United States Patent

[11] 3,600,779

[72] Inventor **Donald B. DeNoyer**
Beloit, Wis.

[21] Appl. No. **884,490**
[22] Filed **Dec. 12, 1969**
[45] Patented **Aug. 24, 1971**

[73] Assignee **Allis-Chalmers Manufacturing Company**
Milwaukee, Wis.

[54] **PRESS ROLL WITH TAPERED GROOVES**
5 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** ..... **29/121 A**
[51] **Int. Cl.** **B21b 27/02**
[50] **Field of Search** ..... 29/121 R, 121 A, 121 H, 110; 19/66 T, 65 T; 162/357, 358, 368; 130/5 C, 5 D

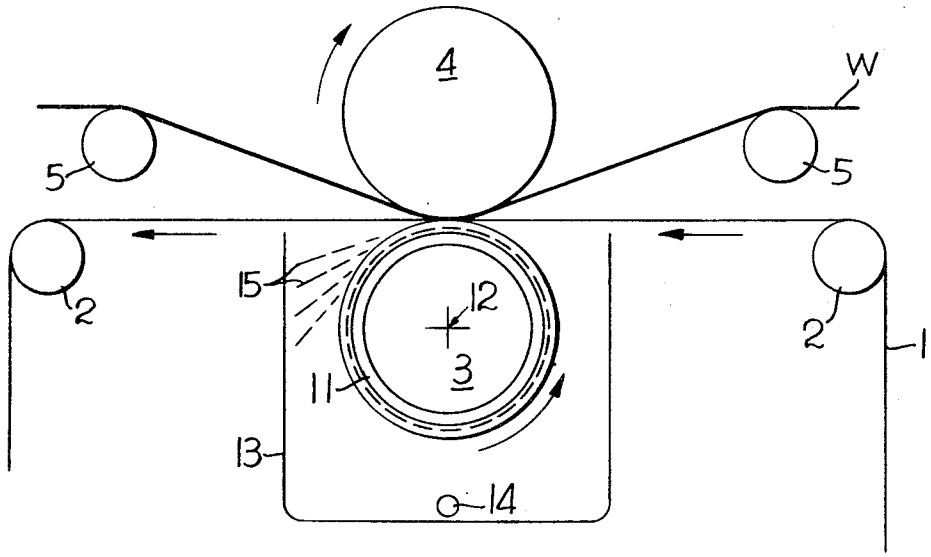
[56] **References Cited**

UNITED STATES PATENTS

1,144,597	6/1915	Hind et al.	29/121 A
1,517,036	11/1924	Wagner	29/121 A
1,552,098	9/1925	Wagner	29/121 A
3,198,697	8/1965	Justis	29/121 A X

Primary Examiner—H. Hampton Hunter
Attorneys—Arthur M. Streich, Robert B. Benson and John P. Hines

ABSTRACT: A grooved press roll shell is disclosed for dewatering a newly formed web of paper. The shell may be grooved with a continuous helical groove in its periphery. The groove presents a continuous radially inward converging taper from the outer cylindrical surface of the roll to the bottom of the groove. The bottom of the groove is defined by a cylindrical surface concentric to the outer cylindrical surface of the roll. The groove tapers inwardly for a distance which is preferably more than twice the width of the groove at the outer periphery of the roll, to define an included angle preferably in a range of from 8° to 10° and a bottom surface between one-half and two-thirds of the width of the groove at the outer periphery of the roll. The continuous taper of the flat bottom groove from the roll surface radially inward to such depth provides desired dewatering without an undesired counter pressure of water trapped in the groove and without the groove become clogged or plugged with felt hair or fiber.



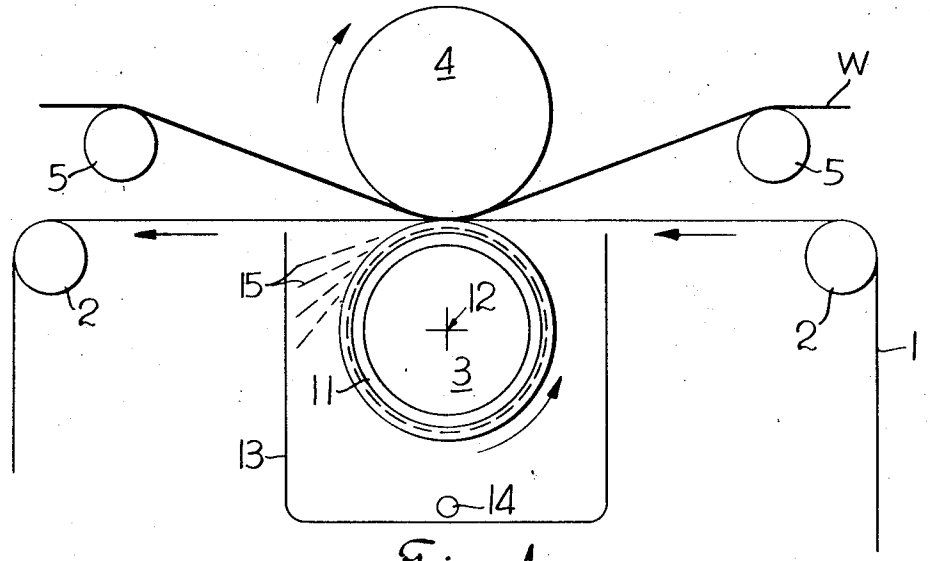


Fig. 1

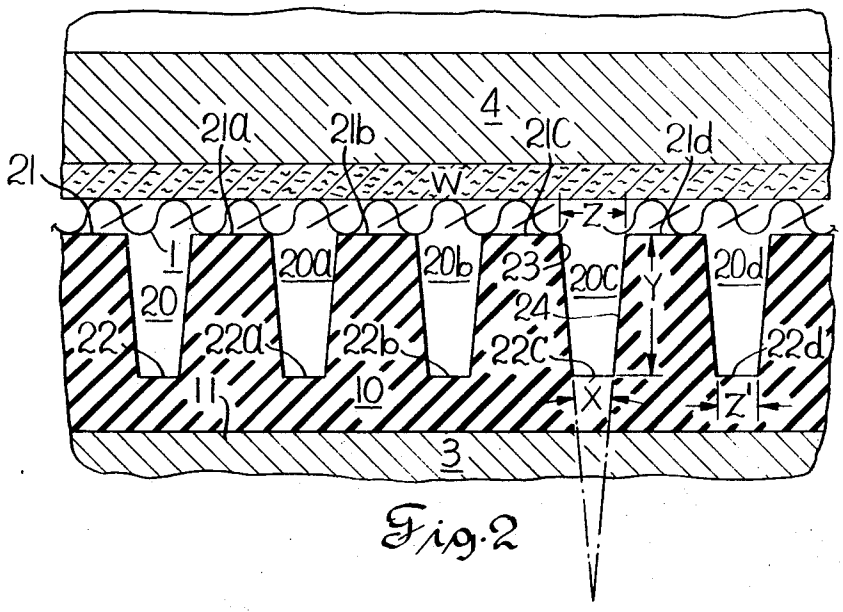


Fig. 2

Inventor
Donald B. DeRoyer
By Arthur M. Streich
Attorneys

PRESS ROLL WITH TAPERED GROOVES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the art of making paper and to a portion of a papermaking apparatus called a press assembly which performs the function of dewatering a wet web of paper that has been formed by a Fourdrinier, cylinder or other web forming assembly. In particular, the present invention relates to a press roll shell having a grooved surface for pressing water out of a web.

2. Description of the Prior Art

Grooved press roll shells are disclosed in U.S. Pat. Nos. 1,517,036; 1,520,489; 1,552,098; 2,858,747 and 3,198,697. The specification of U.S. Pat. No. 3,198,697 discusses in detail the other of the aforementioned patents as well as many others. U.S. Pat. Nos. 1,517,036 and 1,552,098 to R. E. Wagner both disclose the problem of counter pressure of water trapped in a groove that had been attributed to earlier grooved roll shells of what may be termed a wide V-cut groove (i.e., 1–3 millimeters wide) and both proposed narrower grooves, first narrow and deep as taught in U.S. Pat. No. 1,517,036 and then grooves less than 1 millimeter wide and less than 1 millimeter deep as taught in U.S. Pat. No. 1,552,098. Included in the disclosure of U.S. Pat. No. 1,552,098 are tapered and U-shaped grooves that while narrow in terms of then existing prior art, are nevertheless wider than they are deep. The later patent, U.S. Pat. No. 3,198,697 followed the teaching of the earlier Wagner patents and suggested the possible need that the groove walls be at least as far apart as the axial dimension of the groove mouth, for at least an initial groove depth equal to the axial dimension of the groove mouth and that the cross-sectional area of each groove be equal to at least twice the square of the groove width. Commercial operation of a roll shell with grooves according to U.S. Pat. No. 3,198,697 has revealed however that the grooves can become plugged with felt hair and fiber which reduces the effectiveness of the roll in removing water from the web. It is to this problem that the present invention is directed and the principal object of the present invention is to provide a roll shell groove configuration which will achieve the desired dewatering action but without clogging or plugging with felt hair and fiber.

SUMMARY OF THE PRESENT INVENTION

In a preferred embodiment of a grooved press roll shell according to the present invention a continuous helical groove in the periphery of the roll shell presents a continuous radially inward converging taper from the outer cylindrical surface of the roll to the bottom of the groove. The bottom of the groove is defined by a cylindrical surface concentric to the centroidal axis of the roll and of a width that measures between one-half and two-thirds the width of the groove at the surface of the roll. The groove tapers inwardly uniformly from the roll surface to the groove bottom, for a distance which is greater than the distance between the groove walls at the mouth of the groove, and preferably this inward taper is for a distance more than twice the distance between the sidewalls at the mouth opening. The taper of the sidewalls of each groove define an included angle from about 5° to 15° and preferably within the range of from 8° to 10°.

Other features and objects of the invention that have been attained will appear from the more detailed description to follow with reference to an embodiment of the present invention shown in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 of the accompanying drawing shows diagrammatically a side elevation of a press section of a papermaking machine utilizing a press roll with a shell grooved according to the present invention; and

FIG. 2 is a fragmentary enlarged view of an axial section through the press nip between the rolls shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 the reference numeral 1 designates an absorbent carrier band, such as felt, looped around guide rolls 2. The upper run of the felt 1 conveys a web W through the nip of a press roll assembly comprising a dewatering roll 3 and a smooth surface top roll 4 cooperating with the roll 3 to provide therebetween a press nip. The web W may be raised off the felt 1 and passed over lifting rolls 5 before and after the web W and felt 1 pass through the nip between rolls 3 and 4 of the press assembly. The dewatering roll 3 is provided with a shell 10 which is grooved in a manner that will be hereinafter described. The shell 10 may be either a steel cylinder or a rubber sleeve although if shell 10 is a rubber sleeve the roll 3 must be provided with a rigid inner cylinder 11 for supporting the rubber sleeve shell 10. The roll 3 is journaled in support structure (not shown) for rotation about its centroidal axis, indicated in FIG. 1 as the intersection 12 of a vertical and horizontal plane. A pan 13 having a drain 14 is provided to catch water thrown from the roll 3 as shown at 15.

Referring to FIG. 2, it is there shown how the smooth surface top roll 4 presses the web W and felt 1 on the shell 10 of the dewatering roll 3. The shell 10 is provided with a continuous helical groove 20 which presents to the pressure nip with roll 4, a peripheral surface portion having alternating grooves 20*a*, 20*b*, 20*c* and 20*d*, and ridges 21, 21*a*, 21*b*, 21*c* and 21*d*. The ridges 21, 21*a*–21*d*, have an outer periphery which is a cylindrical surface concentric to the cylinder 11 and centroidal axis 12. The helical groove 20 has a flat bottom surface 22, which in the peripheral surface portion facing roll 4, provides each groove 20–20*d* with an inner periphery 22–22*d* which is concentric to cylinder 11, ridges 21–21*d*, and centroidal axis 12. Referring in particular to groove 20*c* in FIG. 2, it is shown that the groove 20 has a pair of sidewalls 23, 24 that present a continuous radially inward converging taper from the outer peripheral surfaces 21*c*, 21*d* to the inner groove surface 22*c*, to define an included angle X from about 5° to 15° and preferably with the range of from 8° to 10°. The grooves 20–20*d* have a depth Y which should be a distance greater than a groove mouth opening Z measured between the adjacent outer cylindrical surfaces of adjacent ridges 21*c* and 21*d*, and preferably the depth Y is more than twice the mouth opening Z. A specific example of groove according to this invention tapers with an included angle of 8°; has a groove mouth opening Z of about 0.035 inch; a groove depth Y of about 0.08 inch; and a groove bottom width Z′ of about 0.020.

In the operation of the described apparatus the felt 1 carries the web W through the press between the smooth surface top roll 4 and the dewatering roll 3 having a shell presenting at the nip between rolls 3 and 4, alternating ridges 21 and deep tapered grooves 20 for receiving water pressed from web W and through felt 1. The relatively deep tapered groove (i.e., the continuous taper projects inwardly to a depth which is preferably more than twice the distance at the mouth of the groove) receives the water to provide the desired dewatering, without an undesired counter pressure of trapped water, and most important, this is accomplished without the grooves becoming clogged or plugged with felt hair and fiber.

From the foregoing detailed description of the present invention, it has been shown how the objects of the invention have been attained in a preferred manner. However, modifications and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included within the scope of this invention. Thus, the scope of this invention is intended to be limited solely by the scope of the claims such as are or may hereafter be appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a generally cylindrical press roll shell adapted to be mounted for rotation about its centroidal axis and to present

to a pressure nip a peripheral rotary surface portion, said surface portion having alternating generally circumferentially aligned grooves and ridges, the ridges having an outer periphery presenting a cylindrical surface concentric to the centroidal axis, and the grooves having a radially inner portion projecting radially inward of the adjacent outer cylindrical surfaces of adjacent ridges by a distance greater than the distance between the adjacent outer cylindrical surfaces of adjacent ridges, the improvement comprising:

each said groove having a pair of sidewalls presenting a continuous radially inward converging taper from the adjacent outer cylindrical surfaces of adjacent ridges to the radially inner portion of each said groove and with said continuous taper converging for a distance greater than the distance between the adjacent outer cylindrical surfaces of adjacent ridges; and

said sidewalls convergingly tapering to define an included angle from about 5° to 15°.

2. In a roll shell according to claim 1, said radially inner portion of said grooves presenting an inner cylindrical groove surface concentric to the outer periphery of the ridges and the centroidal axis; and said inner cylindrical groove surface having a width, measured along a line parallel to the centroidal axis, that measures between one-half and two-thirds the distance between adjacent outer cylindrical surfaces of adjacent ridges.

3. In a roll shell according to claim 1, the taper presented by the pair of sidewalls converging continuously and radially inward for a distance at least twice the distance between the adjacent outer cylindrical surfaces of adjacent ridges.

4. In a roll shell according to claim 2 said sidewalls convergingly tapering to define an included angle from about 8° to 10°.

5. In a roll shell according to claim 3 and in which the grooves in said surface portion presented to a pressure nip, are all portions of a single continuous spiral groove about the cylindrical roll shell.