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(54) Method and device for introducing water into a ground layer

(57) Method for introducing water into a ground layer to be infiltrated, comprising the steps of (i) providing a drill formed by a first tube provided at an outer end with a drilling head with a central opening, (ii) inserting the drill into the ground while simultaneously supplying a drilling liquid into the drill, wherein the supplied drilling liquid initially wells up via the drilling head along the outer side of the first tube until the drilling head has reached a depth at which the supplied liquid no longer wells up, (iii) ceasing insertion of the drill into the ground and supply of drilling liquid into the drill as soon as the supplied liquid no longer wells up, (iv) inserting into the first tube an infiltration tube formed by a second tube, the length of which is at least equal to the length of the first tube and the outer diameter of which is smaller than the respective inner diameters of the first tube and of the central opening of the drilling head, the lower end part of which second tube is provided with perforations and the wall of which is otherwise closed, (v) removing the drill from the ground, and (vi) supplying the water into the second tube, wherein the flow rate of the supplied water is limited to a value at which no water wells up along the outer side of the second tube via the end part of this second tube, and device for performing this method.

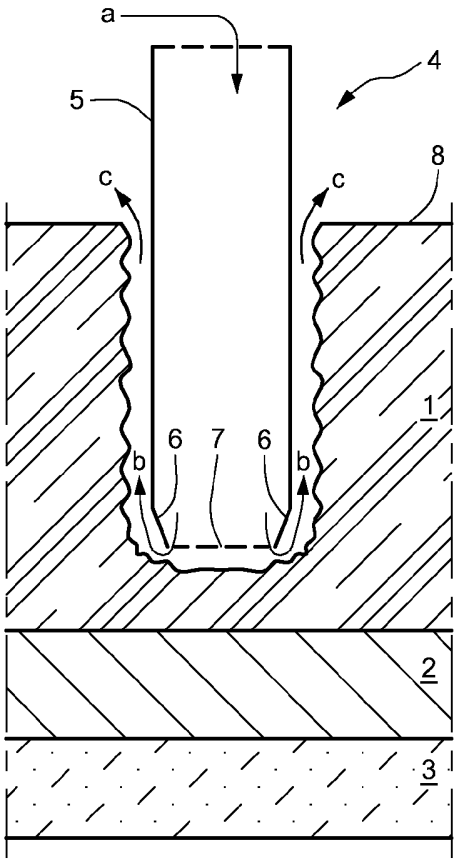

Fig. 1a

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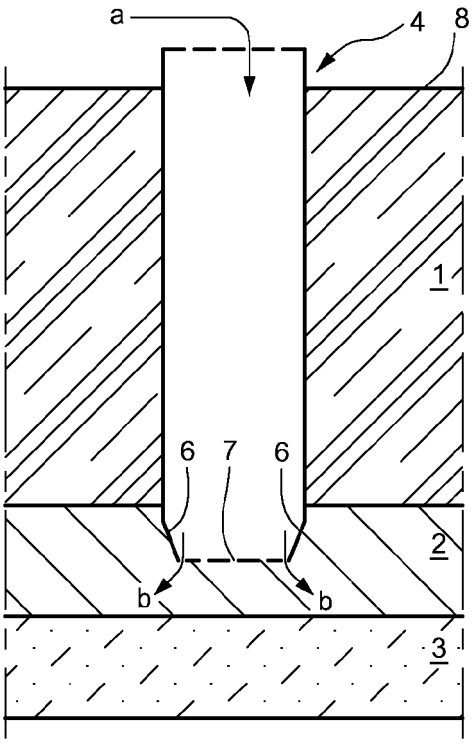

Fig. 1b

Description

[0001] The invention relates to a method for introducing water into a ground layer to be infiltrated.

[0002] Introducing water into a ground layer is a per se known operation which is applied by way of groundwater level control in the vicinity of locations where water is extracted from the ground in order to lower the ground water level, usually temporarily, for example for the purpose of construction operations at such locations.

[0003] According to a known method, at a location deemed suitable on the basis of experience and assessments a so-called infiltration well is drilled with a diameter and depth chosen on the basis of experience, into which is lowered a tube of a smaller diameter provided with perforations, after which the space between the tube and the well wall is filled with gravel. Water is then introduced into the tube thus inserted into the ground and disappears into the ground via the perforations and the gravel packing.

[0004] The known method has the drawback that the capacity of the infiltration well can only be determined afterwards, so that it can only later become apparent that this capacity is too high or too low for the supplied amount of water to be introduced into the ground. Excessive over-dimensioning or under-dimensioning of an infiltration well has the result that this well does not function properly and the exploitation thereof entails additional costs which are in principle unnecessary.

[0005] It is an object of the invention to propose a method for introducing water into a ground layer to be infiltrated which does not have the above recited drawbacks.

[0006] This object is realized, and other advantages gained, with a method of the type stated in the preamble, comprising the steps according to the invention of

(i) providing a drill formed by a first tube provided at an outer end with a drilling head with a central opening,

(ii) inserting the drill into the ground while simultaneously supplying a drilling liquid into the drill, wherein the supplied drilling liquid initially wells up via the drilling head along the outer side of the first tube until the drilling head has reached a depth at which the supplied liquid no longer wells up,

(iii) ceasing insertion of the drill into the ground and supply of drilling liquid into the drill as soon as the supplied liquid no longer wells up,

(iv) inserting into the first tube an infiltration tube formed by a second tube, the length of which is at least equal to the length of the first tube and the outer diameter of which is smaller than the respective inner diameters of the first tube and of the central opening of the drilling head, the lower end part of which second tube is provided with perforations and the wall of which is otherwise closed,

(v) removing the drill from the ground, and

(vi) supplying the water into the second tube, wherein the flow rate of the supplied water is limited to a value at which no water wells up along the outer side of the second tube via the end part of this second tube.

[0007] The method according to the invention is based upon the surprising insight that in step (ii), inserting the drill into the ground while simultaneously supplying a drilling liquid into the drill, the depth which the drilling head has reached at which the supplied fluid no longer wells up is precisely the desired depth at which the absorbing capacity of the ground is at a maximum. Prior to ceasing the supply of drilling liquid as according to step (iii) this absorbing capacity can be determined in simple manner by increasing the flow rate of the drilling liquid until a maximum value is reached, this maximum value corresponding to the absorbing capacity of the ground layer to be infiltrated and also determining the dimensioning of the infiltration tube to be inserted according to step (iv).

[0008] The invention further relates to an assembly for a device for performing the above described method for introducing water into a ground layer to be infiltrated, the assembly comprising: a drill formed by a first tube provided at an outer end with a drilling head with a central opening, and an infiltration tube formed by a second tube, the length of which is at least equal to the length of the first tube and the outer diameter of which is smaller than the respective inner diameters of the first tube and of the central opening of the drilling head, the lower end part of which second tube is provided with perforations and the wall of which is otherwise closed.

[0009] In a drill for such an assembly the drilling head comprises for instance a hollow cylinder, a peripheral edge of which is provided with drilling elements.

[0010] In order to increase the speed of drilling, the drilling head is preferably provided with turbulence-generating means, which are for instance formed by drilling elements extending in axial and radially inward direction from the peripheral edge of the hollow cylinder or by an internal peripheral edge in the drilling head.

[0011] In an embodiment the infiltration tube for an assembly according to the invention is provided with at least one support body above the lower end part for supporting a nozzle extending into the lower end part.

[0012] The support body comprises for instance an internal peripheral edge.

[0013] In an embodiment an infiltration tube provided with a support body is provided with a nozzle supporting on the support body and extending into the lower end part for the purpose of injecting water to be introduced into the lower end part.

[0014] A nozzle results in an increase in the flow rate of the introduced water for infiltration into the ground layer.

[0015] In a practical advantageous embodiment the nozzle can be releasably coupled to a rod which can extend through the second tube.

[0016] A releasably coupled nozzle provides the advantage that it can be placed in the infiltration tube in

simple manner.

[0017] In order to enable easy removal of the nozzle from the infiltration tube for the purpose of maintenance or repair, in an embodiment it is coupled to a cable which can extend through the second tube.

[0018] In order to further increase the flow rate of the introduced water for infiltration into the ground layer, the nozzle is preferably provided with turbulence-generating means.

[0019] In another embodiment such a nozzle is provided by a third tube, wherein the turbulence-generating means comprise obstacles extending from the inner wall of this third tube.

[0020] The invention will be elucidated hereinbelow on the basis of exemplary embodiments and with reference to the drawings.

[0021] In the drawings

Fig. 1a - Fig. 1e show a schematic view of an embodiment of a method according to the invention for introducing water into a ground layer to be infiltrated, in successive steps and in axial cross-sections through the drill and the infiltration tube.

Fig. 2 is a perspective view of the head of a drill according to the invention,

Fig. 3 is a schematic view of an embodiment of an infiltration tube according to the invention, in axial cross-section through this tube, and

Fig. 4 shows in axial cross-section a detail of the infiltration tube of fig. 3.

[0022] Corresponding parts are designated in the figures with the same reference numerals.

Fig. 1a shows a ground with a water-bearing layer 2 between a surface layer 1 and a deeper layer 3, neither of which bear any water. Inserted into surface layer 1 is a drill 4 which consists of a tube 5 provided with a drilling head 6 with a central opening 7. During drilling a drilling liquid (for example water) is fed into tube 5 (represented by arrows a), which initially wells up via drilling head 6 (represented by arrows b) along the outer side of tube 5 and emerges (represented by arrows c) at the ground level 8.

Fig. 1b shows the situation in which drilling head 6 has reached the water-bearing ground layer 2, wherein the supplied drilling liquid (arrows a) flows out via opening 7 in drilling head 6 (arrows b) and is taken up into ground layer 2.

Fig. 1c shows the situation in which the supply of drilling liquid has been stopped and an infiltration tube 9 is inserted into drill 4. Infiltration tube 9 consists of a closed casing 10 and an end part 11 provided with perforations and extending into the drilling head 6. An extension 12 is placed on infiltration tube 9.

Fig. 1d shows the situation in which drill 4 has been partially withdrawn from the ground 1, 2, wherein infiltration tube 10, 11 remains behind and protrudes with its perforated end part 11 into ground layer 2.

Fig. 1e shows the situation in which drill 4 and extension 12 have been removed and water is introduced into infiltration tube 9 (represented by arrow A) which at the bottom of tube 9 is taken up into the water-bearing layer 2 via the perforations in end part 11 and the open outer end (represented by arrows B).

Fig. 2 shows a drilling head 6 with three drill bits 14 which are placed along the tops of a wave-shaped peripheral edge 15 of a hollow cylinder 13. Drill bits 14 extend in axial and radially inward direction and bound at their outer ends a central opening (shown by broken line 7). Turbulences are generated in the supplied drilling liquid by the radially inward direction of drill bits 14. In order to further enhance the creation of turbulences in the drilling liquid an interior peripheral edge (shown by broken lines 16) is arranged in the casing of cylinder 13.

Fig. 3 shows an infiltration tube 9 which has been inserted into a ground layer 1, 2, 3. Arranged on the underside of the closed tube casing 10, just above the perforated end part 11, is an interior peripheral edge 17 on which rests a nozzle 18 with tubular end part 20. End part 20 of nozzle 18 just protrudes into the perforated end part 11 of infiltration tube 9. Nozzle 18 is coupled releasably to a tube 19 which extends outside infiltration tube 9.

Fig. 4 shows nozzle 18 in detail with, in addition to the parts already mentioned, a number of turbulence-generating protrusions 21 comprising obstacles extending from the inner wall of tube 20.

Claims

1. Method for introducing water (A) into a ground layer (2) to be infiltrated, comprising the steps of

   (i) providing a drill (4) formed by a first tube (5) provided at an outer end with a drilling head (6) with a central opening (7),

   (ii) inserting the drill (4) into the ground (1, 2) while simultaneously supplying a drilling liquid (a) into the drill (4), wherein the supplied drilling liquid (a) initially wells up (c) via the drilling head (6) along the outer side (b) of the first tube (5) until the drilling head (6) has reached a depth at which the supplied liquid (a) no longer wells up,

   (iii) ceasing insertion of the drill (4) into the ground (1, 2) and supply of drilling liquid (a) into the drill (4) as soon as the supplied liquid no longer wells up,

   (iv) inserting into the first tube (5) an infiltration tube (9) formed by a second tube (10), the length of which is at least equal to the length of the first tube (5) and the outer diameter of which is small-

er than the respective inner diameters of the first tube (5) and of the central opening (7) of the drilling head (9), the lower end part (11) of which second tube (10) is provided with perforations and the wall of which is otherwise closed,
(v) removing the drill (4) from the ground (1, 2), and
(vi) supplying the water (A) into the second tube (10), wherein the flow rate of the supplied water (A) is limited to a value at which no water wells up along the outer side of the second tube (10) via the end part (11) of this second tube (10).

2. Method as claimed in claim 1, wherein the drilling head (6) comprises a hollow cylinder (13), a peripheral edge (15) of which is provided with drilling elements (14).

3. Method as claimed in any of the claims 1-2, wherein the drilling head (6) is provided with turbulence-generating means (14, 16).

4. Method as claimed in claim 3, wherein the turbulence-generating means are formed by drilling elements (14) extending in axial and radially inward direction from the peripheral edge of the hollow cylinder (13).

5. Method as claimed in any of the claims 3-4, wherein the turbulence-generating means are formed by an internal peripheral edge (16) in the drilling head (13).

6. Method as claimed in any of the claims 1-5, wherein the infiltration tube (9) is provided with at least one support body (17) above the lower end part (11) for supporting a nozzle (18, 20) extending into the lower end part (11).

7. Method as claimed in claim 6, wherein the support body comprises an internal peripheral edge (17).

8. Method as claimed in any of the claims 6-7, wherein the infiltration tube (9) is provided with a nozzle (18, 20) supporting on the support body (17) and extending into the lower end part (11) for the purpose of injecting water to be introduced into the lower end part (11).

9. Method as claimed in claim 8, wherein the nozzle (18, 20) can be releasably coupled to a rod (19) which can extend through the second tube (5).

10. Method as claimed in any of the claims 8-9, wherein the nozzle (18, 20) is coupled to a cable which can extend through the second tube (5).

11. Method as claimed in any of claims 8-10, wherein the nozzle (18, 20) is provided with turbulence-generating means (21).

12. Method as claimed in claim 11, wherein the nozzle (18, 20) is provided by a third tube (20), and the turbulence-generating means comprise obstacles (21) extending from the inner wall of this third tube (20).

13. Assembly (4, 9) for a device for performing a method as claimed in claim 1 for introducing water into a ground layer (2) to be infiltrated, comprising:

a drill (4) formed by a first tube (5) provided at an outer end with a drilling head (6) with a central opening (7), which drilling head (6) comprises a hollow cylinder (13), a peripheral edge (15) of which is provided with drilling elements (14), and an infiltration tube (9) formed by a second tube (10), the length of which is at least equal to the length of the first tube (5) and the outer diameter of which is smaller than the respective inner diameters of the first tube (5) and of the central opening (7) of the drilling head (6), the lower end part (11) of which second tube (10) is provided with perforations and the wall of which is otherwise closed, **characterized in that** the drilling head (6) is provided with turbulence-generating means (14, 16).

14. Assembly (4, 9) as claimed in claim 13, **characterized in that** the infiltration tube (9) is provided with an internal peripheral edge (17) above the lower end part (11) for supporting a nozzle (18, 20) extending into the lower end part (11).

15. Assembly (4, 9) as claimed in any of the claims 13-14, **characterized in that** the infiltration tube (9) is provided with a nozzle (18, 20) extending into the lower end part (11) for injecting water to be introduced into the lower end part (11).

16. Assembly (4, 9) as claimed in claim 15, **characterized in that** the nozzle (18, 20) is provided by a third tube (20) and is provided with turbulence-generating means comprising obstacles (21) extending from the inner wall of this third tube (20).

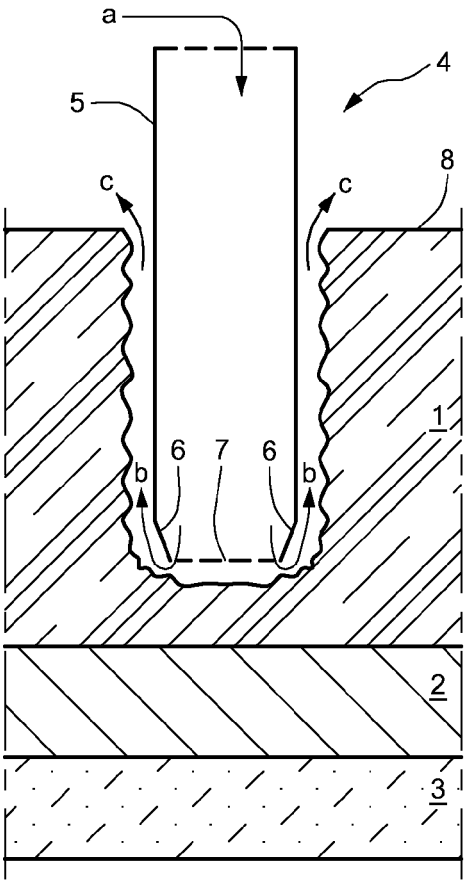

Fig. 1a

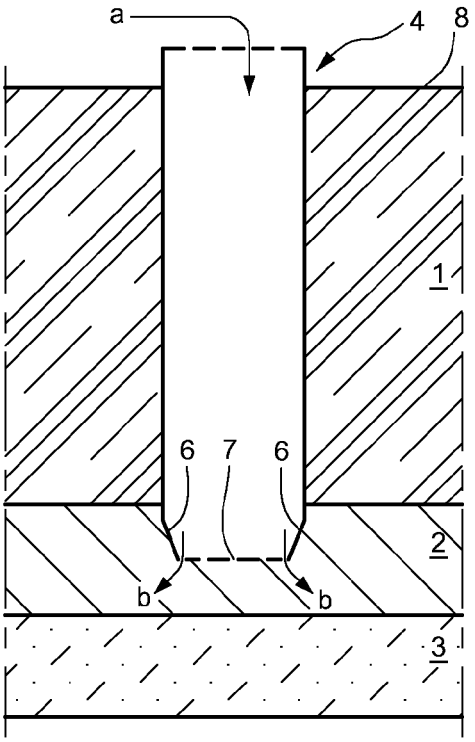

Fig. 1b

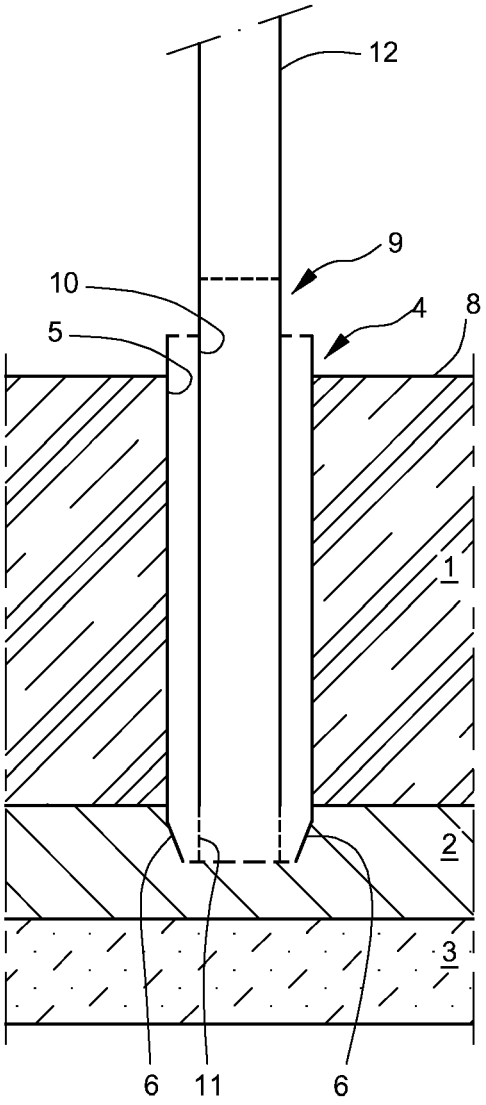

Fig. 1c

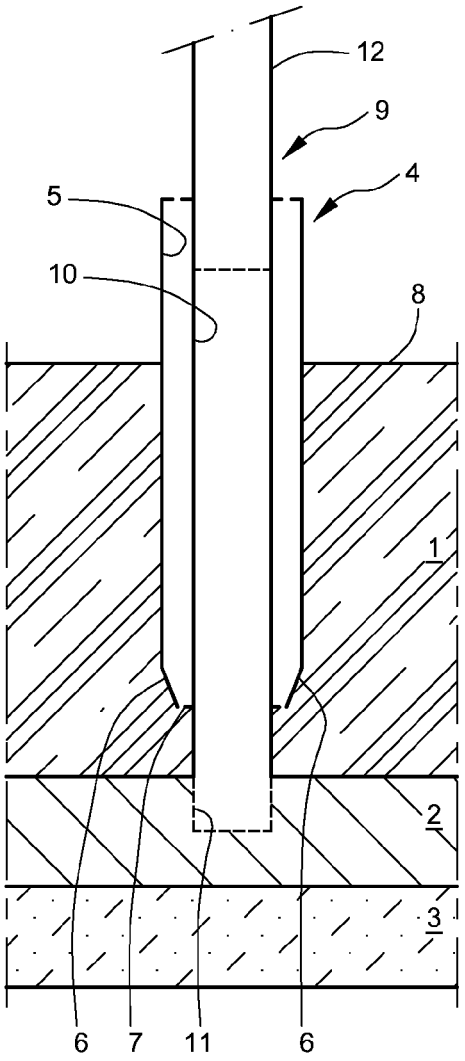

Fig. 1d

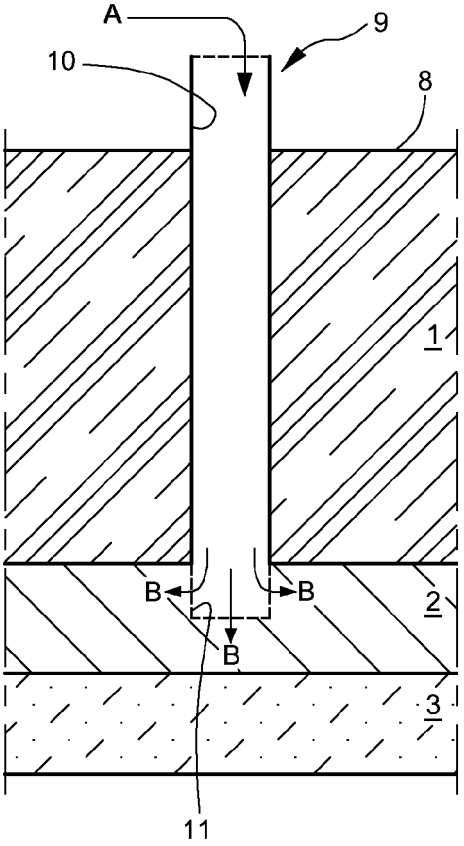

Fig. 1e

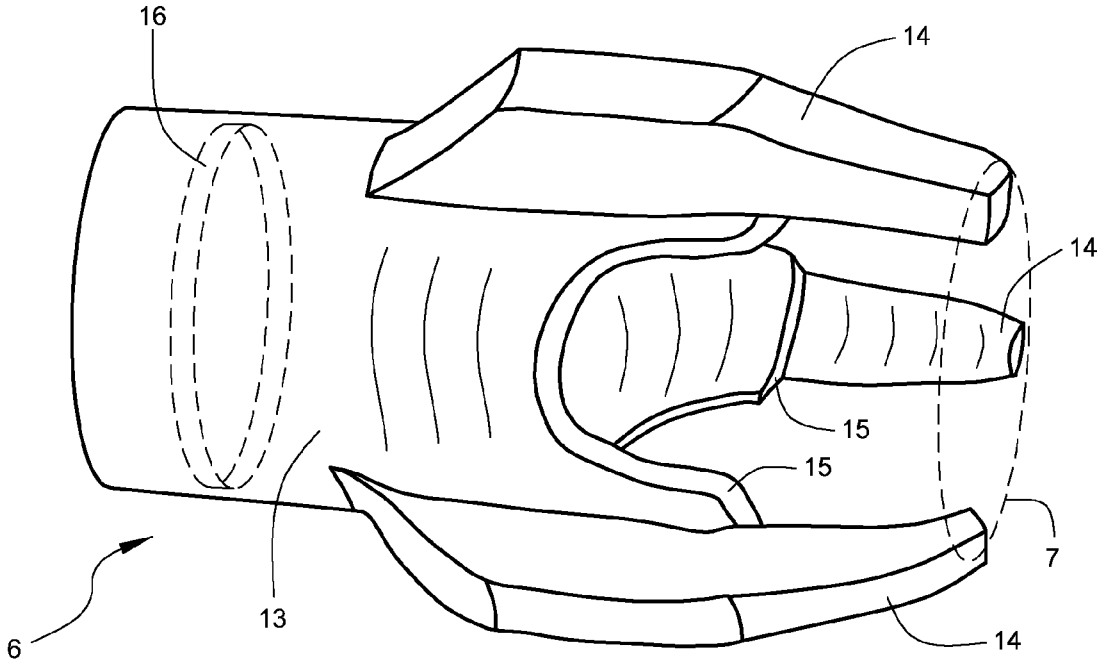

Fig. 2

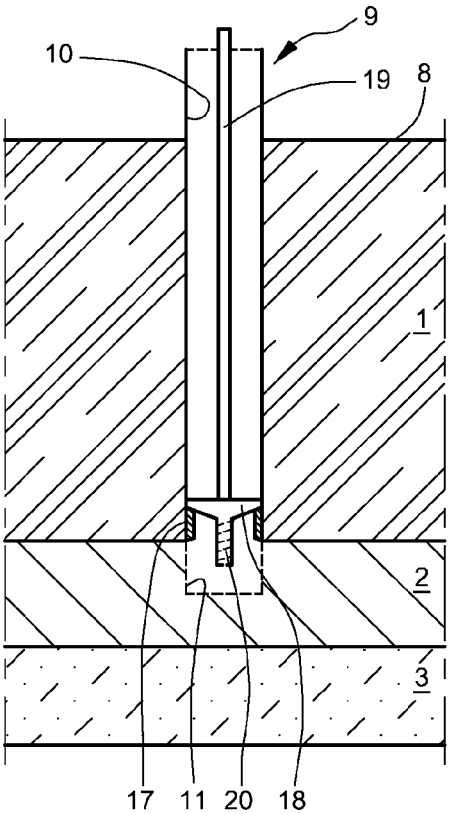

Fig. 3

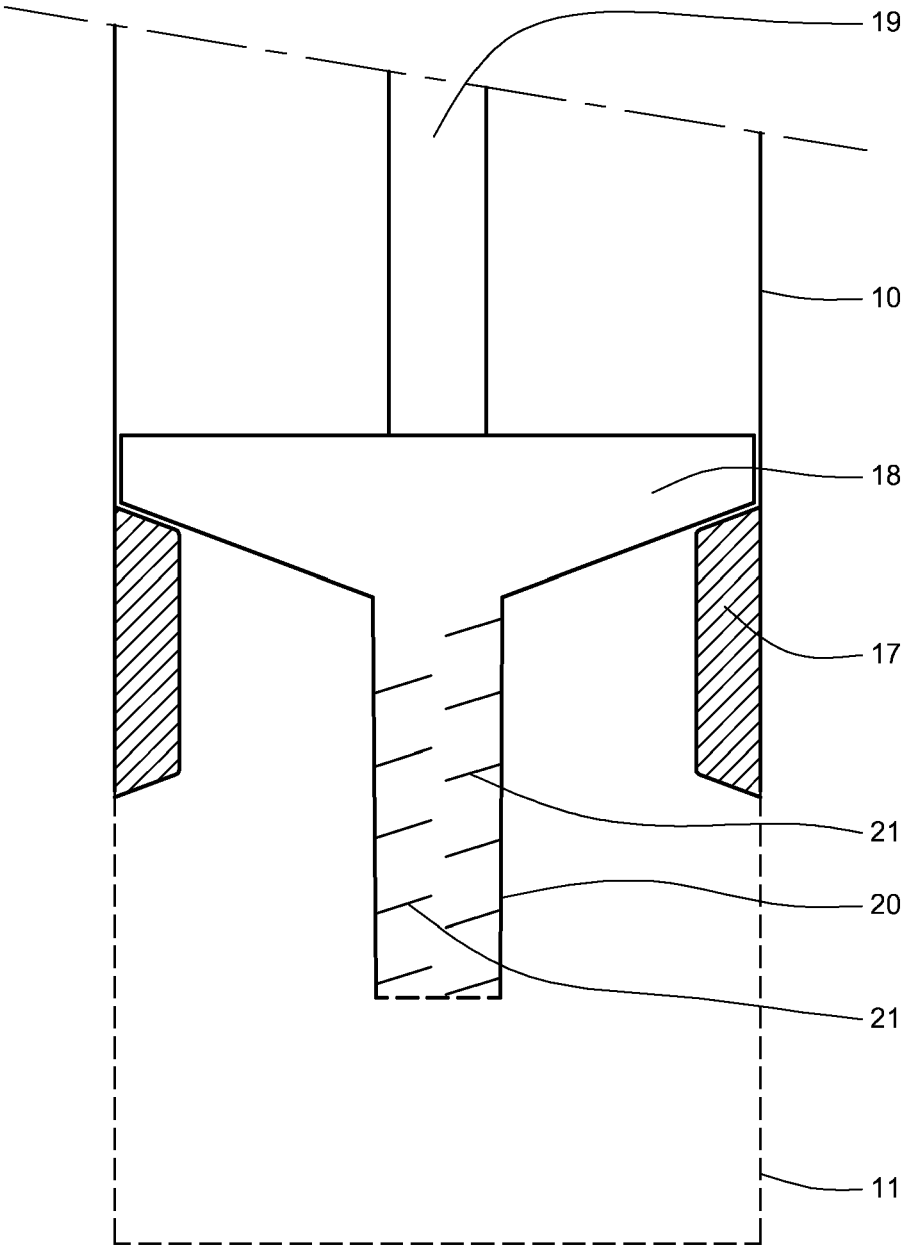

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 0226

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* zamenvatting WPI 1994-157684 * * figure *	1-12	

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A	* page 3, lines 18-36 * * figures *	1-12	

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			E03B E21B E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 September 2011	Urbahn, Stephanie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 0226

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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26-09-2011

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