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(54) **Title:** A DRAINING PIPE MESH

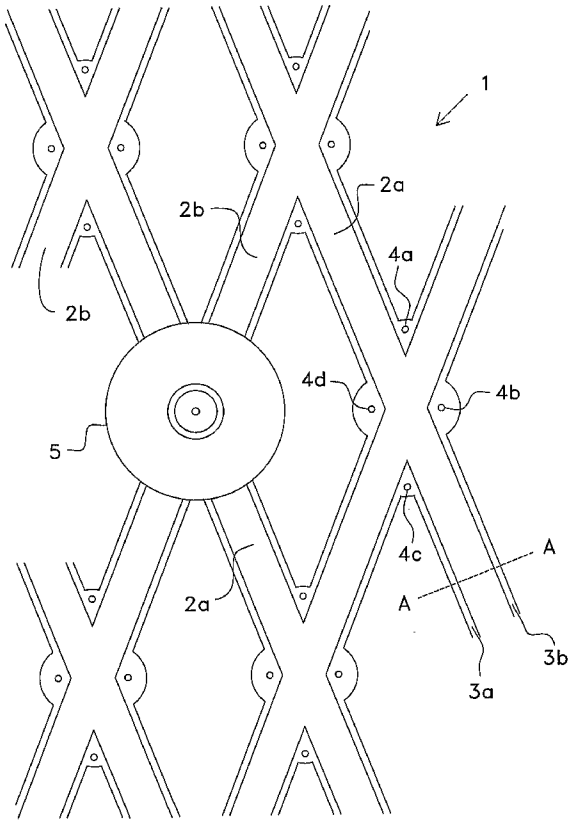


Fig. 1

(57) **Abstract:** The invention relates to a draining pipe mesh (1), which is adapted for mounting on a surface and for being covered by shotcrete. The mesh is made from a resilient substance and it is arranged to be laid over surfaces of any chosen shape and surface texture, such as the interior walls of a tunnel. The invention further relates to such a draining pipe mesh (1) which is provided with intersection boxes (5). The intersection box (5) is provided with access tubes (8) adapted to extend to the surface of the shotcrete. In a particularly advantageous embodiment of the invention, the access tubes (8) may be provided with flushing units (14) or pressure indicators (15).

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A draining pipe mesh

The present invention relates to a draining pipe mesh according to the introductory portion of the independent claim.

Background of the invention

Draining of tunnels or the interior surfaces of other constructions is often necessary. An example of a fixed construction with draining channels is disclosed by US4395381. Here, condensing water has to be drained so the walls are provided with draining channels fixed to the walls. Obviously, the channels have to be shaped such that they are adapted to the particular shape of a chosen fixed construction, and the draining channels are not adapted to be arranged on surfaces of any chosen shape and texture.

EP1035300D3 discloses a set of channels for drainage where the channels are arranged in a tree like structure. In the tree like structure, two or more incoming channels intersect and merge into a single outgoing channel. This outgoing channel in turn intersects new outgoing channels which in turn merge into a new channel. With this tree like structure, clogging of a major channel, ie. a trunk channel, would block drainage from a large part of the tree like structure, which is disadvantageous.

An object of the invention is therefore to provide draining pipe mesh which is more resilient to blockages and adapted to be arranged on surfaces of varying shape.

A further object of the invention is to provide draining pipe mesh which is provided with means to prevent blockages.

These and other objects are attained by a draining pipe mesh according to the characterising portion of the independent claim.

Summary of the invention

The invention relates to a draining pipe mesh 1, which is adapted for mounting on a surface and for being covered by a substance 10-12, such as shotcrete. The mesh is made from a resilient

substance and it is advantageously arranged to be laid over surfaces of any chosen shape and surface texture, such as the interior walls of a tunnel. The mesh shape further gives liquid or gas being drained many different alternative routes, minimising the effect of a particular part of a pipe being clogged.

The invention further relates to such a draining pipe mesh 1 which is provided with at least one intersection box 5 arranged at an intersection between pipes. The intersection box 5 is provided with access tubes 8 adapted to extend to the surface of the covering substance 10-12. In a particularly advantageous embodiment of the invention, the access tubes 8 may be provided with flushing units 14 or pressure indicators 15.

Brief description of the drawings

Fig. 1 shows a first embodiment of the draining pipe mesh

Fig. 1b shows a cross section of the draining pipe mesh along A-A

Fig. 2 shows a tunnel wall with the draining pipe mesh in cross section

Fig. 3 shows in cross section an intersection box attached to the draining pipe mesh

Fig. 4 shows in cross section an intersection box with an attached flushing unit

Fig. 5 shows in cross section an intersection box with a pressure indicator

Fig. 6 shows the intersection box with the pressure indicator in a pressurised state

Fig. 7 shows the intersection box at an angle

Description of preferred embodiments

Fig. 1 shows a first embodiment of the draining pipe mesh 1. The mesh is constituted by a network of pipes, made up of two sets of pipes 2a, b. The pipes in each of the two sets are equally spaced apart and parallel to each other, directed mainly downwards. The first set 2a is angled at an acute angle towards right, the other set 2b towards left. The two sets of pipes

intersect each other at an array of intersection areas. By mesh is here meant a net like structure comprising a set of elongated elements, where a number of elements intersect other elements such that they surround sections not covered by the elongated elements. It is here embodied with rhomboid sections, but the sections may obviously be square shaped, hexagonal or the sections may vary in shape.

As illustrated in fig. 1b, which shows a cross section of the draining pipe along A-A, the pipes have an essentially U-shaped cross section and extend from the surface they a laid upon. The edges of the U-shaped pipes align with the surface and along both sides extend narrow bands 3a, b over the surface. The bands are intended to prevent shotcrete from entering the pipes when sprayed over them. The initially downwards open U-shaped pipes are not closed and constitute pipes in the ordinary sense of the word until they have been covered by shotcrete, but the word pipe is here used to denote the U-shaped elements themselves and the same elements that when aligned on a surface and covered by some filling substance effectively constitute pipes.

As seen in fig. 1 the bands 3a, b extend from the edges of the pipes along most of the length between the intersection areas. At the intersection areas fastening portions 4a-d extends from the edges of the pipes over the underlying surface in a fashion similar to the bands. The fastening portions extend further from the pipes than the bands and are provided with bores for receiving nails or similar while temporarily attaching the mesh towards the surface before concrete is sprayed over it. The areas between the pipes are essentially rhombus shaped and give access to at least fifty percent of the underlying surface in order for the concrete to have a sufficient area to adhere to.

At one of the intersection, the pipes are attached to an intersection box 5. Intersection boxes are arranged at regular intervals where needed. The intersection box is further illustrated in fig. 7 and is essentially a cylindrical element, open at its bottom and top, with four receiving arms 6a-d extending from openings from the sides of the box. The receiving arms are similar in design to the draining pipes but slightly wider and higher, in order to be able to receive draining pipes in each of them at an intersection area. When the intersection area has been received into the intersection box, the pipes are cut inside the box such that the pipes are connected to the box. The intersection box is then covered by a lid 7, illustrated in fig. 3.

Fig. 3 shows in cross section an intersection box 5 attached to the draining pipe mesh 1. The

mesh and box are placed on a tunnel wall and are covered by concrete. The lid 7 on the box is provided with an opening from which extends a short tube portion. An access tube is connected to the short tube portion and the access tube extends through layers of concrete and other substances covering the pipe mesh, leaving an access to the interior of the pipe mesh. The access tube is held tightly around the short tube using bentonite waterstop strip 9 such as Quellmax.

The intersection boxes and draining pipe mesh is first covered by a first layer of ordinary shotcrete, which attaches the pipe mesh to the surface and seals the mesh such that only water emanating from cracks 13 in the surface can enter the pipes from below. The pipe mesh the drains this water flow and let it exit at suitable places. On top of the ordinary shotcrete is an at least 50 mm thick layer of watertight shotconcrete 11. The shotcrete may be made watertight by addition of crystallizing substances, such as Xypex, ICS/Penetron or similar. This layer may also be reinforced with steel or plastic fibre. The next layer is a heat insulating shotcrete 12 with addition of ia. expanded Perlit or foaming agents. This layer may too be reinforced with steel or plastic fibre. The topmost two layers may be constituted by a single, both watertight ang thermally insulating layer.

The thermally insulating layer protects the underlying layer against freezing, thereby mitigating the risk of cracking as a result of ice building up beneath the shotcrete.

Fig. 4 shows in cross section an intersection box with an attached flushing unit 14 having a check valve. The flushing unit is used to supply water under pressure to the pipe mesh, in order to remove accumulated substances in the mesh.

Fig. 5 shows in cross section an intersection box with a pressure indicator 15. The pressure indicator is normally pushed fully into the access tube and is provided with an indication stick 16 that in the figure does not extend from the surface of the shotcrete. The pressure indicator is tightly arranged in the access tube using O-rings 17a, b. If part of the mesh is being clogged, water pressure in that part of the mesh increases, forcing the pressure indicator out.

Fig. 6 shows the intersection box with the pressure indicator in a pressurised state, and here the pressure indicator has been forced out though the access tube by the water pressure. The indication stick extends out from the outer surface of the shotcrete, indication high pressure, that is part of the pipe mesh has been clogged. It may then be flushed clear of debris that clogs it..

The pressure indicator propagates outwards when the pressure has increased beyond a chosen threshold, and is prevented from leaving the access tube at its furthest by an element limiting its maximum propagation. The pressure indicator may also be provided with electrical sensors that sense that it has reached this movement limiting element. In the figure these sensors 18a, b are illustrated as electrodes extending from the outermost face of the pressure indicator. As the electrodes are brought into contact with the movement limiting element, they are electrically connected to each other through the electrically conducting limiting element. One thus achieves an electrical signal that indicates increased pressure. Obviously, the sensors may be embodied differently, such as using electromechanical switches.

Fig. 2 shows a tunnel wall with the draining pipe mesh 1 in cross section. An access tube 8 exits the outermost shotcrete layer. The pipe mesh extends over the top and sides of the tunnel interior wall but the pipes are left open at the bottom, such that water may exit downwards and be removed through further pipes or similar.

Although the invention has been described in conjunction with a number of preferred embodiments, it is to be understood that various modifications may still be made without departing from the scope of the invention as defined by the appended claims.

Claims

1 A draining pipe mesh (1), **characterised in** that said pipe mesh (1) is adapted for mounting on a surface and for being covered by a substance (10-12).

2 A draining pipe mesh (1) according to claim 1, **characterised in** that said pipe mesh (1) is provided with at least one intersection box (5) arranged at an intersection between pipes, where said intersection box (5) is provided with access tubes (8) adapted to extend to the surface of the covering substance (10-12).

3 A draining pipe mesh (1) according to claim 2, **characterised in** that at least one of said access tubes (8) is provided with a flushing unit 14.

4 A draining pipe mesh (1) according to claim 2 or 3, **characterised in** that at least one of said access tubes (8) is provided with a pressure indicator 15.

5 A draining pipe mesh (1) according to any one of the preceding claims **characterised in** that pipe mesh (1) is made from a resilient substance.

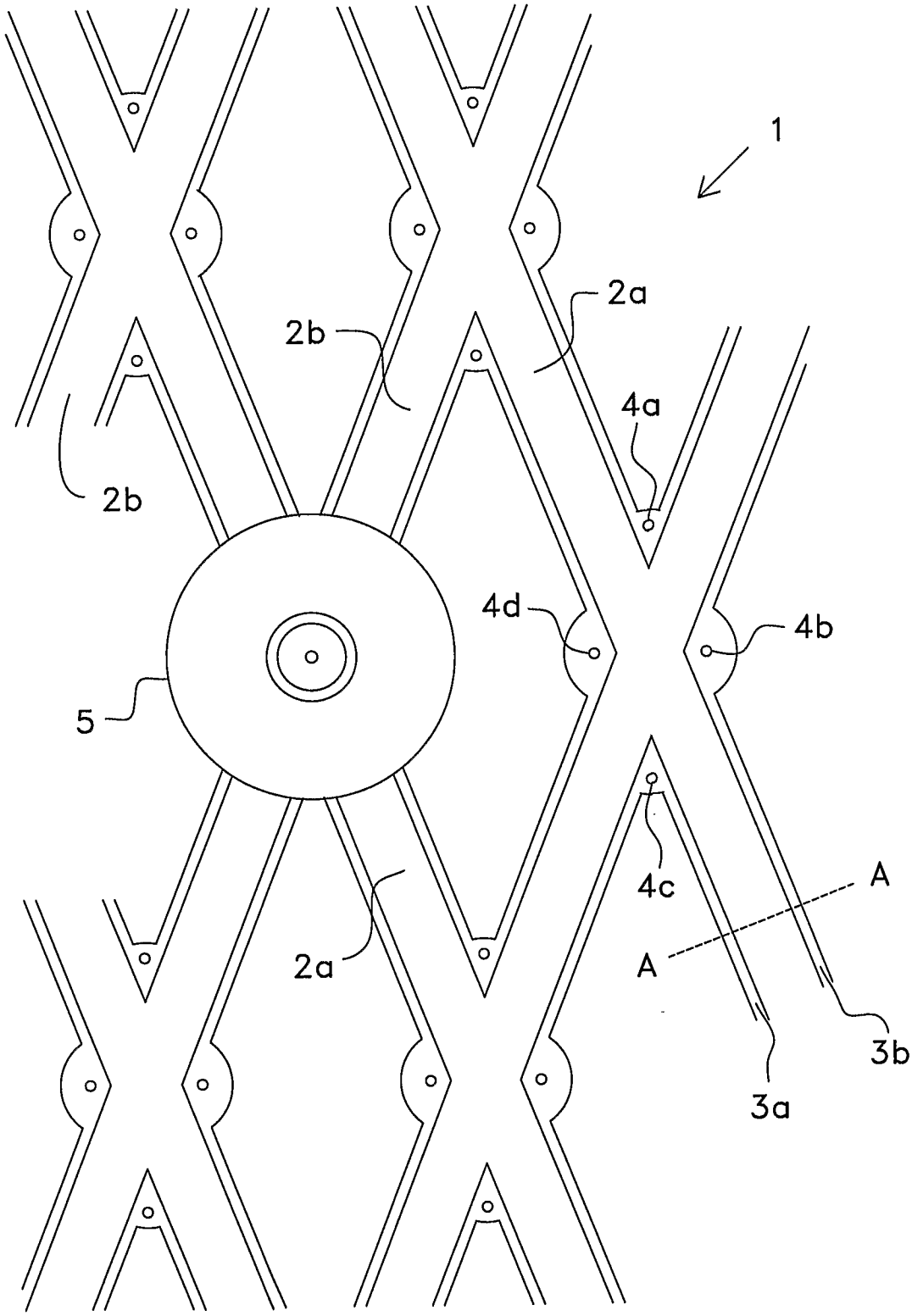


Fig. 1

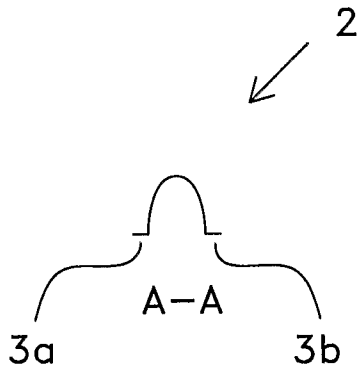


Fig. 1b

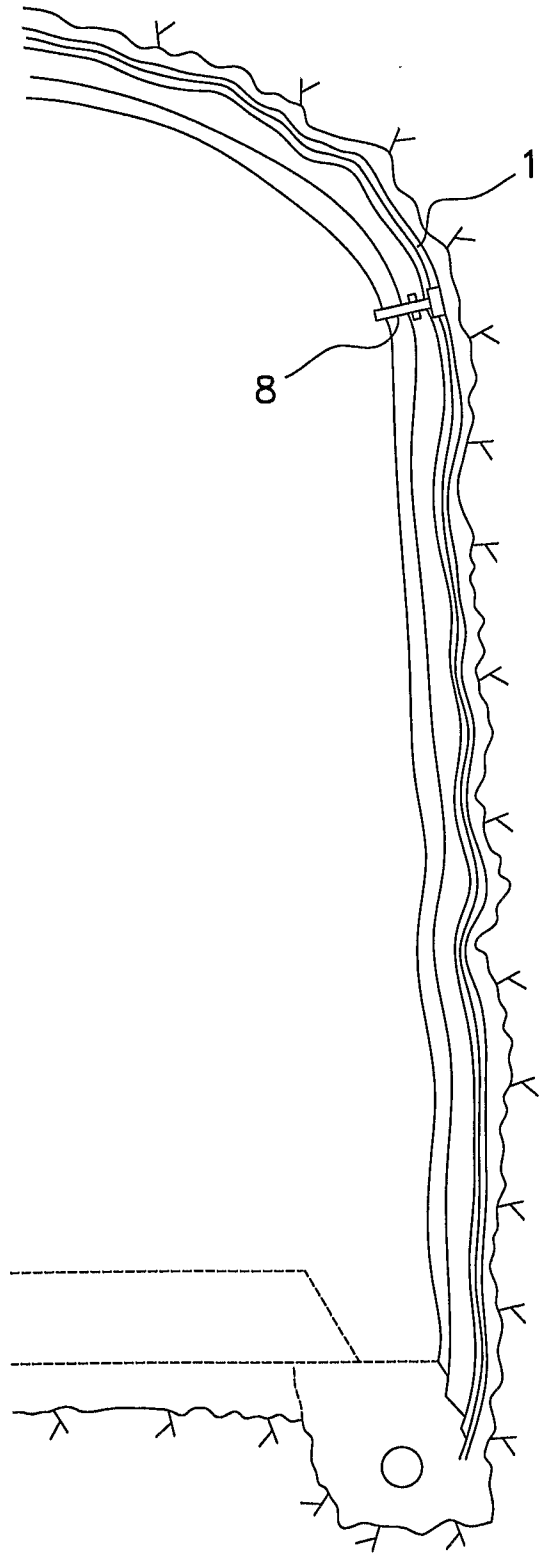


Fig. 2

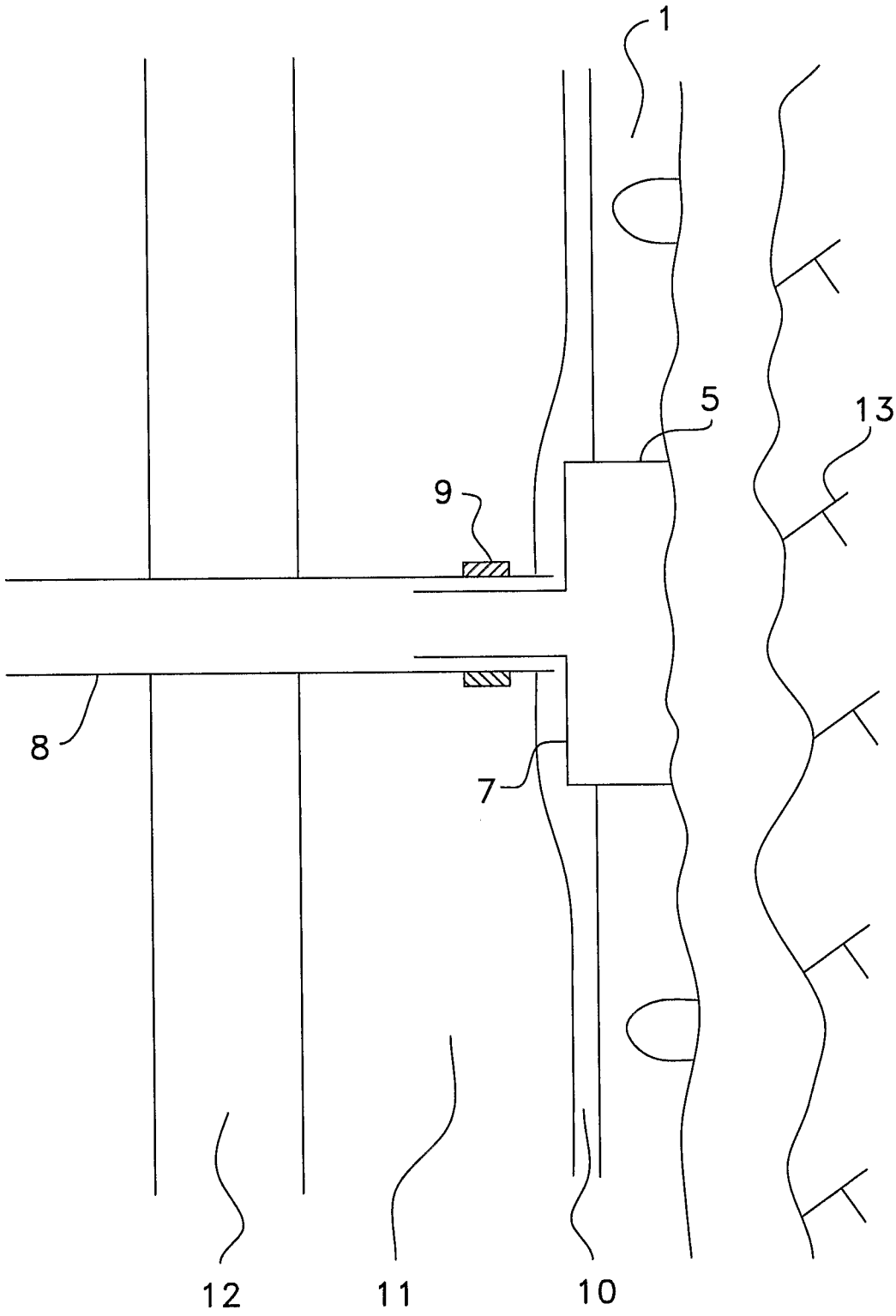


Fig. 3

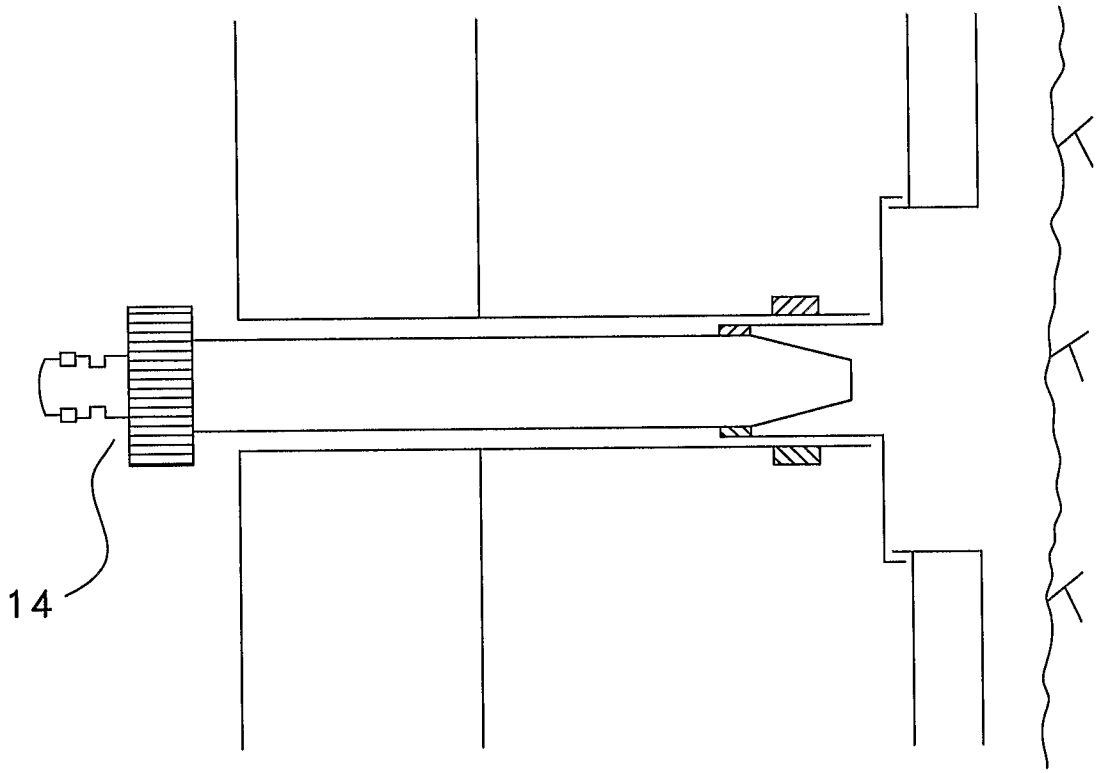


Fig. 4

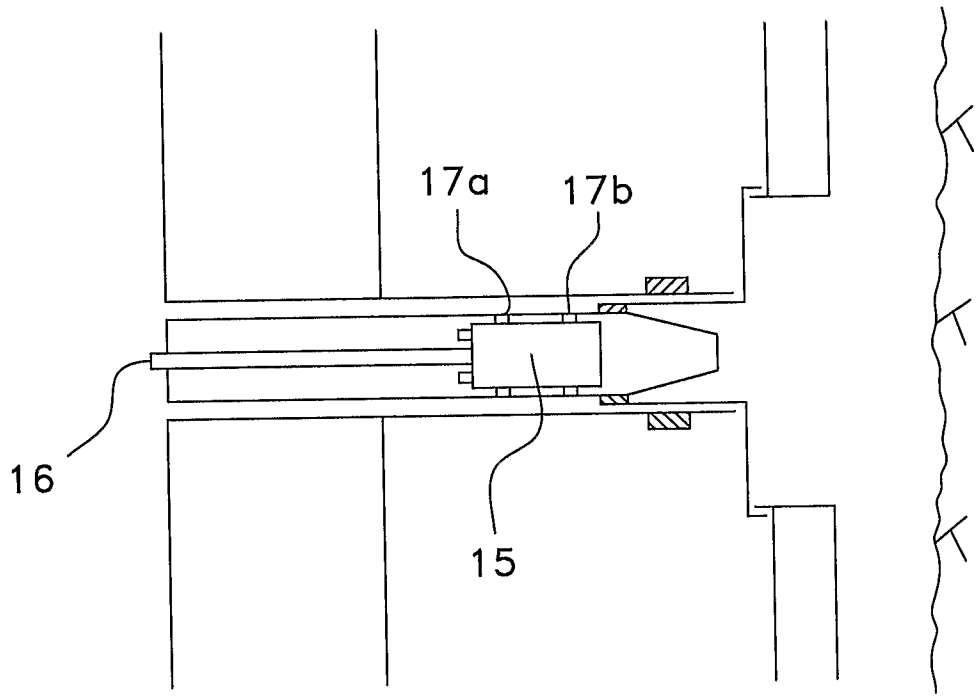


Fig. 5

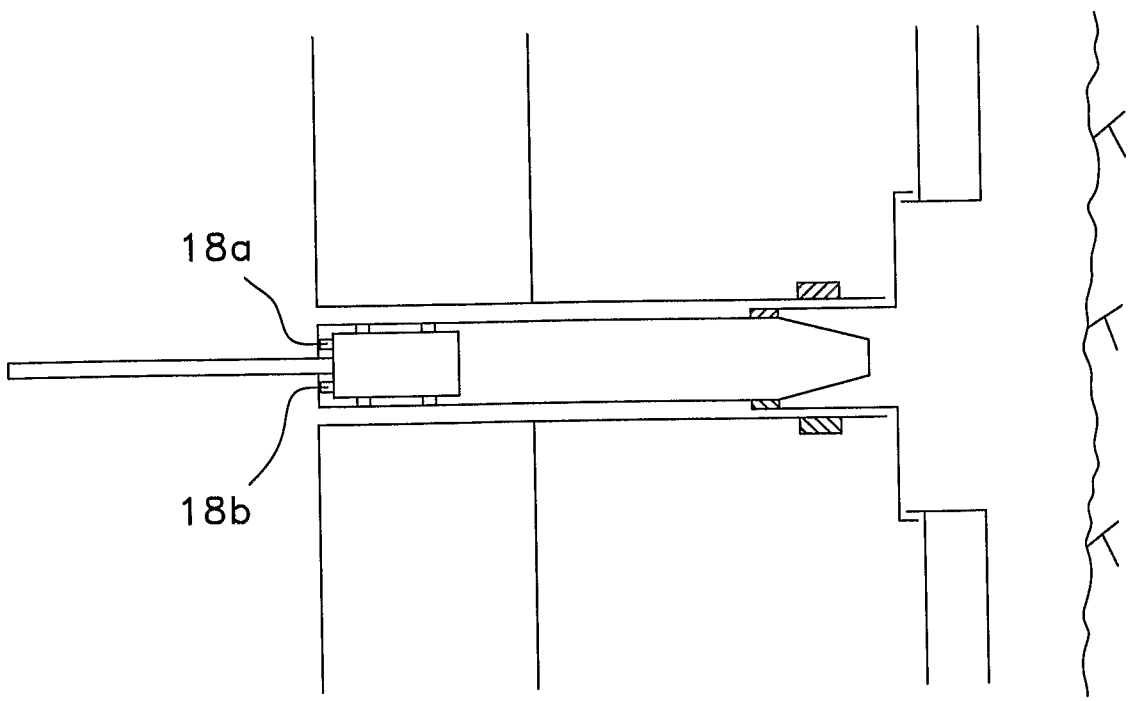


Fig. 6

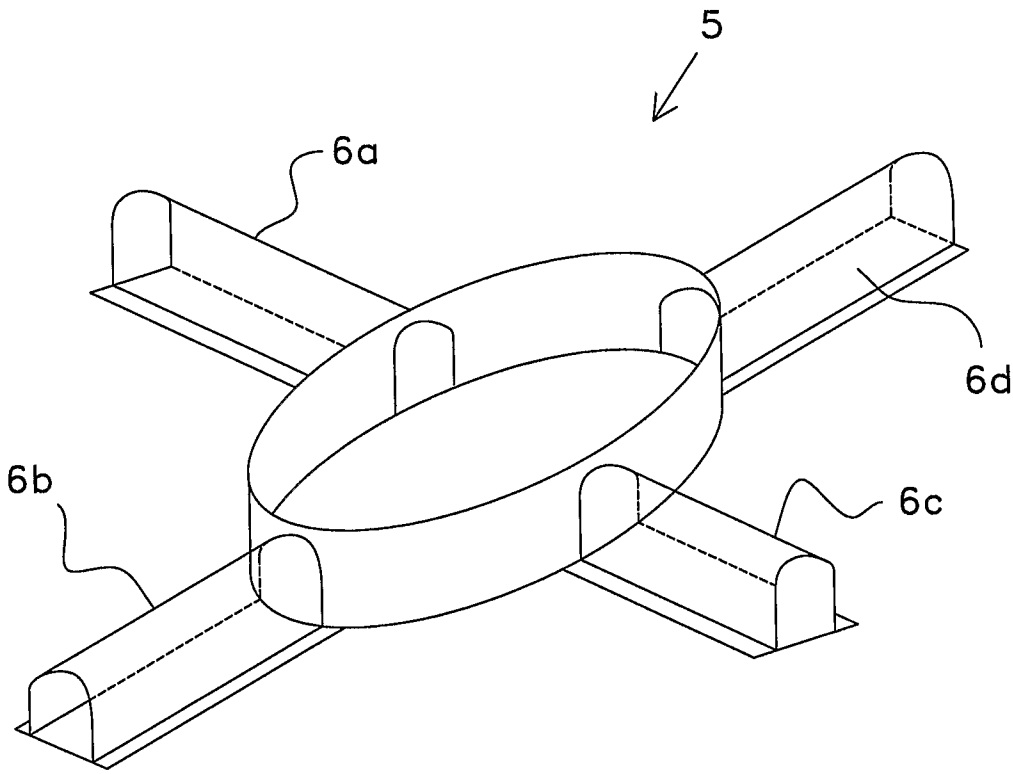


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/000418

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21F, E21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1035300 A1 (FOSROC INTERNATIONAL LIMITED), 13 Sept 2000 (13.09.2000), column 3, line 2 - line 3, figure 1	1,5
	--	
A	EP 0738825 A1 (GUBLER, H. ET AL), 23 October 1996 (23.10.1996)	1.5
	--	
A	GB 2258480 A (ISOLA A/S), 10 February 1993 (10.02.1993)	1-5
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 October 2008	07-10-2008
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Christer Bäcknert / MRo Telephone No. +46 8 782 25 00

International patent classification (IPC)

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Use the application number as username.
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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

EP	1035300	A1	13/09/2000	AT	249570	T	15/09/2003
				CA	2265104	A	09/09/2000
				CH	691697	A	14/09/2001
				DE	19738488	A	11/03/1999
				DE	69911163	D,T	24/06/2004
EP	0738825	A1	23/10/1996	NONE			
GB	2258480	A	10/02/1993	DE	4225883	A,C	11/02/1993
				GB	9213663	D	00/00/0000
				NO	913052	D	00/00/0000