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

(11) **EP 1 546 611 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.01.2008 Bulletin 2008/04

(21) Application number: **03771125.6**

(22) Date of filing: **24.07.2003**

(51) Int Cl.:
F24D 3/10 *(2006.01)*

(86) International application number:
PCT/FI2003/000580

(87) International publication number:
WO 2004/011851 (05.02.2004 Gazette 2004/06)

(54) MANIFOLD FOR CENTRAL HEATING SYSTEMS

VERTEILER FÜR ZENTRALHEIZUNGSSYSTEME

COLLECTEUR POUR SYSTEMES DE CHAUFFAGE CENTRAL

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

(30) Priority: **25.07.2002 FI 20021412**
10.10.2002 FI 20020407 U

(43) Date of publication of application:
29.06.2005 Bulletin 2005/26

(73) Proprietor: **Ojala, Risto Antero**
07110 Hinthaara (FI)

(72) Inventor: **Ojala, Risto Antero**
07110 Hinthaara (FI)

(74) Representative: **Salomäki, Juha Kari Ensio**
Salomaki Oy
Kankurinkatu 4-6
05800 Hyvinkää (FI)

(56) References cited:
EP-A1- 0 034 996
US-A- 3 986 666
US-A- 4 770 341
US-A- 6 092 734

EP 1 546 611 B1

Description

[0001] The present invention relates to a manifold as defined in the preamble of claim 1 for central heating systems, which is known from US-A-4 770 341.

[0002] The present invention is very applicable to central heating systems and particularly suitable in connection with ground source heat pumps described for example in the Finnish patent application No. 20020407.

[0003] It is known to divide a central heating system up into independently controllable heating circuits by means of a manifold. In the known manifolds the fittings of the return pipe and the flow pipe of each heating circuit are placed side by side and the circulating pump of the circuit is installed at either of the pipes.

[0004] This leads to a very long construction of the body of the manifold because ample space between the circulating pumps of two adjacent circuits must be reserved to allow installation of valves if such are required and to enable accomplishment of the installation work. Minimum total length of a 5-circuit manifold as per US patent No. 6,092,734 including pumps and valves is 90 cm. A manifold assembly of this size can neither be installed within the frame of a standard sized ground source heat pump nor on top of a standard sized heating boiler.

[0005] In the above-mentioned manifold the fittings of the return pipes and the flow pipes are factory-mounted by welding them onto fixed positions of the manifold body. Therefore the position and the direction of the return pipes and the flow pipes are prefixed and can not be changed at the site of the installation which is often likely to lead to a complex piping causing additional plumbing work this being particularly true in cases of retrofitting as the construction of the site do not take the new technology into the account.

[0006] The said type of a manifold includes such box-like constructions that it cannot be produced of cast iron.

[0007] The said type of a manifold includes several welded seams, which are prone to corrosion.

[0008] The said type of a manifold includes several sharp corners, such as cut off tube ends, which are likely to worsen flowing dynamics. This problem could easily be eliminated if the manifold body could be made of cast iron.

[0009] It is also known to manufacture a modular manifold as per US patent No. 6,345,770, which is suggested being suitable to be manufactured in both modular and monoblock versions. An individual module of this type of a manifold can be made of cast iron, but in such a case only one module will have 4 joints that have to be sealed by O-rings or similar sealing elements. A combined modular manifold of such type for 5 heating circuits will then have all 20 joints to be sealed. Such a solution is prone to leaks and its lifetime is limited. Otherwise there are similar problems as with the manifold as per US patent No. 6,092,734. The length of the manifold as per US patent No. 6,345,770 can even be longer than that of the manifold as per US patent No. 6,092,734.

[0010] In all manifolds of above-mentioned types there is a common problem in case they are used in a heating system that is using ground source heat pump as the heat source. In a common situation that only a part of the heating circuits are in use at a time, the excess of the flow of the heating liquid is led to the return pipe i.e. back to the condenser of the ground source heat pump via the communication port of the manifold. This will increase the temperature of the refrigerant returning to the condenser, i.e. the condensing temperature of the refrigerant will increase, as it is the temperature of the into the condenser returning heating circuit liquid which is decisive for the condensing temperature in the first place. In a ground source heat pump increase of the condensing temperature leads to lower C.O.P. (Coefficient Of the Performance).

[0011] An object of the present invention is to provide a manifold from which such disadvantages as mentioned above are removed and which is essentially smaller in height and length than the known solutions. The present invention also provides a manifold design which allows production by casting which is not only an economical mass production method but allows designs and forms that are most advantageous from the point of view of flowing dynamics.

[0012] The object is solved by a manifold according to the characterising portion of claim 1.

[0013] A manifold in accordance to the present invention is advantageous also in the sense that, thanks to the modular pump, the directions of the return and the flow pipes can freely be chosen according to the conditions at the site of the installation, this feature, however, is not likely to make the manifold prone to leaks in any measure.

[0014] In the present invention a manifold is provided in which the communication channel is placed outside of the manifold body which, in case the manifold is part of a ground source heat pump in accordance to the Finnish patent application No. 20020407, will offer the possibility to lead the heating circuit liquid to flow, when required, via the heat-accumulator to reduce the temperature of the heating circuit liquid down to a wanted level before it flows into the condenser of the ground source heat pump to remove the problem caused by the heating circuit liquid returning to the condenser of the ground source heat pump in too high a temperature.

[0015] And further, in the present invention a manifold is provided which can be installed directly to the side of a tank or into a flow line by using a simple mounting flange. And further, in the present invention a manifold is provided which allows connecting it together with additional manifold modules of one or multiple heating circuits i.e. a manifold is provided which allows retrofitting of the heating system with new heating circuits. Such a connection, being a flange joint, is not prone to leaks.

[0016] Briefly and more exactly said, the manifold according to the present invention is characterized by what is presented in the characterization part of claim 1. Other embodiments of the invention are characterized by what

is presented in the other claims.

[0017] In the following the present invention will be described in detail by the aid of an embodiment example with reference to the attached drawings describing constructive details of the manifold and the modular pump according to the present invention wherein:

Fig. 1 presents the front view, the side view, and the side view with partial cross-section of a pump in accordance to the present invention,

Fig. 2 presents the front view, the side view, and the cross-section of a return port adapter,

Fig. 3 presents a manifold according to the present invention with overlapping mounting flanges as seen from the side of the manifold,

Fig. 4 presents the design of the manifold according to the present invention with overlapping mounting flanges with partial cross-section as seen from the side of the manifold,

Fig. 5 presents the manifold according to the present invention as seen from the side of the manifold with overlapping mounting flanges and with pumps and return ports adapters installed in the same direction,

Fig. 6 presents the manifold according to the present invention as seen from the side of the manifold with overlapping mounting flanges and with pumps and return ports adapters installed in different directions,

Fig. 7 presents the manifold according to the present invention as seen from the side of the manifold and connected with one heat=source and with five heating circuits,

Fig. 8 presents another embodiment of the manifold according to the present invention as seen from the side of the manifold,

Fig. 9 presents a modified embodiment of the manifold according to the present invention as seen from the side of the manifold,

Fig. 10 presents yet another embodiment of the manifold in according to the present invention in cross section as seen from the front of the manifold, and

Fig. 11 presents the manifold shown in Fig. 10 as seen from the front of the manifold, and installed with the pumps and connected the heating system.

[0018] One type of a pump 27 used in the present invention is shown in Fig. 1. The body of the pump 27 is a cast iron piece having a mounting flange 1 with a machined sealing surface 8 and boltholes 2 for fixing the pump at any of the mounting flanges 19 of the manifold 35. The pump housing 3 is formed by internal machining the body of the pump to match with the runner 9 of the pump 27. The pump motor 4 and the runner 9 can be a commercial standard product, such as Wilo or Grundfors makes. Intake opening 5, which is centric to the pump housing 3 and to the sealing surface 8 and to the boltholes 2, extends into the space the liquid is taken in from. The pump motor 4 is fixed at the pump housing 3 with its own fixing bolts and is sealed to the housing with original sealing elements 7 exactly the same way as it would be fixed and sealed to an original housing of the said pump manufacturer. The motor 4 and the runner 9 are therefore exchangeable parts and in service situations no other parts of the system need to be dismantled. Outlet port 6, which is in connection with the pump housing 3, is placed at the side of the pump housing 3.

[0019] In Fig. 2 one possible type of a return port adapter 28 used in the present invention is shown. The return port adapter 28 consists at least of a mounting flange 10 with mounting holes 11 and an aperture 13 in the middle of the flange 10. In addition the return port adapter 28 has a pipe fitting 12 joined in the outer side of the flange 10 and in the middle of the flange so that the pipe fitting 12 covers the aperture 13. The pipe fitting 12 of this type is for example a bended tube forming an angle of 90°. The inner surface 14 of the mounting flange 10 is flat and forms a leak-proof surface.

[0020] The external dimensions of the mounting flange 10 and the size and the position of its mounting holes 11 are identical with the corresponding parts of the pump 27 described in Fig.1. Therefore the pump 27 and the return port adapter 28 can freely be mounted at any of the fixing flanges 19 of the manifold 35 shown in Fig. 3 and the directions of the outlet port 6 of the pump 27 and the pipe fitting 12 of the return port adapter 28 can freely be chosen.

[0021] In Fig.3 the manifold 35 according to the present invention is shown with overlapping mounting flanges 19. The body 15 of the manifold 35 is a monoblock cast iron piece, which is economical in production from the point of view of flowing dynamics and from the point of view of mass-production. The mounting flanges 19 of the manifold are embossments at the body casting around the flow-openings 20, which are machined flat to be sealing surfaces and in which holes 17 for fixing bolts are drilled or tapped. The upper mounting flanges 19 form together with the flow-openings 20 flow ports 16 for flow-pipes. The pumps 27 are situated between the flow ports 16 and the flow-pipes. Correspondingly the lower mounting flanges 19 form together with the flow-openings 20 return ports 18 for return-pipes. The return port adapters 28 can be situated between the return ports 18 and the return-pipes. The flow ports 16 and return ports 18 have been

arranged so that the incoming directions and/or positions of the flow-pipes and return-pipes to be connected to the manifold 35 are adjustable in connection with the installation of the manifold 35.

[0022] At the upper side of the manifold 35 there is provided a fitting 21, 22 for installing an automatic air-vent or measuring devices or alike.

[0023] An external communication channel 23 is provided, which will return excessive flow back to the heat-source in the case that only a part of the heating circuits are simultaneously working. One end of the communication channel 23 is connected to the upper part of the lower chamber 25 of the manifold 35 and the other end to the upper chamber 26 of the manifold 35 so that a connection between the two chambers is formed.

[0024] Fig.4 presents the design of the manifold 35 according to the present invention with overlapping mounting flanges with partial cross-section. The figure shows that the internal space of the manifold 35 is divided, with a horizontal wall 24, into two from each other separated chambers, which are the upper chamber 26 and the lower chamber 25. If necessary a hole with a non-return valve in the dividing wall 24 can be provided to function as a communication port between the two chambers 25, 26.

[0025] In Figs. 5 and 6 it is shown how the pumps 27 and return port adapters 28 can be installed on the manifold 35 when the manifold is equipped with the overlapping mounting flanges 19. In Fig. 5 the pumps 27 and the return port adapters 28 have been installed all in the same direction, whereas in Fig. 6 the pumps 27 and the return port adapters 28 have been installed in different directions.

[0026] Fig. 7 presents the manifold 35 according to the present invention connected with one heat-source 33 and with five heating circuits 34. The heat-source 33 is installed on the flow ports 16 of the manifold 35 so that the heated water is brought from the heat-source 33 to the upper chamber 26 of the manifold 35 and the cooled water from the heating circuits 34 is returned to the heat-source 33 from the lower chamber 25 of the manifold 35.

[0027] In another embodiment of the invention shown in Fig. 8 the mounting flanges 19, which are meant for fixing the pumps 27, are placed close to each other at the upper part of the face 29 of the manifold 35. The return ports adapters 28 are not at the face but are placed at the fixed positions at the bottom 30 of the manifold 35. In this case the return-pipe is always behind the corresponding flow-pipe and do not take additional sideward space. The dimensions of the mounting flanges 19 are decisive for minimum distance between the flow-pipes, this solution therefore resulting with the shortest possible design of the manifold. As the return ports adapters 28 differ from those mentioned earlier and are factory-mounted at the fixed positions, the variability of this manifold is not as good as that of the solution presented in figures 3 - 7, but it is suitable for applications in which available space is limited, as is the case with the ground source heat pumps or with central heating boilers or furnaces.

[0028] Fig. 9 presents the manifold according to the present invention modified for use as a part of the ground source heat pump in accordance to the Finnish patent application No. 20020407 or with any other type of a ground source heat pump. In this solution the communication channel 23 is replaced with two pipe fittings 31 and 32 through which the excessive flow is led to flow via the preheating tank of the domestic hot water in order to lower the temperature of the liquid returning to the heat source, which is likely to improve the efficiency of the ground source heat pump.

[0029] It is obvious to the person skilled in the art that the invention is not limited to the example described above, but that it may be varied within the scope of the claims presented below.

[0030] Thus, for example the body 15 of the manifold 35 can also be manufactured by welding from steel plate and the mounting flanges 19 can be replaced with steel profile forming flow-ports 16 and return ports 18. One advantageous embodiment of the invention is presented in Figs. 10 and 11. In this embodiment the manifold 35 is presented where the modular pump 27 can be replaced with a circulation pump 36 with axial intake such as Wilo type AC 20/5-0. The flow ports 16 and return ports 18 of the manifold 35 are internally or externally threaded pipe-fittings and the pumps 36 are mounted directly to the corresponding ports by using the own fittings of the pumps. This solution enables free setting of the direction of the flow- and return=pipes within a sector of about 270 degrees.

[0031] In this embodiment the wall 24 dividing the body 15 of the manifold 35 into the two chambers can be installed in such a way that the communication port 23 is formed in the middle of the manifold 35 inside of it. In this case the dividing wall 24 is made of two halves of equal length. These are fixed symmetrically inside of the manifold 35 one extending from the left end and the other from the right end of the manifold towards the middle of the manifold. The halves are made short so that they do not reach each other in the middle of the manifold but an opening is formed between their ends which opening forms the communication port 23. If the dividing wall 24, for its essential part, is installed to form an angle of 45 degrees with the horizontal line of the manifold, the pumps can be placed closer to each other and the manifold can be made even smaller and more compact.

[0032] If the communication port 23 is placed inside and in the middle of the manifold 35 and the flowing speed of the pumps is controlled, the communication port 23 can act in two ways and the manifold 35 can be used both as a manifold and as a mixer valve without any other moving parts than the pumps. In the known manifolds this is not possible as in them the communication port 23 is at one or another end of the body which makes stable mixing function impossible.

Claims

1. Manifold (35) for central heating systems comprising at least a manifold body (15), an upper chamber (26) of the manifold, a lower chamber (25) of the manifold, a dividing wall (24) between the two chambers (25, 26), flow ports (16) for pumps or flow-pipes and return ports (18) for return-pipes, **characterized in that** the flow ports (16) and return ports (18) have been arranged at the front face and at the both ends of the manifold body (15), and that the flow ports (16) and the return ports (18) have pipe-fittings (19a) or mounting flanges (19) with flow-openings (20) for mounting pumps (27, 36) with flow-pipes and return-pipes into the manifold (35).

2. Manifold as defined in claim 1, **characterized in that** the flow ports (16) and the return ports (18) are sideways overlapping so that if the flow-pipes and the return-pipes are installed in the vertical position they are seen side by side in the front view of the manifold (35).

3. Manifold as defined in claim 1 or 2, **characterized in that** in the dividing wall (24) there are one or more communication ports with non-return valves through which the difference of the pressure effecting in the chambers (25 and 26) is balanced.

4. Manifold as defined in claim 1 or 2, **characterized in that** its chambers (25 and 26) are connected with an external communication channel (23).

5. Manifold as defined in any of the preceding claims 1-3, **characterized in that** its chambers (25 and 26) are connected with two fittings (31 and 32), which allow the liquid flow led via a heat user unit.

6. Manifold as defined in any of the preceding claims 2-5, **characterized in that** the pump (27) takes in the liquid through its mounting flange (1) in the direction which is parallel to the shaft of the motor of the pump.

7. Manifold as defined in any of the preceding claims 2-6, **characterized in that** another manifold as defined in any of the preceding claims, prepared for serving one or more heating circuits, is connected to the first manifold (35) with the mounting flanges (19) at the end of the manifold.

8. Manifold as defined at least in one of the preceding claims 2-7, **characterized in that** the pumps (27) at the face (29) of the manifold (35) and the mounting flanges (19) for the pumps (27) are placed at the upper part of the face (29) of the manifold and that the pumps (27) are connected with the upper chamber (26), and that corresponding return ports adapters (28) for the return-pipes are mounted at the fixed positions at the bottom (30) of the manifold (35), and that the said return ports adapters (28) are connected with the lower chamber (25) and seen from the front of the manifold (35) the corresponding flow- and return-pipes of each heating circuit are one after another.

9. Manifold as defined at least in one of the preceding claims, **characterized in that** the dividing wall (24) between the two chambers (25, 26) is made of two parts and is for its essential part set to form an angle of 45° with the body (15) of the manifold (35), and that the ends of the parts of the said dividing wall (24) do not extend to the mid of the manifold (24) but are left short to form an opening between them which forms the communication port (23).

10. Manifold as defined at least in one of the preceding claims, **characterized in that** in the dividing wall (24) there are two or more openings, which form communication ports (2.3).

Patentansprüche

1. Verteiler (35) für Zentralheizungssysteme bestehend zumindest aus einem Köperteil (15) des Verteilers, aus einer oberen Kammer (26) des Verteilers, aus einer unteren Kammer (25) des Verteilers, aus einer Teilwand (24) zwischen den zwei Kammern (25, 26), aus Flussöffnungen (16) für Pumpen oder für Flussröhre und aus Rückflussöffnungen (18) für Rückflussröhre, **dadurch gekennzeichnet, dass** die Flussöffnungen (16) und die Rückflussöffnungen (18) an die Vorderseite und an die beiden Enden des Körperteils (15) des Verteilers aufgestellt worden sind, und dass die Flussöffnungen (16) und die Rückflussöffnungen (18) mit Rohrnippel (19a) oder mit Anmontierungsflanschen (19) mit Flussöffnungen (20) für das Anmontieren der Pumpen (27, 36) mit Flussröhre und Rückflussröhre an den Verteiler (35).

2. Verteiler nach Anspruch 1, **dadurch gekennzeichnet, dass** die Flussöffnungen (16) und die Rückflussöffnungen (18) sich seitwärts überschneiden und im Falle von vertikaler Anmontierung der Flussröhre und der Rückflussröhre diese nebeneinander in der Frontalansicht des Verteilers (35) zu sehen sind.

3. Verteiler nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Teilwand (24) mit einer oder mehreren Kommunikationsöffnungen je mit einem Rückschlagventil für das Balancieren der Druckdifferenz zwischen die Kammern (25 und 26) ausgerüstet worden ist.

4. Verteiler nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** deren Kammern (25 und 26) aneinander mit einem externen Kommunikationskanal (23) verbunden sind.

5. Verteiler nach einem der voranstehenden Ansprüche 1-3, **dadurch gekennzeichnet, dass** deren Kammern (25 und 26) mit zwei Rohranschlüsse (31 und 32) verbunden sind, welche den Fluss durch eine Wärmegebrauchereinheit ermöglichen.

6. Verteiler nach einem der voranstehenden Ansprüche 2-5, **dadurch gekennzeichnet, dass** die Flüssigkeit zu der Pumpe (27) durch seinen Anmontierungsflansch (1) in einer parallelen Richtung mit der Pumpenmotorwelle ankommt.

7. Verteiler nach einem der voranstehenden Ansprüche 2-6, **dadurch gekennzeichnet, dass** ein anderer Verteiler nach einem der voranstehenden Ansprüche, welcher zum Dienen einer oder mehreren Heizungszirkeln vorbereitet ist, an dem erstgenannten Verteiler (35) mit den am Ende des Verteilers befindlichen Anmontierungsflansche (19) verbunden ist.

8. Verteiler zumindest nach einem der voranstehenden Ansprüche 2-7, **dadurch gekennzeichnet, dass** die an der Vorderseite (29) des Verteilers (35) befindlichen Pumpen (27) und die Anmontierungsflansche (19) der Pumpen (27) an dem oberen Teil der Vorderseite (29) des Verteilers platziert worden sind und die Pumpen (27) mit der oberen Kammer (26) angeschlossen worden sind, und dass die entsprechende Rückflussöffnungsadapter (28) für die Rückflussröhre sich an den festen Positionen an der unteren Seite (30) des Verteilers (35) befinden, und dass die genannten Rückflussöffnungsadapter (28) mit der unteren Kammer (25) angeschlossen worden sind, und dass von der Vorderseite des Verteilers (35) angesehen die entsprechende Fluss- und Rückflussröhre jedes Heizungszirkels nacheinander sind.

9. Verteiler zumindest nach einem der voranstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Teilwand (24) zwischen die zwei Kammern (25 und 26) aus zwei Teile gebaut worden ist und dass es im wesentlichen Teil zu 45° Winkel mit dem Körper (15) des Verteilers (35) eingestellt worden ist und dass die Enden der Teile der genannten Teilwand (24) nicht bis auf die Mitte des Verteilers (35) erreichen, sondern sind kurz gelassen worden um zwischen deren eine Öffnung und somit ein Kommunikationskanal (23) zu gestalten.

10. Verteiler zumindest nach einem der voranstehenden Ansprüche, **dadurch gekennzeichnet, dass** es in dem Teilwand (24) zwei oder mehrere Öffnungen geben, welche Kommunikationskanäle (23) gestalten.

Revendications

1. Collecteur (35) pour systèmes de chauffage central comprenant au moins un corps de collecteur (15), une chambre supérieure (26) du collecteur, une chambre inférieure (25) du collecteur, une paroi de séparation (24) entre les deux chambres (25, 26), des orifices d'écoulement (16) pour des pompes ou conduites d'écoulement et des orifices de retour (18) pour des conduites de retour, **caractérisé en ce que** les orifices d'écoulement (16) et les orifices de retour (18) ont été agencés au niveau de la face avant et au niveau des deux extrémités du corps de collecteur (15), et les orifices d'écoulement (16) et les orifices de retour (18) ont des raccords de conduites (19a) ou des brides de montage (19) comprenant des ouvertures d'écoulement (20) pour monter des pompes (27, 36) munies de conduites d'écoulement et de conduites de retour dans le collecteur (35).

2. Collecteur selon la revendication 1, **caractérisé en ce que** les orifices d'écoulement (16) et les orifices de retour (18) se chevauchent latéralement de sorte que si les conduites d'écoulement et les conduites de retour sont installées dans la position verticale, elles sont observées côte à côte dans la vue avant du collecteur (35).

3. Collecteur selon la revendication 1 ou 2, **caractérisé en ce que**, dans la paroi de séparation (24), il y a un ou plusieurs orifices de communication avec des clapets de non-retour à travers lesquels la différence de pression présente dans les chambres (25 et 26) est équilibrée.

4. Collecteur selon la revendication 1 ou 2, **caractérisé en ce que** ses chambres (25 et 26) sont connectées à un canal de communication externe (23).

5. Collecteur selon l'une quelconque des revendications précédentes 1 à 3, **caractérisé en ce que** ses chambres (25 et 26) sont connectées au moyen de deux raccords (31 et 32), qui permettent l'écoulement du liquide conduit via une unité d'utilisateur thermique.

6. Collecteur selon l'une quelconque des revendications précédentes 2 à 5, **caractérisé en ce que** la pompe (27) prend le liquide à travers sa bride de montage (1) dans la direction qui est parallèle à la tige du moteur de la pompe.

7. Collecteur selon l'une quelconque des revendications précédentes 2 à 6, **caractérisé en ce qu'**un

autre collecteur tel que défini dans les revendications précédentes, préparé pour servir un ou plusieurs circuits de chauffage, est connecté au premier collecteur (35) au moyen des brides de montage (19) à l'extrémité du collecteur.

8. Collecteur tel que défini au moins dans l'une des revendications précédentes 2 à 7, **caractérisé en ce que** les pompes (27) au niveau de la face (29) du collecteur (35) et les brides de montage (19) pour les pompes (27) sont placées au niveau de la partie supérieure de la face (29) du collecteur et les pompes (27) sont connectées à la chambre supérieure (26), et des adaptateurs d'orifices de retour correspondants (28) pour les conduites de retour sont montés au niveau des positions fixes au fond (30) du collecteur (35), et lesdits adaptateurs d'orifices de retour (28) sont connectés à la chambre inférieure (25) et, observées depuis l'avant du collecteur (35), les conduites d'écoulement et de retour de chaque circuit de chauffage sont l'une après l'autre.

9. Collecteur tel que défini au moins dans l'une des revendications précédentes, **caractérisé en ce que** la paroi de séparation (24) entre les deux chambres (25, 26) est constituée de deux parties et est pour l'essentiel réglée de manière à former un angle de 45° par rapport au corps (15) du collecteur (35), et **en ce que** les extrémités des parties de ladite paroi de séparation (24) ne s'étendent pas jusqu'au milieu du collecteur (24) mais sont volontairement plus courtes pour former une ouverture entre elles qui constitue l'orifice de communication (23).

10. Collecteur tel que défini au moins dans l'une des revendications précédentes, **caractérisé en ce que**, dans la paroi de séparation (24), il y a deux ouvertures ou plus qui forment des orifices de communication (23).

FIG. 1

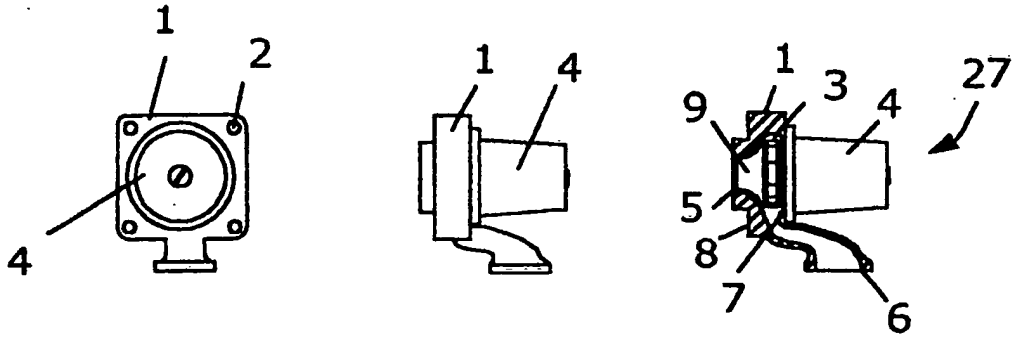


FIG. 2

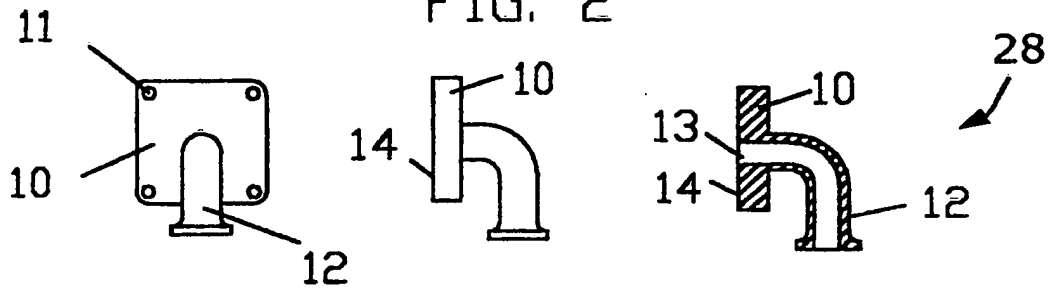


FIG. 3

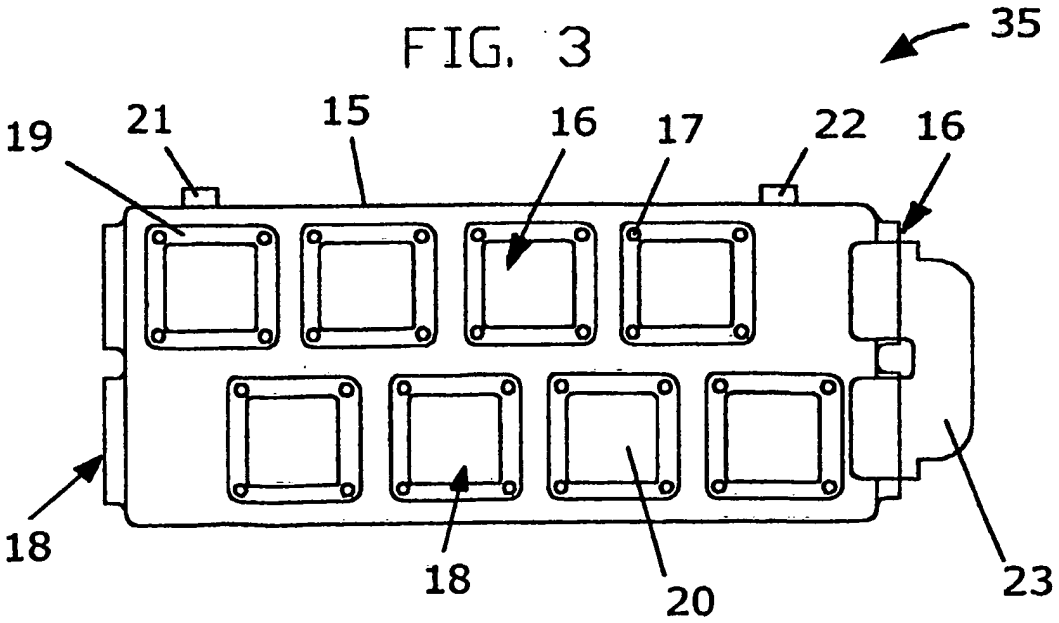


FIG. 4

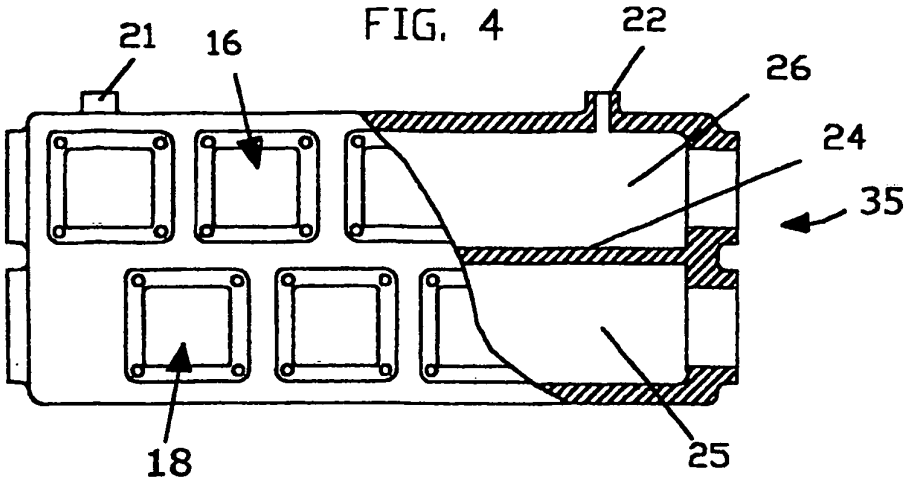


FIG. 5

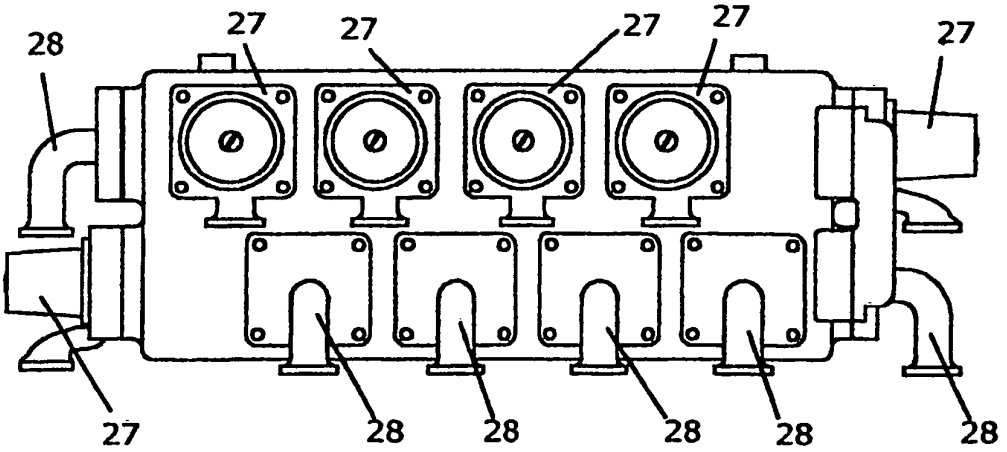


FIG. 6

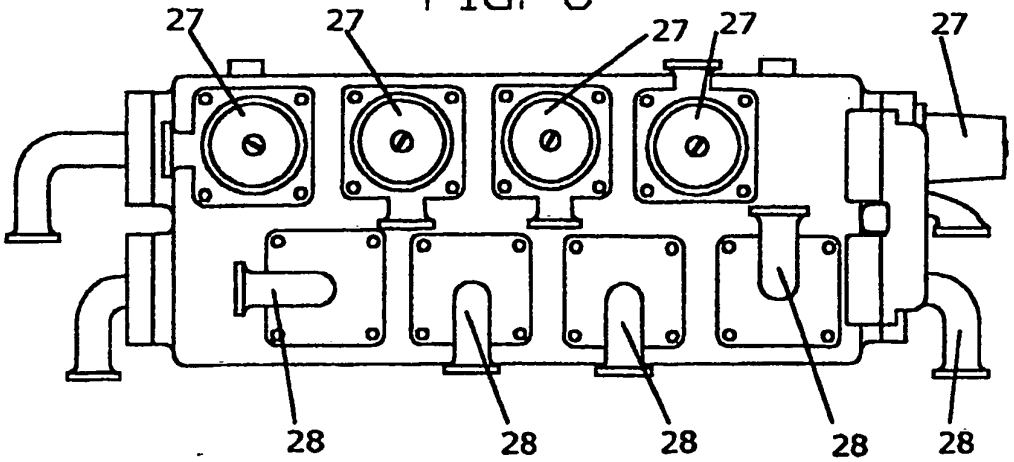


FIG. 7

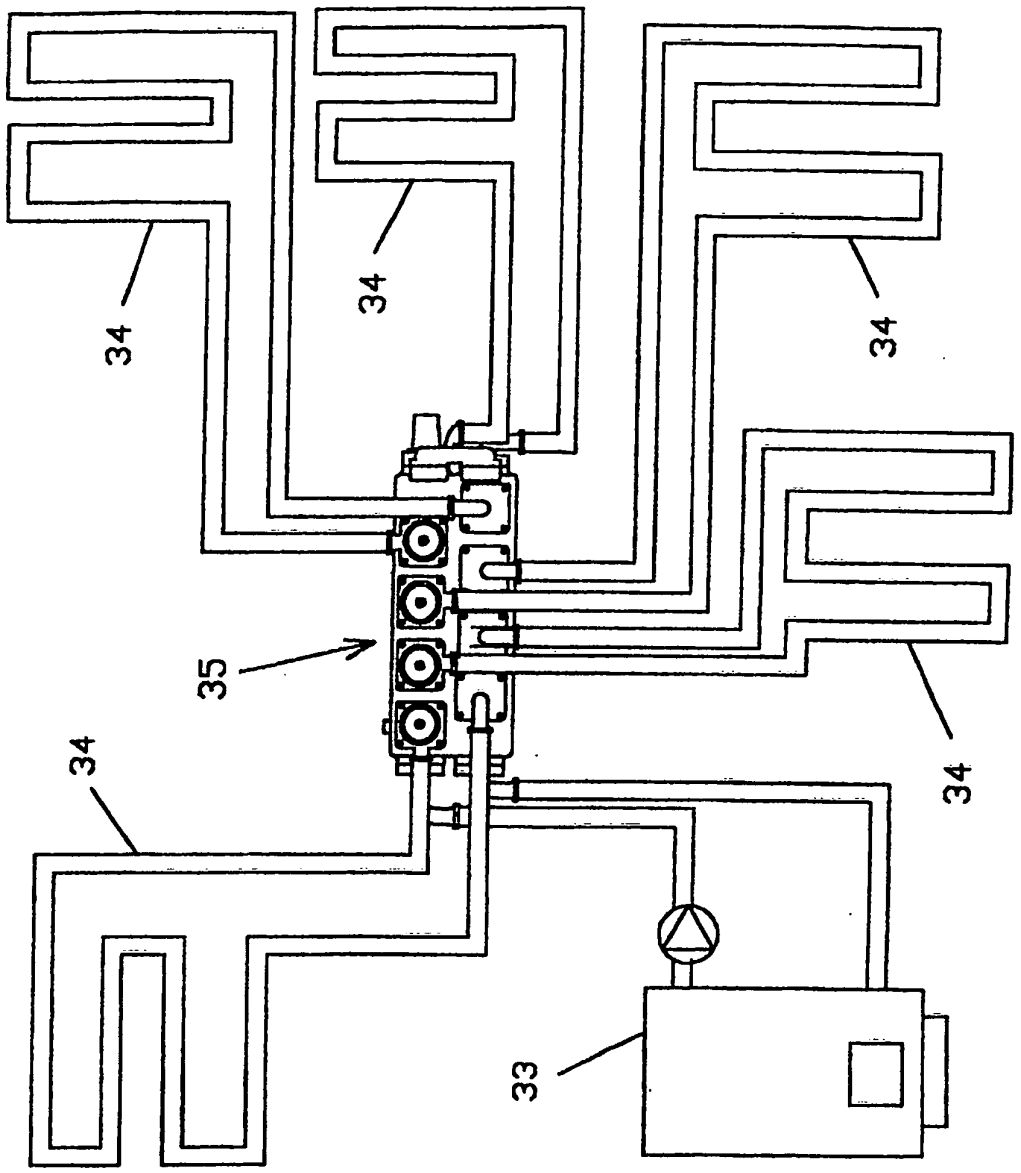


FIG. 8

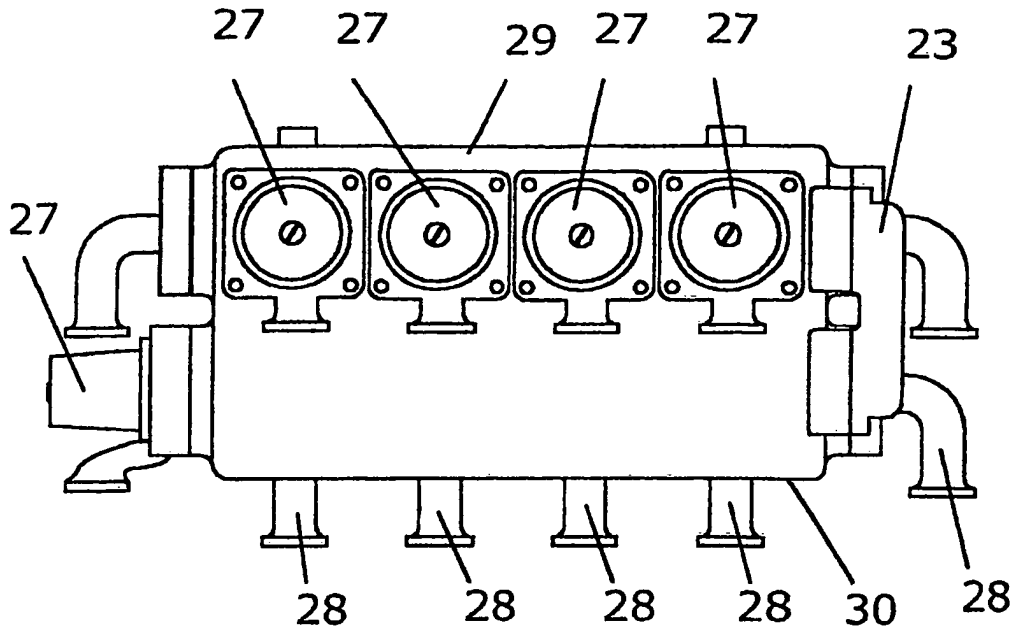


FIG.9

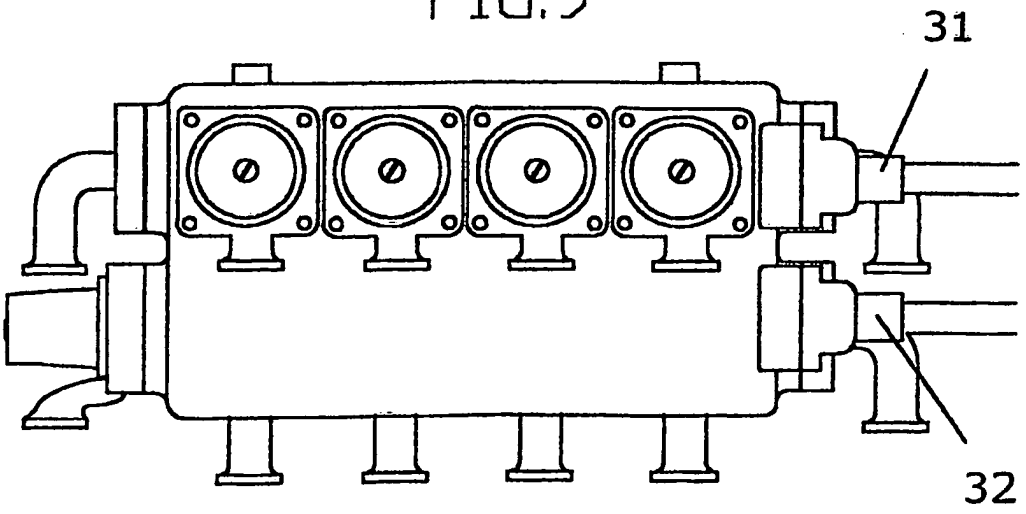


FIG. 10

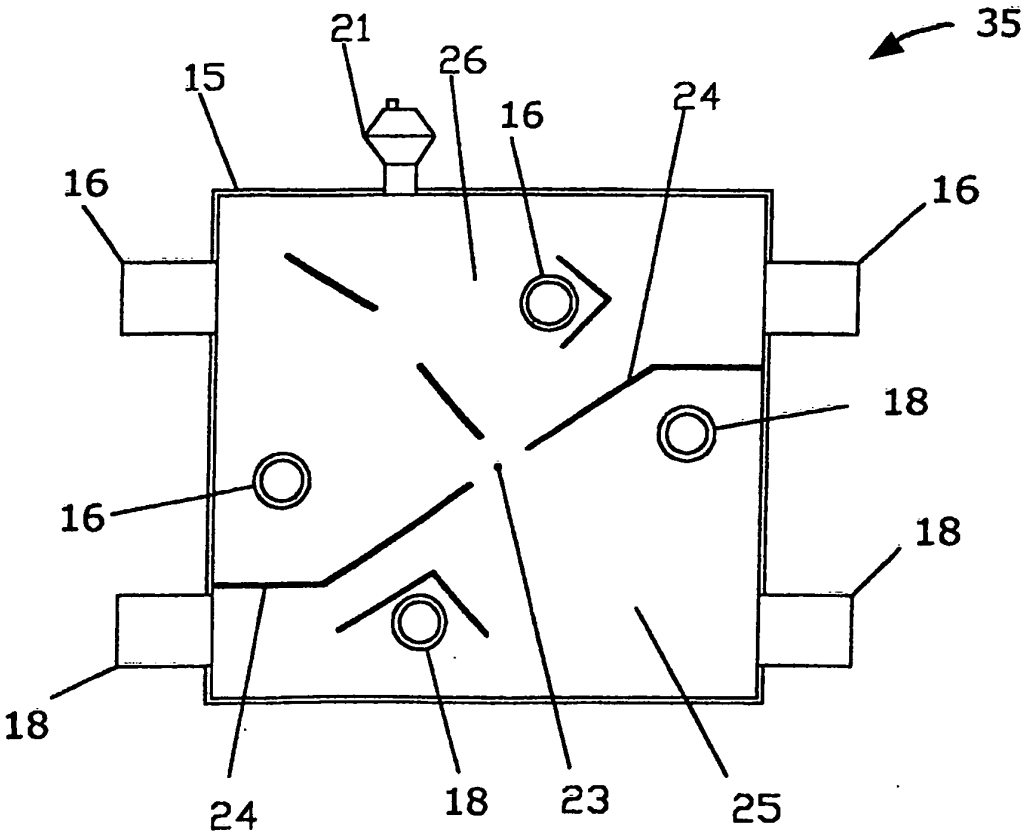
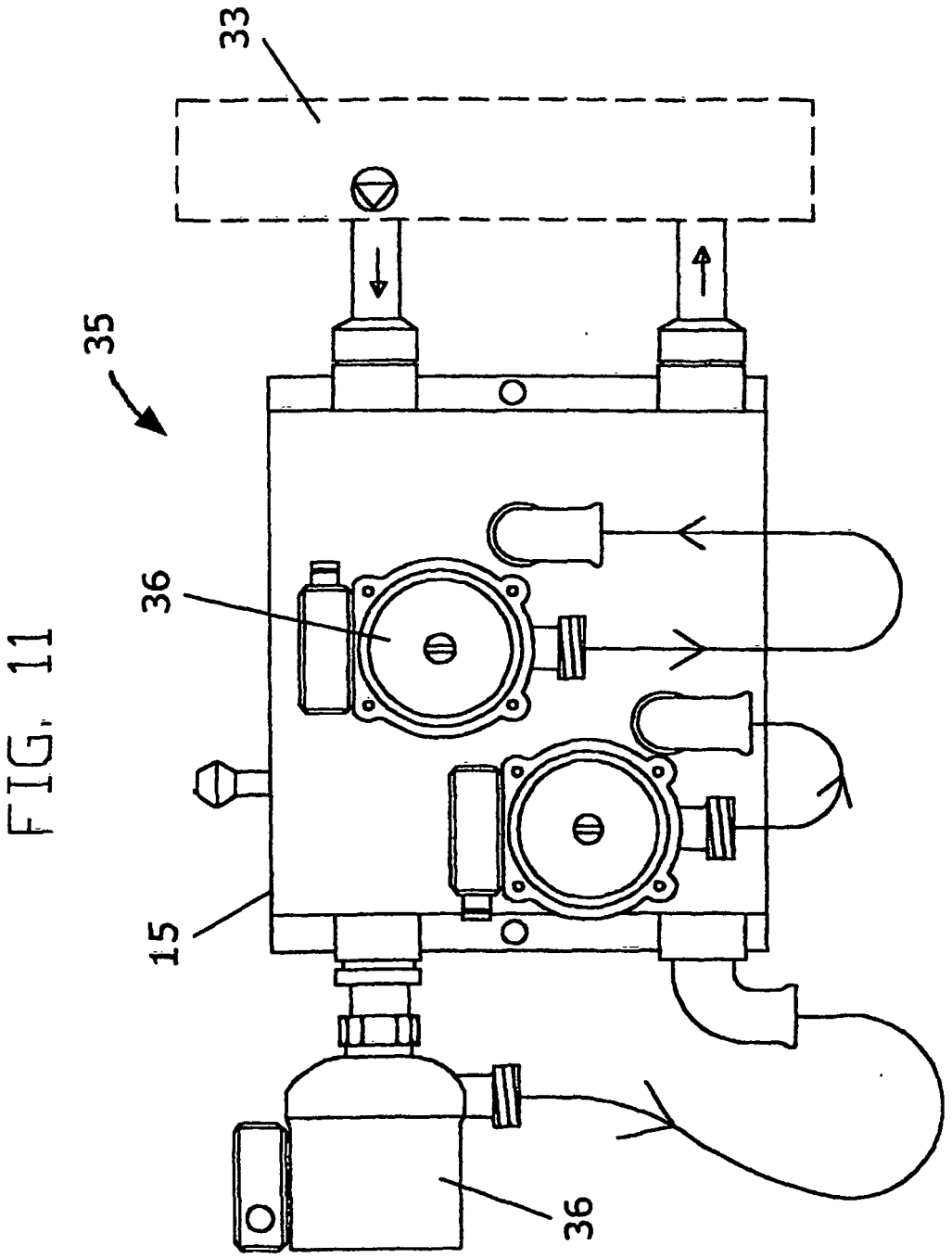


FIG. 11



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

- US 4770341 A **[0001]**
- FI 20020407 **[0002] [0014] [0028]**
- US 6092734 A **[0004] [0009] [0009]**
- US 6345770 B **[0009] [0009]**