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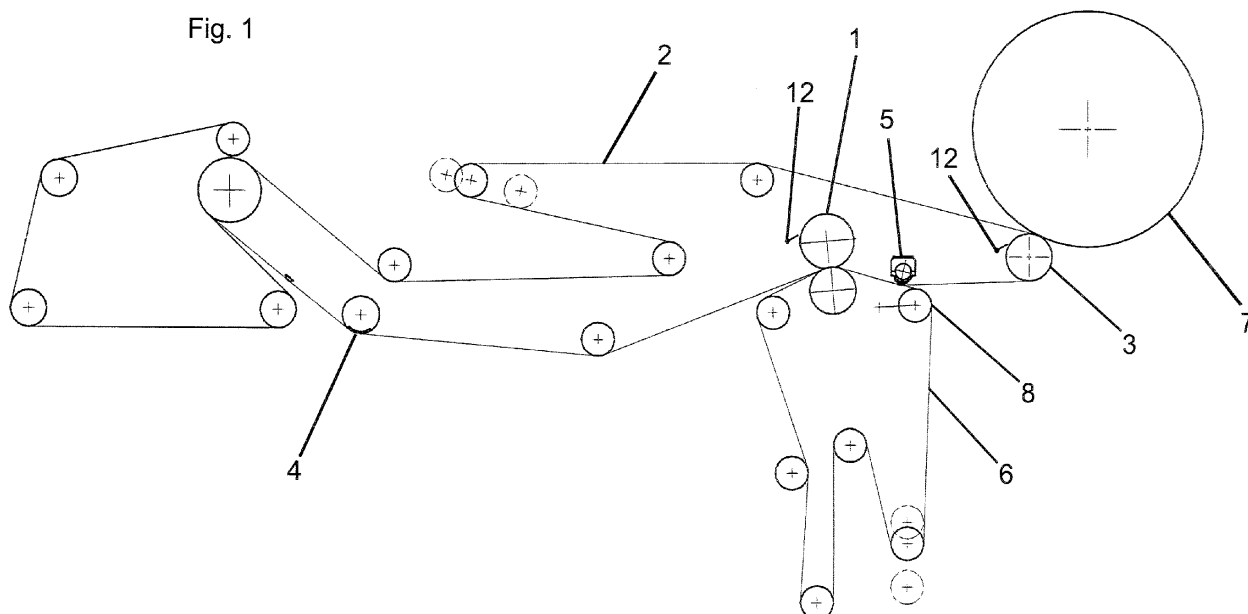
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(54) **Shoe press application for the production of tissue grades**

(57) A crescent former paper machine comprising: a double felted shoe press (1) using a top felt (2) and a bottom felt (6); a suction felt roll (4) located upstream of the double felted shoe press (1); and a dryer section (3) located downstream of the double felted shoe press (1); wherein the crescent former paper machine has a first configuration and a second configuration: a) in which in the first configuration, the top felt (2) carries a paper web

from the suction felt roll (4) to the double felted shoe press (1), the paper web contacting the bottom felt (6) at the double felted shoe press (1), and the top felt (2) carries the paper web from the double felted shoe press (1) to the dryer section (3), and b) in which in the second configuration, the top felt (2) carries the web from the suction felt roll (4) to the dryer section (3), bypassing the double felted shoe press (1).

Fig. 1



Description

[0001] The present invention is directed to tissue paper machines, and the manufacturing methods for producing tissue paper.

[0002] Methods and apparatuses for manufacturing tissue paper have been known for a number of years now. In the tissue making process, paper pulp is transported through a system as a continuous paper web to a drying cylinder. The paper web is then loaded onto a dryer to be dried, and thereafter creped to form the tissue paper.

[0003] One challenge for manufacturing tissue paper is to control the amount of water in the paper web before drying. This is quite crucial in establishing the grade of the paper, and the associated properties, for example the bulk of the paper (i.e. the ratio between the thickness-caliper and weight). Some types of tissue products require a higher bulk characteristic (such as paper towels) than others (such as facial tissues).

[0004] The conventional technology to dry the paper web includes the use of a Yankee cylinder as a dryer. In order to load the paper web onto this dryer, the web which is carried by a felt to the dryer must be pressed onto the very smooth surface of the Yankee cylinder by a press or touch roll. In this case, since the paper web is still very wet when it is loaded to the Yankee cylinder, the bulkiness becomes relatively low, and high drying energy rates are required.

[0005] Some efforts have been made to reduce the wetness levels of the paper web before it is pressed onto a Yankee cylinder in order to increase the bulkiness and decrease the drying energy. One prior art method introduces a pre-heating section to provide an additional drying section for the paper web before it is carried to the Yankee cylinder. A further method includes using a shoe press to dewater the paper web mechanically before being brought to the dryer. However, in such applications, the product will always then have high bulk characteristics, which are not desirable for all tissue products. Alternatively the shoe press might be used in direct contact to the Yankee cylinder, but in this configuration the paper web on the wet felt is directly pressed against the Yankee cylinder surface. This will lead to water conveying problems and less efficient drying.

[0006] Further problems are, that these additional drying components are large in size and cannot be uninstalled from the paper machine in an efficient manner, mechanically and financially. Additionally, these machines have an extended nip application which is less efficient in terms of drain capacity for tissue of very light grades, such as facial products.

[0007] The bulk levels of the tissue paper have also been found to be increased with the use of a through-air drying (TAD) cylinder. However, usage of this component also restricts the products to have high bulk characteristics. Additionally, this dryer is disadvantageous in that the TAD cylinder requires much more space, has limited

capacity, requires a lot of energy and is more expensive to maintain.

[0008] Thus, in all of the above systems it is not possible to use the same system to provide tissue paper with a wide variety of tissue grades, such as bulk and drain efficiency. Once the components of the system are installed, the bulk and grade of the resulting paper that will be produced is quite fixed. Systems using TAD cylinders and Yankee cylinders with additional components to evaporate water will result in bulky paper, whereas systems with Yankee cylinders without such components mainly manufacture low bulk paper.

[0009] Therefore, there exists a need in the field to provide a single flexible system that can allow a wider range of tissue grades production in a manner that is energy and cost efficient and/or having a lower as well as a higher bulky type.

[0010] Starting from these problems, it is an object of the present invention to solve or reduce at least some of these problems in the paper manufacturing process. This object is solved by the crescent former paper machine according to claim 1. Preferred embodiments of this invention are subject of the dependent claims.

[0011] According to the present invention, a crescent former paper machine comprises a double felted shoe press, which uses a top felt and a bottom felt. It further includes a suction felt roll located upstream of the double felted shoe press and a dryer section located downstream of the double felted shoe press. The crescent former paper machine has a first configuration and a second configuration:

(a) in which in the first configuration, the top felt carries a paper web from the suction felt roll to the double felted shoe press, the paper web contacting the bottom felt at the double felted shoe press, and the top felt carries the paper web from the double felted shoe press to the dryer section, and

(b) in which in the second configuration, the top felt carries the paper web from the suction felt roll to the dryer section, bypassing the double felted shoe press.

[0012] The present invention is thus a system which has two configurations, each providing a specific path for a paper web to the dryer, the first one including a shoe press section and the second one bypassing said shoe press section. The system is easily changed from one configuration to another, allowing a flexible solution in producing paper of different paper grades.

[0013] In the present invention, the term "bypass" is intended to mean that the paper web can be transported without being subject to the shoe press section. This can be done by rerouting the felt carrying the paper web underneath or around the shoe press, or by opening the shoe press (for example separating the shoe roll and counter roll) such that the felt and paper web can pass

through without being influenced at all by the shoe press. Other methods achieving this effect are also within the scope of the invention.

[0014] According to the present invention tissue paper or paper means a lightweight paper in the range between 5 g/m² and 45 g/m², preferably between 15 to 30 g/m². Tissue can be made from virgin pulp, recycled paper pulp or a combination thereof. Main properties of tissue are absorbency, basis weight, thickness (bulk), brightness, stretch, appearance and comfort. Typical products made from tissue paper are hygienic tissue papers, facial tissues, paper towels, wrapping tissues, toilet tissues, table napkins and so on.

[0015] In one embodiment, the paper machine further comprises a suction box located after the double felted shoe press. This suction box serves to keep the paper web on the top felt, as well as to prevent water absorbed by the top felt from dropping or flowing back to the paper web. More preferably, the suction box is an inverted suction box and is in contact with the top felt. Felts are commonly used to transport paper webs as it has water absorption properties and is suitable for carrying paper webs using by forces of adhesion based upon its water content.

[0016] The paper machine also includes a dryer section having a touch roll and a dryer. The touch roll and the dryer form a press nip to transfer the paper web from the felt to the dryer. The touch roll can be a conventional roll, a classic suction press roll, a crown controlled roll or a suction press roll with crown control features. According to a further embodiment of the present invention and especially when combining the touch roll with a shoe press roll, the touch roll is preferably a suction press roll with or without crown compensating features, but can also be a conventional roll with fixed crown and/or crown compensating roll. The dryer is typically a Yankee cylinder. According to the present invention a crown compensating roll or a crown controlled suction roll ensures a uniform nip loading across the entire paper width and allows maintaining the same over a wide range of line load. Therefore a crown compensating roll (with or without a suction unit) is capable to vary the crown for the purpose of achieving a uniform nip profile over the entire width and line load range, compensating the deflection of the mating roll. The crown / bending of the shell of a crown compensating roll can either be fixed by shape or adjustable by applying pressure to the internal chamber, like in a swimming roll or by hydrostatic and/or by a hydro dynamically operating shoe or individual support elements/pistons. Beside the overall crown of the roll, depending on the type, can adjust the profile in various zones.

[0017] In the second configuration of the paper machine, the top felt may be arranged to be under the shoe press so as to bypass the shoe press. A sliding bar can be used in this configuration to stabilize the top felt. The top felt in both the first and second configurations can be the same felt. This demonstrates the flexibility of the

present invention, in which the same felt can be used to transport the paper web to the dryer. A guiding roll is also provided in the present system to guide the bottom felt away from the top felt in the first configuration of the system. In the second configuration, where the bottom felt is extracted, the top felt is placed in contact with the guiding roll, which serves to guide the top felt to the dryer.

[0018] According to another aspect of the present invention, a method is provided for delivering the paper web to the dryer with the crescent former paper machine. This method includes carrying the paper web from the suction felt roll to the dryer section. The paper web may or may not be carried to the shoe press, depending on the grade of the paper to be produced. Once at the dryer section, the paper web is loaded onto the dryer by means of a nip press formed by the touch roll with the dryer.

[0019] In the first configuration, the guiding roll guides the bottom felt from the shoe press away from the top felt and the dryer section and in the second configuration, the guiding roll guides the top felt to the dryer section.

[0020] According to another aspect of the present invention the crescent former paper machine comprises an air blade for doctoring the system and is preferably arranged at the shoe roll of the shoe press and/or the touch roll. Instead of a classical doctoring system like a mechanical blade the air blade has a cross blow. This system can be used e.g. on a blind drilled, drilled, grooved and ventanip covers and it is very efficient in terms of water removal. The application of the air blade on rolls like press rolls, touch rolls, suction rolls etc. especially allows higher dewatering performance in terms of general dryness of the web out the press section.

[0021] In an exemplary embodiment, the suction felt roll is used to precondition the top felt.

[0022] These features as well as others are explained in relation to the accompanied drawings below.

Fig. 1 is a schematic diagram of the system according to a first configuration of a first embodiment of the present invention.

Fig. 2 is a schematic diagram of the system according to a second configuration of the first embodiment of the present invention.

Fig. 3 is a schematic diagram of the system according to an alternative second configuration of the first embodiment of the present invention.

Fig. 4 is a schematic diagram of the overlap between the first and second configurations of the first embodiment of the present invention.

Fig. 5 is a schematic diagram of the system according to a first configuration of a second embodiment of the present invention.

Fig. 6 is a schematic diagram of the system accord-

ing to a second configuration of the second embodiment of the present invention.

[0023] The present invention will now be described more fully with reference to the drawings, in which preferred embodiments of the invention are shown. The invention may, however, be embodied in different forms and should not be limited to the embodiments set forth. Like numbers refers to like elements.

[0024] In the mode shown in Fig. 1, a crescent former paper machine in the first configuration is shown. A paper web, generally consisting of the paper pulp to be produced to a paper product, is firstly carried by a top felt denoted by reference numeral 2 through the suction felt roll 4. The suction felt roll 4 is primarily for felt preconditioning, which means controlling the water content of the felt. As can be understood from the figure, the paper web will be on the bottom side of top felt 2 while it is transferred from the suction felt roll 4 to the dryer 7. In order to prevent the paper web from loosening or "falling off" from the top felt 2 due to gravity, this suction felt roll 4 creates a vacuum behind it. This vacuum causes the paper web to be closely adhered to the top felt 2 so as to ensure that the paper web stays on the top felt 2 during its travel. Additionally, the water content of the felt causes the paper web to stay on the felt by properties of adhesion.

[0025] The suction felt roll 4 is preceded by the headbox and forming section which are known in the art. The paper pulp to be formed into the paper product is stored and introduced to the top felt 2 via a headbox (not shown). The paper pulp is provided on the top felt 2 which is passed through a forming section comprising a wire system having a plurality of elements that presses the paper pulp to form the paper web. The paper web is then carried by the top felt 2 to the suction felt roll 4. The top felt 2 is moved throughout the system by various guide felt rolls which can be repositioned to manipulate the tension of the top felt 2.

[0026] The paper machine of the present invention also includes a double felted shoe press 1 having an air blade 12 on the upper press roll. This shoe press 1 includes a shoe roll in the top and a counter roll in the bottom position, or vice versa. The top felt 2 is in contact with the shoe roll and the bottom felt 6 is in contact with the counter roll or alternatively vice versa. In the double felted shoe press 1, the counter roll and shoe roll form a press nip which removes water from the paper web by pressing the paper web between the top and bottom felts. The top and bottom felts absorb the water forced out from the paper web. This helps prevent the squeezed out water from being reintroduced to the paper web and rewetting it.

[0027] The use of a shoe press is advantageous in energy and cost savings in comparison with using a heating section. A shoe press is a mechanical solution and thus does not require as much energy to maintain and operate as a constant heater, resulting in cost savings.

[0028] A number of guide rolls are also provided which work together with the shoe press element to move the

bottom felt 6 in a direction towards the dryer. As can be appreciated, the position of the guide rolls can be adjusted to change the tension of the bottom felt 6. This is shown in the dotted positions of the guide rolls in the Figures as an example.

[0029] Preferably, an inverted suction box 5 is positioned after the press nip on the side of the top felt 2. The suction box 5 creates suction on the top side of the top felt which, like the suction felt roll 4, helps condition the water content of the top felt 2. Additionally this element supports the paper web stay on the top felt 2. This is important, since the press nip asserts a strong force on the paper web against the top and bottom felts. Thus, there is a chance that the paper web may be transferred to the bottom felt 6. The suction box 5 serves to prevent this from occurring. This suction box 5 is also beneficial as an extra measure for stopping water of the top felt 2 from going back to the paper web.

[0030] The counter roll of the shoe press 1 may also be a suction roll, which can perform the functions as described with respect to the suction roll 4 and suction box 5.

[0031] Thereafter, the top felt 2 continues to carry the paper web to the dryer section including a touch roll 3 and a dryer 7. In this embodiment, the dryer 7 is a Yankee cylinder. Similar to the counter roll and shoe roll, the touch roll 3 and dryer 7 are arranged to form a press nip. However, in this section the touch roll is arranged so that the paper web on the bottom side of the top felt 2 is pressed against the smooth surface of the dryer 7. This arrangement facilitates the transfer of the paper web to the contacting surface of the dryer 7. As shown in Figure 1, the top felt 2 is wrapped around the touch roll 3 to enable the separation of the paper web from the felt.

[0032] The touch roll 3 can be a conventional roll with or without fixed crown, a suction press roll with or without fixed crown, a suction roll with crown control or a crown controlled roll. The touch roll according to this embodiment comprises an air blade 12. These types of rolls are advantageous because they ensure linear contact across the width of the paper web with the Yankee cylinder. Usage of a crown controlled roll or crown controlled suction roll also allows a wider line load range as compared to the conventional touch roll.

[0033] After the paper web is transferred to the surface of the Yankee cylinder, the paper web is dried by the pressure vessel of the cylinder. A doctor blade (not shown) of the Yankee cylinder then scrapes the dry paper from the surface of the cylinder, in a known method called *crêping*, producing the paper product.

[0034] As one can appreciate the dryer section can further include a through-air drying cylinder as known in the art.

[0035] Such a configuration having a shoe press installed upstream of the Yankee cylinder is preferable when a paper product having a high bulk level is desired and a dryer paper web can be provided to the Yankee cylinder.

[0036] The second configuration of the system of the

present invention is shown in Figure 2. In this configuration, most sections of the paper machine are identical to that of the first configuration shown in Figure 1. The main difference pertains to the arrangement of the top felt 2 in the shoe press section 1 before the dryer section.

[0037] As can be seen in Figure 2, the same top felt 2 carrying the paper web is not brought into the shoe press 1. Rather, the shoe press 1 is bypassed by rerouting the top felt 2 from the suction felt roll 4 to lead directly to the touch roll 3 of the dryer section.

[0038] In this configuration, a few changes to the system of Figure 1 are necessary. The bottom felt 6 is extracted from the system and the top felt 2 is passed underneath the shoe press 1. The guide roll 8 which was a guide roll for the bottom felt 6 in the first configuration shown in Figure 1 now acts as a guide roll for the top felt 2.

[0039] It is highly desirable to provide a relatively smooth route for the top felt 2 to the dryer section. This reduces the risk of the paper web from peeling off the top felt 2 at kinks along the transfer route. The configuration shown in Figure 2 provides a smooth path to the dryer 7 by making another small modification to the configuration shown in Figure 1. Specifically, the guide roll 8 following the shoe roll is lowered to a position that makes a smoother path, especially at the portion following the suction felt roll 4, than if it were left in the same position as in Figure 1.

[0040] Additionally, a sliding bar 9 is provided between the suction felt roll 4 and the dryer section. This sliding bar 9 is for stabilizing the top felt 2 at high speed.

[0041] This second configuration is preferable when a paper product having lower bulkiness is desired, as the paper web bypasses the shoe press application 1 on its path towards the dryer section.

[0042] Figure 3 illustrates an alternative construction of the second embodiment. In particular, the inventors of the present invention realized that a similar effect can be achieved with the top felt 2 carrying the paper web through the shoe press section 1 but with the shoe roll and the counter roll separated such that a press nip is not formed. According to this embodiment one roll or both rolls are shifted to create sufficient space for the top felt 2 to be run between the separated counter roll and shoe roll. This removes the need for the top felt 2 to be rerouted underneath the entire shoe press 1 as in the construction shown in Figure 2. In this way, the paper web also effectively bypasses the shoe press application 1 without touching or dewatering the paper web. This is advantageous as the paper machine does not require the top felt 2 and the bottom felt 6 to be rerouted. Of course there are additionally several alternatives to ensure that sufficient space is supplied for the top felt 2 to be run between both rolls and that these rolls can be shut off for energy saving reasons.

[0043] Figure 4 is a schematic diagram of the overall paper machine with the combination of the two configurations described with respect to Figures 1 and 2. This figure demonstrates how the majority of the components

of the paper machine remain in place. Only a few changes are necessary to convert the paper machine from the first configuration to the second configuration.

[0044] A second embodiment of the present invention is depicted in Figure 5. In this embodiment, the functions of the shoe press and the touch roll for the dryer are combined into one component. In particular this invention includes a shoe press roll 10 nipped with a touch roll 11. The top felt 2 is wrapped around the touch roll 11 such that the paper web can be directly loaded onto the Yankee cylinder 7, following the touch roll 11. In this way, the shoe press roll 10, touch roll 11 and the Yankee cylinder 7 work as a single arrangement. According to this configuration the touch roll 11 can be a suction roll and/or a crown compensated roll and/or a suction roll with crown compensating features. The shoe press roll 10 in the bottom position is preferably linked to the touch roll and also held in levers (not depicted) to be lowered down quickly. According to a preferred embodiment the touch roll 11 shown in figure 5 is a suction roll 11 comprising a vacuum zone 13 starting at the area of the first nip between the shoe press 10 and the suction roll 11 and ending in at the area of the second nip between the Yankee cylinder 7 and the suction roll 11.

[0045] As shown in Figure 6, a second configuration (bypass mode) can be achieved in the second embodiment by separating the shoe press roll 10 and the touch roll 11. The entire shoe press is shifted downwards and then the shoe roll 10 is separated from the touch roll 11 to a degree such that the paper web can pass through without being dewatered similar to the configuration described with respect to Figure 3. The touch roll 11 must be moved up, however, in order to act as the touch roll for loading the paper web onto the Yankee cylinder. To ensure that the touch roll 11 in this situation provides without the shoe roll 10 a uniform nip against the Yankee cylinder 7 the touch roll should preferably have crown compensation features. An added benefit to this configuration is the possibility of leaving the bottom felt 6 along the bottom felt guide rolls. This allows the customer to switch quickly between the first configuration and the second configuration without the need to remove the bottom felt 6.

[0046] The advantage of this second embodiment is the higher compactness and economy in the investment/installation as fewer components are required in the paper machine.

[0047] From the foregoing, it can be seen that the present invention is a system which can produce paper products over a wide variety of tissue grades and moisture levels via the two configurations described above and exemplified in Figures 1 to 4. Moreover, it is a simple task to convert the system from the first to the second configuration. In the exemplary embodiment of Figures 1 and 2, the only changes required are to (a) extract the bottom felt 6; (b) lower the top felt 2 out of the shoe press 1 and (c) reposition the guide roll 8. All other components of the system remain unchanged. The opposite holds

true in converting the system from the second configuration to the first configuration. The same conveniences apply to the examples shown for Figures 3 to 6.

[0048] The present invention is advantageous over the prior art in that it allows the optimization of the pressing process. To produce on a crescent former machine high bulky products as well as conventional products, whichever is desired, with a simple rerouting of the same felt or reconfiguration of the shoe press is of advantage. When the paper machine is running with the shoe press, high bulk products with high press efficiency can be produced with substantial fiber and energy cost savings. In this case, the touch roll will have a very light load only. This configuration is ideal for producing products of heavier tissue grades, such as kitchen towels. Low drying energy consumption is also achieved in this mode because of the higher dryness achieved out of the press section.

[0049] On the other hand, when the paper machine is running in the shoe press bypass mode, the best drainage efficiency for the lighter tissue grades is achieved. The touch roll will have a higher load as compared to the configuration with the shoe press.

[0050] Consequently, the double felted shoe press application of the present invention allows wider production flexibility and reducing at the same time drying energy costs for all of the production conditions due to this flexibility.

Claims

1. A crescent former paper machine comprising:

a double felted shoe press (1) using a top felt (2) and a bottom felt (6);
a suction felt roll (4) located upstream of the double felted shoe press (1); and
a dryer section (3, 7, 11) located downstream of the double felted shoe press (1);
wherein the crescent former paper machine has a first configuration and a second configuration:

- a) in which in the first configuration, the top felt (2) carries a paper web from the suction felt roll (4) to the double felted shoe press (1), the paper web contacting the bottom felt (6) at the double felted shoe press (1), and the top felt (2) carries the paper web from the double felted shoe press (1) to the dryer section (3, 7), and
- b) in which in the second configuration, the top felt (2) carries the paper web from the suction felt roll (4) to the dryer section (3, 7), bypassing the double felted shoe press (1).

2. The crescent former paper machine of claim 1 further comprising:

a suction box (5) located between the double felted shoe press (1) and the dryer section (3, 7, 11), and preferably wherein the suction box (5) is an inverted suction box.

3. The crescent former paper machine of any of the preceding claims, wherein the dryer section (3, 7, 11) comprises a touch roll (3, 11) and a dryer (7) and preferably wherein the touch roll (3, 11) is a conventional roll with fixed crown, a crown controlled roll, a suction press roll or especially preferred a crown controlled suction press roll.

4. The crescent former paper machine of any one of claims 4 or 5, wherein the dryer (7) is a Yankee cylinder or a through-air drying cylinder.

5. The crescent former paper machine of any of the preceding claims wherein the top felt (2) is moved below the double felted shoe press (1) in the second configuration to bypass the double felted shoe press (1).

6. The crescent former paper machine of any of the preceding claims wherein the top felt (2) of the first configuration and the top felt (2) of the second configuration are the same felt.

7. The crescent former paper machine of any of the preceding claims further comprising:

a sliding bar (9) which stabilizes the top felt (2) in the second configuration.

8. The crescent former paper machine of any of the preceding claims further comprising a guiding roll (8) located downstream from the double felted shoe press (1), wherein it guides the bottom felt (6) in the first configuration and guides the top felt (2) in the second configuration.

9. The crescent former paper machine of any of the preceding claims wherein the shoe press (1) at least on its shoe roll and/or the touch roll (3, 11) comprises an air blade (12) for doctoring.

10. A method for delivering a paper web to a dryer (3, 7) with the crescent former paper machine according to any of the preceding claims comprising the steps of:

carrying the paper web from the suction felt roll (4) by the top felt (2) to:

- a) the double felted shoe press (1) of the crescent former paper machine, and/or
- b) the dryer section (3, 7, 11); and

transferring the paper web to the dryer (7).

11. The method of claim 10 further comprising:

stabilizing the top felt (2) with a sliding bar (9). 5

12. The method of any one of claims 10 and 11 further comprising:

preconditioning the top felt (2) with the suction felt roll (4). 10

13. The method of any one of claims 10 to 12 further comprising:

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guiding by a guiding roll (8) the bottom felt (6) from the double felted shoe press (1) away from the dryer section (3, 7, 11) in the first configuration, and
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guiding by the guiding roll (8) the top felt (2) to the dryer section (3, 7, 11) in the second configuration.

14. The method of any one of claims 10 to 13 wherein the transferring of the paper web to the dryer (7) is performed by a touch roll (3). 25

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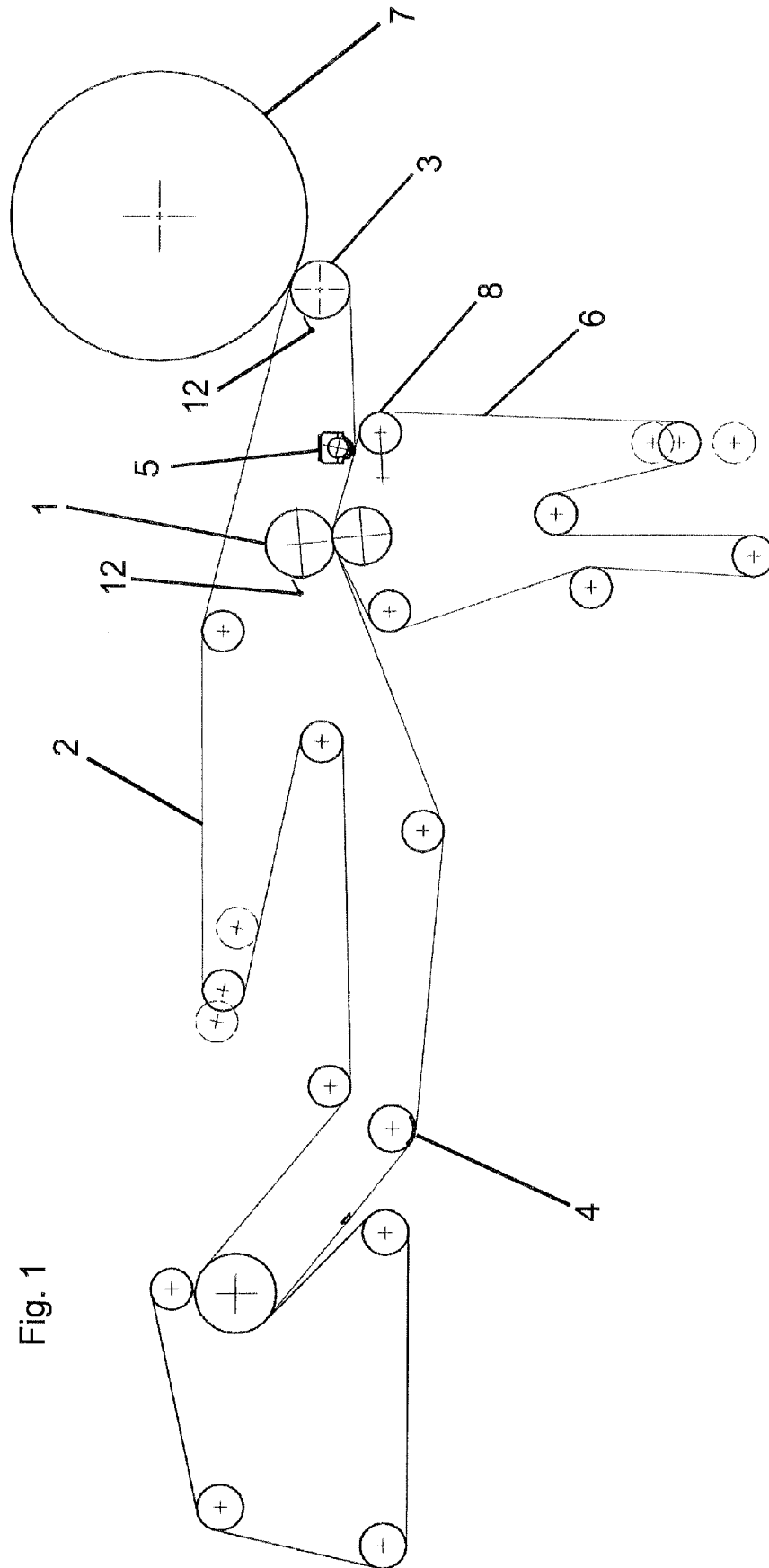


Fig. 1

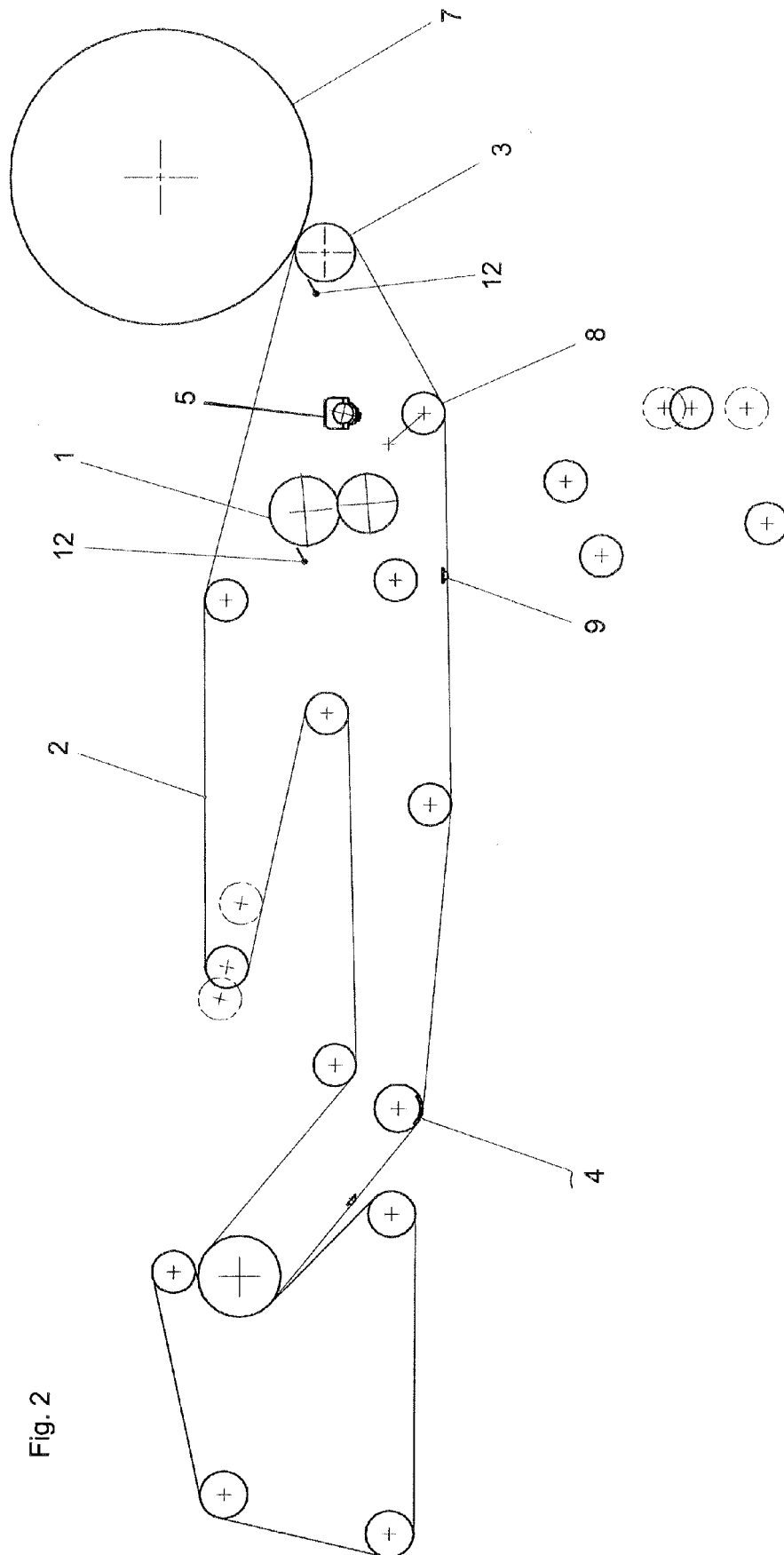


Fig. 2

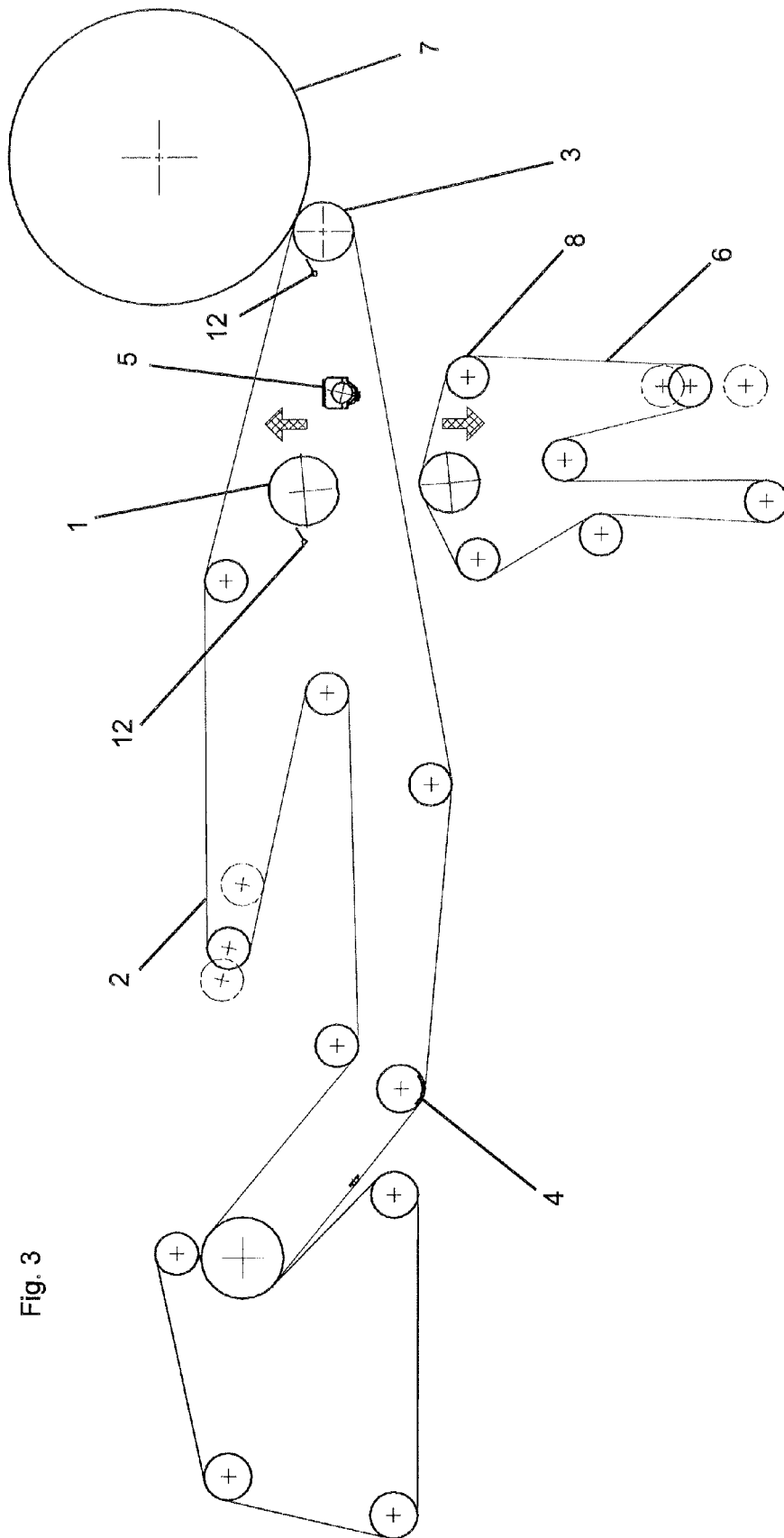


Fig. 3

Fig. 4

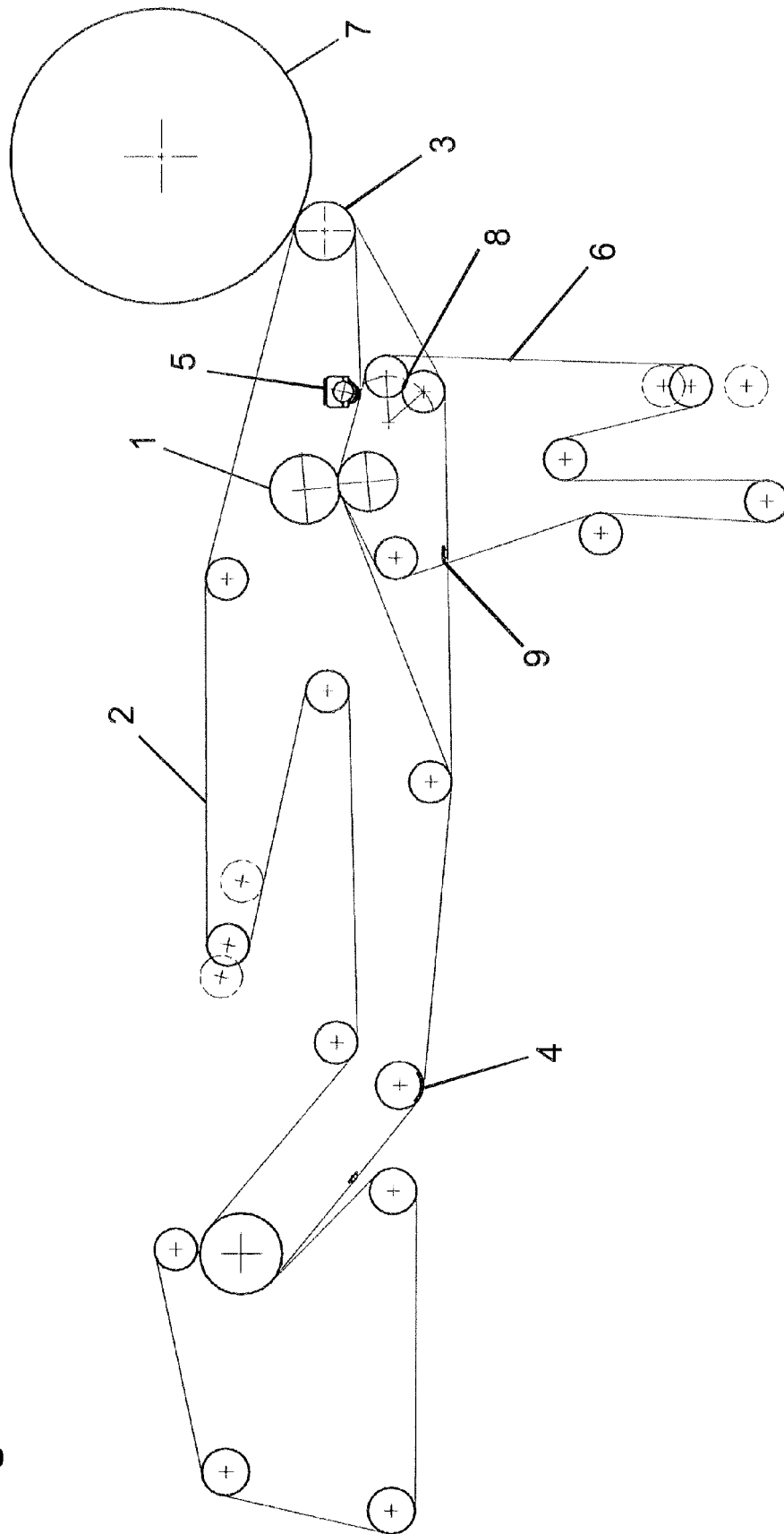
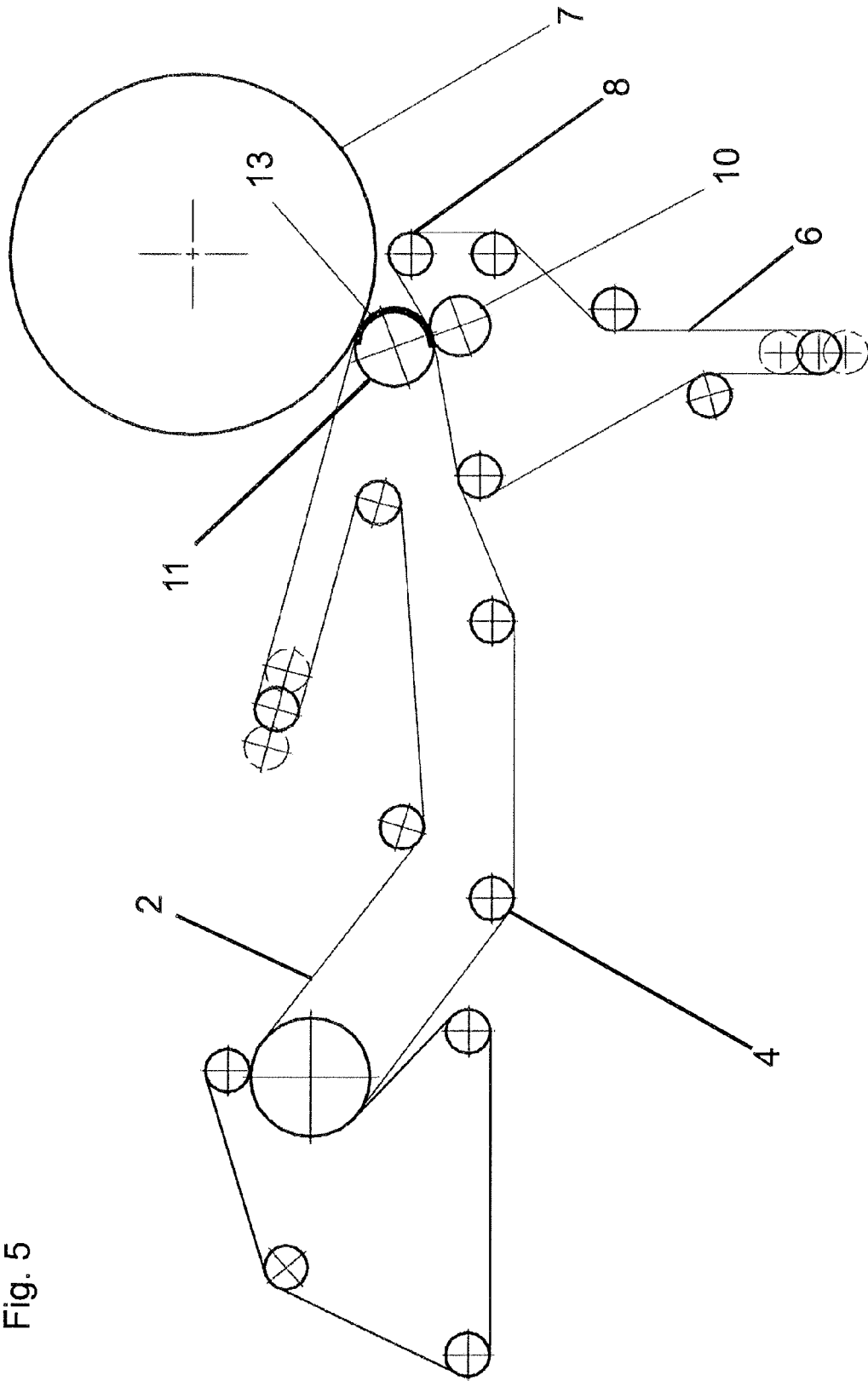


Fig. 5



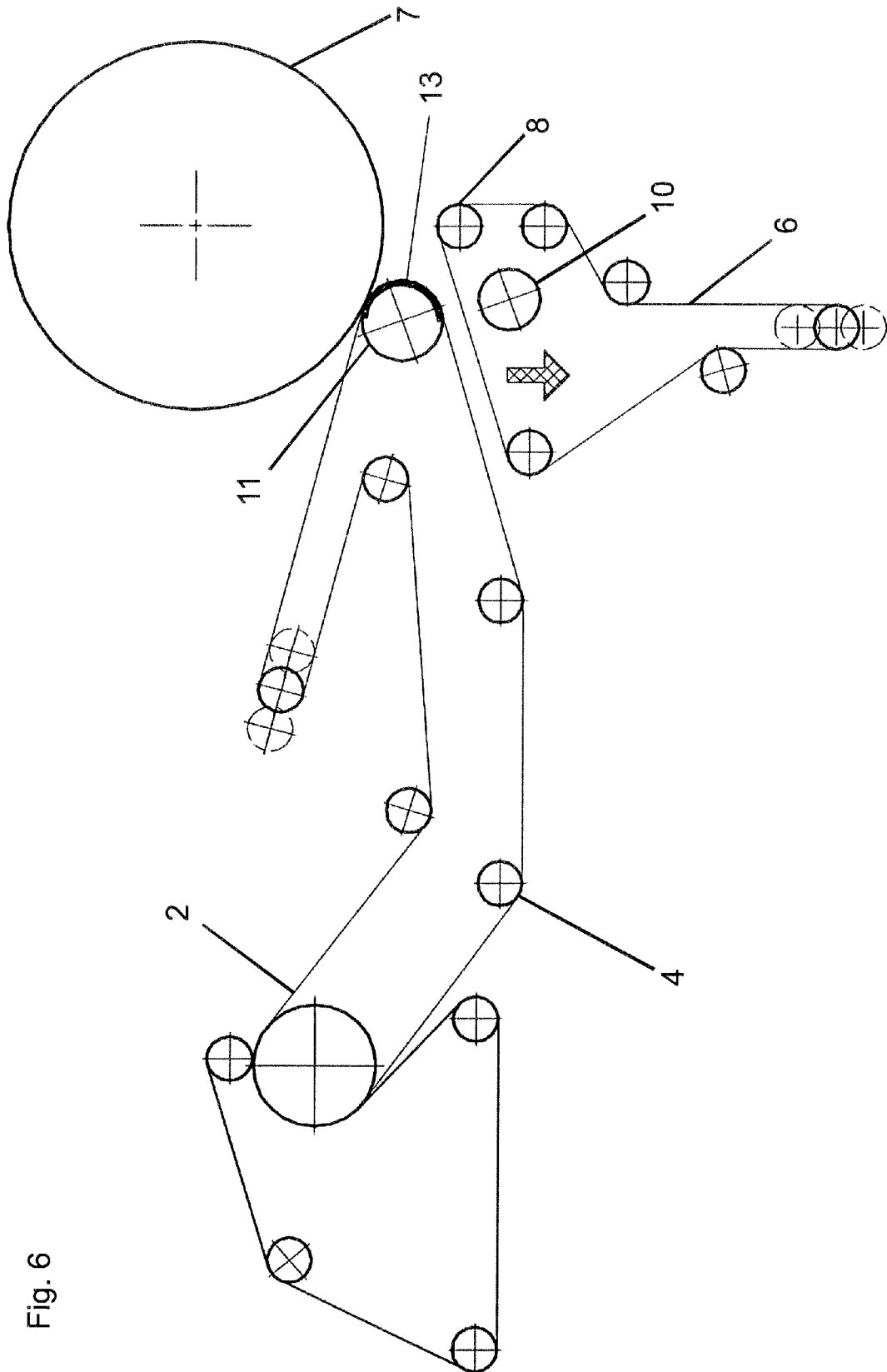


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 13 16 4773

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 99/40255 A1 (VALMET KARLSTAD AB [SE]) 12 August 1999 (1999-08-12) * page 5, line 29 - page 7, line 3; figure 1 *	1,3,4,8, 10,12,14	INV. D21F11/14 D21F9/00
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			TECHNICAL FIELDS SEARCHED (IPC)
			D21F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 July 2013	Examiner Sabatucci, Arianna
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 16 4773

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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