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(54) APPARATUS AND USE THEREOF FOR SEPARATING FIBRE MATERIAL

(57) An apparatus (1) for separating fibre material and the use thereof is disclosed, the apparatus comprising an inner drum (2) with openings (3) defined in the inner drum wall (4), the inner drum (2) being arranged to be rotated about a first axis by means of first drive means, an inlet opening (5) of the inner drum (2) through which said fibre material may be entered into the interior of the inner drum (2), an outer drum (7) which at least partially encompasses the inner drum (2), the outer drum (7) being arranged to be rotated about a second axis by means of second drive means, wherein the first drive means and the second drive means are arranged for rotating the inner drum (2) and the outer drum (7) individually and independently of each other, the outer drum (7) having an inner drum surface (9) provided with one or more conveying blades (10) extending inwardly, so that the rotation of the outer drum (7) will cause the blade(s) (10) to convey material on the inside of the outer drum (7) towards an outlet (11) end of the outer drum (7).

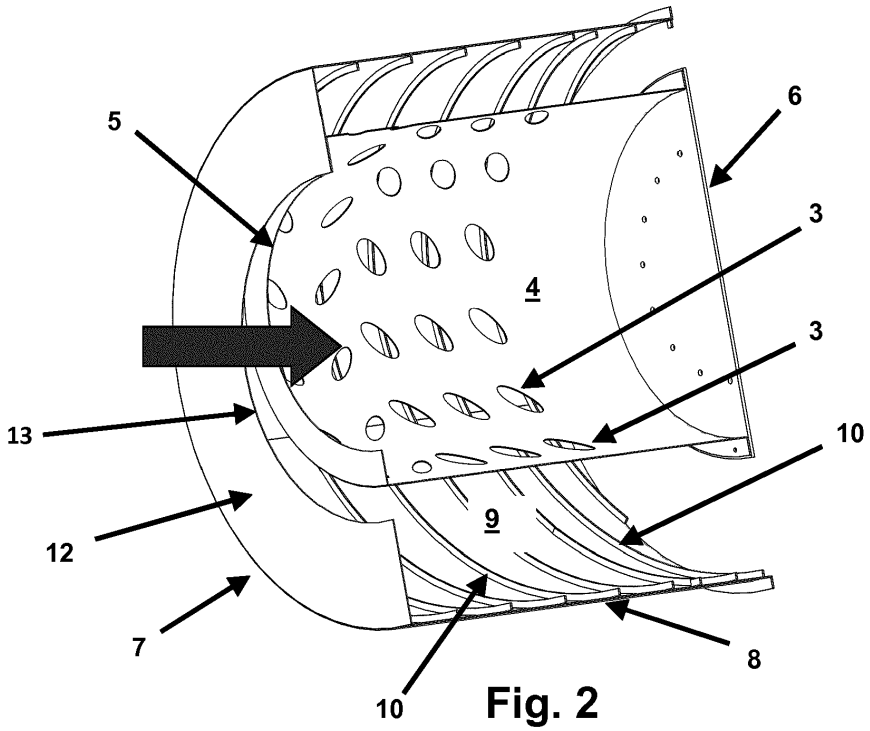

Fig. 2

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Description

[0001] The present invention relates to an apparatus and use thereof for separating fibre material, in particular for metering out material for being admixed in a concrete composition.

Background

[0002] Fibre reinforced concrete is becoming widespread used as the characteristics of the concrete compositions are improved. The fibres being micro or macro fibres of glass, plastics, steel, carbon or natural fibres or a mixture thereof and may be delivered as bulk material or in pucks, which are bundles of macro fibres held together by a plastic tape, and need to be separated in order to be measured out into the concrete mixture.

[0003] One apparatus for doing so is disclosed in Australian patent No. AU 642351 B2 comprising two drums, one inside the other, both having holes in the drums walls for the fibres to pass through when the drums are rotates or oscillated

[0004] An object of the present invention is to provide an apparatus and use of such apparatus for improved separation and handling of such fibre material, in particular where an improved precision in the metering out of the material can be provided.

Brief description of the invention

[0005] The present invention relates to an apparatus for separating fibre material comprising an inner drum with openings defined in the inner drum wall, the inner drum being arranged to be rotated about a first axis by means of first drive means, an inlet opening of the inner drum through which said fibre material may be entered into the interior of the inner drum, and an outer drum which at least partially encompasses the inner drum, the outer drum being arranged to be rotated about a second axis by means of second drive means, wherein the first drive means and the second drive means are arranged for rotating the inner drum and the outer drum individually and independently of each other, the outer drum having a preferably closed inner drum surface provided with one or more conveying blades extending inwardly, so that the rotation of the outer drum will cause the blade(s) to convey material on the inside of the outer drum towards an outlet end of the outer drum.

[0006] The first axis and the second axis of the respective drums may in a preferred embodiment extend in parallel and it is preferred that the first axis extend above the second axis so that more room is available between the inner drum and the outer drum to hold fibre material inside the outer drum during operation of the apparatus.

[0007] The apparatus may further comprise a weighing unit which has a receiving part arranged to receive material from the outlet end of the outer drum, and a weighing part for determining the weight of material received by said receiving part. The output from the weighing part may be used to control the operation of the rotation of the outer drum so as to perform a very precise metering out of fibre material onto the receiving part. It may also be employed to control the emptying of the receiving part into a concrete mixture when the requested amount of fibre material has been metered out. In a particular embodiment, the receiving part comprises a conveyor belt with drive means for emptying said receiving part of material.

[0008] At least some of the openings defined in the inner drum wall are in a preferred embodiment of an elongated shape, preferably an elliptical shape. The elongated openings are preferably arranged with the longer dimension in different directions so as to ensure a diverse orientation of the fibres moving into the outer drum from the inner drum. The longer dimension of the openings are typically between 1 and 4 times the shorter dimension (i.e. including round holes) and preferably from 1.5 to 3 times the shorter dimension, and in the order of 0.8 to 1.2 times the length of the fibres fed into the inner drum. Alternatively, the openings may be of a rectangular shape with similar ratios between the longer and the shorter dimensions of the openings.

[0009] The apparatus may furthermore comprise agitators extending inwardly from the inner drum wall so as to loosen pucks and bundles of fibres or separate entangles fibres when the inner drum is operated. In a particular embodiments, the agitators are constructed as conveying blades so that the rotation of the inner drum will cause the blades to convey material on the inside of the inner drum towards one end of the inner drum and ensure a more even distribution of the fibre material inside the inner drum.

[0010] In a preferred embodiment, the apparatus according further comprises control means for controlling at least said first drive means in response to measurements of the power consumption of the second drive means so than an increase in the power consumption will cause reduction of the speed of rotation of the inner drum.

[0011] In another preferred embodiement, the apparatus further comprises control means for controlling at least said second drive means in response to output from said weighing part, so that the speed of rotation of the outer drum is reduced when a predefined fraction of a required amount of fibre material has been received by said receiving part.

[0012] The present invention also relates to the use of an apparatus as disclosed herein for separation of fibre material to be added to a concrete composite material, wherein the fibre material is entered into the interior of the inner drum.

[0013] The fibres are preferably made from a plastics material, in particular from polypropylene.

[0014] In another embodiment, the apparatus is used for separating steel fibres.

[0015] However, the apparatus according to the

present invention may also be used for separating and preferably metering out of fibres of different materials, such as plastic fibres and carbon fibres, glass fibres or natural fibres.

[0016] Although the apparatus according to the present invention may be used for separation and preferably metering out of micro fibres as well as a mixture of macro and micro fibres it is preferred that at least some of said fibres are of a length in the range of 25 to 75 millimetres and a width in the range of 0.5 to 1.5 millimetres, preferably of a length in the range of 35 to 65 millimetres, and preferably of a width in the range of 0.7 to 1.3 millimetres.

[0017] In a particularly preferred embodiment, the apparatus is used where the fibre material entered into the inner drum comprises bundles of macro fibres, in particular within the above-defined dimensions, which bundles are held together by a band material, i.e. a band of a thin plastic strip.

Brief description of the drawings

[0018] An embodiment of the present invention is shown in the enclosed drawing of which

Figure 1 is a perspective view of an apparatus according to the present invention comprising an inner drum and an outer drum,

Figure 2 is a cut-through perspective view of the apparatus of figure 1,

Figure 3 is a perspective view of the inner drum of the apparatus of figures 1 and 2, and

Figure 4 is a perspective view of the outer drum of the apparatus of figures 1 to 3.

Description of preferred embodiments

[0019] The apparatus 1 shown in the enclosed drawing is one embodiment of the present invention, comprising an inner drum 2 with oval openings 3 in the inner drum wall 4, an inlet opening 5 at one end and an end wall 6 closing off the other end of the inner drum 2. The outer drum 7 has a closed outer drum wall 8, which on the inner side 9 is provided with helical conveyor blades 10 for driving the fibre material towards the outlet opening 11 of the outer drum 7 at one end of the outer drum 7. The opposite end of the outer drum 7 is provided with an end wall 12 with a central opening 13 so as to allow fibre material to be entered into the inner drum 2 through the inlet opening 5 thereof. The end wall 12 prevents fibre material inside the outer drum 7 to spill out at that end of the apparatus 1 during operation of it.

[0020] The inner drum 2 and the outer drum 7 are arranged to be rotated around a first axis and a second axis, respectively, where the second axis is situated parallel to but below the first axis to allow for fibre material to pile up on the inner side 9 of the outer drum 7. The second axis may furthermore or alternatively be displaced to one side with respect to the first axis to allow for piled-up fibre material, since the rotation of the outer drum 7 may cause a larger pile-up at one side of the outer drum 7. The inner drum 2 and the outer drum 7 are driven in the rotation about the respective axis independently by two drive arrangements (not shown) so that the rate of transfer of fibre material from the inner drum 2 to the outer drum 7 and the metering out of fibre material from the outer drum 7 to the receiving part (not shown) may be controlled independently of each other.

[0021] The openings 3 in the inner drum wall 4 are of elliptical shape with varying ratio between the longest and shortest dimension in the range of 3:1 to 1.5:1 and varying orientations which may be seen in Figs. 2 and 3.

[0022] During operation of the apparatus 1 for feeding macro fibres, such as polypropylene fibres of a length of 50 millimetres and a thickness of 1 millimetre, into a mixing of concrete, the macro fibres in bundles of fibres, typically of a diameter of 80 to 120 millimetres, such as 100 millimetres, held together by a strip of a thin, flexible plastics material are fed automatically or operator controlled into the interior of the inner drum 2 through the openings 3, 13 in the inner drum 2 and the outer drum 7 as indicated by the filled arrow in Figs. 1, 2 and 3, and the inner drum 2 is rotated to release the fibres from the bundles and from each other so that the single fibres can pass the openings 3 into the interior of the outer drum 7 as indicated by the non-filled arrows of Fig. 3. The varying orientation of the openings 3 ensures that the fibres will have a broad distribution in direction in the outer drum 7 and when admixed into the concrete. The rotation of the inner drum 2 is controlled to ensure the required flow of fibres from the inner drum 2 into the outer drum7, such as a steady flow of fibres. The outer drum 7 is in one embodiment operated to rotate in response to the output from a weighing unit with a receiving part (not shown) for receiving the fibres from the outlet opening 11 of the outer drum 7 as indicated by the arrows in Fig. 4. The mixing of concrete is usually performed in batches, so that a very specific amount of fibres must be measured out for each batch, and the operation of the rotation of the outer drum 7 may be controlled to measure fibres out with a precision about 50 to 150 g, which is a high degree of precision as compared to other automatic methods. The conveyor blades 10 on the inside 9 of the outer drum 7 ensures the high precision in measuring out of fibre material through the outlet opening 11 of the outer drum 7.

[0023] In order to achieve the high precision in measuring out the correct amount of fibre material and at the same time ensure fast operation, the rotation of the outer drum 7 may in a first mode be relatively fast to measure out e.g. 60 to 85 % of the required amount and a subsequent mode with slower rotational speed of the outer drum 7 in order to precisely measure out the remaining amount.

[0024] In alternative embodiments, the inner drum 2 may be equipped with agitators on the inside of the drum wall 4 of the inner drum 2 so as to promote the loosening of the bundles of macro fibres and to separate such fibres or fibre that are fed into the inner drum 2 in other conditions, such as loose fibres which may be entangled. Such agitators may in particular be formed as conveyor blades so as to help distribute the fibres along the full longitudinal extent of the inner drum 2.

[0025] The apparatus may be employed for separating and metering out of micro fibres as described previously, but also for micro fibres or for a mixture of macro and micro fibres. The openings in the inner drum may be designed more specifically for the type of fibres to be separated by the apparatus.

[0026] The inner drum 2 may be driven in rotation in one direction or the other, or it may in operation be rotated back and forth.

[0027] The rotation of the inner drum 2 is in an embodiment controlled in response to measurements of the power consumption for rotation of the outer drum 7, the larger the power consumption is, the more material is carried by the outer drum 7 and the rotation of the inner drum 2 is reduced or even stopped at a higher power consumption for rotation of the outer drum 7 in order to reduce the flow of fibre material from the inner drum 2 to the outer drum 7. This is a simple manner for controlling the rotation of the inner drum 2 without the need for further sensors, encoders or the like.

[0028] Apart from the batch operation of the apparatus in metering out fibre material, the apparatus according to the present invention may also be employed for continuous operation, i.e. for a producing a continuous flow of fibres from the outlet opening 11 of the outer drum 7 into a continuous mixing process of concrete.

[0029] The apparatus may also be used for separating macro steel fibres and/or micro fibres of steel, micro fibres of plastics, such as polypropylene, and/or micro fibres of e.g. glass, carbon or natural fibres.

References

[0030]

1	Apparatus
2	Inner drum
3	Openings in the inner drum
4	Inner drum wall
5	Inlet opening of inner drum
6	Closed end wall of inner drum
7	Outer drum
8	Outer drum wall
9	Inner side of outer drum wall
10	Conveyor blades
11	Outlet opening of outer drum
12	End wall of outer drum
13	Central opening in end wall of outer drum

Claims

1. Apparatus (1) for separating fibre material, the apparatus comprising
an inner drum (2) with openings (3) defined in the inner drum wall (4), the inner drum (2) being arranged to be rotated about a first axis by means of first drive means,
an inlet opening (5) of the inner drum (2) through which said fibre material may be entered into the interior of the inner drum (2),
an outer drum (7) which at least partially encompasses the inner drum (2), the outer drum (7) being arranged to be rotated about a second axis by means of second drive means,
wherein the first drive means and the second drive means are arranged for rotating the inner drum (2) and the outer drum (7) individually and independently of each other,
the outer drum (7) having an inner drum surface (9) provided with one or more conveying blades (10) extending inwardly, so that the rotation of the outer drum (7) will cause the blade(s) (10) to convey material on the inside of the outer drum (7) towards an outlet (11) end of the outer drum (7).

2. Apparatus according to claim 1, wherein said first axis and said second axis extend in parallel.

3. Apparatus according to claim 1 or 2, wherein the first axis extend above the second axis.

4. Apparatus according to any of claims 1 to 3, further comprising a weighing unit having a receiving part arranged to receive material from the outlet end of the outer drum, and a weighing part for determining the weight of material received by said receiving part.

5. Apparatus according to claim 4, wherein said receiving part comprises a conveyor belt with drive means for emptying said receiving part of material.

6. Apparatus according to any of the preceding claims, wherein at least some of the openings (3) defined in the inner drum wall (4) are of an elongated shape, preferably an elliptical shape.

7. Apparatus according to any of the preceding claims, further comprising agitators extending inwardly from the inner drum wall (4).

8. Apparatus according to claim 7, wherein said agitators are constructed as conveying blades so that rotation of the inner drum (2) will cause the blades to convey material on the inside of the inner drum (2) towards one end of the inner drum.

9. Apparatus according to any of the preceding claims,

further comprising control means for controlling at least said first drive means in response to measurements of the power consumption of the second drive means so than an increase in the power consumption will cause reduction of the speed of rotation of the inner drum (2).

10. Apparatus according to any of claims 4 to 9, further comprising control means for controlling at least said second drive means in response to output from said weighing part, so that the speed of rotation of the outer drum (7) is reduced when a predefined fraction of a required amount of fibre material has been received by said receiving part.

11. Use of an apparatus according to any of claims 1 to 10 for separation of fibre material to be added to a concrete composite material, wherein the fibre material is entered into the interior of the inner drum (2).

12. Use according to claim 11, wherein the fibres are made from a plastics material, in particular from polypropylene.

13. Use according to claim 11, wherein the fibres are made from steel.

14. Use according to any of claims 11 to 13, wherein said fibres are of a length in the range of 25 to 75 millimetres and a width in the range of 0.5 to 1.5 millimetres.

15. Use according to any of claims 11 to 14, wherein the fibre material entered into the inner drum comprises bundles of fibres held together by a band material.

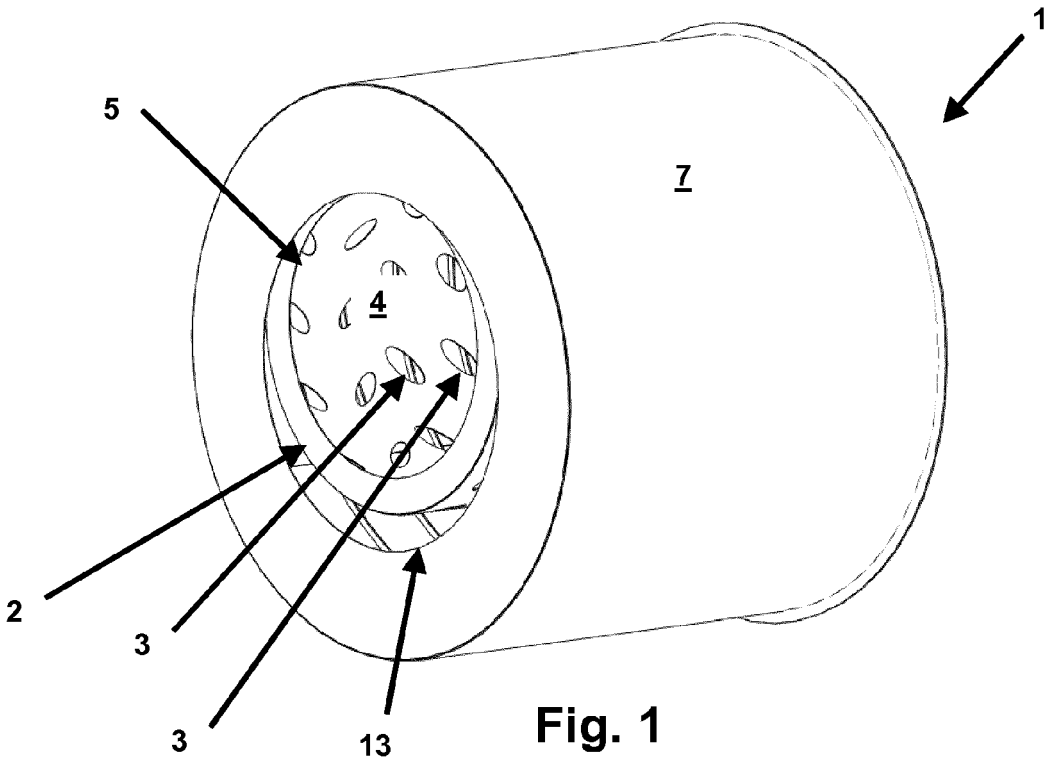

Fig. 1

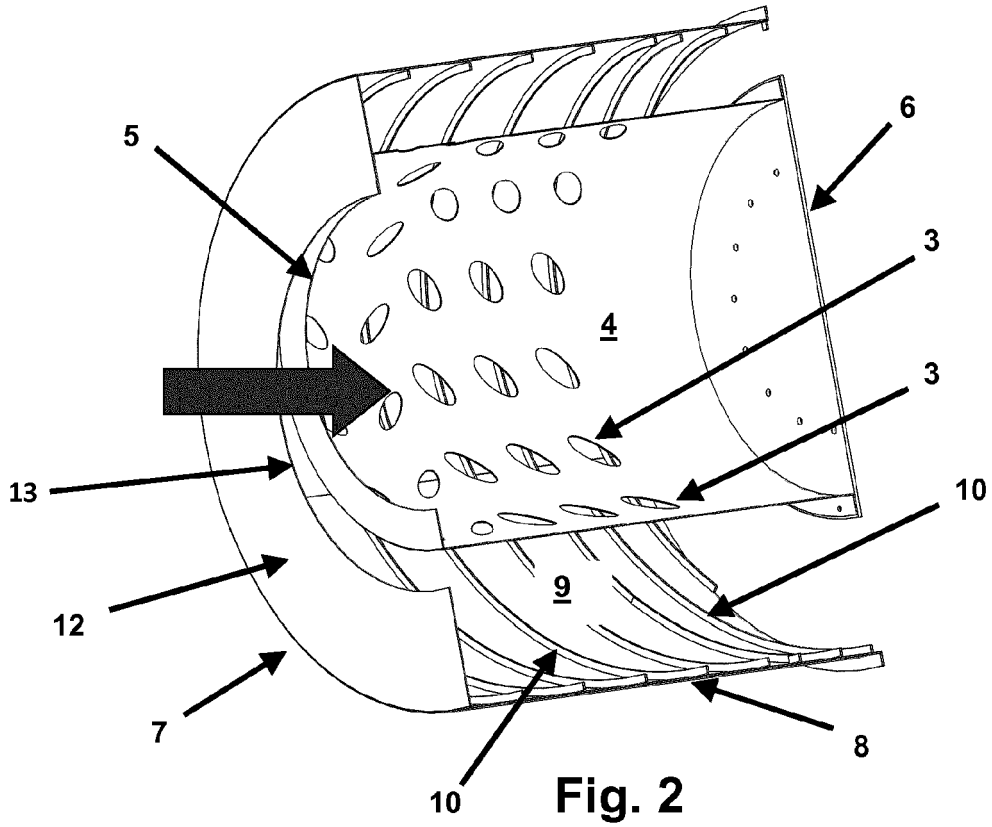

Fig. 2

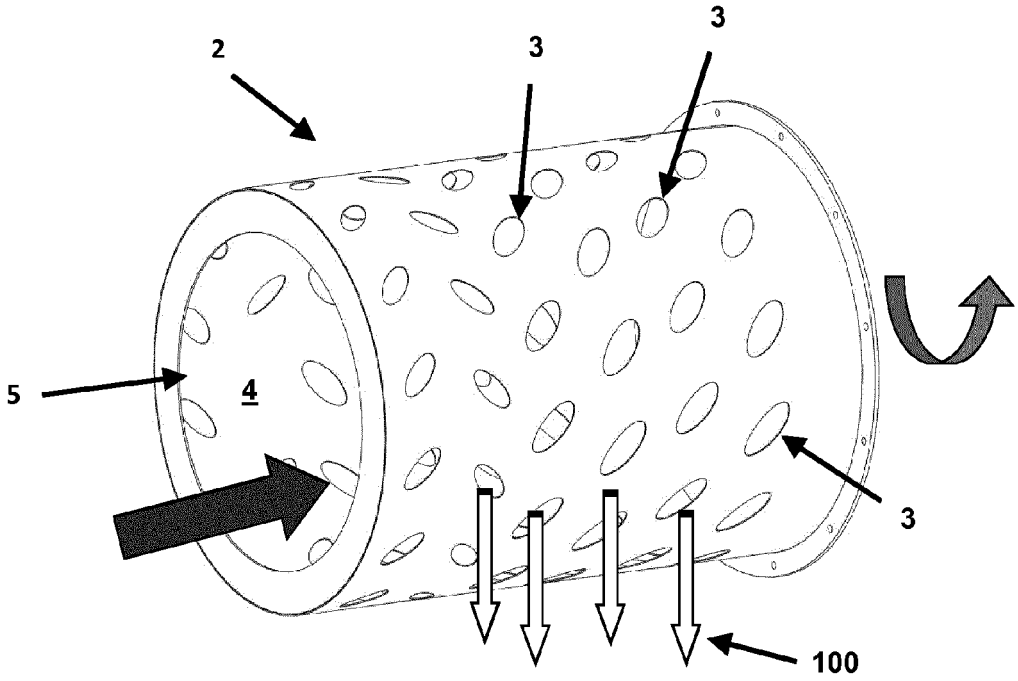

Fig. 3

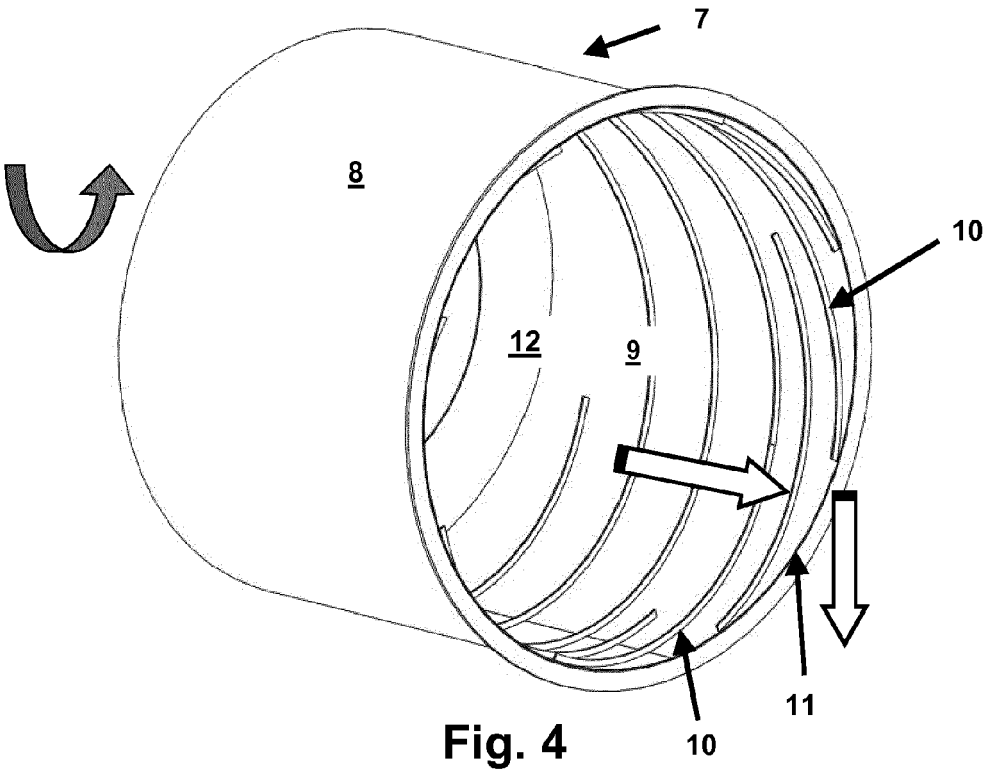

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 4965

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 745 204 A1 (COGEMA [FR]) 29 August 1997 (1997-08-29)	1,2,4-10	INV. B07B1/24
Y	* page 4, line 1 - page 5, line 9 * * page 8, line 29 - page 10, line 12 * * page 11, line 6 - line 25 * * page 12, line 20 - page 13, line 30; claims 1-5; figures 1-4 *	11-15	B07B13/16
X	GB 2 277 044 A (QED INT LTD [GB]) 19 October 1994 (1994-10-19) * page 2, line 1 - line 13 * * page 3, line 25 - page 5, line 13; claims 1-10; figures 1-4 *	1-5,9,10	
Y,D	AU 642 351 B2 (AMATEK LTD) 14 October 1993 (1993-10-14) * page 2, line 11 - line 17 * * page 2, line 33 - page 3, line 18 * * page 3, line 36 - page 4, line 25; claims 1-10; figures 1-2 *	11-15	

TECHNICAL FIELDS SEARCHED (IPC)

B07B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 March 2016	Lang, Xavier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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