Nov. 16, 1954 L. HORNBOSTEL 2,694,345

WATER REMOVAL DEVICE FOR PAPER FORMING WIRE

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Fig. 1

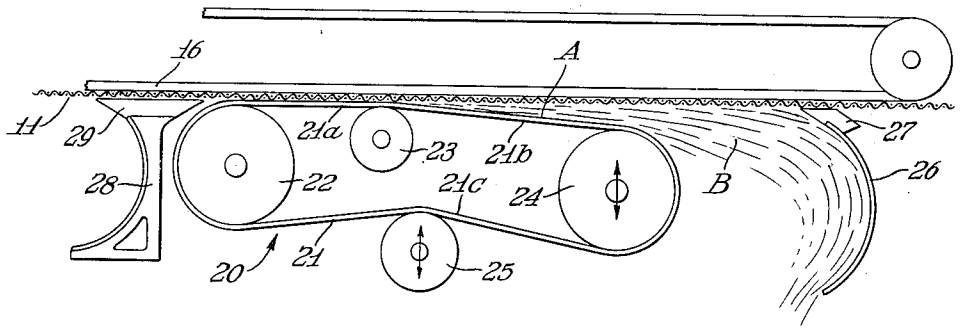


Fig. 2

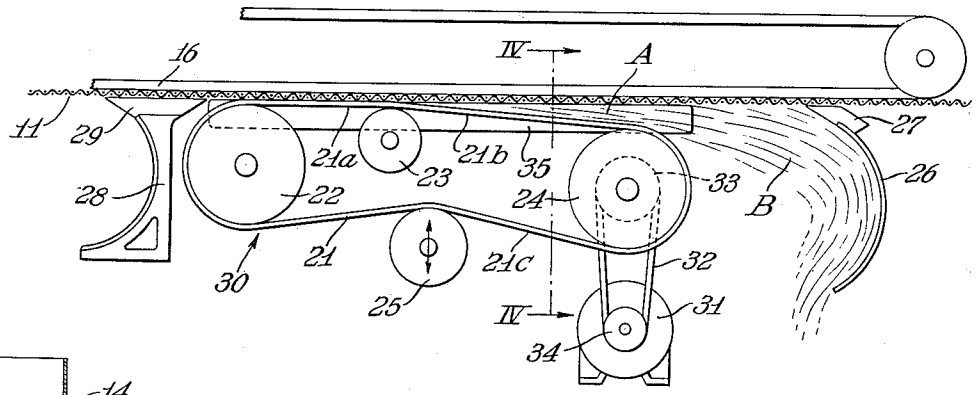


Fig. 3

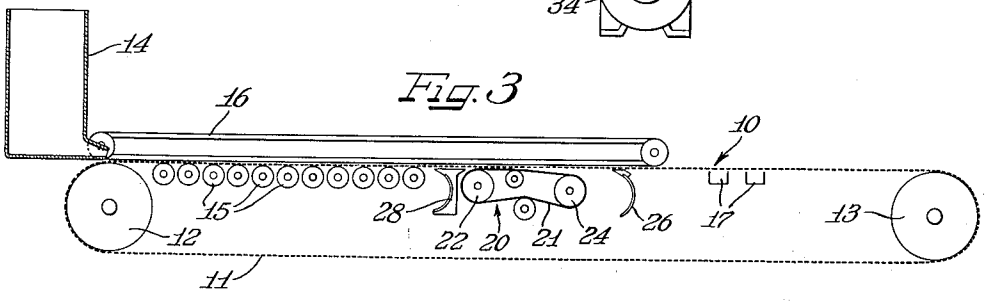
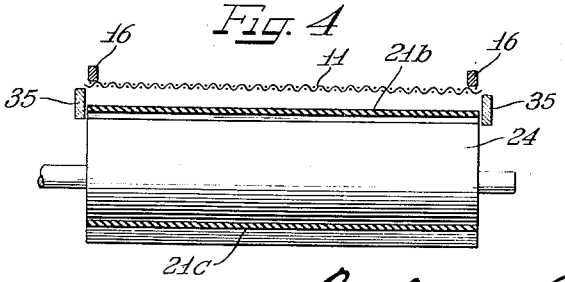


Fig. 4



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WATER REMOVAL DEVICE FOR PAPER FORMING WIRE

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6 Claims. (Cl. 92—44)

The present invention relates to a water removal device for a paper machine forming wire and more particularly to a device positioned within the loop of a paper forming wire for removing excessive moisture from the under surface of the wire.

In conventional Fourdrinier-type paper making machines, a dilute solution of paper stock is caused to flow onto a foraminous forming wire, excess water being drained through the wire to deposit thereon a layer of stock fibers. During initial water removal, i. e., immediately after the stock has been introduced onto the wire, the wire is conventionally supported by a plurality of spaced table rolls and free water drainage occurs through the wire. Subsequent water drainage is facilitated by suction boxes disposed within the wire for subjecting the undersurface thereof to sub-atmospheric pressures so that a differential air pressure advantage is gained to aid in water removal.

The present invention now proposes the employment of an additional device along the web forming or upper wire run in advance of the suction boxes to aid in the removal of water through the wire. The present device thus prevents the flooding of the initial suction boxes by the large quantity of water initially removed from the stock and thus makes possible the more efficient removal of water.

In general, the device of the present invention comprises an endless belt which is trained about a supporting structure, such as a plurality of rotatable rolls, to directly underlie the upper run of the paper machine forming wire. The belt has its upper run traveling in the same direction as the upper run of the overlying forming wire and is preferably moisture and air impermeable so as to facilitate water removal. The oncoming upper run of the belt preferably contacts the under surface of the forming wire while the offgoing or downstream portion of the upper run is inclined downwardly away from the forming wire. The separation of the traveling belt from the wire creates a reduced pressure area directly underlying the forming wire. This reduced pressure area effectively increases the differential pressure upon the upper surface of the forming wire to aid in the drainage of moisture from the forming wire and the web positioned thereon.

Moisture drained through the wire onto the belt is thrown therefrom by centrifugal force and a deflector is provided to underlie the forming wire in order to prevent the water from being thrown against the undersurface of the wire. An additional deflector is preferably provided in advance of the belt to remove excessive moisture from the underside of the wire. The belt may be independently driven or driven by contact with the forming wire surface.

It is, therefore, an important object of the present invention to provide an improved water removal device for a paper machine forming wire.

Another important object of the present invention is to provide an improved water removal device for a paper forming wire, including an impermeable belt contacting the undersurface of the wire for a portion of its run and then separated therefrom along a downwardly inclined path to form a reduced pressure area directly underlying the wire to aid the drainage of moisture therefrom.

It is a further important object of the present invention to provide an improved water removal device for a paper machine forming wire including a continuous impermeable belt trained about a plurality of guide rolls, the belt initially contacting the undersurface of the wire and subsequently being removed from contact therewith to create a suction area directly underlying the forming wire to facilitate the drainage of water therefrom.

Still another important object of the present invention is to provide an improved water removal device for a looped foraminous belt including an impermeable belt closely underlying the foraminous belt within the loop thereof for creating a pressure differential effective to facilitate drainage of water from the foraminous belt and for throwing the removed water adjacent a deflector which prevents re-wetting of the foraminous belt or material thereon.

Yet a further important object of the present invention is to provide a method for the removal of water from a forming wire by creating a differential pressure area underlying the wire, draining water through the wire into the area, and flinging water from the area.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is a fragmentary schematic view illustrating a water removal device of the present invention;

Figure 2 is a fragmentary schematic view similar to Figure 1 illustrating a modified form of a water removal device of the present invention;

Figure 3 is a schematic illustration of the wet end of a Fourdrinier-type paper making machine employing a water removal device of Figure 1; and

Figure 4 is a sectional view taken along the plane IV—IV of Figure 2.

As shown on the drawings:

In Figure 3, reference numeral 10 refers generally to a Fourdrinier-type paper making machine including a looped forming wire 11 trained about a breast roll 12 and a couch roll 13. A conventional stock inlet box 14 is provided to introduce a pulp suspension onto the upper run of the forming wire 11, the undersurface of the first reaches of the wire being supported by a plurality of table rolls 15 and the edges of the web formed on the wire being defined by conventional deckle straps 16. A plurality of suction boxes 17 are provided for facilitating the removal of water from the wet web supported by the wire 11 adjacent the couch roll 13.

A water removal device of the present invention is located to underlie the reach of the wire 11 between the table rolls 15 and the suction boxes 17, this device being, generally indicated by reference numeral 20.

As shown in Figure 1, the device 20 includes an endless belt, preferably formed of air and water impermeable material, such as rubber sheeting, heavily sized fabric, a tightly woven felt, or the like, and the belt is of sufficient width to extend across the width of the forming wire. The belt 21 is trained about a first large guide roll 22 and a second relatively small guide roll 23 so that the initial or oncoming reach 21*a* of the belt 21 contacts the under surface of the forming wire 11.

After passage of the belt 21 over the guide roll 23, the belt is trained about an additional large guide roll 24 rotatable about an axis parallel to but downwardly displaced from the axis of the roll 22, so that a secondary offgoing reach 21*b* of the belt 21 is inclined away from the under surface of the wire 11. A return reach 21*c* of the belt from the guide roll 24 to the initial guide roll 22 is deflected by means of a tension roll 25 outside the loop of the belt. The roll 24 is adjustable vertically to change the inclination of the belt reach 21*b* with respect to the wire 11, and the tension roll 25 is adjustable vertically to vary the tension upon the reach 21*c* of the belt.

Operation of the device will be appreciated from the fact that the belt 21 is preferably impermeable to air and moisture, while the wire 11 is foraminous and therefore permeable to both water and air. The initial reach 21*a* of the belt 21 forms a bottom for the foraminous wire 11, and as this bottom is pulled away from the wire along the downwardly inclined reach or run 21*b*, a constantly increasing gap will be created between the wire and belt. This creates a suction pump effect, and a reduced pressure area A directly underlying the wire is formed. This reduced pressure, in conjunction with

atmospheric pressure exerted on the upper surface of the wire, will serve to force drainage of water from the wire.

The drained white water deposited on the belt will either run down the inclined belt surface presented by the reach **21***b* or will be flung tangentially from the belt **21** as it passes down the guide roll **24** by centrifugal force. The direction lines B of Figure 1 illustrate this flinging of water from the roll **24** and from the belt **21** and it will be seen that an arcuate deflector **26** having an upper scraper blade **27** underlying or contacting the wire **11** is provided to prevent the flinging of water against the under surface of the wire. Water from the deflector **26** and from the belt **21** may be conveyed by gravity or other means to a conventional save-all pan.

An additional deflector **28**, having an upper scraper blade **29** contacting the wire **11** or spaced very closely therefrom, is provided in advance of the belt **21** and the first guide roll **22**. The scraper blade **29** serves to remove excess water from the under surface of the wire **11** prior to its contacting the belt reach **21***a*, thereby preventing possible interference of this excess water with operation of the water removal device **20**.

It will be appreciated that the belt **21** contacts the undersurface of the wire **11** and is driven by the wire **11** and the drive mechanism for the wire. In Figure 2, there is illustrated a modified form of the present invention indicated generally by reference numeral **30**. The device **30** is quite similar to the device **20** hereinbefore described and in the two figures identical reference numerals refer to identical portions of the apparatus. In this embodiment of the invention, an auxiliary source of energy, such as an electric motor **31**, is provided to drive the belt **21***c* by suitable means, as by an endless drive belt **32** trained about a pulley **33** on the roll **24** and the shaft of the motor **31**. In this manner, it is not necessary to rely upon the frictional engagement of the belt reach **21***a* with the belt **11** for driving the belt. However, it is preferred that the belt **21** be driven substantially the same speed as the wire **11**.

In addition, a pair of transversely spaced side closure plates **35** is provided to extend along the longitudinal edges of the belt **21** (Figure 4). It will be seen that the end plates **35** serve to prevent the drawing of air into the longitudinal extremities of the space A defined between the belt reach **21***b* and the wire **11**. Thus the suction effect is increased by the provision of such side plates, although they may not be necessary on a large machine inasmuch as the spacing between the belt reach **21***b* and the wire **11** is very small when compared with the transverse width of the wire and the belt. Each side plate bridges the gap between the belt **21** and the wire edges and the plates extend along the length of the entire free reaches **21***a* and **21***b* of the belt.

The operation of the device of the present invention has been described in some detail, and it will be evident to those skilled in the art that the present invention provides means for aiding in the removal of excess water from paper web while supported on a forming wire. It will be appreciated that various details of the structure and operational conditions may be varied as desired as indicated by the dictates of the specific apparatus and the mode of operation of the particular machine.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In combination with a Fourdrinier-type paper machine forming wire, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a reach of said belt in contact with the undersurface of said wire, and an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire and said last-mentioned guide roll serving upon rotation to fling water from said belt by a centrifugal action.

2. In a Fourdrinier-type paper machine, a looped foraminous forming wire having a substantially horizontal forming reach presenting an upper and an undersurface, means for introducing a paper stock suspension onto the upper surface of said wire, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a first reach of said belt in contact with the undersurface of said wire, and an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire, and said last mentioned guide roll serving upon rotation to fling water from said belt by centrifugal action.

3. In combination with a Fourdrinier-type paper machine forming wire, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a first reach of said belt in contact with the undersurface of said wire, an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire, said last mentioned guide roll serving upon rotation to fling water from said belt by centrifugal action, and an arcuate deflector underlying said wire and in spaced relation to said belt along the travel of the wire for receiving water thrown from said belt.

4. In a Fourdrinier-type paper machine, a looped foraminous forming wire having a substantially horizontal forming reach presenting an upper and an undersurface, table rolls supporting an initial run of said horizontal reach, suction boxes underlying a later run of said horizontal reach, means for introducing a paper stock suspension onto the upper surface of said wire at said initial run, and a liquid removal device positioned within the loop of the wire between the table rolls and suction boxes, said device comprising, in combination, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a first reach of said belt in contact with the undersurface of said wire, and an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire, and said last mentioned guide roll serving upon rotation to fling water from said belt by centrifugal action.

5. In combination with a Fourdrinier-type paper machine forming wire, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a first reach of said belt in contact with the undersurface of said wire, an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire, and said last mentioned guide roll serving upon rotation to fling water from said belt by centrifugal action, and side closure plates extending along the first and additional belt reaches in close-running relation to the lateral edges thereof to cooperate in defining the reduced pressure area.

6. In combination with a Fourdrinier-type paper machine forming wire, an impermeable belt disposed beneath said wire, spaced guide rolls maintaining a first reach of said belt in contact with the undersurface of said wire, an additional guide roll guiding said belt from contact with said undersurface along the direction of travel of the wire to provide an additional belt reach lying at an acute angle with respect to said wire, thereby defining a reduced pressure area directly underlying said wire, said last mentioned guide roll serving upon rotation to fling water from said belt by centrifugal action, side closure plates extending along the first and additional belt reaches in close-running relation to the lateral edges thereof to cooperate in defining the reduced pressure area, and an arcuate deflector underlying said wire and in spaced relation to said belt along the travel of the wire for receiving water thrown from said belt.

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