Title: GROOVED CHILL ROLL FOR A PRINTING PRESS

Abstract: An apparatus and method for cooling a web. A web of paper passes over a chill roll, the web being in thermal contact with the outer surface of the chill roll. The chill roll includes a coolant channel in thermal contact with the outer surface. The chill roll includes at least one groove in the outer surface of the chill roll to decrease the thermal resistance between the web and the outer surface of the chill roll.
GROOVED CHILL ROLL FOR A PRINTING PRESS

Related Applications

This application claims priority to U.S. Provisional Application No. 60/373,291 filed April 17, 2002.

Field of the Invention

The invention relates to a chill roll for a printing press and, more particularly, to a chill roll having a grooved surface for channeling air between a web of paper and the chill roll.

Background of the Invention

Chill rolls are used on printing presses to cool a web of paper having printed images thereon. The web of paper is fed through one or more printing units that print a single or multiple color image on the web. The web is subsequently routed through a thermal dryer and a series of chill rolls. The dryer heats the web to evaporate various solvents in the ink and the series of chill rolls operate to cool the web to set the ink. A chilled liquid is channeled through the chill roll across an inner surface of the chill roll. The web contacts an exterior surface of the chill roll and heat from the web can conduct through the chill roll from the exterior surface to the interior surface. The heat is then carried away by the chilled liquid.

Air or gases are often trapped between the exterior surface of the chill roll and the web preventing the web from contacting the exterior surface at the location of the trapped air or gases. The trapped air or gas decreases the ability of the chill roll to carry heat away
from the web via the chilled liquid by increasing the thermal resistance between the web and the exterior surface of the chill roll.

Summary of the Invention

The present invention provides an improved chill roll for cooling a web of paper. The chill roll includes an outer surface such that the web contacts the outer surface of the chill roll. The chill roll also includes a coolant channel in thermal contact with the outer surface. At least one groove is formed in the outer surface of the chill roll.

In one embodiment, the coolant channel is filled with fluid such that heat is thermally transferred from the web to the fluid via the thermal contact between the web and the chill roll. In another embodiment, the at least one groove in the outer surface includes a plurality of grooves.

The invention includes a method of cooling a web. The method includes heating the web, cooling the web by passing it over at least one chill roll such that the web is in thermal contact with an outer surface of the at least one chill roll, and decreasing the thermal resistance between the web and the chill roll by providing a fixed pathway for the escape of gases trapped between the web and the chill roll. In one embodiment of the invention, the method includes printing an image on the web.

Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, drawings, and claims.

Brief Description of the Drawings

Fig. 1 is a perspective view of a chill roll embodying the invention.

Fig. 2 is a schematic view of a printing press.

Fig. 3 is a partially broken front view of the chill roll in Fig. 1.
Fig. 4 is a cross-sectional view along line 4-4 in Fig. 3.

Fig. 5 is a perspective view of an alternate construction of the chill roll.

Fig. 6 is a perspective view of an alternate construction of the chill roll.

Before one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

**Detailed Description**

Referring to Fig. 1, a chill roll 10 embodying the invention is shown and includes bearing journals 14 extending from each end of the chill roll 10, an exterior surface 18 and grooves 22 defined in the exterior surface 18. In the illustrated embodiment, the grooves 22 are positioned in a cross-hatched pattern. However, the grooves 22 may be positioned in any pattern and still be within the intended scope of the present invention. The grooves 22 can be formed in the exterior surface 18 as the chill roll 10 is turned by, for example, feeding a grooving tool across the roll at a predetermined speed that is coordinated with the rotational speed of the chill roll 10 to produced the desired groove configuration. It should be noted, however, that other methods of forming the grooves can be employed.

The grooves 22 provide a fixed pathway for the trapped air or gas to escape from between a web 30 that travels over the chill roll 10 and the exterior surface 18. The size (i.e. the width and depth) of the grooves 22 is selected so as to maximize the dissipation of the air or gas trapped between the web 30 and the grooves 22 but also maintain the quality
of the printed web 30. If the grooves 22 are too wide, or if there are too many grooves 22, the web 30 can wrinkle due to lack of support while passing over the chill roll 10. The preferred number of grooves, spacing of the grooves, and groove size is related to the roll size, the maximum speed of the web, and the web permeability, all of which affect the thickness of the layer of air trapped between the web 30 and the chill roll 10. These variables can be computed according to known methods in the art, such as illustrated in the column written by David Roisum, Ph.D. in Converting Magazine, August 1995, pg. 26.

Referring to Fig. 2, a portion of a printing press 26 is schematically shown in which a plurality of the chill rolls 10 are utilized. A web 30 of paper is wound around a feed roll 34 and contains no images thereon. The web 30 is unwound from the feed roll 34 and threaded through the printing press 26 where images are printed thereon by printing rollers 38. The web 30 is then subsequently routed through a thermal dryer 42 and a plurality of the chill rolls 10. The dryer 42 heats the web 30 to evaporate various solvents in the ink and the chill rolls 10 cool the web 30 after the drying step to set the ink. The web 30 then advances for further processing. In the illustrated construction, the web 30 is wound onto a take-up roll 46, however, the web 30 may be advanced to any type of further processing and still be within the scope of the present invention, such as, for example feeding the web 30 to a slitter and folder to produce signatures.

Referring to Figs. 3 and 4, the chill roll 10 is shown along with a portion of the web 30 contacting the exterior surface 18 of the chill roll 10. The chill roll 10 includes a coolant channel 50 through which chilled coolant (not shown) may flow. The coolant could be chilled water or any other appropriate coolant that carries away heat from the web 30. The coolant flows through the coolant channel 50 and contacts an interior surface 54 of the chill roll 10. The heat from the web 30 conducts through the chill roll 10 from the exterior surface 18 to the interior surface 54 and is carried away by the chilled coolant.
The grooves 22 channel away air or gas trapped between the web 30 and the exterior surface 18. By eliminating the air or gas between the web 30 and the exterior surface 18 of the chill roll 10, thermal resistance between the web 30 and the chill roll 10 is reduced to more efficiently cool the web 30. Thus, the coolant can more effectively carry heat away from the web 30. As a result, a coolant having a higher temperature can be used and still result in the appropriate level of cooling. Alternatively, the same, lower temperature coolant could be used but less coolant would be required to achieve the desired cooling. Another result of the increased thermal contact of the web 30 with the chill rolls 10 is that the chill rolls 10 could be smaller and still achieve the required cooling, thereby reducing the overall size of the press. Or, fewer chill rolls 10 may be used to produce the same level of cooling. Any one of these variations, or any combination of these variations, could be implemented as a result of improving the efficiency of the chill rolls 10.

Referring to Fig. 5, an alternative construction of the chill roll 10 is shown. The grooves 22 defined in the exterior surface 18 of the chill roll 10 are positioned in a vertical pattern substantially parallel to one another, spaced circumferentially around the chill roll 10, for channeling air or gas from between the web 30 and the exterior surface 18 of the chill roll 10.

Referring to Fig. 6, an alternative construction of the chill roll 10 is shown. The grooves 22 defined in the exterior surface 18 of the chill roll 10 are positioned in a horizontal pattern substantially parallel to one another for channeling the air or gas from between the web 30 and the exterior surface 18 of the chill roll 10.

Although particular constructions of the present invention have been shown and described, other alternative constructions will be apparent to those skilled in the art and are within the intended scope of the present invention.
Various features of the invention are set forth in the following claims.
We claim:

1. A chill roll for use with a web, the chill roll comprising:
   an outer surface selectively in contact with a web;
   a coolant channel in thermal contact with the outer surface; and
   at least one groove in the outer surface.

2. The chill roll of claim 1, wherein the coolant channel is filled with fluid
   such that when the web contacts the outer surface, heat is thermally transferred from the
   web to the fluid.

3. The chill roll of claim 1, wherein the at least one groove in the outer surface
   includes a plurality of grooves.

4. The chill roll of claim 3, wherein the plurality of grooves form a cross-
   hatch pattern.

5. The chill roll of claim 3, wherein the plurality of grooves are concentric
   circles spaced circumferentially around the outer surface.
6. A method of cooling a web, the method comprising:

heating the web;

cooling the web by passing it over a chill roll such that the web is in thermal contact with an outer surface of the chill roll; and

decreasing the thermal resistance between the web and the chill roll by providing a fixed pathway for the escape of gases trapped between the web and the chill roll.

7. The method of claim 6, wherein cooling the web includes forming a coolant channel in the chill roll, the coolant channel being in thermal contact with the outer surface.

8. The method of claim 7, wherein cooling the web includes passing a fluid through the coolant channel formed in the chill roll.

9. The method of claim 6, wherein providing a fixed pathway includes providing at least one groove in the outer surface.

10. The method of claim 9, wherein providing at least one groove in the outer surface includes providing a plurality of grooves in the outer surface.

11. The method of claim 6 further comprising printing an image on the web using a printing press.
12. A method of cooling a printed web in a printing press, the method comprising:

printing an image on a web using a printing press;

heating the web;

cooling the web by passing it over a chill roll such that the heated web is in thermal contact with an outer surface of the chill roll; and

decreasing the thermal resistance between the printed web and the chill roll by providing at least one groove in the outer surface such that gases trapped between the printed web and the outer surface may escape through the at least one groove.

13. The method of claim 12, wherein providing at least one groove includes providing a plurality of grooves.

14. The method of claim 12, wherein cooling the web includes forming a coolant channel in thermal contact with the outer surface, and wherein a fluid is passed through the coolant channel.