(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 January 2014 (03.01.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/001613 A1

(51) **International Patent Classification**:
E02B 15/04 (2006.01) *E02B 15/10* (2006.01)

(21) **International Application Number**:
PCT/FI2013/050623

(22) **International Filing Date**:
10 June 2013 (10.06.2013)

(25) **Filing Language**: Finnish

(26) **Publication Language**: English

(30) **Priority Data**:
20125704 25 June 2012 (25.06.2012) FI

(71) **Applicant**: **M & L PATENT OY AB** [FI/FI]; Sammontie 2 B, FI-10900 Hanko (FI).

(72) **Inventor**: **LUNDIN, Lars Ingram**; Sammontie 2 B, FI-10900 Hanko (FI).

(74) **Agent**: **SEPPO LAINE OY**; Itämerenkatu 3 B, FI-00180 Helsinki (FI).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: OIL COLLECTOR

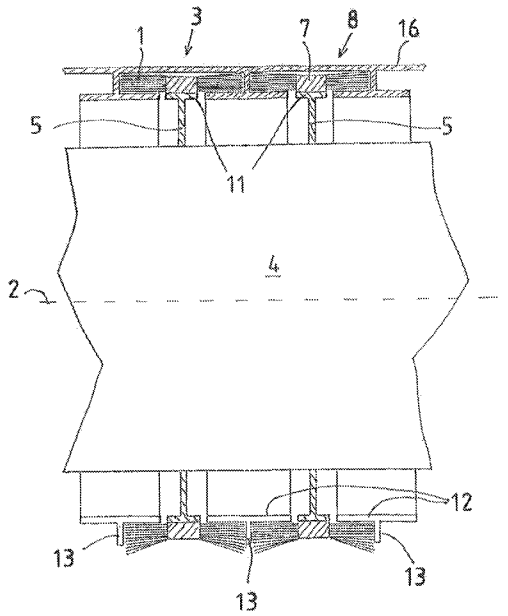


Fig 3

(57) **Abstract**: The invention relates to an oil collector including a brush (3), provided with substantially straight bristles (1) and a horizontal shaft (2), and a cleaning structure in the upper part of the brush for cleaning the brush from oil. According to the invention, the bristles (1) of the brush (3) are substantially parallel to the horizontal shaft (2).

WO 2014/001613 A1

OIL COLLECTOR

FIELD OF THE INVENTION

The invention relates to an oil collector as defined in the preamble of claim 1.

BACKGROUND OF THE INVENTION

A traditional means that has been tried and found to be relatively good in collecting oil from water is a skimmer, i.e. a brush rotated partly in water and partly above the water, wherein the oil adheres to the bristles of the brush and is carried out of the water with the rotation of the brush. The bristles are then cleaned above the water by an appropriate comb structure before rolling once again back into the oily water. A structure based on bristles may be formed by one drum-type brush or alternatively by a brush cassette wherein a belt provided with bristles circulates between two rotating rolls.

However, problems are caused in the prior art by the operation of the brushes particularly in icy oil. Bits of ice are easily caught between radially extending bristles but are not adhered to the bristles; instead, they slip out, bringing along the oil adhered to the bristles. Furthermore, the oil retention capacity of the bristles is not fully satisfactory because the mere centrifugal force of rotation tends to draw oil away from the surfaces of the radial bristles. Thus, the rotational speed of the brushes must be kept quite low so as to prevent back flow of the oil.

OBJECTIVE OF THE INVENTION

The objective of the invention is to remedy the above-mentioned defects. Specifically, the objective of the

invention is to disclose a novel brush structure which is applicable for oil collection, which collects oil better than the prior art, which does not collect any bits of ice from the oil and which keeps the oil better in the bristles until cleaning.

SUMMARY OF THE INVENTION

The oil collector according to the invention is characterized by what has been presented in claim 1.

The oil collector according to the invention includes a brush provided with substantially straight bristles and a horizontal shaft, and a suitable cleaning structure, such as a comb structure, at the upper part of the brush for cleaning the brush from oil. According to the invention, the bristles of the brush are substantially parallel to the horizontal axis of rotation of the brush. Thus, the straight bristles of the brush rotate in the transverse direction, i.e. meet the surface of oily water to be cleaned sideways, i.e. simultaneously over their entire length. In the same way, they rise transversely from the water being cleaned, whereby the centrifugal force caused by the rotation of the brush does not slide the oil in the longitudinal direction of the bristles along the surface thereof; instead, the centrifugal force is exerted on the surface of the bristles in the perpendicular direction. When the bristles are side by side and nearly attached to each other, the oil stays effectively between the bristles and attached to their surfaces.

It is obvious to a person skilled in the art what is meant by the substantially axial orientation of the bristles herein. It is clearly explained in the description how the brush operates differently if the bristles are disposed radially or axially. Since the

bristles are made of a flexible material that changes its direction during use to some extent, it is not reasonable to assume that the bristles be exactly axial at all times. As early as in the manufacturing stage, the bristles that are attached in tight bundles spread out at different angles to some extent, even if they were attached in exactly axial holes or in another exactly axial fashion. Thus, the direction of the bristles is appropriately in practice in the range of ± 20°, preferably ± 10°, for example approximately ± 5° from the axial direction of the brush.

Appropriately, the oil collector is constructed such that it comprises a solid drum and a circular brush support attached on the outer perimeter of the drum. As the brush support is further provided with flow openings, the water that has flowed through the brushes is able freely to flow on the surface of the drum out from both ends of the drum in the axial direction.

Preferably, the brush includes a brush body attached to the brush support, and bristles attached to the brush body. Further, as the bristles extend from the brush body in two directions, i.e. opposed axial directions, the brush structure can be made a compact and tight, well oil collecting structure.

The oil collector according to the invention may be a drum-type and cylindrical structure rotating on one shaft. A second alternative is that the oil collector is a belt-type structure circulating on two shafts.

In both alternatives mentioned above, it is preferred that the oil collector includes a casing which is provided on the path of the brush and along which the oily brush is arranged to travel from the oily water

to the cleaning comb structure. Thus, the casing prevents the dropping of oil back into the water from the brushes and, on the other hand, the brushes carry the oil dropped into the casing up to the comb-type cleaning members. Preferably, the casings are so shaped that they initially contract in a wedge-type and even fashion, whereby they press on the bristles. This suitable pressure removes water from between the bristles and leaves mainly just the oil attached to the bristles.

A highly preferred embodiment of the invention is a brush structure where the inventively transverse bristles are at least partly of different thicknesses. The thickest bristles are disposed at the front, i.e. meet the water to be cleaned first, and the thinner bristles are disposed deeper in the brush. Thus, particularly under ice conditions, the thicker and sturdier bristles effectively prevent the access of ice through the bristles into the brush. At the same time, the thinner bristles inside the brush bind the oil that has travelled therein to the surfaces of the bristles while letting the water flow therethrough. In terms of thickness, the bristles may be provided for example in three different thicknesses, i.e. three layers of bristles of different thicknesses, the thickest outmost and the thinnest inmost. It is also possible that the thickness of the bristles is changed, i.e. reduced, in a nearly stepless manner from the outer surface towards the inner surface.

The oil collector according to the invention has considerable advantages as compared to the prior art. The brush structure according to the invention collects oil to the bristles better than the radial bristles, the oil is kept better attached to the bristles up to

their removal and the bristles do not let ice pass through, which makes the collecting outcome better. Thus, by the brush structure according to the invention, the speed of rotation of the device can be kept higher than with the traditional brushes, whereby the oil collecting capacity is considerably higher.

Further, the brush structure according to the invention operates as an effective filter, whereby, depending on the quality and thickness of the bristles being used and on the fluid being treated, the brush structure suitably admits, recovers or prevents the passage for different components of the fluid.

LIST OF FIGURES

Below, the invention will be described in detail by means of examples with reference to the accompanying drawings, in which

Fig. 1 illustrates a side view of one oil collector according to the invention without bristles,

Fig. 2 illustrates a side view of the oil collector of Fig. 1 with the bristles,

Fig. 3 illustrates a sectional view of the oil collector of Fig. 2,

Fig. 4 illustrates one brush structure according to the invention and

Fig. 5 illustrates the brush structure of Fig. 4 from another direction.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1-3 illustrate the essential parts of one oil collector according to the invention. The oil collector includes a solid drum 4 with a horizontal shaft 2. In other words, the shaft 2 is parallel to the surface of water. A circular flange, i.e. a brush support 5, is mounted on the outer surface of the drum to circu-

late the drum. There is an appropriate number of brush supports spaced apart from one another in the axial direction. A plate-type attachment flange 11 that is perpendicular to the brush support circulates the outer perimeter of the brush support. The brush support 5 is provided, substantially over its entire length, with flow openings 6 allowing the water axially to flow on the surface of the drum 4.

A brush body 7 of the brush 3 is attached to the attachment flange 1 and circularly extends around the entire structure. Bristles are attached to the brush body 7 over the entire length of the perimeter thereof on two opposed sides thereof such that the bristles extend in opposed directions from the brush body in the axial direction of the drum. As illustrated at the lower edge of Fig. 3, the bristles of the brush always spread out to some extent, such that not all of them are fully provided in said axial direction. However, in this invention the substantially axial direction of the brushes means that said axial direction is the main direction thereof.

In the oil collecting area or in Fig. 2 below the water surface 14 up to the lowest point of the brush, the bristles are able freely to spread out to some extent both inward and outward while the water flows through the bristles and out from the flow openings 6. From the flowing water, the oil adheres to the bristles and travels with the bristles towards a mouth 15. The mouth 15 is formed by a cylindrical inner surface 12 which is part of the body of the device and by a cylindrical outer surface 16. Further, edge flanges 13 are attached therebetween to connect them to one another. Thus, the brushes are pressed together to a certain extent in a casing between the outer surface

16, the inner surface 12 and the edge flanges 13, which causes squeezing of the water out from the bristles. Thus, mainly just the oil remains in the bristles as they slide upwards in the casing towards the comb structure for cleaning the bristles.

Fig. 4 and 5 illustrate in more detail a preferred embodiment of the invention, wherein the bristles 1 of the brushes 3 are of different thicknesses such that the bristles 9 of the outer perimeter on the front, i.e. the oil collecting side, are thicker while the bristles 10 on the side of the inner perimeter are thinner. In the illustrated embodiment, the distribution of the bristles according to thickness is even more detailed, i.e. in the middle of the brush there are bristles having a thickness between the thicknesses of the outer bristles and the inner bristles.

As shown in Fig. 4, the thick and stiff bristles 9 of the front edge function as a good barrier for bits of ice 17, preventing the access thereof into the bristles. Thus, only water and oil are able to flow into the bristles, wherein, as the bristles become thinner and their number increases, the oil adheres to the bristles and only water is finally able to pass through the bristles to exit the device.

The invention is not limited merely to the examples referred to above; instead, many variations are possible within the scope of the inventive idea defined by the claims.

CLAIMS

1. An oil collector including a brush (3), provided with substantially straight bristles (1) and a horizontal shaft (2), and a cleaning structure in the upper part of the brush for cleaning the brush from oil, characterized in that the bristles (1) of the brush (3) are substantially parallel to the horizontal shaft (2).

2. The oil collector according to claim 1, characterized in that the oil collector includes a solid drum (4) and a circular brush support (5) attached on the outer perimeter of the drum.

3. The oil collector according to claim 2, characterized in that the brush support (5) includes flow openings (6) to enable the flow of water axially on the surface of the drum.

4. The oil collector according to any one of claims 1-3, characterized in that the brush (3) includes a brush body (7) attached to the brush support (5) and bristles (1) attached to the brush body.

5. The oil collector according to any one of claims 1-4, characterized in that the bristles extend in opposed axial directions from the brush body.

6. The oil collector according to any one of claims 1-5, characterized in that the oil collector is a drum-type structure rotating on one shaft.

7. The oil collector according to any one of claims 1-5, characterized in that the oil collector is a belt-type structure circulating on two shafts.

8. The oil collector according to any one of claims 1-7, characterized in that the oil collector includes a casing (8) which is provided on the path of the brush (3) and along which the oily brush is arranged to travel to the cleaning structure for cleaning from the oily water.

9. The oil collector according to any one of claims 1-8, characterized in that the bristles (9) of the outer perimeter of the brush are larger in cross section than the bristles (10) of the inner perimeter of the brush.

10. The oil collector according to any one of claims 1-9, characterized in that the direction of the bristles is in the range of ± 20°, preferably ± 10°, for example approximately ± 5° from the axial direction of the brush.

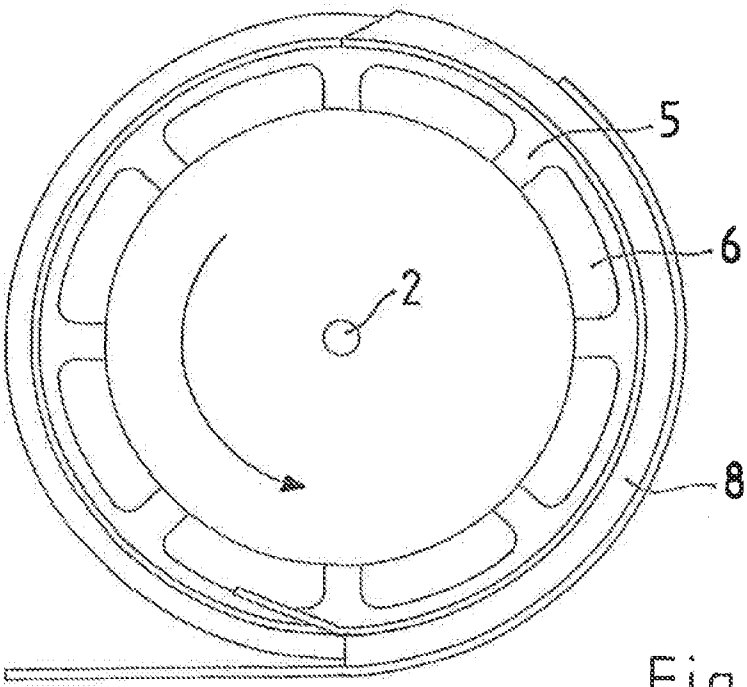


Fig 1

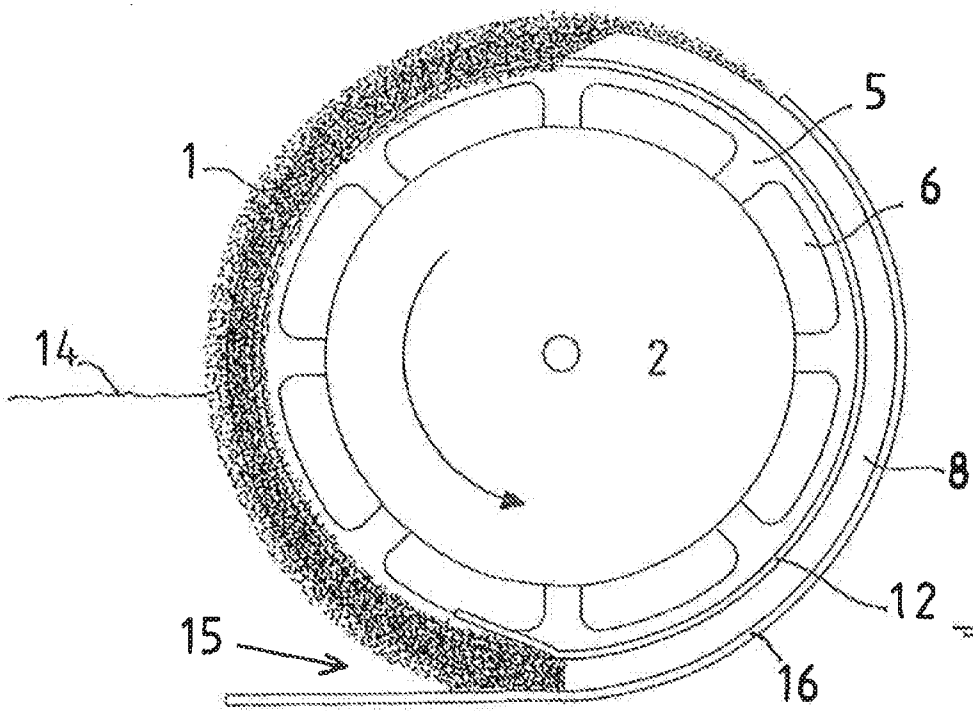


Fig 2

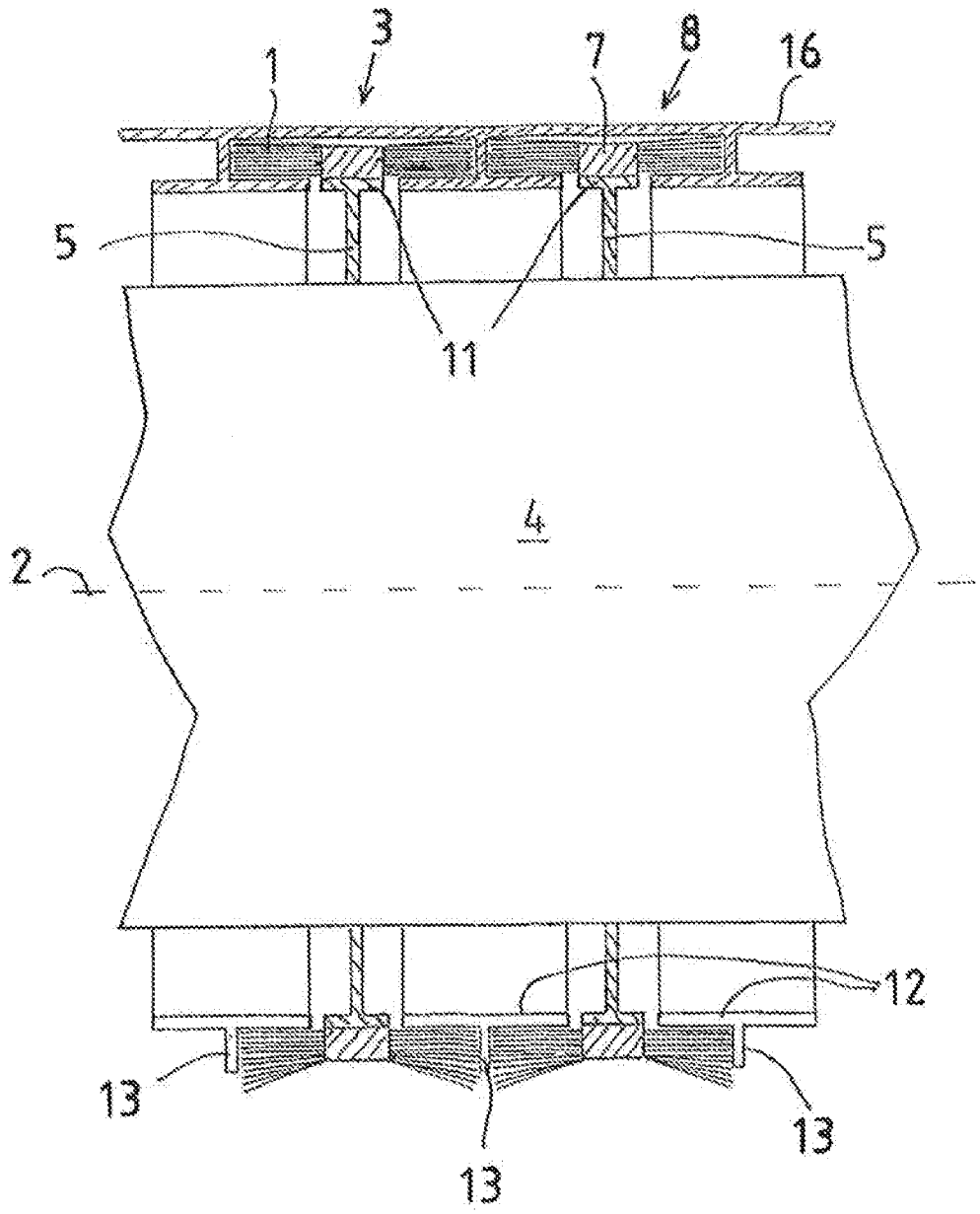


Fig 3

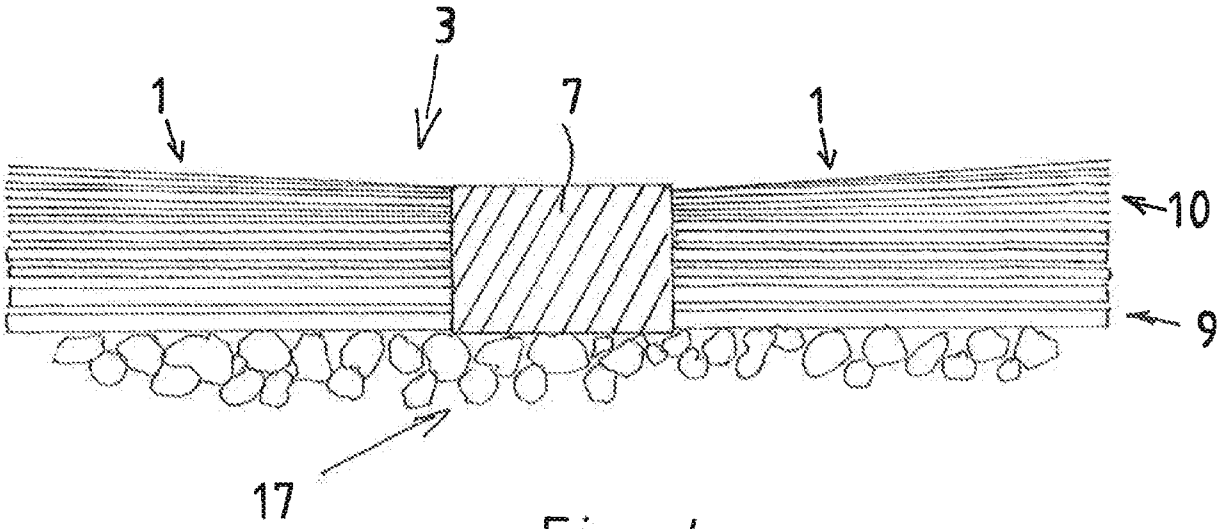


Fig 4

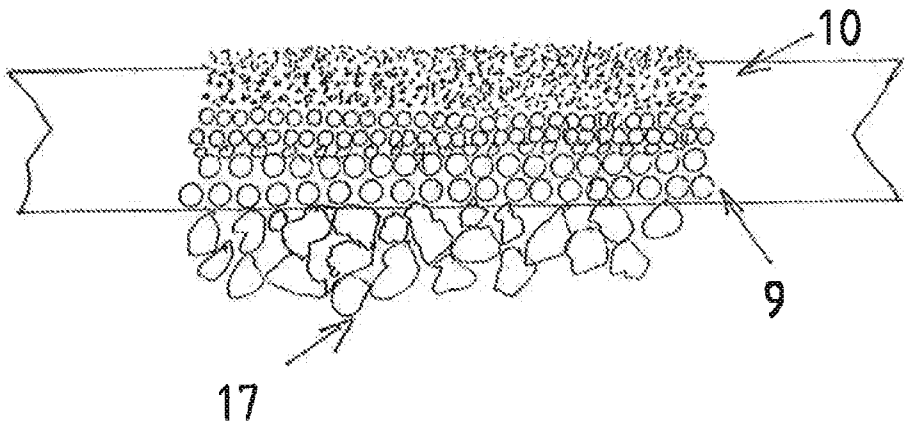


Fig 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2013/050623

A. CLASSIFICATION OF SUBJECT MATTER

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: E02B, B63B

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

FI, SE, NO, DK

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

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4264450 A (AYERS RAY R et al.) 28 April 1981 (28.04.1981) whole document, especially column 2, lines 7-12 & claims 16 and 17 & figures 1 and 2	1-10
A	EP 0128729 A2 (LUNDIN LARS) 19 December 1984 (19.12.1984) whole document	1-10
A	WO 9739194 A1 (ORREBO BUSINESS AB OY [FI]) 23 October 1997 (23.10.1997) whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 September 2013 (23.09.2013)	25 September 2013 (25.09.2013)

Name and mailing address of the ISA/FI
National Board of Patents and Registration of Finland
P.O. Box 1160, FI-00101 HELSINKI, Finland
Facsimile No. +358 9 6939 5328

Authorized officer
Jaakko Niemensivu
Telephone No. +358 9 6939 500

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2013/050623

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 4264450 A	28/04/1981	None	
EP 0128729 A2	19/12/1984	AU 561710 B2	14/05/1987
		AU 2923984 A	13/12/1984
		CA 1230561 A1	22/12/1987
		DE 3467010 D1	03/12/1987
		DK 276784 D0	04/06/1984
		DK 276784 A	10/12/1984
		DK 156892 B	16/10/1989
		DK 156892 C	26/02/1990
		EP 0128729 B1	28/10/1987
		FI 832079 A	10/12/1984
		FI 71596 B	10/10/1986
		FI 71596 C	19/01/1987
		GR 82008 A1	12/12/1984
		IS 1382 B6	28/08/1989
		JP S6058289 A	04/04/1985
		JP H0585234 B2	06/12/1993
		MX 162798 A	26/06/1991
		NO 842300 A	10/12/1984
		NO 156728 B	03/08/1987
		NO 156728 C	11/11/1987
		US 4834880 A	30/05/1989
		YU 100484 A	31/10/1987
		YU 46812 B	10/06/1994
WO 9739194 A1	23/10/1997	AU 2295597 A	07/11/1997
		EE 9800350 A	15/04/1999
		EE 04064 B1	16/06/2003
		EP 0894168 A1	03/02/1999
		FI 960779 A	18/10/1997

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2013/050623

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
E02B 15/04 (2006.01)
E02B 15/10 (2006.01)