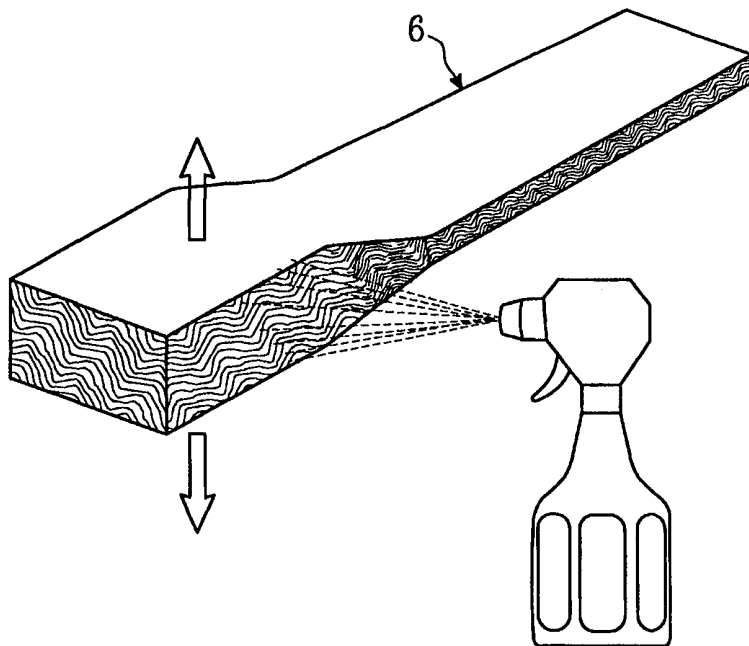




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(21) International Application Number: PCT/SE99/02317 (22) International Filing Date: 10 December 1999 (10.12.99) (30) Priority Data: 9804281-5 10 December 1998 (10.12.98) SE (71)(72) Applicant and Inventor: KUMLIN, Jerry [SE/SE]; Torsgatan 23, S-774 41 Avesta (SE). (74) Agent: GÖTEBORGS PATENTBYRÅ DAHLS AB; P.O Box 606, S-182 16 Danderyd (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Swedish).</i>

(54) Title: PROCESS FOR PREPARING EXPANDABLE FIBROUS MATERIAL**(57) Abstract**

The present invention relates to a process for the manufacture of expandable elements having a determined shape, whereby a mass (1) consisting of organic fibres, which are expandable by the addition of a hydrophilic liquid, is compressed in one or more determined directions to a density of 300 to 1500 kg/m³, preferably 600 to 800 kg/m³, and that elements having the determined form are shaped from said mass, as well as an expandable element and its use.

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TITLE**Process for preparing expandable fibrous material****DESCRIPTION**Technical field

10 The present invention relates a process for the manufacture of an expandable fibrous material as well as a material manufactured according to the process. The invention further comprises a method for expanding the expandable material.

At caulking or sealing of interspaces between building details, e.g., window frames and
15 surrounding beams expanding polymer foam is often used today, e.g., polyurethane foam. Such foam materials can in case of fire, irritate skin and air ways. Furthermore, they are difficult to apply in a sufficient amount and are relatively costly to use.

Thus there is a need for obtaining an expanding material without these drawbacks.
20

Summary of the invention

This object can be achieved by a process for the manufacture of expandable elements having a determined form, characterized in that a mass consisting of organic fibres is compressed in one or more determined directions to a density of 300 to 1500 kg/m³,
25 preferably 600-800 kg/m³, and that elements having the determined form are formed from said mass. Such an expandable material can easily be placed in a determined place and then become expanded by the addition of water or other hydrophilic liquid. At the expansion of such a material no noxious compounds are developed or used and such a material thus allows for a particularly environmental way to seal interspaces between e.g., window frames
30 and surrounding beams. Further one may, by choice the direction or directions, as the fibrous mass has been compressed in, to control the direction or directions of expansion.

In a preferred embodiment the elements are given the determined form at the compression

but it is also possible to think that the elements can be punched or cut from the compressed mass. The mass may consist of spruce fibres and the compression of the fibrous mass can be achieved by extrusion, rolling or form pressing. A water soluble binding agent in pulverulent form can be mixed into the fibrous mass prior to compression.

5

The invention further relates to a method for expanding an element which consists of a mass of organic fibres compressed to a density of 300 to 1500 kg/m³ characterized of adding a hydrophilic liquid to the element.

- 10 In a particular embodiment the invention relates to a process for filling interspaces between building details which interspace(-s) have a longitudinal as well as widening extension, characterized in that an element which consists of a mass of organic fibres is compressed in its thickness direction to a density of 300 to 1500 kg/m³ and which element has substantially the same length as the interspace but a thickness that is considerably smaller
- 15 than the width of the interspace, is introduced in each interspace whereupon a hydrophilic liquid is added to each element in such an amount that the interspace is filled as the element expands in its direction of thickness while absorbing such liquid. At a practical use of this process for sealing interspaces between a window frame and surrounding beams such elements are applied around the periphery of the window frame and after having attached
- 20 the window frame to the surrounding beams water is added, e.g., by spraying. In this way the elements expand in their direction of thickness to fill the gap between the window frame and the neighbouring beam.

- In a preferred embodiment of these expansion processes the liquid added comprises one or
- 25 more additives, such as binding agents, preservation agents, putrefaction agents or pest insecticides. Likewise, the dry fibrous material can contain such agents in dry form which are activated and absorbed by the expanding fibre.

- The invention also relates to an expandable element which is characterized in that it consists
- 30 of a mass of organic fibre, preferably cellulose fibre, compressed to a density of 300 to 1500 kg/m³ and comprising a web in its central portion.

Figure legends

The invention will now be described with reference to the attached figures, of which FIG. 1 shows schematically a device for the manufacture of an expandable material in accordance with one embodiment of the invention;

5 FIG. 2 shows schematically a piece of an expandable element in accordance with one embodiment of the present invention, and

FIG. 3 and 4 illustrate schematically a use of an embodiment of the invention in which expandable elements are used to seal the interspace between a window frame and surrounding beams.

10

Description of embodiments

In figure 1 a process for the manufacture of an expandable material is shown schematically, starting from a mass 1 of organic fibres, e.g., spruce fibres, arranged onto a conveyor, not shown, running in the feeding direction A. The spruce fibre mass has been obtained by
15 mechanical milling. The fibrous mass 1 is compressed by letting it pass through the pinch between a pair of rolls 2-4, which are placed after each other in the feeding direction A with successively decreasing distance between the rolls of the pair of rolls. After having passed the last pair of rolls the fibrous mass has been compressed to a hard board having a density of 300 to 1500 kg/m³, preferably 600 to 800 kg/m³. Finally, longitudinal elements are cut
20 from this hard compressed fibre board using a suitable cutting device, such as a punch.

In figure 2 such a cut element 6 is shown which at its left end part (of the figure) has been sprayed with water from a spraying bottle 7. The compressed element absorbs the water added and expands simultaneously. It has turned out that the element at the addition of
25 water in an amount enough, can expand up to 10 times its thickness when compressed to a hard board. After the expansion the element has obtained a foam-like consistency. After drying the element maintains its expanded volume.

The compression of the mass can also take place by extrusion or form pressing, preferably
30 using a dry mass. At the process described the mass 1 is compressed in one direction only when passing the pinch of the pair of rolls. This is of course possible to compress the block

in a direction perpendicular to this direction and the feeding direction by letting the side walls, as arranged in the device shown, but not shown in figure 1, to prevent fibrous mass from expanding side-wise at the passage of the pair of rolls, converge towards each other in the feeding direction A. An element produced in this way will at the absorption of water of
5 course expand in the cross directional of the element.

Wooden fibrous mass can be delivered in the form of compressed sheets or block and the expandable elements can also be produced starting from such blocks or sheets by splitting and, optionally, a further compression of these .

10

Figures 3 and 4 show schematically how expandable elements 6 manufactured in accordance with the above can be used for sealing the interspaces between a window frame 7, which has been inserted into a wall opening and the beams 8-11 which restrict the opening. The window frame 7 is provided with four pieces of elements 6' which extend in a
15 surrounding groove or milled track formed in those sides of the window frame 7 which face the beams 8-11. In figure 4 a cut piece of the window frame 7 is shown having an element 6' arranged in the groove of the window frame. The elements 6' have a suitable thickness of 2 to 8 mm.

20

After having inserted such a window frame in a common way in a wall opening and attached it to the surrounding beams it is enough to add water, e.g., by means of a spray bottle 12 or the similar, onto the outside of the window frame in order to have the elements 6' expand and fill the interspaces or the whole gap width between the windows and the
25 beams 8-11. Such a use of the invention contributes to a particularly simple mounting of the window frame in a wall opening. The elements 6' are further preferably manufactured in such a way that they will only expand in the direction of thickness at the addition of water. Thereby it is made sure that any after treatment to eliminate excess sealing material is not necessary, such as is the case when using conventional expanding polymer foam materials
30 which expand in all directions. In an expanded state the elements are able to take up movements in the construction without losing its sealing and silencer function.

In the embodiment described the elements 6' are factory mounted onto the window frame and are suitably covered by a removable, surrounding tape to prevent the elements from being subject to unintentional addition of water, e.g., rain water. It is of course in stead possible to attach the elements 6' to the window frame when this shall be mounted to the wall opening. For this purpose one side of the elements can be covered with a self-adhering glue or the similar.

The above described expandable elements can of course be used to fill other interspaces and voids between or within building details. At voids having a more complicated three dimensional form elements having been compressed in all directions, of course, have to be used. The elements according to the invention can be adopted to the voids to be filled by cutting, figure sawing or treatment in another suitable way.

The expandable elements according to the invention are delivered suitably in the form of longitudinal lathes or fillets and are, preferably provided with a self-adhering coating on their one side to facilitate attachment of the elements to a building detail or the similar.

In a variation of the process described one or more webs or the similar be placed in the mass prior to the compression thereof in order to improve the mechanical strength of the expandable elements. It is also possible to bring in liquid blocking layers in the fibrous material prior to the compression.

The element according to the invention can also be used as mere sealing fillets to exclude water or other liquid. The expanding properties of the elements are used at such use only to have the element expand into unevennesses of the surfaces the interspaces shall be sealed, whereby the degree of expansion is little. The abutment pressure against the two surfaces is, however, large. Even if the water will be absorbed by such an element so that its surface become wet water will, however, not leach out of the element.

The elements described above are made from fibres of spruce. Such fibres are long and flexible and the fibrous mass can be compressed to a density of up to 1500 kg/m³ without

destroying the fibres to any substantial degree. At a higher compression it has turned out that the expansion when adding water is reduced, which implies that too a high degree of the fibres have been damaged at the compression. For this reason the density, after compression should not exceed 1500 kg/m^3 . Even other wood species than spruce can be used to
5 manufacture the expandable elements according to the invention and it is also thought possible to use other organic fibres, preferably cellulose fibres, such as certain species of straw, in order to obtain a material according to the invention.

The hydrophilic liquid, preferably water, which is added to the elements, can
10 advantageously contain additives, such as glue, preserving agents, putrefaction agents or pesticides. It is also thought possible to mix a water soluble glue in pulverulent form into the fibrous mass prior to the compression in order to have the expanding material adhere to the surface it expands against in such a way, at the subsequent addition of water.

15 The expanded material according to the invention can, in sheet form, also be used as an insulating material. As the material in compressed form only takes minimal space such sheets can be attached in advance onto e.g., wall sheets and then be expanded prior to or in connection with the mounting of the wall sheets.

20 The expandable material according to the invention is a mere product of nature and has thereby great environmental advantages compared to the expandable polymers and other expandable conventional insulating material, as the material is thought to replace. The spruce fibre is approved the Asthma and Allergy Society. The spruce fibre material is also relatively cheap and the material described can be produced to a relatively low cost. Further,
25 the material can be reused in a number of ways. For example, after use it can be recompressed where after it can be used as expandable material again. However, the degree of expansion decreases successively with the number of times the material has been expanded and recompressed, probably due to the fact that the degree of damaged fibres of the material increases at each compression. The expanding material can also be
30 dismembered and be used as an absorption material for oils, liquid chemicals, and the similar.

The embodiments described can of course be varied within the framework of the invention. For example, the expandable elements can be given another shape than longitudinal elements or sheets at the compression. Further, more pair of rolls than three can be used at rolling. The invention shall thus only be restricted to the contents of the accompanying

5 claims.

CLAIMS

1. Process for the manufacture of an expandable elements having a determined shape,
characterized in

5 that a mass (1) consisting of organic fibres, which are expandable by the addition of a hydrophilic liquid, is compressed in one or more determined directions to a density of 300 to 1500 kg/m³, preferably 600 to 800 kg/m³, and that elements having the determined form are shaped from said mass

2. Process according to claim 1,
10 **characterized in** that the elements are cut out of the compressed mass.

3. Process according to claim 1,
characterized in that the element is given the determined shape at the compression.

15 4. Process according to claim 3,
characterized in that the mass (1) consists of spruce fibres.

5. Process according to claim 2,
characterized in that the compression of the fibrous mass is obtained by means of
20 extrusion, rolling or mould pressing.

6. Process according to claims 1-5,
characterized in that a water soluble binding agent in pulverulent form is mixed into the fibrous mass prior to the compression.

25

7. Expandable element

characterized in that it consists of a mass of organic fibres, which are expandable by the addition of a hydrophilic liquid, compressed to a density of 300 to 1500 kg/m³.

30 8. Expandable element according to claim 7,
characterized in that it comprises one or more webs embedded into the mass.

9. The use of an expandable element according to claims 7-8, to fill interspaces between building details (7, 8-11), which interspace(-s) has an extension in longitudinal and widening directions,

characterized in that an element (6') which consists of a mass of organic fibres, compressed
5 in its thickness direction to a density of 300 to 1500 kg/m³, preferably 600 to 800 kg/m³,
and which element has substantially the same length as the interspace but a thickness that is
considerably smaller than the width of the interspace, is introduced in each interspace (7, 8-
11), whereupon a hydrophilic liquid is added to each element (6') in such an amount that the
interspace is filled as the element expands in its direction of thickness while absorbing such
10 liquid.

10. Use according to claim 9,

characterized in that the liquid added contains one or more additives, such as binding
agents, preserving agents, putrefaction agents or pesticides.

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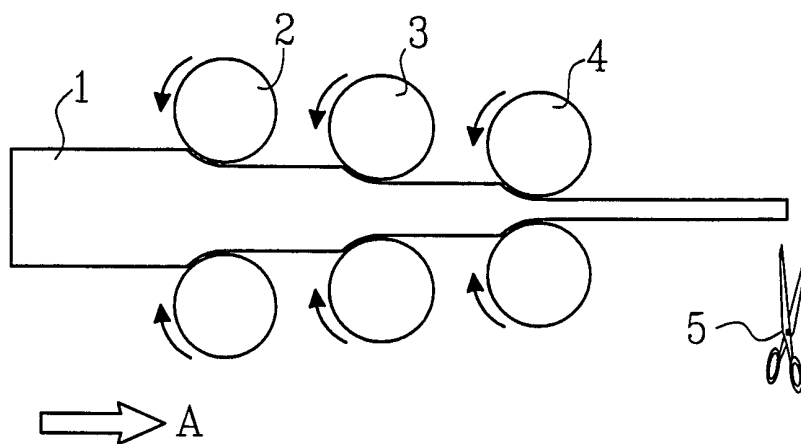


FIG. 1

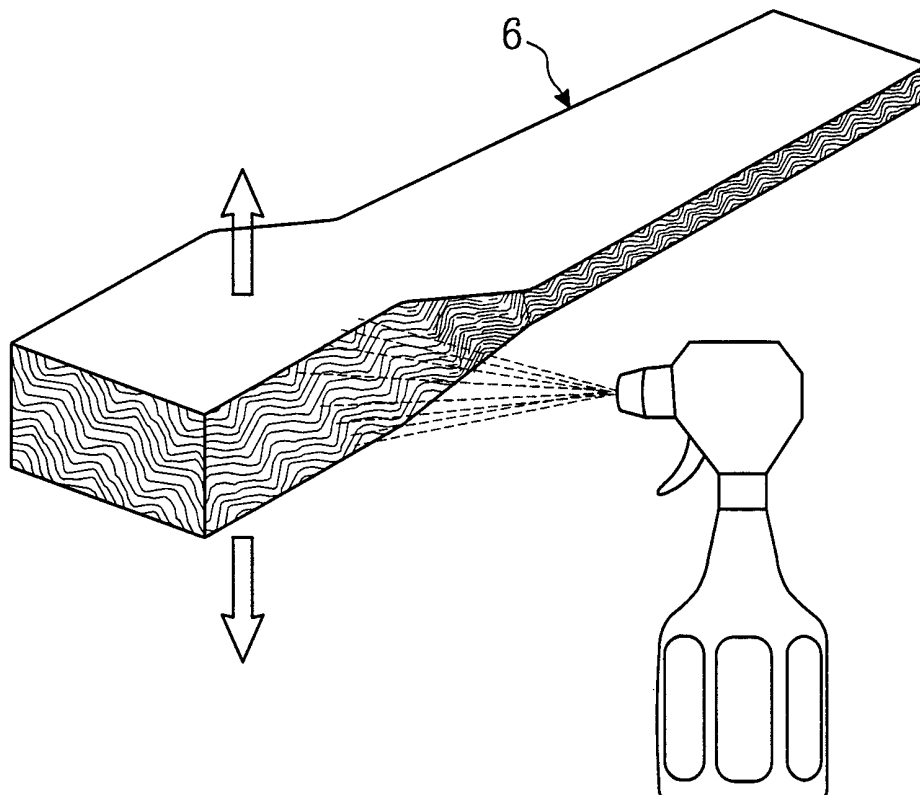


FIG. 2

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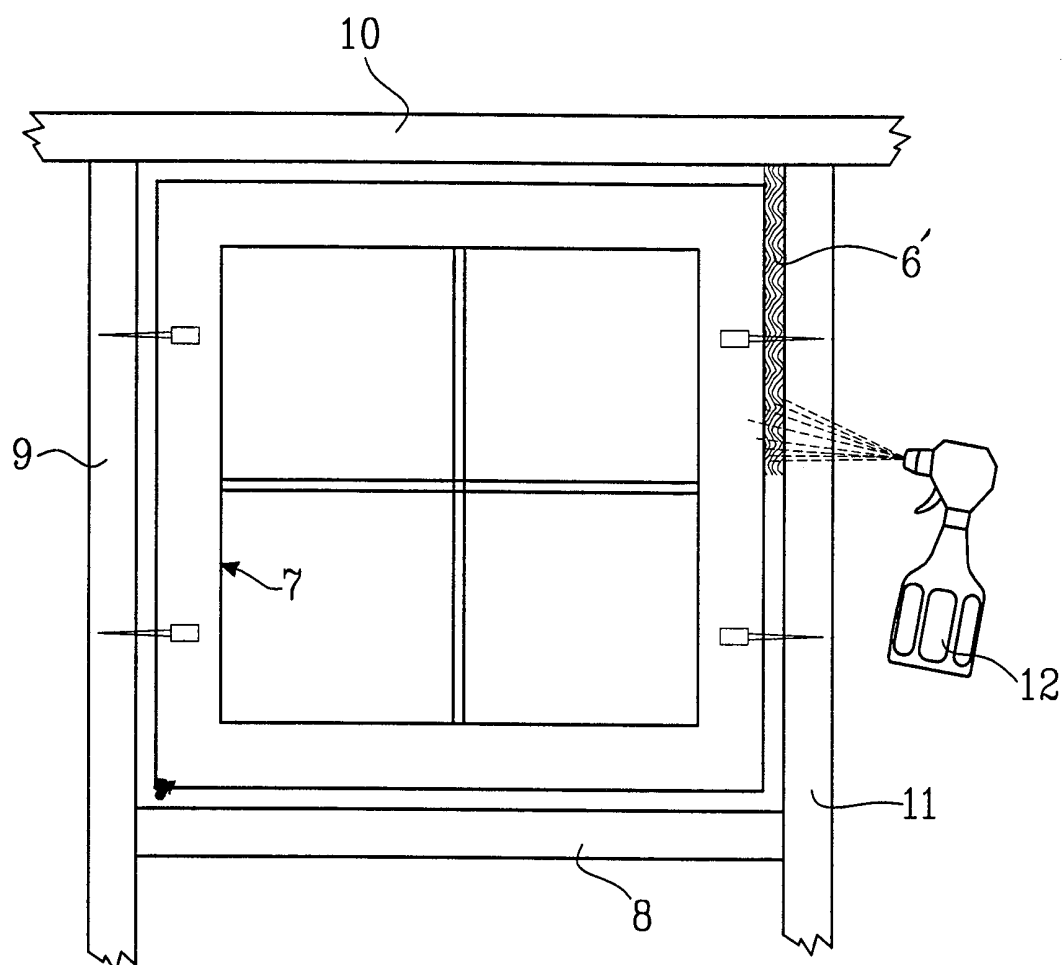


FIG. 3

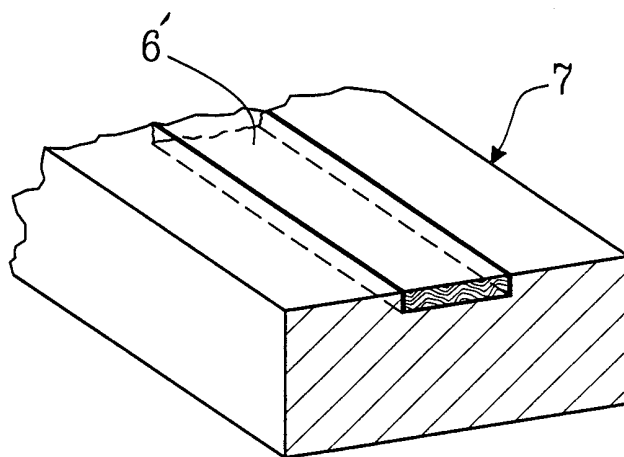


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02317

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E06B 1/62

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)

IPC7: E04B, E06B

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 115663 C (C.A. AJNE), 15 January 1946 (15.01.46) --	1-10
A	SE 183977 C (SKANDINAVISKA ETERNIT AB), 28 May 1963 (28.05.63) --	1-10
A	SE 334011 B (P-O. NYLUND), 5 April 1971 (05.04.71) --	1-10
A	SE 500533 C2 (ROCKWOOL AB), 11 July 1994 (11.07.94) --	1-10

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02317

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 1784467 A (N.V. ASPHALT-BITUMEN-ONDERNEMING ASBITON), 11 November 1971 (11.11.71) --	1-10
A	WO 9845565 A1 (STRÖMBERG, J.), 15 October 1998 (15.10.98) -- -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/SE 99/02317

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
SE	115663	C	15/01/46	NONE	
SE	183977	C	28/05/63	NONE	
SE	334011	B	05/04/71	NONE	
SE	500533	C2	11/07/94	SE 9002346 A	05/01/92
DE	1784467	A	11/11/71	AT 296706 A,B	15/01/72
				BE 719585 A	17/02/69
				BR 6801410 D	00/00/00
				CH 482137 A	30/11/69
				ES 357000 A	01/05/70
				FR 1544724 A	00/00/00
				IE 32914 B	23/01/74
				NL 157074 B	15/06/78
				NL 6810914 A	19/02/69
				SE 435755 B,C	15/10/84
				SE 7802846 A	13/03/78
WO	9845565	A1	15/10/98	AU 707669 B	15/07/99
				AU 3714097 A	10/02/98
				AU 7092798 A	30/10/98
				EP 0914224 A	12/05/99
				PL 331250 A	05/07/99
				SE 9701292 D	00/00/00