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(54) Distributor in a floor heating system

(57) The present invention provides a distributor in a floor heating system, comprising a first compartment provided with a first connecting part for connecting of the feed flow from an external heating system and a second connecting part for connecting of the floor heating, a second compartment provided with one or more first connecting parts to which the relatively cold return flow of the floor heating can be connected, and a second connecting part for connecting a discharge with which the cold liquid can be carried to the external heating system, at least one passage opening which is provided between the first and second compartment and along which the second sub-flow can be guided for mixing of the second sub-flow with the feed flow, and wherein a wall of at least one of the compartments is provided with an opening along which a flow limiting element can be inserted, using which the throughflow between the compartments can be limited in the inserted position.

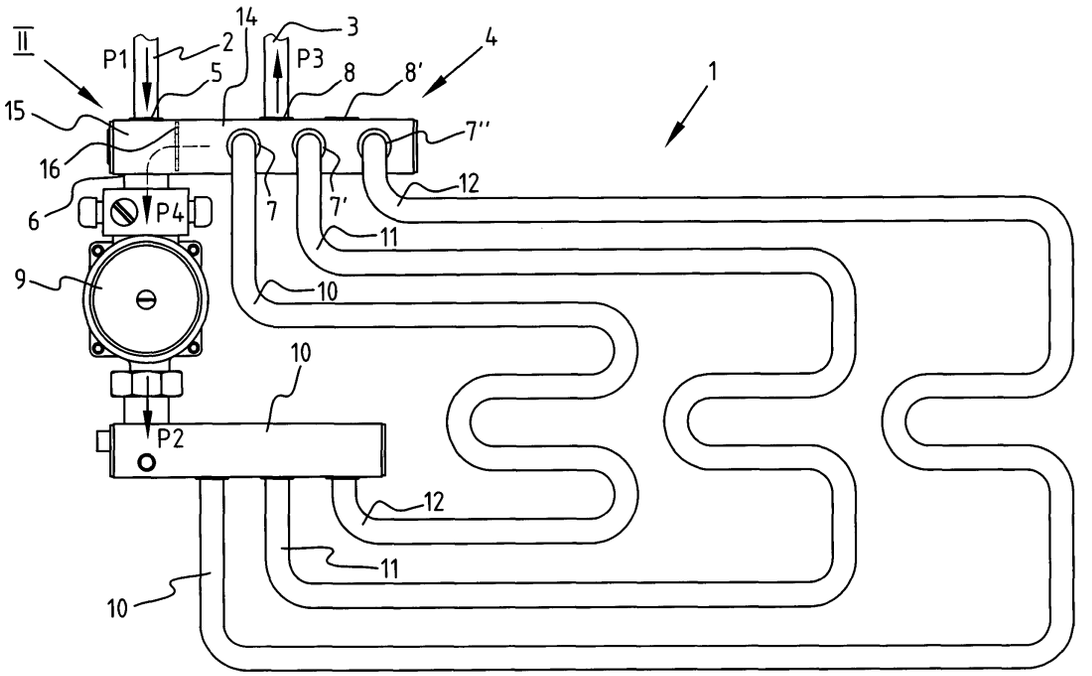

FIG. 1

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Description

[0001] The present invention relates to a distributor in a floor heating system, and to a floor heating system provided with such a distributor.

[0002] Central heating units for heating spaces are known with which water is heated using for instance a burner fuelled with gas or oil. The unit subsequently guides the heated water along diverse heating radiators which are positioned in the spaces and which relinquish their heat to the ambient air. Each structural unit, such as for instance a house, normally has its own (domestic) heating installation with which the rooms of the structural unit can be heated.

[0003] An alternative to such central heating units is the system of district heating. Excess heat, for instance from a power station, is herein used to heat water, whereafter the heated water is carried via an extensive pipe network to the different structural units, such as houses. Such systems are used in practice to provide a whole city, or at least a few districts thereof, with hot water. Thus the term district heating.

[0004] The hot water from the central heating unit (CH) or from the district heating is used to heat a number of heating radiators arranged in a house. These radiators generate heat directly to the ambient air. Systems are however known wherein the hot water is guided along heating conduits arranged in a structural part, such as for instance a floor. The hot water then heats the structural part, and the structural part transmits the heat to the ambient air. Such systems are known as floor heating systems. It is noted that a floor heating system is here also understood to mean a system in which such heating conduits are arranged in a structural part other than a floor, for instance in the wall or in the ceiling of a room.

[0005] A floor heating system in most cases forms an addition to the above mentioned heating radiators which heat the ambient air directly. A floor heating system is usually provided with hot water via the above mentioned central heating unit or via the district heating system. Connected for this purpose to the pipe network of the central heating unit or the district heating is a distributor which guides the incoming hot water to the heating conduits and then feeds back a part of the relatively cold return flow to the pipe network of the central heating unit or the district heating, and mixes another part with the supplied hot water coming from the central heating system or the district heating system.

[0006] A floor heating distributor fulfils a number of basic functions. The first function is to regulate the temperature in the floor heating conduits, i.e. down-regulate CH water or district heating water which is too hot to temperatures suitable for the floor heating. Part of this function is also to protect against water of high temperature such that the floor could be damaged thereby. A further function is to distribute the water over the different floor heating groups. The water is distributed over different groups to enable the heating of different floor parts to be switched on and off individually. Distribution over groups also has the advantage that the conduit length, and thereby the pressure drop over the conduits, can remain limited.

[0007] Owing to the regulations of particular power companies which provide houses with hot water using district heating and owing to problems which occur in practice, roughly three basic types of distributor can be distinguished at this moment. A first type of distributor is used when there is no district heating and the central heating unit transports sufficient hot water to the floor heating distributor.

[0008] A second type of distributor is used in the case of district heating and when there are additional regulations laid down by the power companies. This means in practice, among other things, that the distributor must be embodied with a non-return valve which, in the case of malfunctions, for instance because for whatever reason the pump of the distributor does not operate, prevents a direct flow from the hot water feed to the discharge being able to take place, with the consequence that water at too high a temperature is fed back into the district heating system.

[0009] A third type of distributor is used in the case of a central heating unit which does not deliver sufficient hot water to the floor heating distributor. This may be caused for instance because the central heating boiler has a circulation pump with too little capacity, because the radiators are not adjusted, or not sufficiently so, or because the pipe network of the radiators is embodied with too small a diameter and therefore too high a resistance. In such situations it is desirable to make the distributor "active", i.e. the pump of the floor heating contributes to a greater or lesser extent to the feed of the water from the external central heating unit to the floor heating. It is important in this type of distributor that the degree of suction, performed by the pump of the floor heating, of the central heating water to the floor heating system is adjustable.

[0010] A drawback of the above mentioned types of distributor is that a separate type of distributor must be manufactured for each individual situation. This not only means relatively high manufacturing costs, but also means that a relatively large number of distributors of different types must be held in stock.

[0011] A further drawback is that, when a known distributor of a specific type is installed, this distributor cannot be modified when for instance a different type of distributor is required. The distributor must in that case be replaced in its entirety. If for instance a new external central heating unit is arranged when there is an existing floor heating system, this can result in a distributor of the latter mentioned type being required instead of a distributor of the former mentioned type. When known distributors are in use, this means that the system has to be switched off, only after which is it possible to proceed with replacement of the existing distributor by another

type.

[0012] Another drawback is that different components of the known distributors are susceptible to wear in the case of prolonged use, which means that the whole distributor must be replaced. This is labour-intensive and costly.

[0013] It is an object of the present invention to provide a distributor in a liquid heating system in which the above stated drawbacks are obviated and which is universally applicable in different situations.

[0014] A further object of the invention is to provide a distributor, the operation of which can still be modified in simple and rapid manner even after prolonged use.

[0015] According to a first aspect of the invention, there is provided a distributor for distributing the relatively cold return flow from the floor heating over a first sub-flow for discharge and a second sub-flow to be mixed with the relatively hot feed flow, the distributor comprising:

- a first compartment provided with a first connecting part for connecting of the feed flow from an external heating system and a second connecting part for connecting of the floor heating;
- a second compartment provided with one or more first connecting parts to which the relatively cold return flow of the floor heating can be connected, and a second connecting part for connecting a discharge with which the cold liquid can be carried to the external heating system;
- at least one passage opening which is provided between the first and second compartment and along which the second sub-flow can be guided for mixing of the second sub-flow with the feed flow;

wherein a wall of at least one of the compartments is provided with an opening along which a flow limiting element can be inserted, using which the throughflow between the compartments can be limited in the inserted position.

[0016] The throughflow is here defined as the volume of the liquid flowing through the opening per unit of time. Because the flow limiting element can be arranged from outside by placing it via the openings in one of the two or both compartments, the remaining part of the distributor can be used for the different situations, i.e. in the situation of connection to a properly operating central heating unit, the situation of connection to a poorly functioning central heating unit wherein the pump capacity of the floor heating system itself has to be used to supply extra hot liquid from the central heating unit, and in the situation of connection to a district heating system. This means that a single type of distributor according to the invention can be applied in all the stated situations. It is therefore possible to suffice with a single type of standard distributor which can be modified simply and rapidly to the specific situation. This also makes extremely simple the replacement of the flow limiting element, such as for instance in the form of an adjusting valve or non-return valve as discussed below.

[0017] As a producer it is thus possible to make three types of distributor with one basic distributor. In the known distributor systems it is the case that the different types cannot be converted or modified, or only with difficulty, so that they can perform a different function. This means a stock of three types instead of one type. It is also the case that three different types have to be produced, with the associated cost.

[0018] A wholesaler also has the advantage of one standard type with for instance the option of assembling the distributors by means of separate components to be supplied. This is also a great advantage in respect of stocking and flexibility.

[0019] Finally, an installer, at least if working with stock, also has the advantage which applies for the wholesaler. In practice it will moreover still be possible during installation to modify the distributors to local conditions.

[0020] According to a preferred embodiment of the invention, the openings in the compartment wall are closable with a closing element. In the situation of a properly operating central heating unit, the openings in the compartment wall(s) need only be closed, and further measures in the standard distributor can be dispensed with. In the outer outlined situations measures must be taken, and the flow limiting element serves for this purpose. The closing element and the flow limiting element preferably take a combined form, which means that functions of closing the opening(s) in the compartment wall (s) and the limiting of the flow through the passage opening between the compartments can be brought about with a combined element.

[0021] According to a specific preferred embodiment, which is particularly suitable for applications where the central heating system delivers too little liquid and/or liquid at too low a temperature, the limiting element comprises an adjusting element for adjusting the flow through the passage opening. Adjustment of the throughflow takes place in that the adjusting element is is embodied for displacement toward and away from the passage opening for the purpose of reducing respectively enlarging the passage of the passage opening.

[0022] In an advantageous embodiment the closing element comprises a sealing plug for fitting in the opening and provided with a bore, and the flow limiting element comprises an adjusting valve provided in the bore and displaceable therein. The adjusting valve can be moved reciprocally in the bore so as to thus vary the distance between the adjusting valve and the passage opening, resulting in a corresponding variation in the flow through the passage opening.

[0023] In a particularly advantageous and simple embodiment, the sealing plug and the adjusting valve comprise screw thread so that by rotating the adjusting head it can be displaced relative to the sealing plug. A correct passage can thus be adjusted by rotating the adjusting

valve. In this embodiment the adjusting valve is preferably accessible from outside via the bore in the sealing plug, so that the throughflow is readily adjustable, also in mounted state, for instance when it is found after a time that too little hot water is being delivered by the central heating, this without the pressure in the system having to be released.

[0024] In a preferred embodiment the adjusting element has an at least partially rounded adjusting head. The adjusting head is herein directed toward the passage opening. Owing to this form of the adjusting head, a flow through the passage opening can remain uniform and a minimal pressure loss occurs.

[0025] A further preferred embodiment relates to one or more sealing rings, preferably manufactured from rubber, for arranging between the adjusting valve and the sealing plug. These sealing rings ensure that the pressurized central heating system does not lose liquid, and therefore pressure.

[0026] In another preferred embodiment, which is particularly suitable for situations in which district heating is applied, the flow limiting element comprises a non-return element for leaving almost wholly clear the flow in the direction from the second compartment to the first, and for almost wholly preventing the flow in the opposite direction. During "normal" operation the pump pressure caused by the pump of the floor heating system ensures that the passage opening is left (almost) wholly clear, so that an unimpeded flow of the second sub-flow can take place. If for whatever reason the pump does not operate, or at least insufficient pump pressure is produced, the non-return element closes the passage opening.

[0027] In a further preferred embodiment, the non-return element is displaceable toward and away from the passage opening, and the non-return element comprises one or more springs for urging the non-return element toward the passage opening under predetermined spring pressure. The non-return element is hereby always pressed against the wall(s) between the compartments so that the passage opening is closed, except when the pump can generate sufficient pump pressure to displace the non-return element counter to the spring action so that the passage opening is opened.

[0028] In a particularly advantageous embodiment, the closing element comprises a sealing plug for fitting in the opening and provided with a bore, and the flow limiting element comprises a spring provided in the bore, a guide element displaceable along the sealing plug and a head which is provided on the guide element and with which the passage opening can be closed. The closing element and the sealing plug hereby form a combined component which can be placed in one simple operation in the relevant compartment(s) and with which both the functions, of closing the compartment and closing the passage opening between the compartments in particular situations, can be fulfilled.

[0029] According to another aspect of the present invention, there is provided a floor heating system which comprises:

- a distributor of the above stated type connectable to an external heating system such as central heating or district heating;
- a number of floor heating conduits arranged between the circulation pump and the distributor; and
- a circulation pump with which liquid can be pumped through floor heating conduits.

[0030] Owing to the embodiment of the distributor, and in particular the closing element and the sealing plug, the standard distributor is universally suited for connection to central heating, optionally with sufficient pump capacity, and connection to a district heating network.

[0031] Further advantages, features and details of the present invention will be elucidated on the basis of the following description of several embodiments thereof. Reference is made in the description to the figures, in which:

- figure 1 shows a schematic view of a floor heating system according to the invention;
- figure 2A shows a cross-section of a first preferred embodiment of the distributor in closed position;
- figure 2B shows a cross-section of the embodiment of figure 2A in opened position;
- figure 3A shows a cross-section of a second preferred embodiment of the distributor according to the invention in opened position;
- figure 3B shows a cross-section of the second embodiment of figure 3A in closed position; and
- figure 4 shows a cross-section of a third preferred embodiment of the distributor according to the invention.

[0032] Figure 1 shows a floor heating system 1 in schematic manner. Via an external heating system, such as district heating or a central heating unit (CH), hot water is supplied (in the so-called feed flow in direction P_1) and guided via a distributor 4 and a pump 9 through a number of conduits 10,11,12 arranged in the floor of the building (direction P_2). The hot water runs through the conduits 10-12 and relinquishes heat to the floor in which the conduits are arranged. Conduits 10-12 are herein placed in a number of channels arranged in the concrete floor or the covering floor provided thereon. The route of the conduits in the floor is only indicated schematically in figure 1. In practice there are many options for the route of the conduits through the floor, all of which are deemed to lie within the reach of the skilled person.

[0033] When the water, which in the meantime has at least partially cooled, returns to the distributor (the so-called return flow), a part thereof is discharged (direction P_3) and another part of the return flow is mixed with the feed flow (direction P_4). Distributor 4 is provided for this

purpose with a hot water connecting element 5 onto which can be connected a hot water supply pipe 2 of the district heating or the central heating unit. Distributor 4 is further provided with a connecting element 6 to which the pump 9 can be connected. Pump 9 is coupled to a further distributor unit 10 which distributes the supplied hot water over the conduits. It will be apparent that the number of conduits varies from one, in the case of relatively small floor areas, to several (for instance five) conduits 10-12 in the case of larger floor areas.

[0034] Distributor 4 is further provided with one or more connecting elements (7,7',7") to which the return conduits 10-12 can be connected. Finally, the distributor is provided with a connecting element 8 to which can be connected the return pipe 3 leading to the central heating unit or district heating.

[0035] Distributor 4 comprises two compartments 14,15 mutually separated by means of a partition wall 16. Connecting elements 5,6 are provided on left-hand compartment 15, while connecting elements 7,7',7",8 are provided in right-hand compartment 14.

[0036] Figures 2A and 2B show a part of distributor 4 in more detail. The distributor shown here is applied when the external heating system is a district heating system.

[0037] Figure 2A shows that in partition wall 16 there is provided a passage opening 30 along which the part of the return liquid for mixing with the feed flow can flow in the direction P_4. Further provided in the wall of compartment 15 is an opening, along the edges of which is arranged screw thread 28. In this opening is placed an element 13 with which the opening in compartment wall 22 and passage opening 30 in the partition wall 16 between compartments 14,15 can be closed.

[0038] As already discussed above, the embodiment of element 13 shown in figures 2A and 2B forms a non-return valve for the situation in which the distributor is applied to a district heating system. Figure 2A herein shows the valve in closed state, while figure 2B shows the valve in opened state. Element 13 comprises a valve guide plug 17 provided with a part which is provided with screw thread 27 and with which the plug can be screwed into the opening in compartment wall 16. Valve guide plug 17 is provided with an elongate bore 18 in which a guide element 19 is displaceable. Guide element 19 is provided on its end surface with a flange 22 which acts as support for a sealing part 24 manufactured from flexible material. Sealing part 24 is preferably manufactured from rubber, but can also be made from another material suitable for the purpose. Guide element 19 is provided on its opposite end with a bore 20. A pressure spring 21 is provided in this bore 20 of guide element 20 and the bore 18 of valve guide plug 17. Pressure spring 21 provides a continuous pressure on guide element 19, whereby in the drawn situation this latter is pressed in the direction of arrow P_5. This has the consequence that passage opening 30 in partition wall 16 is closed and that there is no flow between compartments 14,15. The passage opening is also closed in exceptional situations where for instance the pump of the floor heating system does not function, or does not function satisfactorily. When pump 9 does however function satisfactorily, the pump creates a pressure difference between compartments 14 and 15 such that guide element 19 is displaced in direction P_6 counter to the action of spring 21, so that passage opening 30 is opened and flow occurs from the right-hand compartment 14 to the left-hand compartment 15. Sealing part 24 can be displaced in the direction P_6 until the recesses 25 therein come to lie on the outer end 26 of sealing plug 17.

[0039] When pump 9 functions properly, opening 30 is therefore opened as shown in figure 2B. In this situation the distributor can perform the above described mixing function. If for whatever reason pump 9 of the floor heating system does not operate, the valve will close as shown in figure 2A, and no direct flow is possible from the feed via connecting element 5 to the discharge via connecting element 8.

[0040] Figures 2A and 2B further show that flange 22 is preferably provided with chamfered edges 23. The chamfering functions here as positioning edge so that guide element 19 is always centred in the opening in compartment wall 16. This ensures that guide element 19 is always positioned in correct manner.

[0041] Figures 3A and 3B show a second preferred embodiment of the invention. In this embodiment the element 13' functions as adjusting valve for use in situations where the quantity of feed water from the central heating unit is insufficient. A plug 31 is now fitted into the standard distributor 4 already discussed in respect of the embodiment of figures 2A and 2B, for instance by screwing the plug, using screw thread 27, into the screw thread 28 in compartment wall 22. Plug 31 is provided in this embodiment with a full continuous bore 32. Bore 32 is provided on the inner side with screw thread 33. An adjusting valve 34 is arranged in bore 32. Adjusting valve 34 is provided on its peripheral surface with outer screw thread 35 corresponding with inner screw thread 33, so that adjusting valve 34 is displaceable in bore 32 by rotation. Because adjusting valve 34 and plug 31 are provided with inner and outer screw thread 33, 35 respectively, the rotating movement of adjusting valve 34 will be converted into a linear movement, wherein the outer end 36 of adjusting valve 34 closes the passage opening 30 of partition wall 16 to a greater or lesser extent. The outer end of the adjusting valve has a head 36 of rounded form. The diameter of head 36 is slightly larger than the diameter (d) of passage opening 30 in partition wall 16. The head 36 has a rounded form so as to ensure a uniform change in the flow through passage opening 30 during displacement of head 36.

[0042] In the shown embodiment the element 34 has an elongate recess 37 on its outer end opposite the head 36. Recess 37 is accessible from the outside of distributor 4 via bore 32. This provides the option of arranging an external tool, for instance a screwdriver, into recess

37 from the outside in order to turn the adjusting valve 34 therewith, with the result that head 36 is displaced in the direction of opening 30 (P_5) or in the opposite direction (P_6).

[0043] In the case of a passage opening completely closed by adjusting valve 34, all liquid displaced by distributor pump 9 will pass via the connecting element 5 of the feed flow and the connecting element 8 of the discharge flow. When the passage opening is fully open, wherein the head 36 has been rotated back as far as possible in the direction of arrow P_6, the entire quantity of liquid displaced by the distributor pump will pass through passage opening 30 and there is no flow via connecting element 5 of the feed flow and via connecting element 8 of the return flow. This means that the distributor 4 has a substantially neutral effect on the central heating unit. The adjustment options of the present adjusting valve 34 lie within a fully open and fully closed situation.

[0044] Because element 34 is further provided with O-rings 38 of flexible material which are arranged in recesses 39 in element 34, a liquid-tight closure is created whereby the pressurized water in the central heating system does not lose any water, and therefore any pressure, and it is still possible to adjust the adjusting element 34 from outside.

[0045] Figure 4 finally shows a third preferred embodiment of the invention. This embodiment is applied when the distributor is connected to a properly operating external central heating unit. In such a situation it is not necessary to arrange a non-return valve in the passage opening to prevent hot water from the feed flow entering the discharge flow in the case of malfunctions, nor does an adjusting valve have to be provided for the purpose of compensating for an external central heating unit which is not operating properly. In the shown embodiment the opening in wall 22 of compartment 15, which opening is provided with screw thread 28, is sealed with a sealing plug 42 provided with corresponding screw thread 28.

[0046] The rights sought are not defined by the above described preferred embodiments of the invention. The rights sought are rather defined by the following claims, within the scope of which many modifications can be envisaged.

Claims

1. Distributor in a floor heating system for distributing the relatively cold return flow from the floor heating over a first sub-flow for discharge and a second sub-flow to be mixed with the relatively hot feed flow, the distributor comprising:

   - a first compartment provided with a first connecting part for connecting of the feed flow from an external heating system and a second connecting part for connecting of the floor heating;
   - a second compartment provided with one or more first connecting parts to which the relatively cold return flow of the floor heating can be connected, and a second connecting part for connecting a discharge with which the cold liquid can be carried to the external heating system;
   - at least one passage opening which is provided between the first and second compartment and along which the second sub-flow can be guided for mixing of the second sub-flow with the feed flow;

   characterized in that
   a wall of at least one of the compartments is provided with an opening along which a flow limiting element can be inserted, using which the throughflow between the compartments can be limited in the inserted position.

2. Distributor as claimed in claim 1, wherein the opening in the compartment wall is closable with a closing element.

3. Distributor as claimed in claim 2, wherein the closing element and the flow limiting element are combined.

4. Distributor as claimed in any of the foregoing claims, wherein the limiting element comprises an adjusting element for adjusting the flow through the passage opening.

5. Distributor as claimed in claim 4, wherein the adjusting element is displaceable toward and away from the passage opening for the purpose of reducing respectively enlarging the passage of the passage opening.

6. Distributor as claimed in either of the claims 4-5, wherein the adjusting element comprises an at least partially rounded adjusting head.

7. Distributor as claimed in any of the claims 4-6, wherein the closing element comprises a sealing plug for fitting in the opening and provided with a bore, and the flow limiting element comprises an adjusting valve provided in the bore and displaceable therein.

8. Distributor as claimed in claim 7, wherein the sealing plug and the adjusting valve comprise screw thread for displacing the adjusting valve by rotation thereof.

9. Distributor as claimed in claim 7, wherein the adjusting valve is accessible from outside via the bore

in the sealing plug.

10. Distributor as claimed in any of the claims 4-9, comprising one or more sealing rings, preferably manufactured from rubber, for arranging between the adjusting valve and the closing plug.

11. Distributor as claimed in any of the claims 1-3, wherein the flow limiting element comprises a non-return element for leaving almost wholly clear the flow in the direction from the second compartment to the first, and for almost wholly preventing the flow in the opposite direction.

12. Distributor as claimed in claim 11, wherein the non-return element is displaceable toward and away from the passage opening, and wherein the non-return element comprises one or more springs for urging the non-return element toward the passage opening under predetermined spring pressure.

13. Distributor as claimed in claim 12, wherein the springs comprise pressure springs for pressing shut the passage opening with the non-return element.

14. Distributor as claimed in claim 12, wherein the springs comprise draw springs for pulling shut the passage opening with the non-return element.

15. Distributor as claimed in any of the claims 11-14, wherein the closing element comprises a sealing plug for fitting in the opening and provided with a bore, and the flow limiting element comprises a spring provided in the bore, a guide element displaceable along the sealing plug and a head which is provided on the guide element and with which the passage opening can be closed.

16. Distributor as claimed in any of the claims 11-15, comprising a sealing part manufactured from flexible material, preferably rubber.

17. Floor heating system, comprising:

- a distributor as claimed in any of the foregoing claims connectable to an external heating system such as central heating or district heating;
- a number of floor heating conduits arranged between the circulation pump and the distributor; and
- a circulation pump with which liquid can be pumped through floor heating conduits.

18. Floor heating system as claimed in claim 17, wherein the distributor is suitable for connection to central heating and for connection to district heating.

19. Use of a distributor or a floor heating system as claimed in any of the foregoing claims.

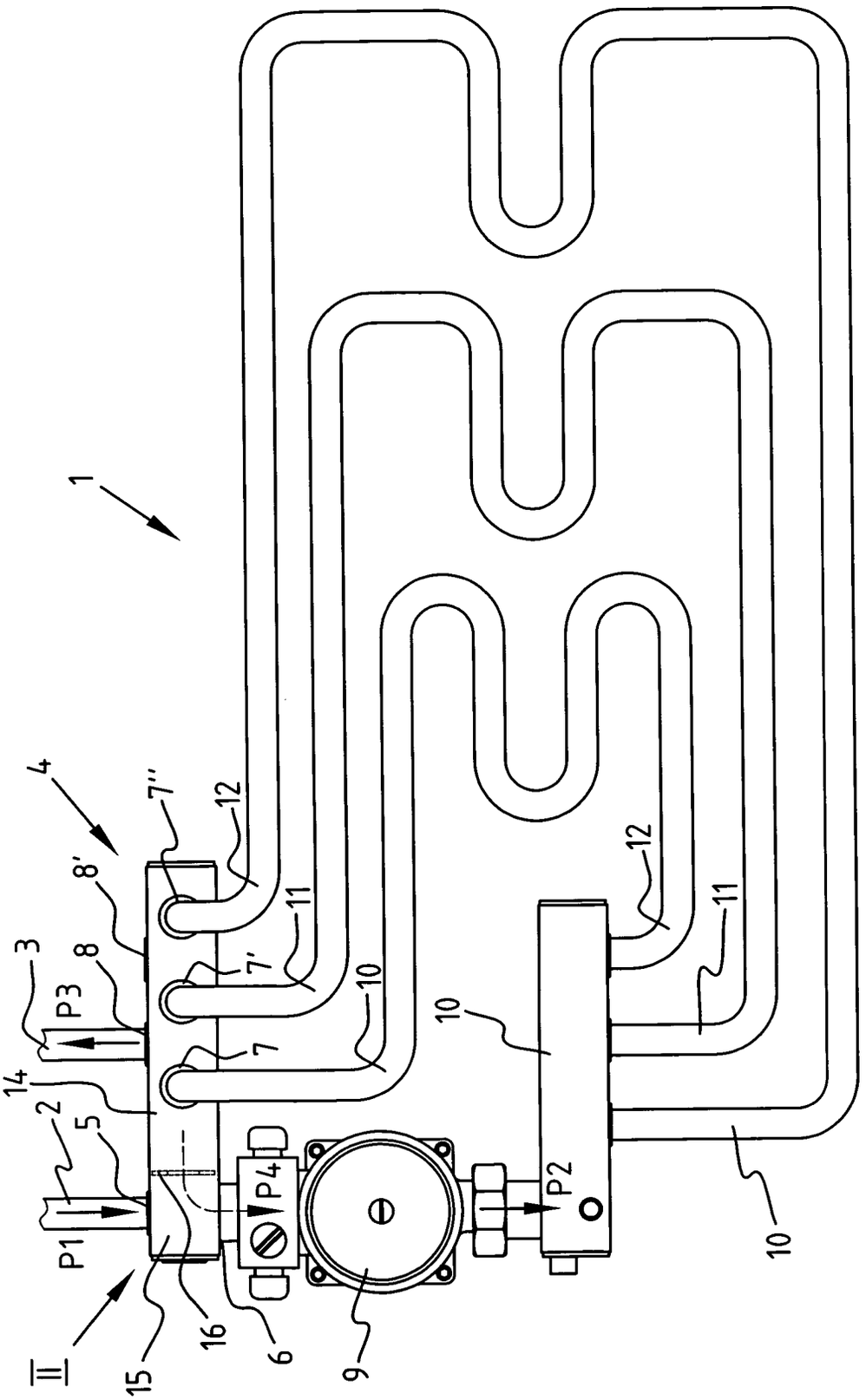

FIG. 1

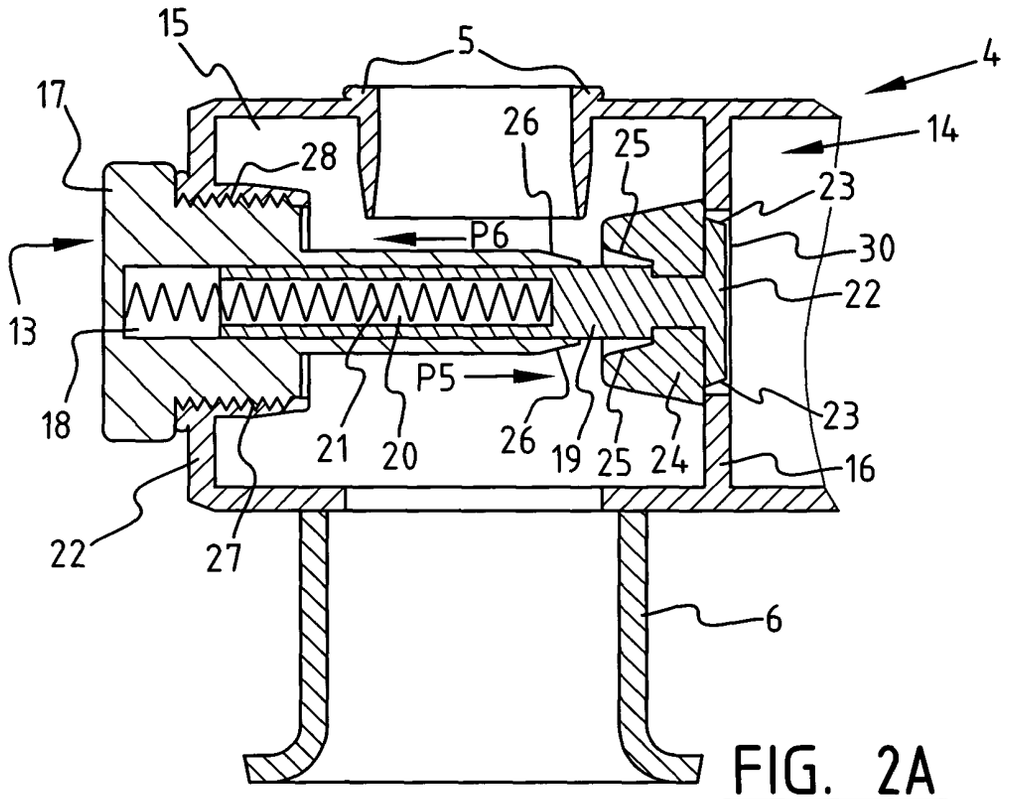
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FIG. 2A

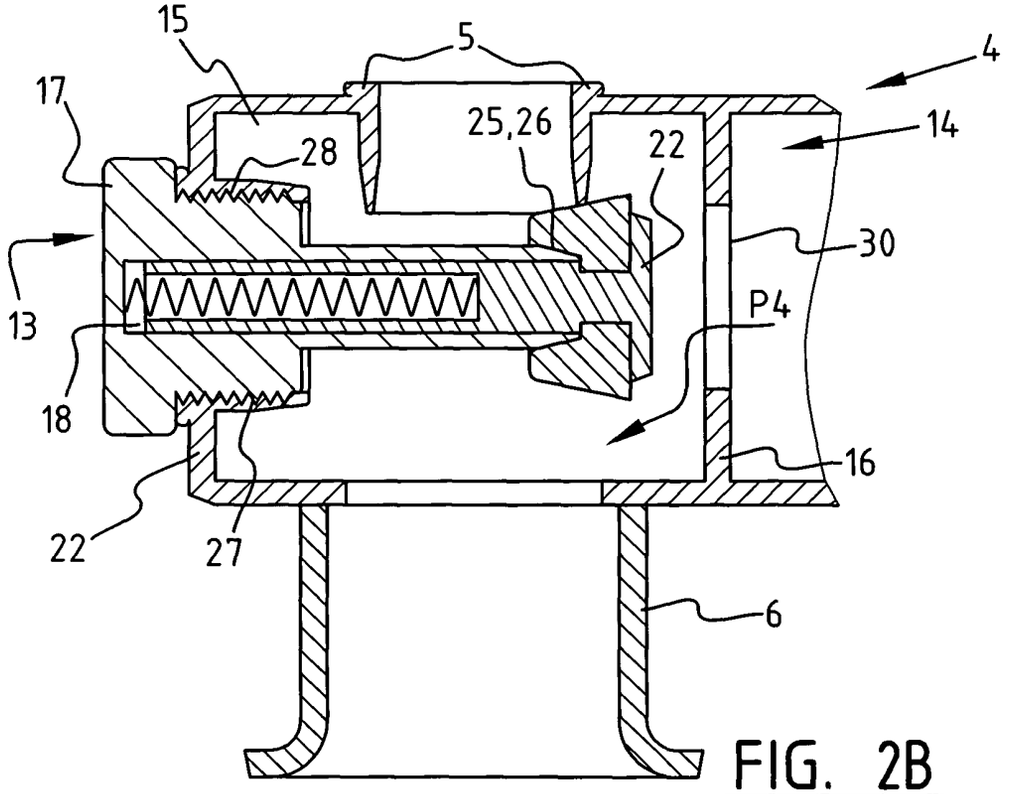
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FIG. 2B

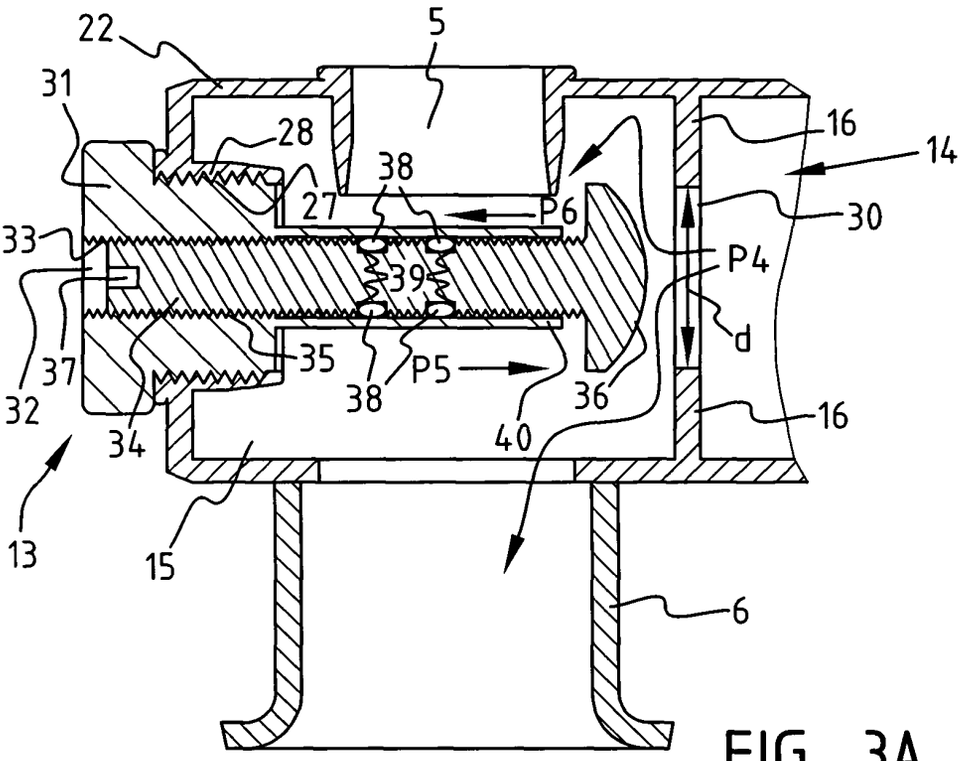
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FIG. 3A

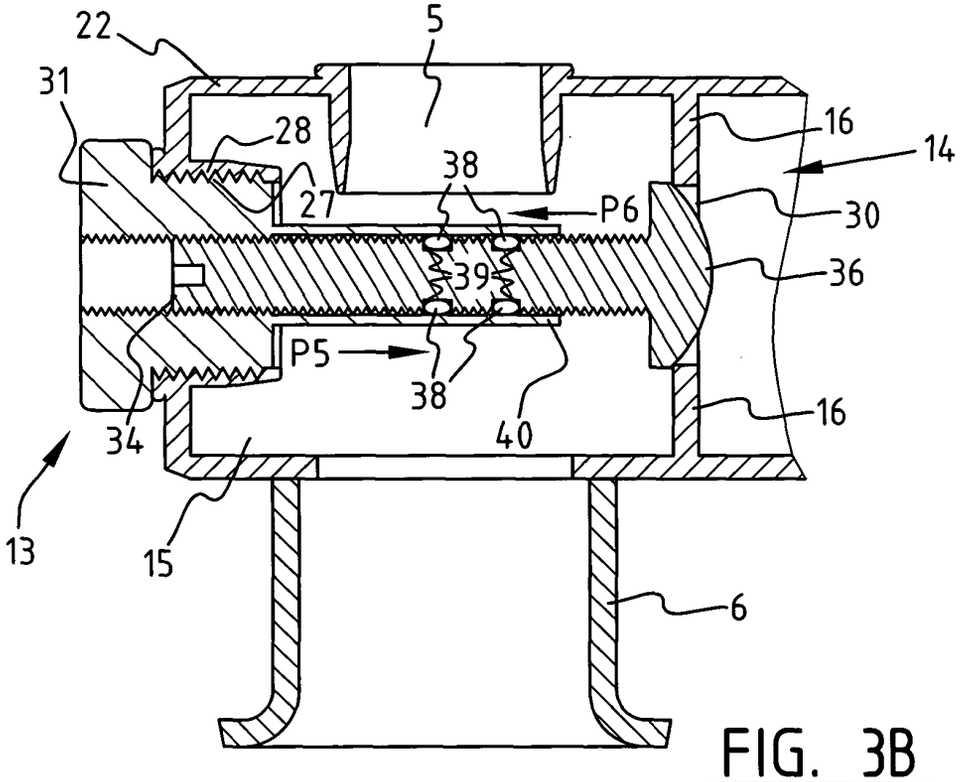
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FIG. 3B

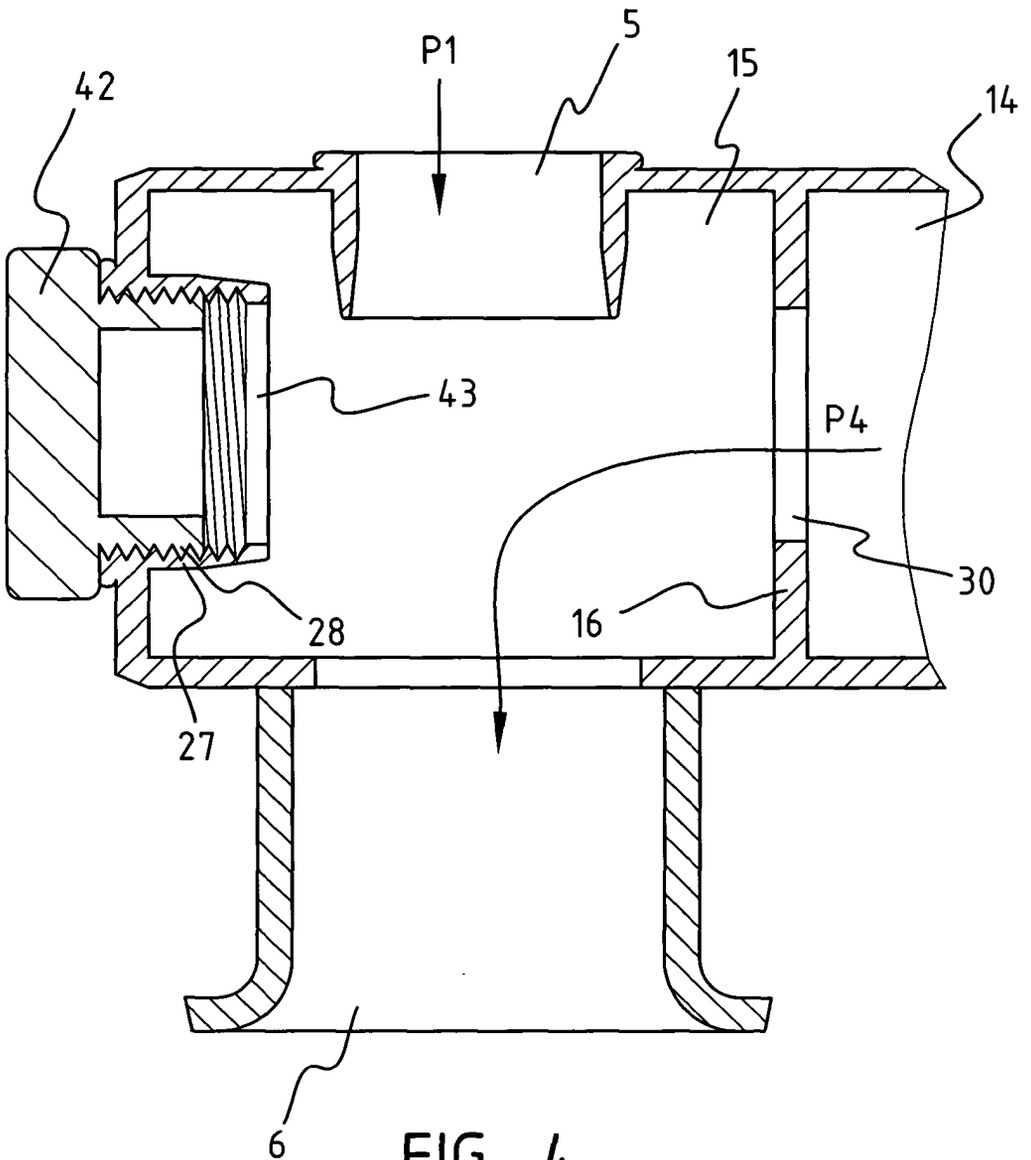

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 8503

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)
A	DE 42 41 139 A (TRILLITZSCH HARALD) 9 June 1994 (1994-06-09) * abstract *	1,17	F24D3/10
A	NL 7 709 960 A (CORNELIS ANTONIUS JOHANNES SAN) 13 March 1979 (1979-03-13) * figure *	1,17	
A	EP 0 592 788 A (GRAMMER MEINRAD) 20 April 1994 (1994-04-20) * abstract *	1,17	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 June 2005	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
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