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(54) **PRESS SECTION OF A FIBER WEB FORMING MACHINE**

(57) The invention relates to a press section of a web forming machine, which press section includes a press nip (10). The press nip (10) is formed between a roll (11) and a counter roll (12). Of the rolls, said roll (11) is a hollow-faced press roll (13). The counter roll (12) is an elastic roll (12'). Moreover, the elastic roll (12') has been adapted to be equipped with a flexible roll mantle (22), inside which is an elastic loading element (23) against the press roll (13).

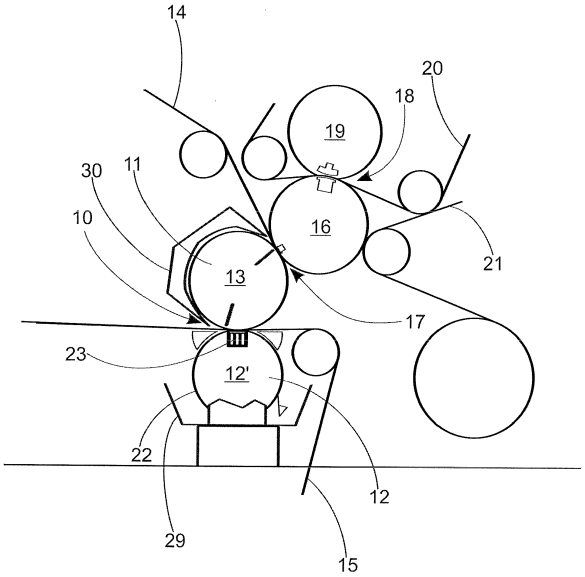

Fig. 2

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Description

[0001] The invention relates to a press section of a web forming machine, which press section includes a press nip, which is formed between a roll and a counter roll, of which rolls said roll is a hollow-faced press roll.

[0002] Figure 2 of EP patent application number 0799932 presents a concept of a shoe press of a centre roll without the first press nip. Figure 3 of US patent number 5759355 presents an application that has reached several production records and that is still sold under Valmet's trade name *SymPress B.* The press section contains three consecutive press nips, the two first ones of which are roll nips and the third is a so-called extended nip. The first press nip is formed between a hollow-faced press roll and a tube roll serving as a counter roll. In the press section in question, the fibre web is well under control even at high production speeds, and at the same time consecutive effective pressing events accomplish a high dewatering capacity. Moreover, the press section is compact, which facilitates the adaptation of the press section into fibre web machines to be modernised.

[0003] Rolls located close to each other in the press section must be positioned accurately, and most rolls are special rolls, which requires structures with dimensional accuracy as well as a backup roll for each roll. Moreover, the removal of one roll also requires the removal of at least an adjacent roll. Correspondingly, the supporting of movable rolls by means of moving arms increases sensitivity to vibration, and the roll nips are susceptible to for example broke accumulations in the web.

[0004] The object of the present invention is to accomplish a novel kind of press section of a fibre web machine, which press section is simpler than previously but more effective and more easily modifiable than earlier. The characteristic features of the press section according to the present invention are described in the enclosed claims. In the press section according to the present invention, the pressing event is started in a novel and surprising manner. In this case, dewatering begins in a controlled manner without disrupting the structure of the fibre web. Dewatering is still effective. Moreover, it is possible to adjust the pressing event, in which case the changing of stock and grade can be carried out without structural changes to the press section. In other respects, too, the structure of the press section is simpler than earlier, and for example the supporting of the rolls can be carried out more easily than previously. Present press sections can be updated easily with minor structural modifications to conform to the invention. In this case, it is possible to easily increase the production capacity of the fibre web machine. The new pressing arrangements are very well suited to high grammage grades, where grammage exceeds 100 g/m^2. At the same time, it is possible to influence the quality of the end product.

[0005] The invention is described below in detail by making reference to the enclosed drawings that illustrate some embodiments of the invention, in which:

Figure 1 shows a press section of a prior art fibre web machine,

Figure 2 shows a first application of a fibre web machine press section according to the invention,

Figure 3 shows a press nip according to the present invention, with a cross section of a loading element,

Figure 4 shows a second application of a fibre web machine press section according to the invention.

[0006] Figure 1 shows a prior art press section, which contains three consecutive functional press nips. In a first press nip 10, the fibre web is between two different fabrics, and the press nip 10 is formed between a roll 11 and a counter roll 12. In a known solution, the roll 11 is a press roll 13 and the counter roll 12 is a tube roll. The upper fabric 14 is usually a press felt. Correspondingly, the lower fabric 15 is usually a press felt. After the first press nip 10, the fibre web follows the upper fabric 14 to a second press nip 17 formed by the press roll 13 and a so-called centre roll 16 and further to a third press nip 18 on the surface of the centre roll 16, which press nip 18 is formed between a shoe press roll 19 and the centre roll 16. In the second and third press nips, the fabric is only against one side of the fibre web. The third fabric 20 is also a press felt, into which water is transferred from the fibre web. The fibre web is transferred from the centre roll 16 to the drying wire 21 and supported by it further to the drying section. The drying wire itself is not presented in the figures, with the exception of Figure 3. A fibre web machine means for example paper, board and pulp machines.

[0007] The invention relates to a press section of a web forming machine, which press section includes a press nip 10 (Figures 2 and 4). In the press nip, water is removed from the fibre web between two rolls. More specifically, the press nip 10 is formed between the roll 11 and the counter roll 12, of which rolls the roll 11 is a hollow-faced press roll 13. In the invention, the press roll 13 is a press suction roll (Figure 2) or a grooved roll (Figure 3). The suction effect created by the press suction roll intensifies dewatering and at the same time guides the fibre web to a direction determined by the press suction roll. In this case, the fibre web remains well under control. In the invention, the counter roll 12 is an elastic roll 12', and the elastic roll 12' has been adapted to be equipped with a flexible roll mantle 22, inside which is an elastic loading element 23 against the press roll 13 (Figure 3). In this case, the pressing event begins gradually without a sudden pulse to the fibre web. Moreover, the pressing event continues beyond the roll nip. However, the loading accomplishes a significant loading to the press nip, with which loading dewatering from the fibre web is effective. In this case, it is possible to increase

the dewatering capacity of the press section without impairing the properties of the fibre web. In practice, the properties of the end product are even improved, and it is possible to have a greater effect on the properties of the fibre web than earlier.

[0008] The press nip 10 is advantageously the first press nip of the press section. In this case, due to the elastic loading element, the first pressing event of the fibre web begins gradually and is gentle, in which case the structure of the fibre web remains undisrupted. At the same time, the adjustment of the pressure medium of the loading element can be used for influencing the intensity of the pressing event. In this way, depending on the grade, the loading of the first press nip can be adjusted as desired without structural changes.

[0009] Figure 3 shows an elastic loading element 23 according to the invention, which elastic loading element 23 has been adapted into an elastic roll 12'. The shaft 24 of the elastic roll 12' contains a suitable support structure 28 for keeping the elastic loading element 23 in place despite the loading and the rotation of the roll mantle. The support structure forms a support for the elastic loading element on five sides, only leaving the loading direction free. In this case, the deformation of the loading element is controlled, and a deformation to other directions has been prevented.

[0010] The elastic loading element 23 is advantageously non-metallic. In this case, it yields for example at the location of broke accumulations in the web, and on the other hand it adapts to the shapes of the press roll. At the same time, a potential small alignment difference between the press roll and the elastic roll evens out by the yielding of the loading element. Secondly, in addition to the elasticity, the loading element accomplishes the required loading in the press nip. Moreover, the structure is simple and easily adjustable. Here, a broken line is used for also presenting the fibre web 25, which comes into the press nip 10 with the upper press fabric 14. On the side of the elastic roll 12', there is a lower press fabric 15 and in addition to these a flexible roll mantle 22. After the press nip 10, the fibre web 25 follows the press roll 13 and the upper press fabric 14 that is on its surface. In this case, the fibre web is guided naturally to the correct direction despite even a high production speed.

[0011] In the application example of Figure 3, there are three pressure chambers 26 in the elastic loading element 23. According to the invention, the elastic loading element contains at least one pressure chamber 26 for creating a loading effect by changing the dimension of the elastic loading element by means of pressure medium. When the pressure chamber is pressurised, the dimension of the elastic loading element adapted into the elastic roll changes. In this way, the surface of the loading element rises together with the flexible mantle and press felt against the surface of the roll 11. In this case, the loading element is loaded against the press roll by increasing the pressure, creating a nip load. The pressure chambers may contain stiffeners that correspond to the shape of the pressure chamber, which stiffeners contain openings to the loading direction. In this way, a pressure chamber of a greater pressure does not affect the loading of an adjacent pressure chamber, when a stiffener is installed in at least the pressure chamber of a lower pressure. Surprisingly, the rolls of the first press nip lack loading cylinders of the mantle, and the press roll also lacks a loading element. The pressure medium used is advantageously oil, in which case the loading element is hydraulic. In this way, a sufficient nip load and pressure are achieved with the loading element. At the same time, the hydraulic loading is easily adjustable to a desired level. The achievable nip load can be up to 200 kN/m, but usually the nip load is 100 - 150 kN/m. Due to the elastic loading element, the pressure profile of the press nip is also even.

[0012] The direction of change of the dimension of the elastic loading element is adapted primarily in the direction of the radius of the elastic roll, in which case the distance of the glide face of the elastic loading element changes in relation to the shaft of the elastic roll. In this case, it is possible to press the elastic loading element against the press roll by changing the pressure of the pressure medium, and hence it is possible to define a suitable nip load. In accordance with the structure, there is a roll mantle and one or more press fabrics as well as the actual fibre web in between. The elastic loading element hence has a certain stroke length of the same magnitude as the change in the dimension, which stroke length can also be utilised for so-called opening of the nip. In this case, a single loading element is used for accomplishing both the opening of the nip and the creation of the nip load. In this case, the elastic roll can be supported stiffly without known loading arms and loading cylinders.

[0013] In addition to adjustable loading, the elastic loading element accomplishes other advantages, too. Now the elastic roll can be supported stiffly to the web forming machine, when the necessary loading is created with the loading element inside the elastic roll. In this case, prior art loading arms and external loading devices are unnecessary. Similarly, conventional loading cylinders inside nip rolls can be omitted completely. At the same time, the susceptibility of the press nip to vibration is reduced, and the elastic loading element also serves partly as a damper. Moreover, the press roll and the elastic roll have been supported independently of each other, in which case they can be removed without removing the other roll.

[0014] The change in the dimension of the elastic loading element according to the invention in the loading direction is 1 - 40 mm, more advantageously 5 - 30 mm. In this case, in addition to loading, the loading element can be used for opening the press nip for example for the duration of the changing of a fabric. At the same time, the elastic roll can be supported stiffly to the fibre web machine, which simplifies the structure of the press section and reduces the vibration of the structures. When

the structures become simpler, the costs are also reduced. In practice, the press roll is the only roll that is supported movable by means of loading arms in connection with these three press nips.

[0015] The various dimensions of the elastic loading element can vary in different applications. Generally speaking, the length of the elastic press nip according to the invention in the travel direction of the web is 60 - 150 mm, advantageously 75 - 125 mm. In this case, the length of the pressing event is considerably longer than a normal roll nip, in which case there is time for more water than previously to be removed. As an example, the nip length formed by a loading element with one pressure chamber can be 60 mm, while a nip length of 150 mm is achieved with three consecutive pressure chambers. With two and more pressure chambers, it is also possible to adjust a desired nip pressure profile in the machine direction. In this case, in practice there is a small nip load at the beginning of the press nip, which nip load increases at the location of the next pressure chamber. By adjusting the pressures of the pressure chambers, it is also possible to change the position of the elastic loading element in order to adjust the pressing event. This change corresponds to the adjustment of a shoe press roll, which requires the opening of the shoe press roll plus mechanical changes. With an elastic loading element, the adjustment can be carried out by changing the pressures and without opening the elastic roll. The adjustment can even be carried out during operation without stopping the fibre web machine.

[0016] The supporting of the elastic roll also simplifies the structure of the press section. In the invention, the roll 11 and the elastic roll 12' have been supported independently of each other. In this case, for example, said rolls can be changed without removing the other roll, which simplifies the service measures.

[0017] Figure 2 shows one application of the press section according to the invention. Here, a centre roll 16 has been arranged into nip contact against the press roll 13 in order to form a second press nip 17. Moreover, an extended nip roll 19 has further been arranged into nip contact against the centre roll 16 in order to form a third press nip 18. Said structure is compact, and the press section according to the invention can be formed simply by changing the elastic roll. In this case, it is possible to obtain more dewatering capacity and various adjustment possibilities to the press section.

[0018] Figure 4 shows a second application of the press section according to the invention. Here, there is a separate press nip 27 after the press nip 10. In other words, there are two consecutive but separate press nips in the press section in question. According to the invention, in the first press nip 10 the counter roll 12 is an elastic roll 12', which contains an elastic loading element 23 against the press roll 13. In this case, the advantages described above are reached in this application, too. Unlike in the first application, here the press roll 13 is in the lower position, which facilitates in the collection of the removed water. The separate press nip 27 has a shoe press roll 19. The counter roll of the shoe press roll 19 is a variable crown roll, the structure of which resembles the above-mentioned centre roll.

[0019] In the solution of Figure 4, a solid press roll, in other words a tube roll, which has a thick mantle, can also be used instead of a suction press roll. The thickness of such a mantle is 70 - 150 mm, and the diameter of a tube roll is less than 1800 mm, usually 1000 - 1600 mm. The thick mantle of a solid press roll carries the loading without internal loading devices and other internal equipment. A solid press roll advantageously contains a surface structure or coating that has space, such as grooving, for the pressed water. In this way, the pressing arrangement is inexpensive and easy to arrange to be functional in terms of runnability and geometry. Moreover, in connection with a small-diameter roll there is more room and an easier configuration to arrange the vats belonging to the water collection system to respond to the increasing dewatering capacity.

[0020] The press application contains strong-walled rolls intended for pressing, the surface structure of which rolls always contains space for water when the loading removes considerable amounts of water from a web with a higher grammage. Moreover, the reasonable diameters of the rolls enable the placement of the other dewatering equipment in the immediate vicinity of the nip, in connection with both nip rolls. In this case, the access of the removed water back into the fabrics and into the web is avoided. Moreover, the travel of the web into the press nip is advantageously rather straightforward and hence easily controllable. Figures 2 and 4 show a large saveall 29 placed underneath the lower roll, which saveall 29 collects the water that is removed in the press nip 10. The water circulating with the roll is removed by means of a doctor into the saveall. The saveall also prevents the water from splashing into the inner circulation of the press felt 15. In Figure 2, there is a saveall 30 around the roll 11. A corresponding saveall 30 has been placed on the outlet side of the press nip 10 in Figure 4. There can also be a corresponding saveall (broken line) on the inlet side, especially when producing heavy grades. The figures also present small savealls below the press felt 15. Figure 4 presents a doctor strip 31 adapted against the press felt 15, which doctor strip 31 can be used instead of the outlet side saveall.

[0021] In the roll nip, there are two hard fixed-mantle rolls against each other, which rolls can have different types of surface structures. A shoe roll nip is a press nip between a variable crown roll with a hard mantle and a variable crown roll equipped with a shoe and having a flexible mantle. The structure of the shoe with a hard surface is concave, matching the shape of the counter roll. Moreover, the shoe is loaded by means of cylinders from below the rigid shoe structure. The mantle of the hard-mantle roll is also loaded via glide shoes by means of cylinders.

[0022] The structure and components of the press sec-

tion according to the invention can be otherwise known, but an elastic loading element together with a flexible roll mantle is arranged in an elastic roll. In this case, an extended press nip is achieved, with the extended press nip having positive impacts on production and on the quality of the fibre web. An extended and elastic press nip accomplishes greater dewatering capacity than earlier without disrupting the fibre web that has just come from the web forming section. A higher bulk than earlier is achieved at the same time, and the ratio of the bulk to the dry matter content can also be controlled now. It is also possible to adjust the strength properties of the fibre web. The elastic roll itself has a simple and operationally reliable structure, and its costs are clearly more inexpensive than with other special rolls. Furthermore, the elastic roll requires less alignment than earlier.

[0023] The invention relates to a press section of a web forming machine, which press section includes a press nip (10). The press nip (10) is formed between a roll (11) and a counter roll (12). Of the rolls, said roll (11) is a hollow-faced press roll (13). The counter roll (12) is an elastic roll (12'). Moreover, the elastic roll (12') has been adapted to be equipped with a flexible roll mantle (22), inside which is an elastic loading element (23) against the press roll (13).

Claims

1. A press section of a web forming machine, which includes a press nip (10) that is formed between a roll (11) and a counter roll (12), of which rolls said roll (11) is a hollow-faced press roll (13), **characterised in that** the counter roll (12) is an elastic roll (12'), which has been adapted to be equipped with a flexible roll mantle (22), inside which is an elastic loading element (23) against the press roll (13).

2. A press section according to claim 1, **characterised in that** the press nip (10) is the first press nip of the press section.

3. A press section according to claim 1 or 2, **characterised in that** the elastic loading element (23) is non-metallic.

4. A press section according to any one of the claims 1 - 3, **characterised in that** the elastic loading element (23) contains a pressure chamber (26) for creating a loading effect by changing the dimension of the elastic loading element (23) by means of pressure medium.

5. A press section according to claim 4, **characterised in that** the change in the dimension of the elastic loading element (23) in the loading direction is 1 - 40 mm, more advantageously 5 - 30 mm.

6. A press section according to any one of the claims 1 - 5, **characterised in that** the elastic roll (12') has been supported stiffly to the web forming machine.

7. A press section according to any of the claims 1 - 6, **characterised in that** the length of the press nip (10) in the travel direction of the web is 60 - 150 mm, more advantageously 75 - 125 mm.

8. A press section according to any one of the claims 1 - 7, **characterised in that** the roll (11) and the elastic roll (12') have been supported to the web forming machine independently of each other.

9. A press section according to any one of the claims 1 - 8, **characterised in that** the press roll (13) is a press suction roll or a grooved roll.

10. A press section according to any one of the claims 1 - 9, **characterised in that** a centre roll (16) has been arranged into nip contact against the roll (11) in order to form a second press nip (17), and further a shoe roll (19) has been arranged into nip contact against the centre roll (16) in order to form a third press nip (18).

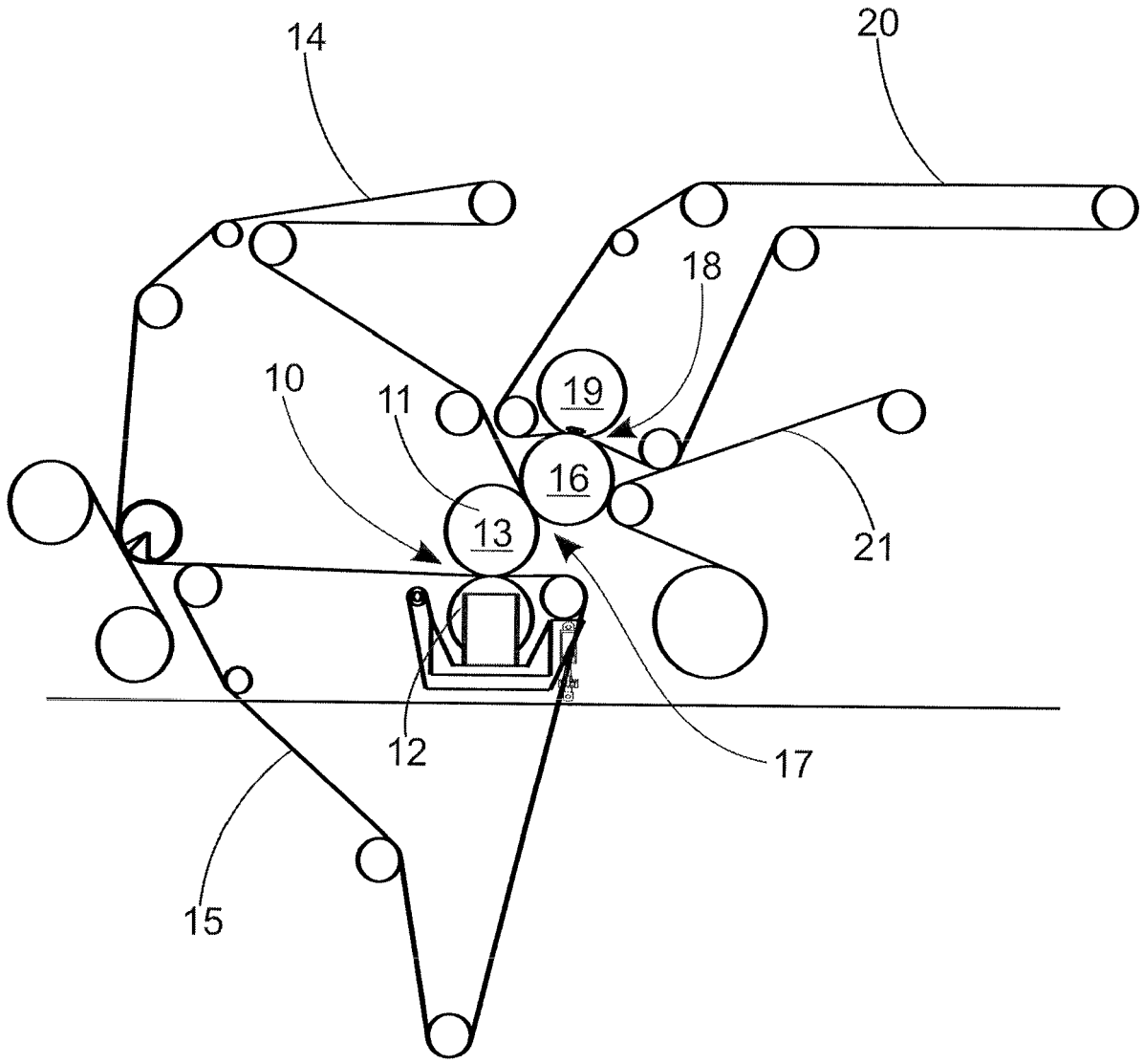

Fig. 1

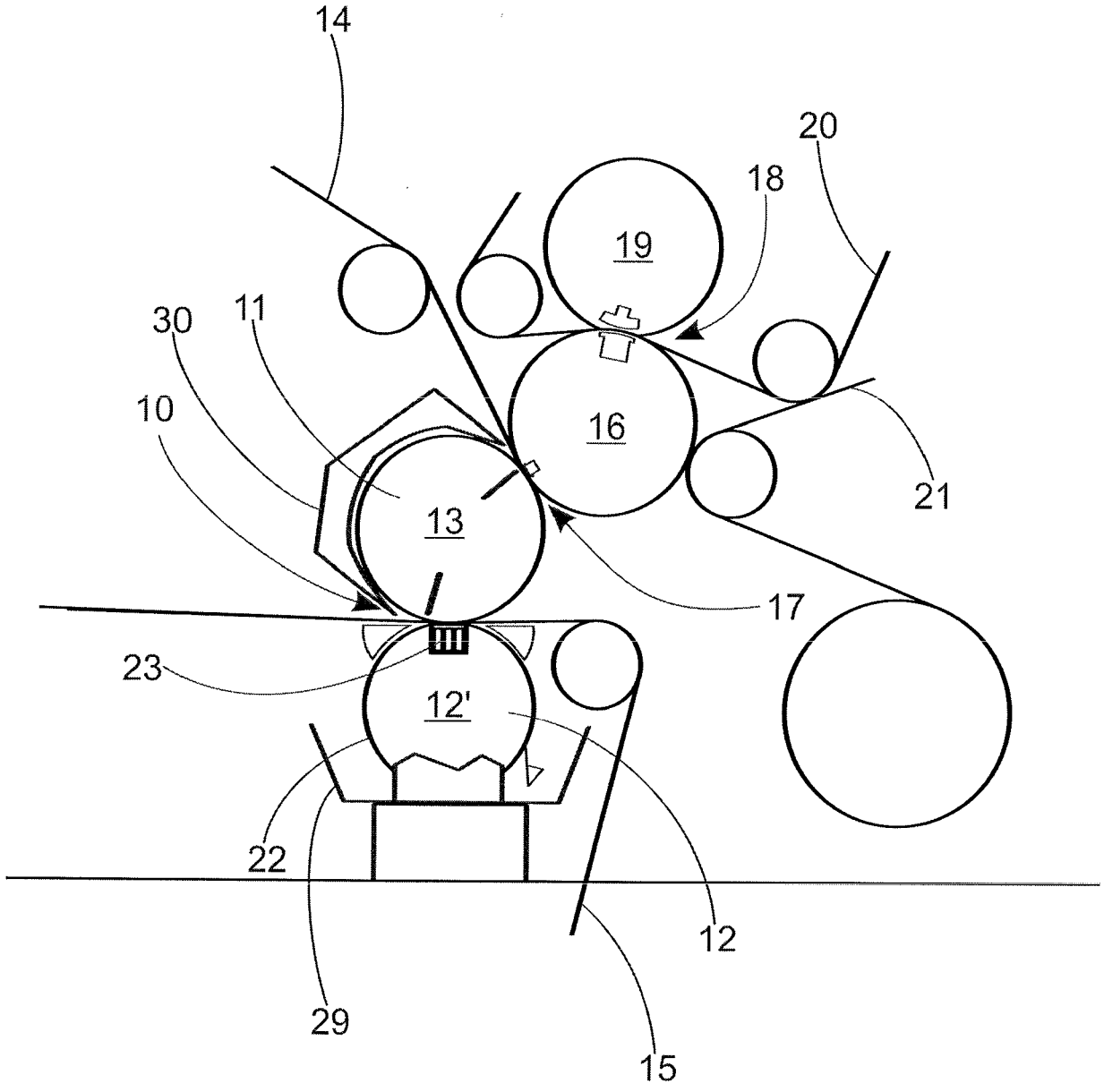

Fig. 2

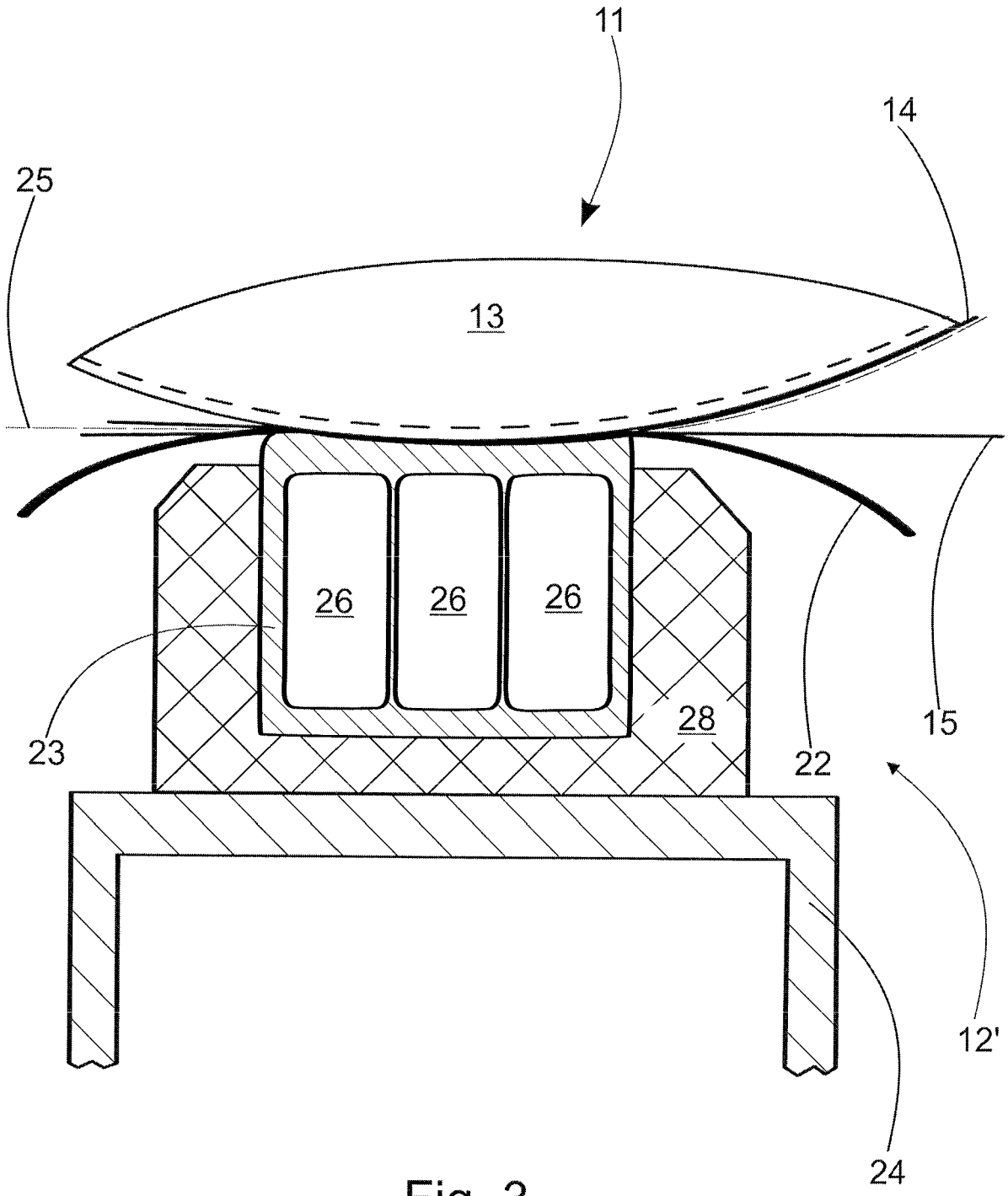

Fig. 3

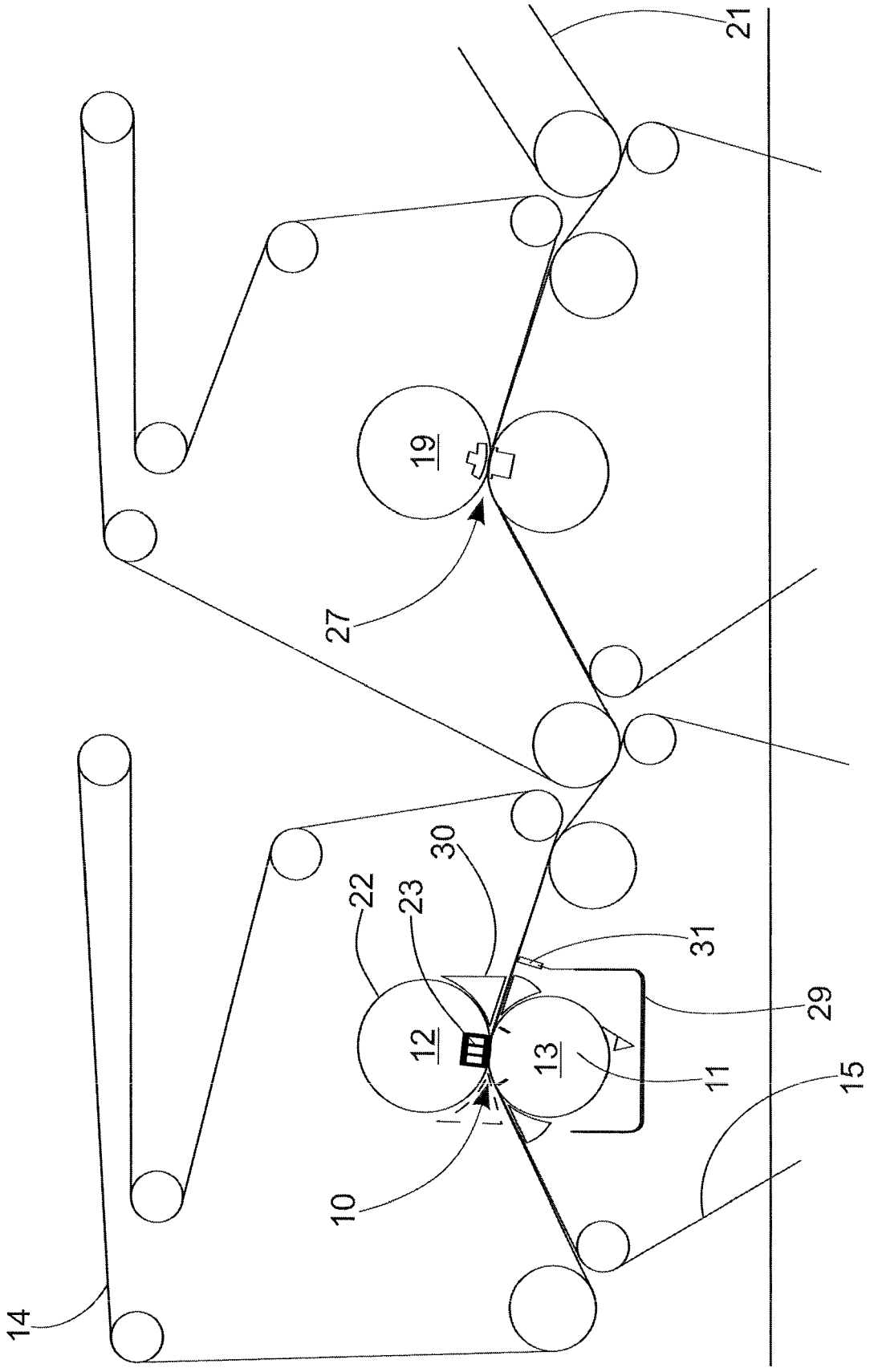

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 7093

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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
Munich	11 April 2018	Maisonnier, Claire

CATEGORY OF CITED DOCUMENTS

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