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(71) Applicant *(for all designated States except US)*: **NORDIC WATER PRODUCTS AB** [SE/SE]; Box 1004, S-149 25 Nynäshamn (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **LARSSON, Hans F** [SE/SE]; Nordic Water Products AB, Box 1004, S-149 25 Nynäshamn (SE). **GUSTAFSSON, Kjell** [SE/SE]; Nordic Water Products AB, Box 1004, S-149 25 Nynäshamn (SE).

(74) Agent: **BERGENSTRAHLE & LINDVALL AB**; Box 17704, S-118 93 Stockholm (SE).

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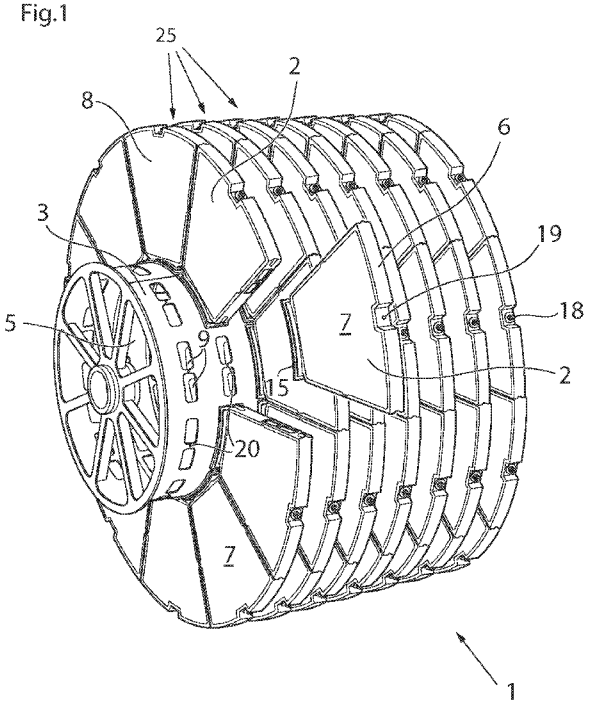
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[Continued on next page]

(54) Title: FILTER ELEMENT FOR A DISC FILTER

(57) Abstract: A filter element (2) for use in a disc filter (1), wherein a plurality of filter elements (2) are arranged on a rotor shaft (3) in a manner allowing liquid communication between the inside (4) of the filter elements (2) and the inside (5) of the rotor shaft (3), for the filtering of liquids. The filter element (2) comprises a framework (6) carrying a filter cloth (7) on both its side surfaces (8), wherein the framework (6) and the filter cloth (7) are permanently joined forming a single use filter element (2) and the filter element has at least one passage (21) in each edge (22) for liquid communication between the inside (4) of adjacent filter elements. A disc filter (1) comprising a single use filter element (2) is also provided.

Fig.1



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Filter element for a disc filter

Technical field

The present invention relates to a filter element for use in a disc filter for filtering liquid containing particles, wherein a plurality of filter elements is arranged on a rotor shaft in a manner allowing liquid communication between the inside of the filter elements and the inside of the rotor shaft, for filtering liquids. The filter element comprises a framework or structure carrying filter cloth on both side surfaces.

Background

When filtering is to take place from the inside out, the rotor shaft has a hollow core and liquid to be filtered is fed to the inside of the rotor shaft. The filter element and the rotor shaft have suitable openings through which the liquid to be filtered is fed to the inside of the filter element. The filtering takes place from the inside of the filter element and out though the filter cloth. Particles in the liquid are separated on the inside of the filter cloth.

A plurality of filter elements is attached to the rotor shaft around the periphery thereof, together forming filter discs. The rotor shaft is usually capable of carrying a plurality of such discs.

During operation, the rotor shaft carrying the filter discs is rotated and the filter discs are partially immersed in filtered liquid during rotation. The liquid level inside the filter discs is higher than the liquid level outside the filter discs. Particles separated on the inside of the filter cloth are rinsed away with the help of spray nozzles placed so that the jets of liquid from the nozzles hit the outside of the filter cloth when the filter cloth is in the air. The particles are rinsed away and flow through the filter element and into the rotor shaft, where they are caught in a reject trough.

The filter element according to the present invention can also be used in disc filters for filtering from the outside of the filter discs and into the rotor shaft, wherein particles are deposited on the outside of the filter cloth and the filtered liquid flows into the rotor shaft. A reject trough can be arranged on the outside of the filter discs

to catch reject that has been rinsed away, so that this can be rinsed down and "creamed off".

Usually known filter elements consist of a framework or structure over which a bag of filter cloth is treaded and crimped, or a framework and replaceable panels of filter cloth. The basic thought is that the framework is reused.

Summary of the invention

An object of the invention is to provide a filter element which is simple and cost-efficient to manufacture, has light weight, and is easy to replace.

The present invention fulfils this object by a filter element as initially described, where the framework and the filter cloth are permanently joined forming a single use filter element, wherein the filter element has at least one passage in each edge for liquid communication between the inside of adjacent filter elements when the filter elements are assembled edge to edge forming a filter disc.

A filter element according to the invention consists of a single component, whereas a conventional filter element for disc filters consists of at least two parts when the bag type is concerned, and at least four components in the type having replaceable filter cloth panels, i.e. a frame, two replaceable filter cloth panels and a lid which locks the filter cloth panels in place.

The passages on the edges cause liquid and gas to flow between the filter elements during rotation of the filter discs. This facilitates filling and emptying the filter elements, facilitates filtering, and results in increased capacity.

The filter element according to the invention is preferably manufactured entirely in one or more polymeric materials, allowing rational manufacture. The filter element is much lighter than the conventional filter element, making it possible to build the rotor shaft with reduced wall thickness compared to the conventional case and to operate the filter at less expense.

Another advantage is that the filter element is easier to replace due to its low weight. Also, it does not require as complicated fastening as conventional filter elements and is thus much easier to replace, for example if the filter media is damaged. As the filter

element according to the invention can be manufactured entirely of polymeric materials, it can be easily disposed of, e.g., by incineration.

A filter element according to one embodiment of the invention is attachable to the rotor shaft through a single fastening organ. It is kept in place by an attachment organ comprising a long bolt and nut, which works well as the filter element has low weight.

In the above embodiment of the filter element, a seal can be arranged between the filter element and the rotor shaft, and a seal can be arranged around the passage to the adjacent filter element on one edge only. Using only two seals compared to four, as conventionally used, minimizes the risk for leakage of unfiltered liquid into filtered liquid.

One embodiment of the filter element preferably has a width between the side surfaces of filter cloth between 1.15 to 1.40 times the width of a passage for liquid communication in the rotor shaft. As the filter elements have a narrow construction, a more compact disc filter is made possible, meaning that more filter discs can be arranged on the same rotor shaft compared to disc filters assembled from conventional filter elements. This results in a significantly higher capacity of the disc filter.

According to the present invention, a disc filter assembled from filter elements according to the invention is also provided.

Short description of the drawings

The present invention will now be described in exemplifying embodiments by reference to the attached drawings, in which:

Fig. 1 shows a perspective view of a disc filter according to the invention having filter elements according to the present invention,

Fig. 2 shows a framework or structure in an embodiment of a filter element according to the present invention in a perspective view from above,

Fig. 3 shows an embodiment of a fastening organ for fastening a filter element in a disc filter,

Fig. 4 shows an embodiment of a filter element according to the present invention in a perspective view from above, and

Fig. 5 shows seals arranged on a filter element according to the present invention.

Detailed description of preferred embodiments of the present invention

Fig. 1 shows a disc filter 1 having a plurality of filter elements 2 arranged on a rotor shaft 3 and forming a filter disc 25. Liquid communication can take place between the inside 4 of the filter elements 2 and the inside 5 of the rotor shaft 3 through at least one cutout or opening 9 in the rotor shaft 3 and at least one cutout or opening 10 in the filter element 2. Fig. 2 shows the filter element 2 comprising a framework 6, which carries filter cloth 7 on both its side surfaces 8, see also Fig. 4. The framework 6 and the filter cloth 7 are permanently joined so that the filter element 2 forms a single use filter element 2.

The framework 6 preferably comprises a frame 11, a crossbar 12 for each side surface 8 and a central support 13 extending from the outer part 14 of the frame 11, forming a part of the periphery of the filter disc 25 when in use, to a connecting part 15, adjacent to the rotor shaft 3 when in use. The filter element 2 is preferably manufactured in its entirety of one or more polymeric materials. This term should also be considered to include reinforced polymeric materials or similar materials mainly consisting of a polymer. The term also includes filter element that comprise minor parts, such as screws, made of a different material, such as a metal.

Fig. 3 shows a fastening organ 16 comprising a long bolt 17 and a nut 18. The long bolt 17 is threaded in both ends. When the filter element 2 is fastened to the rotor shaft 3, the long bolt 17 is threaded through a hole 19 and along the central support 13. The filter element is kept in the desired place on the rotor shaft 3 and the long bolt 17 is screwed in place in a threaded opening 20 in the rotor shaft 3, and thereafter the bolt 18 is screwed in place in the part of the long bolt 17 protruding through the hole 19. In this fashion the filter element 2 can be fastened to the rotor shaft 3 using only one fastening organ 16.

The framework 6 of the filter element 2 has at least one passage 21 in each edge 22 for liquid communication between the inside 4 of adjacent filter elements 2 in assembled position when the filter elements 2 are arranged edge 22 to edge 22

forming a filter disc 25. Similarly, the central support 13 has at least one passage 21. The inside 4 of the filter element thereby forms one single compartment for fluids.

Fig. 5 shows a first seal 23 arranged between the filter element 2 and the rotor shaft 3 and a second seal 24 arranged around the passage 21 to the adjacent filter element 2 on one edge 22 only.

The width between the side surfaces 8 of filter cloth 7 are between 1.15 and 1.40 times the width of an opening 9 for liquid communication in the rotor shaft 3. Experiments have shown that an opening 9 of 55 mm in the rotor shaft 3 requires a width of at least 65 mm of the filter element 2 according to the invention, whereas the same 55 mm opening requires a width of at least 90 mm in the conventional filter element.

Preferred embodiments of a filter element and a disc filter have been described. It will be appreciated that these can be varied with the scope of the appended claims without departing from the inventive idea.

Claims

1. A filter element (2) for use in a disc filter (1), wherein a plurality of filter elements (2) are arranged on a rotor shaft (3) in a manner allowing liquid communication between the inside (4) of the filter elements (2) and the inside (5) of the rotor shaft (3), for the filtering of liquids, wherein the filter element (2) comprises a framework (6) carrying a filter cloth (7) on both its side surfaces (8), **characterized in** that the framework (6) and the filter cloth (7) are permanently joined forming a single use filter element (2), wherein the filter element has at least one passage (21) in each edge (22) for liquid communication between the inside (4) of adjacent filter elements (2) when the filter elements (2) are assembled edge (22) to edge (22) forming a filter disc (25).

2. The filter element (2) according to claim 1, being manufactured entirely of one or more polymeric material or materials.

3. The filter element (2) according to claim 1 or 2, being attachable to the rotor shaft (3) through a single attachment organ (16).

4. The filter element (2) according to claim 1, having a seal (23) arranged between the filter element (2) and the rotor shaft (3) and a seal (24) arranged around the passage (21) to the adjacent filter element (2) on only one edge (22) thereof.

5. The filter element (2) according to any one of the preceding claims, wherein the width between the side surfaces (8) of filter cloth (7) is between 1.15 to 1.40 times the width of an opening (9) for liquid communication in the rotor shaft (3).

6. The filter element (2) according to any one of the preceding claims, wherein the filter element is adapted for filtering taking place from the inside of the filter element and out though the filter cloth.

7. The filter element (2) according to any one of the preceding claims, wherein the inside 4 of the filter element forms one single compartment for fluids.

8. A disc filter (1) comprising a filter element (2) according to any one of the preceding claims.

Fig.1

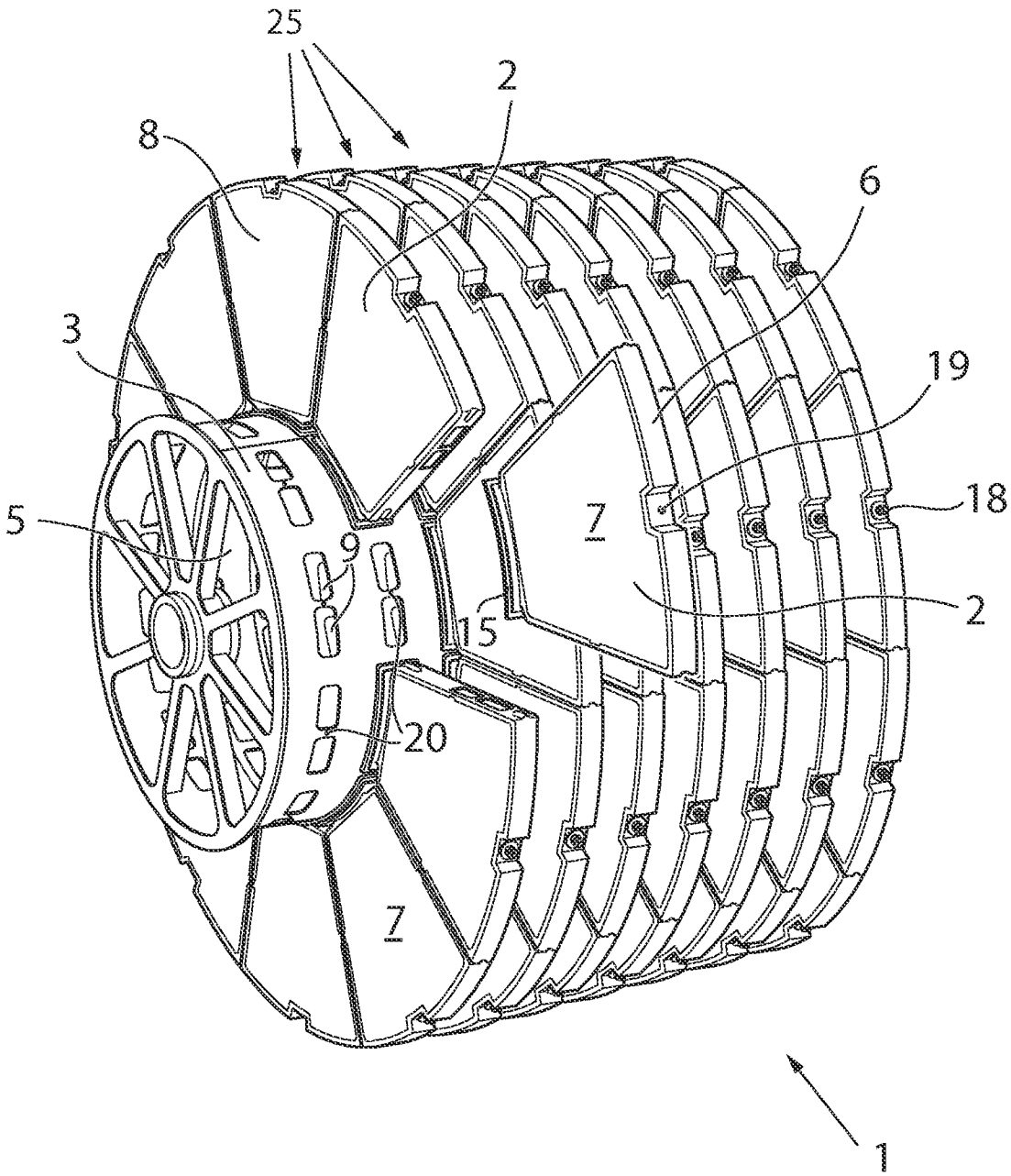


Fig.2

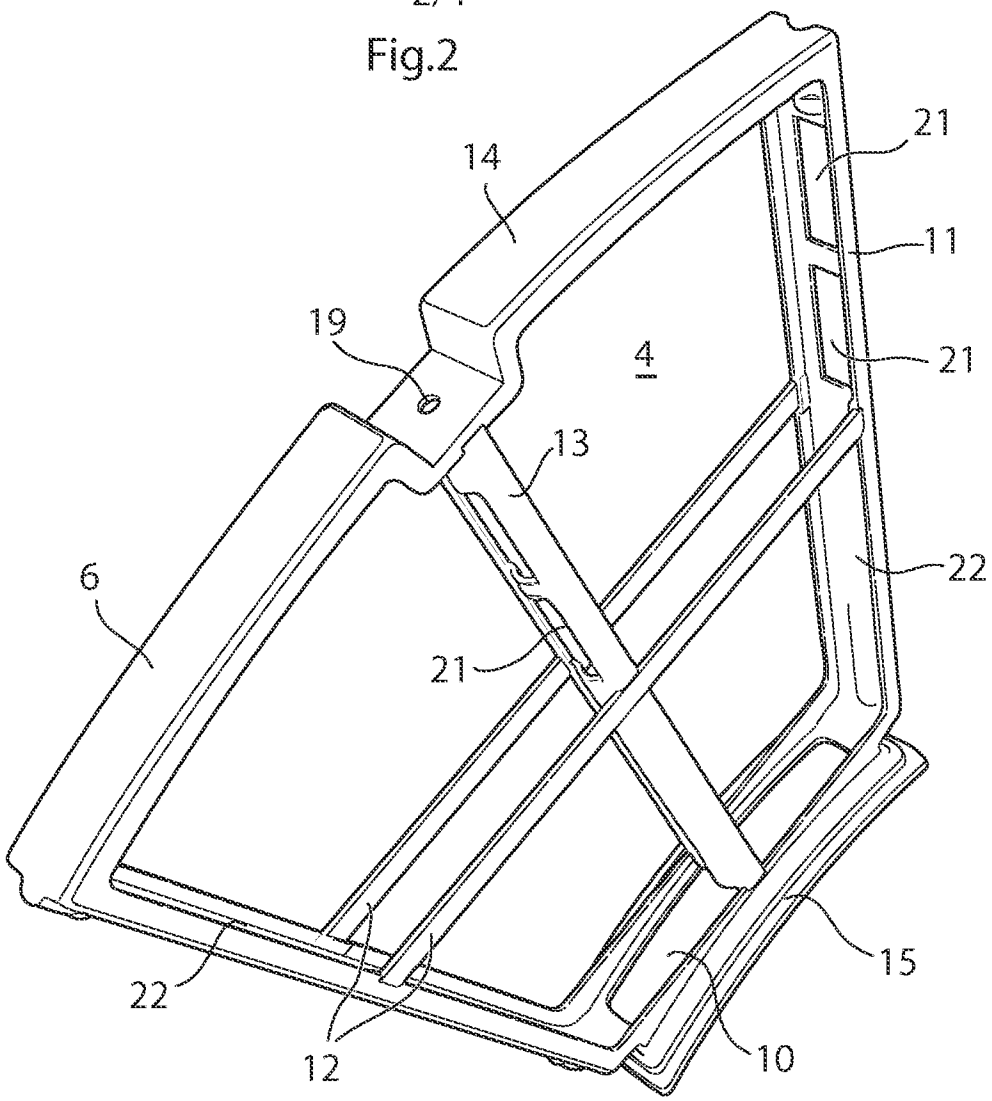


Fig.3

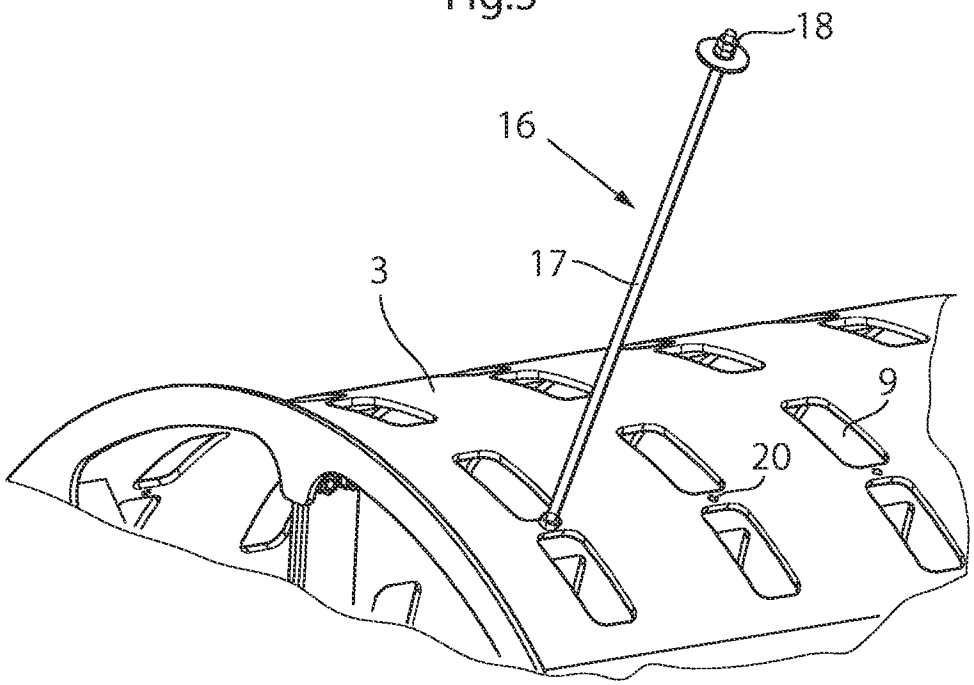


Fig.4

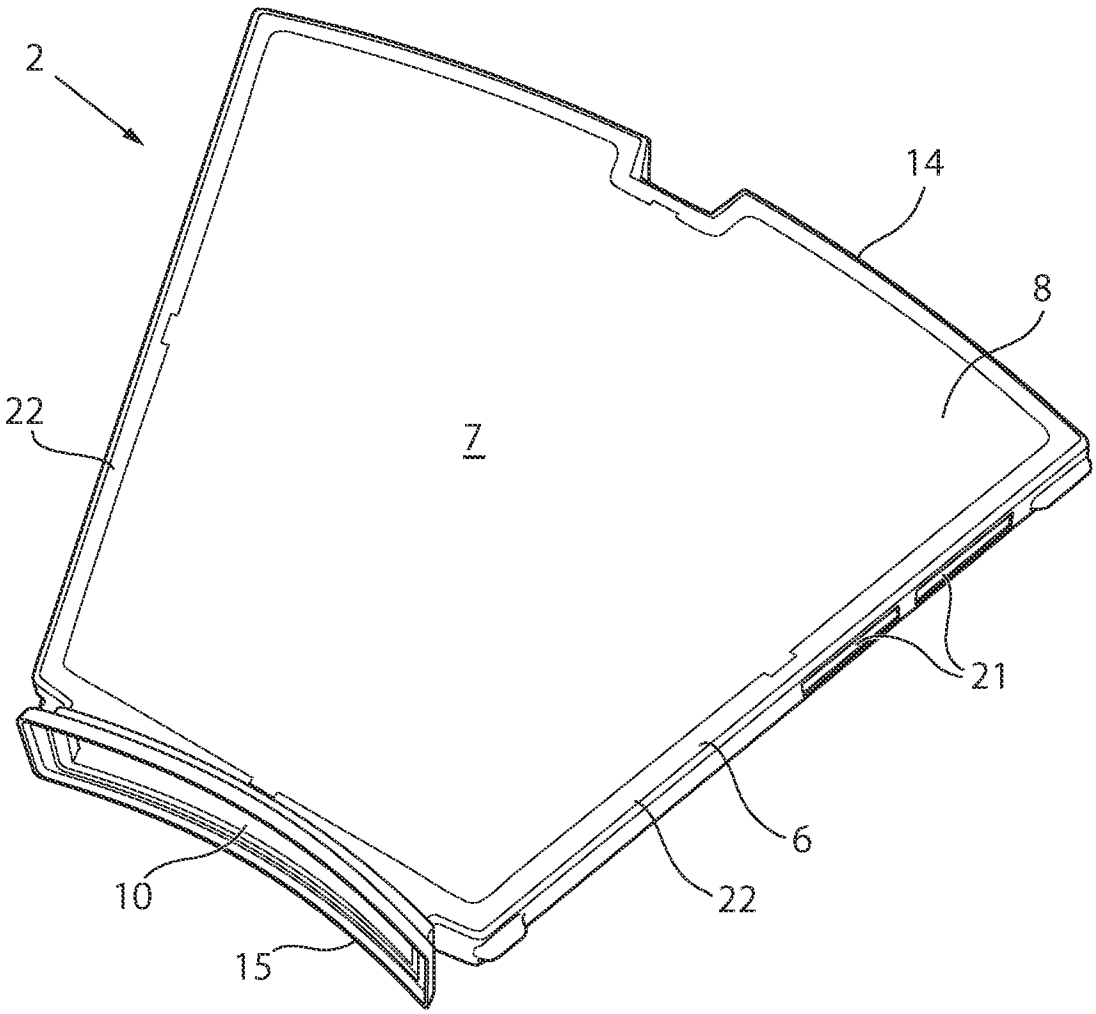
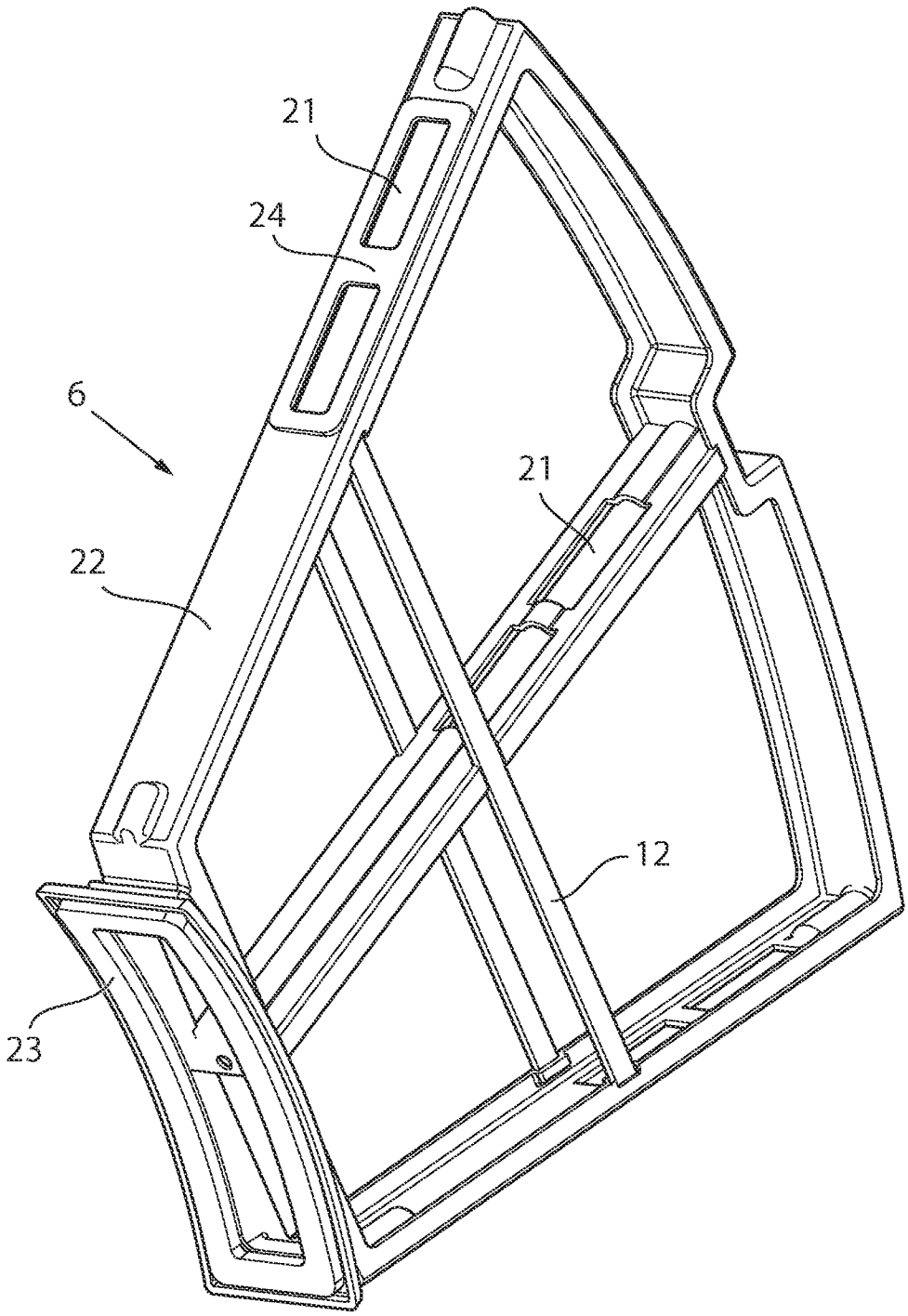


Fig.5



INTERNATIONAL SEARCH REPORT

International application No.
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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: B01D

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.
Y	CA 2070341 A1 (PERAELAE, AULIS ET AL), 8 December 1992 (08.12.1992), page 4, line 16 - line 23, figures 1-3d	1-2,4-6,8
A	--	3,7
Y	WO 2004076026 A1 (HYDROTECH NILS-ÅKE PERSSON AKTIEBOLAG), 10 Sept 2004 (10.09.2004), page 3, line 10 - line 16; page 9, line 26 - page 10, line 2, figures 1-4	1-2,4-6,8
A	--	3,7

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 June 2009	12 -06- 2009
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 Jens Waltin/EÖ Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2009/050165

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9419088 A1 (CELLECO-HEDEMORA AB), 1 Sept 1994 (01.09.1994), page 2, line 24 - page 3, line 8, figures 1-8 --	1-8
A	US 6231761 B1 (MOHLIN, ANDERS ET AL), 15 May 2001 (15.05.2001), figures 1-9 -- --------	1-8

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

CA	2070341	A1	08/12/1992	AU	1801492	A	10/12/1992
				DE	4218217	A	10/12/1992
				FI	912760	A	08/12/1992
				FR	2677266	A	11/12/1992
				SE	9201742	A,L	08/12/1992
WO	2004076026	A1	10/09/2004	AT	347428	T	15/12/2006
				CN	1753716	A	29/03/2006
				CN	100337716	C	19/09/2007
				DE	602004003562	D,T	05/04/2007
				DK	1596958	T	30/04/2007
				EP	1596958	A,B	06/12/2006
				SE	1596958	T3	
				ES	2276283	T	16/06/2007
				JP	2006519101	T	24/08/2006
				KR	20050108367	A	16/11/2005
				PT	1596958	E	28/02/2007
				SE	526692	C	25/10/2005
				SE	0300532	A	28/08/2004
				US	20060260999	A	23/11/2006
WO	9419088	A1	01/09/1994	AT	154762	T	15/07/1997
				CA	2155125	A	01/09/1994
				DE	69403952	D,T	20/11/1997
				EP	0684868	A,B	25/06/1997
				FI	953889	A	17/08/1995
				JP	8506761	T	23/07/1996
				NO	953233	A	17/08/1995
				SE	501367	C	23/01/1995
				SE	9300541	A,L	19/08/1994
				US	5635062	A	03/06/1997
US	6231761	B1	15/05/2001	NONE			