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

(11) EP 1 239 231 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.09.2002 Bulletin 2002/37

(51) Int Cl.[7]: F24D 3/10

(21) Application number: 02075377.8

(22) Date of filing: 28.01.2002

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 26.01.2001 NL 1017198

(71) Applicant: Cnossen, Jan Henk
8723 EV Koudum (NL)

(72) Inventor: Cnossen, Jan Henk
8723 EV Koudum (NL)

(74) Representative:
Grootscholten, Johannes Antonius Maria
Arnold & Siedsma
Sweelinckplein 1
2517 GK Den Haag (NL)

(54) SYSTEM FOR TEMPERATURE TREATMENT WITH TRANSFER MEDIUM

(57) The invention relates to a ystem for treating the temperature of a space in a building, comprising:

- a closed pipe system for circulating a transfer medium under pressure during operation of the system,
- a heat exchanger connected to the pipe system for acting on the temperature of the transfer medium;
- at least one additional heat exchanger in the space for treating and connected to the pipe system for treating the temperature of the air in the space by means of the transfer medium supplied via the pipe system; and
- replenishing means connected to the pipe system for selective replenishing of the transfer medium in the pipe system to maintain the pressure thereof above a predetermined minimum pressure,

wherein the replenishing means are connected via a controllable valve to a replenishing source under pressure, and comprise a sensor to detect the need for replenishing of the transfer medium, which comprise a protection against replenishing of the transfer medium when there is leakage in the pipe system.

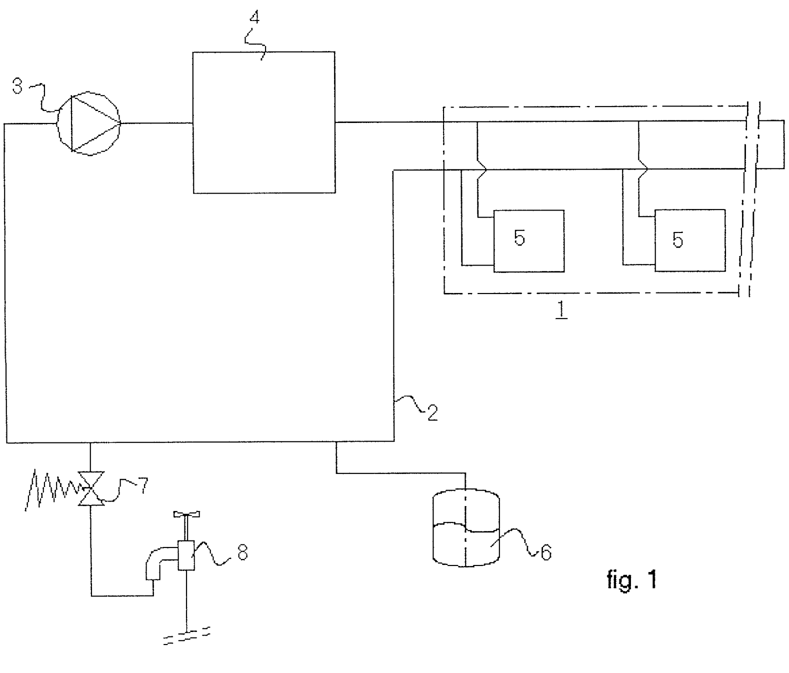


fig. 1

EP 1 239 231 A2

Description

[0001] The present invention relates to a system for treating the temperature of a space in a building, comprising:

- a closed pipe system for circulating a transfer medium under pressure during operation of the system,
- a heat exchanger connected to the pipe system for acting on the temperature of the transfer medium;
- at least one additional heat exchanger in the space for treating and connected to the pipe system for treating the temperature of the air in the space by means of the transfer medium supplied via the pipe system; and
- replenishing means connected to the pipe system for selective replenishing of the transfer medium in the pipe system to maintain the pressure thereof above a predetermined minimum pressure.

[0002] Such systems are generally known, for instance heating systems. The heat exchanger is in the heating system, for instance a heating boiler, and the additional heat exchangers can be convectors or radiators. The invention also relates however to for instance a cooling system. All that is important is that the transfer medium is under a pressure which may preferably become no lower than a minimum pressure, and that replenishing means are provide to ensure that the pressure of the transfer medium in the system does not become lower during operation than this minimum pressure. There is however a need for improved replenishing means, since the existing replenishing means do not anticipate quickly enough the need to increase the pressure in the system.

[0003] According to the present invention a system is provided for this purpose which is distinguished in that the replenishing means are connected via a controllable valve to a replenishing source under pressure, and comprise a sensor to detect the need for replenishing of the transfer medium, which comprise a protection against replenishing of the transfer medium when there is leakage in the pipe system.

[0004] Because the replenishing means comprise a direct connection, albeit via a controllable valve, to a replenishing source under pressure, such as a drinking-water pipe, the necessity of replenishing transfer medium in the system can be anticipated very quickly. According to the present invention however, the protection at the same time ensures that replenishing does not continue interminably, which would result in considerable damage in the case of a leakage.

[0005] Preferred embodiments within the scope of the present invention are defined in the dependent claims. In one preferred embodiment the valve and the sensor can form a unit which is then for instance mechanical. A very simple manner is thus provided of realizing the invention.

[0006] The system can also have the features according to claim 4. In such an embodiment an open connection will be established between the first and second connections to thus bring about replenishing when the forces exerted by the resilient elements on the plunger cause an aligned positioning of the plunger. This is an exceptionally elegant basic embodiment which is particularly advantageous when the system has the features according to claim 5. The pressure on the side of the pressure chamber is herein variable and corresponds with that in the pipe system and, when there is sufficient pressure in the pressure chamber and therefore in the pipe system, the plunger is held away or pressed away from a position in which the connections and the channels are respectively aligned, and replenishing is thus prevented when it is not necessary. This can be implemented in particularly favourable manner with the measures according to claim 6. In one embodiment, particularly one with a resilient element on one side of the plunger with a spring force corresponding to the pressure in the pipe system, the spring force of the resilient element located opposite is adjustable as defined in claim 7. This has the favourable effect that the minimum pressure can be adjusted therewith. Account can in any case be taken of the progression of spring forces and possibly changing insights relating to the desired minimum pressure.

[0007] In one embodiment with a resilient element which acts on the plunger with a force corresponding to the pressure in the pipe system, a system according to the invention preferably has the features according to claim 8. The use of a membrane which acts on the plunger makes the force of the membrane acting on the plunger directly proportional to the pressure in the pipe system. Such a direct relation between the pressure in the pipe system and the force on the plunger enables a simple construction with a direct connection between the pipe system and the pressure chamber.

[0008] In an embodiment with a plunger, a system according to the present invention can display the features of claim 9. In such an embodiment as according to claim 9, the channel corresponding with the second connection to the pipe system has a throttling action, this being favourable for the filling behaviour of the valve in normal operating conditions, while a rapid filling position is simultaneously provided using the third channel when the first channel and the third channel are aligned with respectively the first and second connections. This is advantageous for instance when rapid filling of the system is desired prior to initial use.

[0009] The plunger then preferably does not automatically arrive at the position for rapid filling, and has for this purpose the feature according to claim 10. For the same reasons the system has the features of claim 11, whereby the protection is also realized in that the aligned position of the plunger is lost when the pressure in the pipe system falls too low, which would indicate a leakage. Use is made for this purpose of a harmonizing between the spring forces exerted on the plunger by the first and second resilient elements which can be seen as a kind of balance. This can be disturbed in order to reach the filling position using the measures according to claim 12. The system will not therefore reach the rapid filling position of its own volition during operation, which would also be highly undesirable. This is further defined in claim 13. In order to avoid the forcing means having to remain energized during filling of the system at high speed, which would cost the fitters or installers an undesirable amount of time for a large system, the measures of claim 14 can be taken.

[0010] A preferred embodiment prevents transfer medium being able to flow back from the pipe system into the replenishing source. This is particularly undesirable when the replenishing source is a drinking-water pipe. The measures according to claim 15 can be taken for this purpose.

[0011] In such a system a non-return valve preventing transfer medium from running back to the replenishing source can be designed as a double non-return valve, while an outlet as according to claim 16 is provided at the position thereof. If for instance the temperature in the pipe system then rises, and therewith the pressure, excess transfer medium, which can cause an overpressure, can be safely drained without the risk of it being returned under pressure to the replenishing source. Additionally or alternatively to the above described preferred embodiments of the system according to the present invention, an embodiment as according to claim 17 can also be realized. The level of the transfer medium in an expansion reservoir is herein used as indication of the pressure in the pipe system, this level being detected with the float, so as to carry the switching means into the associated position corresponding therewith.

[0012] In such an embodiment the system preferably has the features according to claim 18. The switching means can be positioned at a favourable location by means of the transmission. Such a favourable positioning is defined for instance in claim 19. The guide herein provides a reliable switching action of the transmission or, if this transmission as defined according to claim 18 is not present in mechanical sense but includes for instance electrical contact switches, the configuration of claim 19 has the favourable feature that the switching means can be designed, without many special measures, as electric switches, since they will never come into contact with the transfer medium, such as water, in the expansion reservoir.

[0013] The switching means are then preferably designed as two separate switches at different distances from the float, as defined in claim 20. A higher one of the switches relative to the float indicates a desired replenishment, while a lower one of the switches relative to the float indicates a leakage, wherein no further replenishment is desired. The lower of the two switches relative to the float therefore forms the protection.

[0014] In one embodiment the system according to the invention can have the feature as according to claim 21. Degasification is thus brought about via the expansion reservoir. Because a riser pipe is used here as embodiment, the level of the transfer medium will seldom rise much higher than the lower opening of the riser pipe, which contributes further to the protection of the switching means, which can therefore be embodied as electric switches, even though they are mounted in the interior of an expansion reservoir containing the transfer medium. In a favourable preferred embodiment the riser pipe also forms a guide for transporting the float to the switching means.

[0015] It is further advantageous if a system according to the present invention displays the feature according to claim 22. Assembly is hereby very simple. It is moreover possible, when the basic element and the open passage in the expansion reservoir are situated in the upper part thereof, to ensure that electric switches can be applied as switching means with all possible protection measures, particularly in combination with a riser pipe for degasification, since the switching means will then always be located above the level of the transfer medium in the expansion reservoir.

[0016] In the description following hereinbelow of specific embodiments of the present invention, which is formulated in combination with and with reference to the annexed drawings, further features and advantages will be elucidated in non-limitative manner. In the drawings:

fig. 1 shows a highly schematic view of a system according to the present invention;

fig. 2 shows a schematic cross-sectional view of an embodiment of a controllable valve according to the present invention;

fig. 3-6 show operating positions of the controllable valve shown in fig. 2;

fig. 7-12 show schematic cross-sectional views of an alternative embodiment of a controllable valve according to the present invention;

fig. 13 shows a second alternative embodiment of a part of a system according to the present invention; and

fig. 14-19 show a number of operating positions of a design according to the present invention corresponding with the embodiment shown in fig. 13.

[0017] Fig. 1 shows a system 1 according to the present invention. System 1 comprises a closed pipe system 2 having therein a pump 3, a first heat exchanger in the form of a heating boiler 4, convectors or radiators 5, an expansion tank 6 and a controllable valve 7 as connection to a replenishing source in the form of a drinking-water connection 8. In the description following below the expansion tank 6 and controllable valve 7 will be specifically described as embodiments within the scope of the present invention.

[0018] A control valve 9 as an embodiment of valve 7 in the system 1 according to the invention is shown in the drawing of figure 2, wherein control valve 9 is operated on the basis of the system pressure of the heating system.

[0019] Figure 2 shows how the system pressure acts via a connection in the form of a port 10 on a membrane 24 with a plunger 26 which is fixed thereto and which will move up and downward in a pressure chamber 17 counter to the action of the spring pressure of a spring 29, depending on the magnitude of this system pressure and the spring tension.

[0020] Plunger 26 is provided with channels formed as openings 13, 14 which correspond with the ports 11 and 12 and a central passage 18. The seals between control valve housing 21, the different ports and plunger 26 are ensured by seven rubber seals 27 (O-rings). Port 11 is intended for connection to an external liquid source 8 in fig. 1 from which replenishing can take place.

[0021] This will usually be a connection to the drinking-water system.

[0022] Arranged in port 11 as additional protection is a double non-return valve which contains a valve 31 with a seating bush 33 having therein a spring 34 with which a liquid flow is only possible in the direction of the arrow at port 11. On the other side the seating bush 33 is positioned against a rubber seal 35 by the spring pressure of spring 32 increased by the liquid pressure in the flow direction of 11. Using a second rubber seal adjacently of rubber seal 35, enclosed by control valve housing 23, the sealing in the flow direction of the arrow at port 11 is ensured.

[0023] Seating bush 33 will however be moved counter to the spring pressure of spring 32 when there is a greater liquid pressure counter to the flow direction of the arrow at port 11. Seating bush 33 will hereby no longer seal on rubber seal 35, whereby liquid flow will escape via a port 16. Because this is a safeguard against a calamity, preventing liquid being able to flow back to the replenishing source, port 16 will preferably be connected onto the sewage system. Port 12 can be connected to the heating device. At a normal system pressure the plunger 26 will remain in an upper position, wherein spring 29 is compressed. There is now no connection between ports 11 and 12.

[0024] This situation is shown in figure 3. In figure 4 the system pressure has fallen below a minimum pressure. In the associated position the plunger 26 is slightly lower than in figure 3, whereby ports 11 and 12 communicate with a small opening because the opening 14 associated with port 12 is smaller than the passage 18 and ports 11 and 12. A controlled throughflow and replenishment will hereby take place. When there is a real leakage, the system pressure will drop further and plunger 26 will sink slightly further as shown in fig. 5. The shown connection between ports 11 and 12 is now blocked because it is not desirable to replenish in the case of a greater leakage. It is noted that membrane 24 has a certain inherent resilience or flexibility. Even if the system pressure on port 10 decreases wholly to zero, the resilience of membrane 24 will ensure that, counter to the force exerted on plunger 26 by spring 29, the plunger 26 will not move further downward than the position of plunger 26 in plunger housing 21 shown in fig. 5. As will be apparent from the foregoing, a good harmonizing of the spring forces of spring 29 and of membrane 24 is highly necessary and, in view of the description of the intended functionality in the foregoing, is well within the reach of the normal ability of a person with ordinary skill in the art. Further description of this harmonization is therefore unnecessary.

[0025] There is also a possibility of filling a heating system from a for instance still empty state. A plug 30, which is shown in figure 2, can be pressed in for this purpose as shown in figure 6. By means of a ball 19, shown in a bore 20 in upper cover 22, pressed by spring 39 the plug 30 will be held in the pressed-in position on a groove 37 which is for this purpose arranged on plug 30.

[0026] By pressing in the plug 30, additionnally to this pressure of spring 29, the force on plunger 26 is increased. Plunger 26 is displaced further downward since the above stated harmonization between membrane 24 and spring 29 is disturbed, whereby a maximal opening is brought about between ports 11 and 12 when an opening 38 which forms a third channel and is larger than the second opening 14 comes into line with port 11. The distance between opening 38 and opening 13 is substantially the same as that between openings 13 and 14, so that opening 13 is then also aligned with connection 12. The heating device is now filled, wherein the control valve (if placed) must of course be fixed in the position of figure 4.

[0027] When the system pressure has increased to a desired value, the pressure on membrane 24 or plunger 26 via spring 29 will eventually cause plug 30 to shoot back through the locking caused by the ball 19 in groove 37 of plug 30. The pressure will then have to correspond with the plunger positions according to figures 3 or 4.

[0028] Plug 30 is arranged for screwing into the upper cover 22 so that the force to be exerted by spring 29 on plunger 26, and directly thereby also the minimum pressure, is adjustable.

[0029] Further referred to is the sealing plug 25 of control valve 9 in figure 2 with which the bore in plunger 26 is sealed and membrane 24 is held in place. Membrane 24 is then clamped between lower housing 20 and upper housing 21. Further noted are venting openings 36 for enabling the volume changes without the consequences of pressure on the side of the pressure chamber 17 opposite port 10.

[0030] Fig. 7-12 show an alternative embodiment of a valve 7 of figure 1 designed as a control valve 40.

[0031] Here also is provided a port 10 which forms an open connection between pressure chamber 17, in which a membrane 24 is arranged, and the pipe system 2 (not shown here). In pressure chamber 17 a resilient element designed as spring 29 is placed on the side of membrane 24 opposite port 10. The varying system pressure in port 10 and the constant spring pressure of spring 29 are thus here also kept mutually separated by membrane 24. Placed once again on membrane 24 on the side of port 10 is a plunger 26, the position of which in valve housing 21 is determined by the ratio of the pressure in the pipe system via port 10 and the constant spring force of spring 29.

[0032] The term "constant spring force" in respect of "spring 29" is relative. As in the embodiment of figure 2, the force to be exerted by spring 29 on membrane 24 is adjustable, although here using a screw 42 which is arranged for screwing in valve housing 21, and spring 29 is clamped between membrane 24 and a spring seat 41 which rests on the other side on screw 42. The force to be exerted by spring 29 on membrane 24, and thereby the minimum pressure, can therefore be adjusted by rotating screw 42.

[0033] Plunger 26 extends through bush 43, which is likewise movable up and downward in valve housing 21. Plunger 26 is moreover movable in bush 43. Bush 43 and plunger 26 extend from the side of the membrane through valve housing 21 into a chamber 44 into which also debouches port 11 which provides a connection to a replenishing source under pressure such as the mains water supply. In chamber 44 the bush 43 comprises recesses 46 on the outside in which flexible arms 45 engage to hold the bush 43 against valve housing 21 in order to thus keep closed a passage 48 through valve housing 21 along the outer side of bush 43. An elongate finger bush 49 connected to plug 30 extends between the resilient arms and the outer side of bush 43.

[0034] The upper side of valve housing 21 is closed with a cover 22 through which plug 30 extends to the elongate finger bush 49.

[0035] Plunger 26 once again comprises a central passage 18 with openings 13 and 14 on respectively the side of chamber 44 and of port 10.

[0036] The operation of control valve 40 as embodiment of valve 7 of figure 1 according to the present invention is then as follows.

[0037] Before control valve 40 is taken into use, there is no pressure prevailing in pressure chamber 17 on the side of port 10, since no transfer medium is present in the pipe system. Spring 29 therefore presses plunger 26 upward via membrane 24 to the position shown in figure 2. The plunger in turn presses against bush 43, although this is held in place by the laterally flexible arms 45. By pressing in the plug 30, as shown in figure 8, the elongate finger bush 49 moves downward between the outer side of bush 43 and arms 45, this being designated with arrow A. The arms 45 are herein bent laterally in the direction of arrow B. Bush 43 is herein released for movement and moves upward under the influence of the spring force generated by spring 29, whereby passage 48 is left clear. Transfer medium coming from port 11 can thereby pass at high speed along bush 43 through passage 48 to port 10 in order to then fill the pipe system. When the pressure in pipe system 10 has increased sufficiently, i.e. when the system is filled, this system pressure acts on membrane 24 counter to the influence of spring 29. Plunger 26 is herein pulled downward and connects onto bush 43 while closing the opening 13. The combination of bush 43 and plunger 26 is herein also pulled downward to a position wherein the bush 43 comes to lie against valve housing 21 and closes passage 48. Plug 30 has then moved upward again under the influence of the pressure in chamber 44 of the transfer medium coming from port 11 as shown in figure 9, so that finger bush 49 no longer forms an obstruction against arms 45 engaging in the recesses 46 on the outer side of bush 43. Bush 43 is thus fixed in place. The system is now filled and ready for use as shown in figure 10.

[0038] When the system pressure, which acts on membrane 24 via port 10 in pressure chamber 17, has decreased to below a minimum pressure to be set with the screw 42, plunger 26 will move upward, although bush 43 remains in the position defined with arms 45. Opening 13 is herein left clear as shown in figure 11, and transfer medium can flow through the central passage and opening 14 to port 10 to replenish the transfer medium in the system. Bush 43 in chamber 44 is provided for this purpose with passages (not shown), or the transfer medium simply flows away over the upper edge of bus 43 along the arms 45 to opening 13.

[0039] Passage 48 is considerably larger than passage 18 and/or openings 13, 14, so that release of passage 48 brings about a much greater throughflow of transfer medium to port 10. A rapid filling position is thus realized when the bush is clear of arms 45, this via the large passage 48, while a steadier, controlled replenishment flow can be set into motion through passage 18, if necessary, with bush 43 fixed by arms 45 at the position shown in figure 7 and with plunger 26 in a position slightly lower than that shown in fig. 7 relative to bush 43 and valve housing 21, wherein opening 14, like opening 13, is left clear.

[0040] A protection against leakage is also provided in this embodiment of the present invention. If the system pressure on membrane 24 becomes too low the plunger 26 is pressed so far upward by spring 29 that the passage 14 on the underside of passage 18 through the lower part of bush 43 is closed in a position as shown in figure 7 and figure 12.

[0041] The starting position for use of control valve 40 is therefore also the protection position which occurs when a leakage occurs in the pipe system, and this can only be remedied by pressing in the plug 30 again.

[0042] Pressing in of plug 30 would however not be possible without additional measures, because the finger bush 49 moves down round bush 43 in closing manner, and for instance water as transfer medium cannot be compressed. Formed for this purpose in finger bush 49 is a chamber 71 having therein a piston 68 on which acts a spring 69. Chamber 71 communicates via channel 70 with the outside air. Pressing in of plug 30 then results in downward movement of finger bush 49 and an upward movement of piston 68 in finger bush 49, so that the medium enclosed between finger bush 49 and bush 43 is not or does not even have to be compressed.

[0043] Figure 13 shows an alternative embodiment of a part of a system according to the present invention. The view of figure 13 shows an expansion tank 50 having therein a riser pipe 51 which forms a guide for a transmission tube 52. A float 53 is arranged on the underside of transmission tube 52. At the top of riser pipe 51 switches 53 and 54 are arranged on a base plate 55 which is arranged in an opening of expansion tank 50 to close this opening using a cover plate 56. Riser pipe 51 extends through base plate 51 and cover plate 56. A float is arranged in the top of riser pipe 51 to prevent exit of transfer medium from expansion tank 50. Above float 57 is also arranged a non-return valve 58 which serves to prevent the possibility of ambient air flowing into expansion tank 50. This is useful and necessary in bringing about a degasification function.

[0044] A particularly favourable embodiment of the present invention is shown in the view of figure 13. By positioning switches 53 and 54 in the top of expansion tank 50 the likelihood is very high that they will never come into contact with the transfer medium. The transmission tube 52 is applied for this purpose. With switches 53, 54 at the top on base plate 55 it is moreover possible to realize a very simple configuration. During assembly only the transmission tube 52 with the float 52 thereon need for instance to be placed in the opening of the expansion tank, followed immediately by the assembly of the base plate with switches 53, 54 and riser pipe 51 thereon. Cover plate 56 is then fitted with a sealing ring 62 between base plate 55 and cover plate 56, so that expansion tank 50 is closed in airtight manner. Because the likelihood is very high that switches 53, 54 will never come into contact with moisture, this being brought about with riser pipe 51 and transmission tube 52, use can be made of electric switches. An example hereof are reed contacts. These are connected to a central control 61 which controls the diverse components to be further described below for a correct desired operation thereof.

[0045] On the underside of the expansion tank a conduit 59 is connected thereto which runs to a pump 60 connected to the pipe system (not shown).

[0046] The part of the system shown in figure 13 further comprises a connection 62 to a replenishing source and an overflow 63 to a sewer outlet. With the configuration shown here of valves 64, 65 controlled by control 61 and pressure-dependent valve 66, a large number of functions are implemented in very simple manner, including: 1) replenishment to the system via pump 60; 2) replenishment to expansion tank 50; 3) discharge to overflow 63 from the pipe system (not shown) or from expansion tank 50; 4) discharge from the pipe system to expansion tank 50; 5) feedback of transfer medium from expansion tank 50 to the pipe system via pump 60, and so on. The manner in which the diverse valves 64, 65 and 66 must be adjusted by control 61 or by adjustment of the spring force in valve 66 in order to achieve the desired functionality will be immediately apparent to the skilled person. More important is the operation as will be described below with reference to figures 14-19.

[0047] Figure 14 shows that under the operation of control 61 valve 65 is opened and valve 64 is closed. This indicates an overpressure in the pipe system, wherein transfer medium is being guided from the pipe system to expansion tank 50. The level of the transfer medium in expansion tank 50 hereby rises. Degasification takes place owing to the drop in pressure which occurs when transfer medium enters the expansion tank. This is shown in figure 15. The gas 67 released from the transfer medium can escape along the top of transmission tube 52 through riser pipe 51 to non-return valve 58 which allows these gases to exit the expansion tank 50. When the level of the transfer medium in expansion tank 50 rises further than the level shown in figure 10, the transfer medium in riser pipe 51 will, as shown in figure 16, rise more rapidly than the transfer medium in the surrounding parts of expansion tank 50 as a result of the smaller diameter of riser pipe 51. This is the consequence of the diameter of riser pipe 51 being smaller than the diameter of expansion tank 50. When the transfer medium in riser pipe 51 reaches the float, this will close the outlet to non-return valve 58 so that no transfer medium can flow out of the expansion tank. This is further a situation in which the transfer medium in the parts of the expansion tank 50 surrounding the riser pipe will not rise further, or hardly so, so that switches 53, 54 also actually remain "dry".

[0048] If after reaching the situation just described above a further transport of transfer medium out of the pipe system is desired, valve 66 is then opened for draining thereof to the sewer, until the undesired overpressure in the pipe system has been remedied. Such an overpressure occurs for instance when the temperature of the transfer medium in the pipe system continues to be increased and an upper limit of the pressure in the pipe system is reached, wherein the discharge to the expansion tank begins, until float 57 prevents a further rise of the transfer medium in the expansion tank.

[0049] Figure 17 shows a situation wherein transfer medium is pumped out of expansion tank 50 with pump 12. The level of the transfer medium in the expansion tank herein falls. When a level of transfer medium as shown in figure 17 is reached in expansion tank 50, the first switch 53 is energized, which is a signal for the control 61 to open valve 64 for replenishment from replenishing source under pressure 62. Figure 18 shows that the level of the transfer medium in the expansion tank will thereby rise again. If this is not the case however, the situation is then reached as shown in figure 19. Float 52 drops to a level wherein the second switch 54 is also energized since replenishment by opening valve 64 is evidently pointless because of leakage in the pipe system. If the central control 61 receives such a signal from switch 54, the system is then taken out of operation. The protection is thus realized which is associated with direct replenishment from a replenishing source under pressure, without which protection an all but disastrous situation could occur in the case of a leakage in the pipe system.

[0050] In the configuration shown in figures 14-19 the level of the transfer medium thus provides a direct indication of the pressure in the pipe system, and thereby the need for replenishment, or even an indication of a leak, thereby realizing the protection according to the present invention in combination with a direct replenishment from a replenishing source under pressure. It will be apparent from the foregoing that very diverse embodiments are possible within the scope of the present invention. The switches in the top of the expansion tank can for instance be mechanical instead of electrical. In such a case the control can also take place mechanically, wherein a mechanical transmission is applied between the switches and the associated valves.

[0051] The valve designed as control valve as according to figures 1-7 can also be mechanically constructed in many other ways, as long as the direct connection defined in the main claim to a replenishing source under pressure and simultaneously a protection against leakage are realized. The spring in the pressure chamber can for instance be replaced by another random resilient element, such as another compressible element, as long as there is a separation between the pipe system and such a compressible element, such as an elastic body of for instance plastic. In such a case even the membrane can be omitted and simply be replaced by the compressible body. Such a compressible body preferably does have a spring constant which is constant in the range of actual pressures. In such a configuration the plunger can be connected to the compressible body. As will be apparent, the embodiments described explicitly in the foregoing in no way imply a limitation in the scope of protection in accordance with the appended main claim, but should only be deemed as illustrative of specific embodiments within the scope thereof.

Claims

1. System for treating the temperature of a space in a building, comprising:

- a closed pipe system for circulating a transfer medium under pressure during operation of the system,
- a heat exchanger connected to the pipe system for acting on the temperature of the transfer medium;
- at least one additional heat exchanger in the space for treating and connected to the pipe system for treating the temperature of the air in the space by means of the transfer medium supplied via the pipe system; and
- replenishing means connected to the pipe system for selective replenishing of the transfer medium in the pipe system to maintain the pressure thereof above a predetermined minimum pressure,

wherein the replenishing means are connected via a controllable valve to a replenishing source under pressure, and comprise a sensor to detect the need for replenishing of the transfer medium, which comprise a protection against replenishing of the transfer medium when there is leakage in the pipe system.

2. System as claimed in claim 1, wherein the valve and the sensor form a unit.

3. System as claimed in claim 2, wherein the unit is mechanical.

4. System as claimed in claim 1, 2 or 3, wherein the valve comprises an elongate plunger which is enclosed between two resilient elements and which is displaceable in a plunger housing, wherein the plunger housing comprises a first connection to the plunger from the replenishing source and a second connection to the plunger to the pipe system, which first and second connections are offset relative to each other in longitudinal direction, and the plunger comprises a longitudinal passage with at least two radial channels which debouch in the passage and which have a mutual distance in longitudinal direction corresponding with the offset between the first and second connections.

5. System as claimed in claim 4, wherein a first of the resilient elements comprises a pressure chamber in which there prevails a pressure acting on the plunger and corresponding with the pressure in the pipe system.

6. System as claimed in claim 5, wherein the spring force of a second of the resilient elements and the pressure in the pressure chamber corresponding with the pressure in the pipe system are harmonized for replenishing the transfer medium at the minimum pressure or a lower pressure.

7. System as claimed in claim 6, wherein the spring force of the second resilient element is adjustable.

8. System as claimed in claim 5, 6 or 7, wherein opposite the resilient element a membrane acts on the plunger and the pressure chamber on the side of the membrane located opposite the plunger is in open connection with the pipe system.

9. System as claimed in any of the claims 4-8, wherein the channel corresponding with the first connection and the passage are larger than the channel of the plunger corresponding with the second connection, and wherein the plunger comprises a third channel opposite the second channel relative to the first channel which debouches in the passage, wherein the third channel is larger than the second channel, and wherein the first and third channel have a mutual distance in longitudinal direction of the plunger corresponding with the offset between the first and second connections for rapid filling of the transfer medium counter to the action of the protection.

10. System as claimed in claim 9, wherein the plunger is movable, without forcing, in front of the position in which the first connection and the third channel respectively the second connection and the first channel come into open connection.

11. System as claimed in claims 4-10, wherein spring forces of the first and second resilient elements are harmonized to hold the plunger for displacement in a range during normal operation, which range comprises an aligning position close to an extreme position within the range, in which the first connection is aligned with the first channel and the second connection is aligned with the second channel, and, at a pressure much lower than the minimum pressure, which indicates leakage, to carry the plunger beyond the aligning position outside the range so as to prevent replenishing of the transfer medium and to form the protection.

12. System as claimed in any of the foregoing claims, wherein the valve comprises forcing means (30) which are adapted to carry the plunger into a filling position in which the first connection and the third channel respectively the second connection and the first channel come into open connection.

13. System as claimed in claims 9 and 11, 12, wherein the forcing means act on the plunger from an orientation corresponding with the second resilient element in order to disturb the harmonization between the spring forces and to carry the plunger into the filling position.

14. System as claimed in claim 12 or 13, wherein the forcing means comprise holding means (28) for maintaining the open connection until a higher than the minimum pressure is reached in the pipe system.

15. System as claimed in any of the foregoing claims, wherein the first connection comprises a non-return valve to prevent transfer medium running back to the replenishing source under pressure.

16. System as claimed in claim 15, wherein the non-return valve comprises a double non-return valve, and in the double non-return valve an outlet P4 is provided for draining a quantity of transfer medium causing an undesirable overpressure in the pipe system.

17. System as claimed in any of the foregoing claims, wherein the replenishing means comprise an expansion reservoir, wherein the level of the transfer medium therein corresponds with a pressure in the pipe system, and the sensor comprises a float associated with switching means, wherein a first position of the switching means corresponds with desirable replenishment of the transfer medium and a second position of the switching means, which forms the protection, corresponds with leakage, and a third position which corresponds with normal operation.

18. System as claimed in claim 17, wherein the float coacts with the switching means via a transmission to detect the level of the transfer medium.

19. System as claimed in claims 17 and 18, wherein the switching means are arranged at the top of the reservoir, substantially above the transfer medium, and the float is arranged substantially at the bottom of the reservoir, with between the float and the switching means an elongate switching element movable reciprocally along a guide relative to the switching means as transmission for the purpose of energizing the switching means selectively and subject to the level of the transfer medium.

20. System as claimed in claim 19, wherein the switching means comprise at least two separate switches at different distances from the float.

21. System as claimed in claim 19 or 20, wherein the guide comprises a riser pipe for discharging gas coming from the transfer medium.

22. System as claimed in claims 17-21, wherein the switching means are arranged on a base element which forms a closing part for an open passage in the expansion reservoir, wherein during assembly the float is to be placed first in the reservoir through the passage, followed by bringing about a connection between the float and the switching means in the vicinity of the passage, and closing the passage with the closing part.

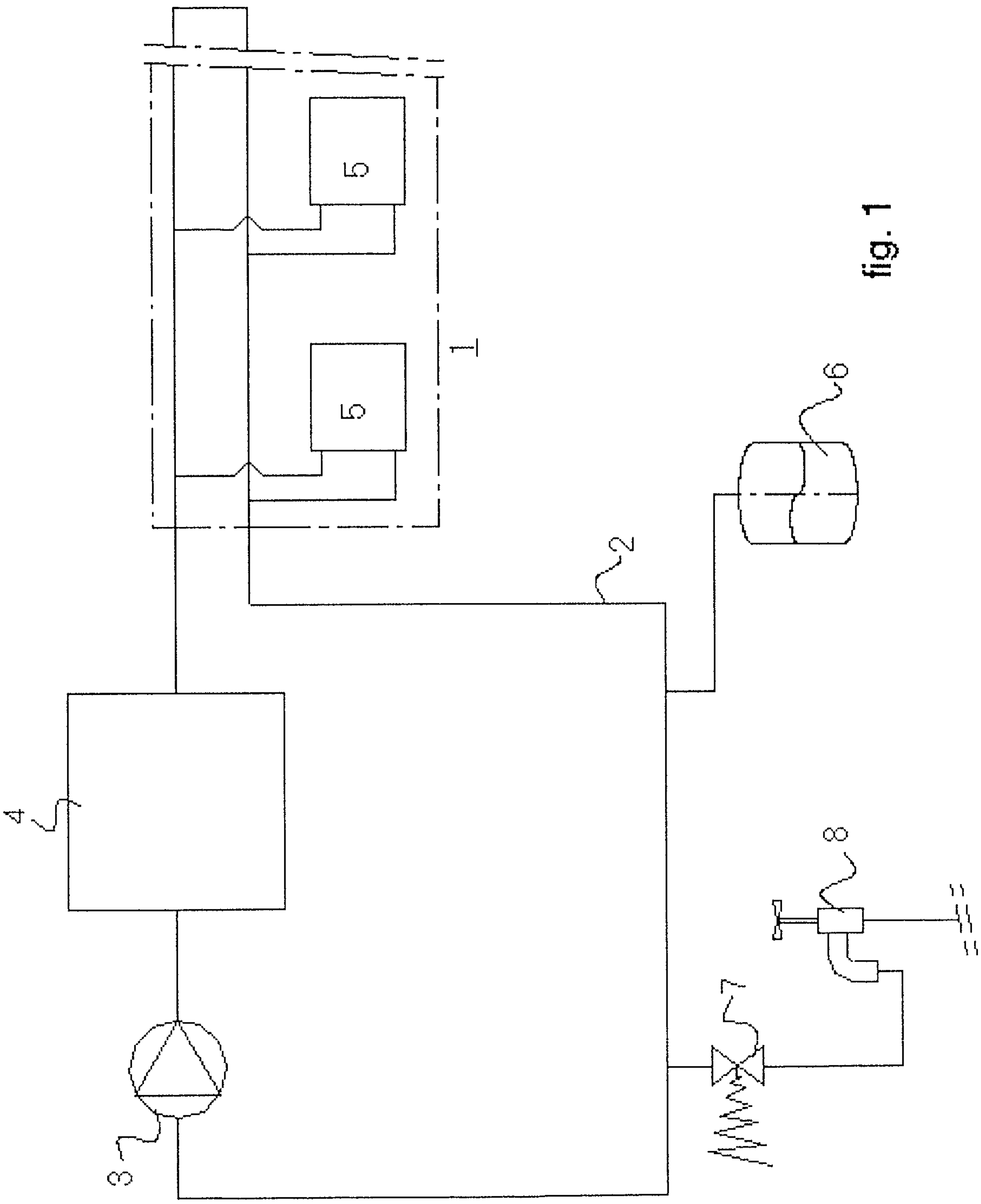
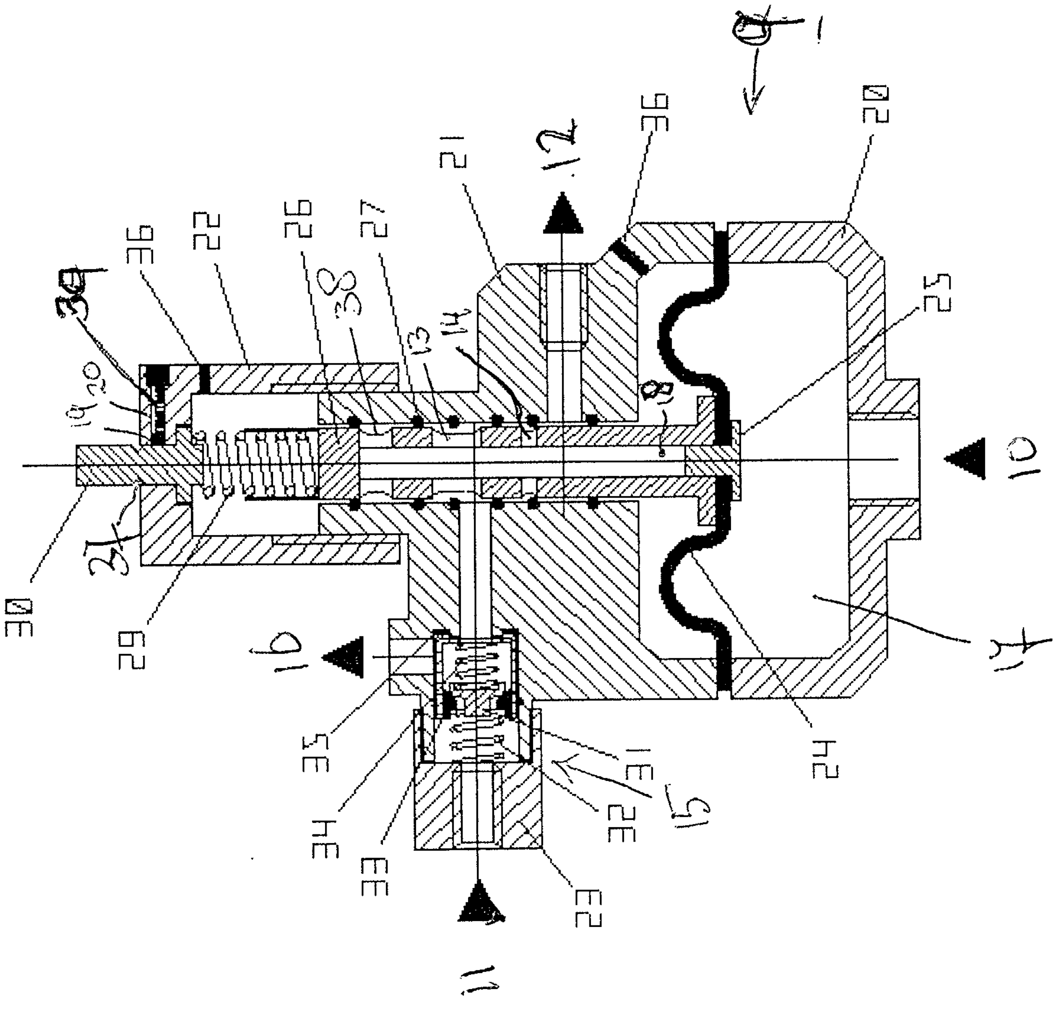
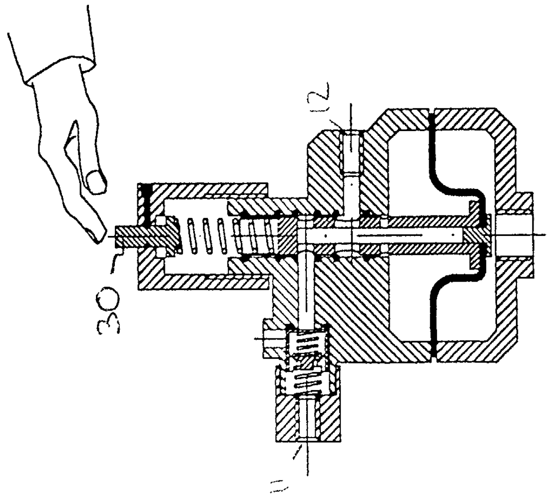


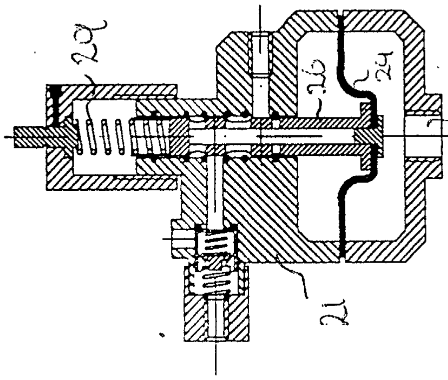
fig. 1


1
9
20
36
21
12
36
22
26
27
38
13
14
39
19
20
30
37
29
8
25
10
17
24
16
35
34
33
23
32
31
15
11

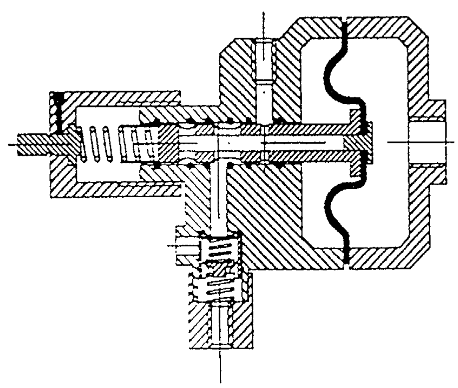
FIGUR 2



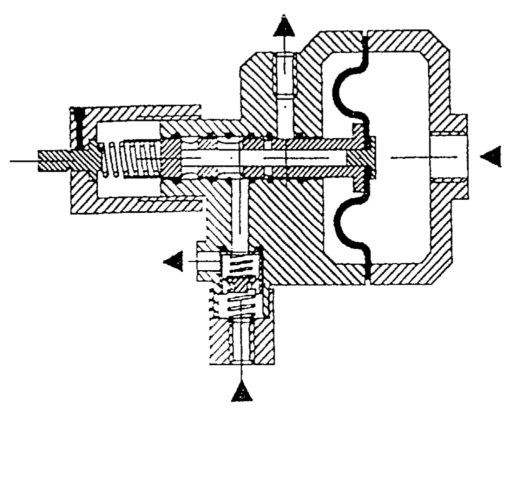
figuur 6



figuur 5



figuur 4



figuur 3

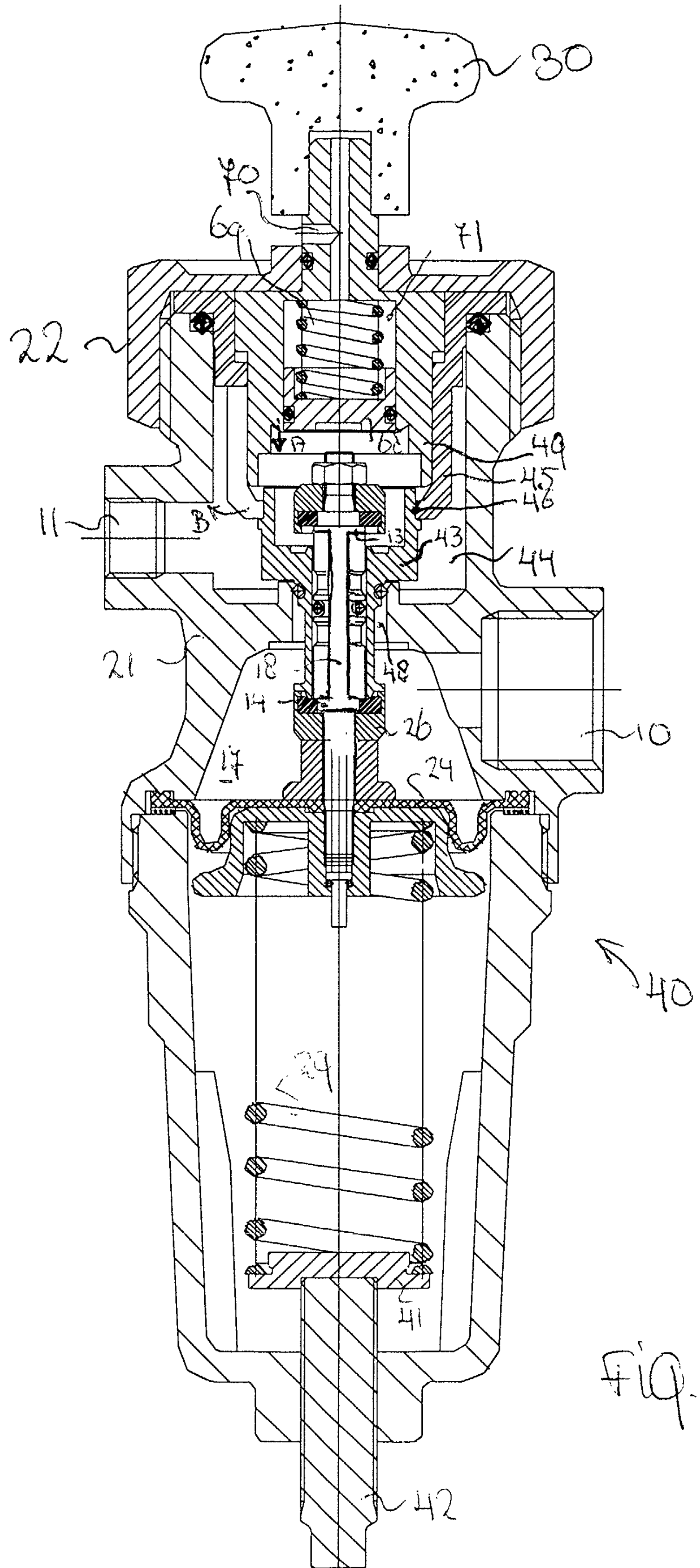

30
70
69
71
22
A
62
49
45
46
11
B
13
43
44
21
18
48
14
10
26
17
24
40
29
41
42

FIG. 7

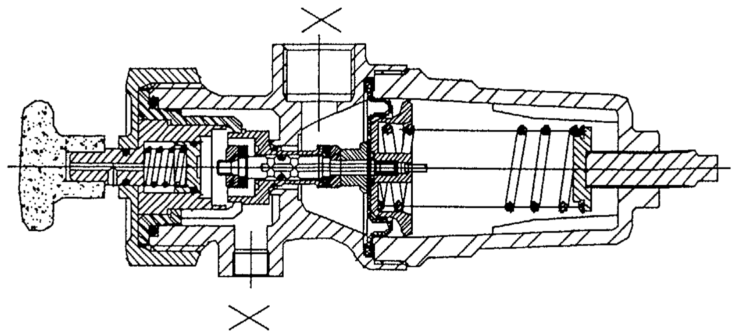


Fig.12

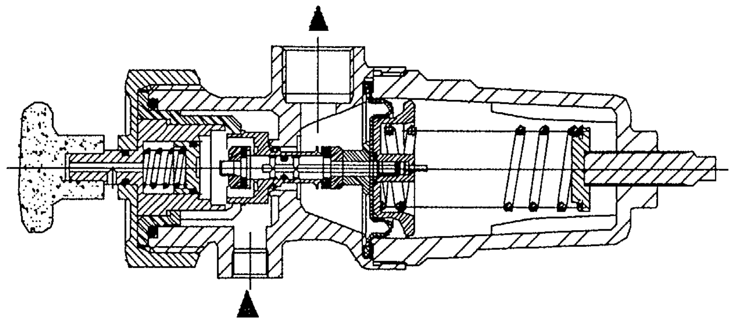


Fig.11

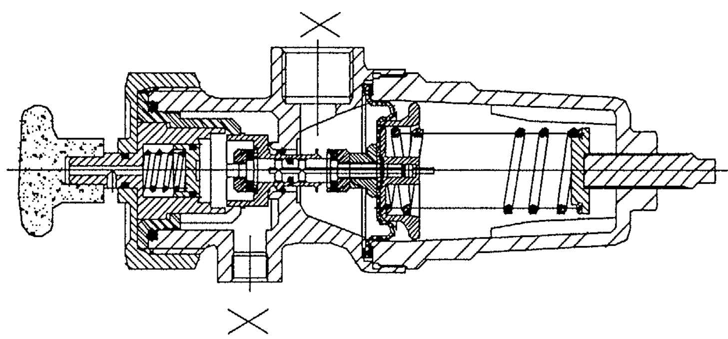


Fig.10

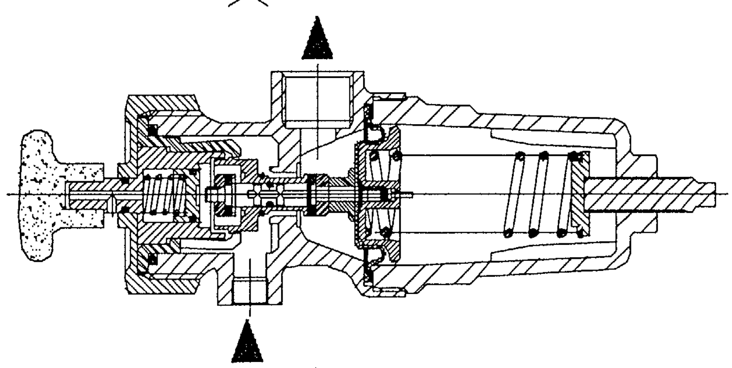


Fig.9

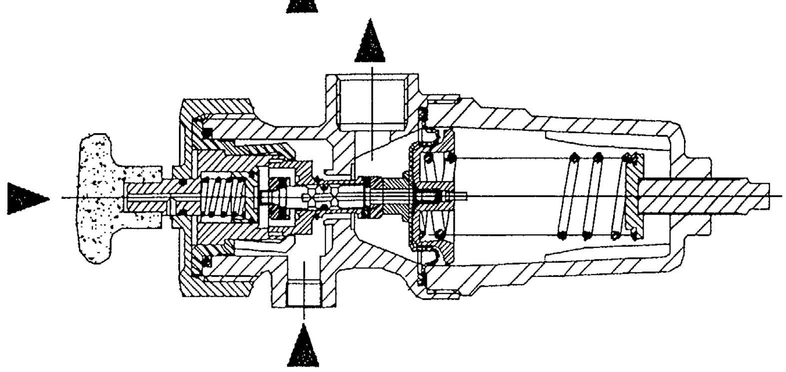


Fig.8

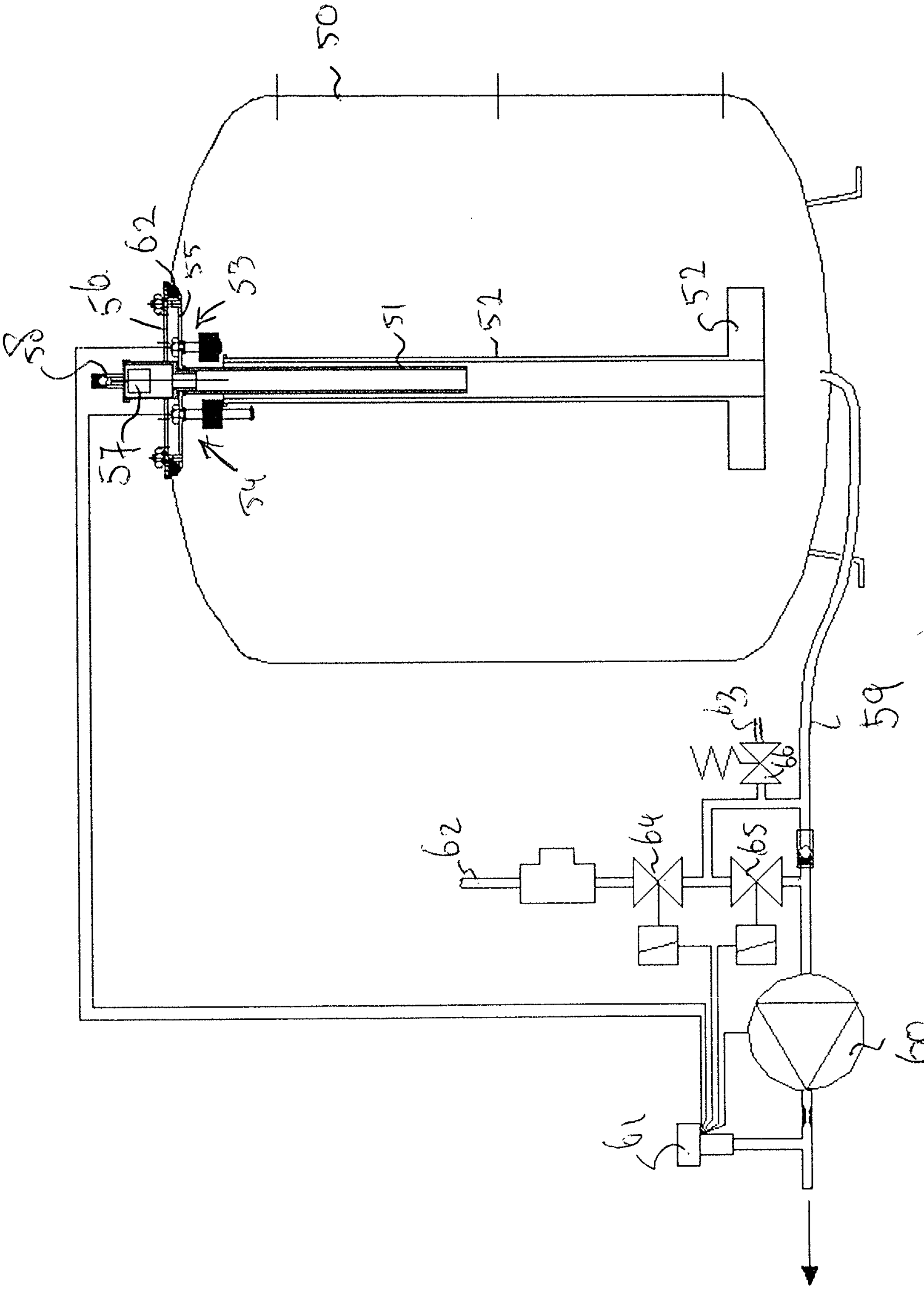


FIG. 13

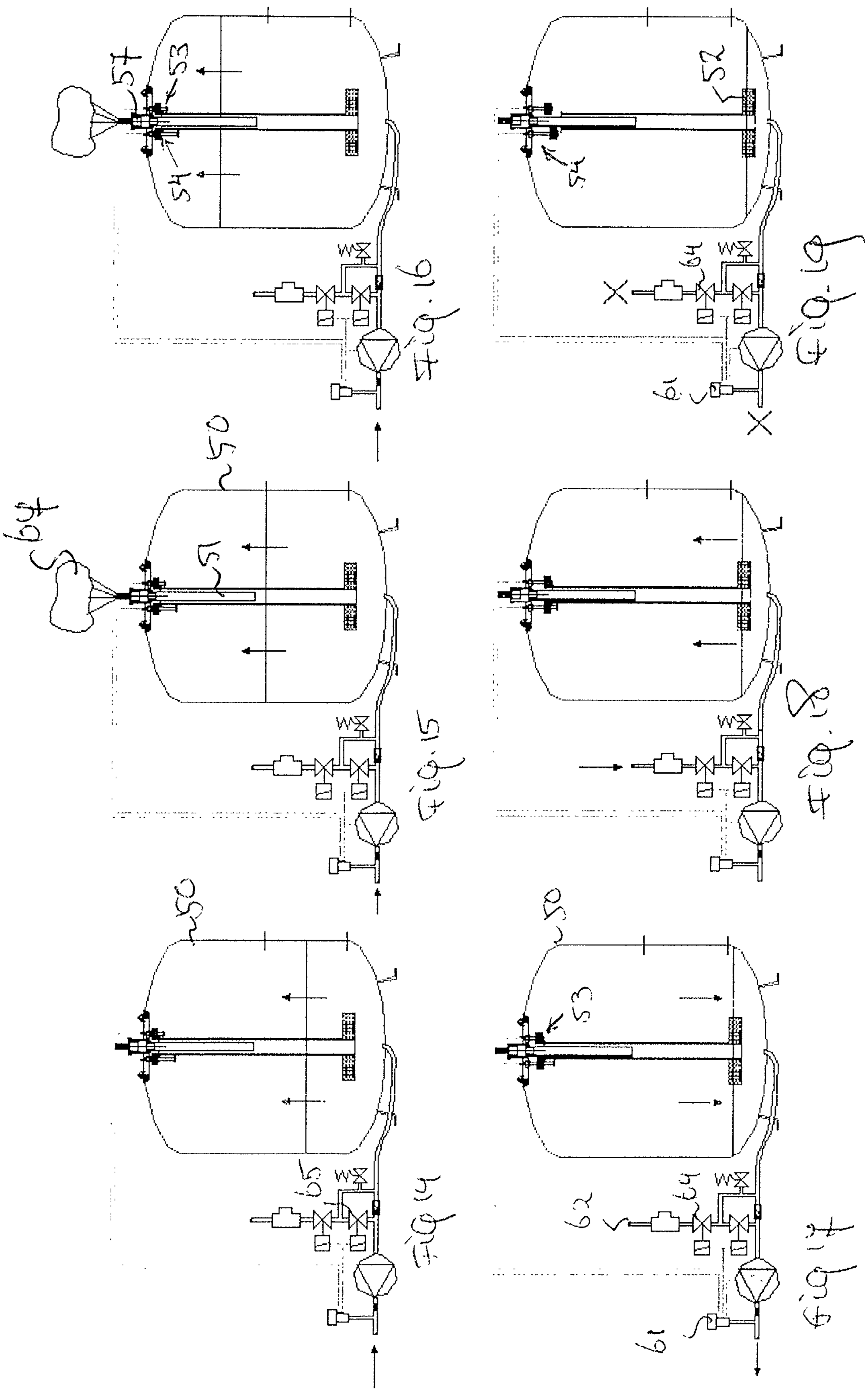


Fig. 14
Fig. 15
Fig. 16
Fig. 17
Fig. 18
Fig. 19
50
51
52
53
54
57
61
62
64
65