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(54) An apparatus for unwinding and slitting a material web

(57) The invention relates to an apparatus (1) for unwinding a material web (2), which is wound up onto a core (3), the apparatus comprising a conveyor unit (5) arranged to pull the unwound material web (2) along a conveyance path, wherein the conveyor unit includes a first roller (7) and a second roller (8) extending substantially across a width of the material web and sandwiching the material web in-between, wherein the first and second rollers are configured to frictionally engage the material web (2) in a longitudinal and lateral direction, wherein at least one of the first and second rollers is provided with at least one cutting disc (10) arranged to penetrate the material web so that the material web is slitted into strips.

As the cutting discs are attached to one of the rollers in the conveyor unit the number of components and the number of cutting discs can be reduced, thereby reducing the complexity and cost of the equipment for unwinding and slitting the material web.

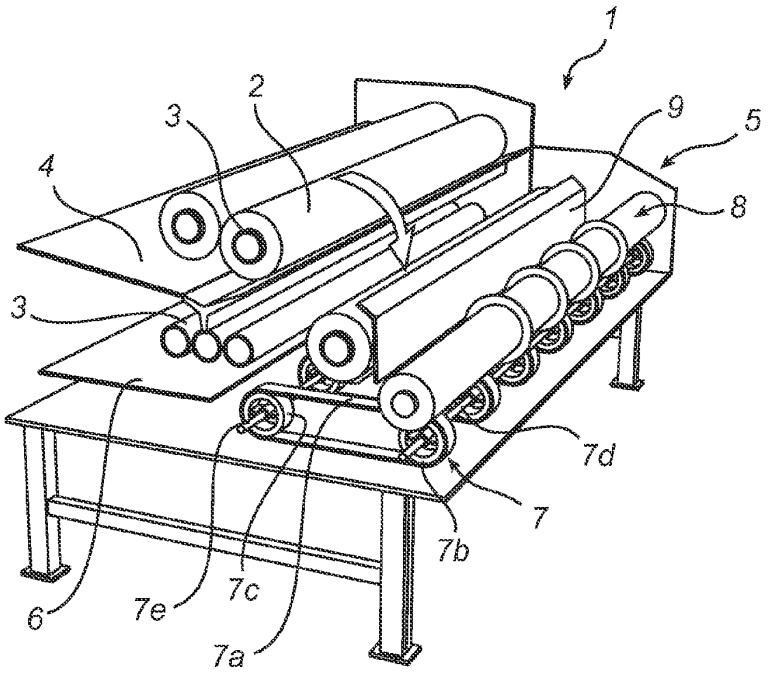

Fig. 2

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Description

Technical field

[0001] The present invention relates to an apparatus for unwinding and slitting a material web, which is wound up onto a core.

Background of the invention

[0002] In the manufacture of paper or the like, the finished paper web is typically wound up on a core. As the paper web is subsequently processed in a sheet cutter, a printing press, a corrugator machine, a laminator or the like, not all of the paper will be utilized and there will be a butt roll, i.e. a core with remnant paper thereon. To be able to reuse the core and recycle the paper of the butt roll, the remnant paper must be separated from the core. One way to separate the remnant paper from the core is to utilize a core stripper. An example of a known core stripper is described in US 4,298,173, where the core with the web is placed on a conveyor belt that supports and rotates the core with the web under retention, while the unwound paper web runs through a nip formed between the belt and a pressure roller.

[0003] However, the unwound paper web that is fed out of the core stripper tends to be bulky and therefore difficult to handle. One way to overcome this problem is to let the paper web that is fed out of the core stripper pass through a slitter with upper and lower sets of opposing circular knifes that cuts the paper web into longitudinal strips. The paper strips can then e.g.be manually collected or directly fed to a process that mechanically or chemically dissolves the paper.

[0004] However, although the slitter reduces bulkiness and facilitates handling of the unwound paper web, it would be desirable to reduce the complexity and cost of the equipment that is required for unwinding and slitting the paper web.

Summary of the invention

[0005] In view of the above, an object of the invention is to solve or at least alleviate the problems discussed above. In particular, an object is to provide at a reduced cost, an apparatus for unwinding and slitting a material web, which is wound up onto a core.

[0006] According to an aspect of the invention, there is provided an apparatus for unwinding a material web, which is wound up onto a core, the apparatus comprising: a conveyor unit arranged to pull the unwound material web along a conveyance path, wherein the conveyor unit includes a first roller and a second roller extending substantially across a width of the material web and sandwiching the material web in-between, wherein the first and second rollers are configured to frictionally engage the material web in a longitudinal and lateral direction, wherein at least one of the first and second rollers is provided with at least one cutting disc arranged to penetrate the material web so that the material web is slitted into strips.

[0007] The present invention is based on the understanding that a cutting disc, provided at one of the rollers and configured to penetrate the material web, can be used to slit the unwound material web into strips. Because the material web is frictionally engaged by the first and second rollers, lateral movement of the material web (i.e. movement in an axial direction of the rollers) is prevented and as the material web's ability to flex is restricted the cutting disc will stretch the material web and cut and/or tear the material web into strips. It should be noted that this technique, where the material web is stretched by the cutting disc until it is slitted into strips, is fundamentally different from the conventional slitters used in prior art solutions where the material web is sheared between opposing knives (in the same way that a pair of scissors cut a paper). Further, as the cutting discs are attached to one of the rollers in the conveyor unit the number of components and the number of cutting discs can be reduced, thereby reducing the complexity and cost of the equipment for unwinding and slitting the material web. Furthermore, as the material web is slit by having the cutting disc stretch the material web, the sharpness of the cutting edge is less crucial than when the material web is sheared between opposing knives. Moreover, it should be noted that although it may be preferable to have a substantial frictional force between the material web and both of the rollers, the inventive apparatus may function also when substantially all of the frictional force applied to the material web occurs between the paper web and one of the rollers.

[0008] In this application the term roller is intended as any component or any arrangement of components that can support and frictionally engage the material web such as, for example, a single cylindrical element, a set of wheels, or a set of belts.

[0009] The first and second rollers may preferably be configured to form a plurality of nips (i.e. two or more locations where the material web is squeezed between the first and second rollers) spaced in an axial direction of the rollers. In particular, there may preferably be one nip from the plurality of nips arranged on each side of the cutting disc. An advantage associated herewith is that the portion of the material web located in-between the nips cannot flex. Thus, the cutting disc can more easily penetrate the material web.

[0010] Further, a plurality of cutting discs may be interleaved in-between the nips so that the material web can be slit into a plurality of strips. By interleaved is here intended that the cutting discs are arranged in-between different pairs of nips. However, there may also be multiple cutting discs arranged between two adjacent nips. The number of cutting discs and the distance between the cutting discs may vary. However, the cutting discs may preferably be arranged to slit the material web into strips having a width in the range 100 mm to 600 mm,

and more preferably in the range 200 mm to 400 mm, as strips with a width that falls within these ranges can be conveniently handled manually or automatically, and facilitates further mechanical processing, e.g. by means of a fan that cuts the strips into smaller pieces.

[0011] At least one of the first and second rollers may be actuated, or driven (e.g. by a motor), so that the actuated roller can pull the material web along the conveyance path.

[0012] The first roller may comprise at least one belt, wherein at least one of the nips is formed between the at least one belt and the second roller. The at least one belt may also be arranged to support the core with the material web and to rotate the core with the material web to unwind the material web.

[0013] According to an embodiment, the first roller may comprise a plurality of laterally spaced belts so that a plurality of laterally spaced nips is formed between the belts and the second roller.

[0014] The first roller may comprise at least one wheel, arranged in-between the belts to provide additional support as the material web is penetrated by the cutting disc. Optionally, additional nip(s) may be formed between the at least one wheel and the second roller. The wheel(s) further reduces the movement of the material web and improves the accuracy of the cut, especially when the distance between the belts is relatively large.

[0015] The at least one cutting disc may preferably have a circular shape as this tends to increase the accuracy of the cut. However, the disc may also have other shapes such as e.g. octagonal, hexagonal, or rectangular. Furthermore, the cutting edge may be uniform or be provided with teeth or various patterns.

[0016] The at least one cutting disc may preferably be detachable, as this allows the number of cutting discs and/or their position to be changed. It also allows replacement of the cutting disc, e.g. if it is worn out or broken.

[0017] Other objects, features and advantages will appear from the following detailed disclosure, from the attached dependent claims as well as from the drawings.

Brief description of the drawings

[0018] The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of the present invention, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig. 1 is a perspective view schematically illustrating an apparatus for unwinding and slitting a material web;

Fig. 2 is a perspective view schematically illustrating the interior of the apparatus in Fig. 1;

Fig. 3a is a close-up view of a portion of the conveyor unit of the apparatus in Fig. 1;

Fig. 3b schematically illustrates how the conveyor unit in Fig. 3a slits the material web into strips;

Fig. 4 schematically illustrates a conveyor unit provided with an alternative pressure roller; and

Fig. 5 schematically illustrates a conveyor unit where the first roller is provided with a set of wheels to provide additional support for the material web.

Detailed description of preferred embodiments

[0019] Figs. 1-3 schematically illustrate an embodiment of an apparatus 1 for unwinding and slitting a material web 2, which is wound up onto a core 3. The apparatus 1 is here a so-called core stripper which is used to separate the remnant paper from the core in a butt roll. Although the material web is here assumed to be paper, the invention is equally applicable to other types of material webs, such as e.g. board, liner or plastic. Moreover, the core is here assumed to be a paper core, but can be made of any other suitable material, such as e.g. plastic, or aluminium.

[0020] The core stripper comprises a conveyor unit 5 for unwinding and slitting the paper web 2. Optionally, the core stripper also includes an upper table 4 supporting a plurality of butt rolls waiting to be processed, and a collecting table 6 for stripped cores. The conveyor unit includes a first roller 7 and a second roller 8 extending substantially across a width of the paper web 2 and sandwiching the paper web in-between. In this embodiment, the first roller 7 comprises a plurality of laterally spaced belts 7a (e.g. V-belts or the like) which are arranged on front pulleys 7b and rear pulleys 7c fixedly mounted on a front shaft 7d and a rear shaft 7e, respectively. The front shaft 7d is preferably actuated, or driven, by means of an electric motor (not shown). Furthermore, the belts 7a are preferably made of a material having a high frictional coefficient, such as rubber, to promote frictional engagement between the belts and the paper web.

[0021] The second roller 8, also referred to as pressure roller, is preferably arranged above the front pulleys 7b where the paper web is fed out of the core stripper. The pressure roller 8 is here a circular cylindrical element, such as a tube, that extends across all of the belts 7a. However, as is recognized by a person skilled in the art, the pressure roller may take other shapes. For example, as illustrated in Fig. 4, the pressure roller 8 may be a shaft 8a having a wheel 8b disposed above each belt 7a.

[0022] Further, the pressure roller may be hollow or solid, and can be made of steel, aluminum, plastic, or any other suitable material. Optionally, to promote frictional engagement with the paper web, the pressure roller may have a surface of a material with a high frictional coefficient, such as rubber.

[0023] Through either of the arrangements, a nip is formed between the pressure roller 8 and each of the belts 7a. Thus, as the paper web 3 passes the pressure roller 8, the paper web 3 will be squeezed between the pressure roller and each belt.

[0024] The pressure roller 8 is provided with a plurality of cutting discs 10 that extend radially from the pressure roller. The cutting discs are disposed in-between the belts 7a and extend beyond the belts into the spaces that are formed between adjacent front pulleys 7b. The number of cutting discs, and the distance between adjacent cutting discs, depend on the desired width of the strips. However, in a typical core stripper the cutting discs are preferably arranged in such a way that the widths of the strips are in the range 100 mm to 600 mm. Although, the cutting discs are here illustrated as circular knives, the cutting discs may take other shapes. Furthermore, the cutting discs is not necessarily made in a single piece, but may be composed of two or more parts that together form the cutting disc (such as a cutting disc composed of two semi-circular parts). The cutting discs are mounted to the pressure roller 8 in such a way that the cutting discs rotate along with the pressure roller. The cutting discs may be permanently mounted to the pressure roller, e.g by welding, or more preferably detachably mounted, e.g by means of screws. The cutting discs may be positioned half-way between the belts, but may also be located closer to one of the belts.

[0025] In operation, a single butt roll is fed from the upper table 4 down onto the belts 7a. The motor is energized so the belts begin to move and the core with the paper web is moved up to a stop device 9 where it is caused to rotate so that the paper web 2 is fed into the nips formed between the pressure roller 8 and the belts 7a. As the paper web 2 is pressed against the belts 7a by the pressure roller 8, the paper web 2 is frictionally engaged with the belts 7a, and the belts 7a pulls the paper web 2 along the conveyance path and out of the core splitter. The speed of the paper web may vary but is typically between 100-300 m per minute, and more typically about 200 m per minute. Furthermore, the friction between the pressure roller 8 and the moving paper web 2 will cause the pressure roller 8 and the cutting discs 10 to rotate at a speed that corresponds to the speed of the paper web 2 and the belts 7a. Moreover, as the paper web 2 is squeezed in the nips between the belts 7a and the pressure roller 8 lateral movement of paper web is prevented so that the paper web cannot flex. Thus, as the paper web reaches the circular cutting discs, each cutting disc will stretch the paper until the paper web is penetrated. Consequently, the paper web will be cut and/or torn into strips. The paper strips may then e.g. be collected or fed directly to a process where the strips are mechanically or chemically dissolved. For example, a fan may be used to cut the strips into smaller pieces.

[0026] Fig. 5 schematically an embodiment of the conveyor unit where the first roller 7 is provided with wheels 7f (without belts) arranged on the front shaft 7d in-between the belts 7a to provide additional support for the paper web. This further reduces the vertical movement (and thus the flex) of the paper web and makes it easier for the cutting discs to penetrate the paper web.

[0027] The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended claims. For example, one or more cutting discs may be provided on the first roller, e.g. by arranging cutting discs on the front shaft in-between the pulleys that hold the belts. These cutting discs may be used instead of, or be a complement to, the cutting discs on the second roller. Furthermore, the first roller does not necessarily include belts. For example, each belt may be replaced by a wheel that supports and frictionally engage the material web. Moreover, the conveyor unit may include additional means (such as additional rollers) for pulling the paper web along the conveyance path. Consequently, it is not necessarily to provide a motor that directly actuates the first or second roller, as both the first and second rollers can be caused to rotate by the moving paper web. Yet another alternative may be to actuate both the first and second rollers by motors.

Claims

1. An apparatus (1) for unwinding a material web (2), which is wound up onto a core (3), said apparatus comprising:

   a conveyor unit (5) arranged to pull the unwound material web (2) along a conveyance path, wherein said conveyor unit includes a first roller (7) and a second roller (8) extending substantially across a width of said material web and sandwiching said material web in-between, wherein said first and second rollers are configured to frictionally engage said material web (2) in a longitudinal and lateral direction;
   characterized in that
   at least one of said first and second rollers is provided with at least one cutting disc (10) arranged to penetrate said material web so that said material web is slitted into strips.

2. The apparatus according to claim 1, wherein said first (7) and second (8) rollers are configured to form a plurality of nips spaced in an axial direction of said rollers.

3. The apparatus according to claim 2, wherein there is a nip arranged on each side said cutting disc (10).

4. The apparatus according to claim 2 or 3, wherein a plurality of cutting discs (10) are interleaved in-between the nips.

5. The apparatus according to any one of the preceding claims, wherein at least one of said first (7) and sec-

ond (8) rollers is actuated.

6. The apparatus according to any one of the preceding claims, wherein said first roller (7) comprises at least one belt (7a), wherein at least one of said nips is formed between said at least one belt (7a) and said second roller (8).

7. The apparatus according to claim 6, wherein said at least one belt (7a) is arranged to support the core (3) with the material web (2) and to rotate the core (3) with the material web (2) to unwind the material web (2).

8. The apparatus according to claim 6 or 7, wherein said first roller (7) comprises a plurality of laterally spaced belts (7a) so that a plurality of laterally spaced nips are formed between said belts (7a) and said second roller (8).

9. The apparatus according to any one of claims 6 to 8, wherein said first roller (7) comprises at least one wheel (7f) arranged in-between said belts (7a) to provide additional support as said material web (2) is penetrated by said cutting disc (10).

10. The apparatus according to any one of the preceding claims, wherein said at least one cutting disc has a circular shape.

11. The apparatus according to any one of the preceding claims, wherein said at least one cutting disc is arranged to slit the material web into strips having a width in the range 100 mm to 600 mm.

12. The apparatus according to any one of the preceding claims, wherein said at least one cutting disc is detachable.

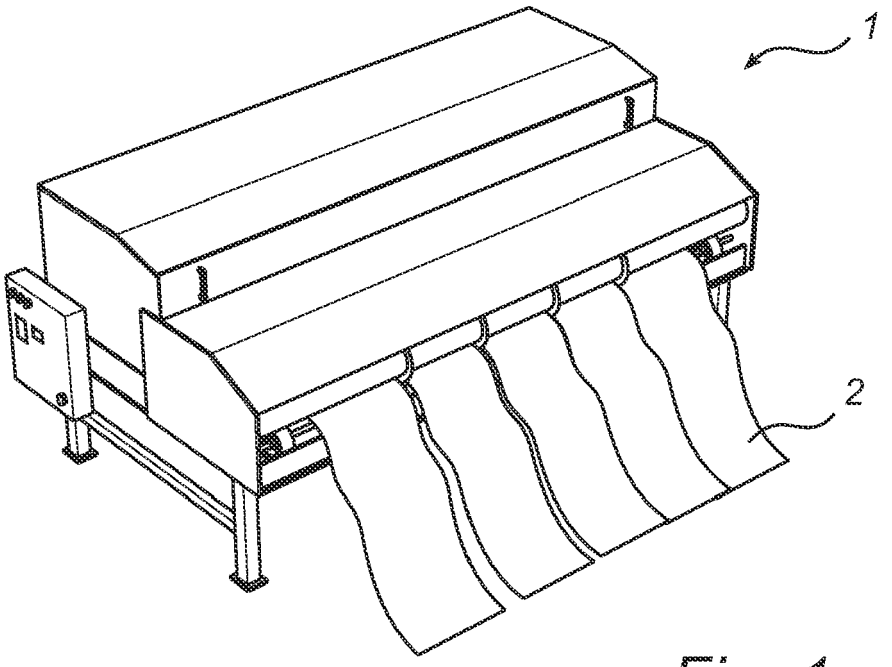

Fig. 1

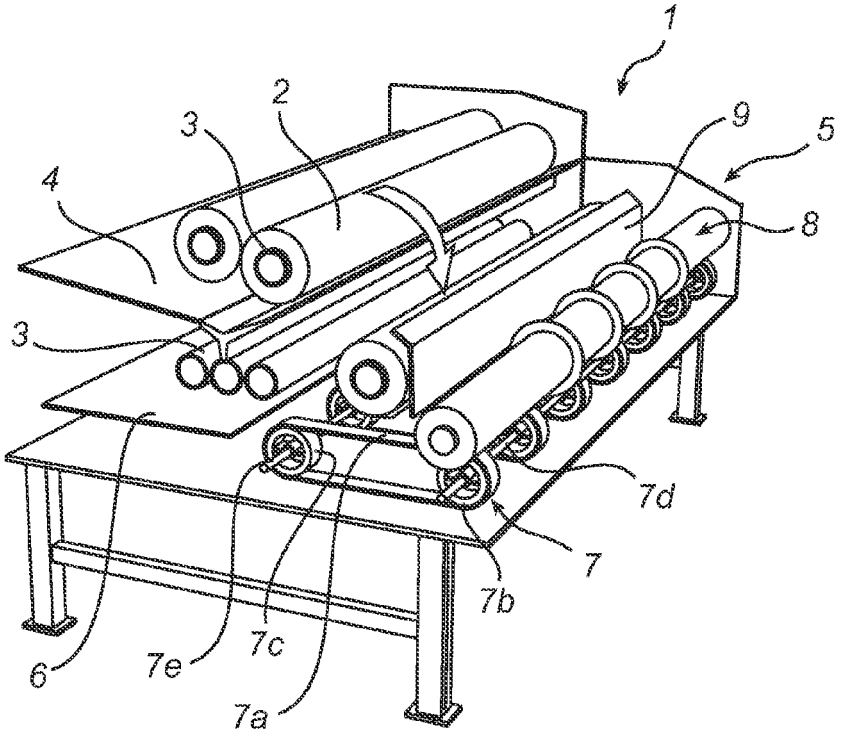

Fig. 2

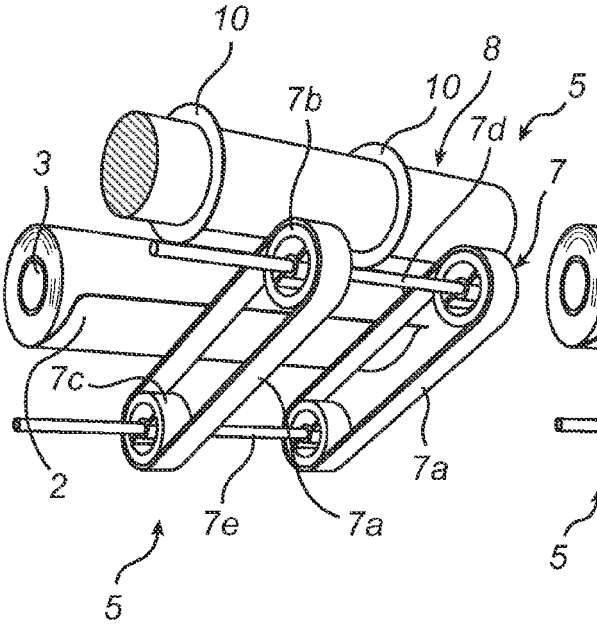

Fig. 3a

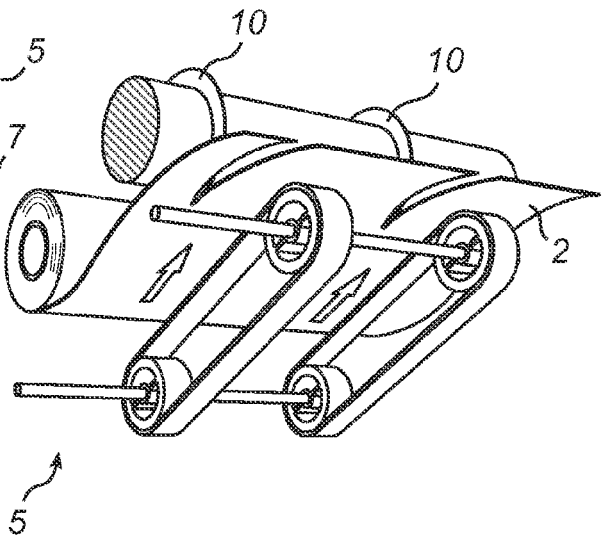

Fig. 3b

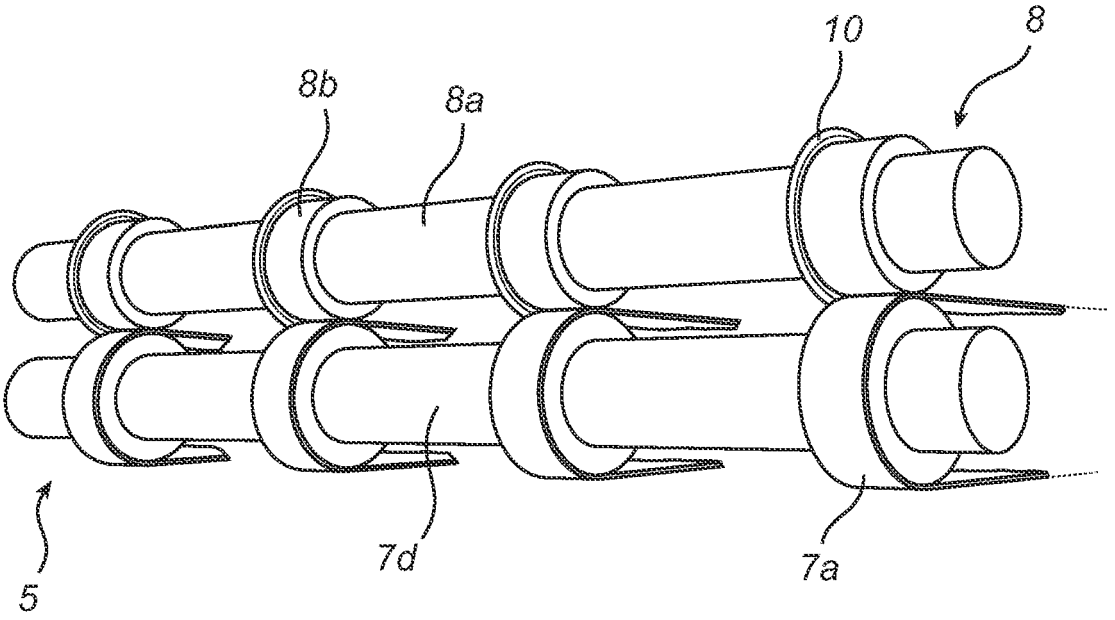

Fig. 4

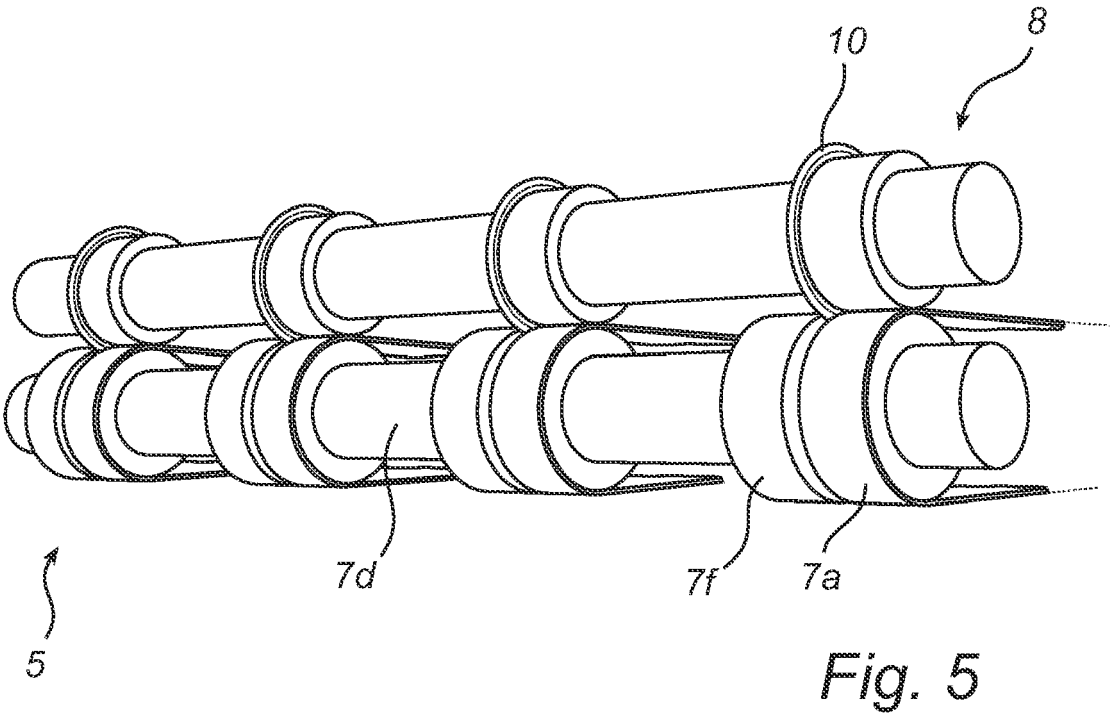

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 4494

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 October 2010	Cescutti, Gabriel

CATEGORY OF CITED DOCUMENTS

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