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3,485,715

CYLINDER MOLD WHEREIN THE HEADBOX IS OFFSET FROM THE FEED ROLL

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FIG. 1

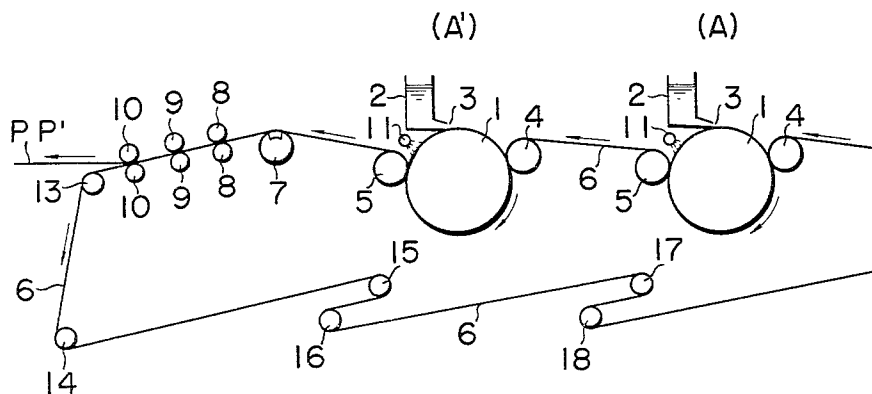


FIG. 2

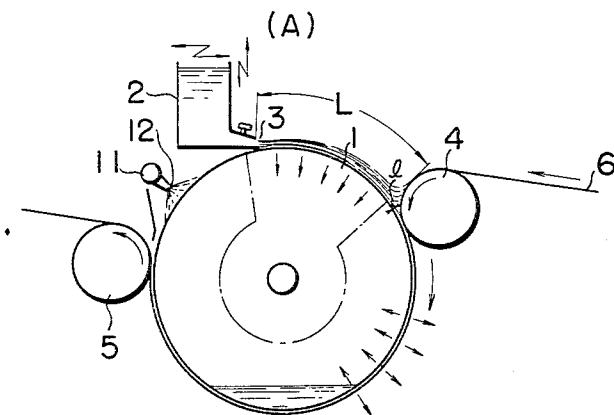
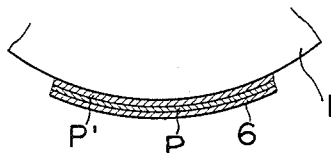


FIG. 3



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3,485,715 CYLINDER MOLD WHEREIN THE HEADBOX IS OFFSET FROM THE FEED ROLL

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3 Claims

ABSTRACT OF THE DISCLOSURE

A paper making machine having a horizontal row of web-forming units. Each unit has a wire cylinder with a flow box over it disposed to supply stock over the side of the cylinder between a feed roll and a screen belt over to a couch roll on the other side, passing along the lower side of the cylinder. The web from the first unit is carried along the endless belt over to the feed roll of the second unit where it joins the stock supplied by the flow box at the second unit, forming a combined web which is then passed on in the same way to successive units, the endless belt carrying the stock from one unit to the next until finally the stock is removed and the belt returns to the first unit. The flow box is located on angular distance of from 20° to 60° from the feed roll.

This application is a continuation-in-part of United States patent application Ser. No. 425,269 filed Jan. 13, 1965, now abandoned.

This invention relates to a combination paper machine having a horizontal row of web-forming units, each consisting of a horizontal wire cylinder with a flow box opening above it to furnish stock over the side of the cylinder, a feed roll set on the cylinder at a proper distance in the direction of the stock flow, a couch roll set on the cylinder opposite the feed roll across the cylinder, and a felt or wire screen belt carried from the feed roll along the lower side of the cylinder to the couch roll, said belt running endlessly from one web-forming unit to another and back again to the first.

It is an object of the present invention to make a web of well entwined fiber texture, and another object of the invention is to provide a simple device capable of producing a firmly bound web.

Of the drawings attached hereto,

FIGURE 1 is a rough sketch of the entire system under the present invention.

FIGURE 2 is a magnified sectional view of a part of a web-forming unit thereof.

FIG. 3 is an enlarged fragmentary elevation of the bottom of the wire cylinder of a second in a series of web forming units showing the build-up of web layers between the belt and cylinder.

In a typical embodiment of the present invention as illustrated in these drawings, a wire cylinder 1 has a flow box 2 set above it, and the stock outlet or slice 3 of the flow box opens onto the side of the wire cylinder 1 which has a diameter of about four to about ten feet.

Facing the slice 3 of the flow box 2, at a proper angular distance L, a feed roll 4 of between four to fourteen inches in diameter is set so as to turn freely on the periphery of the wire cylinder 1. This feed roll 4 may be angularly shifted forward and backward between about 20° to about 60° along the angular distance L from the flow box 2 (considering the flow box outlet 3 as 0°) and may be adjusted freely to change its clearance from the side surface

of the wire cylinder 1, whereas the flow box 2 may be angularly shifted forward and backward about 45° along the surface of the wire cylinder and consequently can change its vertical position relative to the cylinder.

A couch roll 5 of about the same size as feed roll 4 is provided opposite the feed roll across the wire cylinder 1 and set on its periphery.

A felt or plastic or metal screen belt 6 runs from over the feed roll 4 along the lower side of the wire cylinder 1 to the couch roll 5. These components make up a web-forming unit A. A number of such units A are arranged horizontally in a row, and the belt 6 runs endlessly from one to another of these web-forming units until it leaves the last unit A', after which the belt goes through a proper arrangement of a suction roll 7, pairs of press rolls 8—8, 9—9 and 10—10, and other rolls before it returns to the first web-forming unit, although this arrangement is not essentially different from a conventional roll arrangement.

A cleaning water pipe 11 with a nozzle 12 is provided to shower water on the surface of the wire cylinder 1 to clean it.

In the system of the present invention, the turning speed of the wire cylinder 1 and the running speed of the belt 6 should be adjusted to each other; and stock furnished from the slice 3 of the flow box 2 in the direction of the feed roll 4 will flow freely along the distance L, during which the fibers in the stock will be laid in all directions and entwined well while some of the water contained in the stock will be separated and removed through the wire cylinder 1. The stock then gets in between the belt 6 from the feed roll 4 and the wire cylinder 1, and is pressed as it moves on, the moisture being forced out in the meantime, to become a wet web P, which is then carried over a couch roll 5 and a belt section 6 to the feed roll 4 of the next web-forming unit.

In the second or any later stage, stock is dewatered on a wire cylinder 1, as in the first stage, and is laid over the previously formed web P; together they get in between the wire cylinder 1 and the belt 6 and are pressed as they move on, the moisture being forced out in the meantime, so that the new layer P' is firmly bonded to P before the combined web proceeds from a couch roll 5 to the next stage. See FIG. 3. Thus the web continues to grow until, after the last web-forming unit A', the belt 6 carries the combined web through a suction roll 7, pairs of press rolls 8—8, 9—9, 10—10, etc. Finally, the combined web P—P, and so on, leaves the belt 6 and goes to a drying section not shown while the belt 6 returns via properly arranged guide rolls 13, 14, 15, 16, 17, 18 etc. to the first web-forming unit A, thus running endlessly.

Depending on the consistency of the stock, the feed roll 4 may be shifted forward or backward to change its distance L from the flow box outlet 3, or the flow box 2 may be shifted forward or backward. Also, depending on the thickness of the individual stock layer to be formed, the clearance between the feed roll 4 and the wire cylinder 1 may be adjusted properly. This clearance will be between ¼ inch to about 1½ inches. To dewater the stock through the wire cylinder 1, gravity, or partial vacuum suction as shown by the broken lines in FIGURE 2, or general suction inside the cylinder, or any other desired means may be used. Water thus separated from the stock and collecting in the wire cylinder 1 is discharged by vacuum pump, exhaust pump, or any other conventional means.

In a conventional multi-layer paper machine, as is well known, stock is furnished between an upper and a lower endless belt and becomes a web as the belts move on.

Since stock comes in immediately where the upper and lower belts meet first, it has no time to be dewatered before it gets in between the belts, and its fibers have little time to be entwined sufficiently to form a web of satisfactory texture. Complicated sucking devices are required to remove water from the stock as it is carried between the upper and lower belts, which sway more or less, resulting in wrinkles or twists in the web and much wear on the belts.

In the present invention, on the other hand, stock supplied from the flow box 2 is first allowed to flow freely on the wire cylinder, permitting the fibers to settle naturally in all directions and to be entwined firmly while shedding a part of its moisture content through the wire cylinder 1 before getting in between the cylinder and the belt 6 from the feed roll 4, where it is pressed and dewatered further as it moves on to become a web of well-entwined fiber texture. In the second and later stages, each new layer is firmly bonded to the web already made; and as the web is formed between the wire cylinder 1 and the belt 6, it does not sway and consequently cannot be wrinkled or twisted as it would in a conventional machine with an upper and a lower belt. Furthermore, the present invention does not require such complicated suction devices or high belt tension as a conventional machine does to dewater the web while it is formed, resulting in less belt wear and other advantages.

The invention has the following three features:

(a) A flow box opens above the side of a wire cylinder, and a feed roll is set on the cylinder at a proper distance L of between about 20° to about 60° in the direction of the stock flow, the space L constituting the section where the web texture is prepared.

(b) A couch roll is set on the cylinder opposite the feed roll across the cylinder, and a felt or wire screen belt is carried from the feed roll along the lower side of the cylinder to the couch roll, the space between feed roll and the couch roll constituting the section where the fiber layer is developed and concentrated.

(c) A number of web-forming units each consisting of the parts mentioned in (a) and (b) are arranged in a horizontal row, and the said belt is carried endlessly from one web-forming unit to another and back again to the first, running in each unit from the feed roll along the lower side of the cylinder to the couch roll, to combine the layer from each unit.

It is of great significance that the space L on the upper side of the wire cylinder allows for the preparation of the web texture, and that it is followed by a section on the same cylinder, that is, on the lower side of the cylinder, where the fiber layer is developed and concentrated.

In the space L where the web texture is prepared, the stock weights on the cylinder as it flows; hence the flow is stable. Also, the stock flows in an open state without meeting with any external resistance in particular, with the result that the fibers are allowed to entwine each other freely. Since the stock flow weighs on the cylinder, and water is drawn from it naturally through the wire cylinder, the fibers settle uniformly over the L section of the side of the cylinder.

While the mat made in the L section is still in a plastic state, its individual fibers are closely bound together in the section between the feed roll and the couch roll, making the mat firmer and more compact.

Moreover, this process, taking place over the side of each of a number of wire cylinders arranged in a horizontal row, naturally can proceed very fast.

Generally, it is an essential requirement in a paper-making process to produce paper with uniform fiber distribution. For this purpose, it is important to use a stock in which fibers are uniformly suspended, to supply same in a uniform manner over the texture-forming section of the wire cylinder, and to let individual fibers move more or less freely relative to each other while settling, for the

ultimate purpose of minimizing entanglement of fibers and obtaining a firm, close web texture.

The distance L in the present invention effectively achieves these purposes. Its essential effects are:

(1) *Uniform stock distribution*.—Stock is supplied over the distance L provided on the wire cylinder so that individual fibers contained therein will be able to move more or less freely relative to each other and to settle uniformly on the wire cylinder, and so that the resulting mat will be uniform in weight along its length.

(2) *Adjustment of settling rate relative to stock concentration*.—If the stock is low in concentration, that is, contains more water, the distance L may be increased so that the stock will lose more water on the wire cylinder before reaching the feed roll. On the other hand, if the stock concentration is high, that is, contains less water, the distance L may be reduced so that the stock will lose less water before reaching the feed roll. Thus, the stock settling rate may be kept constant regardless of the concentration of the stock supplied.

(3) *Uniform fiber settling throughout mat*.—As more and more water is removed through the wire while the stock moves along the distance L, individual fibers suspended in the stock settle uniformly on the wire.

(4) *Compaction*.—The fiber mat formed over the distance L, after passing the feed roll, is pressed against the web from the last web-forming unit and squeezed between the belt and the wire cylinder so that the two layers are effectively combined together, resulting in a closely compacted texture.

(5) *Dewatering*.—Before reaching the feed roll, the stock is sufficiently dewatered over the distance L to become a firm mat.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art will readily understand.

I claim:

1. A combination paper making machine, comprising:

(a) a first web forming unit including a rotary driven wire cylinder,

(b) a liquid stock flow box means disposed vertically above the longitudinal axis of said cylinder and radially outwardly of the periphery thereof to provide stock onto the surface of said cylinder,

(c) a rotary feed roll mounted parallel to and in proximity to said wire cylinder and angularly offset 20° to 60° from said flow box means in the direction of rotation of said cylinder,

(d) a couch roll mounted parallel to and in proximity to said wire cylinder and on the opposite side thereof from said feed roll,

(e) endless belt means carried over said feed roll and along the lower peripheral portion of said cylinder and over said couch roll; and

(f) at least one other identical web forming unit including a flow box means, a wire cylinder, a feed roll and a couch roll disposed adjacent to said first unit so that said belt means passes from said couch roll of the first unit over the feed roll of said identical unit and then between the feed roll and cylinder of the identical unit and then over the identical unit couch roll, whereby said belt runs endlessly from one web forming unit to at least one other identical unit and back again to the first unit, the composite web formed by the units being removed after passing through the last of said units.

2. In a combination paper making machine having a large diameter wire cylinder disposed for rotation in the vertical plane, a smaller diameter feed roll disposed alongside said cylinder and in proximity thereto, stock flow box means, and belt means extending over said feed roll, under and about a portion of said cylinder, and roll

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means to guide said belt away from said cylinder on the side of said cylinder opposed from said feed roll; the improvement comprising, said stock flow box means having slice means at the outlet thereof and being disposed vertically above the longitudinal axis of said cylinder and radially outwardly of the periphery thereof to deliver stock onto the surface of said cylinder, said feed roll being angularly offset from said flow box means from 20 to 60 degrees in the direction of rotation of said cylinder, whereby water may be drawn from the stock through said wire cylinder between said flow box means and said feed roll so that the stock fibers settle uniformly over the cylinder prior to being compressed by said feed roll and belt means.

3. The machine of claim 2, further comprising suction means to remove moisture from the stock as it passes through said predetermined angular distance.

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162—133, 300, 318, 357