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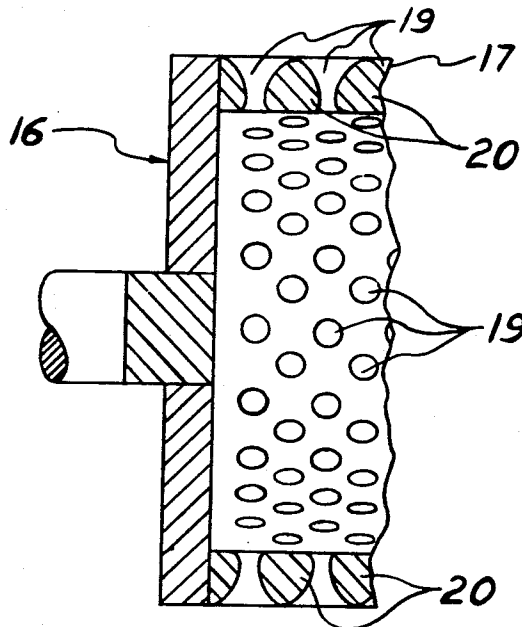
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[54] **RECTIFIER ROLL**
3 Claims, 4 Drawing Figs.

[52] U.S. Cl..... **29/121,**
162/342, 222/410
 [51] Int. Cl..... **D21f 1/08**
 [50] Field of Search..... **29/121;**
162/342; 259/9, 10; 28/10, 9; 107/34; 118/DIG.
14; 100/176, 155; 68/244; 15/262; 222/190;
137/547; 241/93

ABSTRACT: A tubular rectifier roll for use in a paper machine headbox is provided with tapered radial perforations of streamlined contour which impart essentially uniform and nonturbulent rectilinear flow to the paper stock emerging from the downstream side of the roll and entering the headbox slice, thereby insuring uniform deposition of the paper stock onto a paper-forming surface.



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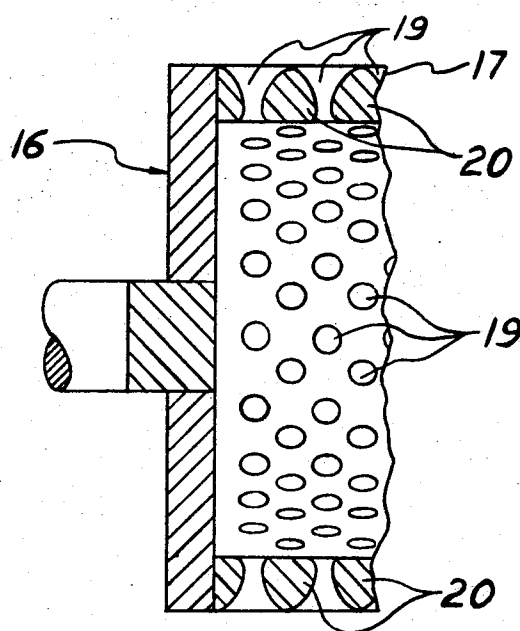
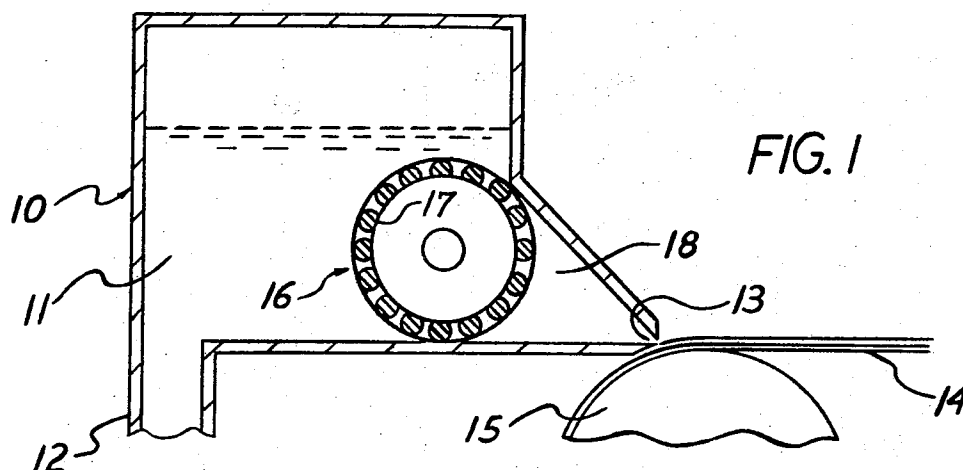


FIG. 2

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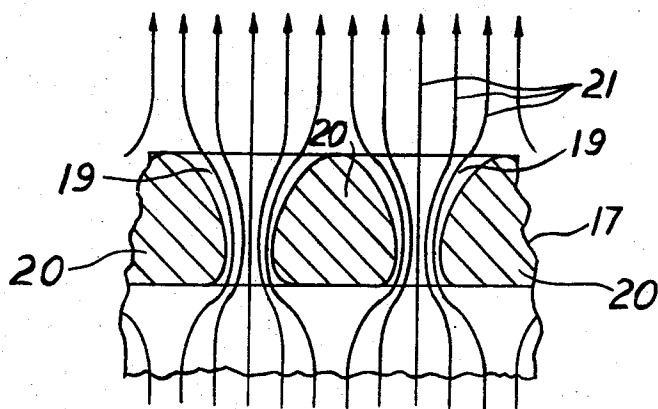


FIG. 3

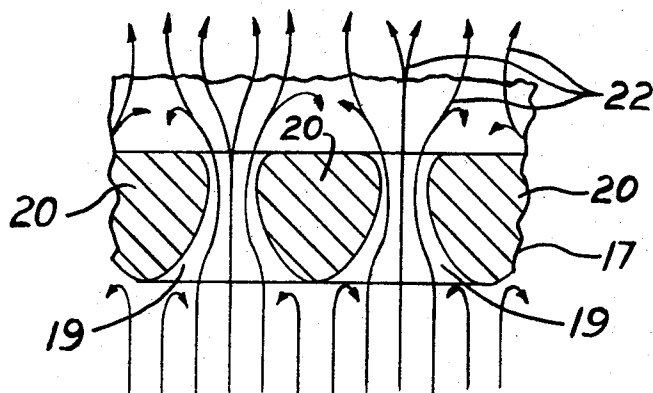


FIG. 4

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RECTIFIER ROLL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to perforated rectifier rolls used in papermaking machines to rectify the flow of paper stock through a headbox slice and onto a paper-forming surface. More particularly, the invention contemplates improving the uniformity of the paper so produced by providing such a rectifier roll with tapered radial perforations of streamlined contour to impart essentially uniform nonturbulent rectilinear flow to the paper stock emerging from the downstream side of the roll and entering the slice.

2. Brief Description of the Prior Art

In order to improve the uniformity with which paper stock is deposited on a paper forming surface from the so-called slice of a paper machine headbox, it is well known to provide one or more rotating rectifier rolls in the flow path of the stock upstream from the slice. Such a rectifier roll typically comprises a tubular shell which is perforated by a pattern of cylindrical holes drilled therethrough in radial relation to the axis of the roll. The roll is rotatably supported parallel to the slice and is rotated about its axis so that the paper stock flows transversely through the roll before entering the slice. By virtue of its constant rotation, the rectifier roll improves the uniformity of the finished paper web by reducing cross velocities and eddy currents which otherwise often develop at the slice. However, since the radial holes of the roll shell are necessarily spaced from one another, the stock emerges from the roll and enters the slice in a flow pattern characterized by localized regions of increased velocity in alignment with the corresponding shell holes traversing the downstream side of the roll facing the slice. Consequently, the stock is deposited on the paper forming surface with corresponding localized regions of increased fiber concentration, which are often visible as streaks in the finished web. Although this undesirable phenomena sometimes can be reduced to acceptable limits by proper selection of the dimensions and pattern of the roll perforations in accordance with other related criteria, such techniques are not entirely successful in all instances, particularly in those cases where the machine in question is intended to produce more than one type or grade of paper.

SUMMARY OF THE INVENTION

In accordance with the present invention, the above-described phenomenon is substantially obviated by the simple but heretofore unobvious expedient of providing a rectifier roll with tapered radial holes of streamlined contour which impart essentially uniform and nonturbulent rectilinear flow to the paper stock emerging from the downstream side of the roll and entering the slice.

Specific means for practicing the invention and other advantages and novel features thereof will be apparent from the following description of an illustrative preferred embodiment of the invention, reference being made to the accompanying drawings in which like reference numerals refer to like elements.

IN THE ACCOMPANYING DRAWINGS

FIG. 1 is a somewhat diagrammatic vertical cross-sectional view of a paper machine headbox equipped with a rectifier roll according to the present invention;

FIG. 2 is an axial cross-sectional view of a portion of a rectifier roll according to a preferred embodiment of the present invention;

FIG. 3 corresponds to an enlarged portion of FIG. 2 and depicts the flow pattern of paper stock emerging from the downstream side of the illustrated rectifier roll toward the headbox slice; and

FIG. 4 corresponds to an enlarged portion of FIG. 2 and depicts the flow pattern of paper stock entering the upstream side of the illustrated rectifier roll.

DESCRIPTION OF THE ILLUSTRATIVE PREFERRED EMBODIMENT

In FIG. 1 of the accompanying drawings, numeral 10 indicates generally the headbox of a Fourdrinier-type paper-making machine. Paper stock 11 is delivered into the headbox through an inlet conduit 12 and is maintained at a predetermined level in the headbox so that it emerges therefrom under constant pressure through outlet slot or slice 13, which deposits it on a moving forming wire 14 supported by breast roll 15. To accelerate the flow of stock through the slice, means well-known in the paper machine art also can be employed to pressurize the air trapped in the headbox above the level of the stock therein.

Tubular rectifier roll 16 is rotatably supported along a horizontal axis with its perforated tubular shell 17 in close radial proximity to the walls of the headbox adjacent throat 18 so that substantially all of the stock that enters slice 13 at the end of the throat must first pass through the rectifier roll. Due to the constant rotation of the roll about its axis by appropriate drive means, not shown, the stock passing through the rectifier roll is thus mixed and directionally stabilized so that it is of uniform consistency and substantially free of cross velocity components and eddy currents as it passes through the slice.

Referring now to FIG. 2 of the drawings, it will be seen that the holes or perforations 19 in the tubular shell 17 of the subject rectifier roll are uniformly disposed in a repetitive pattern, comprising staggered but uniformly spaced parallel rows of holes extending both longitudinally and circumferentially of the roll. Unlike the cylindrical radial holes employed in similar prior art roll shell, however, the radial holes in the illustrative roll shell according to the present invention are tapered inwardly and are streamlined at their extremities so that the ligaments 20 between adjacent holes are likewise of smooth teardrop-shaped profile. Consequently, as best illustrated in FIG. 3, when the stock emerges from the downstream side of the roll toward the slice, each hole along that side of the roll defines a venturi-type nozzle which cooperates with the similar nozzles defined by the laterally adjacent holes to produce an essentially nonturbulent, uniform and parallel flow pattern as depicted by flow arrows 21. Therefore, as indicated in FIG. 3 by the parallelism of flow lines 21 beyond the roll shell, the stock flow is distributed uniformly across the width of the slice and is substantially free of localized velocity variations in the slice. At the opposite upstream side of the roll, the reversed attitude of the tapered rolls relative to the direction of the stock flow reduces the flow-stabilizing effect described above and may tend to produce localized regions of turbulent-varying velocity flow within the roll, as shown by flow lines 22 in FIG. 4. This phenomenon is inconsequential, however inasmuch as such flow pattern disturbances are subsequently rectified by the passage of the stock through the downstream face of the roll toward the slice.

Although the foregoing disclosure describes the present invention in the context of the headbox employing only a single rectifier roll at a specific position, it will be appreciated that the invention is also applicable to installations in which one or more rectifier rolls are disposed at other locations in a headbox or analogous structure and also to applications in which two or more rectifier rolls are located in lateral adjacency to one another so that the total flow of stock through the rectifier roll assembly is divided between the different rolls incorporated therein.

The invention has been described in detail with particular reference to an illustrative preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described heretofore and as defined in the appended claims.

I claim:

1. A papermaking machine rectifier roll comprising a cylindrical tubular shell including surface means defining therein a repetitive pattern of similar holes extending through said shell, said holes being inversely tapered outwardly toward the exterior of said shell and streamlined at their extremities such that fluid emerging from the interior of said shell through laterally adjacent ones of said holes is combined into a substantially nonturbulent flow pattern of relatively uniform velocity extending along the length of said roll, said holes being disposed at uniform intervals along uniformly spaced parallel rows of such holes extending lengthwise of said roll, said holes further being staggered from row to row in a repeti-

tive pattern.

2. A rectifier roll according to claim 1 in which said holes are disposed in generally radial relation to the axis of said tubular shell.

3. A rectifier roll according to claim 2 in which said holes are disposed at substantially uniform distances from adjacent ones thereof, each adjacent pair of said holes defining therebetween a shell ligament which is of generally teardrop shaped cross-sectional profile along a cutting plane generally normal to the exterior surface of said shell.

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