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DRYING ROLL

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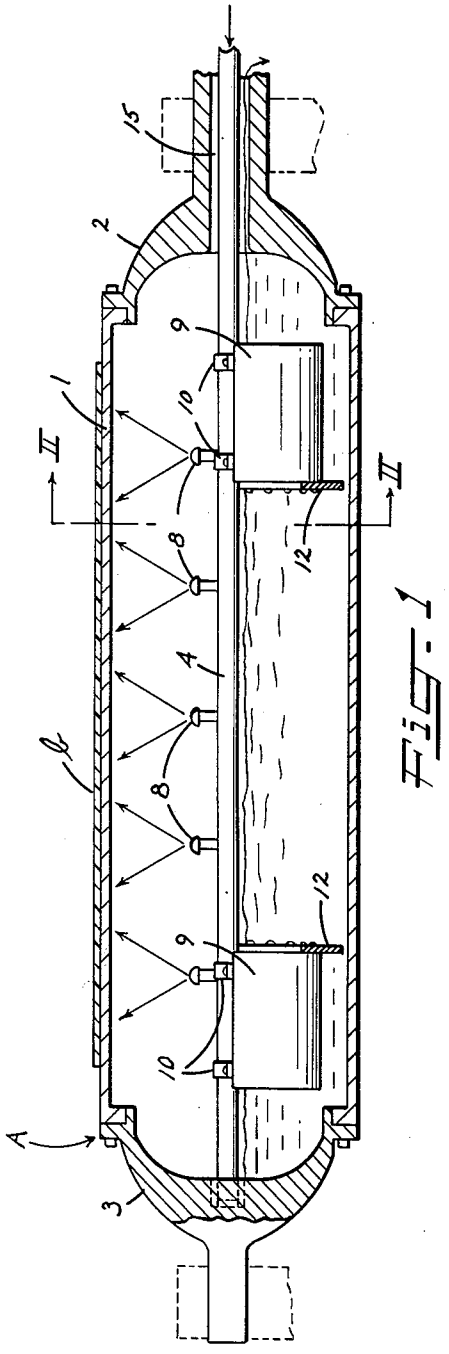


FIG. 1

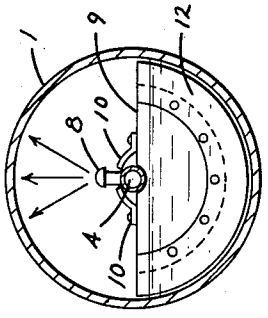


FIG. 2

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DRYING ROLL

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The present invention relates to a drying roll which may be used for drying continuously traveling sheets of flexible material such as cellophane. In particular, the invention relates to a drying roll which, when heated to a drying temperature, maintains a temperature differential between the end and central surface portions of the roll. In addition, the temperature differential may be adjusted as desired.

In the production of continuous sheets of flexible material, such as cellophane, it is the general practice to dry the wet sheets by passing them over a series of rotating, hollow rolls which are internally heated by a suitable heating medium such as steam. The roll surfaces are of substantially uniform temperature and because of this factor many difficulties and disadvantages are encountered which tend to produce final sheet products of inferior quality. For instance, when drying cellophane with the uniform surface temperature rolls, it has been found that the film edge portions are dried more rapidly than the central portion of the film whereby the final sheet has a non-uniform moisture content, the edge portions having less moisture than the central portions of the sheet. As a result of this non-uniform drying pattern, the sheet edge portions shrink more rapidly than the central portions of the sheet whereby the final film or sheet has curly or floppy edges which are easily torn or ripped thus causing damage to the entire sheet. Obvious difficulties are encountered when using such a sheet of non-uniform strength and moisture content in wrapping machines, packaging machines, and multi-colored printing machines.

Various drying methods and apparatus have been experimented with in an attempt to overcome the difficulties and disadvantages mentioned above, but without much success. For example, efforts have been made to mechanically prevent uneven shrinkage of the film during the drying operation by gripping the film on either side with suitable clamps to exert a pull on the sheet edges away from the center of the sheet thereby counteracting the rapid shrinkage of the sheet edge portions. However, it has been found that the clamps tear, rip, or create weak spots within the edge portions of the sheet or film.

It is therefore one object of my invention to provide a drying roll which will uniformly dry all portions of a continuous sheet traveling thereover to provide a final product having a uniform moisture content and a uniform shrinkage pattern.

Another object of my invention is to provide a drying roll wherein a temperature differential is maintained between the end and central portions of the roll surface.

It is a further object of my invention to provide a drying roll wherein the temperature differential of the roll may be varied or adjusted.

Still another object of my invention is to provide a drying drum wherein the maximum heat exchange between the drum surface and the heating medium introduced within the drum interior is substantially confined to the central portion of the drum.

Other objects and advantages of the invention will become more apparent from a study of the following description and drawings in which:

Figure 1 is a longitudinal section of the drying roll showing the internal make-up of the roll; and

Figure 2 is a cross section of the roll taken along line II—II of Figure 1.

Briefly, my drying roll comprises a hollow drum with end supports for journaling the drum in a suitable frame (not shown). A stationary heating medium feed pipe or conduit extends through one of the end supports into the drum interior and is journaled within the opposite end support. Suitable outlets such as spray nozzles leading off from the feed pipe deliver the drying medium to the central portion only of the inner surface of the drum shell and drum interior. Flow restricting pontoons are supported by and lie below the feed pipe adjacent the end portions of the drum interior whereby circulation of the heating medium is somewhat restricted in the end sections of the drum.

Referring now to the drawings, the drying roll A is shown with a sheet of paper such as cellophane or other flexible sheet material *b* passing thereover. The roll A comprises a hollow metal drum **1** having end supports **2** and **3** for journaling the drum in a suitable vertical frame support (not shown). A heating medium feed pipe **4** for conducting steam or other heating medium under pressure to the interior of the drum **1** extends through end support **2** and is journaled in the opposite end support **3**. The pipe **4** is stationary and does not rotate with the drum **1**. A series of spray nozzles **8, 8** extend from the feed pipe **4** to conduct the drying medium from the pipe to the inner surface of the drum shell and to the drum interior. The nozzles **8, 8** break up the drying medium passing therethrough into a fine spray and impel the spray directly against the inner surface of the drum **1**. Since the drying medium introduced to the drum under pressure, the spray strikes the drum surface with a force great enough to prevent the formation of or to break up the coating or film of condensed drying medium and lubricating oil which usually forms on the inner surface of the drum. By breaking up this film or coating, there results a more perfect and rapid heat-exchange between the heating medium and the drum wall.

As seen in the drawing, the nozzle **8, 8** are so positioned that they direct the spray of drying medium on the central portions of the inner drum surface only, there being no nozzles positioned under the end portions of the inner surface of the drum. With this arrangement of the nozzles **8, 8** along the feed pipe **4**, the temperature along the central portion of the inner drum surface and drum interior will be higher than along the end portions of the drum surface and interior. The positioning of the nozzles **8, 8** along the pipe **4** whereby they cooperate with the inner surface of the drum to spray the heating medium on only the central portions of the drum **1** constitute an important feature of my invention.

To further insure a temperature differential between the end and the more central surface portions of the drum **1**, liquid displacing or flow restricting members such as pontoons **9, 9**, another important feature of my invention, are affixed by clamps **10, 10** to the feed pipe **4** so that they lie below the feed pipe and adjacent the ends of the drum A. The pontoons are made of light weight metal, the joints of which are sealed to prevent drying medium from passing thereinto. The pontoons **9, 9** become submerged within the condensed drying medium as the condensed drying medium level builds up within the drum thereby displacing a quantity of the medium at each end of the drum to decrease the amount

of space in the end portions of the drum interior occupied by the heating medium. With this arrangement there is further assured a temperature differential between the end surface portions and the central surface portions of the roll since the greater quantity of the heating medium is restricted to the center of the drum. The pontoons **9**, **9** also restrict the flow of the condensed drying medium between the central and end sections of the roll A thereby decreasing the rate of heat exchange between the warmer medium in the center of the drum and the medium of lower temperature in the end sections of the drum. The position of the pontoons **9**, **9** along feed pipe **4** may be adjusted or varied as desired merely by loosening the clamps and sliding the pontoons lengthwise of the pipe whereby different temperature differentials may be set up within the drying roll A.

Gaskets **12**, **12** of metal or other suitable material, still another feature of my invention, are affixed to the ends of the pontoons **9**, **9** facing central portion of the drum A. The gaskets **12**, **12** extend downwardly from the pontoons **9**, **9** to form a loose fit with the inner surface of the drum **1**. A small clearance remains between the gasket and the inner wall of the drum **1**. The purpose of the gaskets **12**, **12** is to further restrict the flow of the condensed medium from the central to the end portions of the drum thus further decreasing the heat exchange rate therebetween to further effect a temperature differential between the end and central sections of the drum.

As seen in Figure 1, the condensed drying medium is discharged from the drum interior through passageway **15** formed by the bore of end support **2** and feed pipe **4** which extends through the bore.

It should be pointed out that the end surface portions of the drum will be of a sufficient temperature, although of a lower temperature than the central surface portions of the drum, to properly dry the edge portions of the sheet traveling over the drum since heat transfer occurs to a certain degree between the central surface portions of the drum and the end surface portions thereof. In addition, some heat transfer is, of course, effected by the heating medium present in the ends of the drum and the end surface portions of the drum.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. A drying roll for uniformly drying a continuous sheet of flexible material comprising a drum, end supports for the drum, a heating medium supply conduit extending through one end support, at least one outlet nozzle leading off from the supply conduit for directing the heating medium against the central section of the inner surface of the drum, and means affixed to at least one end of the supply conduit for substantially decreasing the area at one end of the drum interior which may be occupied by the heating medium.

2. A drying roll for uniformly drying a continuous sheet of cellophane comprising a drum, end supports for the drum, a drying medium feed pipe extending through one end support and journaled in the opposite end support, a plurality of spray nozzles leading from the feed pipe for directing the drying medium in spray form against the central section of the inner surface of the drum, and pontoons loosely affixed to the feed pipe, said pontoons lying adjacent the drum ends and below the feed pipe.

3. A drying roll for uniformly drying a continuous sheet of flexible material comprising a drum, end supports for the drum, a feed pipe extending through one end support and journaled in the opposite end support, spray nozzles leading from the feed pipe for directing the drying medium against the central section of the inner surface of the drum, pontoons secured to the feed pipe, said pontoons lying below the feed pipe and adjacent the end sections of the drum, and flow restricting members affixed to the pontoon which members extend downwardly to a position adjacent the inner surface of the drum to leave a slight clearance between the drum inner surface and the flow restricting member.

4. A drying roll for uniformly drying a continuous sheet of cellophane comprising a drum, end supports for the drum, a drying medium feed pipe extending through one end support and journaled in the opposite end support, a plurality of spray nozzles affixed to the feed pipe for directing the drying medium in spray form against the central section only of the inner surface of the drum, pontoons affixed to the feed pipe, said pontoons lying adjacent the drum end portions and below the feed pipe, gaskets affixed to the sides of the pontoons facing the center of the drum, said gaskets extending downwardly to a position adjacent the inner surface of the drum to leave a slight clearance between the drum inner surface and the gaskets, and means for discharging drying medium from the drum interior.

5. A drying roll for uniformly drying a continuous sheet of flexible material comprising a drum, end supports for the drum, a drying medium feed pipe extending through one end support and journaled in the opposite end support, a plurality of spray nozzles leading from the feed pipe for directing the drying medium in spray form against the central section of the inner surface of the drum, pontoons adjustably positioned on the feed pipe, said pontoons lying below the feed pipe and adjacent the ends of the drum, clamps affixed to the upper surface of the pontoons for securing the pontoons to the feed pipe, means for discharging drying medium from the drum interior, and gaskets affixed to the sides of the pontoons facing the center of the drum interior, said gaskets extending downwardly to a position adjacent the inner surface of the drum to leave a slight clearance between the drum inner surface and the gaskets.

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