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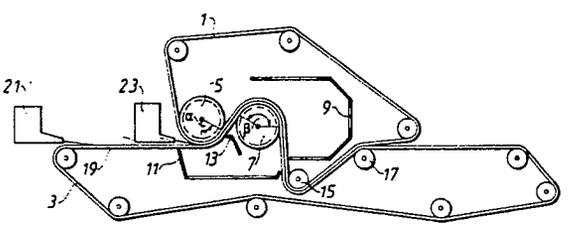
(54) Former for forming a paper web.

(57) It has been found that a hybrid former having two open-surfaced forming rolls (5 and 7) in series after each other can give a paper web of excellent formation. To increase the drainage capacity without waiving the requirements for good formation, the sum of the wrapping angles (alpha and beta) of the fabrics (1 and 3) on the forming rolls (5 and 7) is larger than 165°, the distance between the forming rolls (5 and 7) being smaller than about 0.1 D, where D is the diameter of the second forming roll (7) in the machine direction, and the free fabric length between the rolls (5 and 7) being between 0.1 m and 0.6 m. The forming rolls (5 and 7) may be located at substantially equal levels or substantially on top of each other. In the first case the first wrapping angle (alpha) preferably is larger than about 60°, suitably 60° - 70°, and the second one (beta) preferably is larger than about 135°, suitably 140° - 170°. In addition, in both cases the distance between the forming rolls (5 and 7) preferably is smaller than 0.1 m, suitably on the order of 0.06 m, and the free fabric length between the forming rolls (5 and 7) preferably is 0.3 - 0.4 m. The former is especially suited for the production of thick multilayer paper.

Fig. 1



EP 0 304 098 A1

FORMER FOR FORMING A PAPER WEB

The present invention relates to a former for forming a paper web by draining stock between two endless forming fabric loops, a first forming roll being located within one loop and a second forming roll within the other loop, and said fabrics meeting on the first forming roll, following the periphery thereof over a first wrapping angle and under deflection in a first direction, whereafter the fabrics sandwiching the partially formed paper web between them cross unsupported to the second forming roll and follow the periphery thereof over a second wrapping angle and under deflection in a second direction contrary to the first one, so that the forming of the paper web will be completed on the second forming roll, and said two forming rolls having an open surface, so that the drainage on each of them will be two-sided.

Such a former is disclosed in European patent application EP-A2-0 072 188 and has proved to be excellent for the production of newsprint. For the production of paper grades that are thicker and more difficult to drain, the draining capacity has been insufficient, and it has been found that the good formation of the web has suffered on trying to increase the drainage capacity.

The object of the present invention is to provide a former, which has an improved drainage capacity without waiving the demand for a good web formation, and which is especially suited for the manufacture of thick multilayer papers where the formation in each separate layer is important.

According to the present invention this object is achieved in that said wrapping angles together are larger than 165°, the distance between the forming rolls being smaller than about 0.1 D, where D is the diameter of the second forming roll and the free fabric length between the forming rolls being between 0.1 m and 0.6 m.

Thanks to the greatly increased wrapping by the fabrics of the two open-surfaced forming rolls together with a greatly reduced distance between the forming rolls, the former according to the invention will have an improved drainage capacity combined with a preserved good formation.

In a first preferred embodiment of the former according to the invention the two forming rolls are located substantially at equal levels, and the loop inside which the first forming roll is located is an upper fabric loop, and in addition, the first wrapping angle is larger than about 60° and the second one is larger than about 135°. Suitably the first wrapping angle is between 60° and 70° and the second one between 140° and 170°. The upper limits are approximate figures determined by the problems of handling the white water from the two forming rolls. An old fourdrinier former may well be rebuilt to this preferred embodiment of the former according to the invention.

In an alternative preferred embodiment the two forming rolls are located substantially on top of each other, and the fabric loop inside which the first forming roll is located is a lower forming roll. In addition, the first wrapping angle is larger than about 150° while the second one is larger than about 75°. This former will have a larger height than the one according to the first preferred embodiment, but since the white water handling at the forming rolls is facilitated by gravitation, this former will have a lower minimum speed, which may be an advantage if the capacity in the drying section of the paper machine is low.

Preferably the distance between the forming rolls is smaller than 0.1 m. Suitably the distance is on the order of 0.06 m. The free fabric length between the forming rolls is suitably 0.3 - 0.4 m.

To facilitate the handling of the white water, especially at low speeds, it is suitable that the fabrics with the completely formed paper web sandwiched between them together run off from the second forming roll in a downwards direction substantially vertical.

When manufacturing paper grades that are thicker and more difficult to drain it is suitable that one fabric loop is a lower fabric loop having a predrainage section located upstream of the first forming roll. Such an embodiment of the former according to the invention is excellently suited for the forming of a multilayer paper web. Then a primary headbox is mounted to discharge a homogeneous stock jet to the start of the predrainage section where a first layer of the paper web is formed, and a secondary headbox is mounted to discharge a stock jet onto the first layer of the web adjacent the area where the fabrics start wrapping the first forming roll. Advantageously, the secondary headbox is a multilayer headbox, preferably a two-layer headbox.

If the extra drainage capacity provided by the predrainage section is not required for the forming of the multilayer paper web it is possible - in an alternative embodiment of the former according to the invention - that the fabrics form between them a forming gap curving along a portion of the periphery of the first forming roll, a multilayer headbox, preferably a three-layer headbox, being mounted to discharge a multilayered jet of at least two different stocks into said gap.

In the following the invention will be described in more detail with reference to the appended drawing.

FIGS. 1, 2 and 3 are schematic side views of a first, a second, and a third, respectively, preferred embodiment of a former according to the invention.

The former shown in FIG. 1 comprises two endless forming fabric loops 1 and 3. A first forming roll 5 is located in one loop, in this case the upper loop 1, and a second forming roll 7 in the other loop. Both of the forming rolls 5 and 7 have an open envelope surface, e.g. grooved or blind drilled. In a conventional manner each fabric loop is kept stretched in its intended operational position by means of a plurality of guide rolls, a stretch roll and an alignment roll. The fabrics 1 and 3 meet on the first forming roll 5, follow the periphery thereof over a first wrapping angle alpha under deflection in a first direction, whereafter the fabrics 1 and 3, which between them confine the partially formed paper web, cross unsupported to the second forming roll 7 and follow the periphery thereof over a second wrapping angle beta under deflection in a second direction contrary to the first one, so that the forming of the paper web is completed on the second forming roll 7. Since both of the forming rolls 5 and 7, which preferably are at least substantially of the same size, are open surfaced, the drainage on each of them will be two-sided.

According to the invention, said wrapping angles alpha and beta are together larger than 165°, the distance between the forming rolls 5 and 7 is smaller than about 0.1 D, where D is the diameter of the second forming roll 7, and the free fabric length between the forming rolls 5 and 7 is between 0.1 m and 0.6 m.

In the embodiment shown in FIG. 1 the two forming rolls 5 and 7 are located at substantially equal levels, and fabric loop 1, within which the first forming roll 5 is located, is an upper fabric loop. The first wrapping angle alpha is larger than 60° and preferably is between 60° and 70°, while the second wrapping angle beta is larger than about 175° and preferably is between 140° and 170°. The distance between the forming rolls 5 and 7 is smaller than 0.1 m and preferably is on the order of 0.06 m. The free fabric length between the forming rolls 5 and 7 suitably is between 0.3 and 0.4 m

From the second forming roll 7 fabrics 1 and 3 together with the sandwiched completely formed paper web run off downwards substantially vertical in order to facilitate the handling of the white water. A first save-all 9 is provided within fabric loop 1 for collecting and drawing off white water thrown out from the shell of the first forming roll 5 and from the inner side of fabric loop 1 where it curves along the periphery of the second forming roll 7. In a corresponding manner, a second save-all 11 is provided within fabric loop 3 for collecting and drawing off white water thrown out from the inner side of fabric loop 3, where it curves along the periphery of the first forming roll 5, and from the shell of the second forming roll 7. The second save-all 11 comprises means 13 in the shape of at least one guide vane or guide plate having an arcuate cross section and mounted between the forming rolls for catching the white water thrown out from the first forming roll 5 within fabric loop 3 and preventing the white water thrown out from hitting the second forming roll 7. Such guide vanes or guide plates preferably are designed in the manner disclosed in Swedish patent specification SE-C-387,143 (= US-A-4,028,174).

The sandwich of wires 1 and 3 with the intermediate completely formed paper web, which runs off downwards substantially vertical from the second forming roll 7, is deflected more than 90° over a guide roll 15 and is conducted to a separating roll 17. On the separating roll, which has a plain envelope surface, the outer fabric 1 in relation to the separating roll 17 is separated from the paper web and the inner wire 3 in a manner generally known per se, the inner wire 3 conveying the web to a pick-up location, where a conventional pick-up mechanism, not shown, in a conventional manner picks up the paper web from the fabric for the pressing of the web in a press section, not shown.

In the embodiment shown in FIG. 1 fabric loop 3 is a lower fabric loop having a predrainage section 19 of fourdrinier type. Along this predrainage section fabric 3 is supported by not shown but in fourdrinier sections commonly used fabric supporting draining members, for example suction boxes and/or foils.

A primary headbox 21 is mounted to discharge a homogenous stock jet to the start of the predrainage section 19 for the forming of a first layer of the paper web on the top surface of forming fabric 3 by one-sided drainage downwards. Adjacent the area where fabrics 1 and 3 start curving along the periphery of the first forming roll 5 a stock jet from a secondary headbox 23 is discharged onto the newly formed layer of the paper web. Advantageously, the secondary headbox can be a two-layer headbox, which makes the former according to the invention adapted to the production of three-layer paper webs. The one-sided drainage downwards on the predrainage section 19 is followed by a first two-sided drainage while curving upwards on the first forming roll 5 and a second two-sided drainage while curving downwards on the second forming roll 7, where the forming of the web is completed.

As the basic principle for the embodiments shown in FIGS. 2 and 3 agree with the basic principle for the one shown in FIG. 1, in the description below corresponding elements have been given corresponding reference numerals from the

200-series for FIG. 2 and from the 300-series for FIG. 3. For example, the first forming roll 5 in FIG. 1 corresponds to forming roll 205 in FIG. 2 and forming roll 305 in FIG. 3. In view of the substantial similarities between the different embodiments, only the most apparent differences together with some similarities will be described below.

In the embodiment shown in FIG. 2 the lower forming fabric loop 203 does not have a predrainage section similar to section 19 in FIG. 1. Instead, the former according to FIG. 2 is almost a twin-wire former of roll type, while the former according to FIG. 1 as a rule would be called a hybrid former. Fabrics 201 and 203 define between them a forming gap 225 curving along a portion of the periphery of the first forming roll 205. A multilayer headbox 222, preferably a three-layer headbox, is mounted to discharge a multilayer jet of at least two different stocks into the forming gap 225. Advantageously, the multilayer headbox 222 is the headbox shown and disclosed in Swedish patent specification SE-C-440,924 (= CA-A-1,139,142). As the former according to FIG. 2 in other respects is identical to the one shown in FIG. 1 and described more in detail above, reference numerals corresponding to FIG. 1, but selected from the 200-series are inserted in FIG. 2 even though they are not expressly mentioned in the present paragraph of the description.

In the embodiment shown in FIG. 3 the two forming rolls 305 and 307 are located substantially on top of each other and the fabric loop 301, within which the first forming roll 305 is located, is a lower fabric loop. Thereby predrainage section 319 is incorporated in fabric loop 301. As in the embodiment according to FIG. 1, in the predrainage section there will be a drainage of a homogeneous stock jet discharged from a primary headbox 321 for forming the first layer of the paper web on fabric loop 301. The secondary headbox 323 discharges a preferably two-layered stock jet onto the first layer adjacent the area where the fabrics 301 and 303 start curving along the periphery of the first forming roll 305. The drainage now changes from being one-sided downwards to being two-sided where the fabrics first curve around nearly half the circumference of the first forming roll 305 and then curve in an opposite direction around nearly a quarter of the periphery of the second forming roll 307. Unlike what is the case in FIG. 1 the first wrapping angle alpha is considerably greater than the second one beta and is more than about 150°, while angle beta is more than about 75°.

Like in the embodiment according to FIG. 1 there is a first save-all 309 located within fabric loop 301 and a second save-all 311 located within fabric loop 303. The second save-all 311 comprises means in the shape of at least one guide vane or guide plate having a curved cross section and placed between forming rolls 305 and 307 for catching within fabric loop 303 the white water thrown out from the first forming roll 305 and preventing the thrown out white water from hitting the second forming roll 307. This means corresponds to means 13 in FIG. 1 but is not shown in FIG. 3.

The invention is not restricted to the embodiments shown on the drawing and described above but can be varied within the scope of the appended claims. For example it is, of course, possible for skilled art worker to modify, without any inventive work, the hybrid former shown in FIG. 3 to become a twin-wire former of roll type by applying a change corresponding to the one applied to modify the hybrid former shown in FIG. 1 to become the twin-wire former of roll type shown in FIG. 2.

Claims

1. Former for forming a paper web by draining stock between two endless forming fabric loops (1 and 3; 201 and 203; 301 and 303), a first forming roll (5; 205; 305) being located within one loop (1; 201; 301) and a second forming roll (7; 207; 307) within the other loop (3; 203; 303), the fabrics (1 and 3; 201 and 203; 301 and 303) meeting on the first forming roll (5; 205; 305), following the periphery thereof over a first wrapping angle (alpha) and under deflection in a first direction, whereafter the fabrics (1 and 3; 201 and 203; 301 and 303) sandwiching a partially formed paper web between them cross unsupported to the second forming roll (7; 207; 307) and follow the periphery thereof over a second wrapping angle (beta) and under deflection in a second direction contrary to the first one, so that the forming of the paper web will be completed on the second forming roll (7; 207; 307), and both of the forming rolls (5 and 7; 205 and 207; 305 and 307) having an open surface, so that the drainage on each of them will be two-sided, **characterised** in that said wrapping angles (alpha and beta) together are larger than 165°, a distance between the forming rolls being smaller than about 0.1 D, where D is the diameter of the second forming roll (7; 207; 307), and the free fabric length between the forming rolls (5 and 7; 205 and 207; 305 and 307) being between 0.1 m and 0.6 m.

2. Former according to claim 1, **characterised** in that the two forming rolls (5 and 7; 205 and 207) are located at substantially equal levels, the fabric loop (1; 201), within which the first forming roll (5; 295) is located, being an upper fabric loop, and the

first wrapping angle (alpha) being larger than about 60° and the second one (beta) larger than about 135°.

3. Former according to claim 2, **characterised** in that the first wrapping angle (alpha) is between 60° and 70° and the second one (beta) between 140° and 170°.

4. Former according to claim 1, **characterised** in that the two forming rolls (305 and 307) are located substantially on top of each other, so that the fabric loop (301), within which the first forming roll (305) is located, is a lower fabric loop, the first wrapping angle (alpha) being larger than about 150° and the second one (beta) being larger than about 75°.

5. Former according to any one of claims 1 - 4, **characterised** in that the distance between the forming rolls (5 and 7; 205 and 207; 305 and 307) is smaller than 0.1 m.

6. Former according to claim 5, **characterised** in that the distance is on the order of 0.06 m.

7. Former according to any one of claims 1 - 6, **characterised** in that the free fabric length between the forming rolls (5 and 7; 205 and 207; 305 and 307) is 0.3 - 0.4 m.

8. Former according to any one of claims 1 - 7, **characterised** in that the fabrics (1 and 3; 201 and 203; 301 and 303) with the completely formed paper web in between together run off downwards substantially vertical from the second forming roll (7; 207; 307).

9. Former according to any one of claims 1 - 8, **characterised** in that one of the fabric loops (1 and 3; 301 and 303) is a lower fabric loop and has a predrainage section (19; 319) ahead of the first forming roll (5; 305).

10. Former according to any one of claims 1 - 8 for forming a multilayer paper web, **characterised** in that the fabrics (201 and 203) between them define a forming gap (225) curving along a portion of the periphery of the first forming roll (205), a multilayer headbox (222), preferably a three-layer headbox, being provided for discharging into said gap (225) a multilayer jet of at least two different stocks.

11. Former according to claim 9 for forming a multilayer paper web, **characterised** in that a primary headbox (21; 321) is provided for discharging a homogeneous stock jet to the start of the predrainage section (19; 319) where a first layer of the paper web is to be formed, a secondary headbox (23; 323) being provided for discharging a stock jet onto the first layer of the web adjacent the area where the fabrics (1 and 3; 301 and 303) start curving along the periphery of the first forming roll (5; 305).

12. Former according to claim 11, **characterised** in that the secondary headbox (23; 323) is a multilayer headbox, preferably a two-layer headbox.

Fig. 1

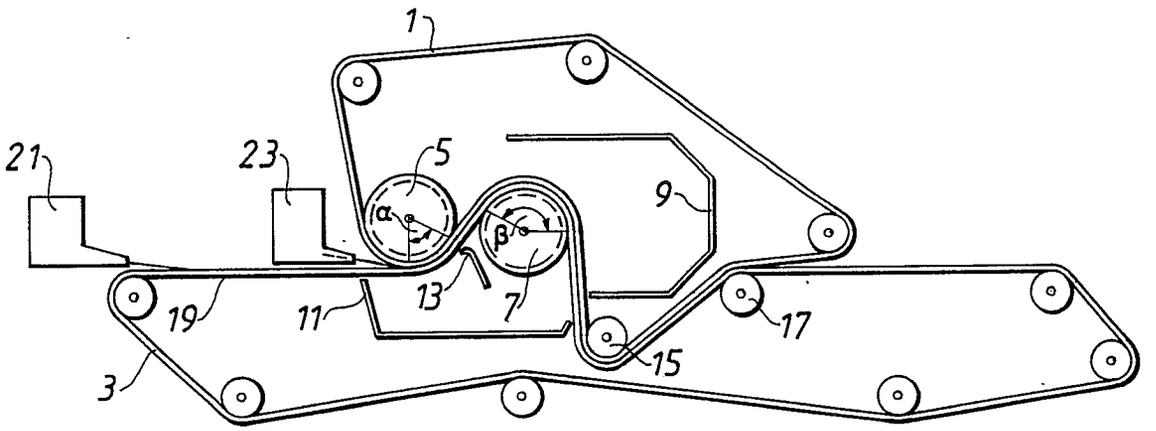


Fig. 2

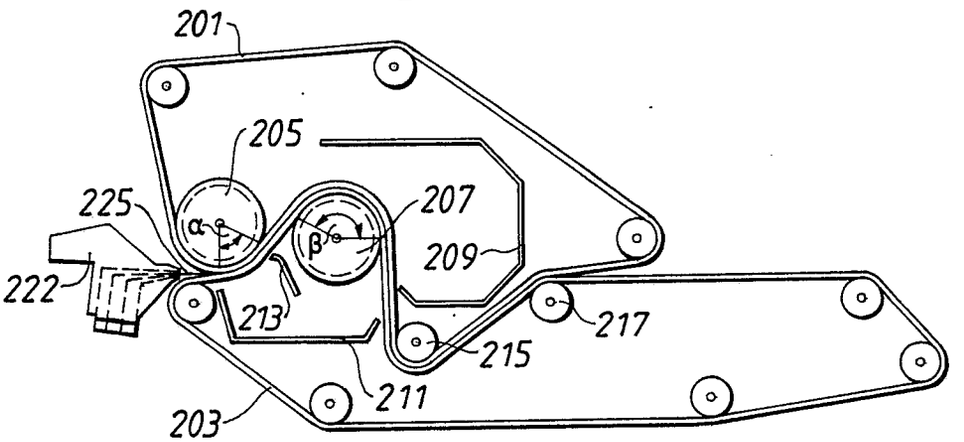
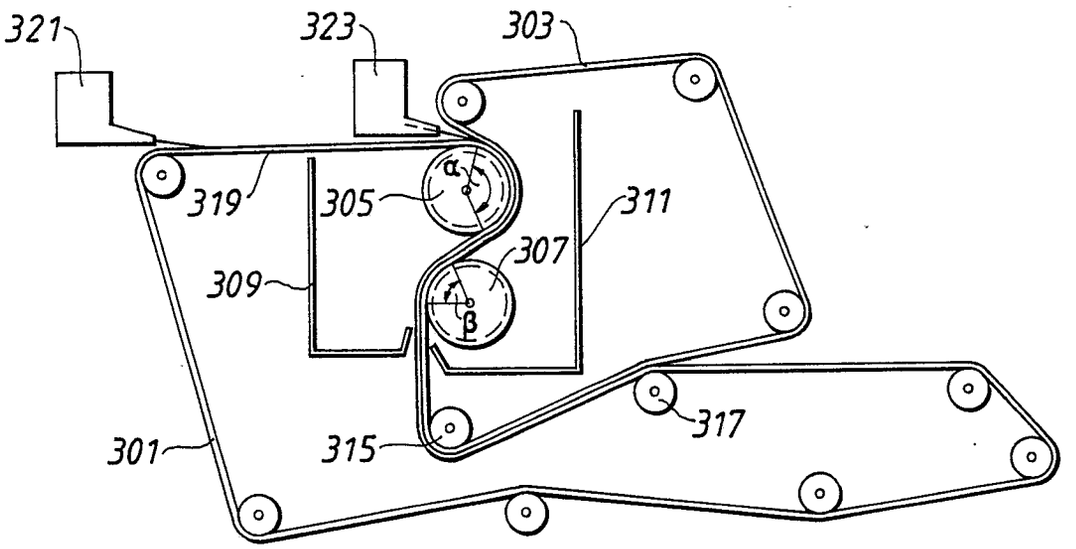


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number

EP 88 20 1361

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.4)
A,D	EP-A-0 072 188 (DOMINION ENGINEERING WORKS LTD) * Figure 2 *	1,2,9	D 21 F 9/00
A	FR-A-2 091 560 (J.M. VOITH GmbH) * Figure 1 *	1,4,5,8,9	
A	WO-A-8 202 910 (J.M.VOITH GmbH) * Figure 1 *	1,2,4,9	
A	AT-A- 375 695 (ESCHER WYSS GmbH) * Figures 1-3 *	10	
A	DE-A-3 532 458 (MITSUBISHI JUKOGYO K.K.) * Figures 7,11,12 *	10	
A	DE-A-3 100 713 (ESCHER WYSS GmbH)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D 21 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17-10-1988	HOEPER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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