(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 333 314 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.06.2018 Bulletin 2018/24

(51) Int Cl.:
D21F 9/00 *(2006.01)*

(21) Application number: **16202856.7**

(22) Date of filing: **08.12.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) **FORMING UNIT**

(57) The invention relates to a forming unit, which is a gap former formed between a lower wire (10) and an upper wire (20), in which first water removal means of the gap former of the forming unit is a forming roll (23) comprising a wrap angle (23V). In the forming unit at a distance (L) of less than 2 meters from the forming roll (23) a sleeve roll (50) is located, which distance (L) is measured between the point, in which lower and upper wires (10, 20) wrap angle (23V) ends on the forming roll (23) and the point, in which contact of the lower and upper wires (10, 20) begins on the sleeve roll (50).

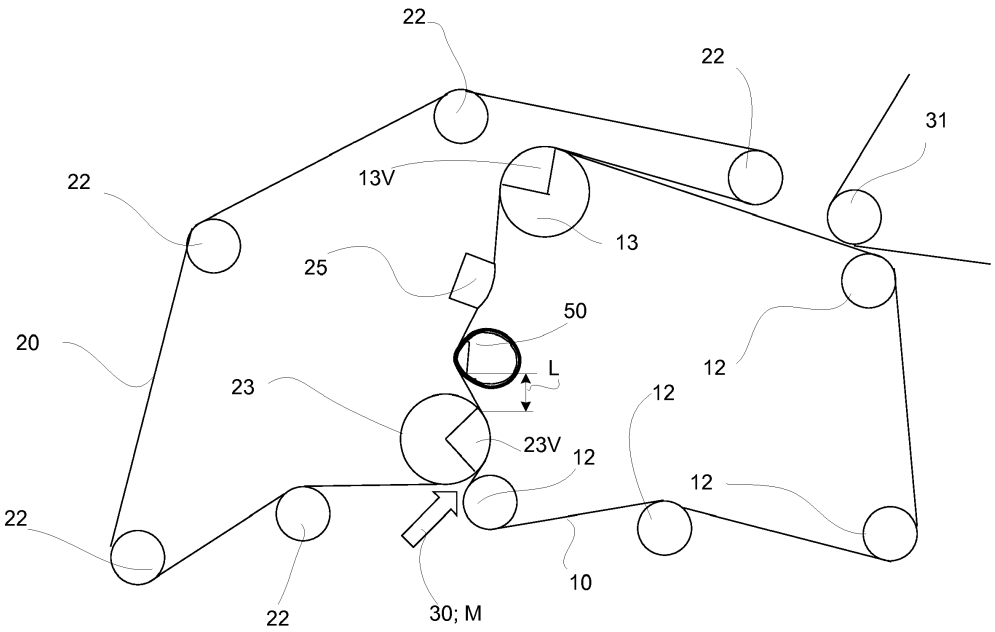

Fig. 2

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Description

[0001] The invention relates generally to producing fiber webs. Particularly the invention relates to a forming unit according to the preamble of claim 1 and to a modernized forming unit according to the preamble of claim 2.

[0002] As known from the prior art in fiber web machines, especially in paper and board machines, the fiber web is produced and treated in an assembly formed by a number of apparatuses arranged consecutively in a process line. A typical production and treatment line comprises a forming section comprising a head box and a forming unit and a press section as well as a subsequent drying section and a reel-up. The production and treatment line can further comprise other devices and sections for finishing the fiber web, for example, a size press, a calender, a coating section. The production and treatment line also comprises typically at least one winder for forming customer rolls as well as a roll packaging apparatus. In this description and the following claims by fiber webs are meant especially container-board or carton-board webs.

[0003] The task of a forming unit is to remove water from fiber suspension fed by the head box. When the web is manufactured of watery fiber stock, water in the stock is removed on the forming section through a forming wire or forming wires for starting the formation of the web. Fibers remain on the forming wire or between the forming wires moving together. Depending on the grade of the web being manufactured, different types of stocks are used. The volume for which water can be removed from different stocks for achieving a web of good quality is a function of many factors, such as e.g. a function of the desired basis weight of the web, the design speed of the machine, and the desired level of fines, fibers and fill materials in the finished product. Many types of devices are known on the forming unit such as foil strips, suction boxes, turning rolls, suction rolls, and rolls provided with an open surface, which have been used in many different arrangements and arrays when trying to optimize the volume, time and location of water being removed when forming the web. The manufacturing a high-quality end-product of desired grade is a function of the volume of dewatering, the dewatering method, the duration of dewatering, and the location of dewatering. When it is desired to improve the water removal capacity and to maintain or improve the quality of the end-product, many times unforeseeable problems are created as the result of which either the water removal volume has to be decreased for maintaining the desired quality or the desired quality has to be sacrificed for achieving the greater water volume.

[0004] In patent publication FI 83102 C is disclosed a web forming unit, in which there is a first and a second forming roll inside the supporting wire loop. The covering and supporting wire loop runs a common vertical route from and with the first forming roll to the second forming roll. The actual web forming occurs in the area of the common run, which from and including the forming gap comprises the following forming and drainage zones: a first forming zone, in which the drainage occurs in the area of the first forming roll with hollowed out surface, first in the gap and thereafter through both the wires on the common sector a of the wires, which covers the first forming roll, a second forming zone in the area defined by a curved cover part of the static forming element, a third forming zone inside the supporting wire loop in the area of the suction roll, which serves as the second forming roll.

[0005] In the gap forming units known form prior art there is typically combined a forming roll with small wrap angle and a long pulsating forming shoe, which provides for good water removal but has high energy consumption. During the in the beginning non-pulsating water removal with the forming roll filtrates the fiber web so much that the static forming element can improve fiber web formation and removes water from the fiber web.

[0006] In figure 1 is schematically shown an example of a forming unit according to prior art, which is a gap former with substantially vertical draw in the twin-wire part. The forming unit receives comprises the stock suspension M from a head box. The stock suspension is fed to the forming unit formed comprising a lower wire 10 and an upper wire 20 with a substantially vertical common run, each wire formed as an endless loop comprising rolls 12, 22 for guiding and driving the wire. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 20. The forming roll 23 is typically a suction roll. The forming roll 23 is followed by pulsating water removal means; a foil box 24 forming pulsating water removal zone Z. The foil box 24 is located inside the loop formed by the upper wire 20. After the foil box 24 the fiber web is further guided between the upper and the lower wire 20, 10 to a suction roll 13 with a wrap angle 13V, which suction roll 13 is located inside the lower wire 10. From the forming roll the runs of the wires 10, 20 separate and the fiber web is guided on the lower wire 10, now running horizontally, slightly downwards towards and to the pick-up roll 31 transferring the fiber web to a press section. These types of forming units typically are used in printing paper machines. At present days an over capacity of paper production is common and thus the paper machines are closed or modernized to be board machines. The types of a gap formers described above are not as such suitable for producing board webs and large scale rebuild is needed in order to have enough water removal capacity at the forming unit. Especially when producing board webs problems occur due to low consistency of fiber stock in the head box, which leads to increased need of water removal capacity in the forming unit, whereby in types of forming units one disadvantage relating to optimizing water removal capacity and desired quality of the board web. Typically this has been

tried to solve by adding water removal devices of the forming unit, which naturally increases costs and complicates the construction of the forming unit.

[0007] In patent application publication WO 2010046527 A1 is disclosed a forming unit comprising two wire loops which form a twin-wire zone which comprises a dewatering element performing initial dewatering and a dewatering device following it. The dewatering device comprises a stationary support shaft on which are supported support elements around which circles an impermeable belt loop. The dewatering device further comprises a curvilinear dewatering zone over which the wires travel supported by the belt loop. The degree of curvature of the curve of the curvilinear dewatering zone increases in the travel direction of the belt such that increasing dewatering pressure is applied to stock suspension travelling between the wires on the curvilinear dewatering zone. Said at least one curvilinear dewatering zone of said at least one dewatering device, consists of two partial curves such that the radius of curvature of a first partial curve is greater than the radius of curvature of a second partial curve following the first partial curve in the travel direction of the web.

[0008] An object of the invention is to create a forming unit, in which the disadvantages and problems of prior art are eliminated or at least minimized.

[0009] In particular an object of the invention is to provide a new type of forming unit in which has improved water removal capacity.

[0010] A non-limiting object of the invention is to create a modernized forming unit, in which the disadvantages and problems of prior art are eliminated or at least minimized.

[0011] In order to achieve the above mentioned objects the forming unit according to the invention is mainly characterized by the features of the characterizing clause of claim 1 or 2. Advantageous embodiments and features are disclosed in the dependent claims.

[0012] According to the invention the forming unit is a gap former formed between a lower wire and an upper wire, in which first water removal means of the gap former of the forming unit is a forming roll. In the forming unit at a distance of less than 2 meters from the forming roll a sleeve roll is located, which distance is measured between the point, in which lower and upper wires wrap angle ends on the forming roll and the point in which lower and upper wires are in the contact on the sleeve roll i.e. the point in which the contact of the lower and upper wires begins on the sleeve roll.

[0013] According to the invention the modernized forming unit is modernized from an existing former comprising a gap former formed between a lower wire and an upper wire, in which first water removal means of the gap former of the forming unit is a forming roll comprising a wrap angle and in the forming unit at a distance of less than 2 meters from the forming roll a sleeve roll is located, which distance is measured between the point, in which lower and upper wires wrap angle ends on the forming roll and the point, in which contact of the lower and upper wires begins on the sleeve roll.

[0014] According to an advantageous feature of the invention the sleeve roll comprises a stationary support shaft, an belt loop, which is led to circle around the stationary support shaft, that the sleeve roll further comprises at least one curvilinear dewatering zone consisting of two partial curves such that the radius of curvature of a first partial curve is greater than the radius of curvature of a second partial curve following the first partial curve in the travel direction of belt loop. Advantageously the sleeve roll (50) comprises support elements supported at a distance from each other on the stationary support shaft, the belt loop led to circle around the stationary support shaft is supported by the support elements and the belt loop is impermeable.

[0015] According to an advantageous feature of the invention in the forming unit the distance between the forming roll and the sleeve roll is in lower and upper wires running direction 0,2 - 2 meters, advantageously 0,3 - 1,5 meters.

[0016] According to an advantageous feature of the invention in the forming unit the run between the forming roll and the sleeve roll is free of suction boxes.

[0017] According to an advantageous feature of the invention in the forming unit a suction roll is located following at a distance the sleeve roll and at the run between the suction roll and the sleeve roll a suction box is located.

[0018] According to an advantageous feature of the invention the forming roll wrap angle is 40 - 110 degrees.

[0019] By the forming unit according to the invention many advantages are achieved. Water removal capacity of the forming unit is increased without need of adding further use or suction power and as less pulsating water removal is used better strength properties of the fiber web are achieved. Short distance from the forming roll to the sleeve roll enables manufacturing of packaging board grades with high quality, efficiency and capacity. The modernization of an existing forming unit is easy and the new devices can be fitted in the places of the removed ones and thus there is no need to move the location of the head box.

[0020] In the following the invention is explained in detail with reference to the accompanying drawing to which the invention is not to be narrowly limited.

In figure 1 is shown schematically an example of a forming unit according to the prior art.

In figure 2 is shown schematically an advantageous example of a forming unit according to the invention.

In figure 3 is shown schematically an advantageous example of a forming unit according to the invention.

In figure 4 is shown schematically an advantageous example of a forming unit according to the invention.

In figure 5 is shown schematically an advantageous example of a forming unit according to the invention.

In figure 6 is shown very schematically a sleeve roll.

[0021] During the course of the following description like numbers and signs will be used to identify like elements according to the different views which illustrate the invention and its advantageous examples. In the figures some repetitive reference signs have been omitted for clarity reasons.

[0022] In figure 1 is schematically shown an example of a forming unit according to prior art, which is a gap former with substantially vertical draw in the twin-wire part. The forming unit receives comprises the stock suspension M from a head box 30. The stock suspension is fed to the forming unit formed comprising a lower wire 10 and an upper wire 20 with a substantially vertical common run, each wire formed as an endless loop comprising rolls 12, 22 for guiding and driving the wire. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 20. The forming roll 23 is typically a suction roll. The forming roll 23 is followed by pulsating water removal means; a foil box 24 forming pulsating water removal zone Z. The foil box 24 is located inside the loop formed by the upper wire 20. After the foil box 24 the fiber web is further guided between the upper and the lower wire 20, 10 to a suction roll 13 with a wrap angle 13V, which suction roll 13 is located inside the lower wire 10. From the forming roll the runs of the wires 10, 20 separate and the fiber web is guided on the lower wire 10, now running horizontally, slightly downwards towards and to the pick-up roll 31 transferring the fiber web to a press section. These types of forming units typically are used in printing paper machines. At present days an over capacity of paper production is common and thus the paper machines are closed or modernized to be board machines. The types of a gap formers described above are not as such suitable for producing board webs and large scale rebuild is needed in order to have enough water removal capacity at the forming unit. Especially when producing board webs problems occur due to low consistency of fiber stock in the head box, which leads to increased need of water removal capacity in the forming unit, whereby in types of forming units one disadvantage relating to optimizing water removal capacity and desired quality of the board web. Typically this has been tried to solve by adding water removal devices of the forming unit, which naturally increases costs and complicates the construction of the forming unit.

[0023] In figure 2 is shown an example of a forming unit, which is a gap former type forming unit and begins with a twin-wire part with a substantially vertical run. From a head box 30 stock suspension M is fed to the forming unit formed as a gap former comprising a lower wire 10 and an upper wire 20, each comprising rolls 12, 22 for guiding and driving the wire as an endless loop. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 10. Wrap angle 23V is advantageously 40-110 degrees for ensuring required water removal capacity. The forming roll 23 is typically a suction roll. The forming roll 23 is followed by a sleeve roll 50, which is located inside the loop formed by the lower wire 10. The distance L between the forming roll 23 and the sleeve roll 50 is in lower and upper wires 10, 20 running direction only about 0,2 - 2 meters, advantageously 0,3 - 1,5 meters. The distance L is measured between the point in which lower and upper wires 10, 20 wrap angle 23V ends on the forming roll 23 and between the point in which lower and upper wires 10, 20 are in the contact on the sleeve roll 50 i.e. the point in which the contact of the lower and upper wires 10, 20 begins on the sleeve roll 50. According to the invention, there is no need to use suction boxes between the forming roll 23 and the sleeve roll 50. After the sleeve roll 50 the fiber web is further guided between the upper and the lower wire 20, 10 to a suction roll 13 with a wrap angle 13V, which suction roll 13 is located inside the lower wire 10 and at a distance towards the pick-up roll 31 transferring the fiber web to a press section the runs of the wires 10, 20 are separated and the end part of the forming unit is formed as a one wire part with substantially slightly downwards inclined horizontal run. Inside the loop formed by the upper wire 20 further water removal means 25 are located as shown in the example of the figure. The further water removal means 25 is advantageously a suction box 25, which supports the run of the fiber web during the lengthy run between the sleeve roll 50 and the suction roll 13.

[0024] In figure 3 is shown an example of a forming unit, which is a gap former type forming unit and begins with a twin-wire part with a substantially vertical run. From a head box 30 stock suspension M is fed to the forming unit formed as a gap former comprising a lower wire 10 and an upper wire 20, each comprising rolls 12, 22 for guiding and driving the wire as an endless loop. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 10. The forming roll 23 is typically a suction roll. The forming roll 23 is followed support foils 26 that support the run of the wires 10, 20 between the forming roll 23 and the sleeve roll 50 and remove water from the surface of the wire 20. The support foils 26 do not itself remove water from the fiber web, so the support foils 26 do not change the course of the wires 10, 20. The support foils 26 are followed by a sleeve roll 50, which is located inside the loop formed by the lower wire 10. The distance L between the forming roll 23 and the sleeve roll 50 is in lower and upper wires 10, 20 running

direction only about 0,2 - 2 meters. The distance L is measured between the point in which lower and upper wires 10, 20 wrap angle 23V ends on the forming roll 23 and between the point in which lower and upper wires 10, 20 are in the contact on the sleeve roll 50 i.e. the point in which the contact of the lower and upper wires 10, 20 begins on the sleeve roll 50. According to the invention, there is no need to use suction boxes between the forming roll 23 and the sleeve roll 50. The support foils 26 can be situated also on the wire run between the rolls 50, 13 (not shown). After the sleeve roll 50 the fiber web is further guided between the upper and the lower wire 20, 10 and at a distance towards the pick-up roll 31 transferring the fiber web to a press section the runs of the wires 10, 20 are separated and the end part of the forming unit is formed as a one wire part with substantially slightly downwards inclined horizontal run. Inside the loop formed by the upper wire 20 further water removal means 25 are located as shown in the example of the figure. The further water removal means 25 is advantageously a suction box device.

[0025] In figure 4 is shown an example of a forming unit, which is a gap former type forming unit and begins with a twin-wire part with a substantially vertical run. From a head box 30 stock suspension M is fed to the forming unit formed as a gap former comprising a lower wire 10 and an upper wire 20, each comprising rolls 12, 22 for guiding and driving the wire as an endless loop. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 10. Wrap angle 23V is advantageously 40-110 degrees for ensuring required water removal capacity. The forming roll 23 is typically a suction roll. The forming roll 23 is followed by a sleeve roll 50, which is located inside the loop formed by the lower wire 10. The distance L between the forming roll 23 and the sleeve roll 50 is in lower and upper wires 10, 20 running direction only about 0,2 - 2 meters, advantageously 0,3 - 1,5 meters. The distance L is measured between the point in which lower and upper wires 10, 20 wrap angle 23V ends on the forming roll 23 and between the point in which lower and upper wires 10, 20 are in the contact on the sleeve roll 50 i.e. the point in which the contact of the lower and upper wires 10, 20 begins on the sleeve roll 50. According to the invention, there is no need to use suction boxes between the forming roll 23 and the sleeve roll 50. After the sleeve roll 50 the fiber web is further guided between the upper and the lower wire 20, 10 to a suction roll 13 with a wrap angle 13V, which suction roll 13 is located inside the lower wire 10 and at a distance towards the pick-up roll 31 transferring the fiber web to a press section the runs of the wires 10, 20 are separated and the end part of the forming unit is formed as a one wire part with substantially slightly downwards inclined horizontal run. Inside the loop formed by the lower wire 10 further water removal means 15 are located as shown in the example of the figure. The further water removal means 15 is advantageously a suction box 15, which supports the run of the fiber web during the lengthy run between the sleeve roll 50 and the suction roll 13 and increases the wrap angle on the sleeve roll 50.

[0026] In figure 5 is shown an example of a forming unit, which is a gap former type forming unit and begins with a twin-wire part with a substantially horizontal run. From a head box 30 stock suspension M is fed to the forming unit formed as a gap former comprising a lower wire 10 and an upper wire 20, each comprising rolls 12, 22 for guiding and driving the wire as an endless loop. The stock suspension M is first fed into a gap formed between the lower wire 10 and the upper wire 20. The first water removal means is a forming roll 23 with a wrap angle 23V, which forming roll 23 is located inside the loop formed by the upper wire 10. Wrap angle 23V is advantageously 40-110 degrees for ensuring required water removal capacity. The forming roll 23 is typically a suction roll. The forming roll 23 is followed by a sleeve roll 50, which is located inside the loop formed by the lower wire 10. The distance L between the forming roll 23 and the sleeve roll 50 is in lower and upper wires 10, 20 running direction only about 0,2 - 2 meters, advantageously 0,3 - 1,5 meters. The distance L is measured between the point in which lower and upper wires 10, 20 wrap angle 23V ends on the forming roll 23 and between the point in which lower and upper wires 10, 20 are in the contact on the sleeve roll 50 i.e. the point in which the contact of the lower and upper wires 10, 20 begins on the sleeve roll 50. According to the invention, there is no need to use suction boxes between the forming roll 23 and the sleeve roll 50. After the sleeve roll 50 the fiber web is further guided between the upper and the lower wire 20, 10 to a suction roll 13 with a wrap angle 13V, which suction roll 13 is located inside the lower wire 10 and at a distance towards the pick-up roll 31 transferring the fiber web to a press section the runs of the wires 10, 20 are separated as the run of the upper wire 20 is turned upwards and the end part of the forming unit is formed as a one wire part with substantially slightly downwards inclined horizontal run. Inside the loop formed by the upper wire 20 further water removal means 25 are located as shown in the example of the figure. The further water removal means 25 is advantageously a suction box 25, which supports the run of the fiber web during the lengthy run between the sleeve roll 50 and the suction roll 13. Inside the loop formed by the lower wire 10 further water removal and supporting means 16 can be located as shown in the example of the figure. The further water removal means 16 are selected from a group consisting of forming shoes and suction devices.

[0027] In figure 6 is schematically shown a sleeve roll 50 with decreasing radius, which comprises a stationary support shaft 51 on which support elements 52 are supported at a distance from each other, an impermeable belt loop 53 which is led to circle around the stationary support shaft 51 supported by the support elements 52.

The sleeve roll 50 further comprises at least one curvilinear dewatering zone K via which the wires 10, 20 are led to travel supported by the belt loop 53. The degree of curvature of the curve of the curvilinear dewatering zone K increases in the travel direction of the belt 53 such that increasing dewatering pressure is applied to the stock suspension travelling between the wires 10, 20 on said at least one curvilinear dewatering zone K. Radius of curvature of the curvilinear dewatering zone K consists of two partial curves such that the radius of curvature K1 of a first partial curve is greater than the radius of curvature K2 of a second partial curve following the first partial curve K1 in the travel direction of belt loop 53. Radius of curvature of the curvilinear dewatering zone K can contain several curves such that the radius of curvatures decreases in the running direction of the wires.

[0028] Above only some advantageous examples of the inventions has been described to which examples the invention is not to be narrowly limited and many modifications and alterations are possible within the invention.

Claims

1. Forming unit, which is a gap former formed between a lower wire (10) and an upper wire (20), in which first water removal means of the gap former of the forming unit is a forming roll (23) comprising a wrap angle (23V), **characterized in that** in the forming unit at a distance (L) of less than 2 meters from the forming roll (23) a sleeve roll (50) is located, which distance (L) is measured between the point, in which lower and upper wires (10, 20) wrap angle (23V) ends on the forming roll (23) and the point, in which contact of the lower and upper wires (10, 20) begins on the sleeve roll (50).

2. Modernized forming unit, which is modernized from an existing former comprising a gap former formed between a lower wire (10) and an upper wire (20), in which first water removal means of the gap former of the forming unit is a forming roll (23) comprising a wrap angle (23V), **characterized in that** in the forming unit at a distance (L) of less than 2 meters from the forming roll (23) a sleeve roll (50) is located, which distance (L) is measured between the point, in which lower and upper wires (10,20) wrap angle (23V) ends on the forming roll (23) and the point, in which contact of the lower and upper wires (10, 20) begins on the sleeve roll (50).

3. Forming unit according to claim 1 or 2, **characterized in that** the sleeve roll (50) comprises a stationary support shaft (51), an belt loop (53), which is led to circle around the stationary support shaft (51), that the sleeve roll (50) further comprises at least one curvilinear dewatering zone (K) consisting of two partial curves such that the radius of curvature (K1) of a first partial curve is greater than the radius of curvature (K2) of a second partial curve following the first partial curve (K1) in the travel direction of belt loop (53).

4. Forming unit according to claim 3, **characterized in that** the sleeve roll (50) comprises support elements (52) supported at a distance from each other on the stationary support shaft (51), that the belt loop (53) led to circle around the stationary support shaft (51) is supported by the support elements (52) and that the belt loop (53) is impermeable.

5. Forming unit according to any of claims 1-4, **characterized in that** in the forming unit the distance (L) between the forming roll (23) and the sleeve roll (50) is in lower and upper wires (10,20) running direction 0,2 - 2 meters, advantageously 0,3 - 1,5 meters.

6. Forming unit according to any of claims 1-5, **characterized in that** in the forming unit the run between the forming roll (23) and the sleeve roll (50) is free of suction boxes.

7. Forming unit according to any of claims 1-6, **characterized in that** in the forming unit a suction roll (13) is located following at a distance from the sleeve roll (50) and that at the run between the suction roll (13) and the sleeve roll (50) a suction box (25) is located.

8. Forming unit according to any of claims 1-7, **characterized in that** the forming roll (23) wrap angle (23V) is 40 - 110 degrees.

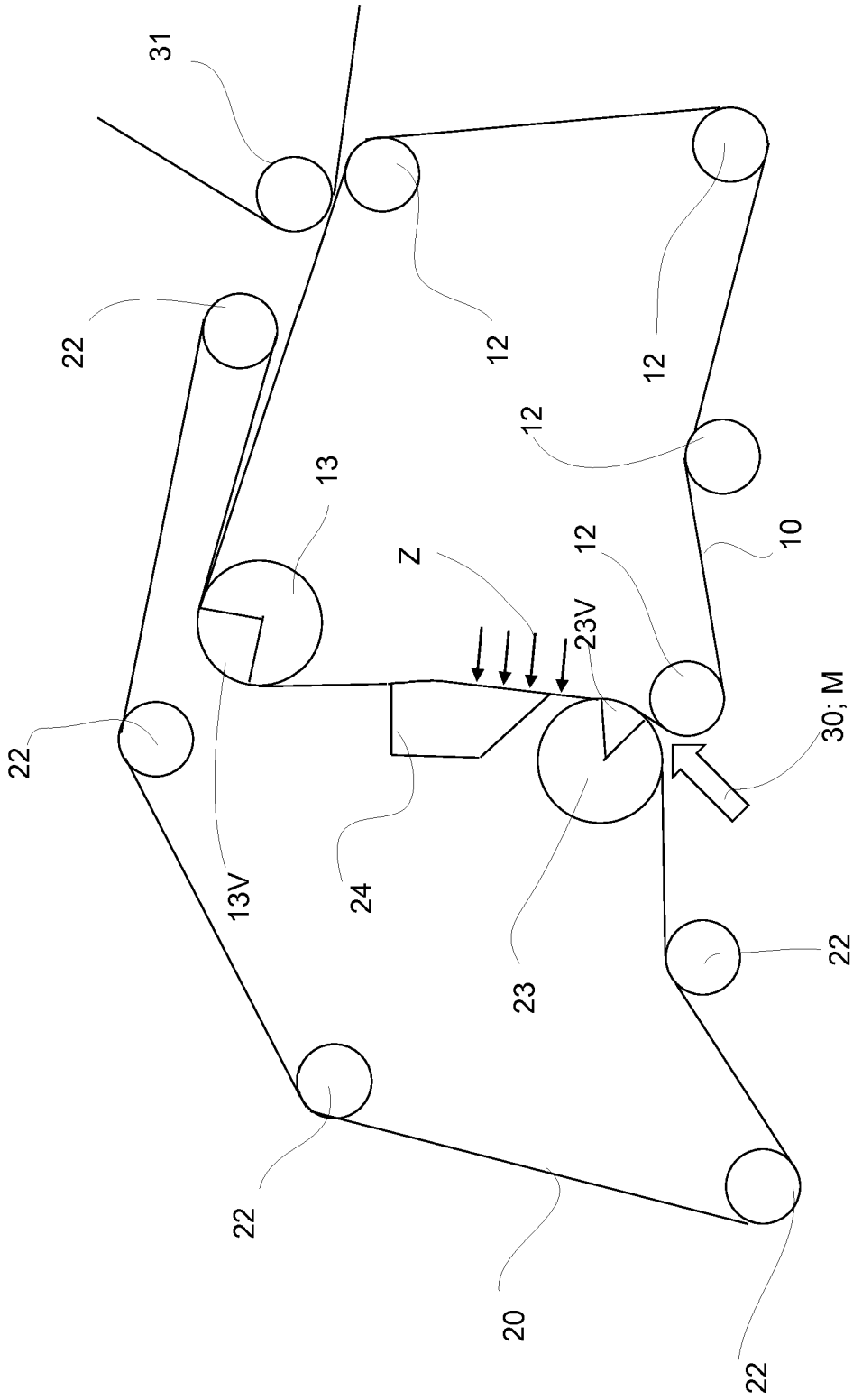
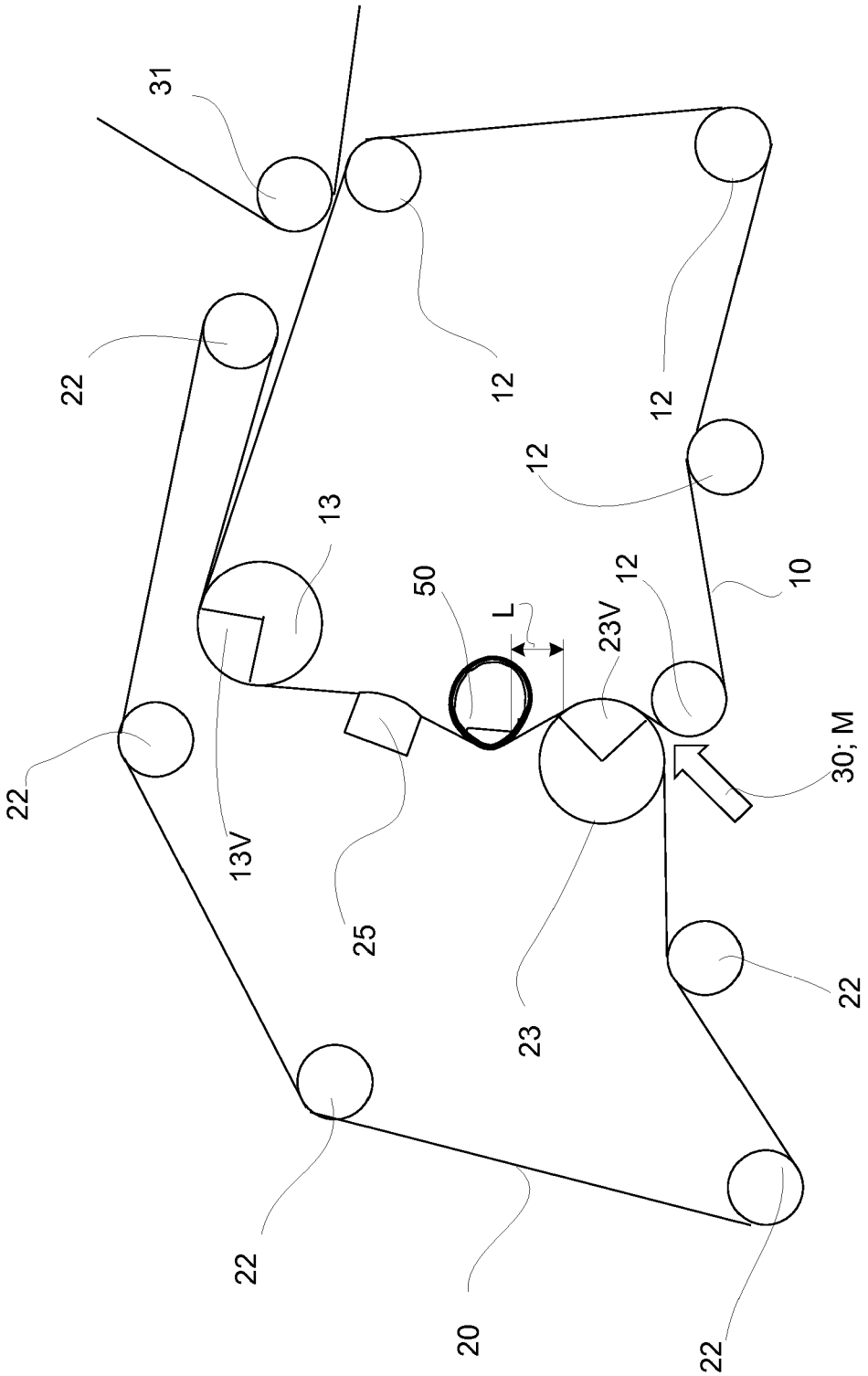


Fig. 1 prior art

Fig. 2



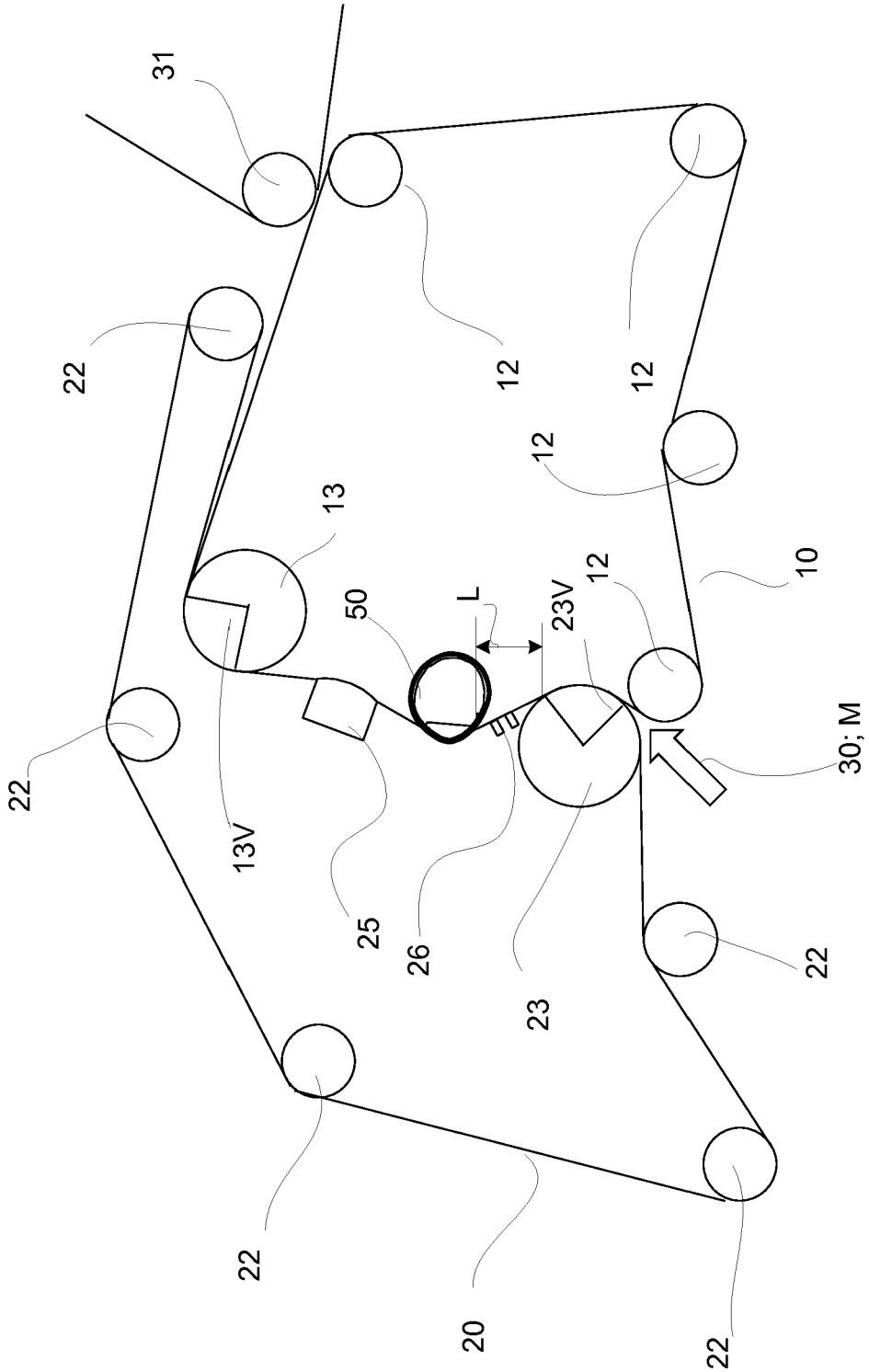


Fig. 3

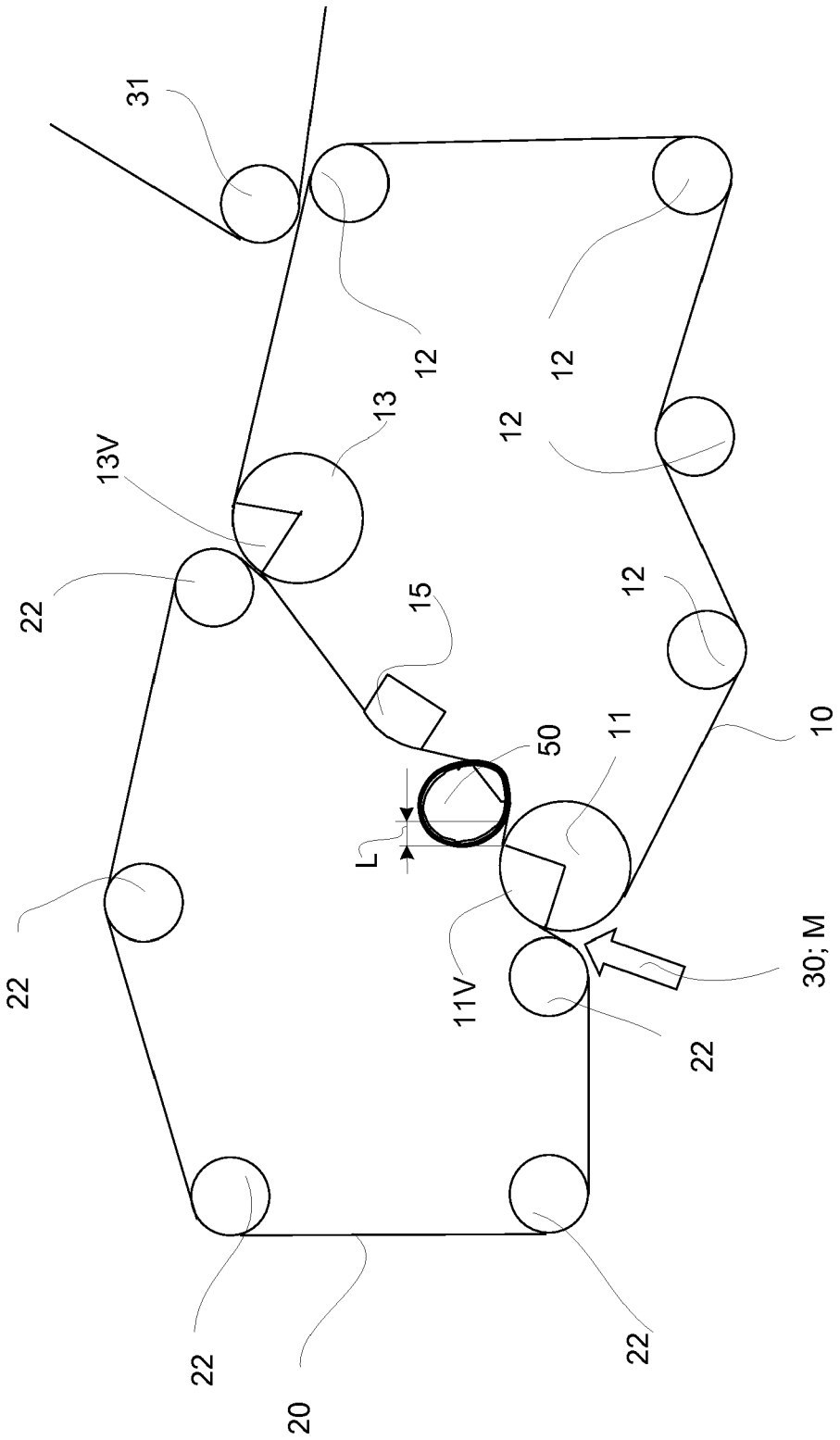


Fig. 4

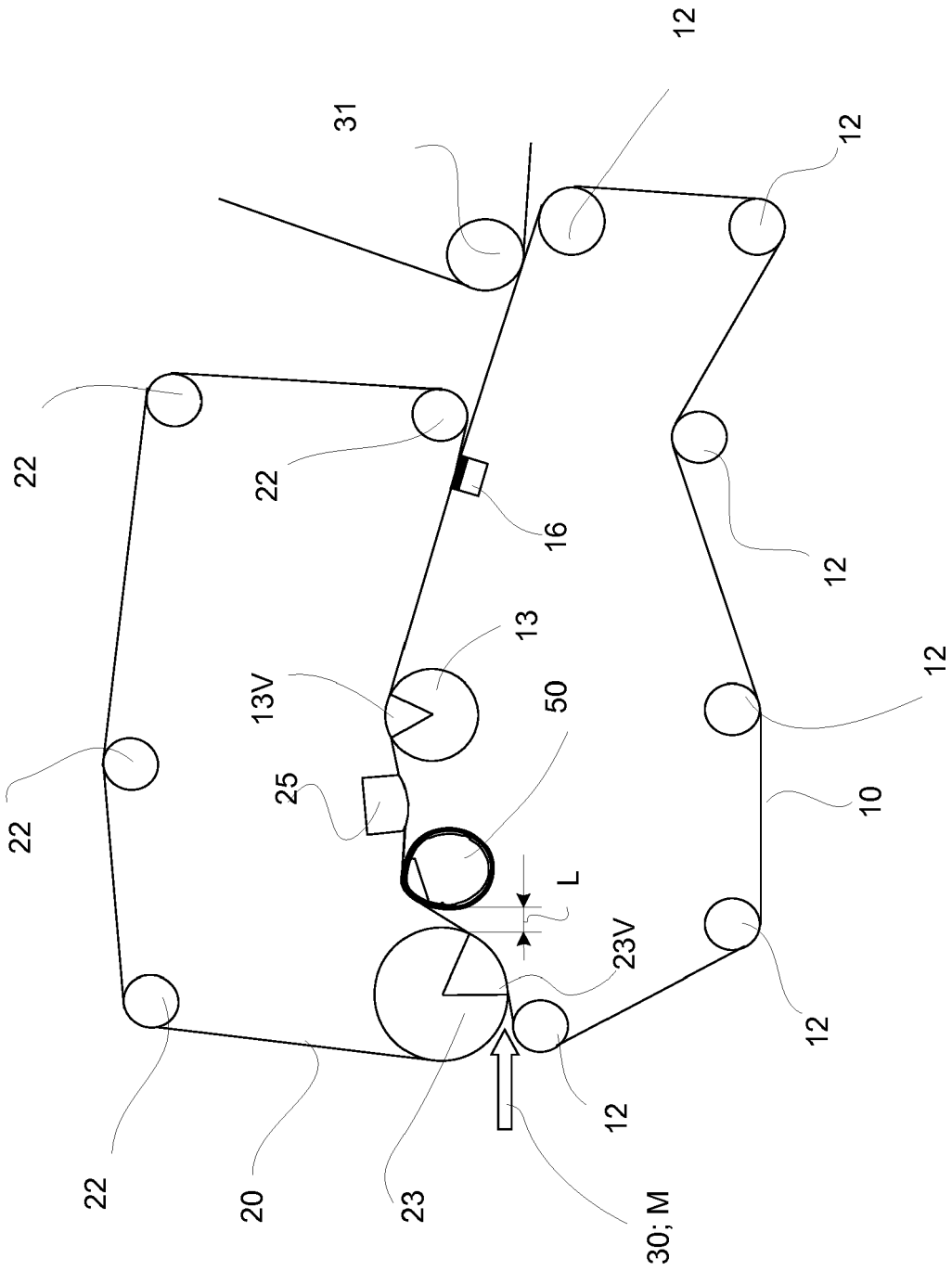


Fig. 5

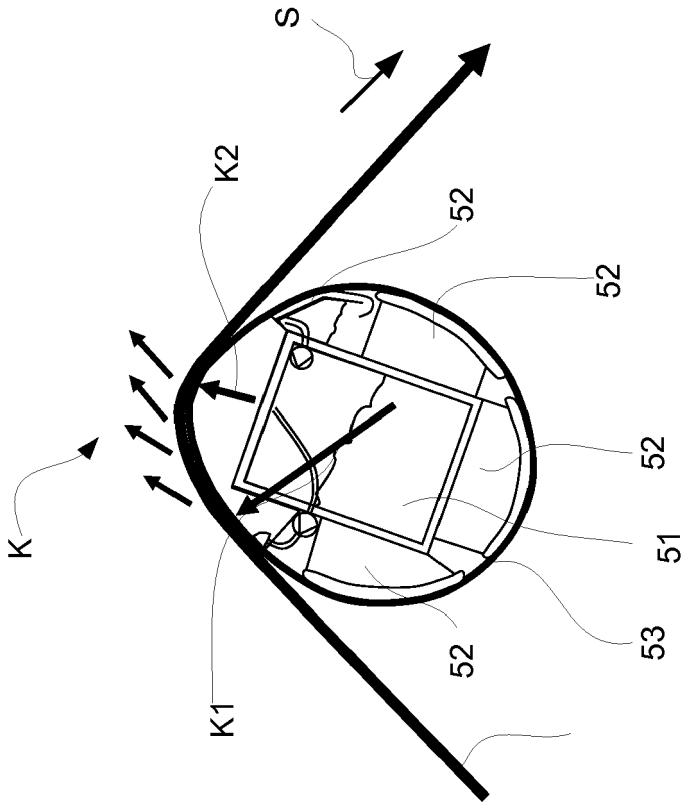


Fig. 6

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 2856

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 4 113 556 A (KANKAANPAA MATTI) 12 September 1978 (1978-09-12) * column 1, lines 60-66 * * column 5, lines 13-57 * * column 7, line 66 - column 8, line 11 * * column 9, lines 22-36 * * figure 1 * -----	1,5-8 3,4	INV. D21F9/00
X Y	EP 0 716 184 A2 (VOITH SULZER PAPIERMASCH GMBH [DE]) 12 June 1996 (1996-06-12) * claim 3 * * figures * -----	1 3,4	
Y,D	WO 2010/046527 A1 (METSO PAPER INC [FI]; POIKOLAINEN ANTTI [FI]) 29 April 2010 (2010-04-29) * page 6, line 12 - page 7, line 6 * * figures * -----	3,4	

TECHNICAL FIELDS SEARCHED (IPC)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 May 2017	Pregetter, Mario

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : 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 16 20 2856

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-05-2017

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