Fluid supply system

The invention relates to a fluid supply system comprising a district hot fluid supply line, a district fluid return line, a district cold fluid supply line, at least one local hot fluid line, at least one heat exchanger and a hot fluid pump, wherein at least one heat exchanger comprises a primary side that is connected at a primary inlet to the district hot fluid supply line and at a primary outlet to the district fluid return line, and wherein the at least one heat exchanger comprises a secondary side that is connected at a secondary inlet to the district cold fluid supply line and at a secondary outlet to the local hot fluid line, and wherein the at least one local hot fluid line is connected to at least one local fluid tapping unit to supply heated fluid from the secondary outlet of the connected heat exchanger, and wherein the hot fluid pump is activated if a need for hot fluid is detected.

For the scope of this application the fluid may be water in particular in the local hot fluid line and the district cold fluid line or in all fluid lines. For the district hot fluid line and the district fluid return line the fluid may alternatively be water steam, decalcified water or a suitable alternative.

A water supply system of the above kind is for example known from EP 1 342 957 A1. Therein the hot water pump is arranged downstream of the secondary outlet of the heat exchanger in the local hot water line. A flow

sensor in the hot water line detects if hot water is dispensed at a local water tapping unit connected to the local hot water line.

This solution is advantageous for a single consumer (e.g. a single house connected to a district hot water supply line remote from other connected consumers). However, in case multiple consumers in close vicinity (e.g. in a development area) are to be connected to the district hot water supply line the above solution is relatively expensive and complicated.

Another document, DE3240343, disclose a fluid supply system comprising a district hot fluid supply line feeding hot water from a common source to the heat exchangers in a plural of rooms. A single pump is connected to the line providing hot fluid to all connected heat exchangers. The solution however does not simple and cheap solution to linking a required flow an activation of the pump.

The task of the present invention is therefore to provide a fluid supply system that simplifies installation and maintenance.

According to the present invention the above task is solved as given in the claims. The solution includes that each heat exchanger is connected at its respective primary inlet to the district hot fluid supply line, at its respective primary outlet to the district fluid return line, at its respective secondary inlet to the district cold fluid supply line and at its respective secondary outlet each to a corresponding local hot fluid line, wherein the hot fluid pump is arranged in the district hot fluid supply line providing hot fluid to all connected heat exchangers, and wherein the hot fluid pump is activated if fluid is tapped at one of the local fluid tapping units.

With this solution each heat exchanger can, for example, be associated with an apartment in a multi-apartment building or with a single household

building. Only one hot fluid pump is necessary to supply one or more heat exchangers which simplifies installation and maintenance and consequently reduces costs. Furthermore, adding an additional consumer to an existing fluid supply system is simplified in particular since no additional pump is required. Furthermore, the solution reduces energy loss due to heat dissipation, reduces the time necessary to reach the desired temperature of the fluid at the local fluid tapping units and reduces the risk of bacteria (e.g. legionella) spreading in the system.

The at least one local fluid tapping unit may also be connected to the district cold fluid supply line.

In an embodiment the fluid is water. Consequently, the fluid supply system may be a water supply system. The district hot fluid supply line may be a district hot water supply line. The district fluid return line may be a district water return line. The district cold fluid supply line may be a district cold water supply line. The at least one local hot fluid line may be at least one local hot water line. The hot fluid pump may be a hot water pump.

In an embodiment the fluid supply system comprises two or more heat exchangers, wherein each heat exchanger is connected at its respective secondary outlet to a different local hot fluid line.

A main sensor may be arranged in the district cold fluid supply line to detect if fluid is tapped at one of the local fluid tapping units. If the main sensor detects that fluid is tapped in one of the local fluid tapping units it may then provide a signal to a control unit. The control unit may then send a activation signal to the hot fluid pump. The main sensor may also send the activation signal directly to the hot fluid pump.

In an embodiment of the invention the fluid supply system comprises a main check valve that is arranged in the district cold fluid supply line, wherein the sensor detects the opening of the main check valve, and wherein the main check valve is normally closed and opens if the fluid pressure downstream the main check valve drops in response to fluid being tapped at one of the connected local fluid tapping units. This solution is relatively simple since the main check valve may be purely pressure controlled without the need of an actuator. The main sensor may in this embodiment be connected to the main check valve to detect if the main check valve is in an open position. If the main sensor detects a change in opening position of the main check valve will then communicate this to the control unit which may in turn start the hot fluid pump. Alternatively, the main sensor may directly signal the hot fluid pump to activate.

A local check valve may be arranged at the secondary side of each heat exchanger, wherein the local check valve is normally closed and opens if the fluid pressure at the corresponding secondary outlet drops in response to fluid being tapped at at least one connected local fluid tapping unit. The local check valve may be purely pressure controlled. This embodiment has the advantage that in principle no connection of the local check valve to the control unit is necessary.

In an embodiment at least one local check valve is arranged at a secondary inlet.

In an embodiment the local check valve only opens in response to fluid being drawn from the local hot fluid line. In this embodiment the local hot fluid line leading to the connected local fluid tapping units is kept separate from the connection of the local fluid tapping unit to the district cold fluid supply line to avoid a pressure drop at the secondary side which may lead to an opening of the local check valve.

In an embodiment a restrictor valve is arranged at the primary side of each heat exchanger to allow or restrict a flow of hot fluid through the primary side of the heat exchanger. This way, it is ensured that the primary side of an inactive heat exchanger is not heated up if a different heat exchanger of the fluid supply system is being activated.

In an embodiment at least one restrictor valve is arranged at the primary outlet.

In an embodiment at least one local check valve is mechanically connected to the restrictor valve arranged at the same heat exchanger. The mechanical connection may be facilitated by a pin translating a change in valve position of the local check valve to a change in valve position of the restrictor valve in the same heat exchanger. The pin may be connected to both valve elements of the local check valve and the restrictor valve. This embodiment has the advantage that both the local check valve and the restrictor valve may be purely pressure controlled which reduces costs of the individual heat exchanger unit.

In an embodiment the restrictor valve is automatically opened if the connected local check valve opens. A simple way to facilitate this functionality is to mechanically connect the restrictor valve to the at least one local check valve in the same heat exchanger. Alternatively, the restrictor valve may be actuated by an actuator to be opened when it is detected that the local check valve has opened.

In an embodiment at least one restrictor valve is a thermostatic valve comprising a thermostatic actuator to control the flow of hot fluid through the primary side of the heat exchanger. This embodiment has the advantage that the flow of hot fluid through the primary side of the heat exchanger can be

more exactly regulated. This is advantageous, for example, if the heat exchanger supplies a multitude of connected local fluid tapping units. In this case, the amount of flow of hot fluid through the heat exchanger can be limited, for example, if only one of a plurality of connected local fluid tapping units requires hot fluid. The thermostatic valve in this case can be controlled by the control unit. The control unit here may be a local control unit associated with the heat exchanger (i.e. with the connected consumer).

In an embodiment at least one secondary sensor is arranged at the secondary side of the at least one heat exchanger to detect the flow of fluid towards the local hot fluid line. The amount of flow detected by the secondary sensor can then be provided to the control unit. Based on the detected flow by the secondary sensor the control unit can then send a control signal to the restrictor valve. Preferably, the secondary sensor is arranged at the secondary outlet.

In an embodiment the control unit limits the opening degree of the restrictor valve according to the amount of flow detected by the secondary sensor in the same heat exchanger.

A preferred embodiment of the invention is now described with reference to the figure wherein:

Fig. 1 shows a fluid supply system according to a preferred embodiment of the invention.

Fig. 1 shows a fluid supply system 1 comprising a district hot fluid supply line 2, a district fluid return line 3 and a district cold fluid supply line 4. The fluid supply system 1 furthermore comprises in this case two heat exchangers 5, 6. Each heat exchanger 5, 6 may be associated, for example, with an apartment in a multi-apartment building or with a single household building

each. The fluid supply system 1 may also comprise a multitude of heat exchangers 5, 6.

Each heat exchanger 5, 6 provides at least one local fluid tapping unit 7, 8. Each heat exchanger 5, 6 may however supply a multitude of local fluid tapping units 7, 8. The local fluid tapping units 7, 8 are connected to their respective heat exchanger 5, 6 via a local hot fluid line 9, 10. Each heat exchanger 5, 6 comprises a primary side 11 and a secondary side 12. The primary side 11 is connected to the district hot fluid supply line 2 at a primary inlet 13. The hot fluid from the district hot fluid supply line 2 flows through the primary side 11 until it exits a primary outlet 14. At the primary side 11 the heat exchanger 5 furthermore comprises a restrictor valve 15 which is in this embodiment arranged downstream of the primary outlet 14.

At the secondary side 12 of the heat exchanger 5, 6 cold fluid from the district cold fluid supply line 4 enters through a secondary inlet 16. When the heat exchanger 5, 6 is active the cold fluid flowing through the secondary side 12 is heated up by the hot fluid flowing through the primary side 11. The heated up fluid at the secondary side 12 then exits at a secondary outlet 17. The secondary outlet 17 is connected to the local hot fluid line 9, 10.

At the secondary side 12 of the heat exchanger 5 furthermore a local check valve 18 is arranged. The local check valve 18 is normally closed an opens if the fluid pressure at the secondary outlet 17 drops in response to fluid being tapped at the connected local fluid tapping unit 7. The local check valve 18 can be connected mechanically to the restrictor valve 15 such that if the local check valve 18 opens the restrictor valve will also be opened.

Alternatively, the restrictor valve 15 can be a thermostatic valve comprising a thermostatic actuator to control the flow of hot fluid through the primary side 11 of the heat exchanger 5. In this case the fluid supply system 1

advantageously comprises a secondary sensor 19 to detect the amount of flow through the secondary side 12. The secondary sensor 19 is here depicted as being located at the secondary outlet 17. A signal from the secondary sensor 19 can then be provided to the thermostatic actuator 20 to change the opening degree of the restrictor valve 15 to control the amount of flow of hot fluid through the primary side 11. The signal may also be provided to a local or central control unit which may control the restrictor valve(s) 15 and/or the hot fluid pump described below.

The fluid supply system 1 comprises a hot fluid pump 21 which is arranged in the district hot fluid supply line 2. If no fluid is being tapped from the local fluid tapping units 7, 8 the hot fluid pump 21 will be inactive. In the district cold fluid supply line 4 a main check valve 22 is arranged. The main check valve 22 opens in response to a drop in pressure downstream of the main check valve 22 due to fluid being drawn from one of the connected local fluid tapping units 7, 8.

Furthermore, the fluid supply system 1 comprises a sensor 23 which detects a change in valve position of the main check valve 22. When such a change to an open valve position of the main check valve 22 is detected by the sensor 23 an activation signal is sent to the hot fluid pump 21. This activation signal may be send by a central control unit. At the same time in the heat exchanger 5, 6 connected to the local fluid tapping unit 7, 8 that has been activated the local check valve 18 will also change the valve position and similarly the restrictor valve 15 in the same heat exchanger 5, 6. Thereby, the heating up of cold fluid flowing through the secondary side 12 by the hot fluid flowing through the primary side 11 will be facilitated such that hot fluid can be supplied through the local hot fluid line 9, 10 connected to the active local fluid tapping unit 7, 8.

The fluid in the above described embodiment may be water, decalcified water, water steam or a suitable alternative fluid. The district hot fluid supply line and the district fluid return line may use a different fluid than the other fluid lines since the district hot fluid supply line and the district fluid return line may form a closed circuit.

Patentkrav

1. Fluidtilførselssystem (1), der omfatter en særskilt tilførselsledning for varm fluid (2), en særskilt fluidreturledning (3), en særskilt tilførselsledning for kold fluid (4), mindst én lokal ledning for varm fluid (9, 10), mindst én varmeveksler (5, 6) og en pumpe for varm fluid (21), hvor den mindst ene varmeveksler (5, 6) omfatter en primær side (11), der er forbundet i et primært indløb (13) til den særskilte tilførselsledning for varm fluid (2) og i et primært udløb til den særskilte fluidreturledning (3), og hvor den mindst ene varmeveksler (5, 6) omfatter en sekundær side (12), der er forbundet i et sekundært indløb (16) til den særskilte tilførselsledning for kold fluid (4) og i et sekundært udløb (17) til den lokale ledning for varm fluid (9, 10), og hvor den mindst ene lokale ledning for varm fluid (9, 10) er forbundet til mindst én lokal fluidtapningsenhed (7, 8) til tilførsel af opvarmet fluid fra det sekundære udløb (17) af den tilkoblede varmeveksler (5, 6), og hvor pumpen for varm fluid (21) aktiveres, hvis der detekteres et behov for varm fluid, hvor hver varmeveksler (5, 6) er forbundet i dens respektive primære indløb (13) til den særskilte tilførselsledning for varm fluid (2), i dens

respektive primære udløb (14) til den særskilte fluidreturledning (3), i dens respektive sekundære indløb (16) til den særskilte tilførselsledning for kold fluid (4) og i dens respektive sekundære udløb (17) hver til en tilsvarende lokal ledning for varm fluid (9, 10), hvor pumpen for varm fluid (21) er anbragt i den særskilte tilførselsledning for varm fluid (2) til tilvejebringelse af varm fluid til alle tilkoblede varmevekslere (5, 6), og hvor pumpen for varm fluid (21) aktiveres, hvis der tappes fluid ved én af fluidtapningsenhederne (7, 8), der er kendetegnet ved, at en hovedsensor (23) er anbragt i den særskilte tilførselsledning for kold fluid (4) til detektering af, om der tappes fluid ved én af fluidtapningsenhederne (7, 8) og fluidtilførselssystemet (1) omfatter en hovedkontraventil (22), der er anbragt i den særskilte tilførselsledning for kold fluid (4), hvor hovedsensoren (23) detekterer åbning af hovedkontraventilen (22), og hvor hovedkontraventilen (22) normalt er lukket og åbner, hvis fluidtrykket nedstrøms for hovedkontraventilen (22) falder som følge af, at der tappes fluid ved én af de tilkoblede lokale fluidtapningsenheder (7, 8).

2. Fluidtilførselssystem (1) ifølge krav 1, der er kendetegnet ved, at fluiden er vand.

3. Fluidtilførselssystem (1) ifølge krav 1 eller 2, der er kendetegnet ved, at fluidtilførselssystemet (1) omfatter to eller flere varmevekslere (5, 6), hvor hver varmeveksler (5, 6) er forbundet i det respektive sekundære udløb til forskellige lokale ledninger for varm fluid (9, 10).

4. Fluidtilførselssystem (1) ifølge et hvilket som helst af kravene 1 til 3, der er kendetegnet ved, at en lokal kontraventil (18) er anbragt i den sekundære side (12) af hver varmeveksler (5, 6), hvor den lokale kontraventil (18) normalt er lukket og åbner, hvis fluidtrykket i det

tilsvarende sekundære udløb (12) falder som følge af, at der tappes vand ved mindst én tilkoblet lokal fluidtapningsenheder (7, 8).

5. Fluidtilførselssystem (1) ifølge krav 4, der er kendetegnet ved, at mindst én lokal kontraventil (18) er anbragt i et sekundært indløb (16).

6. Fluidtilførselssystem (1) ifølge krav 4 eller 5, der er kendetegnet ved, at den lokale kontraventil (18) kun åbner som følge af, at der tappes fluid fra den tilkoblede lokale ledning for varm fluid (9, 10).

7. Fluidtilførselssystem (1) ifølge et hvilket som helst af kravene 1 til 6, der er kendetegnet ved, at en spærreventil (15) er anbragt i den primære side (11) af hver varmeveksler (5, 6) til muliggørelse eller begrænsning af en strømning af varm fluid gennem den primære side (11) af varmeveksleren (5, 6).

8. Fluidtilførselssystem (1) ifølge krav 7, der er kendetegnet ved, at mindst én spærreventil (15) er anbragt i det primære udløb (14).

9. Fluidtilførselssystem (1) ifølge krav 7 eller 8, der er kendetegnet ved, at mindst én lokal kontraventil (18) er mekanisk forbundet til spærreventilen (15), der er anbragt i den samme varmeveksler (5, 6).

10. Fluidtilførselssystem (1) ifølge et hvilket som helst af kravene 7 til 9, der er kendetegnet ved, at spærreventilen (15) åbnes automatisk, hvis den tilkoblede lokale kontraventil (18) åbner.

11. Fluidtilførselssystem (1) ifølge et hvilket som helst af kravene 7 til 10, der er kendetegnet ved, at mindst én spærreventil (15) er en termostatisk ventil, der omfatter en termostatisk aktuator (20) til

regulering af strømningen af varm fluid gennem den primære side (11) af varmeveksleren (5, 6).

12. Fluidtilførselssystem (1) ifølge et hvilket som helst af kravene 1 til 11, der er kendetegnet ved, at mindst én sekundær sensor (19) er anbragt i den sekundære side (12) af den mindst ene varmeveksler (5, 6) til detektering af strømningen af fluid mod den lokale ledning for varm fluid (9, 10).

13. Fluidtilførselssystem (1) ifølge krav 11, der er kendetegnet ved, at åbningsgraden af spærreventilen (15) begrænses i overensstemmelse med mængden af strømning, der detekteres af den sekundære sensor (19) i den samme varmeveksler (5, 6).