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(54) Title: ROLL SHELL AND ROLL

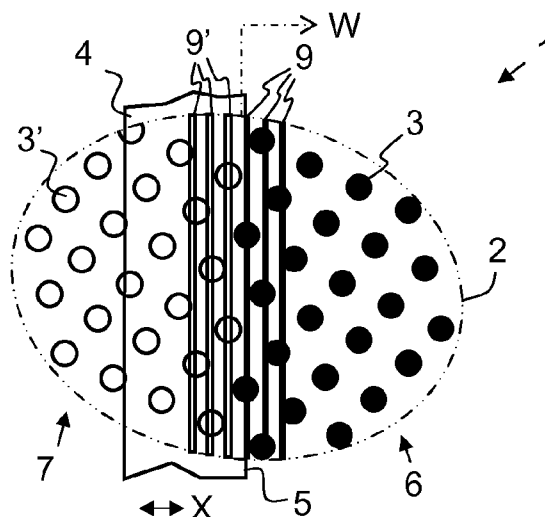


FIG. 2

(57) Abstract: A roll shell (2) for treatment of a fiber web (W), which roll shell (2) comprises a cylindrical outer surface (10) and an inner surface (11) and suction holes (3,3') between the inner and the outer surface, in order to affect a suction to a fabric, a felt and/or a fiber web (W) movable on the outer surface (10) with help of an underpressure arranged inside the roll shell. Circumferential suction grooves (9,9') are formed in the outer surface (10) of the roll shell (2), in the edge area of the roll shell (2), which suction grooves are adapted to connect suction holes (3,3') in circumferential direction and which suction grooves (9,9') are adapted at the edge area of the fiber web (W) that is being treated to spread the suction effect of the suction holes (3,3') to continue in machine direction. A roll (1) comprising a roll shell (2) according to any embodiment.

ROLL SHELL AND ROLL

FIELD OF INVENTION

- 5 The invention relates to a roll shell and a roll. Particularly, but not exclusively, the invention relates to arranging a suction effect that continues in machine direction to the edge area of the fiber web with help of a holed shell.

BACKGROUND ART

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So called edge flipping is known in a press section of a paper machine, in other words, the edge of a paper web does not stay in contact with a fabric which may cause i.a. an edge cut which causes breaks. Such a situation may appear i.a. when a paper web moves from felt to felt in the press section.

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The edge flipping may appear to an operator as a visible temporary flash at the edge of the paper web after which, for example, a web break takes place further in the paper production line due to an edge defect formed in the paper edge or due to a bent edge of the paper web.

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A bad contact of the edge of the paper web in the fabric may prevent an increase of the speed of the paper web in a paper production apparatus and/or may limit desired running speed of the paper machine.

- 25 The publication US5281308A shows a holed pick up roll with help of which the fiber web is transferred from a felt of a forming section to a felt of a press section.

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The publication DE202004020380U1 shows a suction roll of a drying section having a shell with more than two areas which have differing number of holes per surface area unit.

The publication EP1103654A2 shows a suction roll of a drying section that has a spirally formed grooving in whole area of the shell surface.

SUMMARY

According a first aspect of the invention there is provided a roll shell for treatment of a fiber web, which roll shell comprises a cylindrical outer surface and an inner surface and suction holes between the inner and the outer surface, in order to affect a suction to a fabric, a felt and/or a fiber web movable on the outer surface with help of an underpressure arranged inside the roll shell. Circumferential suction grooves are formed in the outer surface of the roll shell in the edge area of the roll shell, which suction grooves are adapted to connect suction holes in circumferential direction and which suction grooves are adapted at the edge area of the fiber web that is being treated to spread the suction effect of the suction holes to continue in machine direction.

Preferably, the roll shell is ungrooved in an area of the roll shell between the edge areas of the roll shell.

The suction groove may be a continuous annular groove. The suction groove may be a discontinuous annular groove. The suction groove may be formed of segments.

A width of the suction groove may be 1 to 5 mm, preferably 1 to 2 mm. A diameter of the suction hole may be 3 to 5 mm, preferably 4 mm.

According a second aspect of the invention there is provided a roll comprising a roll shell according to some embodiment.

The roll may comprise inside the roll shell an underpressurable suction volume adapted to be bounded by an end-sealing, and suction grooves are arranged in the edge area of the roll shell, at the end-sealing.

The roll may comprise a suction volume inside the roll shell, which suction volume is bounded by an end-sealing, which is adjustable in the cross direction of the fiber web, and suction grooves are arranged in the edge area of the roll shell, along an adjusting area of the end-sealing.

The roll may be a suction roll of a press section. The roll may be a suction roll of a drying section. The roll may be a suction roll of a forming section. The roll may be a transfer suction roll. The roll may be a pick-up roll. The roll may be a roll of a drying belt circulation.

Different embodiments of the present invention will be illustrated or have been illustrated only in combination with one or some aspects of the invention. A person skilled in the art understands that any embodiment of one aspect of the invention may be applied in the same aspect of the invention and in other aspects alone or as a combination with other embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described, by way of example, with reference to the accompanying schematical drawings, in which:

Fig. 1 shows schematically a suction roll where underpressure of a suction zone of a holed shell in the edge area is non-unitary and discontinuous;
Fig. 2 shows schematically one suction roll where circumferential grooves are arranged in the edge area of a holed shell in order to arrange underpressure of a suction zone to be unitary and continuous in machine direction; and
Fig. 3 shows schematically a cross section of the suction roll of Fig. 2 at an end-sealing of a suction volume.

DETAILED DESCRIPTION

In the following description, like numbers denote like elements. It should be appreciated that the illustrated drawings are not entirely in scale and that the drawings mainly serve the purpose of illustrating embodiments of the invention.

Fig. 1 shows an area that is defined with a dash-dot-line of a cylindrical shell 2 of a known suction roll 1 inside of which cylindrical shell there are longitudinal sealings (not shown in the Fig.) arranged against an inner surface 11 of the shell 2 and

machine directional end-sealings 4, that is, circumferentially along the shell 2 directional end-sealings. The longitudinal sealings, the end-sealings 4 and the inner surface 11 of the shell 2 form a suction zone on an outer surface 10 of the shell 2, whereto underpressure is directed from an inner suction volume 6 of the shell 2, for example a suction box, via suction holes 3. The length in machine direction, the width in cross direction of the machine and the direction of the suction box 6 define the width and the direction of an underpressurized suction zone affecting on a fabric, a felt and/or a fiber web W on the outer surface 10 of the suction roll 1. An exemplary location of the fiber web W is shown with an arrow W.

10

The shell 2 comprises suction holes 3,3' which pass through the material of the shell. In order to form the suction zone, underpressure is arranged in the suction volume 6, the suction effect of which underpressure extends to the outer surface 10 of the suction roll via the suction holes 3 at the suction zone. The end-sealing 4, particularly its front wall 5 at side of the suction volume 6, bounds the suction effect of the outer suction zone of the suction roll 1 on the outer surface 10 of the shell such that underpressure is created in such suction holes 3 which are partly or wholly in connection with the suction volume 6.

20 At a non-pressurized area 7 behind the end-sealing 4 and an area behind the front wall 5 when viewed from the direction of the suction volume 6, through holes of the shell are denoted 3', since they are not underpressurized. When the end-sealing 4 is moved to left in the figure, the state of the non-pressurized through holes 3' is changed to underpressurized suction holes 3, when the non-pressurized through holes 3' get in to pressure connection with the suction volume 6, and visa versa when the end-sealing 4 is moved in the figure to right.

30 The end-sealing 4 is arranged movable in cross direction of the fiber web machine, for example, between the longitudinal sealings. The location on a felt of the edge of the fiber web W running on the surface 10 of the suction roll 1, for example, may vary i.a. due to the width of the fiber web W. Therefore the location of the end-sealing 4 in the suction roll 1 may be adjusted (bidirectional arrow X) in cross direction to a suitable point corresponding to the location of the edge of the fiber web such that underpressure is not unnecessarily directed outside the area of the

fiber web and thus the underpressure is not weakened or a loss of energy is not caused.

5 The direction of the edge of the underpressurized area formed at the edge area of the suction zone on the surface 10 of the suction roll 1 is shown with a dashed line 8 which is drawn between the underpressurized suction holes 3. The underpressure 8 at the edge area of the fiber web W on the surface 10 of the suction roll 1 is non-unitary and discontinuous. Then, at some places edge flipping may appear since the suction effect directed to the fiber web is insufficient to
10 transfer the edge of the fiber web from the transferrable fabric and to hold it in contact with the fabric transferring the fiber web W.

A suction roll 1 according to one embodiment of the invention is shown in Figs. 2 and 3 where circumferential grooves 9, 9' are arranged in the edge area of the
15 shell 2 provided with suction holes 3 in order to arrange the underpressure affecting the edge of the fiber web W to be unitary and continuous in machine direction. The suction effect caused by the suction roll 1 is recommended to be unitary already when the web is released from the former fabric. In connection with the description of Figs. 2 and 3 reference is made to Fig.1. A partial cross section
20 of the suction roll 1 of Fig. 2 at the end-sealing 4 is shown in Fig. 3. The suction roll 1 has no grooving outside the edge areas and between the edge areas so that marking of the web, for example, can be avoided.

Pick-up and transfer suction rolls are in general uncoated, in which case a
25 grooving outside the edge areas and between the edge areas could in some cases weaken their strength. The stresses at the edge area are, however, at smallest the groovings of the edge area do not substantially weaken the strength. When arranged in the area between the edge areas, the grooving may in some cases be problematic due to a leakage of underpressure in machine direction caused by the
30 grooving, but the leakage of underpressure in machine direction caused by the grooving has no substantial relevance, when the grooving is only at the edge area.

According to some embodiments a diameter of the suction holes 3, 3' is about 3 to 5 mm. According to some embodiments the width of the suction grooves 9,9' is 1

to 5 mm, preferably 1 to 2 mm. The circumferential grooves 9,9' form, preferably, annular grooves. In order to spread the underpressure suction in machine direction unitary and linear, the circumferential groove 9,9' extends on the outer surface 10 of the shell 2 via the suction hole 3, 3' or touches the suction hole such
5 that a pressure connection is formed between the groove 9,9' and the suction volume.

With a unitary and continuous underpressure affected to the edge area of the fiber web W, the edge of the fiber web W can better be kept engaged with even force
10 with the felt or fabric transferring the fiber web W, for example. With help of the grooves 9, the underpressure suction may be realized continuous without points of discontinuity, where there is no suction force present affecting the edge of the fiber web W or the suction force is weak. With help of the grooves 9, the effect of the underpressure suction to the edge of the fiber web W may be arranged linear.
15 With help of the grooves 9, the effect of the underpressure suction to the edge of the fiber web W may be arranged linear in machine direction without blind areas. Then, the suction effect is not directed as weakened to the edge of the fiber web W over a longer distance through the felt, for instance.

20 In Fig. 2, the suction grooves 9 are arranged underpressurized such that all suction holes 3 of the suction zone located at the area of the suction grooves 9 are partly or wholly passed through by the grooves 9 on the outer surface 10 of the shell 2. Naturally, the location of the holes and the grooves may also differ from these, for example, such that one or more hole is not crossed by a suction groove.
25 The end-sealing 4, particularly its front wall 5 at the side of the suction volume 6, bounds the suction effect of the suction zone of the suction roll 1 on the outer surface 10 of the shell such that underpressure is formed in such suction holes 3 and suction grooves 9, which are partly or wholly in connection with the suction volume 6.

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In Fig. 2, the underpressure affecting the outer surface 10 of the shell 2 forms a linear and unitary suction area at the left edge in machine direction (in circumferential direction of the suction roll 2), when in Fig. 1 the underpressure forms a meandering suction effect and a non-unitary suction effect in machine

direction at the edge of the fiber web W.

The suction grooves of the shell are denoted 9', as they are not underpressurized, at a non-pressurized area 7 behind the end-sealing 4 and an area behind the front wall 5, when viewed from the direction of the suction volume 6. In Fig. 2, the suction grooves 9' left underpressurized are shown as grooves that are not filled with black colour. When the end-sealing 4 is moved to the left in the figure, the state of the non-pressurized suction grooves 9' is changed to underpressurized suction grooves 9, when the non-pressurized suction grooves 9' come into pressure connection with the suction volume 6, and visa versa when the end-sealing 4 is moved in Fig. to the right.

Preferably, grooves 9, 9' spreading the suction effect are arranged at the edge area of the suction roll along an adjusting area of the end-sealing 4, such that a unitary and linear suction effect can be created to the edge of the fiber web W in each location of the end-sealing 4.

According to some embodiments the suction groove spreading the suction effect may comprise a circumferential groove, which is discontinuous. The circumferential annular groove may be formed of circumferential segments. Preferably, sections of the annular groove formed of several successive parts or segments of the groove connect several suction holes 3, 3' on the surface 10 of the shell 2. With help of the underpressure suction created to the roll shell at the edge area of the fiber web W with adjacent and successive annular groove sections the suction force affecting to the edge of the fiber web W may be improved compared to a situation where the suction holes are not connected with annular groove sections. Then, the edge of the fiber web W can be kept with an even force in contact with the felt or the fabric transferring the fiber web W, for example.

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According to some embodiments, a washing device and/or suction device may be arranged for the groove which spreads the suction effect, in order to keep the groove clean. The washing device may comprise a washing spray.

Solutions according to some embodiments may be utilized on the forming section and the press section and the drying section the fiber web machine, particularly with the pick-up roll and the transfer suction roll. The transfer suction roll may be in the drying wire circulation. The web may be transferred with the transfer suction
5 roll from a transfer belt or felt to the drying section.

The foregoing description provides non-limiting examples of some embodiments of the invention. It is clear to a person skilled in the art that the invention is not restricted to details presented, but that the invention can be implemented in other
10 equivalent means.

Some of the features of the above-disclosed embodiments may be used to advantage without the use of other features. As such, the foregoing description shall be considered as merely illustrative of the principles of the invention, and not
15 in limitation thereof. Hence, the scope of the invention is only restricted by the appended patent claims.

PATENT CLAIMS

1. A roll shell (2) for treatment of a fiber web (W), which roll shell (2) comprises a cylindrical outer surface (10) and an inner surface (11) and suction
5 holes (3,3') between the inner and the outer surface, in order to affect a suction to a fabric, a felt and/or a fiber web (W) movable on the outer surface (10) with help of an underpressure arranged inside the roll shell, **characterized** in that circumferential suction grooves (9,9') are formed in the outer surface (10) of the
10 roll shell (2) in the edge area of the roll shell (2), which suction grooves are adapted to connect suction holes (3,3') in circumferential direction and which suction grooves (9,9') are adapted at the edge area of the fiber web (W) that is being treated to spread the suction effect of the suction holes (3,3') to continue in machine direction.
- 15 2. A roll shell according to claim 1, **characterized** in that the roll shell (2) is ungrooved in an area of the roll shell (2) between the edge areas of the roll shell.
3. A roll shell according to claim 1 or 2, **characterized** in that the suction
20 groove (9,9') is a continuous annular groove.
4. A roll shell according to any of claims 1 - 3, **characterized** in that the suction groove (9,9') is a discontinuous annular groove.
5. A roll shell according to claim 4, **characterized** in that the suction groove
25 (9,9') is formed of segments.
6. A roll shell according to any of claims 1 - 5, **characterized** in that a width of the suction groove (9,9') is 1-5 mm, preferably 1-2 mm.
- 30 7. A roll (1) comprising a roll shell (2) according to any of claims 1-6.
8. A roll according to claim 7, **characterized** in that the roll (1) comprises inside the roll shell (2) an underpressurable suction volume (6) adapted to be bounded by an end-sealing (4), and suction grooves (9,9') are arranged in the

edge area of the roll shell (2), at the end-sealing (4).

9. A roll according to claim 7 or 8, **characterized** in that the roll (1) comprises a suction volume (6) inside the roll shell (2), which suction volume (6) is bounded
5 by an end-sealing (4), which is adjustable in the cross direction of the fiber web (W), and suction grooves (9,9') are arranged in the edge area of the roll shell (2), along an adjusting area of the end-sealing (4).

10. A roll according to any of claims 7-9, **characterized** in that the roll (1) is a
10 suction roll of a press section.

11. A roll according to any of claims 7-10, **characterized** in that the roll (1) is a transfer suction roll.

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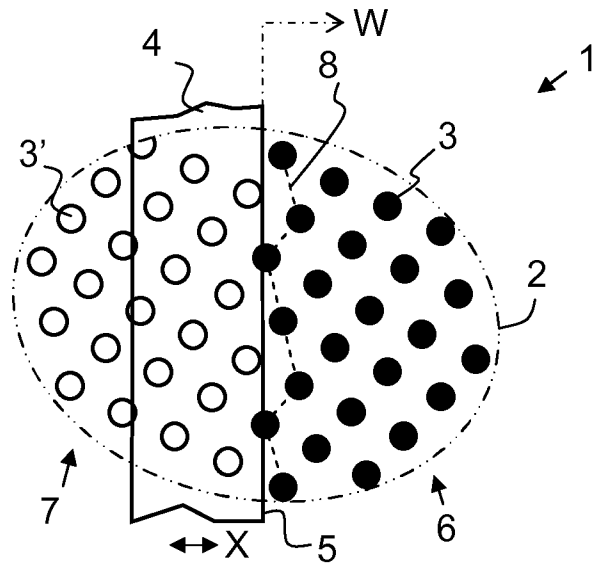


FIG. 1

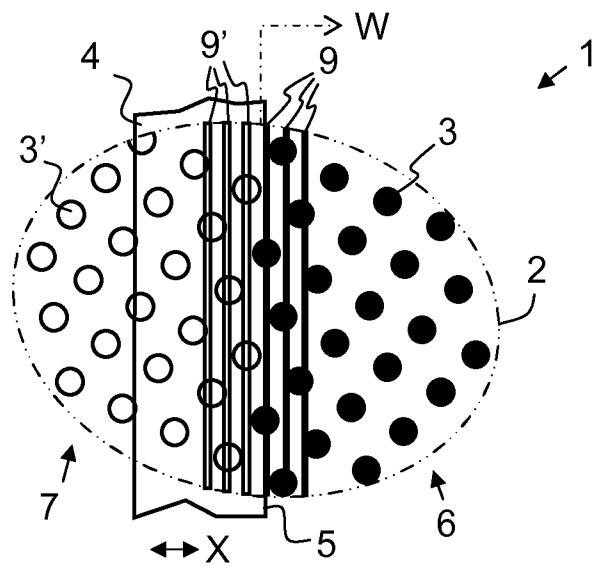


FIG. 2

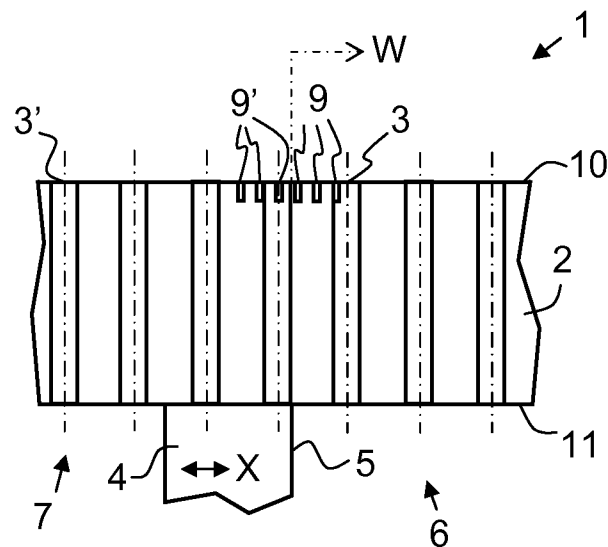


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2010/050677

A. CLASSIFICATION OF SUBJECT MATTER

INV. D21F3/10

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)

D21F

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 562 883 A (KOBAYASHI SHOGO) 16 February 1971 (1971-02-16)	1-8, 10, 11
Y	column 3, line 6 - column 4, line 14; figures 1-6	9
X	DE 297 11 804 U1 (VOITH SULZER PAPIERMASCH GMBH [DE]) 11 September 1997 (1997-09-11) page 8, last paragraph - page 14, paragraph 3; figures 1-6, 11	1-5, 7, 8, 10, 11
X	BE 542 034 A (MILLSPAUGH LIMITED [GB]) 28 August 1959 (1959-08-28) page 4, last paragraph - page 8, paragraph 2; figures	1-3, 7, 8, 10, 11
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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03/12/2010

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INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2010/050677

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 617 162 A2 (VALMET PAPER MACHINERY INC [FI] VALMET CORP [FI]) 28 September 1994 (1994-09-28) column 3, line 55 - column 6, line 27; figures 2A,2B,4,5	1-3,6-8, 10,11
X	GB 1 191 813 A (HUEBER RUDOLF [DE]) 13 May 1970 (1970-05-13) page 1, line 68 - page 2, line 39; figures	1,2,4,5, 7,8,10, 11
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Y	US 3 395 073 A (DAVIS SR WILLIAM P) 30 July 1968 (1968-07-30) column 1, line 64 - column 3, line 47; figures	9
A	US 4 016 032 A (KANKAANPAA MATTI) 5 April 1977 (1977-04-05) the whole document	1,3,7,8, 10,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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