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(12) (19) (CA) **Demande-Application**

(21) (A1) **2,270,755**
(22) 1999/05/04
(43) 1999/11/20

(72) PULKOWSKI, Jeffrey Henry, US
(72) DESHPANDE, Rajendra D., US
(71) BELOIT TECHNOLOGIES, INC., US

(51) Int.Cl.[6] D21F 7/12
(30) 1998/05/20 (082,389) US

(54) **FEUTRE SECHEUR**
(54) **A DRYER FELT DEVICE**

(57) A dryer felt device is disclosed for supporting a web which extends through a single tier drying section of a paper machine. The device includes a looped felt which has a permeability which is greater than 90 cfm.

ABSTRACT OF THE DISCLOSURE

A dryer felt device is disclosed for supporting a web which extends through a single tier drying section of a paper machine. The device includes a looped felt which has a permeability which is greater than 90 cfm.

TITLE: A DRYER FELT DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a dryer felt device for supporting a web which extends through a single tier drying section of a paper machine.

More specifically, the present invention relates to a looped felt which extends around a plurality of dryer cylinders of a single tier drying section.

INFORMATION DISCLOSURE STATEMENT

In the papermaking art, a pressed web is transferred to a drying section of a paper machine so that water remaining in the web is driven therefrom by passing the web around a plurality of dryer cylinders disposed in a single tier.

More specifically, with the advent of the BelChamp type drying section, drying speeds have greatly increased.

More specifically, U.S. Patent No. 4,934,067 assigned to Beloit Technologies, Inc., disclosed a BelChamp type dryer of the single tier type and envisioned that drying speeds of 10,000 feet per minute could be attainable. Already machine speeds of 8,000 feet per minute are being attained on a single tier pilot machine.

However, in the aforementioned arrangement even when a vacuum roll is disposed in close proximity with adjacent drying cylinders, there

exists a tendency for the sheet to blow away from the supporting dryer felt or fabric when the web is moving from the dryer towards the vacuum roll.

The present invention overcomes the aforementioned problem of sheet blowing by the provision of a looped dryer felt having a high permeability. The high permeability tends to permit the vacuum within the vacuum roll to generate a negative pressure on the opposite side of the felt run relative to the web during transit of the web from the dryer to the vacuum roll.

Therefore, it is the primary objective of the present invention to provide a dryer felt device which overcomes the aforementioned problems associated with the prior art arrangements and which make a considerable contribution to the art of drying a web.

SUMMARY OF THE INVENTION

The present invention relates to a dryer felt device for supporting a web which extends through a single tier drying section of a paper machine. The device includes a looped felt which has a permeability which is greater than 90 cfm (cubic feet per minute).

More specifically, the present invention includes a dryer felt having a permeability which is greater than 150 cfm and preferably at least 600 cfm.

Many modifications and variations of the present invention will be readily apparent to those skilled in the art by consideration of the detailed description contained hereinafter taken in conjunction with the annexed drawings. However, such modifications and variations fall within the spirit and scope of the present invention as defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevational view partially in section of a drying cylinder and an adjacent vacuum roll showing the web blowing away from the drying fabric.

Fig. 2 is a side elevational view similar to that shown in Fig. 1 but with the vacuum roll disposed in close proximity to the adjacent dryer.

Fig. 3 is a similar view to that shown in Fig. 2 but includes a dryer fabric which has a high permeability according to the present invention.

Fig. 4 is a side elevational view of a first dryer section of a single tier drying section of a paper machine according to the present invention.

Similar reference characters refer to similar parts throughout the various views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 is a side elevation view of part of a prior art single tier drying section generally designated 10 having a drying cylinder 12 and an adjacent vacuum roll 14. A dryer fabric or felt 16 extends between the drying cylinder 12 and the vacuum roll 14 and the web W is shown being blow away from the supporting fabric 16 during transit between the drying cylinder 12 and the vacuum roll 14.

Fig. 2 is a similar view to that shown in Fig. 1 but it shows the vacuum roll 14 disposed in close proximity relative to the dryer 12.

Fig. 3 is a similar view to that shown in Fig. 1 but shows the vacuum roll 14A disposed in closer proximity to the adjacent drying cylinder 12A and a felt having a high permeability according to the present invention.

Fig. 4 is a side elevation view of a first dryer section 18 of a drying section of a papermaking machine.

More specifically, as shown in Fig. 3, a dryer felt device 16A supports a web WA which extends through a single tier drying section 18 of a papermaking machine. The device 16A includes a looped felt 16A having a permeability which is greater than 90 cfm.

In one embodiment of the present invention, the permeability of the dryer felt is at least 150 cfm and in a preferred embodiment of the present invention the permeability is at least 600 cfm.

In the prior art BelChamp type dryer sections, the dryer felt 16 has typically had a permeability of less than 90 cfm. The aforementioned low permeability fabrics tend to clog easily and they are difficult to clean.

Additionally, another problem with the use of low permeability fabrics or felts is that the application of an effective vacuum at the paper surface as the paper passes over the vacuum roll is reduced.

Also, low permeability or closed fabrics are more likely to lower the drying rate of the paper web.

The present invention includes the employment of an open fabric or dryer felt having a permeability of at least 90 cfm and usually greater than 150 cfm. Additionally, trials on a pilot single tier BelChamp type dryer section have shown that an open fabric having a high permeability of 600 cfm can be used without blowing the sheet in the pocket areas.

Furthermore, such open fabrics are easier to clean and there is the potential for increasing the drying rate.

An additional advantage of using a high permeability fabric is that the cost of production thereof may be reduced.

Clearly, the advantages of using a high permeability fabric include improved machine runnability since the fabric stays open and is easy to clean thereby increasing the drying capacity of the drying section.

The present invention also envisages use of the aforementioned high permeability fabric which is capable of withstanding high temperatures such as is present in those machines incorporating an air cap for blowing heated air through the aforementioned fabric onto the web disposed between the fabric and the dryer cylinder.

The advantage of the aforementioned air cap type drying section is that the length of the dryer section can be reduced thus resulting in capital savings.

Furthermore, the dryer capacity is variable which may be important for future multigrade machines.

Also, drying on both sides of the sheet using air caps provides better curl control and the potential for eliminating any bottom felted sections.

The felt according to the present invention is preferably of the type having an open structure and having a permeability of 600 cfm while being of a lower caliper.

The aforementioned fabric according to the present invention may be utilized in a single tier drying section having vacuum rolls which may be of the stationary type or pivoting vacuum rolls.

Also, the fabric according to the present invention may be utilized in a single tier drying section having passive vacuum boxes which generate a negative pressure due to their proximity to adjacent vacuum rolls.

During trials using a high permeability fabric according to the present invention, the web ran well in all pockets at 3,000 feet per minute. Also at 3,500 feet per minute the web ran well in pockets incorporating passive vacuum boxes of the aforementioned type.

As shown in Fig. 4, vacuum boxes 20 and 22 were disposed in the pockets between the second and third dryers 24 and 26 and the third dryer 26 and fourth dryer 28, respectively.

The vacuum box 22 in the third pocket had felt seals of a simple design due to the fixed geometry. The center shaft and seals in the second and third vacuum rolls 30 and 32 respectively were rotated counterclockwise 4 inches and 2.5 inches respectively, to provide more vacuum in the box 22. The trial plan included comparing a conventional BelChamp type fabric having a permeability of 90 cfm with an open fabric having a permeability of 600 cfm. The trial included the following criteria.

- Run conventional BelChamp 90 cfm fabric.
- Draw: 50 (2nd press) - 60 (sample felt) - 10 (1st press) fpm
- Pocket/vacuum roll # — Gap between dryer and VFR — Vacuum in the roll

Pocket/vacuum roll #	Gap between dryer and VFR	Vacuum in the roll
2 (passive box)	2"	10" water column
3 (passive box with felt seals)	3"	10" water column
4	2"	10" water column
5	3"	10" water column
6-7	0.5"	10" water column

- Machine speed 3000 fpm or higher
- Change following conditions 30 min. prior to shut down
  Draw: 40 (2nd press) - 45 (sample felt) - 10 (1st press) fpm
  Lower VFR 6 and 7 to 3"

- Run open (600 cfm) fabric
- Run same conditions as above
- In case of threading or runnability problems:
  Increase the vacuum in the rolls
  Move the VFRs (4 - 7) closer to the dryer while threading/running
  Reduce machine speed

From the above trials, it became apparent that conventional BelChamp fabrics having a permeability of 90 cfm were causing serious sheet blowing problems without the vacuum boxes at 3,000 feet per minute. However, as shown in Fig. 1, as the gap between the dryer 12 and the vacuum roll 14 increased, the sheet flutter and blowing problem became worse.

Even for the closed gap arrangement shown in Fig. 2, having a gap of .5 inches between the dryer 12 and the vacuum roll 14, the sheet W became slightly separated from the fabric 16 and had a tendency to follow the dryer 12. However, the sheet in the second and third pocket ran very well and stuck to the fabric 16A due to the passive vacuum boxes 20 and 22 even when the vacuum in such boxes 20 and 22 was very low. The vacuum in the second and third roll 30 and 32 was varied to observe the effect of low vacuum in the boxes on runnability. Even for zero vacuum in

the rolls 30 and 32 there was some negative pressure in the boxes 20 and 22 which was enough to hold the sheet WA against the fabric 16A. Such was thought to be due to the foil effect of the cross machine seal. The vacuum levels in the rolls 30 and 32 and the boxes 20 and 22 are given in Table 1. The vacuum in the third pocket box 22 was higher than the second pocket box 20 due to better sealing. The vacuum level in the boxes 20 and 22 had no effect on runnability. Therefore, center shaft and seal rotation are not necessary to obtain more vacuum in the boxes. The change in draw had no significant effect on runnability.

For the open fabric 16A, the sheet WA ran better than with the closed fabric at 3,000 feet per minute machine speed. Threading with vacuum rolls in an open position that is with a three inch gap between the dryer and the vacuum roll, was as good as threading with vacuum rolls in the closed position that is the .5 inch gap. The sheet WA separated from the fabric 16A in pockets 34, 36, 38 and 40 by approximately 3/8 inch but was stable and without flutter. Accordingly, it became apparent that the openness, that is the permeability or cfm value, had a major influence on sheet flutter causing the reduction thereof. The sheet ran very well in the second and third pocket and sheet marking was reduced by decreasing the vacuum level and felt tension.

Table 1
Vacuum in the Rolls and Boxes

Pocket	Vacuum in the roll, in. of water column		Vacuum in the box, in. of water column	
	Bel-Champ Fabric	Open fabric	Bel-Champ fabric	Open fabric
2	9.8	10.3	0.74	0.47
	3	3	0.27	0.18
	0	1.2	0.03	0.08
3	10.2	10	1.25	0.68
	3	1.51	0.47	0.15
	0		0.06	

To study the effect of machine speed, 30 minutes prior to shut down, the speed was increased to 3,500 feet per minute.

The sheet blowing and flutter increased significantly in non-passive vacuum box pockets with increase in speed. Runnability in the passive vacuum box pockets was not affected by speed.

Accordingly, it was concluded that the use of open fabrics in existing BelChamp or single tier designs will greatly increase the speed at which such dryer sections can be operated.

WHAT IS CLAIMED IS:

1. A dryer felt device for supporting a web extending through a single tier drying section of a paper machine, said device comprising:

a looped felt having a permeability which is greater than 90 cfm.

2. A dryer felt as set forth in claim 1 wherein said permeability is at least 150 cfm.

3. A dryer felt as set forth in claim 1 wherein said permeability is at least 400 cfm.

4. A dryer felt as set forth in claim 1 wherein said permeability is at least 600 cfm.

Ridout & Maybee
Suite 2400
One Queen Street East
Toronto, Canada M5C 3B1
Patent Agents of the Applicant

PRIOR ART

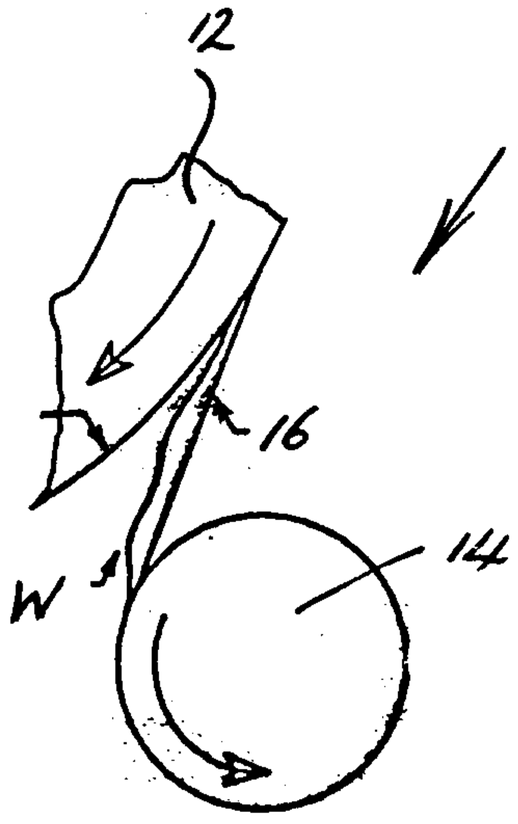

FIG 1

PRIOR ART

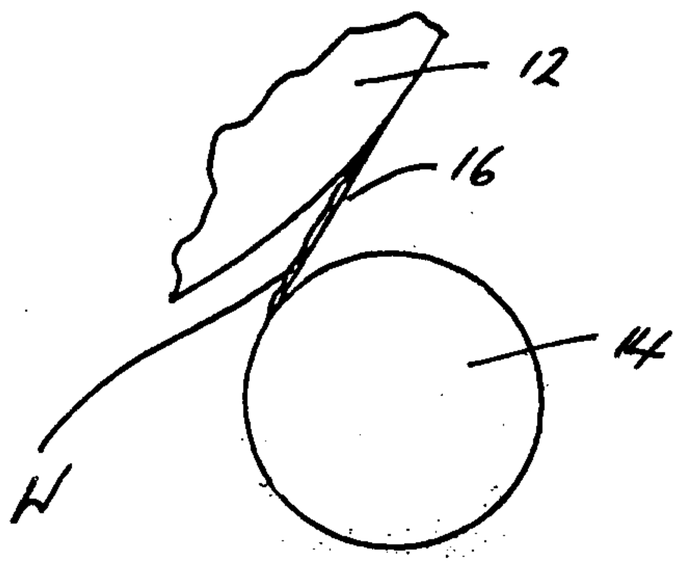

FIG 2

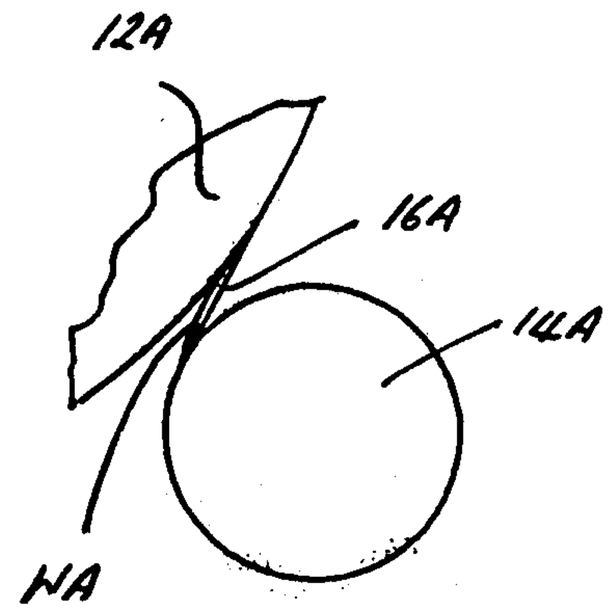

FIG 3.

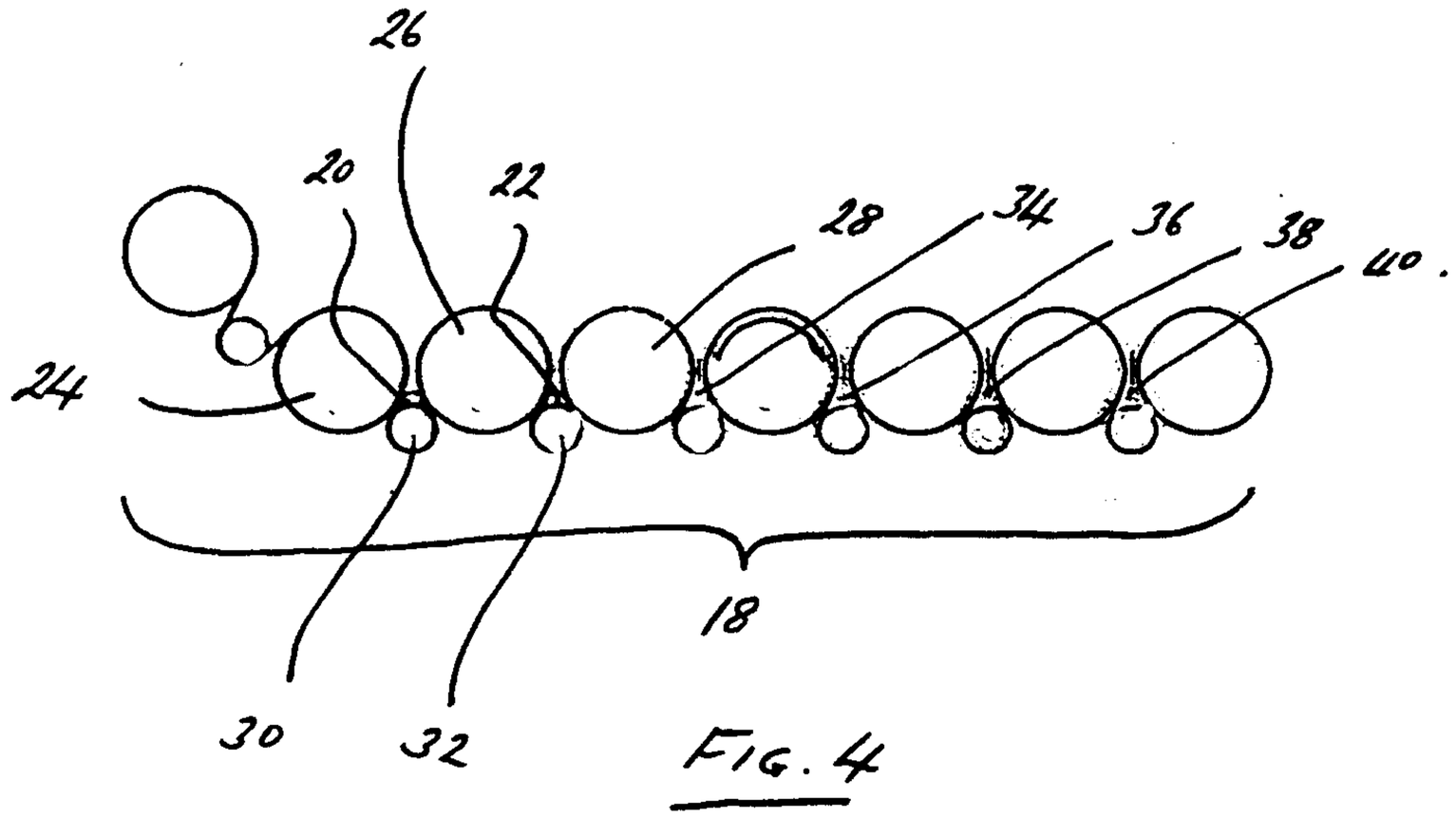

FIG. 4