Jan. 27, 1970 T. G. McKIE ET AL 3,492,200

CORRECTION DEVICE FOR FOURDRINIER COUCH ROLL

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Fig. 1

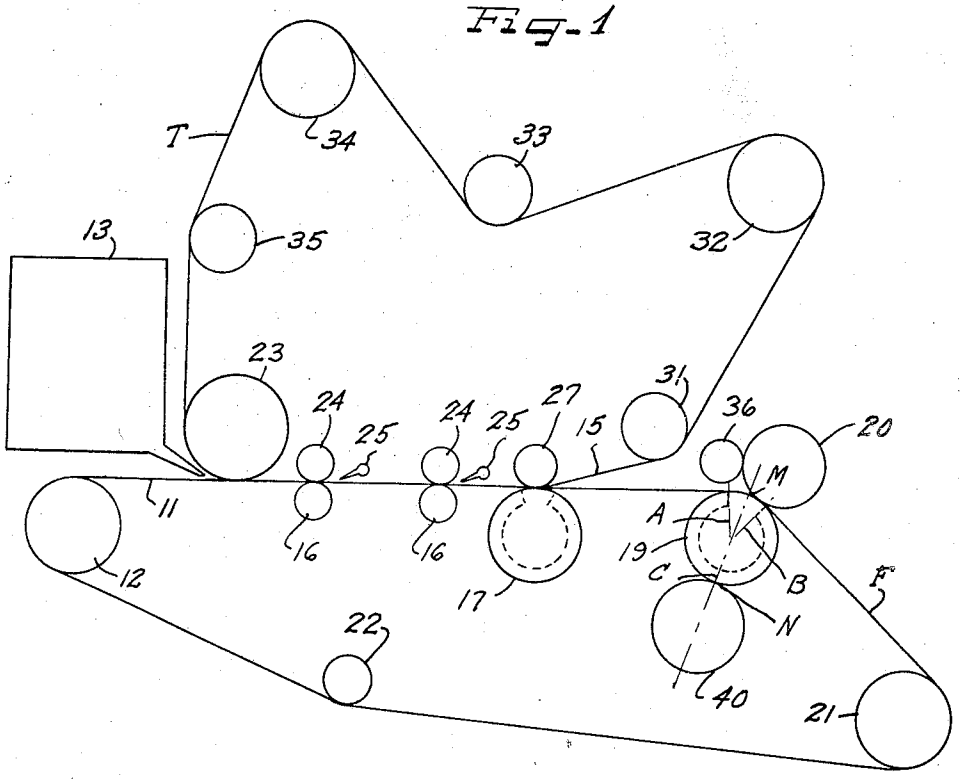


Fig. 2

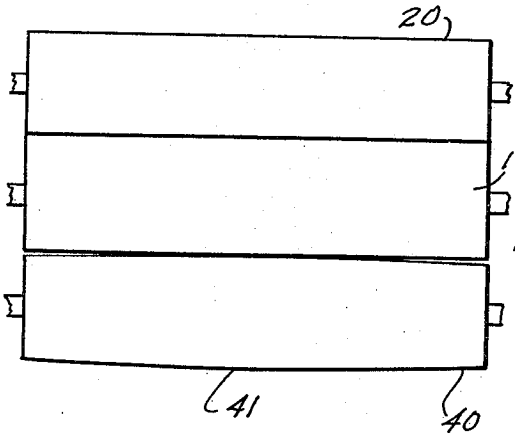
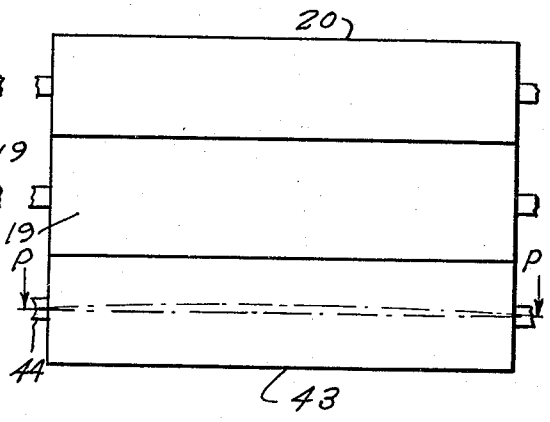


Fig. 3



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CORRECTION DEVICE FOR FOURDRINIER COUCH ROLL

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ABSTRACT OF THE DISCLOSURE

Fourdrinier type paper making machine in which a deflection controlling roll provides a roll couple with the couch roll directly opposite the deflecting forces on the couch roll, caused by the weight of the roll, the weight of the wire and the drive forces between the couch roll and the wire. The deflection controlling roll has a crowned surface engaging the couch roll along a diametral line intermediate the points of tangency of the wire as it enters and leaves the couch roll. The crowned surface of the deflection controlling roll may be formed directly on the roll or may be attained by the application of pressure to the interior of the roll in a region diametrically opposed to the region of the couch roll subject to deflection.

BACKGROUND AND OBJECTS OF INVENTION

The Fourdrinier wire at the forming end of a paper machine is a woven product, formed by weaving warp wires in generally parallel peripheral alignment with respect to the direction of travel of the wire with cross wires extending transversely of the direction of travel of the wire. The cross wires extend generally perpendicular to the warp wires and the warp wires are woven in a generally serpentine configuration over one cross wire, under the next cross wire, over the next cross wire, etc. The wires used are bronze wires and the cost of a Fourdrinier wire may be as much as $4,000 and is usually replaced about once every three to five days of continuous operation of the machine, resulting not only in expense of the wire but also the labor of removing the worn wire and training a new wire about the machine, and the resultant production loss occasioned by changing of the wire.

The wire is trained about and supported on a series of rolls, which may include a couch roll, and these rolls and particularly the couch roll are subject to a load tending to effect central deflection thereof. This deflecting force is caused by the weight of the roll, the weight of the Fourdrinier wire on the roll and tension on the wire, and in the case of a driving roll, the force component resulting from the resistance or reaction of the wire itself to the driving forces. As the roll is deflected by these deflecting forces to sag in its center, the tension on the wire becomes unequal throughout its width, resulting in nonuniform drive tension and undesirable guidance of the traveling wire. This materially reduces the life of the wire and also tends to cause wrinkling of the paper.

The rolls and particularly the driving couch roll, therefore, must have a true peripheral surface in contact with the Fourdrinier wire, in order to avoid the necessity of frequently changing the wire and to provide a better product.

It is, therefore, a principal object of the present invention to lengthen the life of the Fourdrinier wire of a paper machine by maintaining the peripheral surfaces of the rolls true under all conditions of operation of the machine.

Another object of the invention is to lengthen the life of the Fourdrinier wire of a paper making machine by controlling the surface of the couch roll at the end of the forming line, to maintain the surface of the couch roll true.

Still another object of the invention is to prevent the deflection of the couch roll at the end of the forming run of a paper making machine and maintain the tension on a Fourdrinier wire uniform throughout the width thereof, by providing a simple form of means for applying a deflecting force on the couch roll, contra to the deflecting forces on the roll caused by the weight of the roll, the weight of the wire thereon and drive forces between the roll and wire, and to thereby maintain the surface of the couch roll true to exert a uniform tension on the Fourdrinier wire throughout its width.

A further object of the invention is to counteract the tendency of the driving couch roll of a paper making machine to deflect, by the deflecting forces applied thereto by the wire, by providing a roll couple with the couch roll directly opposed to the region of maximum deflecting forces on the couch roll, to thereby maintain the peripheral surface of the couch roll true and maintain the tension on the Fourdrinier wire uniform throughout its width.

Still another object of the invention is to provide a deflecting roll couple with the driving couch roll of a paper making machine, opposed to the lump breaker roll and the deflecting forces placed on the couch roll by the Fourdrinier wire, counteracting the tendency of the weight of the wire and drive forces thereon to bow the couch roll at its center.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a diagrammatic view of the forming end portion of a paper making machine constructed in accordance with the principles of the present invention;

FIGURE 2 is a diagrammatic end view of the machine looking at the forming end of the machine toward the outgoing end thereof and showing a deflection roll providing a roll couple with the driving couch roll; and

FIGURE 3 is a diagrammatic end view of the machine somewhat similar to FIGURE 2 and showing a modified form of deflection roll from the roll shown in FIGURE 2, providing a nip couple with the couch roll, and maintaining the periphery of the couch roll true.

In the embodiment of the invention illustrated in the drawings, we have shown in FIGURE 1 the forming end of a paper making machine of the Fourdrinier type and including an endless permeable forming wire F, commonly termed a Fourdrinier wire and having a top run **11** trained about a breast roll **12**, shown as being disposed beneath a head box **13** supplying stock between the top run **11** of the forming wire F and a cooperating bottom run **15** of the top forming wire T.

From the breast roll **12** the top run **11** of the forming wire F passes over spaced rolls **16, 16** over a transfer couch roll **17**, spaced in advance of the rolls **16, 16** over a couch roll **19** in the nip between said couch roll and a lump breaker roll **20**. The top run **11** of the wire F then passes angularly downwardly to and about a roll **21** at the end of the forming assembly to and under a roll **22** and to and about the breast roll **12**.

The bottom run **15** of the top forming wire T is trained around an oncoming directing roll **23** positioned to press the bottom run **15** of the upper forming wire T down against the top run **11** of the bottom forming wire F. The quadrant of the oncoming directing roller **23**, from the six o'clock position to the nine o'clock position, lies above the top run **11** of the bottom forming wire F and provides a tapering gap converging to the bottom forming wire **11** and within which the stock is discharged, to initiate the formation of the stock into a sheetlike form.

From the directing roll **23**, the bottom run **15** of the top forming wire T passes under spaced rolls **24**, **24** cooperating with the rolls **16**, **16** to provide pressure nips sufficient to dewater the web. Suction slices **25**, **25** are mounted in the loop of the top wire T on the outgoing sides of the rolls **24**, **24** to remove water from the top wire T in a conventional manner. The bottom run of the top forming wire, travelling with the top run of the lower forming wire, is then trained beneath a roll **27** changing the direction of the top wire as the bottom wire passes along the transfer couch roll **17**.

The bottom run **15** of the forming wire T then passes from the direction changing roll **31** and about a series of rolls **32**, **33**, **34** and **35** to the oncoming directing roll **23**, any one or more of which rolls may serve as a drive roll.

The forming end of the paper making machine described herein operates on principles similar to the paper making machine shown and described in Patent No. 2,881,678 granted to Reginald James Thomas on Apr. 14, 1959, and no part of the present invention, so not herein shown or described further.

The transfer couch roll **17** serves to retain the web to the top run **11** of the bottom forming wire F by suction, to be carried by the bottom forming wire through the nip between a roll **20**, commonly termed a lump breaker roll and the couch roll **19**. The couch roll **19** serves as a drive roll for the lower forming wire F. The couch roll **19** may be of any conventional form to drive the wire at the speed of travel of the upper forming wire T and to remove moisture from the web under vacuum, and may be driven in a conventional manner. The roll **21** may also be a drive roll.

The lump breaker roll **20** is suitably pressurized to define a light pressure nip with the couch roll **19** and seal the web to the couch roll, to thereby reduce vacuum leaks between the web and couch roll and maintain a relatively constant vacuum. A squeegee roll **36** is engaged with the lump breaker roll **20** at the outgoing side of the nip between the lump breaker roll and the couch roll, to remove excess moisture from the surface of the lump breaker roll.

The lump breaker roll maintains a light pressure nip with the couch roll **19**, merely sufficient to seal the web to the couch roll and keep the vacuum between the web and couch roll more constant. The driving tension between the couch roll **19** and the wire as well as the tension in the wire maintained by the direction changing roll **21**, which may also be a driving roll, exerts sufficient force on the couch roll to tend to deflect the couch roll inwardly at its center about its opposite ends. This deflecting force is exerted by the wire as it comes into the couch roll, tangentially to the periphery thereof and perpendicular to a radial line A, through a sector of the periphery of the roll to a point where the outgoing run of the forming wire is tangential to the periphery of the roll **19** and perpendicular to a radial line B. The point of deformation is thus between the lines of tangency of the wire to the roll intersecting radial lines A and B, and the point of maximum deflection forces on the couch roll is midway between the lines of tangency intersecting radial lines A and B at a point M intersected by a radial line C.

In order to maintain the surface of the couch roll **19** true throughout its length, we have provided a second roll couple with the roll **19**, the pressure nip of which roll couple is diametrically opposed to point M at the point of intersection of the radial line C with the periphery of the couch roll **19**. As shown diagrammatically in FIGURE 2, the second roll couple is attained by a crown roll **40**, engaging the couch roll **19** and maintaining a pressure nip with said couch roll at N, diametrically opposed to the point M.

The crown roll **40** has a crowned rubber covered periphery **41**, which is formed by machining and finishing

the surface of the roll to give the roll a slightly greater roll diameter in the transverse central portion of the roll than at the ends of the roll and then covering the roll with rubber in a conventional manner. The crown roll **40** will thereby tend to deflect the surface of the roll **19** outwardly at the line of intersection of the surface of the roll with line C, and designated by M. This will counteract the deflecting forces on the couch roll **19** tending to deflect the couch roll at the center thereof, and caused by the weight of the roll, the weight of the wire and the force components resulting from the resistance of the wire itself to the driving forces thereon. The rubber covered crowned periphery **41** of the crown roll **40** may be accurately machined to exactly counteract deflection of the periphery of the couch roll **19** and maintain the periphery of the couch roll **19** uniform throughout its length, to thereby provide a constant tension on the forming wire F.

While we have herein shown a crowned roll having a substantially constant crowned rubber cover, for maintaining the driving periphery of the couch roll **19** true, it should be understood that the crowned roll need not necessarily be rubber covered and that the crowned periphery itself is subject to variation by the crown controlling forces thereon and by variations in temperature, but that the crown is designed to take care of predetermined loads on the roll and to maintain the periphery of the couch roll true under these load conditions.

It should also be understood that one of the many commercial forms of controlled deflection rolls may be used in place of the crowned roll shown. One such controlled deflection roll in which the crown of the roll may be varied in accordance with correcting requirements is shown and described in a United States patent application Ser. No. 339,998, filed Jan. 24, 1964 by Edgar J. Justus and entitled "Adjustable Crown Roll" and now Patent No. 3,276,102. In such a roll an elongated shoe (not shown) within the roll and engaging the inner periphery thereof is forced by fluid under pressure to vary the crown of the roll. The crowning may be regulated by pressure to the extent sufficient to maintain the periphery of the couch roll true under the required operating conditions, and the crown of the roll may be changed as the operating conditions change.

Either roll, however, is effective to maintain the drive periphery of the couch roll true to provide a uniform drive tension on the wire, although a controlled crown roll may be used under widely varying drive conditions. A roll machined to have a crowned peripheral surface is, however, particularly adapted for use where the conditions of operation and forces on the roll are substantially the same for each forming run of the machine.

In FIGURE 3 there is shown still another form of back-up or anti-deflection roll. In this form of the invention a roll **43** provides a roll couple with the couch roll **19**, diametrically opposed to the point of intersection of the line C with the periphery of the couch roll. The roll **43** may be like the roll **11** shown in United States Patent No. 3,060,843 granted to Lawrence Augustus Moore on Oct. 30, 1962. In this form of the invention, deflection forces P acting on opposite ends of a shaft **44** for the roll, deflect the shaft and roll periphery along the nip N to an extent sufficient to exert correcting pressure along the roll at N and maintain the periphery of the couch roll **19** true along a line intersecting point M, and, therefore, provide a uniform drive tension on the forming wire F. In the Moore et al. Patent No. 3,060,343 the correcting forces on opposite ends of the roll shaft may be applied by fluid under pressure, and the pressure may be varied in accordance with that required to maintain the driving periphery of the couch roll **19** true, to provide a constant tension on the forming wire and to avoid wrinkling of the web formed thereon.

It should here be understood that while our invention is herein shown as being applied to the lower forming wire,

the principles of the invention may also be applied to the top forming wire, particularly where a driving couch roll may be in the driving train for the top forming wire, and may also be applied to the transfer couch roll **17**.

It should also be understood that while we have herein shown a crown roll in which the surface of the roll has a required crown formed thereon and have also shown and described forms of rolls in which the crown is formed on the roll by deflecting the roll by forces acting on the roll and on the roll shaft, that various other forms of controlled deflection rolls may be used to attain the result of the present invention, and that in certain forms of couch rolls, the surface of the roll may be maintained true by exerting pressure on the support shaft therefor.

It also should be appreciated that while we have herein shown and described several ways in which the principles of our invention may be carried out, that other modifications in the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.

We claim as our invention:

1. In a Fourdrinier type paper machine,

a forming Fourdrinier wire having a forming run and a return run,

a couch roll adjacent the end of the forming run and having the wire trained tangentially onto said couch roll and from said couch roll at circumferential spaced lines of tangency, as the wire enters and leaves said roll and tending to deflect the surface of the roll between said circumferentially spaced lines of tangency,

a lump breaker roll having a light pressure nip with the couch roll between said circumferentially spaced lines of tangency, for reducing vacuum leakage between the web and couch roll,

and means controlling deflection of said couch roll and maintaining the surface of said couch roll true throughout its length between said circumferentially spaced lines of tangency comprising,

a deflection controlling roll forming a roll couple with said couch roll in diametrically opposed relation with respect to a point midway between said lines of tangency and retaining said couch roll from deflection.

2. A Fourdrinier type paper machine in accordance with claim **1**,

wherein the deflection controlling roll is a crowned roll having a crowned periphery of a larger diameter intermediate its ends thereof than at its ends.

References Cited

UNITED STATES PATENTS

3,161,125	12/1964	Hornbostel	162—348 X
3,097,590	7/1963	Justus	162—358
3,266,976	8/1966	Brezinski	162—358

HOWARD R. CAINE, Primary Examiner

U.S. Cl. X.R.

162—358; 198—202