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(54) A fluid supply system from network to user, with fluid separation, and pressurization of user fluid exploiting the network fluid pressure

(57) In a fluid supply system, for example for water, which entails physical separation between a primary water circuit (12) connected to the municipal network and a secondary water circuit (14) connected to a user, the invention provides a hydraulic actuator (1) on the primary circuit and a hydraulic actuator (2) on the secondary circuit, mechanically connected one to the other,

and a system of valves to let fluid fall alternately into one or the other chamber of the actuator on the primary circuit so that this acts as a fluid motor to operate the actuator on the secondary circuit, which thus acts as a pump to pressurize fluid on the user's side.

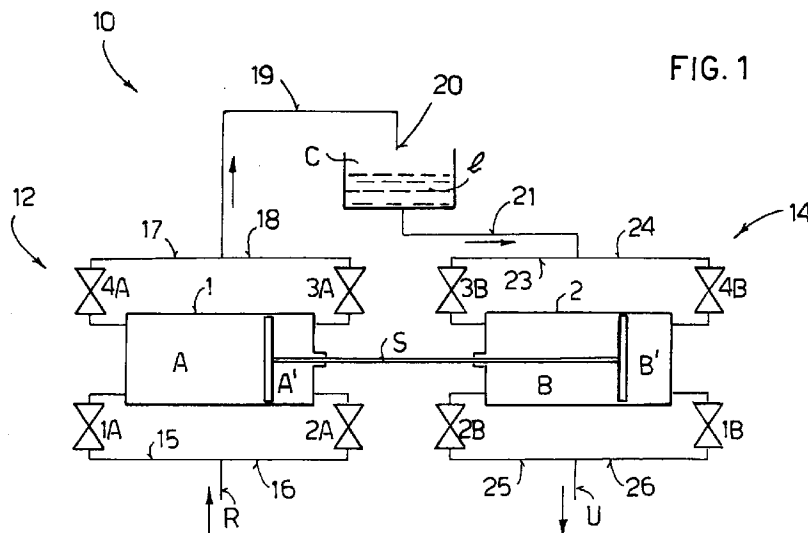


FIG. 1

Description

The invention refers to the field of systems for supplying a fluid from a primary circuit to a secondary circuit, with physical separation of the fluid in the primary circuit from the fluid in the secondary circuit. More particularly, but not exclusively, the invention relates to a water supply system in buildings, for example for drinking water, starting from a public supply network, containing water under pressure, to a user represented, for example, by the circuit of a single building. Another type of use of the invention is, for example, for supplying water to a single sink or sanitary fitting and for forced drainage of water therefrom.

A system for conveying fluid through pipes must generally be suitably pressurized and can at times, for accidental reasons, be subject to a vacuum, drawing the fluid back in the opposite direction. This occurrence cannot always be avoided with check valves.

European regulations require the use of systems designed to protect the public water distribution network from possible accidental or intentional pollution by private users.

To solve this problem, physical separation of the network water from the water distributed to the user is already provided today, this separation usually being effected by letting the water coming from the network pour or sprinkle into a feeder tank that supplies the user. According to the state of the art, however, the water thus separated for the user must be repressurized by means of pumps so that it can be circulated. This entails running costs for the system and in general the disadvantage of the relatively high noise level of the pumps.

The aim of this invention is to overcome the problem of repressurizing user water without being obliged to use separate power consuming devices, such as electric pumps and the like.

The aims have been achieved with a system as stated in claim 1. Further new and advantageous characteristics are stated in the subsequent claims.

In other words, the system of this invention comprises a first fluid circuit connected to a source of fluid under pressure and supplying a second fluid circuit by pouring or sprinkling; the second circuit supplies the user. A first fluid actuator is installed on the first fluid circuit; a second fluid actuator is installed on the second fluid circuit; the first and second fluid actuators have their mobile members physically constrained one to the other; valves are provided on the circuit so as to supply alternately one and the other chamber of the first actuator, which thus acts as a fluid motor to move the second actuator, which pressurizes the fluid in the user's circuit.

The new system or plant makes it possible to use fluid pressure in the first circuit to pressurize fluid in the second circuit without requiring power to be supplied from outside the system, thus without additional operating costs or with minimal additional costs, also overcoming the problem of pump noise, in that the

repressurization system is particularly noiseless.

Exemplary of embodiments of the invention will be described below in greater detail with reference to the appended schematic drawings in which:

Figure 1 shows a first example of a system according to the invention;

Figures 2 to 5 show the system in Figure 4 at various stages in the operating cycle, in particular:

Figure 2 shows a first stage of the operating cycle of the system in Figure 1;

Figure 3 shows a second stage in the operating cycle of the system in Figure 1;

Figure 4 shows a third stage in the operating cycle;

Figure 5 shows a fourth stage in the operating cycle;

Figure 6 shows a variant of the system in Figure 1;

Figure 7 shows a schematic vertical section of a residential building that employs systems according to the invention in various positions for various uses.

With reference first to Figure 1, it shows a system according to the invention, placed between a water supply consisting of the municipal network, indicated by R, and a user, indicated by U. The system, indicated as a whole by reference 10, comprises a primary circuit 12 and a secondary circuit 14. The primary circuit 12 is connected to the municipal network R and comprises, downstream thereof, two pipelines 15 and 16, parallel to each other, connected to opposite chambers A and A' of a fluid actuator 1, consisting, in the particular example, of a cylinder-piston assembly. A valve 1A is on the pipe 15 and a valve 2A on the pipe 16, both being controlled valves.

Downstream from the actuator device 1, the circuit 12 comprises two pipelines 17 and 18, respectively, parallel one to the other, the pipeline 17 being equipped with the valve 4A and the pipeline 18 with the valve 3A, both controlled valves. The pipelines 17 and 18 then converge into the pipe 19 which ends in a spray or pouring head 20. The secondary circuit 14 comprises a free-surface reservoir C, supplied by the sprayer 20 (but in which the fluid or liquid ℓ is physically separated from the sprayer 20), a pipeline 21 downstream from the reservoir C, which supplies two parallel pipelines 23, 24 with valves 3B and 4B which open into opposite chambers B and B' of a fluid actuator 2. In this case the actuator is a cylinder-piston. Downstream of the actuator 2, two pipelines 25 and 26 leave chambers B and B', respectively, and are connected, parallel one to the

other, to a pipeline towards the user U. A valve 2B is present on the pipeline 25, a valve 1B on the pipeline 26. The valves 1B, 2B, 3B and 4B can be check valves or controlled valves. The pistons of the actuator devices 1, 2 are rigidly connected one to the other in this particular case by a single stem S.

An explanation of operation of the invention follows, with reference to Figures 2 to 5.

In the initial resting state (Figure 2) the valves 1A, 2A, 3A and 4A are shut (OFF), the valves 1B, 2B, 3B and 4B are shut (OFF). The piston 102 is completely shifted to the left inside the cylinder 101. Likewise, the piston 202 of the actuator 2 is shifted to the left inside the cylinder 201 of the actuator 2.

The valve 1A feeding the chamber A opens and so at the same time does the valve 3A connected to the chamber A', maintaining the valves 2A and 4A closed, as illustrated in Figure 3. At the same time, in the case of the valves on the user circuit being controlled valves, valves 3B and 1B open. In this situation, the network pressure acts in the chamber A of the actuator 1 and, overcoming the pressure in the chamber A', delivers the liquid contained in A' through the sprayer 20, whilst when the piston 102 moves inside the cylinder 101, there is a simultaneous movement of the piston 202 inside the cylinder 201 which allows the chamber B to fill and the chamber B' to empty. If the size of the actuator 1, acting as a fluid motor, and the size of actuator 2, acting as a pump, are equal, the pressure in chamber A will be substantially equal to the pressure in chamber B', provided there is no friction.

When the piston 102 has reached the extreme right (situation in Figure 4) there is again a brief halt or rest, in which the valves 1A, 2A, 3A and 4A are shut, and the valves 1B, 2B, 3B and 4B are shut. Immediately afterwards the valves 2A and 4A of the circuit 10 and the valves 2B and 4B of the circuit 20 open (ON) (situation in Figure 5). The network under pressure thus feeds the chamber A', pushing the fluid in chamber A through the pipelines 17 and 19 to the sprayer 20. At the same time, the movement of the piston 202 pumps the water from the secondary or user circuit of chamber B through the pipeline 25 of the circuit and the valve 2B to the user, with a pressure substantially equal to that in the chamber A', unless there are energy losses due to friction. When the pistons have reached their extreme or end of stroke positions on the left in the figures, the situation is once more that in Figure 2.

Figure 6 shows a scheme of a system 10x in which, instead of cylinder-piston actuator devices, per se known diaphragm actuator devices are used, indicated by 1x and 2x. Since operation of the system remains essentially identical, no detailed description of the system in Figure 6 is provided, and the same reference numbers as for the preceding figures have been maintained.

Figure 7 shows various ways of using the system or plant of the invention. In particular a system 10 can be

applied at the inlet to a building where the overall circuit of the building is connected to the municipal water supply network R. The pipelines of the municipal network are drawn with a thick unbroken line. The system 10 makes it possible to pressurize the clean water supply circuit of the residential building (drawn with a broken line) though maintaining the physical separation in C with respect to the municipal network and exploiting the network pressure to obtain the supply circuit pressure.

In the lower part of Figure 7 another three systems 10 are illustrated, used in this case on the water circuit of the residential building, to provide pressure in the drains of service apparatus situated on a lower level than the level of the sewage network. The primary circuit in this case consists of the residential water supply circuit (broken line) and the secondary circuit consists of the sewage circuit (chain). The system 10' makes it possible to exploit the clean water pressure present in the domestic water circuit to wash a toilet bowl with falling water and forcibly evacuate the drain. The same applies to the system 10'' situated upstream and downstream from a washroom and to the system 10''' situated upstream and downstream of a sink.

It should be noted that, if one actuator and the other 1 and 2 are of a suitable size, appropriate pressure changes can be obtained between the first circuit and the second circuit. It should also be noted that the mechanical connection between the piston stems could be different from that illustrated, for example it could comprise links through levers, racks etc.

Claims

1. A system for supplying fluid between a fluid source and a user, with physical separation of the fluid between supply and user, characterized in that it comprises:
 - a primary fluid circuit (12) connected to the source (R);
 - a secondary fluid circuit (14) connected to the user;
 - the primary fluid circuit (12) comprising a fluid actuator (1), two pipelines (15, 16) of the circuit connected in parallel upstream of the fluid actuator, each pipeline being equipped with a controlled valve (1A, 2A), two pipelines (17, 18) downstream of the actuator, each pipeline being equipped with a controlled valve (4A, 3A), a pipeline (19) downstream of the two aforesaid pipelines and ending in a spray pouring head (20);
 - said secondary circuit (14) comprising a free surface tank (C) to collect the fluid from said head; a second fluid actuator (2); two pipelines

(23, 24) connected parallel to each other between said tank and the two opposite chambers of the second actuator, each pipeline being equipped with a valve (3B, 4B); two pipelines (25, 26) connected in parallel downstream of the second actuator (2), each pipeline being equipped with a valve (2B, 1B) said two pipelines coming together for the supply to the user;

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- said actuators (1, 2) having respective mobile members mechanically connected to each other.

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2. A system according to claim 1 in which the valves (1B, 2B, 3B, 4B) of the secondary circuit are check valves.
3. A system according to claim 1 in which the valves (1B, 2B, 3B, 4B) of the secondary circuit are controlled valves.
4. A system according to claim 1 characterized in that the fluid actuators are cylinder-piston assemblies (1, 2), the pistons (102, 202) of the two assemblies being mechanically connected to each other.
5. A system according to claim 4, characterized in that the pistons of the two cylinder-piston assemblies have a single stem (S) common to both.
6. A system according to claim 1 characterized in that the actuators of the primary circuit and of the secondary circuit are diaphragm actuators provided with a single stem that connects the two diaphragms.
7. A system according to claim 1 characterized in that the fluid source is the municipal water supply network and the user is a private domestic system.
8. A system according to claim 1 characterized in that the fluid source is the private system of a building and the user is the forced drainage of a sanitary appliance.
9. A system according to claim 1 characterized in that a plurality of actuators is provided on the primary circuit and/or on the secondary circuit.
10. A system according to claim 1 characterized in that the actuators on the primary circuit and on the secondary circuit are of an identical size.
11. A system according to claim 1 characterized in that the actuators on the primary circuit and on the secondary circuit have chambers and/or pistons of different sizes.

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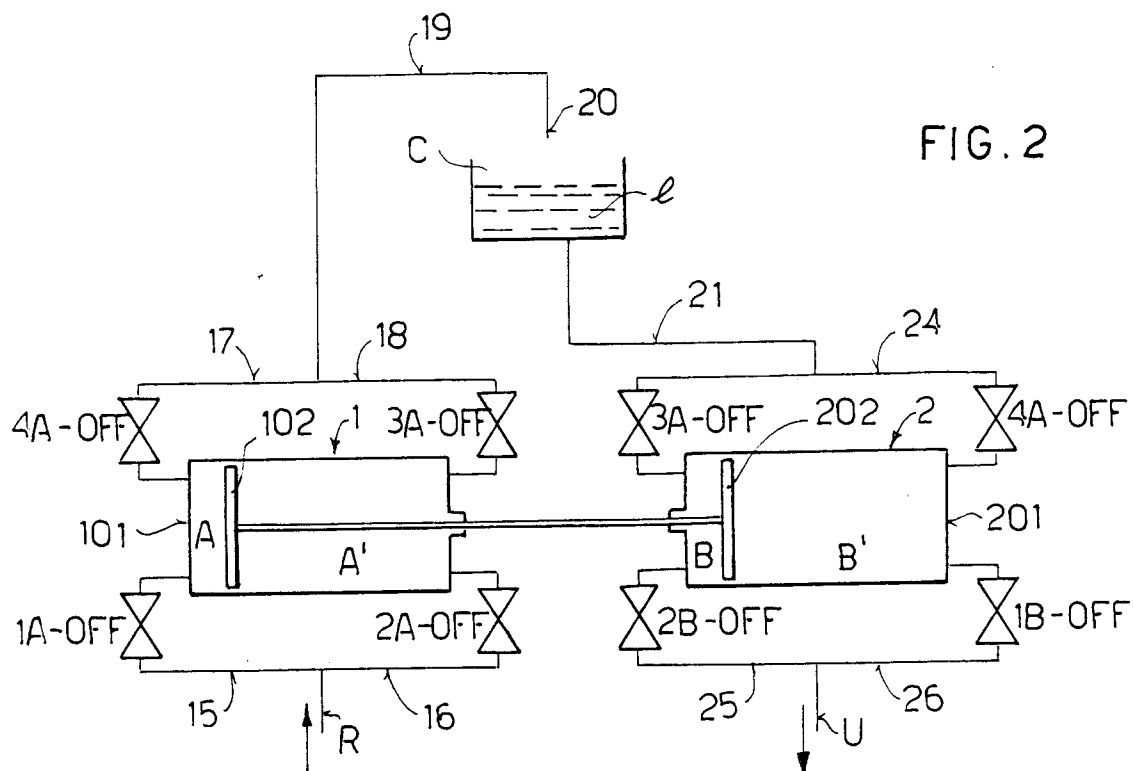
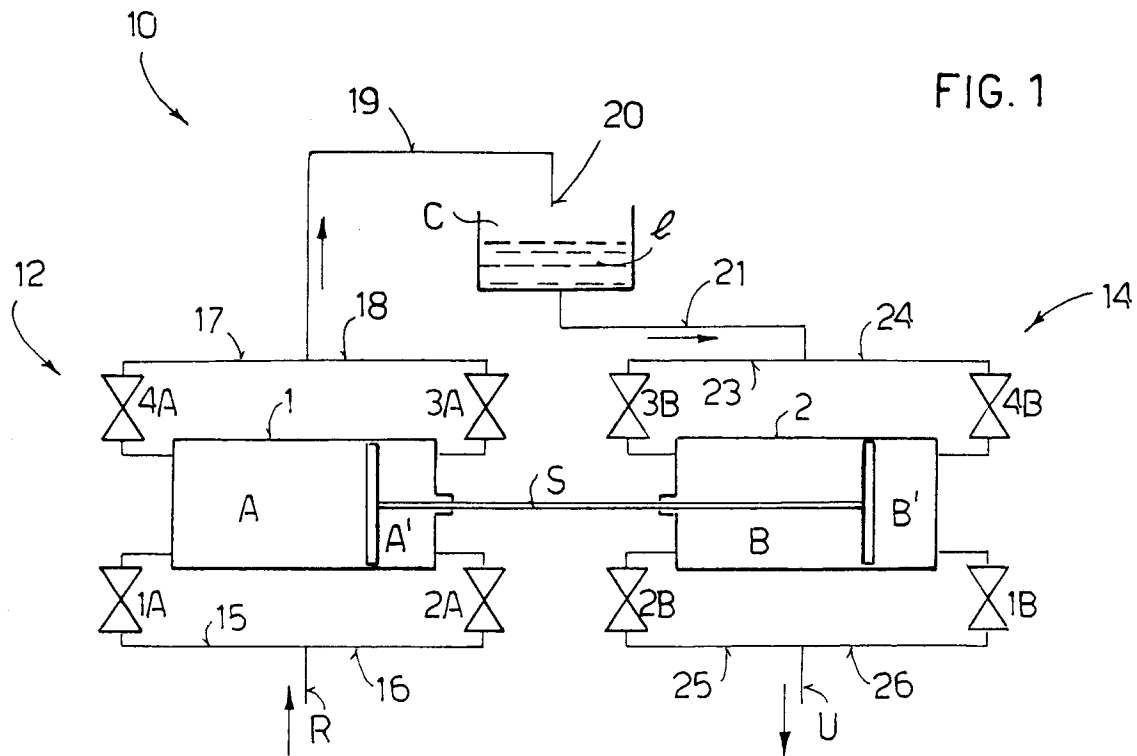


FIG. 3

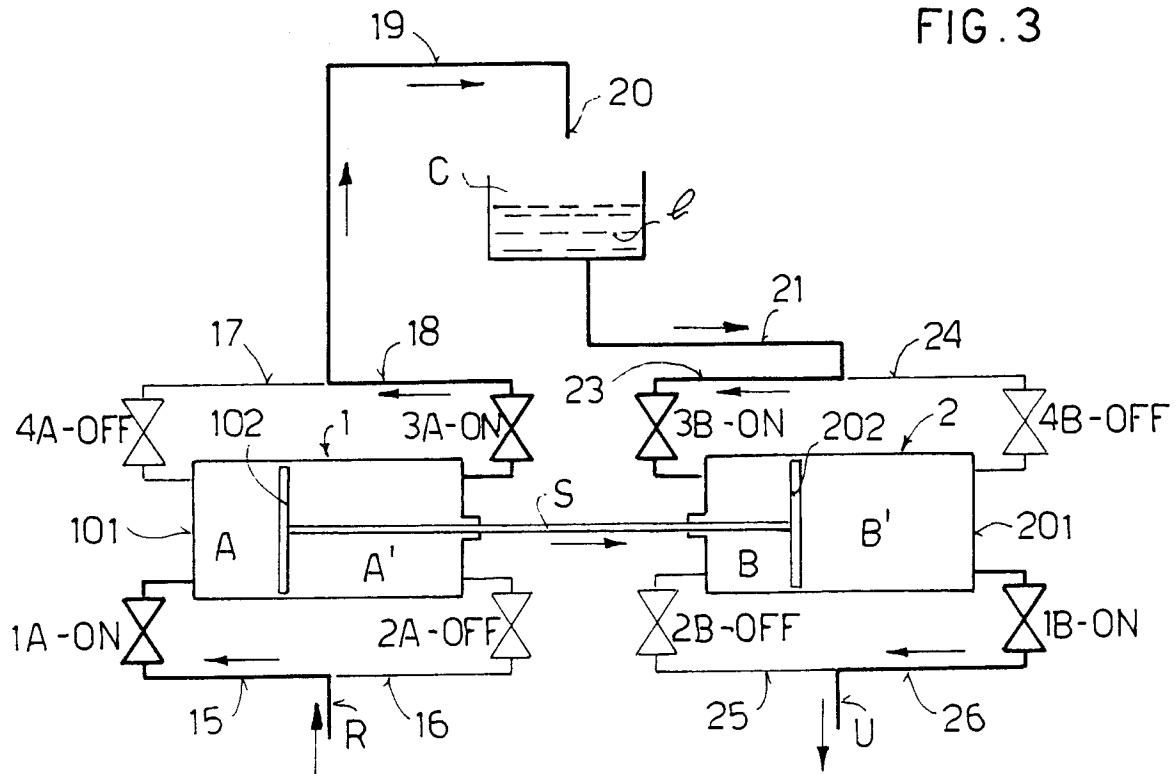


FIG. 4

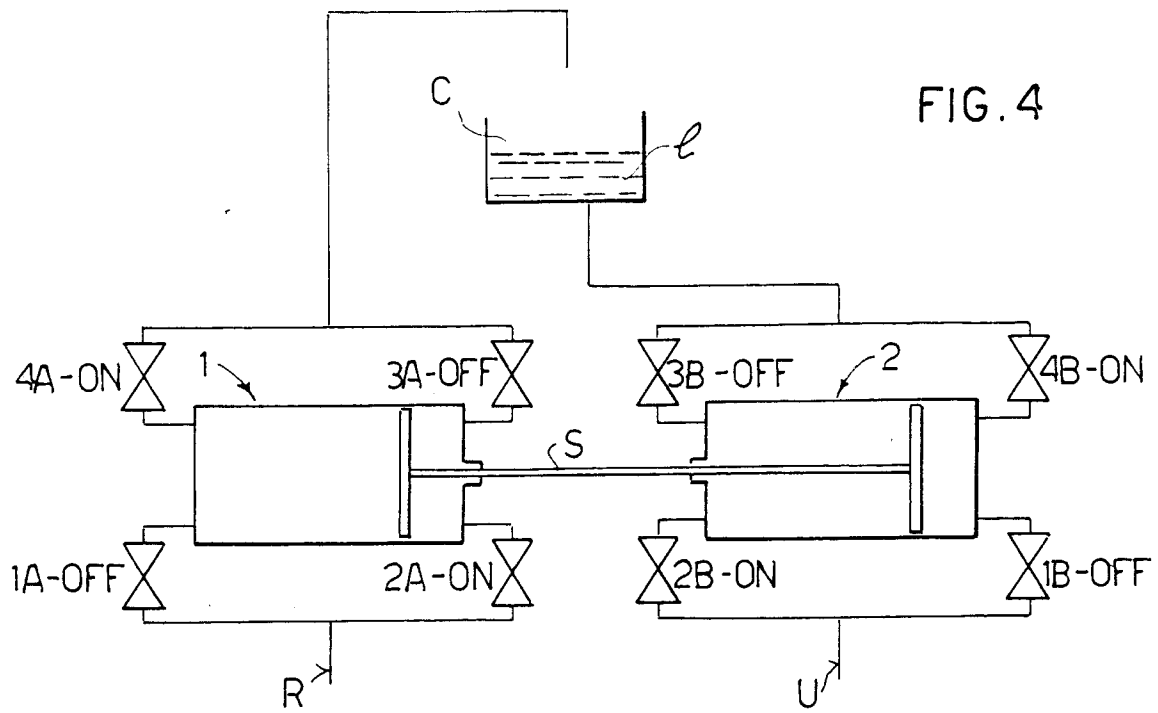


FIG. 5

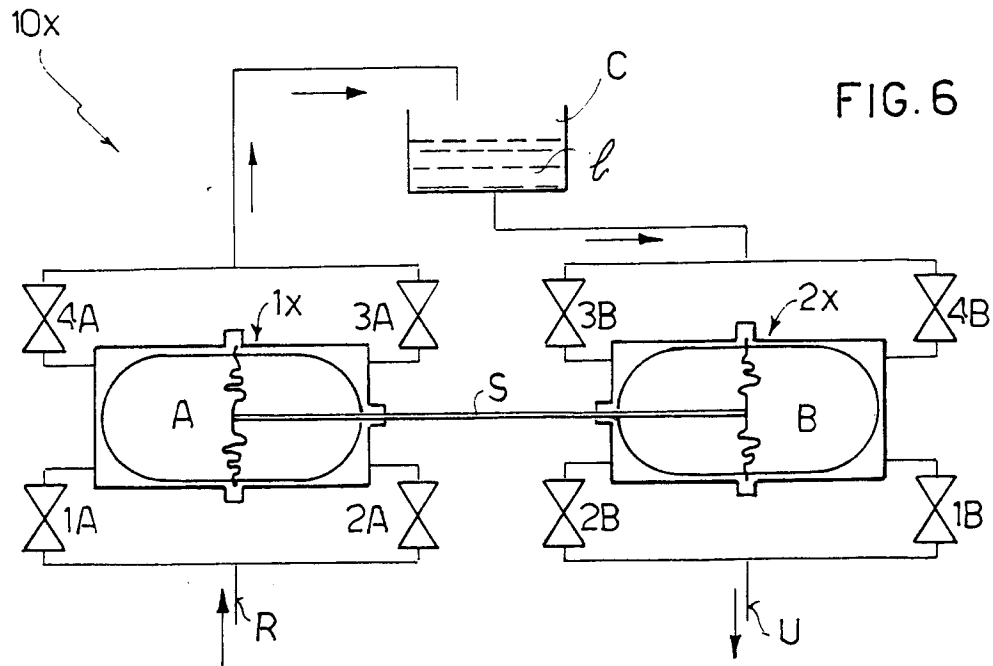
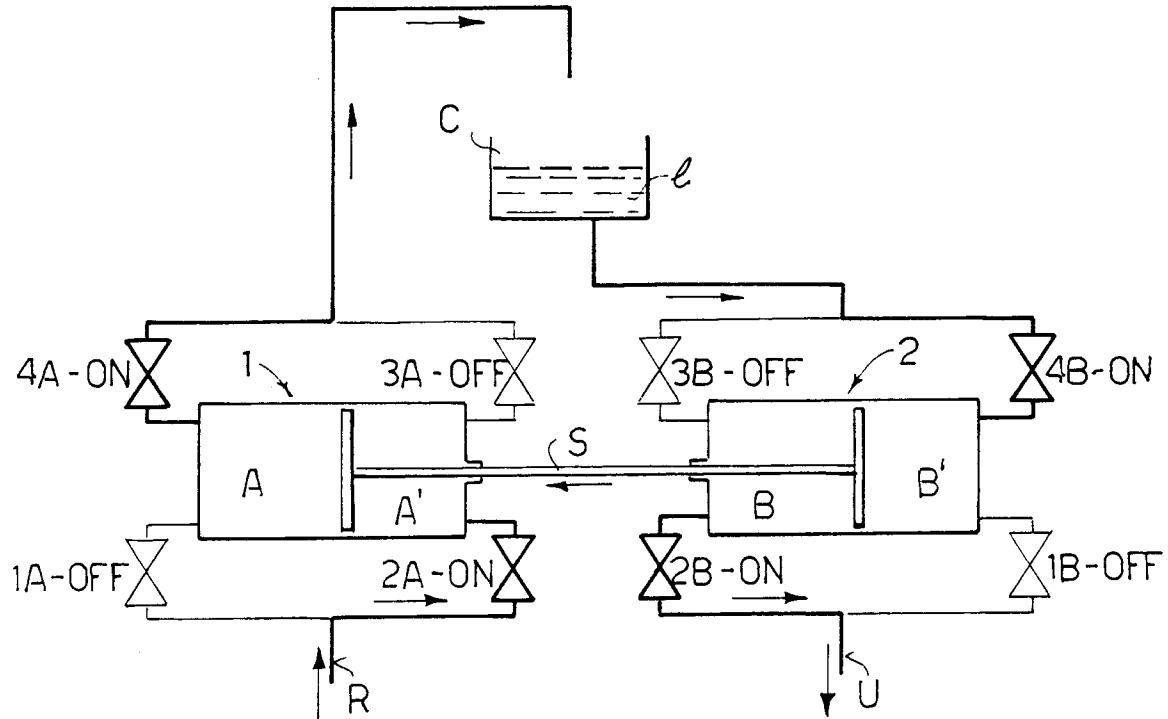
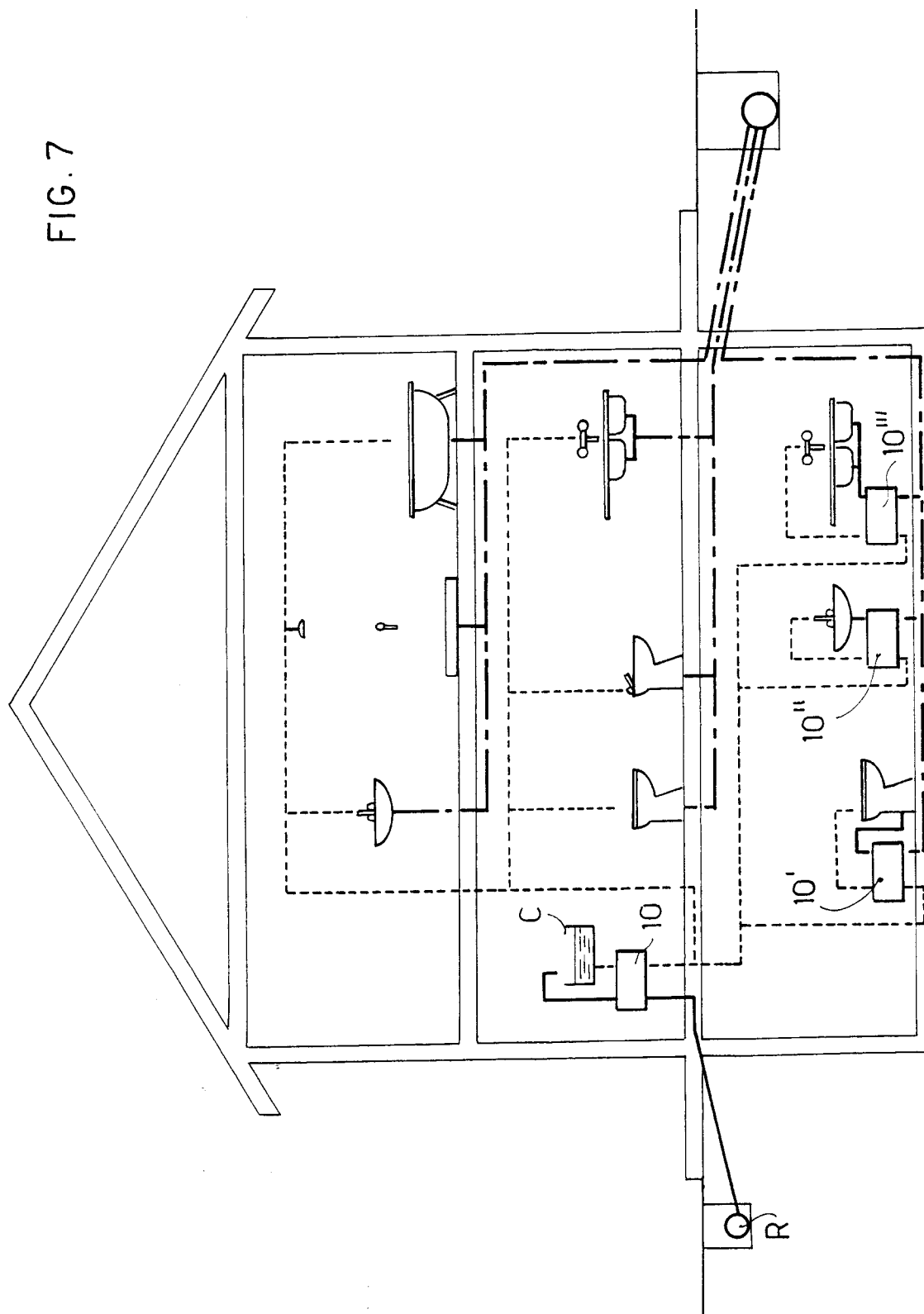


FIG. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2648

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.6)
X	WO 87 05973 A (RAST PTY. LTD.) * the whole document *	1-11	E03B1/00 E03C1/10
A	US 5 007 812 A (HARTT) * figures 1,3,4 *	1	
A	DE 24 17 731 A (AWECO, APPARATE- UND GERÄTEBAU, GMBH & CO KG) * page 5, paragraph 3 - page 6, paragraph 2; figures *	1	
A	DE 24 17 732 B (AWECO, APPARATE- UND GERÄTEBAU GMBH & CO KG) * column 2, line 59 - column 4, line 22; figures *	1	
A	EP 0 579 355 A (WRC P.L.C.) * abstract; figure 1 *	1,6	
A	US 5 032 290 A (NIHONKENSETSU KOGYO CO., LTD.) * abstract; figures *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E03C E03B F04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 July 1997	Examiner De Coene, P
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 E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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