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(54) **Hydraulic circuit for the downflow of water from a tunnel, in particular water of a fire fighting plant**

(57) A hydraulic circuit for the downflow of water from a tunnel (1) is defined by a plurality of siphons (4) which are distributed along the tunnel (1), are mounted below

a roadway (2) of the tunnel (1), are adapted to receive the water on the roadway (2) itself, and are connected in series to one another.

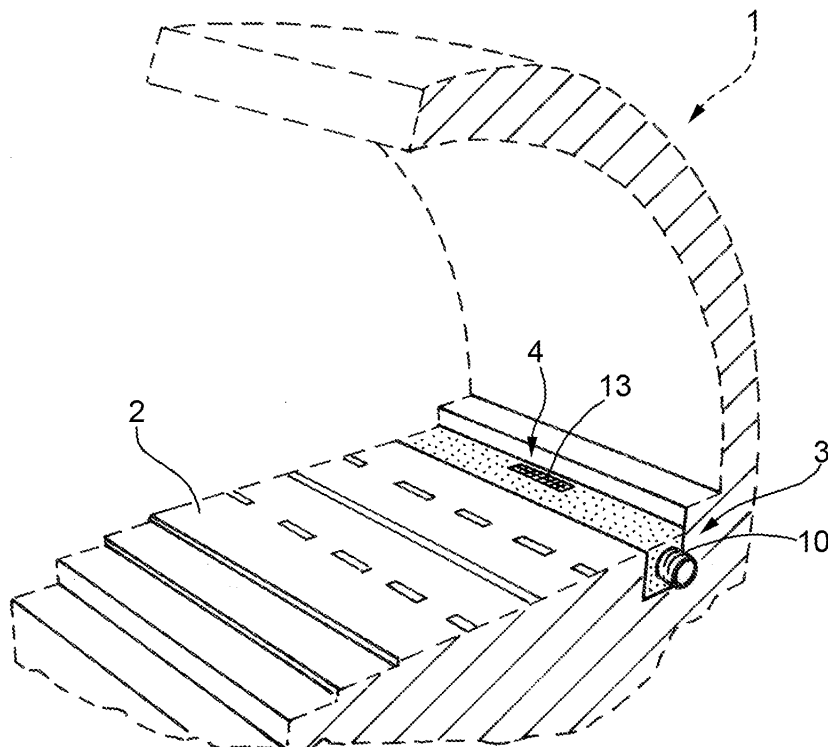


FIG.1

Description

[0001] The present invention relates to a hydraulic circuit for the downflow of water from a tunnel, in particular water of a fire fighting plant.

[0002] In order to allow the downflow of water sprayed by a fire fighting plant into a road tunnel, it is known to provide a hydraulic circuit comprising a plurality of siphons, which are distributed along the tunnel, are mounted below a tunnel roadway, and are adapted to receive the water on the roadway itself and to prevent the introduction into the tunnel of toxic gases generated by possible combustion phenomena which may occur along the hydraulic circuit.

[0003] The siphons are connected in parallel to one another and to a collection header which extends along the tunnel, is mounted below the siphons, and is connected to each siphon by means of a corresponding coupling pipe.

[0004] The known hydraulic circuits of the above-described type have some drawbacks mainly deriving from that the parallel connection of the siphons implies:

making a first excavation for installing the siphons and a second excavation which is deeper than the first excavation for installing the collection header; relatively complex, invasive maintenance interventions in case of breakage of the collection header; using the mentioned coupling pipes; and the propagation of flames along the whole collection header, which are generated by the possible combustion of flammable liquids within the collection header itself.

[0005] Moreover, a further drawback of the parallel connection of the siphons is that the operation of the hydraulic circuit implies filling each single siphon with water by the personnel in charge.

[0006] It is an object of the present invention to provide a hydraulic circuit for the downflow of water from a tunnel, in particular water of a fire fighting plant, which is free from the above-described drawbacks and which is simple and cost-effective to be implemented.

[0007] According to the present invention, there is provided a hydraulic circuit for the downflow of water from a tunnel, in particular water of a fire fighting plant, as claimed in the appended claims.

[0008] The present invention will now be described with reference to the accompanying drawings, which illustrate a non-limitative embodiment thereof, in which:

figure 1 is a schematic perspective view of a tunnel provided with a preferred embodiment of the hydraulic circuit of the present invention;
figure 2 is a schematic perspective view of a detail of the hydraulic circuit in figure 1; and
figure 3 is a longitudinal section of the detail in figure 2.

[0009] With reference to figure 1, numeral 1 indicates as a whole a tunnel, which has a roadway 2 for the circulation of motor vehicles (not shown), is provided with a fire fighting plant (of known type and not shown), and is further provided with a hydraulic circuit 3 for the downflow of water from the roadway 2 itself, in particular water for the mentioned fire fighting plant.

[0010] In second alternative embodiments (not shown), tunnel 1 may obviously be used for uses different from that described above, e.g. as a railway tunnel.

[0011] Circuit 3 comprises a plurality of siphons 4, which are evenly distributed along the tunnel 1, are mounted below the roadway 2, communicate with the roadway 2 for receiving the water on the roadway 2 itself, and are connected in series to one another.

[0012] As shown in figures 2 and 3, each siphon 4 comprises a lower box-like body 5 and an upper box-like body 6 mounted on the body 5 itself.

[0013] The body 5 is substantially U-shaped, and comprises two arms 7 substantially parallel to each other, which extend upwards from a connecting crosspiece 8 which is substantially transversal to the arms 7.

[0014] Each arm 7 has a side outlet 9, which extends transversally to the arm 7 itself, is aligned and coaxial to the outlet 9 of the other arm 7, and is fluid-tightly coupled to a corrugated pipe 10, which is inserted within the outlet 9 by interposing an annular seal (not shown) blocked inside a groove of the pipe 10 itself, and allows to connect the corresponding siphon 4 to an adjacent siphon 4 or to a collection device (not shown) for the water evacuated from the tunnel 1 by means of the circuit 3.

[0015] Each arm 7 further comprises an upper sleeve 11 which protrudes upwards from the arm 7, hydraulically communicates with the arm 7, and has a lower narrow portion 11a and an upper expanded portion 11b.

[0016] The crosspiece 8 has a maximum filling level L1 lower than a minimum inlet level L2 of water in the two outlets 9, and is provided with a central inlet 12 which allows to let water into the body 5, protrudes upwards from the crosspiece 8, extends between the arms 7 parallel to the arms 7 themselves, and comprises a lower narrow portion 12a and an upper expanded portion 12b.

[0017] The body 6 is substantially T-shaped, communicates with the roadway 2 for receiving the water on the roadway 2, its top is closed by a grid 13 which is substantially coplanar with the roadway 2 itself, and is provided with a lower central tang 14 which is fluid-tightly coupled to the outlet 12, and is inserted into the portion 12b by interposing an annular seal 15.

[0018] Body 6 further comprises two tubular appendices 16, which protrude downwards from the body 6 parallelly to the tang 14, and are arranged on opposite sides of the tang 14 itself. Each appendix 16 has a lower end inserted into the portion 11b of a corresponding sleeve 11 and is fluid-tightly coupled to the sleeve 11 itself by interposing an annular seal 17, and further has an upper end which hydraulically communicates with the body 6, and is closed by an extractable plug 18 adapted to allow

the body 5 to be inspected.

[0019] With regard to the above, it is worth specifying that the height of tang 14 and appendixes 16 is selectively checked according to the position of body 5 with respect to the roadway 2.

[0020] The hydraulic circuit 3 has some advantages mainly deriving from that the connection in series of the siphons 4 implies making a single, relatively shallow excavation, requires relatively simple, fast maintenance interventions in case of breakage of siphons 4 and/or pipes 10, and prevents flames and toxic gases generated by the possible combustion of flammable liquids within one of pipes 10 from propagating into the whole circuit 3.

Claims

1. Hydraulic circuit for the downflow of water from a tunnel (1), in particular water of a fire fighting plant, the hydraulic circuit comprising at least two siphons (4) which are distributed along the tunnel (1), are mounted below a roadway (2) of the tunnel (1), and are able to receive the water on the roadway (2); and being **characterized in that** the siphons (4) are connected in series.
2. Hydraulic circuit according to Claim 1, wherein each siphon (4) comprises a first box-type body (5), which is substantially U-shaped, comprises a couple of water outlets (9) from the siphon (4) and an intermediate section (8) connecting the outlets (9), and is further provided with a water inlet (12) in the first box-type body (5); the inlet (12) extending between the outlets (9) and being hydraulically connected to the intermediate section (8).
3. Hydraulic circuit according to Claim 2, wherein the intermediate section (8) extends below the two outlets (9) and shows a maximum filling level (L1) lower than a minimum water inlet level (L2) in the two outlets (9).
4. Hydraulic circuit according to Claim 2 or 3, further comprising a plurality of connecting ducts (10), wherein each of them is fluid-tightly coupled to an outlet (9) of at least a respective siphon (4).
5. Hydraulic circuit according to any one of Claims 2-4, wherein each siphon (4) further comprises a second box-type body (6) which is mounted above the first box-type body (5), opens into the roadway (2) to receive the water, and has an inlet duct (14) fluid-tightly coupled to the inlet (12) of the first box-type body (5).
6. Hydraulic circuit according to Claim 5, wherein the first box-type body (5) has a couple of coupling holes (11) arranged on the opposite sides of said inlet (12); the second box-type body (6) further comprising a

couple of tubular appendixes (16) which are arranged on the opposite sides of the inlet duct (14) and each of them is fluid-tightly coupled to a respective said coupling hole (11).

7. Hydraulic circuit according to Claim 6, wherein each tubular appendix (16) is closed by means of an extractable plug (18) to allow the inspection of the first box-type body (5).
8. Siphon of an hydraulic circuit (3) for the water downflow from a tunnel (1), in particular water of a fire fighting plant, the siphon (4) being **characterized in that** it comprises a first box-type body (5), which is substantially U-shaped, comprises a couple of water outlets (9) from the siphon (4) and an intermediate section (8) connecting the outlets (9), and is further provided with a water inlet (12) in the first box-type body (5); the inlet (12) extending between the outlets (9) and being hydraulically connected to the intermediate section (8).
9. Siphon according to Claim 8, wherein the intermediate section (8) extends below the outlets (9) and has a maximum filling level (L1) lower than a minimum water inlet level (L2) in the two outlets (9).
10. Siphon according to Claim 8 or 9, further comprising a second box-type body (6) which is mounted above the first box-type body (5), opens into a roadway (2) of the tunnel (1) to receive the water, and has an inlet duct (14) fluid-tightly coupled to the inlet (12) of the first box-type body (5).
11. Siphon according to Claim 10, wherein the first box-type body (5) has a couple of coupling holes (11) arranged on the opposite sides of said inlet (12); the second box-type body (6) further comprising a couple of tubular appendixes (16) which are arranged on the opposite sides of the inlet duct (14), and each of them is fluid-tightly coupled to a respective said coupling hole (11).
12. Siphon according to Claim 11, wherein each tubular appendix (16) is closed by means of an extractable plug (18) to allow the inspection of the first box-type body (5).

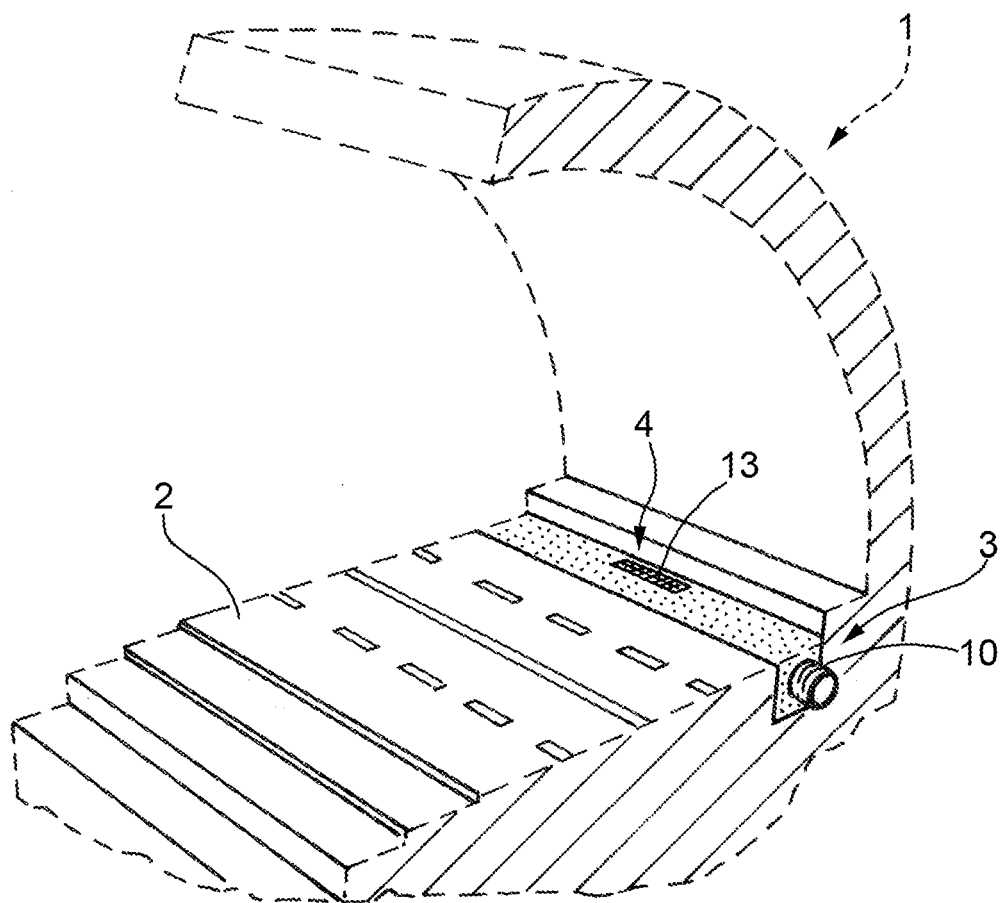
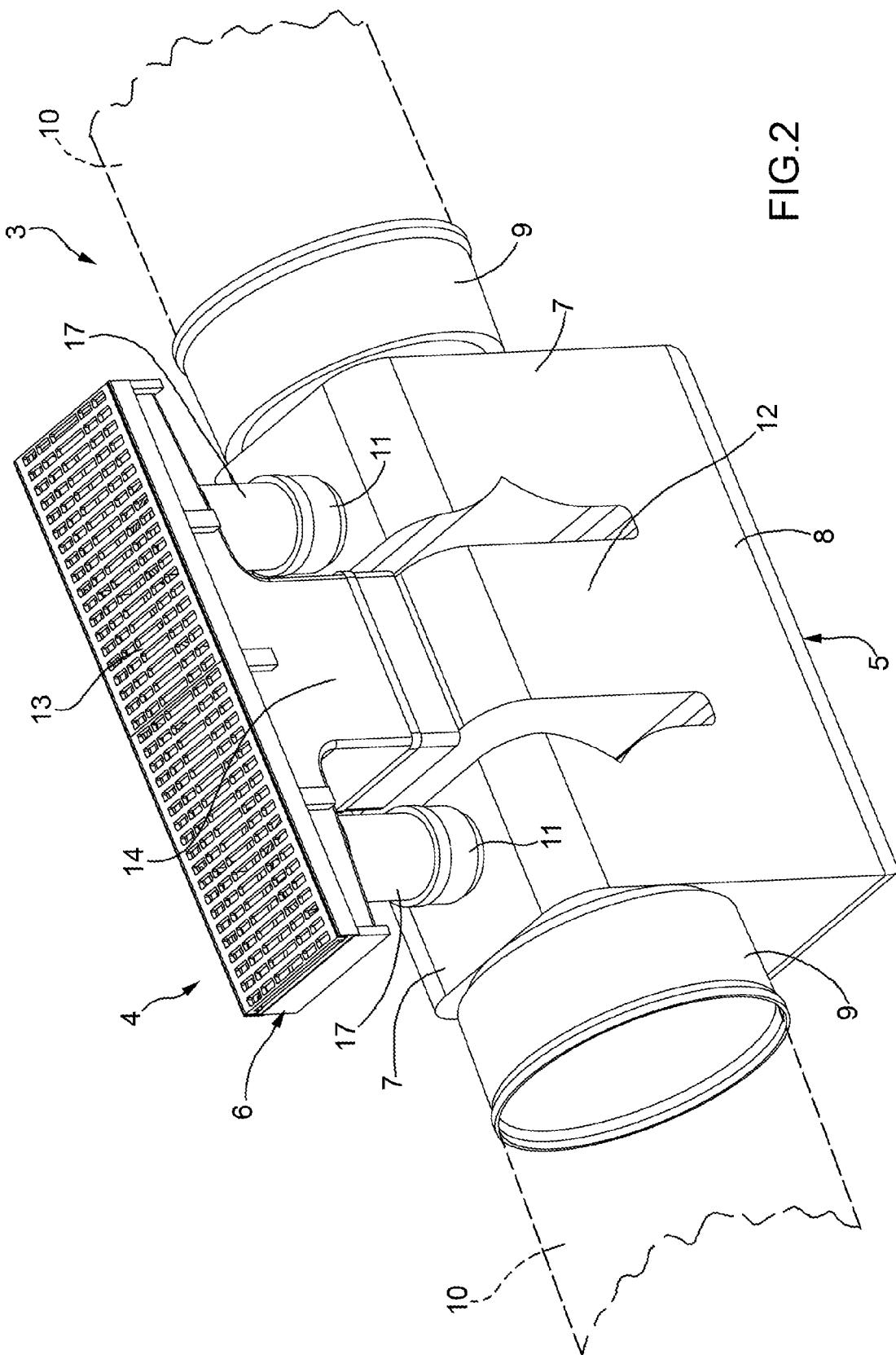
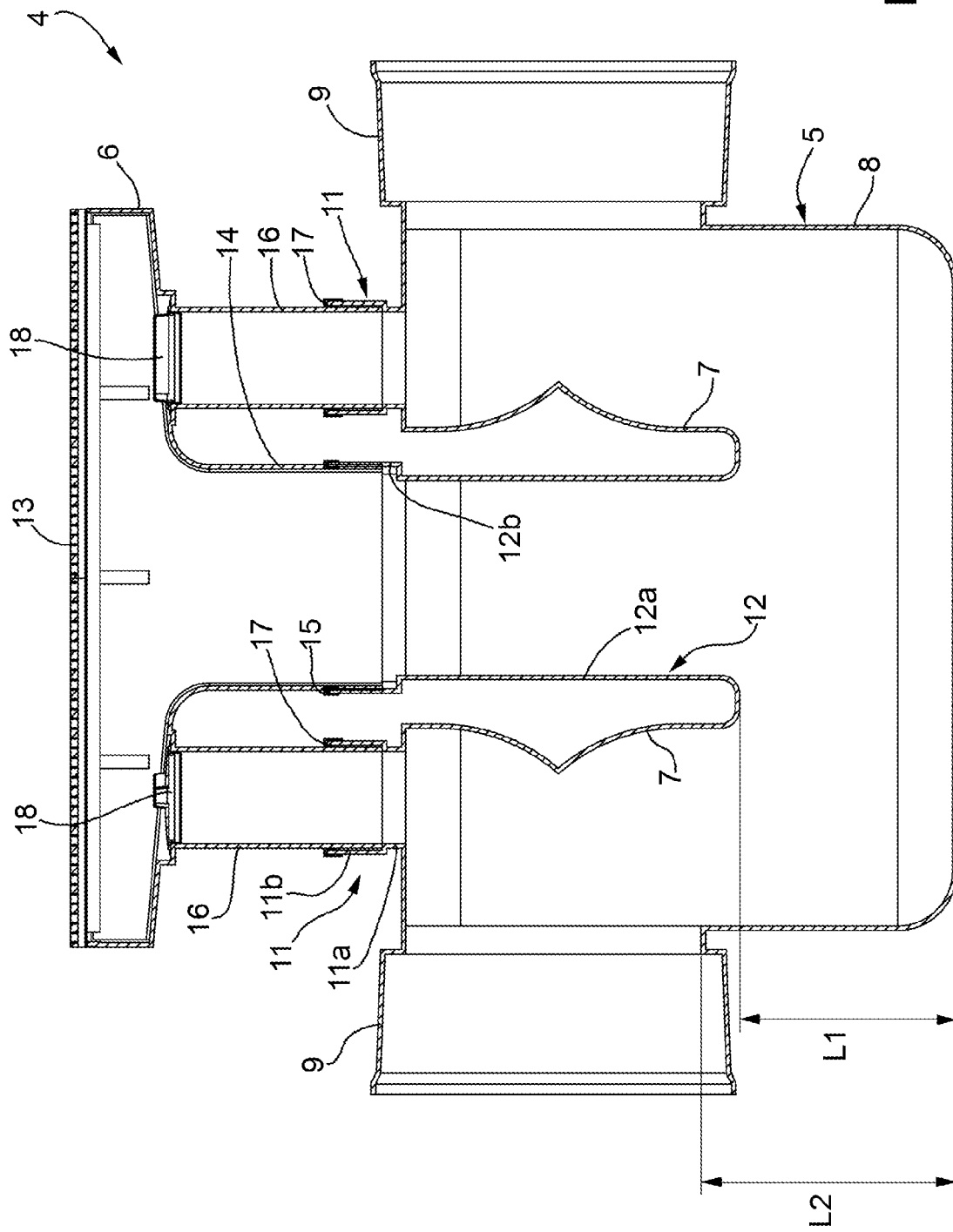


FIG.1







EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6673

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 2001 0092623 A (DAEBON ENGINEERING COMPANY [KR]) 26 October 2001 (2001-10-26) * abstract; figures 2,3,7 * -----	1	INV. E03F3/04 E03F5/04
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			TECHNICAL FIELDS SEARCHED (IPC)
			E03F E01C E21F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 February 2010	Examiner Isailovski, Marko
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 17 6673

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The members are as contained in the European Patent Office EDP file on
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22-02-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82