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(71) Applicant *(for all designated States except US)*: **CAMFIL AB** [SE/SE]; Industrigatan 3, S-619 33 Trosa (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **SCHAEPER, Stefan** [DE/DE]; Dorfstrasse 8, 19217 Thandorf (DE).

(74) Agent: **ALBIHNS AB**; P.O Box 5581, Linnégatan 2, S-114 85 Stockholm (SE).

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(54) Title: A PLEATED FILTER MEDIUM

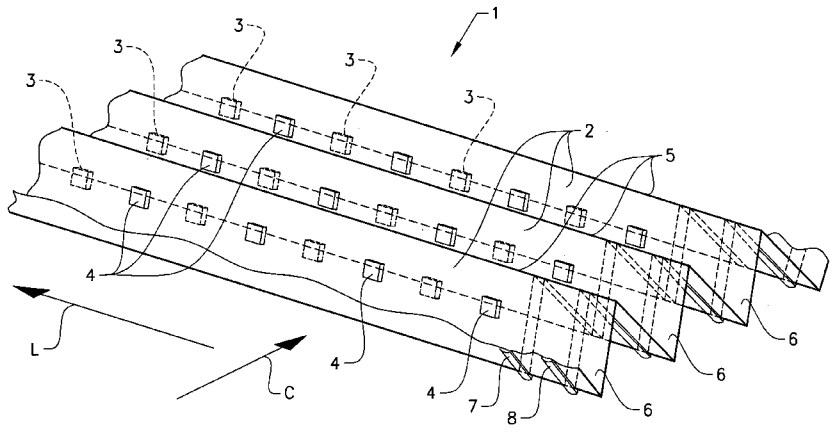


FIG. 1

(57) Abstract: The invention relates to a pleated filter medium (1) having pleats (2) with rectangular sides and a length direction (L) parallel to the fold between the two sides of a pleat (2), comprising several rows of distance elements extending in a cross direction (C) relative to the folds in the pleated filter medium, said rows being distanced from each other along a length direction (L), whereby each row of distance elements is constituted of a line of glue elements (3) distanced from each other and applied to a side of the filter medium. According to the invention rows of glue elements (3, 4) are applied to both the inside and the outside of the filter medium, the rows on the inside being displaced in the length direction in relation to the rows on the outside. The invention also relates to a filter including such a filter medium.

A pleated filter medium.

TECHNICAL FIELD

The present invention relates to a pleated filter medium having pleats with rectangular sides and a length direction parallel to the fold between the two sides of a pleat, comprising several rows of distance elements extending in a cross direction relative to the folds in the pleated medium, said rows being distanced from each other along a length direction, whereby each row of distance elements is constituted of a line of glue elements distanced from each other and applied to a side of the filter medium. The invention also relates to a filter using such a filter medium.

BACKGROUND OF THE INVENTION

Pleated filter media can be used for producing conical filters by being applied around end pieces having different diameters and by affixing the two free sides of end pleats to each other along the length thereof. When the length of the filter, the length direction being the axial direction of such a conical filter, reaches a certain length the pleats in the filter medium must be stabilised. One way of accomplishing such a stabilising is to glue one or more continuous cords around the periphery of the applied filter medium. The stabilising of the pleats thus requires a separate process step being made after the applying of the filter medium to the end pieces.

The objective of the present invention is a pleated filter medium which can be applied to end pieces to form a conical filter without the need for a separate stabilising step after forming of the conical filter.

SUMMARY OF THE INVENTION

This objective is accomplished by a pleated filter medium having pleats with rectangular sides and a length direction parallel to the fold between the two sides of a pleat, comprising several rows of distance elements extending in a cross direction relative to the folds in the pleated filter medium, said rows being distanced from each other along a length direction, whereby each row of distance elements is constituted of a line of glue elements distanced from each other and applied to a side of the filter medium, characterised in that rows of glue elements are applied to both the inside and the outside of the filter medium, the rows on the inside being displaced in the length direction in relation to the rows on the outside. Such a filter medium can be used to manufacture a conical filter without the need of a separate pleat stabilising step after forming of the filter.

In a preferred embodiment, the glue elements in each row of glue elements are distanced from each other in such a way that a glue element is applied to every side of a pleat, and successive rows of glue elements on the inside and the outside of the filter medium are spaced the same distance from each other in the length direction, and the rows of glue elements on the outside of the filter medium are displaced half said distance from the rows of glue elements on the inside of the filter medium.

At least one continuous glue line is preferably applied in the cross direction in one of the end portions of the filter medium.

The length of the glue elements in the cross direction is preferably 10-80% of the width of the side of the pleat.

The invention also relates to a filter, characterised by having such a pleated filter medium, the opposite ends of the filter medium being applied around the periphery of an end piece and sealingly attached thereto. One of the end pieces can have a larger diameter than the opposite end piece so that the filter has the shape of a truncated cone.

BRIEF DESCRIPTION OF THE DRAWING

The invention will now be described with reference to the enclosed figures, of which;

fig. 1 schematically discloses a piece of a filter medium according to a preferred embodiment of the invention with the pleats thereof in a partly folded out, and

fig. 2 schematically discloses a filter according to the preferred embodiment.

DESCRIPTION OF EMBODIMENTS

In figure 1, a small piece of a pleated filter medium 1 according to a preferred embodiment of the invention is schematically shown. This piece of filter medium is shown with the pleats of the filter medium in a somewhat out-folded state compared with the end position of the pleats. In figure 1 only three pleats 2 are shown but a filter medium assembled in a filter contains a lot of pleats. The pleats all have the same dimensions. Furthermore, in figure 1 only an end portion of the filter medium 1 is disclosed. The length direction L of the filter medium 1 is parallel to the direction of the pleats 2 and the cross direction C is perpendicular thereto. The outside of the filter medium 1 is

proximal to the viewer of figure 1 and the inside of the filter medium is distal to the viewer.

Successive rows of distance elements 3 extended in the cross direction C are applied to the inside of the filter medium 1 along the length direction L thereof. The distance elements 3 in each such row are equispaced from each other so that a distance element 3 is located on every second side of a pleat 2. The function of these distance elements 3 is mainly to prevent the sides of the pleats 2 from being pressed together by airflow during use of the filter. The distance elements 3 consist of glue spots and have preferably a thickness of 1-4 mm. The extension of each distance element 3 in the cross direction C is preferably about 10-80% of the width of a side of a pleat 2.

Successive rows of glue spots 4 extended in the cross direction C are applied to the outside of the filter medium 1 along the length direction thereof. The glue spots 4 in each such row are equispaced from each other so that a glue spot 4 is located on every second side of a pleat 2, in the shown example the spots 4 are applied to the same side of a pleat 2 as the spots 3 but on the outside thereof instead of the inside. Depending on the filter media and the glue, the glue spots may be applied on every side of the pleats.

When the filter medium 1 is produced, the pleats are accomplished by a multi-pleat machine, in which the pleats are formed and the adjacent sides of two adjacent pleats are pressed towards each other so that the pleats 2 are attached to each other by the glue spots 4 and also distanced from each other by the spots 4. The function of the glue spots 4 is mainly to stabilise the pleats 2 but the presence of spots 4 will of course reduce the risk that portions of the pleat sides will be pressed together. Also the sides of the pleats will be pressed

towards each other so that these sides will be attached to each other by the glue spots 3.

The rows of glue spots 3 on the inside of the filter medium 1 and the rows of glue spots 4 on the outside are displaced in relation to each other in the length direction L so that each row of glue spots 4 in the length direction is located between two successive rows of glue spots 3. Preferably, the spots 3 and 4 are located on opposite sides of a line extending midway between the tops 5 and the troughs 6. More preferably, the spots 4 are also distanced from the top 5 of a pleat 2 by the same distance as the spots 3 are distanced from the bottom of a trough 6.

In the shown end of the filter medium 1 two continuous glue lines 7,8 are applied to the inside of the filter medium.

The filter medium 1 consists of a foldable material, preferably paper such as Glass Paper, from Sojitz Pla-Net Corporation, Tokyo, Japan, but any material used for air filters can be used. The glue used is preferably a hot melt adhesive, for example Technomelt from Henkel, Heidelberg, Germany but any other glue used for air filters can be used as well.

The distance between successive rows of glue spots 3 can be 50 mm and the distance between successive rows of glue spots 4 is the same. The displacement in the length direction between rows of glue spots 3 and rows of glow spots 4 is preferably half the distance between two successive rows of glue spots 3, i.e. 25 mm.

A filter medium 1 as described above is to be used together with end pieces to form a cylindrical or conical filter.

A filter 9 having the shape of a truncated cone is schematically shown in figure 2. Such a filter is made by wrapping the cross directional end portions of a rectangular, pleated filter medium 1 around cylindrical end pieces 10,11 and by sealingly attaching the wrapped filter medium to the end pieces 10,11 and attaching the length directional ends of the filter medium to each other along the length thereof.

As is evident from figure 2, the end piece 10 has a smaller diameter than end piece 11 which means that in the wrapped condition the initially rectangular pleated filter medium has taken the shape of a cut triangle. Specifically, this change in shape is accomplished by a gradual enlargement in the cross direction of the filter medium starting from the end wrapped around the end piece 10 with the smallest diameter. It is easy to realize that such an enlargement in a pleated filter medium can be obtained by gradually folding out the pleats in the length direction. However, since the pleats 2 are held together by the rows of glue spots 4 and rows of glue spots 3 such a simple folding out of the pleats is not possible in the present case. Instead, the gradual enlargement in the cross direction, i.e. the circumferential direction in the assembled filter 9 schematically shown in figure 2, is accomplished by gradually larger bending out of the portions of the adjacent sides of two adjacent pleats 2 lying between adjacent rows of glue spots 3 and a gradually larger bending out of the portions of the two sides of the pleats 2 lying between adjacent rows of glue spots 4 in a direction from end piece 10 towards end piece 11. The bending out of the portions of the adjacent sides of two adjacent pleats 2 lying between adjacent rows of glue spots 3 will move the glue spots 3 somewhat closer to each other also move the glue spots 4 in the cross direction and the bending out of the portions of the two sides of the pleats 2 lying between adjacent rows of glue spots 4 will move the glue spots

4 closer to each other and also the glue spots 3 in the cross direction. Therefore, the fold lines in the tops and troughs will not run in a totally straight line from the end piece 10 to end piece 11 but run in a slightly tortuous line.

With a conical filter 9 having a pleated filter medium 1 as described above it is not necessary to provide the pleats 2 with one or more continuous glue strings around the periphery of the filter medium after assembly of the filter medium onto the end pieces 10,11 in order to stabilise the pleats. Due to the rows of glue spots 3,4 a stable filter medium is obtained.

A conical filter according to the present invention will thus be much easier to manufacture than a conical filter in which the pleats have to be stabilised in a second step after assembly of the filter. The manufacturing costs of a conical filter according to the invention will thus be significantly lower than for the known filter.

The described filter medium can of course also be used for a filter having a cylindrical shape.

The described embodiment can be modified in several respects without leaving the scope of invention. The distances between the rows of glue spots can be different than described. It is also possible that the rows of glue spots applied to the outside of the filter medium are fewer than the rows of glue spots applied to the inside thereof, however the rows on the outside should still be located between rows on the inside. Furthermore, the glue spots on the outside can be displaced in the cross direction relative to the glue spots on the inside. Other materials for the filter medium than mentioned above can be used and other types of glue. It is not necessary to use the same type of glue

for the rows of glue spots on the outside and inside of the filter medium even if this is preferred. The scope of invention shall therefore only be limited of the content of the enclosed patent claims.

Claims

1. A pleated filter medium (1) having pleats (2) with rectangular sides and a length direction (L) parallel to the fold between the two sides of a pleat (2), comprising several rows of distance elements extending in a cross direction (C) relative to the folds in the pleated filter medium, said rows being distanced from each other along a length direction (L), whereby each row of distance elements is constituted of a line of glue elements (3) distanced from each other and applied to a side of the filter medium, **characterised in** that rows of glue elements (3,4) are applied to both the inside and the outside of the filter medium, the rows on the inside being displaced in the length direction in relation to the rows on the outside.

2. The pleated filter medium according to claim 1, wherein the glue elements (3,4) in each row of glue elements are distanced from each other in such a way that a glue element is applied to every side of a pleat.

3. The pleated filter medium according to claim 1, wherein the glue elements (3,4) in each row of glue elements are distanced from each other in such a way that a glue element is applied to every second side of a pleat.

4. The pleated filter medium according to claim 2 or 3, wherein successive rows of glue elements (3,4) on the inside and the outside of the filter medium (1) are spaced the same distance from each other in the length direction, and the rows of glue elements on the outside of the filter medium are displaced half said distance from the rows of glue elements on the inside of the filter medium.

5. The pleated filter medium according to claim 4, wherein the glue elements (3) in the rows on the inside are displaced also in a cross direction (C) in relation to the glue elements (4) in the rows on the outside.

6. The pleated filter medium according to any one of claims 1-5, wherein at least one continuous glue line (7,8) is applied in the cross direction in one of the end portions of the filter medium (1).

7. The pleated filter medium according to any one of claims 1-6, wherein the length of the glue elements (3,4) in the cross direction (C) is 10-80% of the width of the side of the pleat (2).

8. A filter (9), **characterised by** having a pleated filter medium (1) according to any of claims 1-7, the opposite ends of the filter medium being applied around the periphery of an end piece (10,11) and sealingly attached thereto.

9. A filter (9) according to claim 8, wherein one of the end pieces (11) has a larger diameter than the opposite end piece (10) so that the filter (9) has the shape of a truncated cone.

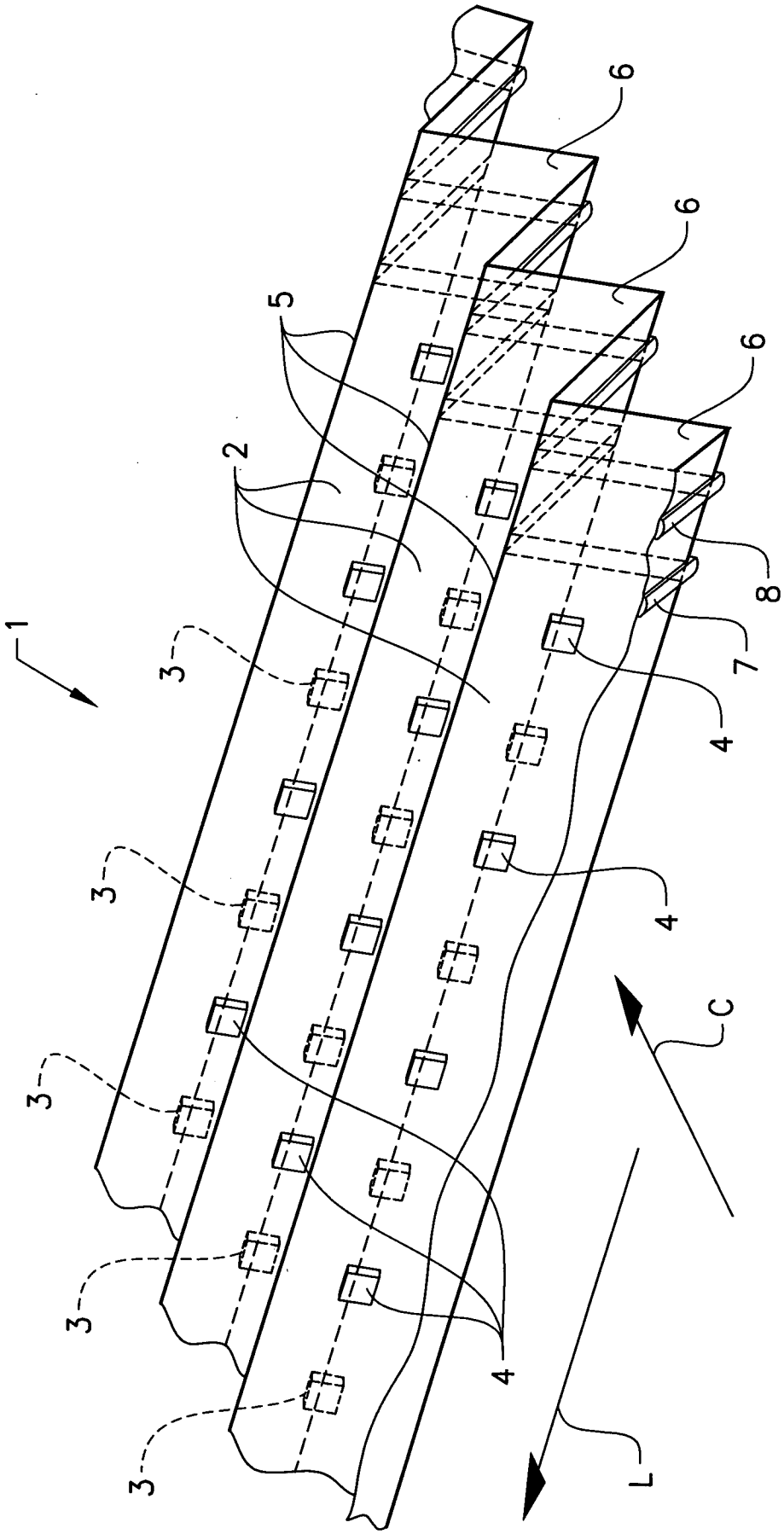


FIG. 1

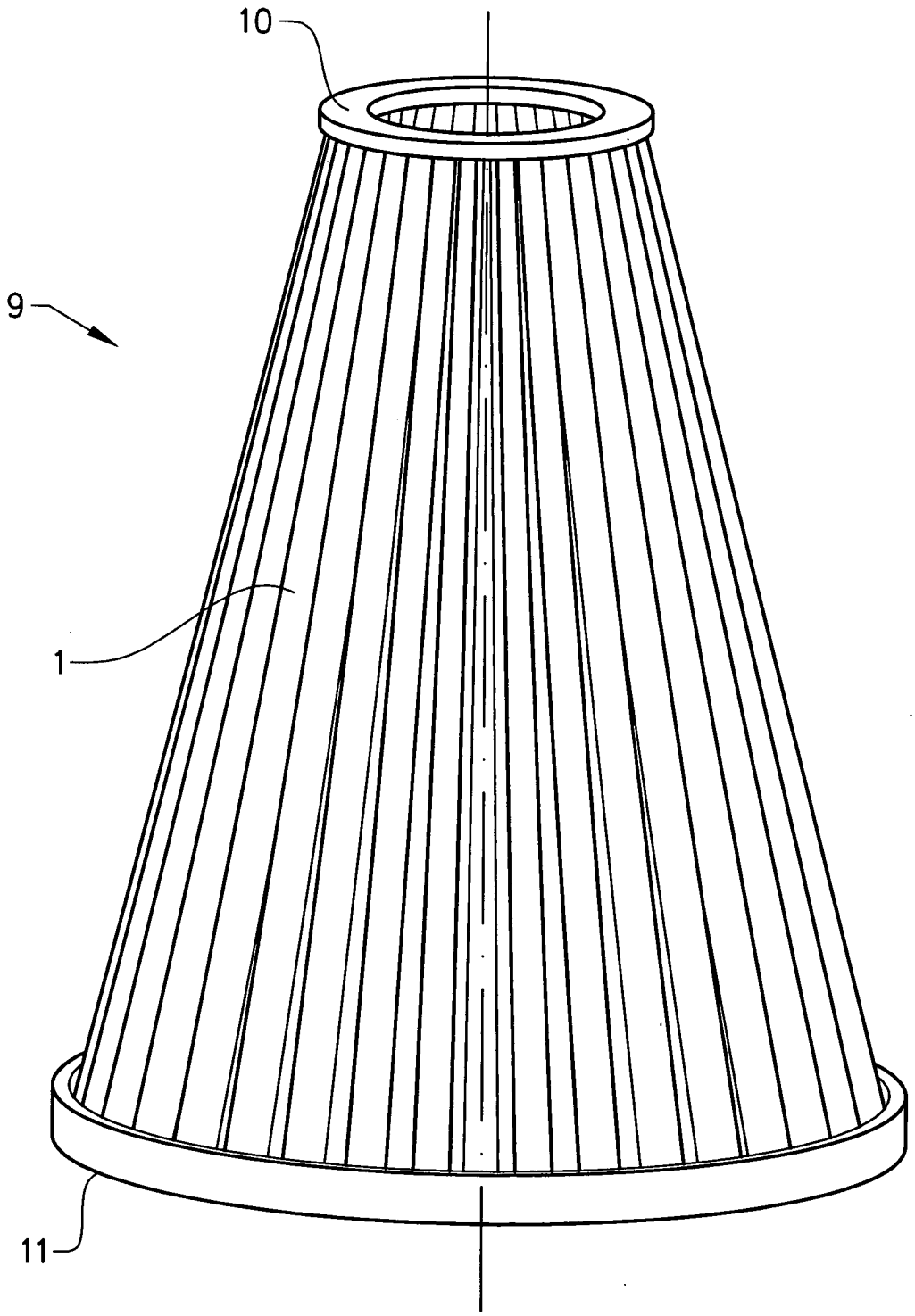


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2008/051339

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.
X	US 3692184 A (MILLER, JR., ROBERT B. ET AL), 19 Sept 1972 (19.09.1972), column 2, line 16 - line 29; column 3, line 6 - line 16; column 3, line 45 - line 55, figures 1-3, abstract	1-3,7-9
Y	--	6
Y	FR 1250201 A (GENERAL MOTORS LIMITED), 28 November 1960 (28.11.1960), column 2, line 32 - column 3, line 3, figures 1-2	6
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X	US 5804014 A (KÄHLER, KAI), 8 Sept 1998 (08.09.1998), column 5, line 25 - line 29, figure 1b, abstract	1-4,7
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[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
22 June 2009	07-07-2009
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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CA 2312825 A1 ("JACOBI"SYSTEMTECHNIK GMBH), 10 June 1999 (10.06.1999), figures 1a-c, abstract --	1-9
A	WO 7900978 A1 (DONALDSON COMPANY, INC.), 29 November 1979 (29.11.1979), figure 1, abstract -- --------	9

INTERNATIONAL SEARCH REPORT

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

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