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[54] **DEVICE AND METHOD FOR FINISHING THE CONTOUR OF PAPER MAKING ROLLS**

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[52] **U.S. Cl.** **162/199,** 34/85, 51/251, 51/270, 162/272

[51] **Int. Cl.** **D21f 5/02**

[58] **Field of Search** 162/272, 199; 51/255, 251, 270; 34/85; 134/104

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[57] **ABSTRACT**

A roll in a paper making machine carrying a web of paper over a portion of its circumference includes a grinding roll engaging the web carrying roll on a non-web carrying portion of its circumference for grinding the surface to a desired contour during actual operation of the roll and of the paper making machine. Means are provided for removing grinding residue from the non-web carrying circumferential surface of the rotating roll to prevent the grinding residue from being carried up beneath the web as it passes over the web-engaging circumference of the rotating roll.

10 Claims, 2 Drawing Figures

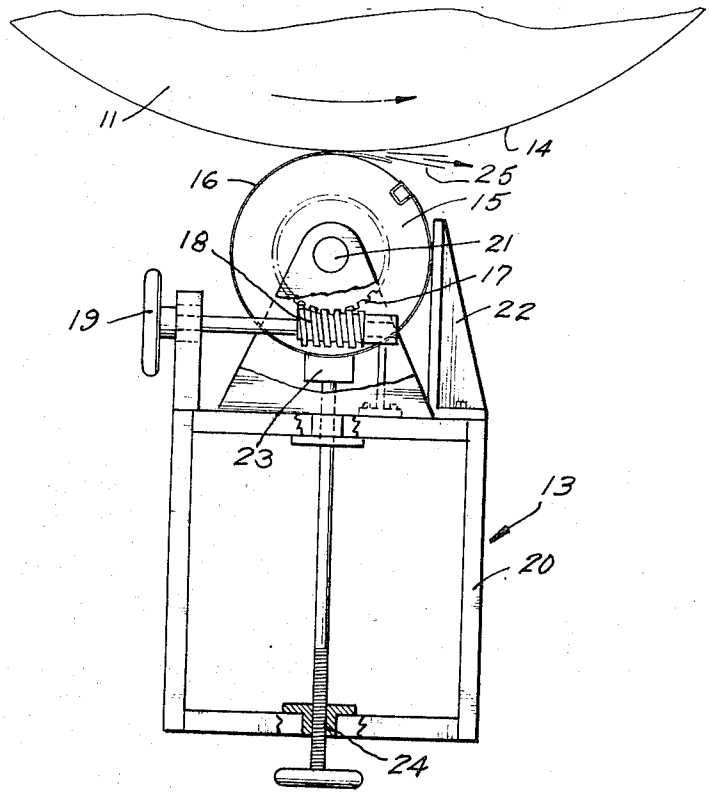


Fig. 1

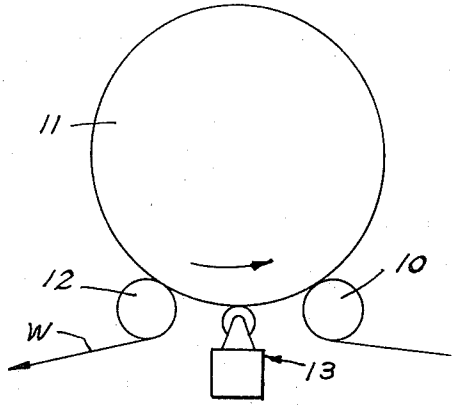
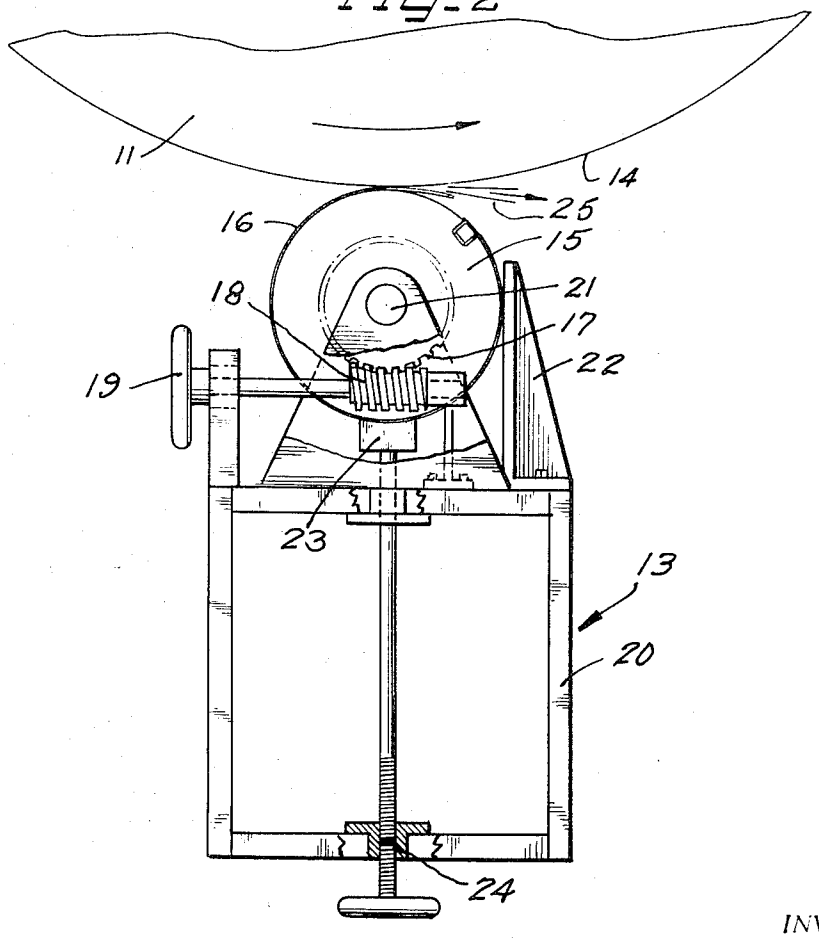


Fig. 2



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DEVICE AND METHOD FOR FINISHING THE CONTOUR OF PAPER MAKING ROLLS

BACKGROUND OF THE INVENTION

In a paper making machine it is essential that many rolls which carry the paper web be produced with accurately contoured surfaces. Many times this surface is crowned to obtain uniform nip pressures in a pressing combination. Another example of such a roll which requires an accurately contoured surface is a Yankee drier drum. However, when these rolls are in operation, temperature conditions across the roll are not uniform. Further, they do not duplicate the temperatures which existed in the roll when it was manufactured and prepared for installing into the paper making machine.

An example of a roll which changes contour due to the effects of the paper web engaging the surface is a Yankee drier drum. The Yankee drier is steam heated and carries a paper web on its surface with the water evaporating from the web. Heat is conducted to the outer surface of the Yankee drier shell from steam within the shell, and as the web is carried on the surface, the outer surface is cooled below the temperature of the inner surface of the shell so that a temperature gradient exists. The temperature gradient will also exist along the length of the drier drum, and the temperature cannot be accurately predetermined or duplicated during grinding and preparation of the drum. Thus, while a Yankee drier drum is manufactured and ground to a desired shape, in operation the change in shape will not necessarily be uniform across its entire face and nonuniformity will occur particularly near the ends or heads of the drum. Some attempts have been made to change the effects of the web in changing the contour of the drum surface by the application of heat or chilling or by mechanical deflection, but these efforts have inherent disadvantages. It is accordingly an object of the present invention to provide a method and means for obtaining a predetermined contour in the surface of a roll in a paper making machine despite adverse effects of temperature changes caused by engagement with the web.

A more particular advantage of the invention is to provide a method and means for actually grinding the contour of the roll surface during operation until the exact predetermined contour is achieved.

Other objects and advantages will become more apparent with the disclosure of the preferred embodiment of the invention in connection with the teaching of the principles thereof in the specification and drawings in which:

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic and elevational view of a portion of a paper making machine showing a Yankee drier drum with mechanism embodying the principles of the invention; and

FIG. 2 is an elongated fragmentary schematic end elevational view of a portion of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 illustrate the invention as embodied in the environment of a Yankee drier drum wherein a paper web W is fed onto the drum by a web support roll **10.** The web passes onto a Yankee drier drum **11** which is provided with the usual heating means, such as,

steam pressure within the hollow drum. The water evaporates from the web during its travel over the drum and is taken off the drum on the offrunning side passing over a roll **12.**

The drum is heated inside and as the web engages the outer smooth hard finished metal surface of the drum, evaporation takes place so that with the heat of vaporization the drum surface is cooled. Heat is conducted through the metal shell of the drum to the outer surface. The contour of the outer surface of the drum will be a function of its temperature along its length. This is substantially impossible to accurately predict at the time of initially manufacturing and finishing the drum since the exact effects of the water evaporation from the web with respect to the surface temperature of the drum cannot be entirely predicted in advance. Thus, when the outer surface of the drum takes its final operating temperature, it will have a contour accordingly, and this contour will deviate from the original contour of the drum as it was originally ground and polished.

In accordance with the method of the present invention, in order to obtain a contour which conforms exactly and absolutely to a predetermined contour, the drum is actually ground during operation so that it will always have the proper contour under operational environment.

For grinding the contour a grinding means **13** is positioned at a location where the roll circumference is free of the web.

The grinding means is in the form of a bar or backing roll **15** which has a hard surface and which carries an abrasive grinding paper **16.** With the hard backing surface metal will be removed from the roll at high points only. A resilient or soft backing is not suitable since this will force the abrasive paper into the low areas cutting away material at these points as well as the high points. The hard backing will put pressure only on the high points and will have sufficient stiffness to bridge over the low areas so that material is removed from the roll surface **14** at the high points. This will smooth the roll to the contour of the backing roll, and any high points or low points caused by temperature differential due to engagement with the web will be brought to a uniform level.

The backing roll is bendable over its length so as to enable grinding a predetermined crown on the drum **11.** This crown can be obtained by suitable means, such as, screws or pneumatic devices provided at intervals along the length of the backing roll which provide the necessary force or pressure where it is necessary to cut or remove material from the drum surface **14.** The operator adjusts the crown of the backing roll **15** to obtain the desired crown of the drum surface **14,** and suitable gauges can be applied during grinding to check the resultant crown.

As illustrated in FIG. **2,** the backing roll is carried on a beam **20** by end supports **21.** Along its length are bending supports **23** shown as being threaded at **24** into the beam whereby rotation of the supports **23** will cause them to apply a bending force to the backing roll **15.**

To obtain lateral stability of the roll, spaced strengthening supports **22** are mounted on the beam at intervals along the length of the backing roll **15.**

To obtain effective grinding, an abrasive paper or cloth **16** is carried on the surface of the backing roll and for changing the grinding surface as the grinding

cloth wears, the roll **15** can be periodically rotated. For this purpose a worm gear **17** is mounted on the end of the roll meshed with a worm **18** and rotation of the hand wheel **19** will turn the backing roll to maintain a fresh grinding surface exposed to the drum surface **14.** As will be appreciated, various types of grinding surfaces may be employed with the backing roll **15.** The device is relatively compact and can be adapted to be used on a relatively small exposed surface area of different rolls or driers in a paper machine installation.

Thus, it will be seen that I have provided improved method and device for finishing and improving the contour of rolls or driers which will obtain the objectives above set forth. The structure can be used periodically to correct the surface of rolls during operation and to accommodate for changes in contour which may occur under different operating conditions such as may be experienced with different webs and different moisture contents and at different temperatures.

There will be a mechanism provided for elevating the grinding mechanism **13** into operating position when the drum is to be prepared. This will usually occur after a new drum is installed and reasonable running time has gone by so that the drum achieves temperature stability.

The grinding of the drum will result in the removal of metal and to prevent the residue from the grinding from being carried up beneath the web of paper, a means for cleaning the drum will be provided. This is shown schematically as a suction nozzle **25** and can include a wiper and cleaner for insuring that the drum surface is absolutely clean.

It is possible that with the processing of different types of papers and the operation of the drum at different temperatures, it may become necessary to further grind the drum and the assembly **13** can be stored in position beneath the drum for such eventualities. Also, a single grinding unit can be used on other drums for other paper machines. The structure is relatively uncomplicated to construct and its efficiency and accuracy relate to the accuracy of the contour of the backup roll **15** which can be assured. It is also possible to use a backup rail or bar in place of the drum, if desired. The operation of the various structures discussed embodies the concept of finishing the surface of a heated roll under normal operating conditions while rotating and carrying a web and grinding material from the surface of the roll to obtain a predetermined contour during operation of the roll and while it is subjected to an operational temperature environment which cannot be positively duplicated while the roll is being manufactured and prior to its installation in the machine.

I claim as my invention:

1. The method of finishing the surface of a hard surface roll in a paper making machine to obtain a predetermined surface contour wherein the roll has first guide means for guiding the web onto the roll and a second guide means for guiding the web leaving the roll, the method comprising:

operating the roll under normal operating circumstances while rotating and carrying the web with the roll having surface contour changes responsive to temperature changes due to contact with the web;

grinding material from the surface of the roll between the first and second guide means at the non-web carrying circumference to obtain a predetermined contour during operation of the roll and while carrying the web;

and removing grinding residue from the non-web carrying circumference surface of the rotating roll to prevent the grinding residue from being carried up beneath the web as it passes over the web-engaging circumference of the rotating roll.

2. In combination in a paper making machine,

first guide means positioned for guiding a web onto a roll,

second guide means positioned for guiding a web leaving the roll,

a rotary hard surfaced web carrying roll positioned between said first and second guide means for receiving the web on a web engaging portion of its circumference,

said roll having surface contour changes responsive to temperature changes due to contact with the web, and

a grinding means positioned between said first and second guide means in grinding engagement with a non-web carrying circumferential surface of the roll for grinding the surface to a predetermined contour while the roll is rotating and carrying the web under operating conditions

and means for removing grinding residue from the non-web carrying circumferential surface of the rotating roll to prevent the grinding residue from being carried up beneath the web as it passes over the web-engaging circumference of the rotating roll.

3. In combination in a paper making machine a structure in accordance with claim **2** wherein an elongate grinding means is provided coextensive with the length of said roll.

4. In combination in a paper making machine constructed in accordance with claim **3** including means for adjustably changing the contour of the grinding means at the location where it engages the roll surface for obtaining a predetermined contour of the roll.

5. In combination in a paper making machine constructed in accordance with claim **2** wherein said roll is a Yankee drier drum which is provided with means for internally heating the drum and said web has a substantial amount of moisture so that the surface of the drum is cooled with the vaporization of said moisture.

6. In combination in a paper making machine constructed in accordance with claim **2** wherein said grinding means includes an elongate rigid support coextensive with the web carrying roll with an abrasive material on the surface of said support in engagement with the web carrying roll.

7. In combination in a paper making machine constructed in accordance with claim **6** wherein said support is in the form of a backing roll parallel to the web carrying roll and the abrasive material is in the form of an abrasive paper.

8. In combination in a paper making machine constructed in accordance with claim **6** wherein the elongate rigid support is in the form of a backing roll parallel with the web carrying roll and includes means along the length of the roll for preventing deflection due to the force between the web carrying roll and the abrasive material.

9. In combination in a paper making machine constructed in accordance with claim **6** wherein the elon-

gate rigid support is in the form of a backing roll parallel to the web carrying roll and means are provided for bowing the backing roll to raise a crown on the web carrying roll.

10. In combination in a paper making machine constructed in accordance with claim **2** wherein said grinding means includes an elongate backing roll having end supports and having adjustable supports along its length to control its contour relative to the web carrying roll, and an abrasive paper supported at one side of the backing roll that extends between the backing roll and web carrying roll for grinding the surface of the web carrying roll.

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