels in Abhängigkeit von der Ausgabe des zu dem Wasserkreislauf zugehörigen Thermostats während der Heizperiode regelt.

4. Ein kombiniertes Warmwasser- und Heizsystem gemäß Anspruch 3, während das Warmwasser- und Heizsystem ein Hauswarmwasser- und -heizsystem ist, wobei der erste Wasserkreislauf Warmwasser für den Hausgebrauch bereitstellt und der zweite Wasserkreislauf Raumwärme bereitstellt, während das zu dem ersten Wasserkreislauf zugehörige Thermostat ein Warmwasserthermostat ist und das zu dem zweiten Wasserkreislauf zugehörige Thermostat ein Raumthermostat ist.

5. Ein kombiniertes Warmwasser- und Heizsystem gemäß einem der vorhergehenden Ansprüche, während die Dauer der vorbestimmten Heizperioden und die Dauer der vorbestimmten Wärmeabfuhrperioden von einem Nutzer wählbar sind.

6. Ein kombiniertes Warmwasser- und Heizsystem gemäß Anspruch 5, während die Dauer der vorbestimmten Perioden ausgewählt werden kann zwischen zwei Minuten und 30 Minuten.

7. Ein kombiniertes Warmwasser- und Heizsystem gemäß Anspruch 5, während die Dauer der vorbestimmten Perioden ausgewählt werden kann zwischen fünf Minuten und zehn Minuten,

Revendications

1. Système de chauffage et d'eau chaude combiné comprenant des moyens d'alimentation d'eau chaude (10) et une pompe (11) pour pomper l'eau des moyens d'alimentation d'eau chaude jusqu'à un premier circuit d'eau (2) et un deuxième circuit d'eau (3) et au moins un moyen de soupape (H, HW), dans lequel l'alimentation de l'eau chaude des moyens d'alimentation d'eau chaude aux premier et deuxième circuits d'eau est régulée par le au moins un moyen de soupape (H, HW), le système comprenant des moyens de commande (8) qui comprennent une minuterie pouvant fonctionner pour déterminer des périodes de chauffage prédéterminées et des périodes de dissipation de chaleur prédéterminées, **caractérisé en ce que :**

lesdits moyens de commande (8) amènent le au

moins un moyen de soupape à empêcher l'alimentation d'eau chaude des moyens d'alimentation d'eau chaude (10) à au moins l'un desdits premier (2) et deuxième (3) circuits d'eau lorsque les moyens d'alimentation d'eau chaude (10) sont en fonctionnement afin de chauffer l'eau et pendant les périodes de dissipation de chaleur.

2. Système de chauffage et d'eau chaude combiné selon la revendication 1, dans lequel le au moins un moyen de soupape comprennent une soupape pour chaque circuit d'eau du système.

3. Système de chauffage et d'eau chaude combiné selon la revendication 1 ou la revendication 2, dans lequel chaque circuit d'eau a un thermostat associé qui commande l'alimentation de l'eau chaude vers chaque circuit d'eau en actionnant le au moins un moyen de soupape en fonction de la sortie du thermostat associé à ce circuit d'eau pendant les périodes de chauffage.

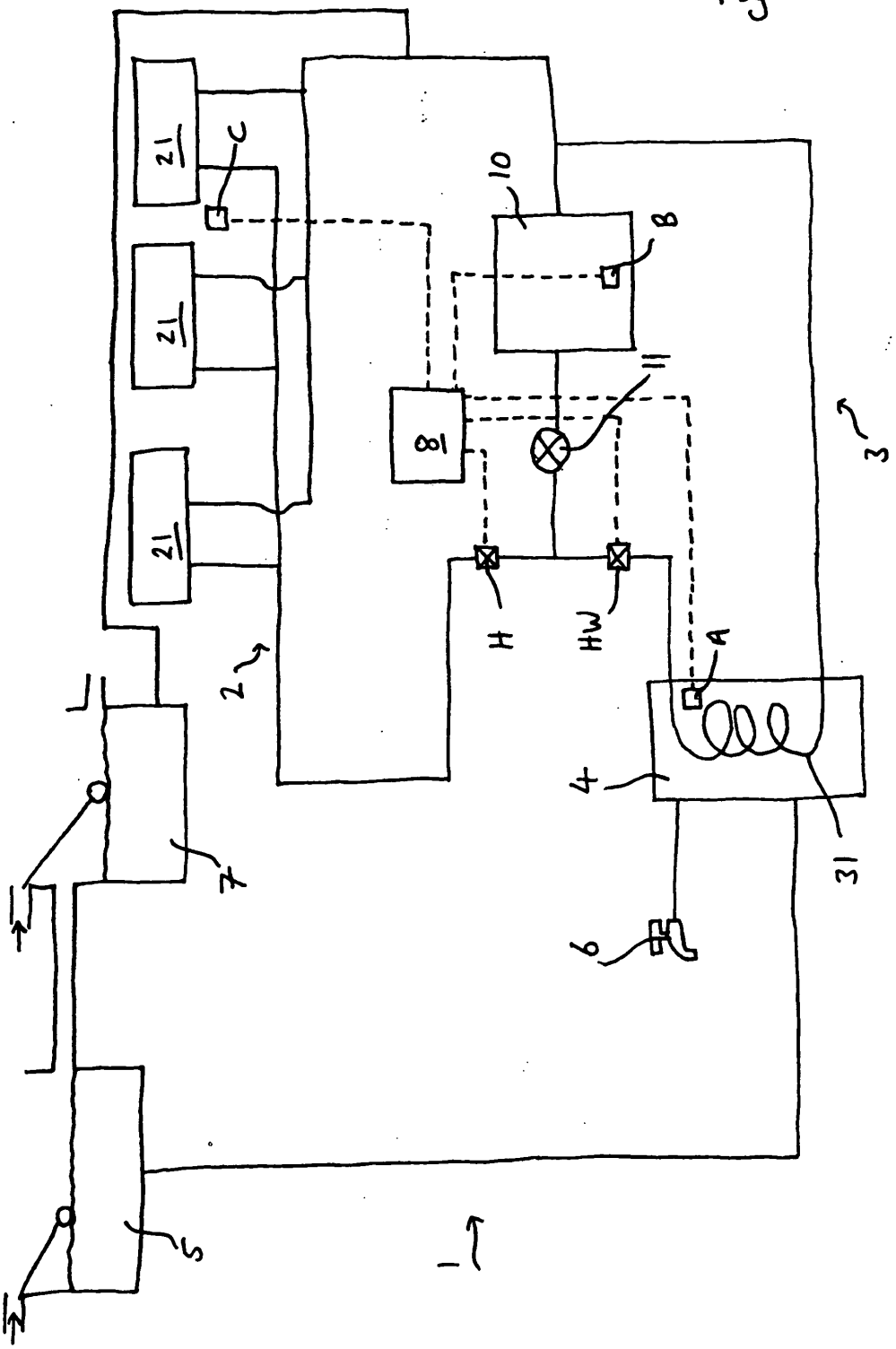
4. Système de chauffage et d'eau chaude combiné selon la revendication 3, dans lequel le système de chauffage et d'eau chaude est un système de chauffage d'eau chaude domestique, le premier circuit d'eau fournit l'eau chaude pour l'usage domestique et le deuxième circuit d'eau fournit le chauffage de l'espace et dans lequel le thermostat associé au premier circuit d'eau est un thermostat d'eau chaude et le thermostat associé au deuxième circuit d'eau est un thermostat d'ambiance.

5. Système de chauffage et d'eau chaude combiné selon l'une quelconque des revendications précédentes, dans lequel la durée des périodes de chauffage prédéterminées et la durée des périodes de refroidissement prédéterminées peuvent être sélectionnées par l'utilisateur.

6. Système de chauffage et d'eau chaude combiné selon la revendication 5, dans lequel la durée des périodes prédéterminées peut être sélectionnée pour être comprise entre 2 minutes et 30 minutes.

7. Système de chauffage et d'eau chaude combiné selon la revendication 5, dans lequel la durée des périodes prédéterminées peut être sélectionnée pour être comprise entre 5 minutes et 10 minutes.

Fig. 1



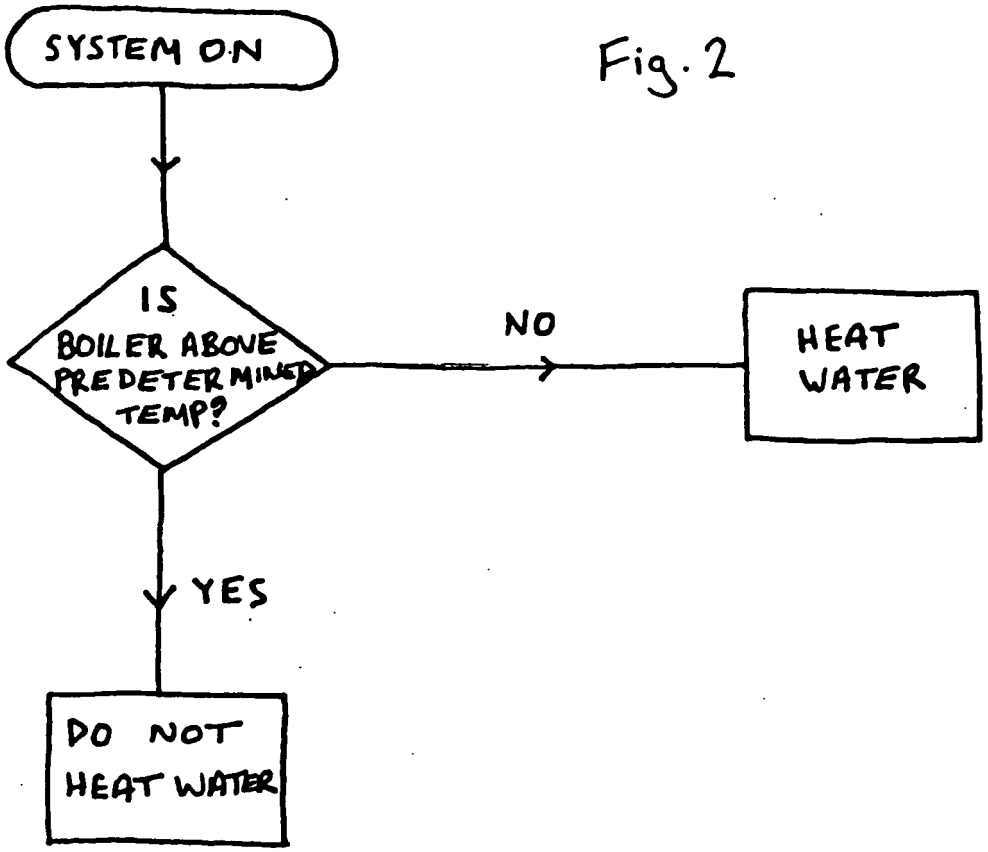

SYSTEM ON
IS BOILER ABOVE PREDETERMINED TEMP?
NO
HEAT WATER
YES
DO NOT HEAT WATER

Fig. 2

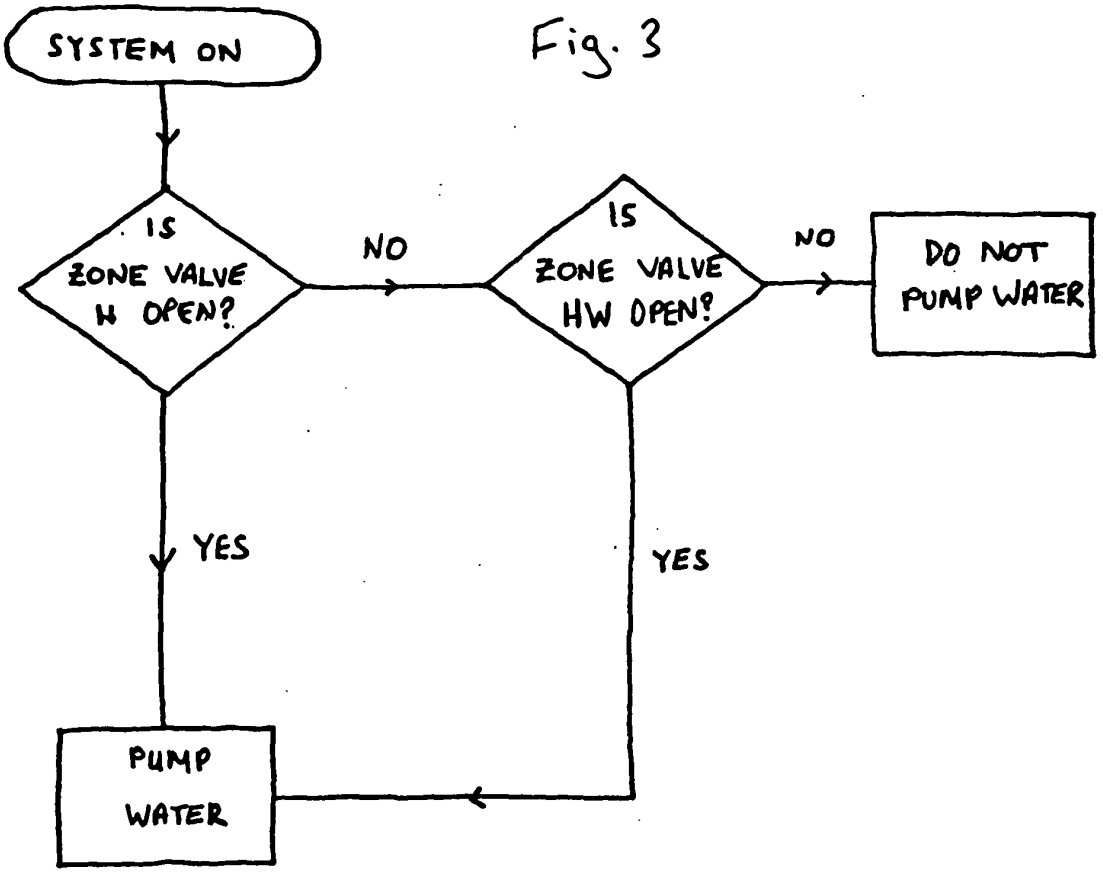
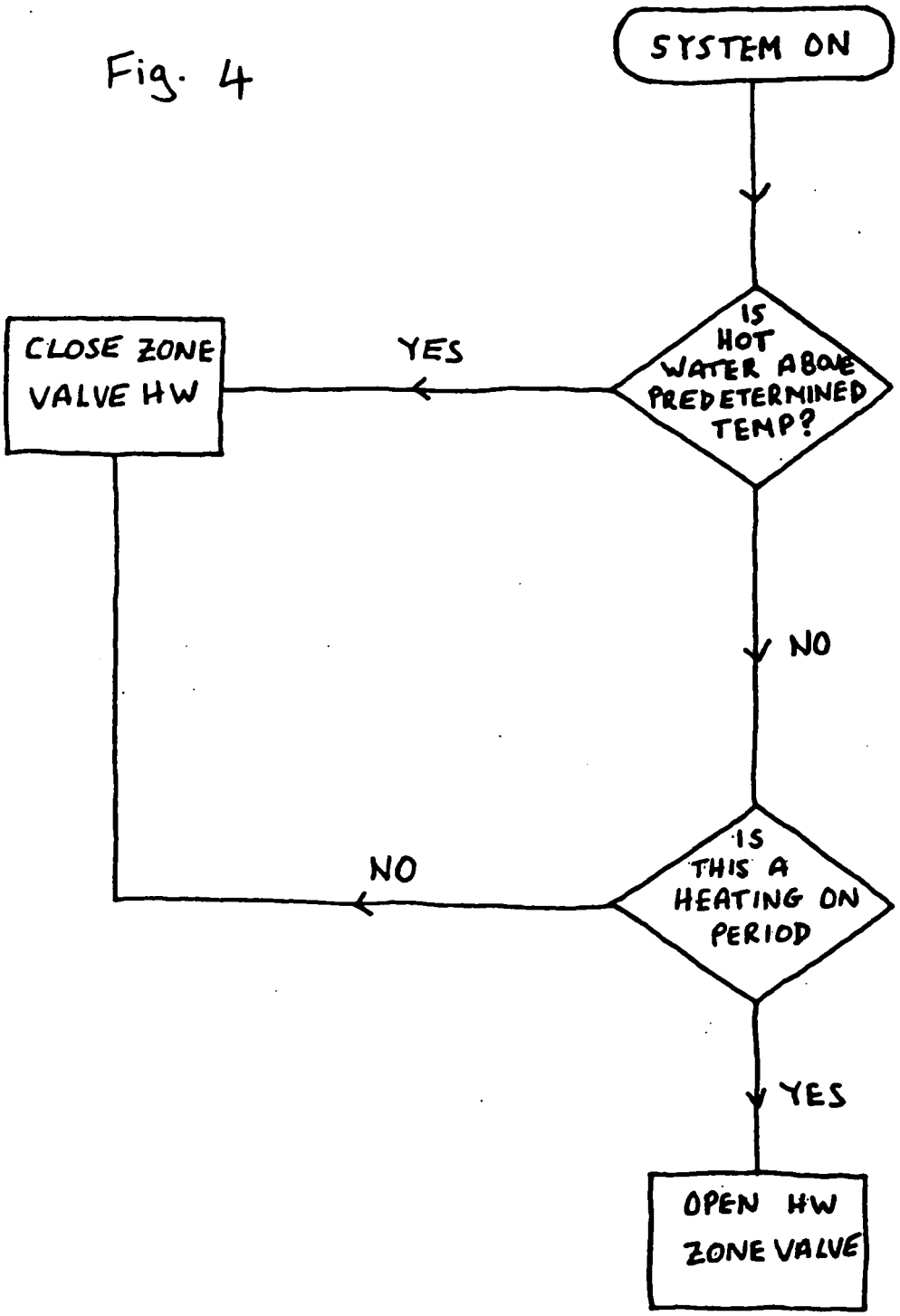

SYSTEM ON
IS ZONE VALVE H OPEN?
NO
IS ZONE VALVE HW OPEN?
NO
DO NOT PUMP WATER
YES
YES
PUMP WATER

Fig. 3

Fig. 4


SYSTEM ON
IS HOT WATER ABOVE PREDETERMINED TEMP?
YES
CLOSE ZONE VALVE HW
NO
IS THIS A HEATING ON PERIOD
NO
YES
OPEN HW ZONE VALVE

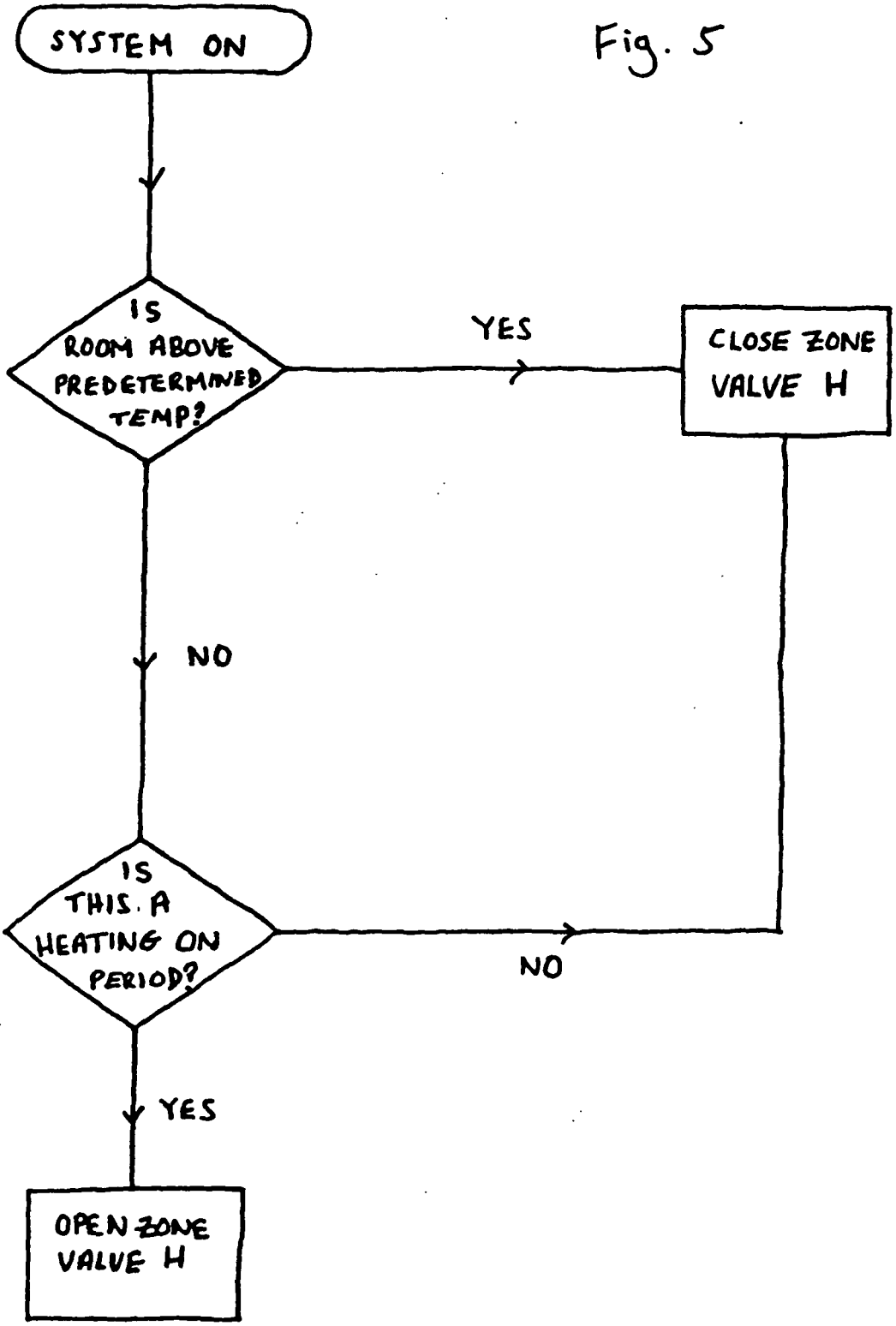
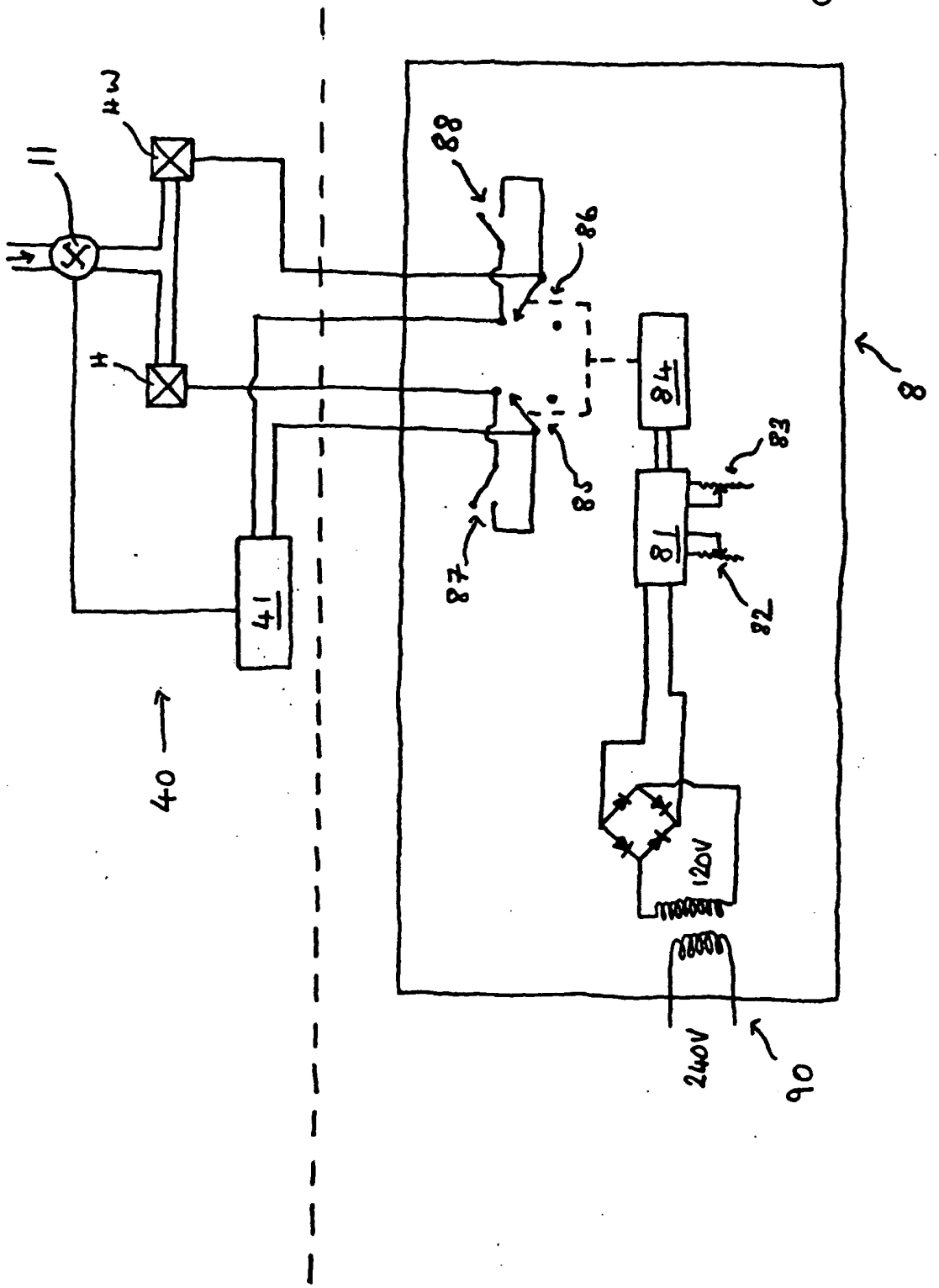

SYSTEM ON
IS ROOM ABOVE PREDETERMINED TEMP?
YES
CLOSE ZONE VALVE H
NO
IS THIS A HEATING ON PERIOD?
NO
YES
OPEN ZONE VALVE H

Fig. 5

Fig. 6



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2320108 A **[0006]**
- DE 3538934 **[0007]**
- DE 3539328 **[0007]**
- FR 2465164 **[0008]**
- US 4671457 A **[0009]**