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[33] **Canada**
[31] **56,304**

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[54] **WEB DRYING**
6 Claims, 7 Drawing Figs.

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34/159
[51] Int. Cl..... F26b 11/02
[50] Field of Search..... 34/114,
156, 159, 161, 113, 118

ABSTRACT: A paper drier of the conventional drying cylinder-type is provided with air pressure caps, to obviate the need of the presser felts, while pocket ventilation is provided and web wrap angle is increased; together with the provision of improved cap-sealing arrangements.

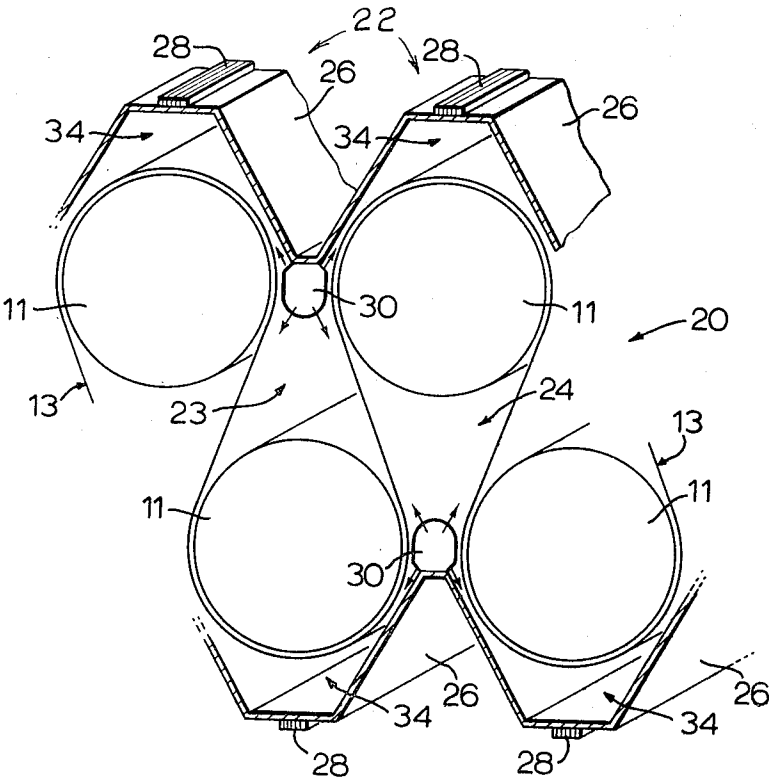


FIG. 1
(PRIOR ART)

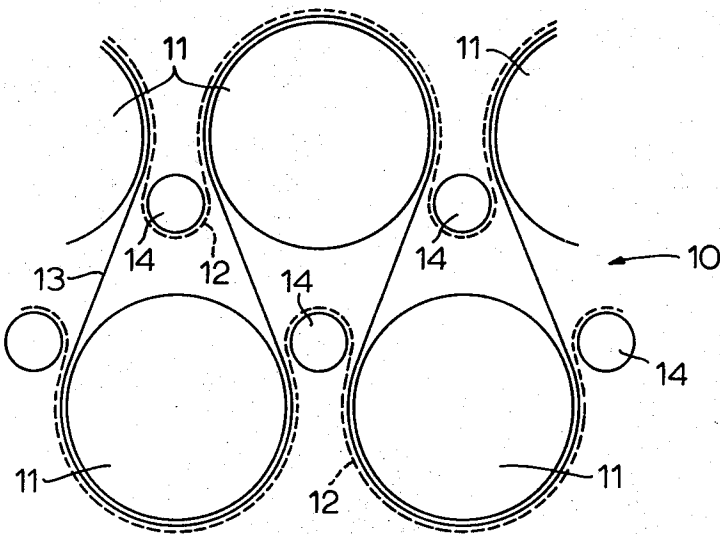


FIG. 2

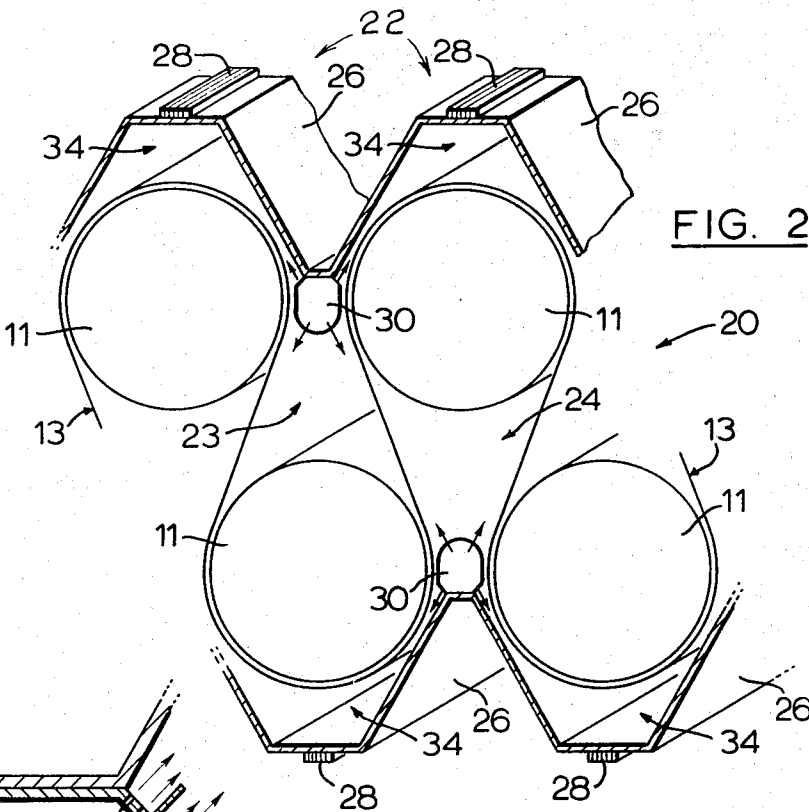
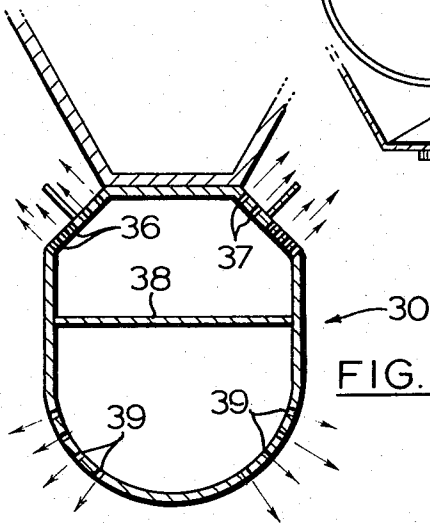


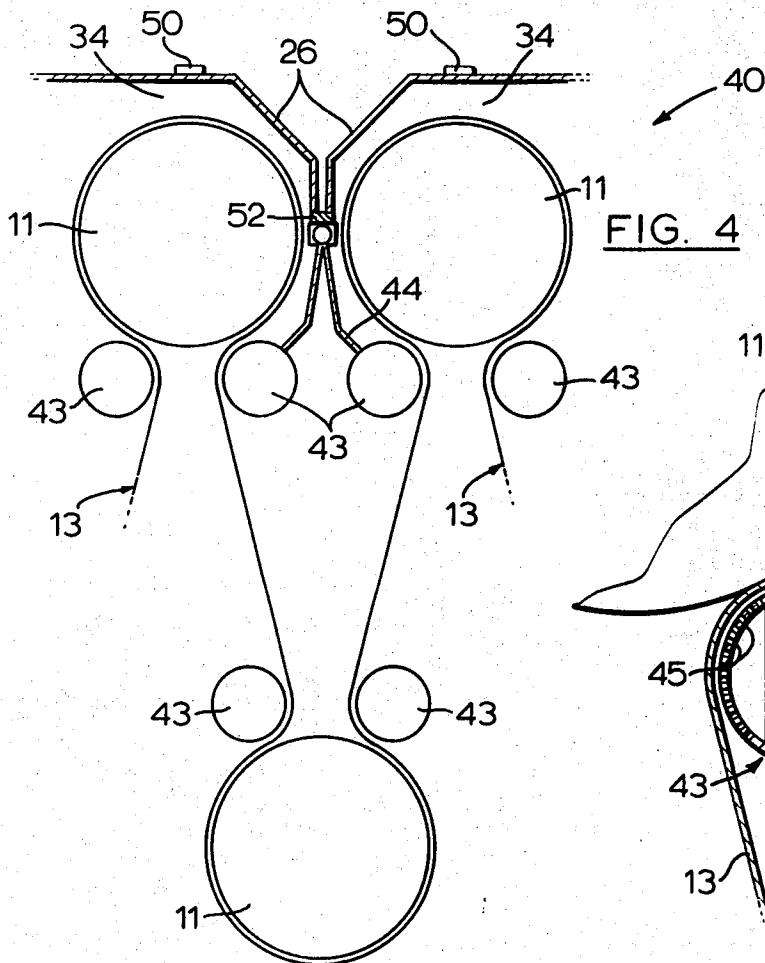
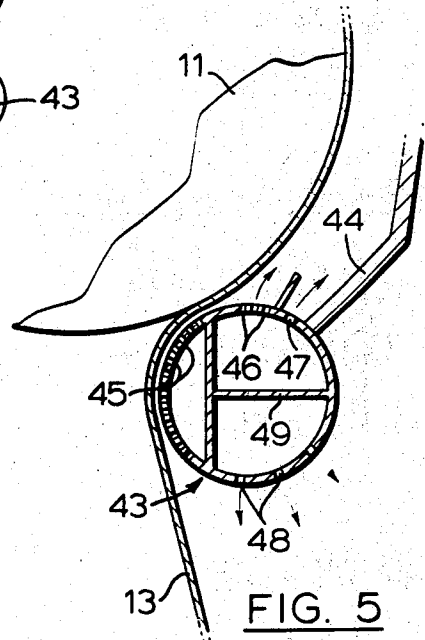
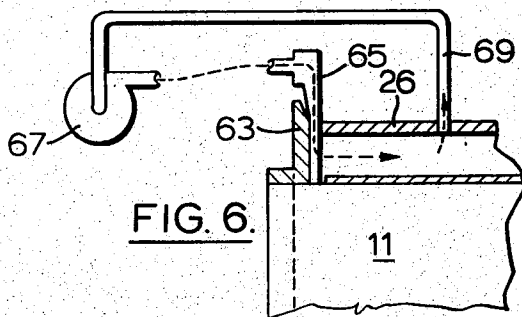
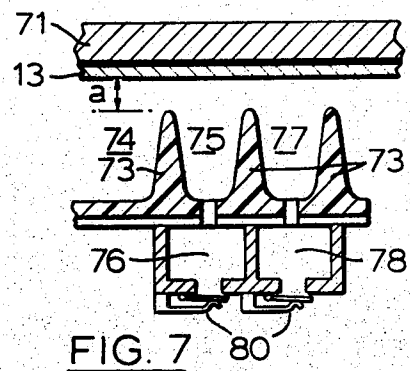
FIG. 3



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WEB DRYING

This invention is directed to an improved method of web drying and to apparatus for carrying out the method.

In the drying of paper during manufacture one well-known type of apparatus in conventional use comprises a series of dryer cylinders in parallel rows having the paper web passing in serpentine fashion over the dryer cylinders, a presser felt being used on the outsides of the web surfaces contacting the drum in order to increase the web pressure against the drum surface.

It has been found that the application of air pressure to the outer surface of the web can provide drum contact forces equal to or in excess of the pressures provided by a pressing felt, permitting the presser felt to be dispensed with. By the provision of a cap or caps extending over the cylinders the application of air pressure can be effected using relatively small quantities of air.

In addition, the present invention includes the provision of ventilating air into the substantially closed pockets formed between the running web surfaces extending between adjacent drums. Provision of such pocket ventilation permits control of the relative humidity of the drying air adjacent to the web, to provide enhanced control of web drying conditions.

A further aspect of the present invention relates to the use of web guide rolls located between the dryer drums, to increase the angle of wrap of the web about the respective drum peripheries while also extending the length of the web path through the dryer.

Certain embodiments of the present invention are described with reference to the accompanying drawings wherein:

FIG. 1 illustrates a dryer arrangement according to the prior art;

FIG. 2 show an arrangement according to the present invention;

FIG. 3 is a detail enlargement from FIG. 2;

FIG. 4 is a further arrangement showing increased wrap angle arrangement;

FIG. 5 is an enlargement detail of FIG. 4;

FIG. 6 is an arrangement of a cylinder end seal;

FIG. 7 is a detail of an alternative cylinder seal arrangement.

FIG. 1 illustrates a prior art general arrangement 10 in which a plurality of dryer cylinders 11 have a paper web 13 passing thereabout in serpentine relation, with a felt 12 passing over felt guide rolls 14, in pressing relation with the web.

Referring to the embodiment of the present invention illustrated in FIG. 2, the assembly 20 comprises a plurality of cylinders 11 having caps 22, with side portions 26, each cap 22 being surmounted by an air outlet damper 28. Air or other pressurized fluids such as steam is admitted through a blow box 30, to pressurize the cap space 34 and also the web pockets 23, 24.

The blow boxes 30, illustrated individually in FIG. 3, are each provided with a divider 38, having outlets 36 adjacent to the curtain openings: the openings 38 provide fluid to the cap spaces 34; and openings 39 provide ventilation of the pockets 23, 24.

Referring to FIG. 4, there are shown a plurality of deflection rolls 43 which serve to increase the wrap angle of the web 13 about the drums 11. While conventional rotary web guide rolls may be employed, there is shown a plurality of stationary blow rolls 43, having the web-guiding surface thereof covered with a low-friction material such as that trademarked "Teflon." Referring to FIG. 5, each of the blow rolls 43 is provided with a series of air zones, each zone having a plurality of apertures related in size and spacing to the purpose of the respective zone.

Reverting to FIG. 4, the caps 22 are each provided with a damper 50 for control of cap pressure, while a seal member 52 limits the interchange of fluid between adjoining cap spaces. The partition members 44 comprise hinged shrouds supporting the blow rolls 43 to permit adjustment of the respective wrap angles and to promote the control of air circulation. The

adjustment provided by the members 44 also facilitates initial threading of the web 13 through the dryer section.

Referring further to the detail of FIG. 5, the stationary rolls 43 are each provided with a partition 49 of T-shape to form peripheral zones, each zone having a series of different type outlets 45, 46, 47 and 48. The air outlets 45 are closely spaced fine bores to provide flotation of the web; the outlets 46 constitute air curtain seal openings; the outlets 47 provide larger openings for cap ventilation, and the outlets 48 similarly provide ventilation to the pockets 23.

Referring to FIG. 6, the cylinder end seal arrangement each includes an end flange 63 on the cylinder 11. An arcuate nozzle box 65 bounding the end of the respective cap 22 provided with sealing air by way of compressor 67, local recirculation of the sealing air taking place through a connection 69 from the cap wall 26. The seal embodiment of FIG. 7, suitable for edge or side seals, comprises a plurality of elongated extruded ribs 73 of extruded or cast elastomeric material mounted in facing relation with the web 13 supported on the drum surface 71. The ribs 73 bound a hood space 74 to be sealed. The ribs are spaced a limited distance "a" from the web surface to provide a restricted flow passage for pressurized air from out of the hood space 74. Between adjacent ribs are formed pressure zones 75, 77. These zones 75, 77 connect with exhaust boxes 76, 78 respectively, each having a spring regulated flap valve 80 to regulate the internal pressure in the respective box 76, 78, and hence to control the pressure in the zones 75, 77. By maintaining substantially equal pressure drops, the rate of air leakage from the hood space 75 can be minimized.

Installation of the disclosed apparatus on existing drier sections is carried out beneath the existing drier hood (not shown). In operation the caps 22 and the associated air supply by the blow boxes 30, and the blow rolls 43 provide localized airflow zones in which the prevailing air temperature and pressure conditions may be individually arranged in relation to the general conditions under the caps. The provision of individually controlled zone heating permits raising of cap air temperature on the side of the web opposite from the cylinder to a temperature level approaching that of the cylinder. This promotes even heating through the web, with consequent improvement in quality.

In conventional cylinder driers, operating on high-speed webs, 80 to 90 percent of the total cylinder heat output is normally used to restore the temperature of the web, after the evaporative cooling of the web occurring in the preceding free draw zone of the drier. Thus only the remaining 10 to 20 percent of cylinder heat output has previously been available for providing evaporation of moisture from the web.

The changed drying conditions provided by the caps provide a favorable change in drying rates.

With the improved arrangement the ventilated pockets 23, 24 produce improved ventilation, enhancing the evaporation of moisture during the free draw so that improved output is obtained in relation both to the cylinder surface and the free draw associated therewith. This in turn changes the functional balance of drum heat output, by making more of this energy available for evaporative drying.

Considering the transverse or spanwise control of drying rates, the transverse spacing of air outlets to the side pockets 23, 24 is arranged to increase airflow to the center of the span, so as to offset the problem of edge drying. Additional control of transverse moisture profiling is provided by segmentation of exhaust dampers 28. Selective adjustment of the transverse segments of the dampers 28 permits localized transverse control of cap airflows, so that wet streaks may be effectively controlled. In addition, the adjustment of airflow in the pockets 23, 24 by adjustable outlet spacing provides additional web profiling control.

Referring more particularly to the arrangement illustrated in FIG. 4, the fluid pressure within the individual cap spaces 34 is controlled by adjustable dampers 50. Maintenance of cap pressure in the order of a fraction of a pound per square inch provides improved drum contact with the web. Thus, a

felt tension of 6.5 pounds per inch in relation to a 5-foot diameter roll, for prior art arrangements is equivalent to a contact pressure of 0.217 p.s.i.g., or 6 inches of water column. This value for cap applied pressure is well below the permeability threshold pressure for the majority of paper grades in the range of moisture content under consideration.

The increased wrap of the web on the dryer cylinders 11 which is provided by the blow rolls 43 makes it possible to increase the effective heat-transfer area of the cylinders to the web by between 30 and 40 percent.

In order to facilitate threading of the web through the dryer the blow rolls 43 may be swung on the hinged shrouds 44 away from the dryer drums 11.

By dispensing with the need for a conventional felt to hold the web against the drums 11, in addition to simplification of the arrangement and the reduction of capital and maintenance costs the necessity of providing felt running and drying arrangements is eliminated.

Utilization of the presently disclosed embodiments, taken singly or in combination permits enhanced drying rates and improved quality control, so that speedup of the mill is possible.

I claim:

1. In a web drying apparatus having a plurality of heated dryer cylinders in spaced arrangement to provide a generally serpentine path for a moving web to pass in drying relation when in operation, the improvement comprising; cap means in airflow control overlying relation with a surface portion of a said cylinder including boundary seal means to seal the edges of said cap relative to the cylinder, to closely limit losses of air from beneath the cap means and to sustain air pressure within the spaced so bounded, and air supply means to supply air at a pressure sufficient to provide pressurized contact between said cylinder and said web, said serpentine path including at least one pocket of tapered section formed between adjacent said cylinders and the web, pocket air supply means located

between a said cap and said pocket to limit transfer of air between said pocket and said cap means and to provide ventilating air to the pocket in a direction toward the enlarged portion of said pocket tapered section, whereby the drying capacity of the apparatus is enhanced.

2. The apparatus as claimed in claim 1 wherein said cap boundary seal means includes an arcuate nozzle extending closely adjacent each end of said cylinder, including air supply passage means to provide reverse inward movement of air relative to an edge portion of the surface of the cylinder whereby air pressure on the outer surface of said web may be controlled.

3. Apparatus as claimed in claim 1, together with web guide means located intermediate said cylinders to increase the wrap of said web about the respective said cylinder and significantly extend the arc of wrap of a said web with the cylinder whereby the contact surface of the web with the respective cylinder is increased, and the web path through the apparatus is extended.

4. Apparatus as claimed in claim 3 wherein said guide means comprise nonrotatable roll means having a perforated arcuate surface, and means to supply air thereto to support said web in air born passage over the roll periphery.

5. Apparatus as claimed in claim 2 wherein said boundary seal means at the end of said caps each comprises an annular collar extending radially from the end of the respective said cylinder in close spaced relation with said arcuate nozzle, having a radially inwardly directed air nozzle attached in sealing relation to an arcuate portion of the cap adjacent said cylinder end, and air compressor means to circulate sealing air in edge sealing relation between the collar and the cap.

6. Web-drying apparatus as claimed in claim 3, wherein said guide means is swingably mounted in relation to a said cylinder, whereby the angle of wrap of said web about the cylinder may be varied, and threading of said web facilitated.

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