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SUCTION FELT ROLL WITH TRANSVERSE BLOW OFF

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The present invention relates to improvements in paper machines and more particularly to an improved mechanism and method for the transfer of a traveling paper web onto a felt such as at an open draw between the Fourdriner and pick up felt of a paper machine.

The transfer of a paper web onto a traveling felt in a paper machine occurs at a number of locations such as following a press nip in various press locations in the machine or between the Fourdriner and the press section of a paper machine. In an open draw arrangement with a conventional structure the safe running speed of the machine is limited on the order of 1200 to 1300 feet per minute depending upon the strength of the sheet at the draw. If speeds are increased it has been discovered that air bubbles will occur between the sheet and felt when they come together creating unstable operation and creating air blows damaging the web when this web and felt pass through a press nip, so that the safe operating speed of the machine is limited. This creates a maximum operating speed limit which cannot be exceeded even though other portions of the machine can effectively and safely handle higher web speeds.

It is accordingly an object of the present invention to provide an improved structure which permits the transfer of a paper web onto a felt at higher speeds than heretofore obtainable which particularly permits the increase of operating speed in a machine utilizing an open draw for the transfer of the paper web.

Another object of the invention is to provide an improved method and mechanism which stabilizes and improves the effective transfer of a traveling web onto a supporting felt.

A still further object of the invention is to provide an improved web receiving and carrying felt with a supporting roll wherein the air pressure in the felt is reduced at the location where the web is received preventing the formation of air blow between the sheet and the felt when they come together.

A still further object of the invention is to provide an improved paper machine having a press section wherein the web is transferred to the press section on a felt and the formation of air between the felt and paper web is prevented thereby preventing carrying air into the press nip.

Another object of the invention is to provide an improved mechanism for transferring a web onto a traveling felt wherein the felt supporting roll utilizes the principles of a transverse flow fan in creating an air flow away the the location where the web is transferred.

The present invention contemplates providing a felt loop for receiving and carrying a paper web with a felt supporting roll shell wrapped by the felt loop engaging the felt over a portion of its circumference and being uncovered by the felt over another portion of its circumference with the shell being perforate and means tending to create an inward flow of air in the perforations beneath the felt where it receives the web, preferably by angling the perforations outwardly in a trailing direction and providing skinber blades extending radially outwardly and angled forwardly with respect to the roll shell at the uncovered portion for withdrawing air outwardly through the openings at the uncovered portion.

The present invention also contemplates the use of a felt supporting roll shell which has a transverse flow of air through its surface and is designed in accordance with the principles of a transverse flow fan rotor. It is also contemplated to utilize a felt supporting roll having recesses on the surface such as those provided by grooves. Other objects, advantages and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a schematic showing of a portion of a paper machine employing a paper web transfer utilizing mechanism and methods in accordance with the principles of the present invention;

FIGURE 2 is an enlarged detailed schematic fragmentary view of a portion of FIGURE 1;

FIGURE 3 is a schematic fragmentary sectional view of one end of a felt carrying roll;

FIGURE 4 is a schematic showing of another form of web transfer mechanism;

FIGURE 5 is a schematic showing of still another form of web transfer mechanism;

FIGURE 6 is a schematic showing of a web transfer mechanism of a further form;

FIGURE 7 is a schematic showing of a web transfer mechanism of another form with portions omitted for clarity; and

FIGURE 8 is a schematic showing of a portion of a web transfer mechanism of another form.

As shown on the drawings:

FIGURES 1 through 3 show a paper web W formed on a traveling Fourdriner wire 10 supported on a couch roll 11. Above the couch roll is a conventional lumpbreaker roll 12. The formed web W following the Fourdriner is transferred to the press section of the machine and is taken off of the wire 10 and transferred onto a traveling felt F.

The couch is shown as being a perforate suction couch with a suction gland 14 therein and the paper web W is transferred to the felt across an open draw D. A tail blow off jet 20 may be located within the couch to assist in the transfer of the web W.

In a conventional structure the felt is supported on a felt supporting roll and it has been discovered that at higher speeds air will become entrained between the felt and web at the location where the web is laid onto the surface of the felt F. These air pockets cause instability in the transfer. The invention utilizes the felt 13 in the roll 15 of such pockets between the felt and web until the web reaches the press will cause air blows to develop damaging the paper web. At lower web speeds these air pockets do not form but they are created at increased speeds so that if an existing machine is improved to be able to handle increased web speeds such web speed may be prevented by the entrainment of air between the felt and web at the open draw. The possible increased speeds are also prevented in new machines by the limits imposed due to the entrainment of air.

In accordance with the present arrangement the air pressure on the felt is reduced slightly at the location where it receives the paper web thereby preventing the formation of air between the felt and web. This is preferably accomplished by providing a felt supporting roll 13 with perforations 14 therein. Means are provided to tend to cause a flow of air inwardly through the perforations 14 in the felt over the area of the roll covered by the felt and particularly where the felt receives the paper web W. To cause the inward flow of air means are provided for drawing air outwardly from the felt supporting roll 13 over the circumferential area uncovered by the felt. This is preferably accomplished by providing the perforations 14 in the roll 13 at an angle extending radially outwardly in a trailing direction with respect to the direction of rotation of the roll 13.
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The trailing perforations pass skinner blades 15 which run close to the outside of the roll shell 13 to produce a slight air movement. The roll shell 13 preferably has a closed end 19, as shown in FIGURE 3 such as by providing a solid end wall supporting the end journal 18a within a roll support bearing 18.

The skinner blades 15 extend radially outwardly and are angled outwardly in a forward direction with respect to the direction of rotation of the roll shell 13.

Various skinner blade arrangements may be employed and forwardly curved blades such as shown at 15 in FIGURE 1 may be employed that may be formed of plastic such as Micarta or stainless steel. Also solid heavier blades such as shown at 15 in FIGURE 2 may be employed formed of plastic to form diverging air passages 24 leading outwardly away from the roll. The blades are suitably mounted at their ends at an end support 22 and spaced arcuate strengthening walls or supports 23 may be provided at axially spaced locations along the blades.

The skinner blades 15 produce slight air movement outwardly of the roll of the uncovered portion, causing an air movement inwardly away from the couch 11 at the felt covered portion.

The pressure reduction within the felt supporting roll 13 is very small and a pressure reduction in the range of 1 to 10 inches of water has been found satisfactory. This small pressure reduction will produce a slight air movement and will reduce the pressure in the felt at the location where it receives the web W following the open draw D.

FIGURE 4 shows an open draw arrangement wherein a couch roll 25 transfers a paper web W onto a felt F supported on a perforate felt roll 27 provided with skinner blades 28. The open draw includes a stabilizing roll 26 engaging the draw of the web preventing fluttering and aiding safe, more stable higher running speeds. The creation of the outward flow of air and reduction of pressure in the felt beneath the web again prevents the capturing of air pockets which may create bulges or wrinkles in the traveling paper web or blow-outs as the web passes through the press nip.

FIGURE 5 shows the principles of the invention in combination with a press couple embodying upper and lower press rolls 29 and 30 with the lower press roll being perforate and having a suction gland 30a. Other press couples may be employed such as having a lower plain press roll 30 or the lower roll may be grooved. A web W is supported on a felt F-1 and following the nip N the web travels a short open draw D onto a felt F-2. The felt F-2 is supported on a perforate supporting roll 31 which is provided with skinner blades 32 on its exposed portion for causing air movement in accordance with the principles of the arrangements of FIGURES 1 through 4. The web W travels onto the felt F-3 with an absence of air therebetween into a second press nip N-2 formed between press rolls 33 and 34.

FIGURE 6 illustrates a press having successive press nips with a center plain press roll 35 and opposed press rolls 36 and 37 diametrically opposite, shown with suction glands 36a and 37a. The web enters the press in the first nip N-1 carried on the first felt F-1. Following the first nip the web follows the circumference of the center press roll 35 and enters the second nip N-2 and is transferred across a draw D onto a second felt F-2. The felt F-2 is supported on a perforate felt supporting roll 38 provided with skinner blades 39 in a construction similar to that shown in FIGURE 2. This arrangement prevents the formation of air pockets beneath the web W and permits the web to be carried on the second felt F-2 free of air pockets and at relatively high speeds.

As a summary of operation, as shown in FIGURE 2, the web W passes across the open draw D onto the felt F which is maintained at a slightly reduced pressure beneath the web W due to the tendency of air to flow inwardly through the perforations 14 in the roll shell 13. Air is drawn outwardly by skinner blades 15 which are in close running relation with the outer surface of the roll shell 13 over its exposed area.

While the device is shown on a pickup roll it will be understood that it is applicable whenever a sheet is traveling on a belt, as, for example, a turning roll.

As shown in FIGURE 7, a web W is transferred onto a felt F carried on a felt supporting roll 41 which is designed in accordance with the principles of a transverse flow fan. The roll 41 has a plurality of radially forwardly curved passages 42 extending therethrough and the roll is hollow being a roll shell so that the passages 42 lead radially through the roll shell. The passages are curved forwardly in the direction of rotation and induce a flow of air inwardly in the area as indicated by the arrows 43 and outwardly in the area indicated by the arrows 44. The rotor or roll shell 41 draws the air transversely through the roll shell preventing a build-up of air pressure just as the web is received on the felt F. The passages 42 are curved forwardly such as by forming openings through the roll shell or by building the roll shell up of curved vanes. The curvature of the passages 42 may, for optimum performance, be designed in accordance with the principles of transverse flow fan rotors of types known to the art. Various types of transverse flow fans which are known are commonly termed the European type, the Buck type, the Coester type and the Datwyler type. Buffers or housings such as shown at 45 may be provided for controlling and directing the flow of air, and in certain types, such as the Coester type, flow passages are provided through the housing for recirculation of a portion of the air flow induced by the rotating rotor or roll shell.

Thus it will be seen that flow of air is induced inwardly in each of the arrangements above described, at the location where the web is placed on the felt. In addition to reducing the pressure at this location, it is also significant that the provision of a roll with recesses in the surfaces provides a path for air to escape. While a passage extending radially through the roll shell is preferred, it is advantageous to provide a path for the escape of air by providing a grooved supporting roll for the felt. As illustrated in FIGURE 8, a web W is received on a looped felt F supported on a roll 46. The roll 46 is provided with grooves or recesses 47 in its surface which preferably either extend axially or circumferentially to provide a path for the escape of air which tends to be trapped beneath the web. The grooves 47 may have a spiral or a herringbone pattern or may extend axially out the ends of the roll and means may be provided for inducing the flow of air through these escape grooves in the surface.

Thus it will be seen that I have provided an improved web transfer structure for use in a web handling machine and particularly for a paper machine, which meets the objectives, advantages and features above set forth. The mechanism permits increase in speeds so that a speed limit on the machine is not imposed by the web transfer section, and the mechanism employed does not necessarily involve mechanism having moving or power driven parts and the structure can be utilized in existing or new machinery without consuming unavailable space.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. In a paper machine the combination comprising:
   1. a felt loop for receiving and carrying a paper web,
   2. a supporting roll shell wrapped by said felt loop engaging the felt over a portion of its circumference and being uncovered by the felt over another portion of its circumference,
said roll shell mounted for rotation in a predetermined direction,
means defining radial openings through said roll shell,
and skinner blades extending radially outwardly and angled inwardly forward with respect to roll shell rotation positioned at said uncovered portion withdrawing air outwardly from said openings and tending to draw air away from the felt in said covered portion.

2. In a paper machine the combination comprising,
a felt loop for receiving and carrying a paper web,
a felt supporting roll shell wrapped by said felt loop engaging the felt over a portion of its circumference and being uncovered by the felt over another portion of its circumference,
said roll shell mounted for rotation in a predetermined direction,
means defining radial openings through said roll shell,
and skinner blades extending radially outwardly and angled inwardly forward with respect to roll shell rotation positioned at said uncovered portion of the roll shell withdrawing air outwardly from said openings and tending to draw air away from the felt in said covered portion.

3. In a web carrying mechanism, the combination comprising,
a felt supporting roll shell for a web carrying felt,
a felt loop trained over said roll shell receiving and carrying a web thereon,
said roll shell having radial vanes which define radial passages therebetween,
said vanes inducing a flow of air radially outwardly where the roll is free of contact with the felt to reduce the pressure within the roll shell and tend to draw air through the felt and hold the web on the felt.

4. In a paper machine the combination comprising,
a felt loop for receiving and carrying a paper web,
a felt supporting roll shell wrapped by said felt loop engaging the felt over a portion of its circumference and being uncovered by the felt over another portion of its circumference,
said roll shell mounted for rotation in a predetermined direction,
means defining radial openings through said roll shell,
and skinner blades extending generally radially outwardly with respect to the roll shell and positioned at said uncovered portion withdrawing air outwardly from said openings and tending to draw air away from the felt in said covered portion.

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