

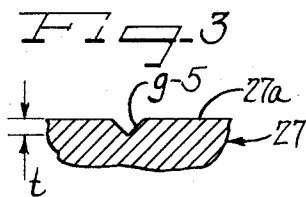
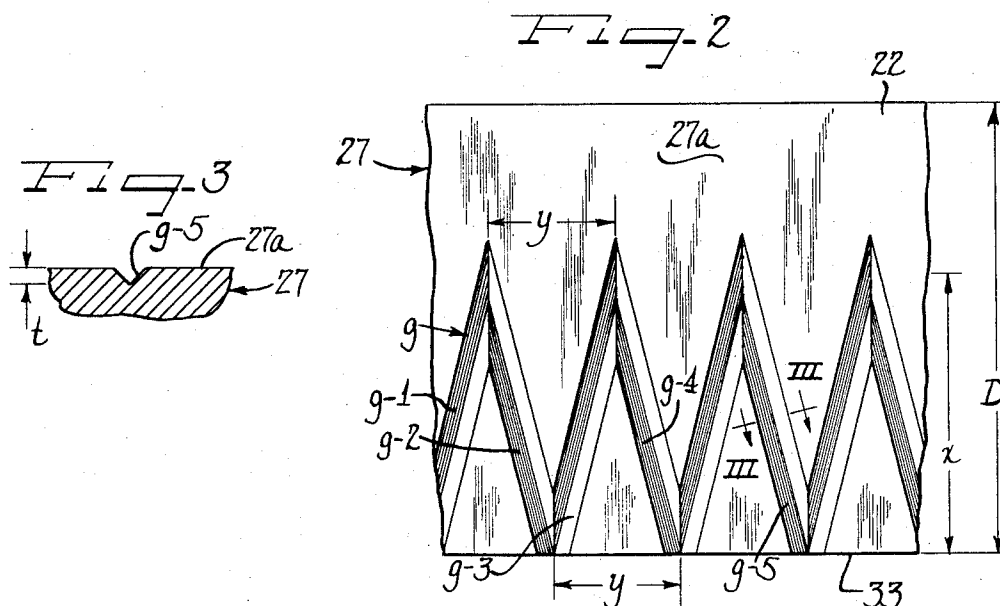
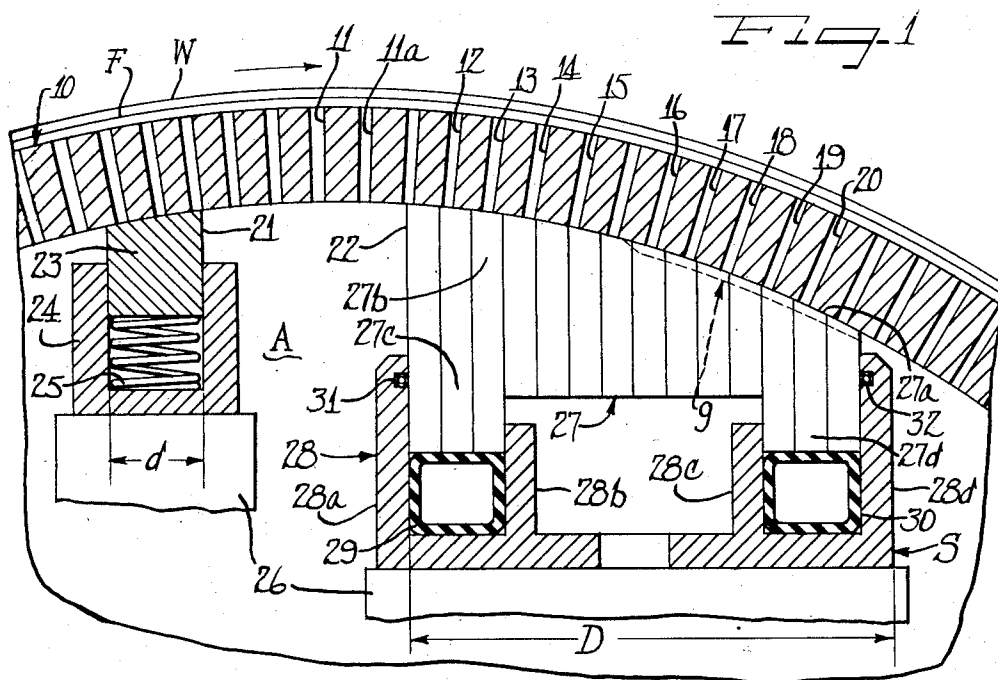
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SILENCERS FOR SUCTION ROLLS

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SILENCERS FOR SUCTION ROLLS

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This invention relates to paper making machines, and more particularly, to an improved suction roll equipped with silencing means.

Although the instant invention may have application in other arts, it will be described primarily in connection with the paper machine art in which the instant invention is used to particular advantage. The conventional suction roll is provided with a perforate rotating cylinder or shell having a stationary suction box operating against the inner surface thereof. The suction box creates a relatively high vacuum which is transmitted to the sheet of pulp through the perforations in the shell to draw water from the sheet and compact the same. Depending upon the particular location in the paper machine, suction rolls may vary in diameter from about 16 inches to as much as about 60 inches; and the perforations therein are relatively small in size having diameters ranging from about $\frac{5}{32}$ to about $\frac{5}{16}$ of an inch (depending upon the shell thickness) and having a depth (or shell thickness) ranging from about 1 inch to about 4 inches. The suction areas may have magnitudes ranging from about 20° to as much as about 70° or 80°; and the suction areas are customarily defined by relatively thin sealing strips mounted on the suction box and extending axially of the roll. Customarily the sealing strips are about $\frac{3}{4}$ inch to 1 inch in peripheral dimension, and this is considered to be the width of the strip required to effect a seal between the rotating shell and the sealing means.

The suction rolls of the prior art, regardless of design or manufacture, produce noise when operating at speeds of about 400 ft./min. or higher, in other words, when the rolls operate at a peripheral speed of about 400 ft./min. or higher, which will also be the speed of the paper and/or felt passing through the machine and over such rolls. Some devices have been suggested for reducing this noise, but each of such devices leaves something to be desired. Suction rolls operating at relatively high speeds of present-day practice, which are in the neighborhood of 2000–3000 or more ft./min., are ordinarily extremely noisy, emitting a high pitch sound which is so irritating and wearisome to the operators that most operators have found it necessary to wear earplugs.

U.S. Patent No. 2,107,812, issued to Earl E. Berry, Lloyd Hornbostel and John E. Goodwillie, shows a silencing device in the nature of multiple pressure reducing chambers separated by sealing strips, but the greatly increased operating speeds of the present-day machines tend to make this device obsolete.

In U.S. Patent No. 2,274,641, issued to Ernest J. Abbott and John D. Kraus, a silencing device associated with the vacuum sealing strips is also shown. In this case, the sealing strip is equipped with an extension diverging from the inner periphery of the shell at the off-running side of the sealing strip so as to provide a slender tapering vent passage of relatively great width to control the flow of air entering into the perforations in the roll shell at the offrunning side of the suction area. Although this device is operative for the use shown in Abbott,

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this device requires rather careful control in the spacing of the diverging portion of the sealing strip from the inner periphery of the roll; and there is a tendency for the device to work out of adjustment because of wear on the portions of the device sealingly engaging the inner periphery of the roll. Abbott provides for adjustment of the device, but this is a manual adjustment.

In contrast, the instant invention resides in a discovery of a novel type of sealing structure for the offrunning side of the suction area. In particular, the instant sealing structure (which may be used at the oncoming or offrunning side of the suction area, but which is preferably used only at the offrunning side where the greatest noise is created) presents a grooved surface with land portions urged flush against the inner surface of the shell and grooves extending from the central portion of the surface outwardly in the direction of travel of the shell opening at the offrunning edge of the sealing strip extension for progressively effectuating equalization of pressure between the holes passing over the sealing strip. Since the land portions of the instant device are urged flush against the shell inner periphery (rather than diverging therefrom), the instant device cannot fall out of adjustment. Although there will be some wearing of all of the surface portions of the sealing strip which engage the shell inner periphery, such wearing will take place in a substantially uniform manner throughout the entire engaging surface area and at such a rate that the cross-sectional dimension of the grooves will be affected to such a little extent that differences in the rate of air flow through the grooves will not occur until the sealing assembly is substantially worn out. In addition, automatic adjusting means are provided in the form of resilient members urging both the oncoming and offrunning sides of the sealing strip against the shell inner periphery, so that automatic adjustment may be made for excessive wearing at localized portions of the sealing strip.

It is, therefore, an important object of the instant invention to provide an improved silencing arrangement for paper machine suction rolls.

It is a further object of the instant invention to provide an improved paper machine suction roll comprising a perforate shell having a plurality of holes, a suction box for applying reduced pressure to said holes, a seal between the suction box and the inner surface of the shell defining areas of pressure change in said holes, and means located at the areas of pressure change in the holes presenting a grooved surface with land portions urged flush against the inner surface of the shell and grooves extending from the central portion of the surface outwardly in the direction of travel of the shell for progressively effectuating equalization of pressure between the holes.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

Figure 1 is a fragmentary detail view in sectional elevation of the sealing means of the instant invention, showing fragmentarily a suction roll shell and associated structure;

Figure 2 is a fragmentary top plan detail view of the sealing means of the instant invention; and

Figure 3 is a detail fragmentary sectional view taken substantially along the line III—III of Figure 2.

As shown on the drawings:

In Figure 1 it will be seen that a suction roll shell 10 is shown fragmentarily with holes or perforations 11–20, inclusive, shown therein. A suction area A is shown ex-

tending from its oncoming side 21 to its offrunning side 22. At the oncoming side 21 a normal sealing strip 23 mounted for slight radial movement in a packing gland 24 is resiliently urged against the inner periphery of the shell 10 by a spring 25 or other suitable means. The packing gland 24 is, of course, mounted on a suction box 26 indicated only fragmentarily, but which has the standard suction box structure which includes a non-rotatable generally axially aligned chamber suitably connected to a vacuum pump through an axial conduit and mounted in the roll so as to expose the inner periphery of the shell 10 to reduce pressure only at the suction area A. By exposing the suction area A at a reduced pressure the pressure in holes such as the holes 11 and 11a is reduced.

As will be appreciated, the normal sealing strip 23 has a relatively short peripheral dimension d (or width) in the nature of from about $\frac{3}{4}$ to about 1 inch and this is a sufficient width to effect a seal between the inner periphery of the shell 10 and the strip 23 per se.

In contrast, a sealing strip 27 of the sealing strip assembly S embodying the instant invention is, in effect, an ordinary sealing strip plus an extension in that it has a peripheral dimension D of about 2 to about 5 times the width d that is required to form a seal. As here shown, the width d is $\frac{3}{4}$ inch, whereas the width D is $3\frac{1}{2}$ inches, for a typical embodiment of the instant invention. The sealing strip 27 is provided with a top surface 27a which will be described in detail hereinafter and the top surface 27a is maintained flush against the inner periphery of the roll shell 10 throughout the entire width D of the sealing strip 27. A felt F is trained over the suction area A of the shell 10 and also over the sealing strip 27. A web W is carried by the felt F.

Although it is not desired to limit the invention to any particular theory, it is believed that the reduced pressure created in the suction area A is retained in the holes 12, 13 and perhaps 14 and 15, so that the forward portion 27b of the sealing strip 27 functions substantially as the sealing strip 23, merely to effect the desired seal. However, grooves g (which will be described in detail hereinafter) are formed in the offrunning side of the top surface 27a of the sealing strip so that air will start to enter through the bottoms of the holes, such as at 16 and 17. In this way substantial volumes of air cannot flow rapidly into a hole such as the hole 16 because of the restricted flow through the grooves g . The hole 16 has a relatively high vacuum and the slight amount of initial leakage of air serves to reduce the vacuum therein partially, so that the flow of a greater amount of air into, for example, the hole 17 will not involve such a substantial pressure change and will not cause an appreciable amount of noise.

The instant sealing strip structure S is also provided with automatic means for compensating for wear on the top surface 27a thereof. As will be noted, the suction box 26 shown fragmentarily mounts a packing gland 28 which provides for limited radial movement of the sealing strip 27. The sealing strip 27, which is formed of any of the usual sealing strip materials which include hard resins, wood, layers of packing, or the like is here formed of a laminated structure of layers of sealing material, as shown in full view, and the sealing strip 27 is provided with an oncoming 27c and an offrunning 27d leg or ridge. The legs 27c and 27d extend radially inwardly from the main body of the sealing strip 27. Guide walls 28a and 28b are provided in the packing gland 28 for receiving the oncoming leg 27 and permitting limited axial movement therebetween. In similar manner, walls 28c and 28d slidably receive the offrunning leg 27d of the packing strip 27. For convenience, an arrow is shown in Figure 1 to indicate the direction of rotation of the shell 10 from which the oncoming and offrunning sides of the various elements can be determined.

Resilient means in the form of a resilient pneumatic tube 29 made of rubber or suitable flexible material con-

nected to a source of air (not shown) under pressure is seated between the guide walls 28a and 28b for resiliently urging the oncoming packing leg 27c toward the inner periphery of the shell 10. In like manner, similar pneumatic means 30 are provided between the walls 28c and 28d for resiliently urging the offrunning sealing strip leg 27d against the inner periphery of the roll 10. In this way, any wear at either the forward or the rear end of the working surface 27a of the sealing strip 27 will not cause separation between the sealing strip surface 27a and the shell 10. Instead, the spaced resilient means 29 and 30 functioning to urge the opposite ends of the sealing strip 27 against the roll shell 10 will compensate for any wear on the sealing strip top surface 27a and continuously maintain the sealing strip top surface 27a against the inner periphery of the shell 10. It will be appreciated that the resilient means 29 and 30 are preferably positioned in spaced relation from each other and coact with the oncoming and offrunning sides of the sealing strip 27 to maintain constant accurate adjustment automatically.

The sealing strip legs 27c and 27d are slightly smaller than the space between the walls 28a and 28b and the walls 28c and 28d, so as to permit sliding movement therebetween and also slight tilting movement in the event that either the oncoming or offrunning portion of the top surface 27a should wear faster than the other. In order to prevent excessive leakage of air between the sealing strip 27 and the gland 28, a small pneumatic sealing device 31 is provided in the wall 28a in the form of a rubber tube which connects to a source of air as urged against the sealing strip 27 to form a seal; and a similar pneumatic member 32 is mounted in the rear wall 28d for cooperation with the offrunning packing strip leg 27b.

As shown in Figure 1, the suction area A is covered with a belt that is resistant to air flow therethrough which is shown in the form of the combination of the felt F with the web W carried thereon. It will also be appreciated that a forming wire with the web thereon will function in a similar manner. The general principles of the instant invention call for maintaining the tops of the holes (e.g. 16 and 17) closed while permitting limited amounts of air to enter the bottoms thereof through the grooves g .

Referring now to Figures 2 and 3, it will be seen that the top surface 27a of the sealing strip 27 extends a distance D in the peripheral direction from the oncoming edge 22 to an offrunning edge 33 (with the oncoming edge 22 defining the offrunning side of the suction area A). It will be seen that the grooves g generally having a zig-zag or serpentine pattern, although individual groove elements $g-1$ and $g-2$ extend from about the middle of the surface 27a a distance x to the offrunning edge 33 where they open to the atmosphere. Although other types of restricted passageways or grooves on the surface 27a may be provided so as to generally channel and restrict the flow of atmospheric air along localized portions of the surface 27a from the offrunning edge 33 to approximately the middle one-third or one-half of the surface 27a, the instant arrangement is preferred. In the instant arrangement a pair of grooves $g-1$ and $g-2$ open to the atmosphere along the offrunning edge 33 in spaced relation to each other but extend convergently back toward the middle of the surface 27a at which the grooves $g-1$ and $g-2$ merge. Correspondingly, the groove $g-2$ merges with a third groove $g-3$ at the offrunning edge 33, and the groove $g-3$ extends divergently with respect to the groove $g-2$ toward the middle of the surface 27a where it becomes merged with a fourth groove $g-4$. In this way adjacent points of merger in the middle of the surface 27a between the grooves $g-1$ and $g-2$ and between the grooves $g-3$ and $g-4$ are spaced apart a distance y and the opening ports in the offrunning side 33 for adjacent non-

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merging grooves, such as the grooves $g-1$ and $g-2$ are also spaced apart a distance y . Preferably y is about one-half x and x is one-fourth to three-fourths of D .

The foregoing pattern of Figure 2 is advantageous in that closely adjacent holes in the suction roll breaking over the middle of the surface 27a will have air initially bled thereinto at different times. In other words, one hole may pass over a point of merger between the grooves $g-1$ and $g-2$ whereas the immediately adjacent hole will be passing over the land area adjacent this point of merger and this hole will not receive air until a fraction of a second later when it passes over a portion of, for example, one of the grooves $g-2$ or $g-3$.

Referring to Figure 3, it will be seen that a groove $g-5$ of Figure 2 in the instant sealing strip 27 is very shallow, having a relatively small depth t . The depth t of the grooves g is substantially the same throughout the entire pattern and preferably ranges from about $0.02x$ to $0.1x$ so as to provide a sufficiently restricted passageway when the grooves g are covered by the shell 10.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of this invention.

We claim as our invention:

1. The combination in a suction roll of a rotatably mounted perforate shell having a plurality of holes, a stationary suction box for applying reduced pressure to said holes, a seal between the suction box and the inner surface of the shell defining areas of pressure change in said holes, and means located at the areas of pressure change in the holes presenting a grooved surface with land portions urged flush against the inner surface of the shell

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and grooves extending from the central portion of the surface outwardly to the trailing edge at an angle to the direction of travel of the shell for progressively effectuating equalization of pressure between the holes.

2. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a stationary suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a traveling felt carrying a web trained over the suction area of the shell and away from the shell surface along a line beyond the offrunning side of the suction area, first sealing means on the suction box urged against the shell inner periphery at the oncoming side of the suction area, and second sealing means on the suction box urged against the shell inner periphery at the offrunning side of said suction area and having an extension thereof extending therefrom toward said line, said extension presenting a grooved surface with land portions urged flush against the inner periphery of the shell and shallow grooves extending outwardly to the trailing edge at an angle to the direction of travel of the shell.

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