

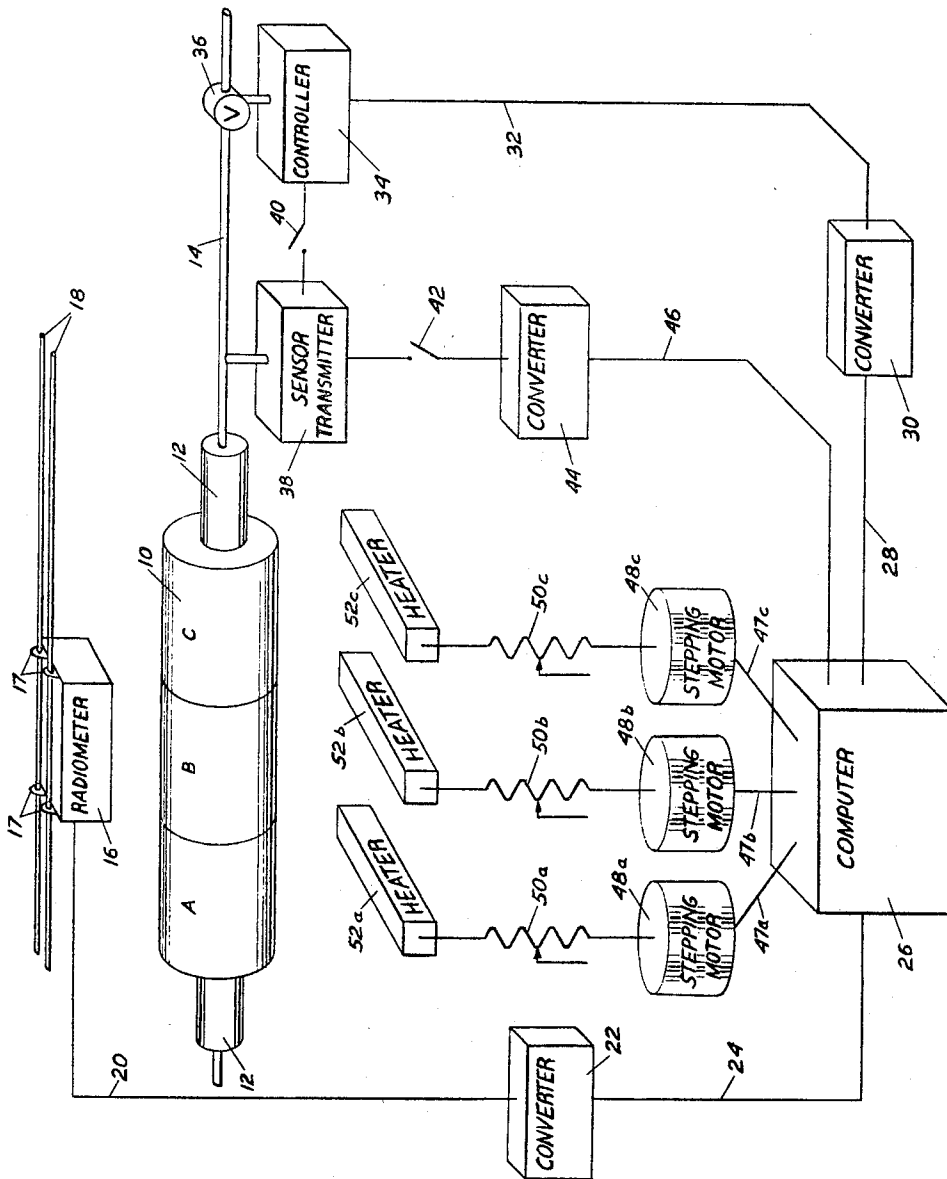
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M. A. KEYES IV

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ROLL TEMPERATURE CONTROL

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MARION A. KEYES IV INVENTOR.

BY John S. Munday
HIS ATTORNEY

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ROLL TEMPERATURE CONTROL

Marion A. Keyes IV, South Beloit, Ill., assignor to Beloit Corporation, Beloit, Wis., a corporation of Delaware
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7 Claims

ABSTRACT OF THE DISCLOSURE

A device for controlling the temperature of a roll including a temperature sensor positioned in operative relationship with the roll and adapted to measure temperatures at various points along the longitudinal length of the roll and to transmit temperature signals as a function of the temperatures which are measured. Computer means are connected to the sensor and adapted to receive the temperature signals. The computer further transmits the control signals in response to the temperature signals, usually by determining the variation from a predetermined desired temperature. In response to the temperature control signals from the computer, first temperature correction means are actuated to adjust the overall temperature of the roll and second temperature correction means are actuated to adjust the temperature at a plurality of points along the longitudinal length of the roll.

This application is a continuation-in-part of U.S. patent application Ser. No. 651,410, filed July 6, 1967, now abandoned.

This invention pertains to a roll temperature control device and method, and more particularly, to a temperature control device and method for a calender roll in a paper machine.

As is well known in the paper making art, a paper web is treated in a calender consisting of a number of rolls in a stack between which the paper is pressed. Frequently, variations in the uniformity of the paper due to changes in basis weight, moisture content, and temperature are caused by variations in the temperature of the roll or rolls in the calender. These nonuniformities are visible to an operator and are known generally as "soft spots" and "hard spots." The operator may compensate for these defects with a device to blow cold air on the calender rolls to cool the paper or the roll at a point corresponding to a "soft spot." However, before corrections can be made, a substantial amount of paper is processed. Moreover, the operator over-corrects or under-corrects in many cases because no accurate means to judge the amount of correction required is available to him.

A further drawback of the present calender systems is that the use of the cold air lowers the average temperature of the roll which therein causes the rolls to effect a different calendering treatment. Thus the web which first comes through the calender before cold air is blown against the rolls may receive a smooth surface but the web which later comes through the calender may have a dull surface due to the cooling of the roll.

Accordingly, it would be a great advance to the art if a device could be developed which would permit automatic monitoring and control of roll temperature to assist in the production of higher quality paper. It would be particularly advantageous if the average temperature of the roll could be controlled while simultaneous control over various portions of the roll were to be adjusted.

It has now been discovered that temperature of the roll may be controlled in the following manner. Basically, the device according to the present invention includes the use of a temperature sensor means positioned in operative

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relationship with a roll and adapted to measure temperature of the roll at a plurality of points along the longitudinal length of the roll. The temperature sensor also transmits temperature signals as a function of the temperatures which are measured. A computer means is further provided which receives temperature signals from the sensor and transmits control signals in response to the temperature signals. This is normally done by comparing the actual temperature with the desired temperature and then by sending a signal which causes the actual temperature to be raised or lowered by that amount necessary to bring it to the desired temperature.

The device further includes temperature correction means attached to the roll and adapted to receive control signals from the computer. The first temperature correction means is adapted to adjust the overall temperature of the roll. Second temperature correction means are also provided and are adapted to receive control signals from the computer. These second temperature correction means adjust the surface temperature of the roll at a plurality of points along the longitudinal length of the roll. Thus where an individual part of the roll is particularly hot or cold, that individual portion may be warmed or cooled even as the overall temperature of the roll is maintained at a desired temperature.

The invention and the preferred embodiments thereof are more fully described in the following description, in conjunction with the annexed drawings, in which:

The figure is a diagrammatic view of a preferred embodiment of the present invention shown in perspective.

As shown in the figure, a roll 10 is mounted on a journal 12. This roll may be employed in many of the various places where rolls are conventionally employed in a paper making machine. Of particular desirability is the use of the roll in a calender stack. It is to be understood that the position of the roll is conventional and that the invention lies in the equipment hereinafter described which permits control of the temperature of the roll.

Normally, the roll will be heated with steam, hot water or other heat transfer fluid, although it is also possible for the roll temperature to be controlled by the use of coolants without departing from the spirit of the present invention.

Positioned above the roll 10 is a temperature sensor means in operative relationship with the roll 10. In this embodiment, the temperature sensor means includes a radiometer 16 which is mounted on traveling tracks 18 and is transferred back and forth over the roll on guides 17. As the radiometer 16 passes across the longitudinal length of the roll, the temperature of the roll at a plurality of points along the longitudinal length of the roll is measured. Three of these areas are shown in the figure as being areas A, B, and C. The radiometer then transmits the temperature signal through line 20 as a function of the temperatures measured at the particular point A, B, and C of the roll. These temperature signals pass through a converter 22 which converts the signals to digital signals. Converters of this type are conventional and may be purchased from a number of manufacturers. The digital signals are transferred from the converter 22 through line 24 to the computer 26.

At this point, the computer 26 possesses information regarding the particular temperatures along the longitudinal length of the roll 10. In addition, the computer possesses the knowledge of the average temperature of the entire roll which is computed by simply averaging each of the particular temperatures along the longitudinal length of the roll. This information is now used by the computer to transmit control signals in response to these temperature signals.

Shown in the figure are two means for controlling the average temperature of the roll. In this embodiment, the

roll 10 is heated by introduction of steam through line 14 into journal 12 and into the roll itself. Because the computer possesses the knowledge of the actual average temperature of the roll, it is able to compare this temperature with the desired average temperature and transmit a signal through line 28 to adjust the average temperature to that which is desired. The converter 30 converts the digital signal from the computer into an analog signal which is then transferred along line 32 to a controller 34. Since the temperature of steam is a function of its pressure, the pressure in line 14 is measured by the sensor transmitter 38 and this knowledge is then transmitted to the controller 34 through the line having switch 40 in it. In this embodiment, switch 40 is closed to make the connection and switch 42 is opened. Thus the controller 34 receives a signal from which the actual average temperature is to be adjusted. Sensor transmitter 38 notifies the controller of the pressure in line 14 through line 40. Valve 36 is then adjusted to increase or decrease the pressure in line 14 to correspond to the temperature as directed by the computer.

In an alternative embodiment, switch 40 is opened and switch 42 is closed, whereby the information relating to the pressure in line 14 is directly transmitted through analog to digital converter 44 through line 46 to the computer which then sends an adjusting signal through line 28 to converter 30 and line 32 to the controller 34 which then adjusts the valve 36 to regulate the pressure.

Simultaneous with the adjustment of the average temperature as above described, the computer is adapted to adjust the particular temperatures at the plurality of points along the longitudinal length of the roll 10. This is accomplished by sending signals to heaters which either increase or decrease the amount of heat being provided to the various segments A, B and C of the roll.

As hereinbefore described, the computer 26 possesses the knowledge of the temperature of the roll along a plurality of points, A, B and C of the roll 10. The computer is also programmed with the desired temperature that each of these points along the roll should have. When the computer finds that, for example, the temperature in area B is less than the desired temperature, a signal is sent through line 47b to actuate stepping motor 48b. Stepping motor 48b then mechanically (or through other means) actuates potentiometer 50b which in turn increases the amount of heat being provided by induction heater 52b. Similarly, should portion A of the roll 10 be too hot, a signal through line 47a, stepping motor 48a, potentiometer 50a and heater 52a will cause less heat to be supplied to the A portion of the roll 10.

Each of the activities of measuring, calculating and adjusting the average temperature and the various particular temperatures of the roll are seen to operate on a continuous basis, whereby the roll temperature is kept as nearly ideal as possible throughout the period of operation of the roll. For that reason, paper of substantially better quality and more uniform quality will be produced. Likewise, if the roll were to be used in other industries, such as in the textile industry, metal treating, and the like, uniform control of roll temperature would provide a more marketable product.

While a preferred embodiment of the invention has been disclosed, along with various changes, omissions and additions which may be made therein, it will be apparent that various other changes, omissions and additions may also be made in the invention without departing from the scope and spirit thereof.

What is claimed is:

1. A device for controlling the temperature of a roll, comprising: temperature sensor means positioned in operative relationship with said roll and adapted to measure the temperature of said roll at a plurality of points along the longitudinal length of said roll, and to transmit temperature signals as a function of said temperature, computer means connected to said sensor means and adapted to receive said temperature signals, said computer means being further adapted to transmit control signals in response to said temperature signals; first temperature correction means attached to said roll and adapted to receive said control signals, said first temperature correction means being adapted to adjust the overall temperature of said roll; and second temperature correction means positioned near said roll and adapted to receive said control signals, said second temperature correction means being adapted to adjust the surface temperature of said roll at a plurality of points along the longitudinal length thereof.

2. The device of claim 1 wherein said temperature sensor includes a radiometer mounted on means adapted to move said radiometer longitudinally along the surface of said roll.

3. The device of claim 1 wherein said first temperature correction means includes a source of heat transfer fluid, means for introducing said heat transfer fluid into said roll, means for controlling the amount of heat transfer fluid in response to said control signal.

4. The device of claim 1 wherein said second temperature correction means includes a plurality of stepping motors, potentiometers, and induction heaters and each stepping motor is individually connected to said computer and adapted to individually adjust a potentiometer, said potentiometer being adapted to individually vary the amount of heat generated by said induction heaters.

5. The device of claim 1 wherein said computer is a digital computer and includes means for converting analog signals to digital signals, and said temperature sensor is adapted to transmit analog signals.

6. The device of claim 1 wherein said computer is a digital computer and includes means for converting digital signals to analog signals, and said first temperature correction means is adapted to receive analog signals.

7. A method for controlling the temperature of a roll, comprising the steps of: measuring the temperature at a plurality of points along the longitudinal length of a roll; generating temperature signals as a function of the temperature at said points; converting said temperature signals to control signals in response to deviation of said temperature signals from desired temperature signals; adjusting the overall temperature of said roll in response to said control signals; and adjusting the temperature of the roll surface at the plurality of points along the longitudinal length of said roll in response to said control signals.

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EDWARD J. MICHAEL, Primary Examiner