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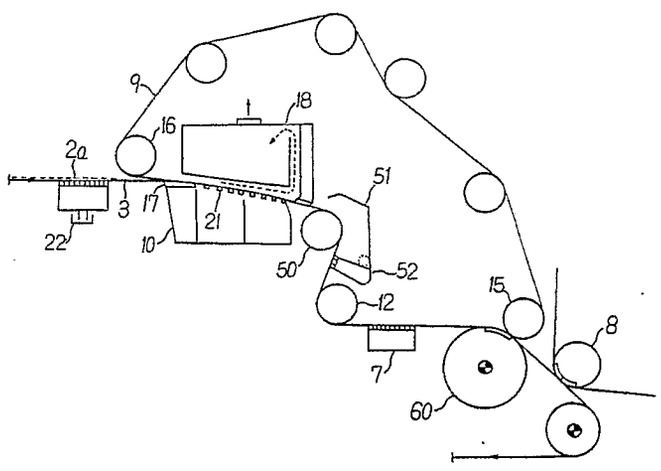
(54) Moist paper forming device for paper machine.

(57) Disclosed is a moist paper forming device for a paper machine, having: upper (9) and lower (3) looped wires for carrying a stock while dewatering it to form moist paper; an introduction roll (16) disposed to constitute a throat part for seizing the moist paper between the upper and lower wires; a shoe box (10) incorporating a plurality of upwardly convex and curvilinearly arranged shoe blades (21); and an autoslice (18) for scraping the dehydration water. The device further comprises: a dewatering roll (50) wound with the upper and lower wires and the moist paper at a curvature prescribed in the same direction as that of a curvature of the shoe blades; a save-all (51) for collecting the dewatered water; a vacuum dewatering unit (52) having slots; a central roll (12) wound with the upper and lower wires and the moist paper at a curvature prescribed in an opposite direction to that of the dewatering roll; and a vacuum dewatering unit (7) for moving the moist paper to the lower wire. Based on this construction, the "crushing" can be prevented with a less amount of contamination on the upper wire but a higher stabilized paper quality.

Fig. 1



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MOIST PAPER FORMING DEVICE FOR PAPER MACHINE

BACKGROUND OF THE INVENTION:

Field of the Invention:

The present invention relates to a moist paper forming device applied to a paper machine.

Description of the Prior Arts:

Referring first to FIG. 4, there is illustrated a typical example of a prior art twin wire device including an upper wire unit.

A stock 2 ejected from a head box 1 is settled down on a lower wire 3 assuming a looped configuration and dewatered downwards by means of an initial dehydrator 4 disposed under the lower wire 3, whereby the stock 2 is changed into a sheet of moist paper 2a. Thereafter, the moist paper 2a is dewatered both upwards and downwards by means of an upper and lower dehydrators 5 and 6 while being sandwiched in between the lower wire 3 and an upper looped wire 9 which constitutes a throat part for holding the stock 2 in combination with introduction rolls 16. Subsequent to this step, the upper wire 9 separates from the moist paper formed on the lower wire 3, while the moist paper is further dewatered downwards by means of a water content adjuster 7 provided downwardly of the lower wire 3. The moist paper is separated from the lower wire by a suction pick-up roll 8 and shifted to a press part subsequent thereto.

Turning to FIG. 5, there is given one example of the prior art upper and lower hydrators 5 and 6 shown in FIG. 4.

The stock 2 depicted in FIG. 4 is dehydrated downwards by low vacuum boxes 22 and lead-in shoes 27 of an initial dehydrating unit 4 and adjusted to exhibit a mat concentration of approximately 1.5%, thereby changing the stock into the moist paper 2a. The moist paper 2a is sandwiched in between the upper and lower wires 9 and 3 at an inlet part of a lower shoe box 10 depicted in FIG. 5 and undergoes pulse dewatering pressures from a plurality of shoe blades 21 and a lead-in shoe 17 of the lower shoe box 10, whereby the moist paper 2a is dewatered to form a paper layer.

The dehydration water accumulated in an upper part of the shoe box 10 is led in an auto-slice 18. The upper wire 9, the stock and the lower wire 3 are wound at a curvature opposite to a curvature of the shoe box 10 with the aid of a central roll 12 located in rear of the auto-slice 18. The stock is subjected to a surface pressure and centrifugal force, thus dewatering the stock downwards. The upward water sucked out of the stock at a separation unit of the central roll 12 and the upper wire 9 is received by a save-all 23. The stock is dewatered between a Fourdrinier part and the upper and lower wires, and a moist paper web formed with a paper layer is carried to the lower wire by use of a sheet transfer box 14 of the upper and lower wire separation unit.

In the prior art upper dewatering devices depicted in FIGS. 4 and 5, as described above, the fibers are re-diffused by the pulse pressures given from the shoe box 10 and dewatered by a constant but higher pressure of the central roll 12 than in the shoe. By virtue of this combination of processes, there is yielded a greater advantage of having a good paper formation than in a so-called a hybrid former shown in FIG. 3 wherein the dehydration is effected mainly by rolls 100a and 10°C provided within a loop shaped by the upper wire 9 and a roll 100b middled between the rolls 100a and 10°C downwardly of the lower wire 3.

If a sheet making velocity increases above 1200 m/sec, however, the downward dehydration at the Fourdrinier part having a certain limited length is limitedly performed, with the result that a quantity of water received in the upper dewatering device increases. On the other hand, an amount of dehydration in the shoe box 10 has also a certain limit, as a consequence of which a flow rate of water entering the subsequent central roll 12 increases. Therefore, the stable transfer of the moist paper entails formation of a water eliminating line (a moist paper concentration is said to be approximately 6 - 7%) on the successive transfer box 14. It is therefore required that as much downward dehydration as possible be effected in the central roll unit 12.

In this case, a so-called "crushing" phenomenon tends to appear because of undergoing a higher dewatering pressure from the central roll 12 in a state where the moist paper concentration, i.e., a moist paper strength is low.

Simultaneously, a rate of the upward dehydration drops down with a rise in the sheet making velocity. Typical paper properties such as a paper formation, a difference between frontside and backside of a paper and a paper thicknesswise strength strongly correlates to the rate of upward dehydration. In order to satisfy those properties, it is required that a proper rate of upward dehydration be held. Hence, as in the prior art moist paper forming device, it is undesirable that the rate of upward dehydration has a dependency on the velocity.

An additional problem is that when the moist

paper concentration is low at the sheet transfer box 14, the sheet transfer becomes unstable, and the upper wire 9 tends to be thereby contaminated.

Increasing a length of the Fourdrinier part is one of methods of obviating the foregoing problems. This in turn, however, tends to deteriorate the paper formation as well as requiring a large space with higher costs in terms of equipments.

A conceivable method is that a vacuum dewatering box 24 is, as illustrated in FIG. 6, provided within a wire loop shaped by the lower wire 3 in front of the central roll 12. This arrangement, however, presents a problem of causing an increment in the rate of downward dehydration.

In contrast, the above-mentioned problems can be eliminated by providing, as depicted in FIG. 7, a vacuum dewatering box 32 formed with a plurality of slots 31 in place of the central roll 12. This arrangement needs the formation of slots the number of which corresponds to a dewatering capability of the central roll, and hence a vacuum dewatering section becomes considerably long. Besides, the water is sucked just in the upper direction, and a vacuum value is required to increase. Under such circumstances, there arises a necessity for driving the vacuum dehydrator 32 as an upper dewatering device. A life-span of the upper wire 9 is diminished. In addition to this, a phenomenon concomitant with the placement for effecting dehydration just in the upper direction is that the slots are jammed with fibers when the mat concentration gradually increases. This problem is serious.

SUMMARY OF THE INVENTION:

It is a primary object of the present invention to provide a moist paper forming device capable of obviating the foregoing problems inherent in the prior art twin wire type moist paper devices.

To this end, according to one aspect of the invention, there is provided a moist paper forming device for a paper machine, comprising: a lower wire, continuously formed in a looped configuration and having its upper part onto which a stock is continuously fed, for carrying the stock while dewatering the stock downwards; an upper wire relatively provided on the way of the lower wire; an introduction roll disposed to constitute a throat part for seizing a sheet of thus formed moist paper between the upper and lower wires; a shoe box incorporating a plurality of upwardly convex and curvilinearly arranged shoe blades, starting from the throat part in a loop shaped by the lower wire, for dewatering the moist paper so that the upper and lower wires and the moist paper travel while being wound thereon; and an auto-slice for scraping the water emerging when the moist paper undergoes upward dehydration by the shoe blades, characterized by further comprising: a dewatering roll disposed on a rear stream side of the shoe box and wound with the upper and lower wires and the moist paper at a curvature prescribed in the same direction as that of a curvature of the shoe blades; a save-all for collecting the water undergoing the upward dehydration by the dewatering roll; a vacuum dewatering unit formed with slots and disposed on a rear stream side of the save-all within a loop shaped by the upper wire; a central roll wound with the upper and lower wires and the moist paper at a curvature prescribed in an opposite direction to that of the dewatering roll; and a vacuum dewatering unit for moving the moist paper to the lower wire.

Based on this construction, the upper and lower wires and the moist paper which have been deflected by the central roll move in a substantially horizontal direction or in an upper direction. The vacuum dewatering unit for moving the moist paper to the lower wire involves the use of a suction couch roll.

A maximum value (P) of a dewatering pressure acting on mats at the central roll is a function of a roll diameter (D) and a wire tension (T) and expressed such as: $P = \frac{2T}{D}$. Besides, the pressure generated becomes greater according as a filtration resistance is larger with respect to the roll diameter and the wire tension.

Turning attention to a process of forming a paper layer, a general idea is that a filtration phenomenon is dominant, wherein the mats are formed sequentially from a part more vicinal to the forming wire and have higher density on undergoing compressive forces. More specifically, the mats formed earlier have greater filtration resistances. According to the present invention, the underside mats of the moist paper formed as a result of effecting the downward dehydration by the lower wire are denser than those disposed thereabove and exhibit larger filtration resistances.

In accordance with the present invention, the upward dehydration is carried out, i.e., toward the upper mats having smaller filtration resistances by use of the shoe box disposed within the lower loop and incorporating a plurality of upwardly convex and curvilinearly arranged shoe blades in cooperation with the dewatering roll wound with upper and lower wires and the moist paper at a curvature prescribed in the same direction as that of a curvature of the shoe blades. With this arrangement, a good deal of dehydration quantity can be obtained with less dewatering pressures. Therefore, the mat concentration well increases at that time. In consequence, the mat concentration when entering the central roll remains sufficiently high even when the sheet making velocity increases, thereby making it possible to prevent the "crushing" phenomenon

from being developed at the central roll.

Since the mat concentration increases due to the upward dehydration by use of the shoe box and the dehydration roll, the contamination on the upper wire is reduced, and a frequency at which the paper is cut off decreases.

Even when the sheet making velocity rises, the paper quality is stabilized without reducing a proportion of the upward dehydration by the shoe box in combination with the dehydration roll.

BRIEF DESCRIPTION OF THE DRAWINGS:

Other object and advantages of the present invention will become apparent during the following discussion taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram illustrating a placement of a first embodiment of the present invention;

FIG. 2 is a diagram showing a placement of a second embodiment of the invention;

FIG. 3 is a diagram depicting a placement of a prior art twin wire type moist paper forming device mainly based on roll dehydration;

FIG. 4 is a diagram of assistance in explaining a prior art twin wire system; and

FIGS. 5 through 7 are diagrams showing examples of placement of conventional moist paper forming devices in the twin wire system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

A first embodiment of the present invention will hereinafter be described with reference to FIG. 1.

Referring to FIG. 1, the same components as those of prior art moist paper forming devices depicted in FIGS. 4 and 5 are marked with the like symbols, and the description is therefore omitted herein.

In accordance with the first embodiment, in a loop shaped by a lower wire 3 of a throat part of an upper wire 9 shaped with the aid of an introduction roll 16, there is provided a lower shoe box 10 incorporating a plurality of shoe blades 21 and a lead-in shoe 17. The plurality of shoe blades 21 are upwardly convex and curvilinearly arranged. An auto-slice 18 is so provided in a loop shaped by the upper wire 9 as to face the lower shoe box 10. Disposed within the loop shaped by the lower wire 3 on a downstream side of the shoe box 10 is a dewatering roll 50 would with the upper and lower wires 9 and 3 and a sheet of moist paper 2a at a curvature prescribed in the same direction as that of a curvature of the shoe blades 21. In the loop shaped by the upper wire 9, a save-all 51 and a vacuum dehydrator 52 are located vis-a-vis with the dewatering roll 50. Disposed on the downstream side of the dewatering roll 50 is a central roll 12 wound with the upper and lower wires 9 and 3 and the moist paper 2a at a curvature prescribed in an opposite direction to that of the dewatering roll 50. The upper and lower wires 9 and 3 and the moist paper 2a which are deflected by the central roll 12 move in a substantially horizontal direction. A water content adjuster 7 and a suction couch roll 60 are provided in the loop shaped by the lower wire 3 in the section of that horizontal movement. Note that the numeral 8 represents a suction pick-up roll, and 15 designates a roll for separating the upper roll 9.

In accordance with this embodiment, the moist paper 2a dewatered downwards by the lower wire 3 is sandwiched in between the upper and lower wires 9 and 3 on the lead-in shoe 17 and dewatered upwards with wire tensions. The moist paper 2a is further dewatered mainly upwards by the upwardly convex and curvilinearly arranged shoe blades 21 of the shoe box 10. The dewatered water is collected by the auto-slice 18 and discharged outside the system. Next, the moist paper 2a is dewatered upwards by means of the dewatering roll 50 wound with the upper and lower wires 9 and 3, and the moist paper 2a at a curvature prescribed in the same direction as that of the curvature of the shoe blades 21. The scattered water enters the save-all 51 and is led to the outside of the system.

Subsequent to this process, the hydration is effected by a vacuum dehydrator 52, and a vacuum value thereof is controlled to obtain an optimum upward dewatering ratio while observing the paper quality. In order to prevent clogging in the slots of the vacuum dehydrator 52, as illustrated in the Figure, an embracing angle of the dewatering roll 50 is set large, and a spacing from the central roll 12 is secured, and a discharge port of the vacuum dehydrator 52 is located lower than the slots. With this arrangement, the clogging can be prevented. Note that an amount of dehydration by the vacuum dehydrator 50 is small, and a vacuum width equivalent to approximately 3 slots at the maximum suffices.

The upper and lower webs and the moist paper 2a are wound on the central roll 12 at a curvature prescribed in an opposite direction to that of the dewatering roll 50, while the moist paper 2a is subjected to the downward dewatering action of the central roll 12. As explained earlier, the mat concentration of the moist paper wound on the central roll is to increase because of having performed the upward dehydration of the moist paper 2a up to the central roll 12, thereby steering clear of the "crushing" phenomenon at the central roll 12. The moist paper web 2a is deflected upwardly in a

horizontal direction where the downward dehydration is carried out by the central roll 12 and further dewatered by the water content adjuster 7. The moist paper web 2a is transferred to the lower wire on the suction couch roll 60 and further to the next press part after being separated from the lower wire by the suction pick-up roll 8.

As discussed above, in accordance with this embodiment, the moist paper 2a is dewatered upwards by the dewatering roll 50 as well as by the shoe box 10 and then dewatered downwards by the central roll 12. Since the mat concentration of the moist paper 2a has already increased, the occurrence of the "crushing" phenomenon at the central roll 12 can be prevented.

Even when increasing the sheet making velocity, the sufficient upward dehydration is performed by the shoe box 10 and the dewatering roll 50 as well, whereby the paper quality can be stabilized.

Besides, the transfer of the moist paper 2a to the lower wire 3 is made at the final stage of dehydration by the moist paper forming device, and hence the moist paper has a high concentration. Almost no adhesion of fibers to the upper wire 9 can be seen, resulting in a remarkably small amount of contamination on the upper wire 9. In addition, a frequency at which the paper is cut off can be reduced.

A descriptive emphasis will next be placed on a second embodiment of the present invention with reference to FIG. 2. The components employed and the dewatering functions in the second embodiment are much the same as those in the first embodiment. A characteristic arrangement is that the deflection at the central roll 12 is set large; and the upper wire 9, the lower wire 3 and the moist paper 2a are moved upwardly by a sheet transfer box 14 disposed on the downstream side of the central roll 12 for returning the level to a height of the existing wire. There is thus provided a structure by which the existing Fourdrinier part can readily be reformed into the device relative to the second embodiment of the invention. Note that the components illustrated in FIG. 2 are marked with the symbols corresponding to those of FIG. 1.

The present invention exhibits the following effects.

(1) The upward dewatering capability can be improved, and the sheet making velocity can be increased without elongating the Fourdrinier part;

(2) It is possible to stabilize the paper quality with no reduction in the upward dewatering rate even in the case of higher sheet making velocities; and

(3) The upper moist paper layer which has undergone the sufficient dewatering process is transferred to the lower wire, thereby minimizing the contamination on the upper wire and reducing the frequency at which the paper is cut off.

Although the illustrative embodiments of the present invention have been described in detail with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those precise embodiment. Various changes or modifications can be effected therein without departing from the scope or spirit of the invention.

Claims

1. A moist paper forming device for a paper machine, comprising:
a lower wire, continuously formed in a looped configuration and having its upper part onto which a stock is continuously fed, for carrying said stock while dewatering said stock downwards;
an upper wire relatively provided on the way of said lower wire;
an introduction roll disposed to constitute a throat part for seizing a sheet of thus formed moist paper between said upper and lower wires;
a shoe box incorporating a plurality of upwardly convex and curvilinearly arranged shoe blades, starting from said. throat part in a loop shaped by said lower wire, for dewatering said moist paper so that said upper and lower wires and said moist paper travel while being wound thereon; and
an auto-slice for scraping the water emerging when said moist paper undergoes upward dehydration by said shoe blades, characterized by further comprising: a dewatering roll disposed on a rear stream side of said shoe box and wound with said upper and lower wires and said moist paper at a curvature prescribed in the same direction as that of a curvature of said shoe blades;
a save-all for collecting the water undergoing the upward dehydration by said dewatering roll; a vacuum dewatering unit formed with slots and disposed on a rear stream side of said save-all within a loop shaped by said upper wire; a central roll wound with said upper and lower wires and said moist paper at a curvature prescribed in an opposite direction to that of said dewatering roll; and
a vacuum dewatering unit for moving said moist paper to said lower wire.

2. The moist paper forming device as set forth in Claim 1, wherein said upper and lower wires and said moist paper which have been deflected by said central roll move in a substantially horizontal direction.

3. The moist paper forming device as set forth in Claim 1, wherein said upper and lower wires and said moist paper which have been deflected by

said central roll move in an upper direction.

4. The moist paper forming device as set forth in Claim 1, wherein said vacuum dewatering unit for moving said moist paper to said lower wire involves the use of a suction couch roll.

Fig. 1

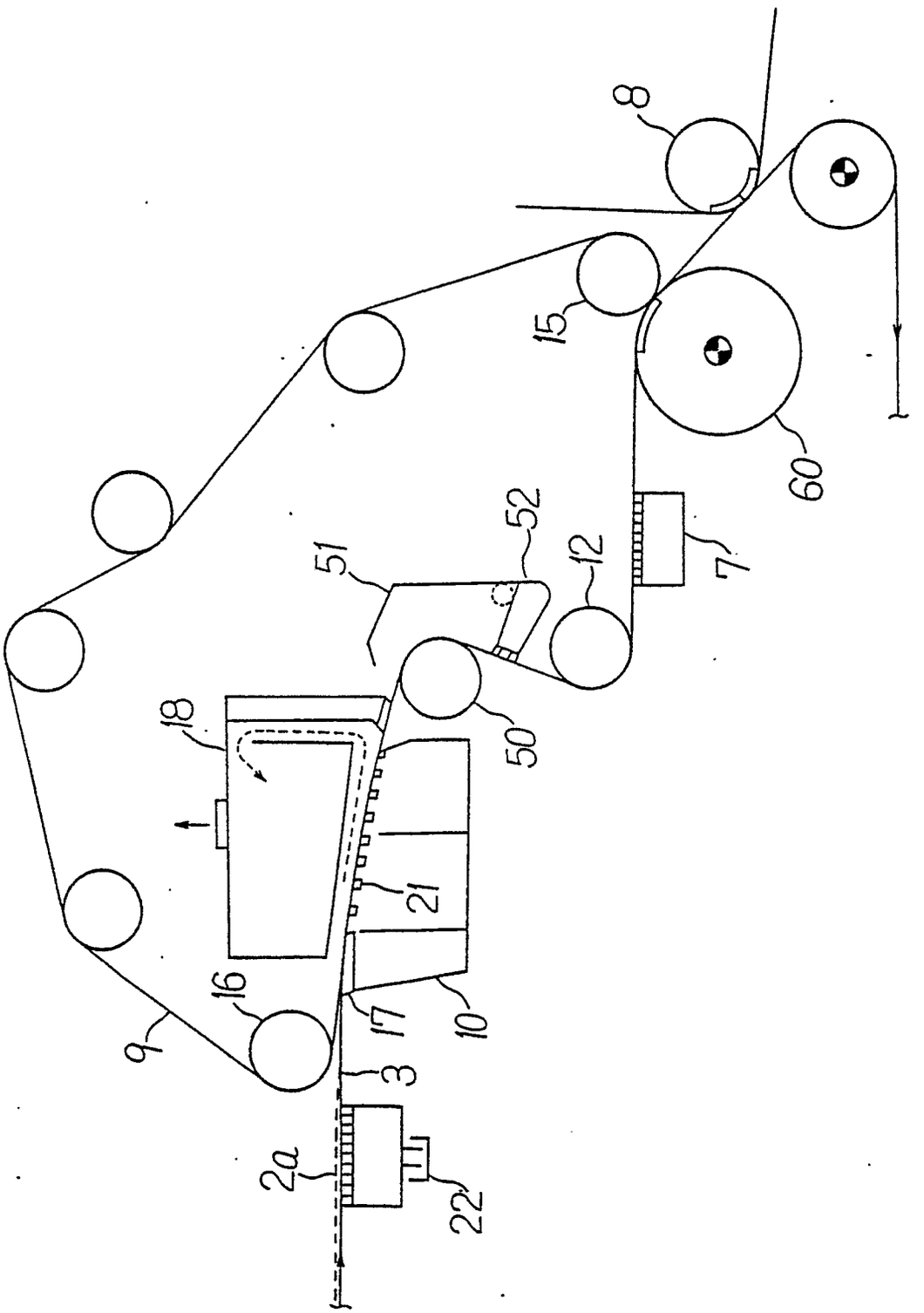


Fig. 2

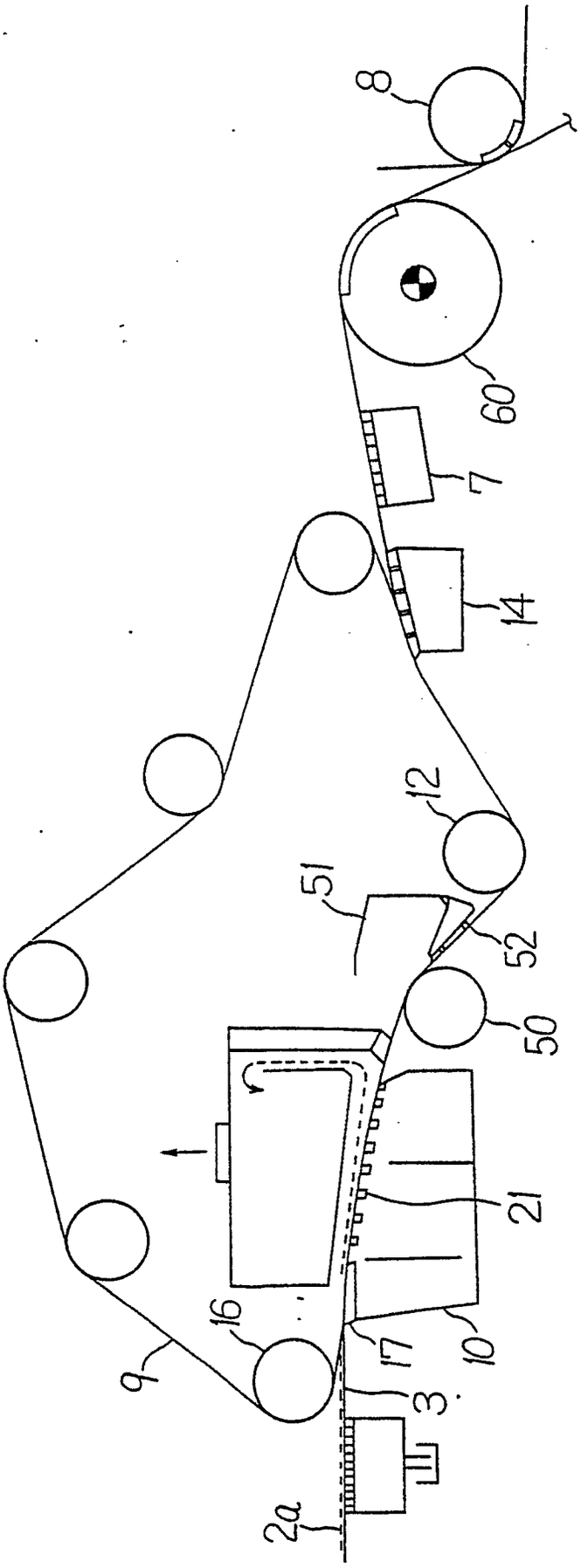


Fig. 3

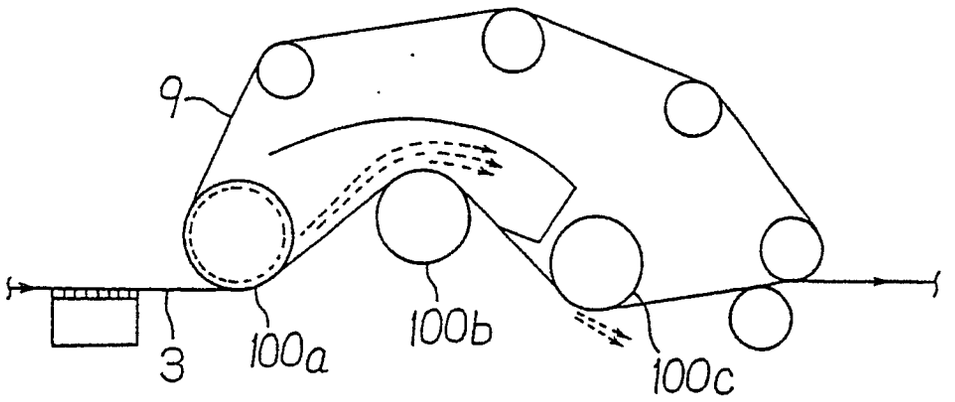


Fig. 4

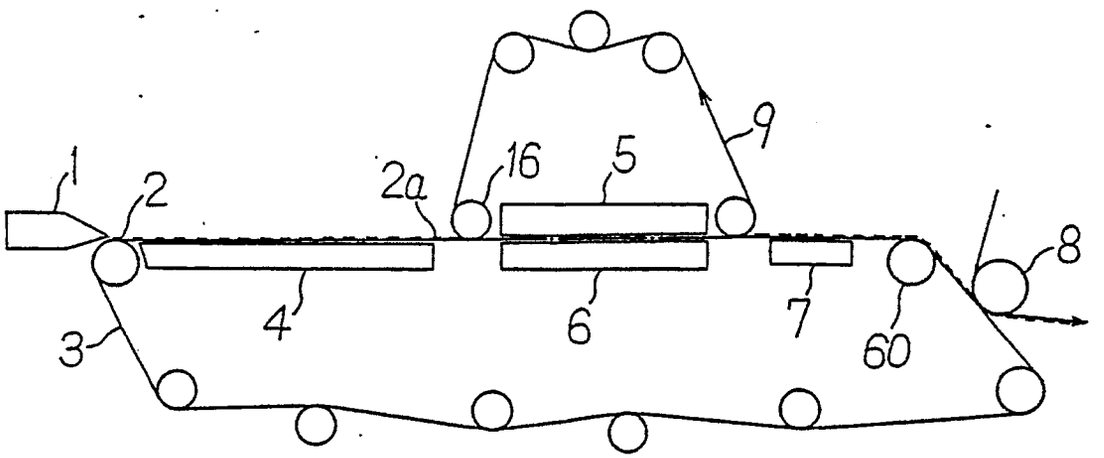


Fig. 5

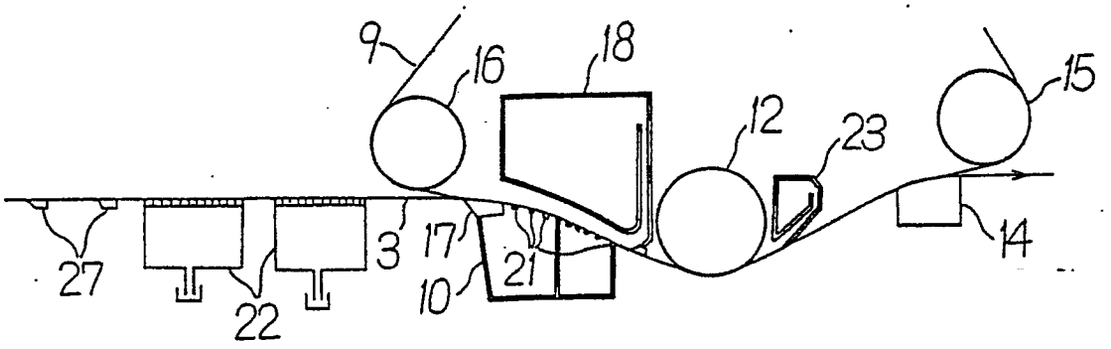


Fig. 6

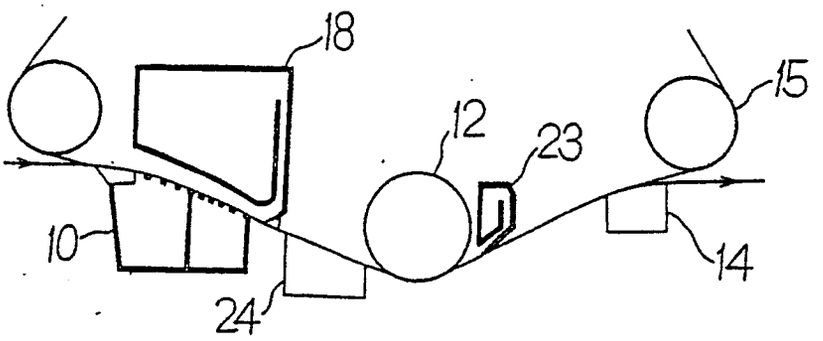
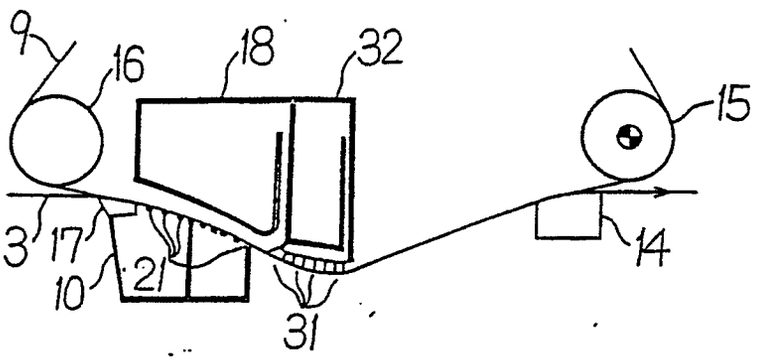


Fig. 7



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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 0145

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	AT-B-382655 (ESCHER WYSS) * the whole document *	1, 3, 4	D21F1/48 D21F9/00
Y	DE-A-3447509 (MITSUBISHI JUKOGYO) * the whole document *	1, 3, 4	
A	DE-A-3138133 (ESCHER WYSS)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 OCTOBER 1990	DE RIJCK F.

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