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(71) Applicant: **Clivio S.r.l.**
43015 Noceto (Parma) (IT)

(72) Inventor: **SANELLA, Antonio**
43015 NOCETO (PARMA) (IT)

(74) Representative: **Monelli, Alberto**
c/o BUGNION S.P.A
Largo Michele Novaro, 1/A
43121 PARMA ITALY (IT)

(54) **WATER DRAINAGE SYSTEM**

(57) A drainage system comprising:
- a water drainage tube (2) comprising a wall (20) having through holes (21);
- a group (300) of filtering bodies fitted in the corresponding holes (21); the filtering bodies of said group (300) comprising at least a first filtering body (3) fitted in one of said holes (21) and which assumes a first configuration in which it comprises water-soluble waterproofing means (31) which prevents passage of water and a second configuration wherein the water-soluble waterproofing means (31) is dissolved, enabling the water to pass through the thickness of a wall (20) of the tube.

The first filtering body (3) of said group comprises snap-fitting means (30) to the wall (20) of the tube (2), said snap-fitting means (30) comprising flexible anchoring fins (301) to an internal surface (201) of the tube (2).

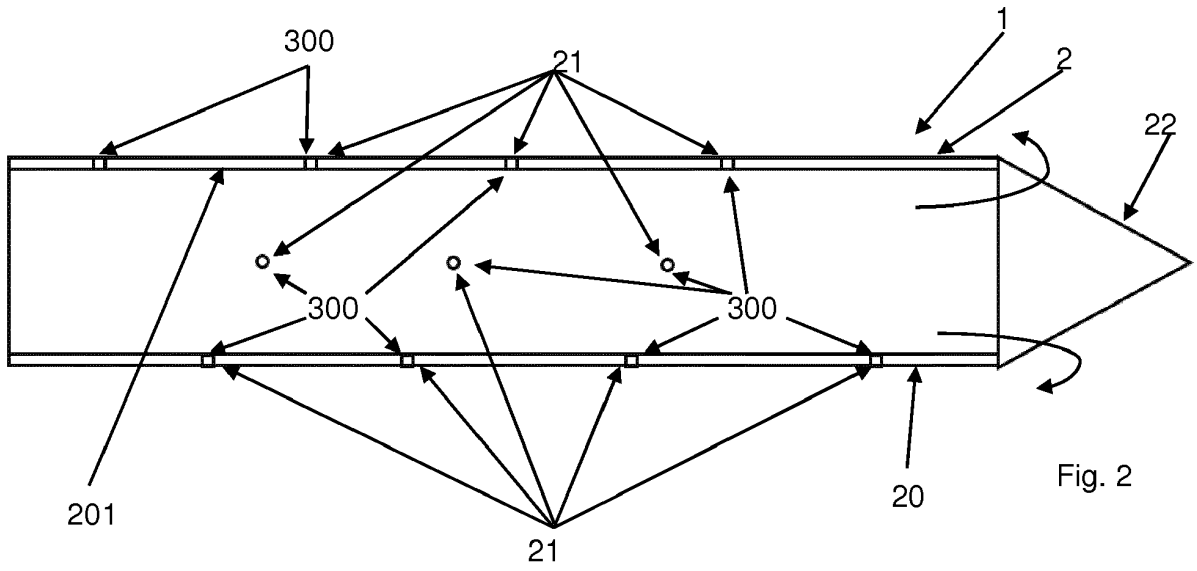

Fig. 2

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Description

[0001] The present invention relates to a subsoil water drainage system. Drainage systems are used in various sectors such as the stabilisation of an underground area subject to landslides or to increase safety during drilling, for example drilling tunnels.

[0002] In fact, by removing the presence of water, the risk of subsiding or landslide movements can be reduced. In fact, the lubricating action offered by the water is taken away and the solid structure remains more stable.

[0003] To date one of the draining methods envisages the building of a small reinforced concrete tunnel in proximity to the area subject to landslides or the place in which a tunnel is to be built. The tunnel is sufficiently wide to allow the passage of the workers. From such tunnel, drilling can be performed through corresponding drainage tubes. A disposable drill bit is placed at the end of each drainage tube. The tube is placed in rotation and in this way it is made to advance in the subsoil transversally to the tunnel. Pressurised water is pumped to the bit in order to facilitate drilling, the removal of the drilled material and cooling. The water is conveyed to the bit inside the tube, then it exits by crossing a non-return valve. In this way it will tend to be arranged in the gap between the tube and the hole just drilled pushing the material removed by the bit towards the tunnel. As the drainage tube advances new chunks are added at the base to accompany the need to extend the tube. Along the wall of the tube there are filtering bodies that after installation must allow the passage of water from the outside to the inside of the tube so that it can then be drained. During installation such filtering bodies must be obstructed so as to prevent the water that is pumped into the tube and must reach the disposable bit exiting the tube before reaching its destination. On this point, the filtering bodies are obstructed by a water-soluble waterproofing cap. Therefore during installation such cap will prevent the exit of the water. But, being water-soluble, it will dissolve in contact with water and therefore once the installation is complete the filtering bodies will allow the passage of water from the outside to the inside. The filtering bodies are placed by interference inside through holes made on the wall of the tube. The tube is made of metallic material and also the filtering bodies have an outer portion made of metallic material.

[0004] A drawback of this embodiment is that the pressurised water that is introduced into the tube during installation could overcome the interference between the filtering bodies and the tube, expelling the filtering bodies from the respective seats. This could therefore compromise both the correct installation of the drainage tube reducing the water flow rate to the disposable bit and the correct operation of the drainage pipe once installed. In fact, the absence of filtering bodies would cause the entry of debris. Or the filtering bodies, if removed from the correct position, could even obstruct the channel in an undesired way.

[0005] In this context, the technical task underlying the present invention is to propose a drainage system which obviates the drawbacks in the known art as described above.

[0006] In particular, an object of the present invention is to provide a drainage system able to improve the correct operation.

[0007] The defined technical task and the specified aims are substantially achieved by a drainage system comprising the technical characteristics set forth in one or more of the appended claims.

[0008] Further characteristics and advantages of the present invention will become more apparent from the indicative and thus non-limiting description of a preferred but non-exclusive embodiment of a drainage system, as illustrated in the attached drawings, in which:

- figure 1 shows a schematic view of a drainage system according to the present invention;
- figure 2 shows a schematic view of a drainage system as an alternative to that of figure 1;
- figures 3 and 4 show two perspective views of a component of a drainage system according to the present invention;
- figure 5 shows a front view of an alternative component to that of figures 3 and 4 and related to a drainage system according to the present invention;
- figure 6 shows a side view of an alternative component to that of figures 3, 4 and 5 and related to a drainage system according to the present invention;
- figure 7 shows a partially sectioned side view of an alternative component to that of figures 3, 4, 5 and 6 and related to a drainage system according to the present invention.

[0009] In the appended figures of the drawings, reference numeral 1 denotes a drainage system. The drainage system 1 comprises a water drainage tube 2 for draining a liquid, typically water. Appropriately, the tube 2 is made of metallic material. The tube 2 comprises a wall 20 provided with through holes 21. The wall 20 is a side wall of the tube 2 and the holes 21 cross the thickness of the wall 20.

[0010] Appropriately, the system 1 comprises a drill bit 22 placed at an end of the tube 2. The drill bit 22 is preferably at least partially disposable. In fact it could be a single-use bit. Once used for drilling it is left in situ (until the end of drilling). In the solution of figure 2 the bit 22 is completely disposable. In an alternative solution the bit 22 could be at least partially removed making it transit inside the tube 2 (solution exemplified in figure 1).

[0011] The drainage system 1 comprises a group 300 of filtering bodies fitted in the corresponding holes 21. The holes 21 are advantageously distributed along the length of the tube 2. They advantageously lie along the same straight line. The holes 21 are facing along different dimensions. For example they may be distributed according to a helical trend. For example a part of the holes 21

face upwards, or downwards, others are afforded on the lateral sides.

[0012] Appropriately, the drainage system 1 is self-drilling. This means that the tube 2 responsible for drainage and comprising the bit 22 performs the drilling itself.

[0013] The tube 2 advantageously extends along an inclined straight line. In particular the bit 22 is higher. This facilitates the outflow of water.

[0014] The filtering bodies of said group 300 comprise at least a first filtering body 3 fitted in one of said holes 21. The first filtering body 3 assumes a first configuration in which it comprises water-soluble waterproofing means 31 which prevents passage of water. The first filtering body 3 assumes a second configuration wherein the water-soluble waterproofing means 31 is absent, enabling the water to pass through the thickness of a wall 20 of the tube 2. In fact, in the second configuration the water-soluble means 31 has been dissolved. This is because of the contact with the water pumped through the tube 2 during drilling or however with the subsequent contact with the water present in the subsoil and that the tube 2 proposes to drain. Such water-soluble means 31 is/comprises for example a water-soluble glue (an example of the water-soluble means 31 could be the material known by the trade name of Hydrolene). It internally obstructs a passage section of the first body 3. One or more of the characteristics described with reference to the first filtering body 3 can be repeated for all the other filtering bodies of said group 300 of filtering bodies.

[0015] The first filtering body 3 of said group 300 comprises snap-fitting means 30 to the wall 20 of the tube 2. The snap-fitting means 30 comprises flexible anchoring fins 301 to an internal surface 201 of the tube 2. Such fins 301 define flexible hooks. The fins 301 are elastically deformable. The first filtering body 3 of said group 300 comprises at least three fins 301 arranged along a circumference.

[0016] Advantageously, the first filtering body 3 of said group comprises at least six fins 301 arranged along a circumference.

[0017] During the fitting to the tube 2 the fins 301 are first deformed by moving towards each other and then they tend to return to the initial position moving away from each other. The fins 301 are therefore first compressed towards the centre of the circumference and then they move away from said centre. Each of said flexible anchoring fins 301 comprises a first and a second wall 304, 305 facing along opposite directions. The first wall 304 defines a guide for insertion of the first filtering body 3 into the tube 2, in particular in one of the holes 21. The second wall 305 opposes the extraction of the first filtering body 3 from the tube 2.

[0018] At least the first filtering body 3 of said group comprises a perimeter collar 302 and a grid 303 placed inside the collar 302. The grid 303 performs a filtering action in the second configuration. In fact, it allows any debris to be kept outside preventing entry into the tube 2 letting the water to be drained pass through. In the first configuration the grid 303 is buried inside the waterproofing means 31.

[0019] In the preferred solution, the collar 302 and the grid 303 are in a single monolithic body. Appropriately the collar 302 and possibly also the grid are 303 made of plastic material. The fins 301 could be made of plastic material. In an alternative solution the fins 301 are made of metallic material. In particular the fins 301 are made of steel. Appropriately, the collar 302 is made of metallic material (preferably steel). Advantageously, the grid 303 is made of metallic material, in particular steel.

[0020] The fins 301 are made in a single body with the collar 302 and are positioned at an end of the collar 302 that is located inside the tube 2.

[0021] Appropriately the collar 302 is connected by interference in one of said corresponding holes 21.

[0022] At least one of said holes 21 (in particular each one of said holes 21) is defined by a lateral surface that narrows a passage section proceeding from the inside of the tube 2 towards the outside of the tube 2 (moving along the thickness of the tube 2). In particular the lateral surface is a truncated cone shape. In this way it offers greater resistance to the movement of the filtering bodies 300 inside the tube 2.

[0023] In the preferred solution, the tube 2 comprises a plurality of chunks connected together. For example they can be screwed to each other.

[0024] The collar 302 externally comprises one or more reliefs 306 which increase the anchorage to the tube 2 (in particular the anchorage to the holes 21). Advantageously said one or more reliefs extend along an arc, particularly circumferentially (see figure 6).

[0025] Appropriately the system 1 comprises a seal 307 interposed between the collar 302 and the tube 2 (see figure 7).

[0026] During use (see figure 2), the tube 2 provided with the bit 22 at one end is inserted into the ground to be dug generating a drilling action. During drilling pressurised water is conveyed through the tube 2 to the bit 22 and then dispensed externally. Such water flowing between the tube 2 and the drilled hole facilitates the removal of drilling debris. It also facilitates the dissolution of the water-soluble waterproofing means 31 so as to allow the passage through said group 300 of filtering bodies of the water to be drained.

[0027] In an alternative solution (see figure 1), to minimise the risk of any subsiding during drilling, the tube 2 provided with the bit 22 has a further conduit 23 inside it. Such conduit 23 and possibly at least a part of the bit 22 can be removed once drilling has finished. During drilling the water pumped to the bit 22 returns upstream passing into a gap interposed between the conduit 23 and the tube 2.

[0028] The present invention achieves important advantages.

[0029] First of all it allows the corresponding tubes 21 of said group 300 of filtering bodies to be kept in position better. This is also thanks to the presence of the fins 301

that allow an improved retaining action to be performed. Any fins 301 made of metallic material also provide a contribution in such direction. The narrowing of the wall shapes the holes 21 so that they have a larger external section and a smaller internal section than the thickness of the tube 2, which makes it possible to prevent the filtering bodies being able to exit from the holes 21 and falling into the tube 2.

[0030] The invention as it is conceived is susceptible to numerous modifications and variations, all falling within the scope of the inventive concept characterising it. Furthermore, all the details can be replaced with other technically equivalent elements. In practice, all the materials used, as well as the dimensions, can be any according to requirements.

Claims

1. A drainage system comprising:

- a water drainage tube (2) comprising a wall (20) having through holes (21);
- a group (300) of filtering bodies fitted in the corresponding through holes (21); the filtering bodies of said group (300) comprising at least a first filtering body (3) fitted in one of said holes (21) and which assumes a first configuration in which it comprises water-soluble waterproofing means (31) which prevents passage of water and a second configuration wherein the water-soluble waterproofing means (31) is dissolved, enabling the water to pass through the thickness of a wall (20) of the tube;

characterised in that the first filtering body (3) of said group comprises snap-fitting means (30) to the wall (20) of the tube (2), said snap-fitting means (30) comprising flexible anchoring fins (301) to an internal surface (201) of the tube (2).

2. The system according to claim 1, **characterised in that** the first filtering body (3) of said group (300) comprises at least three fins (301) arranged along a circumference.

3. The system according to claim 1 or 2, **characterised in that** said fins (301) are made of steel.

4. The system according to any one of the preceding claims, **characterised in that** each of said holes (21) is defined by a lateral surface which narrows a perpendicular section, proceeding from outside the tube (2) to inside the tube (2).

5. The system according to any one of the preceding claims, **characterised in that** each of said flexible anchoring fins (301) comprises a first and a second wall (304, 305) facing along opposite directions, the first wall (304) defining a guide for insertion of the first filtering body (3) into the tube (2), the second wall (305) opposing extraction of the filtering body (3) from the tube (2).

6. The system according to any one of the preceding claims, **characterised in that** at least the first filtering body (3) of said group comprises a perimeter collar (302) and an internal grid (303) which performs a filtering action in the second configuration.

7. The system according to claim 6, **characterised in that** the fins (301) are made in a single body with the collar (302) and are positioned at an end of the collar (302) positioned inside the tube (2).

8. The system according to claim 6 or 7, **characterised in that** said collar (302) and said grid (303) are a single monolithic body.

9. The system according to any one of claims 6 to 8, **characterised in that** said collar (302) externally comprises reliefs (306) which increase the anchorage to the tube (2).

10. The system according to any one of claims 6 to 9, **characterised in that** it comprises a seal (307) interposed between said collar (302) and the tube (2).

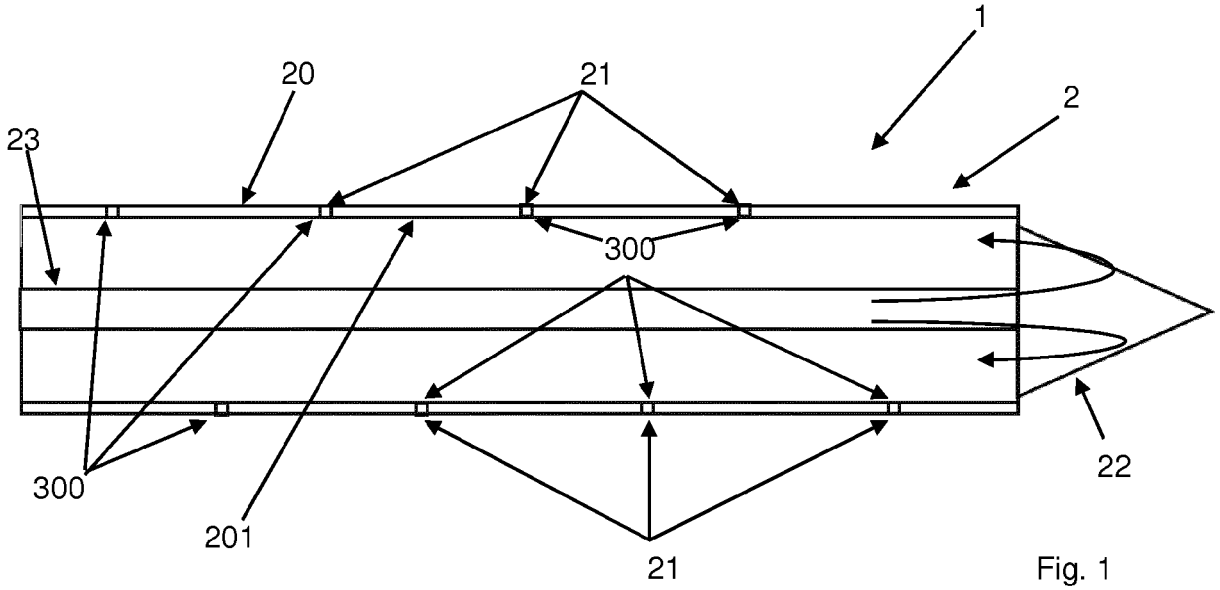

Fig. 1

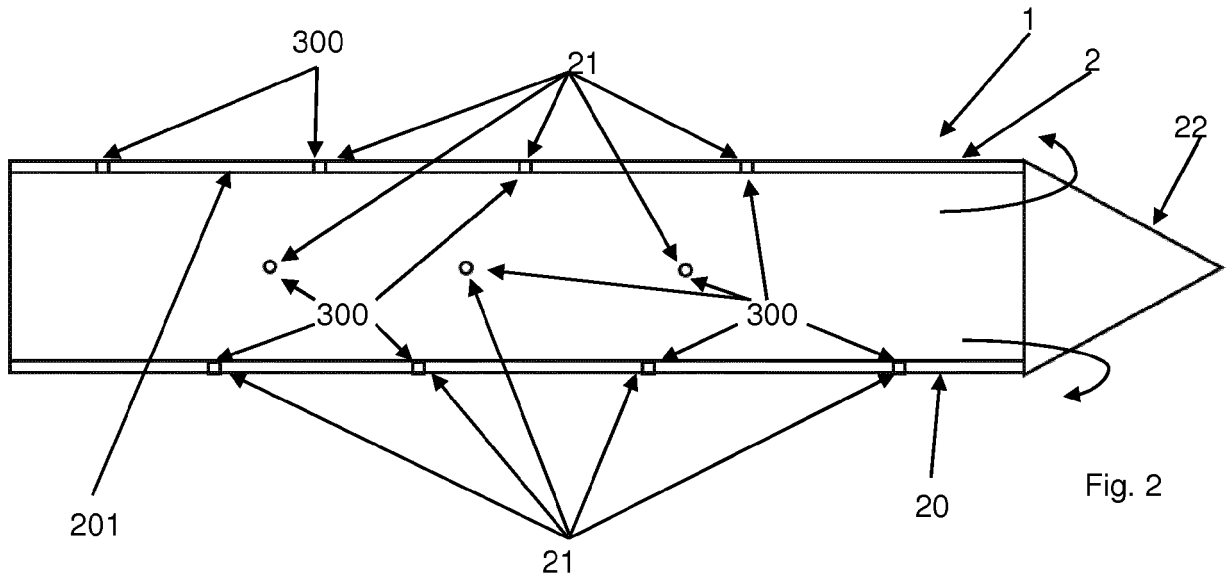

Fig. 2

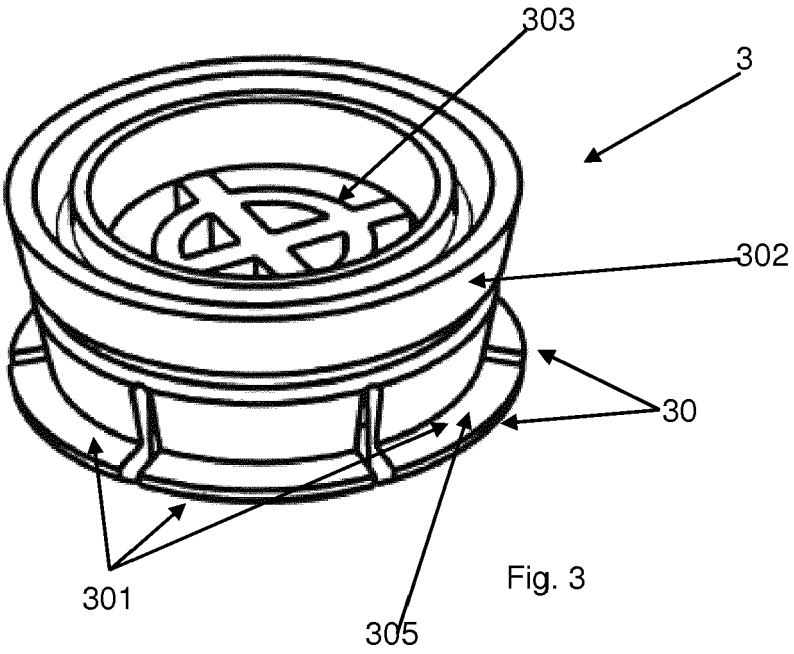

Fig. 3

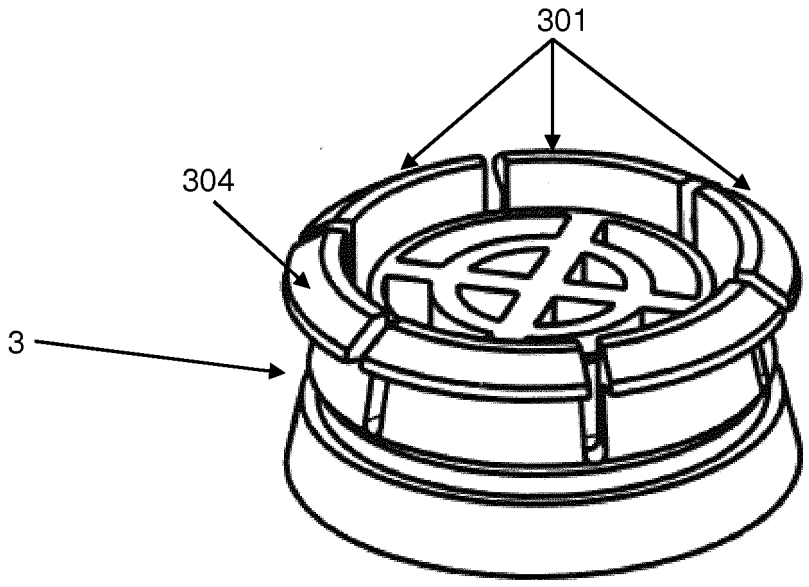

Fig. 4

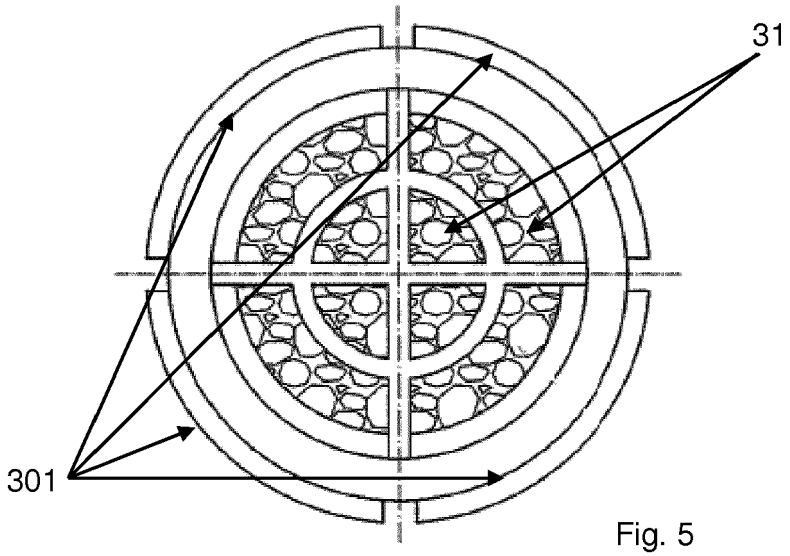

Fig. 5

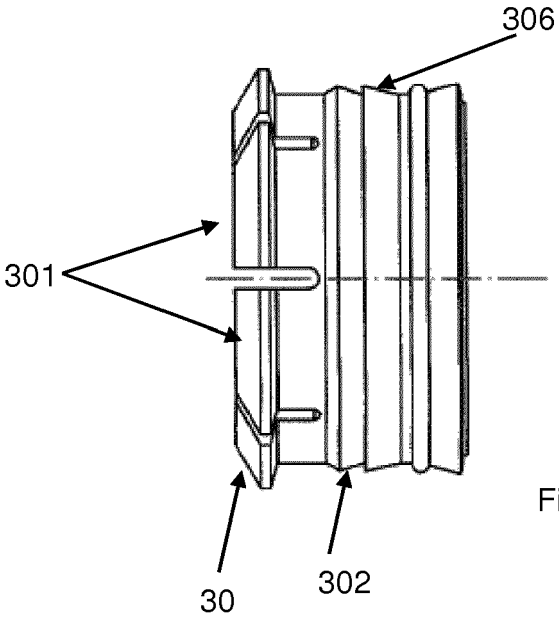

Fig. 6

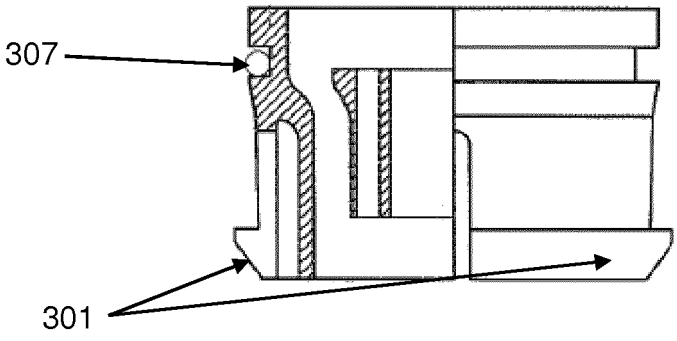

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 2486

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 908 884 A2 (MELEGARI CESARE [IT]) 9 April 2008 (2008-04-09) * paragraph [0031] - paragraph [0038]; figure 4 *	1-10	INV. E21F17/02 E21F16/00 E21F16/02
A	EP 1 911 886 A1 (MELEGARI CESARE [IT]) 16 April 2008 (2008-04-16) * paragraph [0019] - paragraph [0039]; figure 1 *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

E21F
E21B
E02D
E02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 August 2019	Strømmen, Henrik

CATEGORY OF CITED DOCUMENTS

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21-08-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1908884 A2	09-04-2008	EP 1908884 A2	09-04-2008
		US 2008080931 A1	03-04-2008
EP 1911886 A1	16-04-2008	AT 427386 T	15-04-2009
		EP 1911886 A1	16-04-2008
		ES 2324839 T3	17-08-2009
		US 2008078585 A1	03-04-2008

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