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DRYING CYLINDERS WITH FELT IDLERS POSITIONED TO PREVENT FLUTTERING OF THE WEB BEING TREATED

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FIG. 1

PRIOR ART

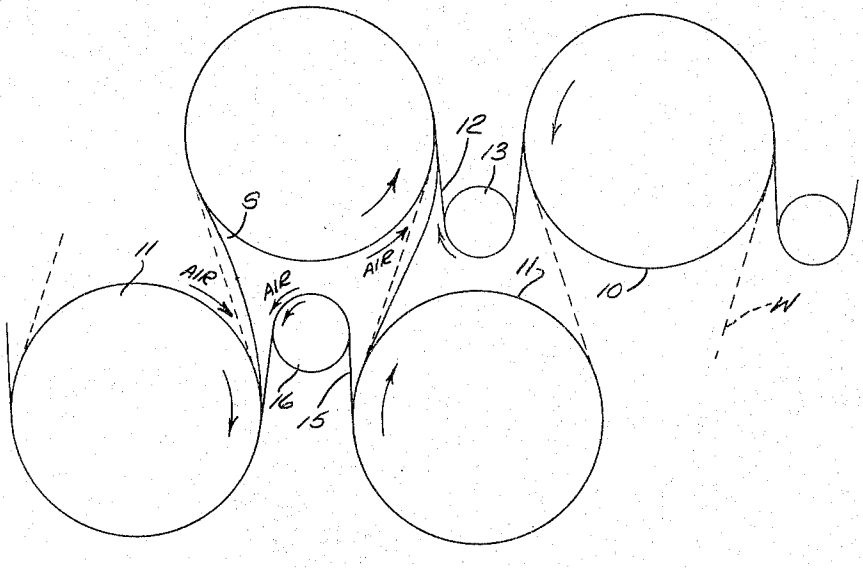
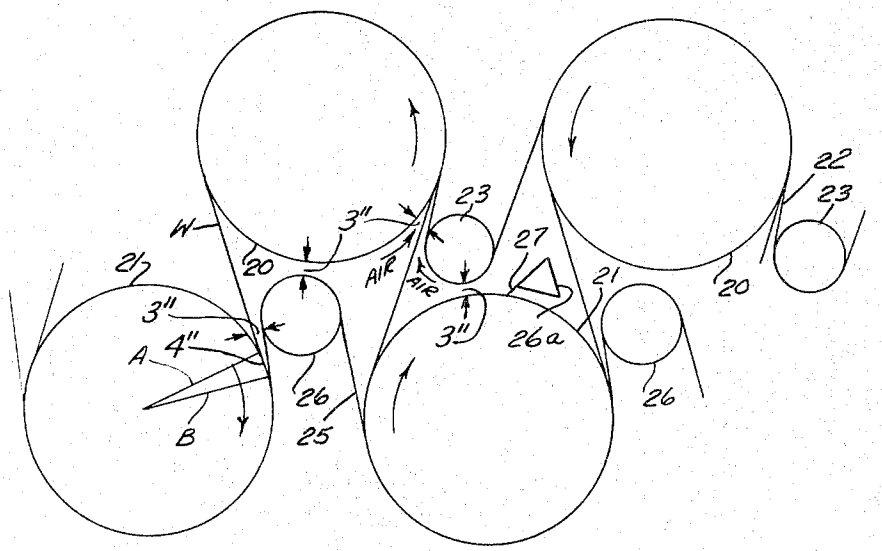


FIG. 2



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DRYING CYLINDERS WITH FELT IDLERS POSITIONED TO PREVENT FLUTTERING OF THE WEB BEING TREATED

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ABSTRACT OF THE DISCLOSURE

Paper drying apparatus and system having rows of upper and lower drying cylinders along which a fibrous web is trained in a serpentine path. Separate upper and lower felt runs are partially wrapped about the drying cylinders, to hold the fibrous web to the cylinders. These felt runs are trained about upper and lower felt idlers between the cylinders of each row of cylinders, which reverse the travel of the felts and create air currents in the pockets between the incoming and outgoing runs of the web. The felt idlers are closely positioned adjacent the outgoing and incoming sides of the drying cylinder of two vertically spaced rows of drying cylinders and a substantial distance from a next succeeding outgoing drying cylinder to equalize the air currents on the outgoing and incoming sides of the web as trained from a lower drying cylinder to an upper drying cylinder and back to a lower drying cylinder.

This invention relates to improvements in dryers for drying fibrous webs and more particularly relates to an improved felt idler arrangement for paper machine dryers.

Paper machine dryers usually consist in a series of rotatable drying cylinders arranged one after the other in two vertically spaced horizontally extending rows. The wet fibrous web is trained in a serpentine path partially about an upper drying cylinder and then downwardly partially about a lower drying cylinder and upwardly partially about a next succeeding upper drying cylinder and alternately about the lower and upper drying cylinders to the end of the dryer.

Separate felt runs are provided for the rows of upper and lower drying cylinders to hold the fibrous web to the cylinders as it travels thereabout from an upper to a lower cylinder and then from a lower to an upper cylinder throughout the length of the dryer line. A series of felt idlers between the rows of upper and lower drying cylinders retains the felts to pass about the respective rows of dryer cylinders.

In conventional dryers the felt idlers are usually located midway between the upper drying cylinders for the upper felt run and midway between the lower drying cylinders for the lower felt run. With such a location of felt idlers the rotating drying cylinder creates air currents at the incoming run of the felt. Similar, but equal currents are created by the felt as it passes about its felt idler to the incoming drying cylinder.

On paper webs and particularly on light weight papers there is a tendency for the wet sheet to relax as it passes about the drying cylinder. This, with the unequal air currents, causes a fluttering or billowing of the web, with the result that the web frequently breaks and must be rethreaded about the drying cylinders, resulting in the idling of the dryer and a time consuming operation of rethreading the web.

A principal object of the present invention is to remedy the foregoing deficiencies in dryers, by so arranging the felt rolls of a continuous dryer that the air pressures on each side of the web as it passes from a drying cylinder of one row of drying cylinders to a drying cylinder of another vertically spaced row of drying cylinders will be substantially balanced.

Another object of the invention is to improve upon the fibrous web dryers heretofore in use by locating the felt idlers closer to the incoming drying cylinders of each row of drying cylinders than the outgoing drying cylinders in the same row of drying cylinders, to equalize the air pressures on opposite sides of the web as the web passes from an upper drying cylinder to a lower drying cylinder.

A further object of the invention is to provide an improved arrangement of felt idlers for training the upper and lower felt runs to the upper and lower rows of drying cylinders of a fibrous web dryer, in which the felt idlers for the upper felt runs are spaced closer to the incoming drying cylinders than the outgoing drying cylinders of the same row of drying cylinders and are spaced substantially the same distance from the outgoing side of a drying cylinder of one level of rows of drying cylinders as from the incoming drying cylinder of a different level of rows of drying cylinders, to equalize the pressures on opposite sides of the fibrous web as trained from a lower drying cylinder to an upper drying cylinder and from an upper drying cylinder to a next adjacent lower drying cylinder, to thereby prevent fluttering or billowing of the fibrous web as passing from one vertically spaced drying cylinder to another.

Still a further object of the invention is to provide an improved form of dryer in which the pressures on opposite sides of the fibrous web as trained from an upper to a lower drying cylinder and vice versa are equalized by spacing the felt idlers to close the area between the felt idler and incoming drying cylinder of one row of drying cylinders and the outgoing drying cylinder of a second row of drying cylinders and vice versa to equalize pressures on opposite sides of the web and to effect the directing of wads of broken web into the nips between the felts and drying cylinders to be conveyed out of the dryer section by the felts and drying cylinders.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawing wherein:

FIGURE 1 is a diagrammatic view of a part of a section of a conventional drying section; and

FIGURE 2 is a diagrammatic view of a part of a section of a drying section constructed in accordance with the principles of the present invention.

In FIGURE 1 of the drawings we have diagrammatically shown a portion of a dryer section of a paper machine in which a paper web W, indicated by dashed lines, travels from right to left and is trained in a serpentine path to first pass partially around an upper drying cylinder **10** of a row of successively arranged upper drying cylinders **10** and downwardly partially around a lower drying cylinder **11** of a row of successively arranged lower drying cylinders **11** and upwardly from the lower drying cylinder partially around the next upper drying cylinder and downwardly therefrom to the next adjacent lower drying cylinder to the end of the drying section. The paper web W is maintained in engagement with the top series of drying cylinders **10**, **10** by a felt **12** partially wrapped about said cylinders by felt idlers or rollers **13** disposed therebetween. In a like manner the web is maintained partially wrapped around the bottom series of drying cylinders **11**, **11** by a felt **15** partially wrapped about said cylinders by felt idlers **16**, **16** therebetween.

The felts **12** and **15** are formed of an open type or regular felt fabric for encouraging evaporation of moisture from the web, but may also be formed of plastic

wire fabric such as is used on fourdriniers. A material such as a foraminous plastic wire or fabric of the type known as Formex fabric permits moisture vapor to be driven out of the pockets between the drying cylinders and enables the fabric to be maintained clean and open. A dense felt, however, may also be used and would be equally as effective as an open type felt for many installations.

The fibrous web usually passes to the drying cylinders **10** and **11** to be partially wrapped thereabout by the felts **12** and **15**, as it leaves the nip of a press section, and is trained partially about the upper and lower drying cylinders in a serpentine path either by hand or by "sheehan ropes" in a conventional manner, which need not herein be shown or described since it forms no part of the present invention.

The upper and lower felts **12** and **15** pass from the last drying cylinder of the series of drying cylinders to felt dryers, and in passing to the felt dryers are trained so that the sides of the felts engaging the drying cylinders as they pass about their respective drying cylinders, are trained outside of their training idlers, to face the outside, and the felts leave the last drying cylinder of the series of drying cylinders and are dried when passing from the last to the first drying cylinder, as shown and described in our application Ser. No. 429,977 filed Feb. 3, 1965.

With the felt idler arrangement shown in FIGURE 1 air currents are generated by the drying cylinders in the direction of rotation thereof while contra air currents will be generated by the felts in the direction of travel thereof and on the opposite side of the sheet or web from the air currents generated by the rotating drying cylinder.

With conventional forms of felt idler arrangements shown in FIGURE 1 the air pressures on opposite sides of the web are unequal and the air currents generated establish a suction area as the web leaves one drying cylinder and a pressure area of less pressure than the pressure generated through the incoming drying cylinder. The wet web also has a tendency to relax as it passes to the incoming drying cylinders, particularly where the web is of a light weight material. The relaxing of the web and unequal air pressures cause fluttering or billowing of the web with the resultant frequent breaking of the web.

In FIGURE 2 we have shown a method of reducing fluttering or billowing of the web by closing the spaces between the felts and the incoming drying cylinders. Two upper drying cylinders **20** of a series of aligned upper drying cylinders are shown and two lower drying cylinders **21** of a series of lower drying cylinders are shown as disposed therebetween and therebeneath, and having a web W trained about said cylinders in a serpentine path. An upper felt **22** is wrapped about the web wrapped partially about the drying cylinders **20**, **20** by felt idlers **23**, **23**. A lower felt **25** is wrapped about the web wrapped partially about the lower drying cylinders **21**, **21**, by lower felt idlers **26**, **26**. The felt idlers **23**, **23** and **26**, **26** are so arranged with respect to the drying cylinders **20** and **21** and the incoming and outgoing runs of the web, as to close up the areas between the felts and web and thereby equalize the air currents on opposite sides of the web and prevent fluttering or billowing of the web, even where the web may slacken as it passes to an incoming drying cylinder.

As shown in FIGURE 2, an upper felt idler **23** is spaced close to the lower outgoing drying cylinder **21** and the upper incoming drying cylinder **20** and is spaced equal distances from the peripheries of the two cylinders.

In a similar manner a lower felt idler **26** is spaced close to the lower incoming drying cylinder **21** and the periphery of the upper outgoing drying cylinder **20** the same distance as the felt idler **23** is spaced from the outgoing and incoming drying cylinders.

The particular spacing shown should be at least 3 inches, although the spacing may be increased slight amounts where required. It should further be noted that with the construction shown line A is a radial line perpendicular to the web as it comes onto the drying cylinder **21** while line B is drawn perpendicular to the felt run as it comes onto the drying cylinder **21**.

The space between these lines along the periphery of the cylinder may be in the order of 4 inches, indicating a travel of the web for a distance of four inches prior to being contacted by the felt **25** and further reducing the tendency of the web to relax as it comes onto a drying cylinder and thereby maintaining the web taut.

In FIGURE 2 we have also shown a doctor back **26a** and doctor blade **27** spaced from the incoming felt run as it enters a first drying cylinder **21**, in doctoring cooperation with said drying cylinder. The doctor back **26** is spaced from the incoming felt run a distance sufficient to provide a relatively closed area and stabilize the draw and reduce blowing or unequal pressures on opposite sides of the web, as it comes onto the incoming drying cylinder **21**.

By bringing the top felt idler close to the incoming and outgoing drying cylinders, where the web may break for one reason or another, wads of broken web, commonly called broke, will be restricted from floating through the drying section and the wads will be directed into the felt and drying cylinder nip and carried out of the drying section thereby. The closing up of the area between the felt idlers and drying cylinders not only provides more uniform air pressures on opposite sides of the web with the resultant reduction in the tendency of the web to flutter, but also brings the felt into contact with the web as the web comes onto its drying cylinder in such spaced relation with respect thereto as to stabilize the draw and further reduce the tendency of the felt to flutter.

It may here be seen that the closing up of the area between the felt idlers and drying cylinders, in the manner shown in FIGURE 2 results in a distinctly improved dryer, substantially reducing breaking of the web caused by fluttering and billowing of the web, but also provides a self cleaning dryer in which the closely spaced felt idlers and drying cylinders restrict wads of broken web from floating through the dryer section, and direct the wads of web into the felt and drying cylinder nips to be carried out of the dryer section thereby.

While we have herein shown and described one form in which the invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

We claim as our invention:

1. In a drying apparatus for fibrous webs,

a series of drying cylinders arranged one after the other in vertically spaced rows and having a fibrous web trained thereabout in a serpentine path,

upper and lower felt runs in association with said upper and lower rows of drying cylinders and partially wrapping the web about said cylinders and absorbing moisture in the web when wrapping the web thereabout,

an upper felt idler between each pair of upper drying cylinders, changing the direction of the upper felt run as it passes from an outgoing to an incoming cylinder,

and a lower felt idler between each pair of lower drying cylinders changing the direction of the felt run as it passes from an outgoing to an incoming cylinder,

each upper felt idler being spaced closer to the incoming upper drying cylinder than the outgoing upper drying cylinder and being spaced from the next adjacent lower outgoing drying cylinder substantially the same distance it is spaced from the incoming upper drying cylinder, and

each lower felt idler being spaced closer to the incoming lower drying cylinder than the outgoing lower

drying cylinder and being spaced the same distance from the incoming lower drying cylinder as from the outgoing upper drying cylinder, and said upper and lower felt idlers closing the spaces between the web and said drying cylinders and providing contact of the web with the incoming drying cylinders prior to contact of the felt with the web, and thereby stabilizing the draw on the web and equalizing the air currents on opposite sides of the web.

2. A drying apparatus in accordance with claim 1 wherein the felt idlers are spaced from the associated incoming upper drying cylinder and outgoing lower drying cylinder and incoming lower drying cylinder and outgoing upper drying cylinder distances of at least three inches, and substantially lesser distances than the spacing of said felt idlers from the outgoing drying cylinders of each associated vertically spaced row of drying cylinders,

wherein the felt idlers so position the felt with relation to the web as the web travels from an outgoing to an incoming drying cylinder that travel of the web prior to being contacted by the felt is in the order of four inches.

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