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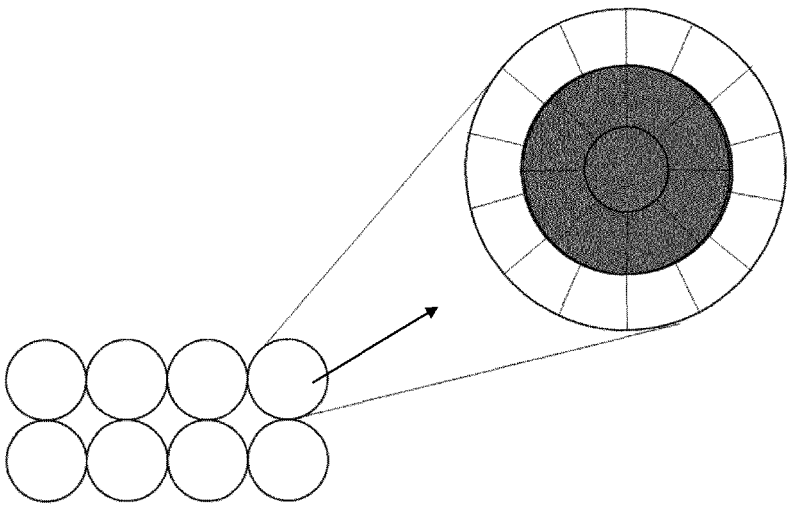
(54) Title: MULTIPLE SYNTHETIC MATERIAL MOORING ROPE AND PRODUCTION PROCESS

Fig. 2



8-strand braided rope,
cross-section

(57) Abstract: A mooring rope comprising two different types of synthetic materials which provide the mooring rope with a larger diameter and greater wear resistance without causing the strength of the rope to increase. The mooring rope may comprise a plurality of rope strands, wherein each strand has a core comprising primarily polypropylene with high molecular weight polyethylene rope yarns twisted around it. The production process for manufacturing such mooring ropes is disclosed, too. Synthetic materials include liquid crystal polyester, aramid and ceramics.

Multiple synthetic material mooring rope and production process

The present invention concerns a mooring rope comprising two different types of synthetic materials which provide the mooring rope with a larger diameter and greater wear resistance without causing the strength of the rope to increase. In particular, the invention concerns a mooring rope comprising a plurality of rope strands, wherein each strand has a core comprising primarily of polypropylene with rope yarns comprising HMPE twisted around it. The invention also comprises the production process for manufacturing such mooring ropes.

Prior art

Mooring ropes composed of various synthetic fibres are used in mooring of ships. The synthetic materials most commonly used for mooring ropes are polyester, polyamide, polypropylene and HMPE (high molecular weight polyethylene). In general, these synthetic materials are durable and have an optimal strength/price ratio. Such mooring ropes are much lighter, much easier to handle and show less snapback after breakage, which makes them safer for the crew of a ship.

The structure of current mooring ropes constitutes a twisted, braided or plaited construction of subropes, also referred to as strands, wherein the subropes absorb the entire force together. Examples of suitable subropes include a twisted bundle of rope yarns, 3 or 4-strand twisted rope, a 6+1-strand twisted rope or an 8-strand or 12-strand rope. Various types of synthetic materials are used in mooring rope as the rope yarn making up the subropes or strands.

Mooring ropes are susceptible to wear, in particular due to contact with winches, guides, pulleys, fairlead rollers and chocks. In particular, if the angle of contact with the guide is smaller, the pressure at the point of contact with the mooring rope is increased, causing wear. As a possible solution, various types of synthetic materials are already used in manufacturing mooring ropes, but these solutions appear to be unsatisfactory with respect to the useful life of mooring ropes. Another solution in use is that of plaiting the mooring rope so as to make it rounder, more stable and more

compact, with fewer irregularities on the rope surface. However, this solution also appears unsatisfactory for increasing wear resistance.

Description of the invention

The invention concerns a mooring rope with strands whose core is filled with rope yarn having lower tensile strength and elongation at break compared to HMPE yarns. This invention provides a larger diameter, which has a positive effect on wear resistance without increasing the strength of the rope.

The mooring rope of the invention comprises a plurality of strands of synthetic materials, wherein the rope yarns of the strands are twisted around a core comprising rope yarn having lower tensile strength and greater elongation at break compared to the rope yarn of the strands. The rope yarns of the strands may comprise synthetic fibres having high tensile strength and low elongation at break, such as e.g. HMPE, aramids, para-aramids, LCP or ceramic fibres.

In particular, the invention concerns a mooring rope with a plurality of strands of synthetic materials wherein the core of these strands comprises a central polypropylene rope yarn enclosed by one or a plurality or layers of any more or less symmetrical combination of a rope yarn comprising polypropylene and a rope yarn comprising one of the following synthetic materials: HMPE, aramids, para-aramids, LCP or ceramic fibres. Within the meaning of the invention, the term 'more or less symmetrical combination' is understood to mean that although the intention is to achieve a perfectly symmetrical combination, due to tolerance in the production process or normal use of the rope yarns, slight displacements may occur in the position of these yarns, and such a displaced embodiment must also be understood to fall within the scope of the various embodiments of the invention.

In a preferred embodiment, such a mooring rope is characterized in that the layer or layers comprising the combination of rope yarn are also enclosed by one or a plurality or layers of rope yarn consisting entirely of HMPE, aramids, para-aramids, LCP or ceramic fibres, or some combination of these synthetic fibres.

In a further preferred embodiment, the strands of the mooring rope of the invention in the outermost layer or layers of rope yarn consist entirely of HMPE, wherein the innermost layer or layers of rope yarn consist entirely of polypropylene.

In a further preferred embodiment, the mooring rope comprises 3 or 4-strand twisted rope, or e.g. a 6+1-strand twisted rope or an 8-strand or 12-strand rope. However, in a particularly preferred embodiment, the mooring rope of the invention comprises a 12-strand twisted rope.

The invention also comprises a mooring rope composed of 3, 4, 6+1, 8 or 12 twisted mooring ropes, wherein the composition of these mooring ropes is in accordance with any of the embodiments described above.

The mooring rope of the invention can be used for various maritime applications, but also for any application outside this field. In particular, the mooring rope of the invention can be used for mooring ships.

The invention also comprises the production process for manufacturing the mooring ropes of the invention, wherein a production process known in the area of mooring ropes is used.

Description of the figures

Fig. 1A: An external view and cross-section of a mooring rope of the invention in a 3-strand embodiment.

Fig. 1B: An external view and cross-section of a mooring rope of the invention in a 6+1-strand embodiment.

Fig. 1C: An external view of a mooring rope of the invention in an 8-strand embodiment.

Fig. 1D: An external view and cross-section of a mooring rope of the invention in a 12-

strand embodiment.

Fig. 2: An 8-strand mooring rope, wherein each strand has a core of polypropylene rope yarn, eight polypropylene rope yarns twisted around said core, and 14 further HMPE rope yarns also twisted around said core.

Fig. 3: A 12-strand mooring rope, wherein each strand has a core of polypropylene rope yarn, four polypropylene rope yarns and four HMPE rope yarns symmetrically twisted around said core, and 14 further HMPE rope yarns also twisted around said core.

Fig. 4: A 6+1-strand mooring rope, wherein each strand has a core of polypropylene rope yarn, four polypropylene rope yarns and four HMPE rope yarns symmetrically twisted around said core, 14 further HMPE rope yarns also twisted around said core, and a layer of HMPE rope yarns also twisted around said core.

Fig. 5: A 4-strand mooring rope, wherein each strand has a core of polypropylene rope yarns, eight polypropylene rope yarns twisted around said core, 14 further HMPE rope yarns also twisted around said core, and a layer of HMPE rope yarns also twisted around said core.

Fig. 6: A 12-strand mooring rope, wherein each strand has a core of polypropylene rope yarns, two layers of polypropylene rope yarns twisted around said core, and two layers of HMPE rope yarns also twisted around said core.

CLAIMS

1. Mooring rope comprising a plurality of strands of synthetic materials, wherein the rope yarns of the strands are twisted around a core comprising polypropylene rope yarn and wherein the rope yarn of the core has lower tensile strength and higher elongation at break compared to the rope yarn of the strands.

2. Mooring rope according to claim 1, wherein the rope yarns of the strands comprise HMPE, aramids, para-aramids, LCP or ceramic fibres.

3. Mooring rope according to any of the preceding claims, wherein the core is enclosed by one or a plurality or layers comprising any more or less symmetrical combination of rope yarn comprising polypropylene and a rope yarn comprising one of the following synthetic materials: HMPE, aramids, para-aramids, LCP or ceramic fibres.

4. Mooring rope according to claim 3, wherein the layer or layers comprising a combination of rope yarns are also enclosed by one or a plurality of layers of rope yarns consisting entirely of HMPE, aramids, para-aramids, LCP or ceramic fibres.

5. Mooring rope composed of 3, 4, 6+1, 8 or 12 strands of synthetic materials, wherein each of the strands has the characteristic of any of the preceding claims.

6. Mooring rope according to claim 3, wherein the layer or layers comprising a combination of rope yarn consist entirely of polypropylene.

7. Mooring rope according to claim 4, wherein the layer or layers of rope yarn enclosing the layer or layers comprises/comprise a combination of rope yarns consist(s) entirely of HMPE.

8. Use of a mooring rope according to any of claims 1 through 8 for the mooring of ships.

9. Production process for the manufacture of a mooring rope comprising a plurality of strands of synthetic materials, wherein the strands are twisted as specified in one of claims 1 through 8.

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Fig. 1A:

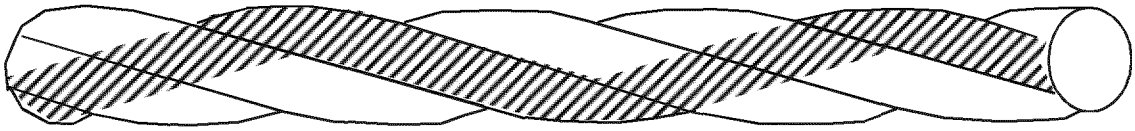


Fig. 1B:

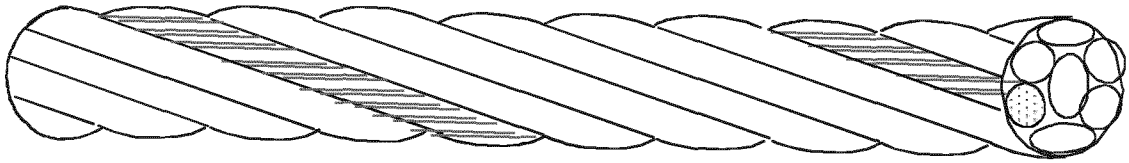


Fig. 1C:

Fig. 1D:

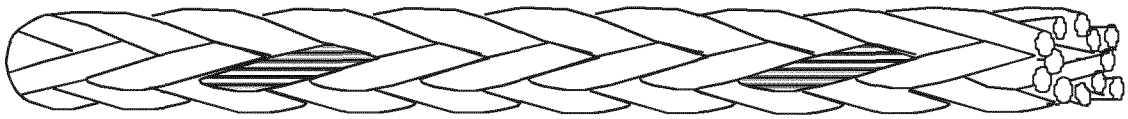
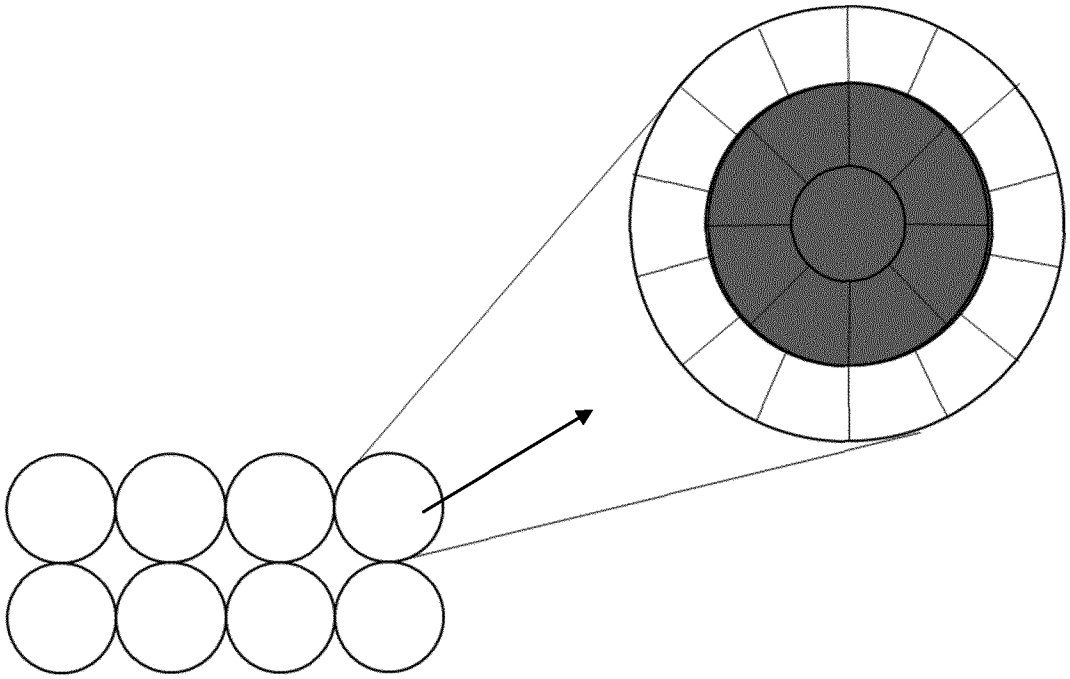


Fig. 2



8-strand braided rope,
cross-section

Fig. 3:

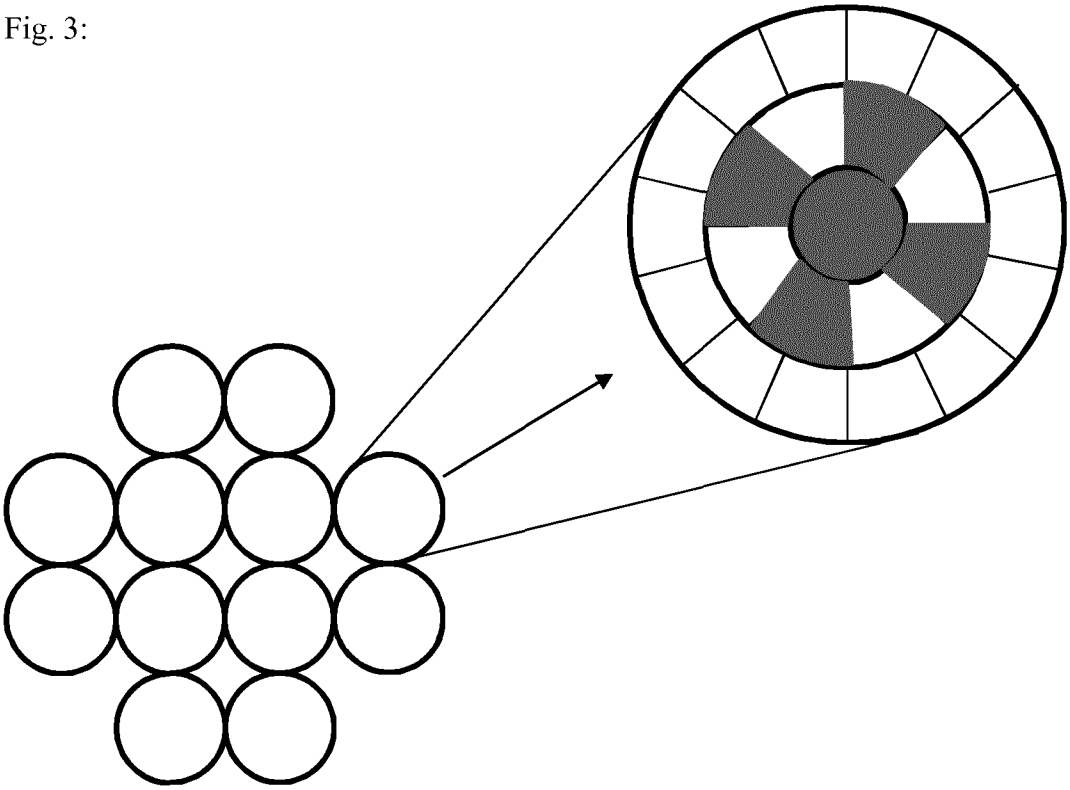


Fig. 4:

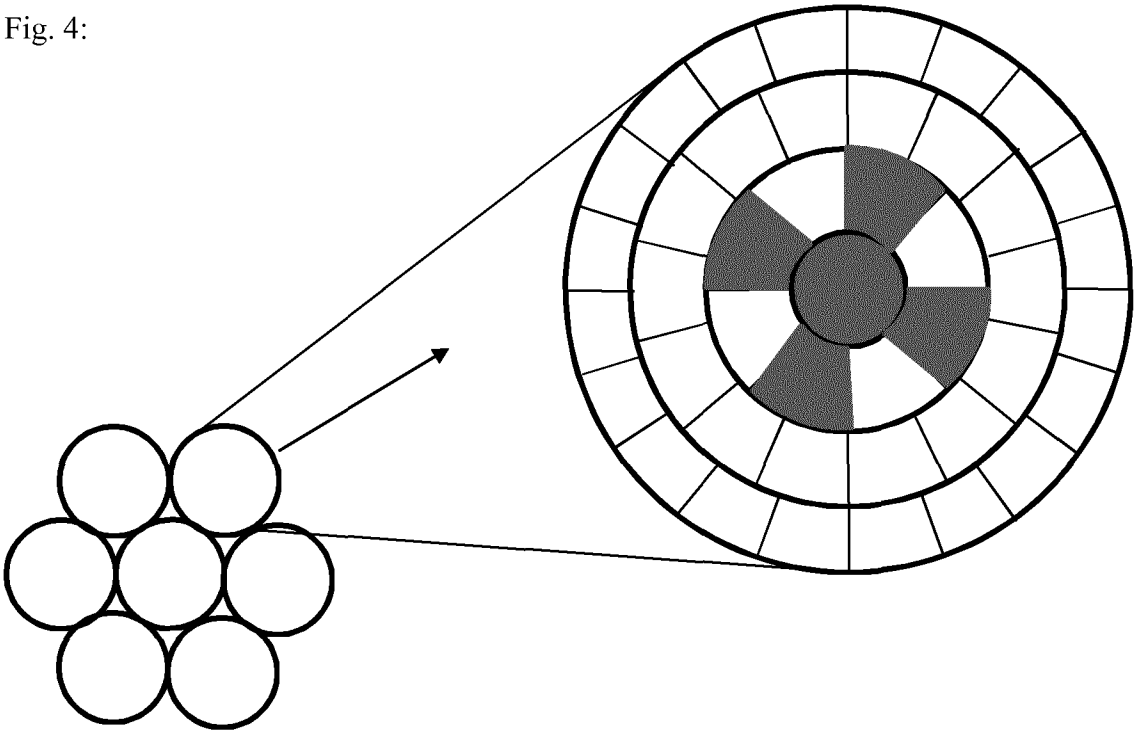


Fig. 5:

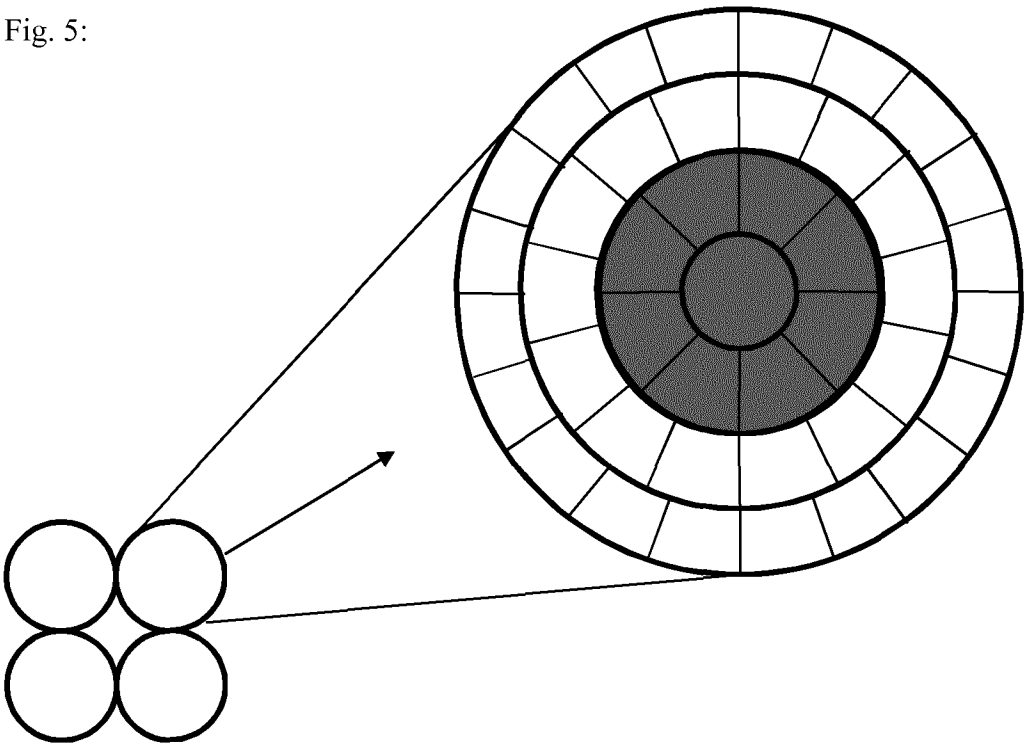
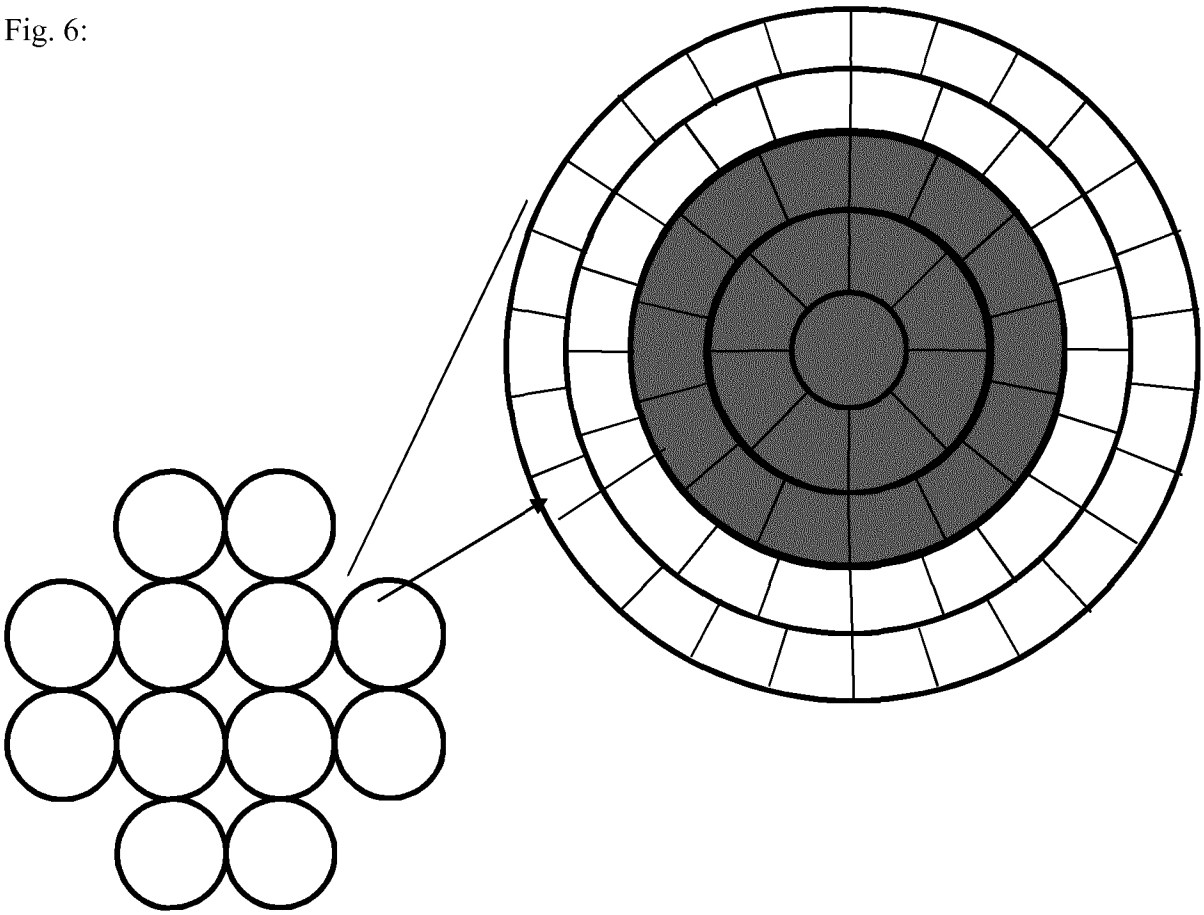


Fig. 6:



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/055025

A. CLASSIFICATION OF SUBJECT MATTER
INV. D07B1/02
ADD.

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)
D07B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 92/22701 A1 (DSM NV [NL]) 23 December 1992 (1992-12-23) page 2, lines 34,35 page 3, line 9 - line 32 page 5, lines 4,5 page 6, line 36 - page 7, line 16 page 9, line 4 - page 10, line 9; claim 1; figures	1,2,8,9
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A	GB 825 627 A (HOECHST AG) 16 December 1959 (1959-12-16) page 1, line 50 - line 56 page 2, line 75 - page 3, line 2	1

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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
23 May 2016	02/06/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Uhlig, Robert

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 852 926 A (BREEDLOVE JAMES R [US]) 29 December 1998 (1998-12-29) column 2, lines 23,55-64; figures 2,3 column 3, line 1 - column 4, line 62; claim 5	1,2,5,8, 9
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/055025

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