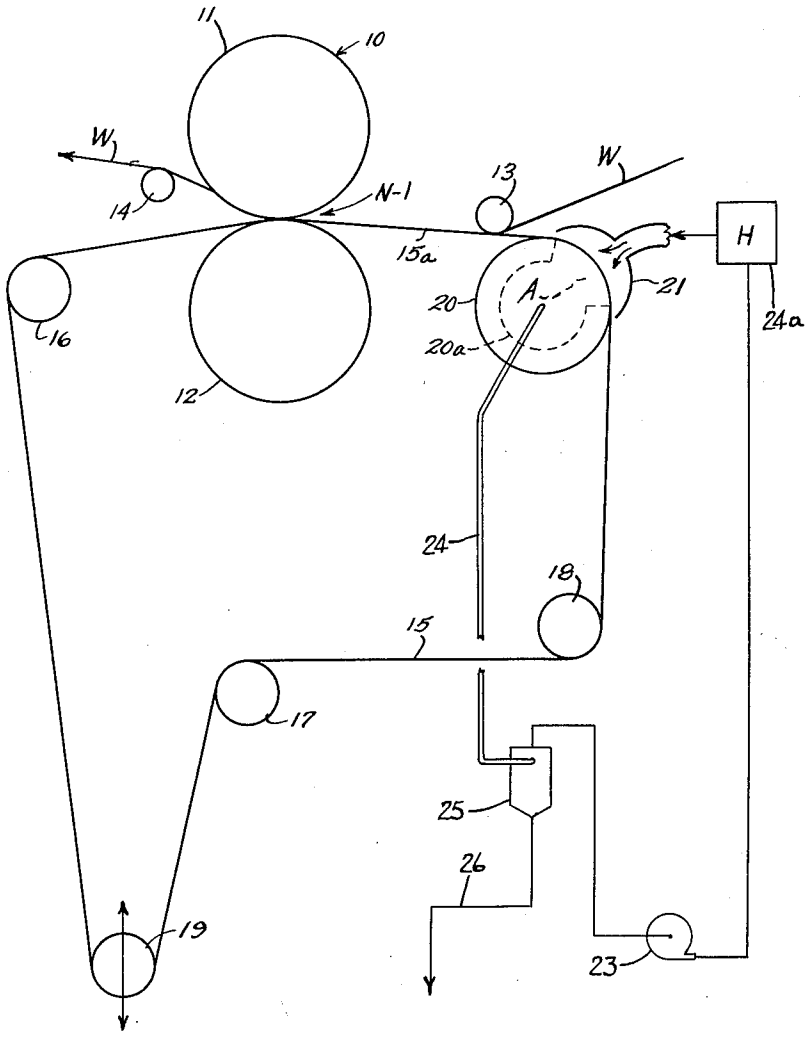
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PLAIN PRESS WITH SUCTION FELT DRYING MEANS

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Fig-1



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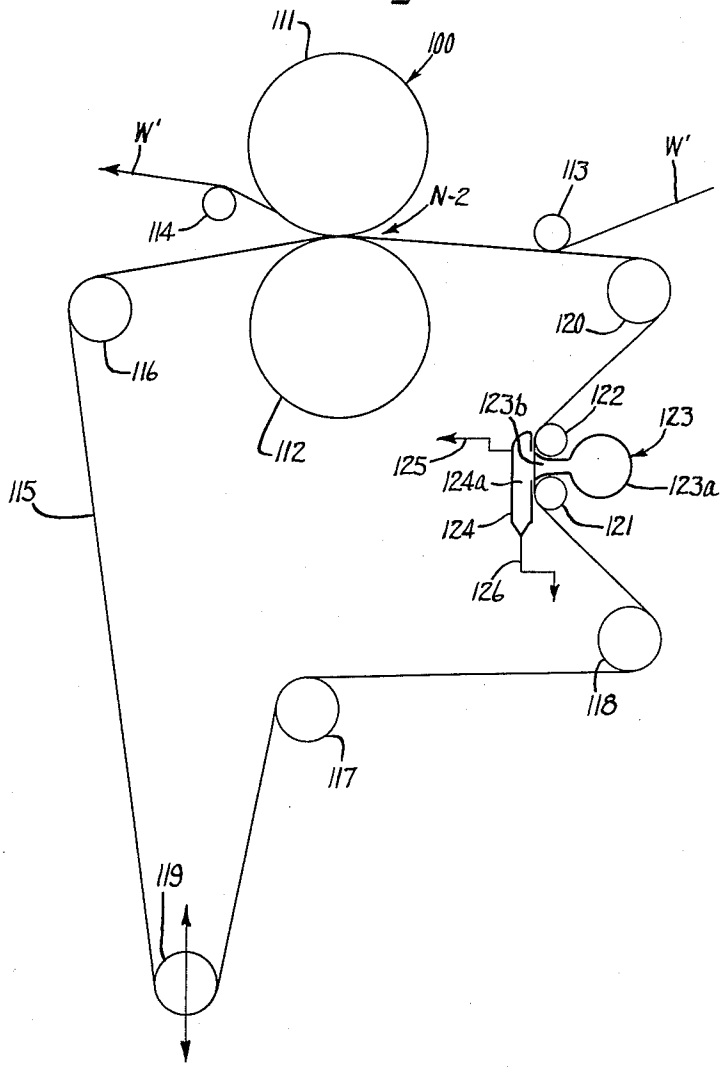
by Kill, Sherman, Morris, Gast & Merriam Attys.

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Fig. 2



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PLAIN PRESS WITH SUCTION FELT DRYING MEANS

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4 Claims. (Cl. 162—199)

The instant invention relates to paper machine presses, and more particularly, to a paper machine press with an auxiliary felt drying device.

Although the instant invention may have application in a number of fields, it is particularly useful in connection with the paper making industry and will be described in detail hereinafter in connection with this use. Despite a number of advantages, plain press rolls have been useful in paper machines only at relatively low speeds or at nip pressures such that the water removed would not damage the web. With such presses, the felt operates primarily as a conveyor for the web and water is drained downwardly against the rotation of the roll primarily by gravity. The development of suction rolls permitted considerably increased speeds, not so much because of suction, but because an exit was provided for the water expressed in the nip. Once free of the web and/or felt, the water drained at an accelerated rate because of suction. On occasions, however, an objectionable pattern may be shown in the web because of the difference in dryness over the holes in the suction roll and over the surrounding land portions. Water removal by suction rolls is limited by the centrifugal force developed at higher speeds, as well as some other physical forces. Also, suction rolls are obviously limited by the maximum of one atmosphere pressure differential which may be applied.

With the speed of modern paper machines, the water expressed from the web in a plain press roll cannot be removed merely by gravity and there is a tendency to build up very substantial pressures at the press nip. In any event, in such situations the only place that the water may go from the sheet is into the carrying felt. The instant invention is based upon an improved method and apparatus for dewatering and conditioning the felt so as to obtain more effective drying of the web without disrupting the web formation (as by the use of excessive nip pressures or the like). The instant device also effects aeration of the felt and conditioning of the surface thereof so as to improve the felt to absorb water.

The instant invention is also based upon a discovery that press felts have an optimum dryness for water removal from the web at the nip. This optimum dryness may be determined by experimentation in any given paper machine, with a certain type of web, at predetermined speeds, etc. Experiments have determined that the felt can be brought to its optimum condition of dryness by the passage through it of large volumes of air. This is most effectively accomplished with high velocities of the air moving through the felt. Other gases may, of course, be used and there are certain desirable features in using hot gases. The use of hot gases depends upon the economic conditions involved, but the function of such hot gases, if used, is to heat the water so as to reduce its viscosity and make possible the more ready mechanical removal of water from the felt by the gas flow therethrough. Basically the physical action contemplated is mechanical in which a friction force and possibly a momentum interchange at the air-water interface is sufficient to remove the water from the felt. Vaporization of the water, if it occurs, is incidental; and such heat as may be added to the gases is preferably limited to that required to raise the temperature of the water, thereby affecting the viscosity.

It is, therefore, an important object of the instant invention to provide an improved means and method for dewatering a felt to be passed through a press nip in a paper machine.

It is another object of the instant invention to provide an improved paper machine press section comprising a pair of press rolls defining a press nip receiving a web, a looped traveling felt passing through the nip, gas supply means blowing gas through the felt to dewater the same, and guide means bringing the web into contact with the felt between the press nip and said gas supply means.

Still another object of the instant invention is to provide an improved method of dewatering a web which comprises receiving a web on a traveling felt, subjecting the web and felt to pressure to squeeze water therefrom, and mechanically removing water from the felt prior to receiving the web thereon by subjecting the web to a gas blast.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

FIGURE 1 is an essentially diagrammatic elevational view of one embodiment of the instant invention; and

FIGURE 2 is an essentially diagrammatic elevational view of another embodiment of the instant invention.

As shown on the drawings:

In FIGURE 1, the reference numeral **10** indicates generally a press assembly comprising a pair of press rolls **11** and **12** defining therebetween a press nip N–1. Preferably, the press rolls **11** and **12** are plain press rolls. A web W guided by rolls **13** and **14** passes through the nip N–1 in the direction indicated by the arrowhead. A looped felt **15** lapping the press roll **12** receives the web W from the guide roll **13** and travels therewith to the nip N–1 and then around a guide roll **16** carrying the felt away from the web W which adheres temporarily to the uprunning side of the upper plain press roll **11**. The felt **15** is mounted on conventional guide rolls **16**, **17** and **18** with a tensioning roll **19**.

The guide roll **13** places the web W on the felt **15** close to the oncoming side of the nip N–1; and shortly before the felt **15** receives the web W it is trained over a perforate rotatable shell, which is here shown as a suction roll **20**. In the instant arrangement, it has been found preferable to maintain a minimum distance between the nip N–1 and the suction roll **20**. Some space remains for the guide means **13** to place the web W onto the felt run **15***a* at the oncoming side of the nip N–1, but otherwise the space between the nip N–1 and the suction roll **20** is maintained preferably at a minimum and the reach of felt **15***a* therebetween is preferably a horizontal reach, so that the web W can be readily placed on the reach **15***a* and the length of the reach **15***a* may be maintained at a minimum.

The suction roll **20** has a large open area (i.e., a high ratio of perforation area to land area) and is provided with a gland **20***a* which defines the peripheral dimensions of a suction area A of substantial size for the purpose of drawing as much air through the felt **15** as rapidly as is practical for dewatering of the felt **15**. Side sealing strips are, of course, also employed in alignment with the lateral edges of the felt **15**, although these are not shown in the drawing for purposes of simplification. Gas supply means, in the form of a hood **21** having a mouth commensurate in area with the suction area A provides a source of high velocity gas or air. As here shown, air is used, but other gases may be used. Preferably, the hood **21** is shaped to permit expansion of the air or gas used to accelerate the speed of the flow, thus employing kinetic energy of the air stream to assist in dislodging

water in the felt **15**. The hood **21** extends the full length of the suction roll **20** and thus the full width of the felt, as well as extending the full peripheral dimension of the suction area A. The hood **21** is mounted in close running relation to the felt **15**, so that it may effect an increase in gas pressure above the atmospheric pressure at the outside of the felt **15** and thus increase the dewatering effect. The volume of air found to be required is greater than that customarily used in paper machine suction rolls. For this reason, the large "factor" or ratio of perforation area to land area is used. As much as one pound of air may be used per pound of water removed, although the usual requirement may be less.

As here shown a blower **23** is used to exhaust the suction area and to pump gas back through the hood **21**. The blower **23** is a centrifugal exhauster. It withdraws air and moisture from the suction area **20***a* by way of a conduit **24** feeding into a gas water separator **25**. Water flows from a drain line **26** out of the bottom of the separator **25**, but the air is preferably returned into the blower **23**, where heat is imparted thereto by compression and then flows from the discharge of the blower **23** into the hood **21**. In this system some heat is lost through the water drain **26** and additional heat is imparted at the blower **23**. Still more heat may be added to the system by a standard air heater **24***a* at the inlet of the hood **21**.

In the instant method of dewatering the web W, the web W is received on the traveling felt run **15***a*. The web W and the felt **15** are subjected to pressure to squeeze the water therefrom at the nip N–1 between plain rotating surfaces. Prior to receipt of the web W on the felt run **15***a*, the felt is subjected to a high velocity gas flow. As here shown, such gas flow is created by a pressure differential which is effected by the creation of a vacuum on the suction area side of the felt and superatmospheric pressure on the side of the hood **21**.

In another embodiment of the instant invention, the positions of the suction roll **20** and the hood **21** are reversed, so that the suction roll is exposed to the outside of the felt loop **15** and the hood **21** is within the loop. In this way the air flows opposite to the direction of water movement at the nip N–1, in that the air travels from within the loop to outside of the loop of the felt **15**. In most instances, it has been found preferable to force the air through the felt in the direction shown in FIGURE 1, which is the direction in which expressed water will travel.

In still another modification of the instant invention, the blower is reversed in direction so that it will discharge into the suction roll **20** and drive air into the hood, which will be equipped with a separator such as the separator **25** to effect separation of water driven by the air blast out of the felt **15**.

Still another embodiment of the instant invention is shown in FIGURE 2. In FIGURE 2, a device is shown, indicated generally by the reference numeral **100**. The device **100** comprises a pair of press rolls **111** and **112** defining therebetween a nip N-2. The press rolls **111** and **112** are plain press rolls, A web W' guided by rolls **113** and **114** passes through the nip N–2 traveling in the direction indicated by the arrowhead. A looped felt **115** lapping the press roll **112** receives the web W' from the guide roll **113** and travels therewith to the nip N–2 and then around a guide roll **116** carrying the felt **115** away from the web W' which adheres temporarily to the uprunning side of the upper plain press roll **111**. The felt **115** is mounted on conventional guide rolls **116**, **117**, **118** and **120**, with a tensioning roll **119**. The elements **111** through **119** here described correspond to the elements **11** through **19** described in connection with the embodiment **10** of FIGURE 1.

The lip is also trained over two closely spaced guide rolls **121** and **122**. In the small space between the guide rolls **121** and **122** there is positioned gas blast means **123** to which is fed gas under pressure by suitable means (such as those shown in FIGURE 1). The hot gas or air is fed into a header portion **123***a* which extends the full width of the felt **115** under superatmospheric pressure and the air then flows through an expanding mouth **123***b* to accelerate the same and employ kinetic energy of the jet stream to assist in dislodging water from the felt **15** and driving the same into a drain housing **124** which has a mouth **124***a* that corresponds in height and width to the mouth **123***b*. The air may be permitted to exit from the drain housing **124** through a suitable line **125** and this line may recycle the air in the manner shown in FIGURE 1. The water separates from the drain **124** through a line **126**.

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

We claim as our invention:

1. In a paper machine press section, a pair of press rolls defining a press nip receiving a web, a looped traveling felt passing through the nip, a perforate shell lapped by said felt, means for supplying gas other than steam positioned opposite said shell aiming said gas at the felt to dewater the same, pump means withdrawing gas from said shell and feeding it into said gas supply means, and guide means bringing the web into contact with the felt between the press nip and said gas supply means.

2. In a paper machine press section, a pair of press rolls defining a press nip receiving a web, a looped traveling felt passing through the nip, a perforate shell lapped by said felt, means supplying gas other than steam positioned opposite said shell aiming said gas at the felt to dewater the same, heater means heating the gas for said gas supply means, pump means withdrawing gas from said shell and feeding it into said heater means, and guide means bringing the web into contact with the felt between the press nip and said gas supply means.

3. In a paper machine press section, a pair of press rolls defining a press nip receiving a web, a looped traveling felt passing through the nip, a perforate shell lapped by said felt, gas supply means opposite said shell aiming gas at the felt to dewater the same, heater means heating the gas for said gas supply means, a gas-water separator connected to said shell, pump means withdrawing gas from said separator and feeding it into said heater means, and guide means bring the web into contact with the felt between the press nip and said gas supply means.

4. A method of dewatering a web which comprises receiving a web on a travelling felt, subjecting the web and felt to pressure to squeeze water therefrom, mechanically removing water from the felt prior to receiving the web thereon by subjecting the felt to a hot gas flow to prevent the condensation of water vapor, and directing said gas flow through a recirculating path after leaving the felt to again pass through the felt.

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