The instant 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 % to about % 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 70° or 80°; and such 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 % 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 sheet 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 the 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 disagreeable to the operators that most operators have found it necessary to wear earplugs.

In U. S. Patent No. 2,107,812, issued to Earl E. Berry, Lloyd Hornbostel and John E. Goodwillie, a silencing device in the nature of multiple pressure reducing chambers separated by sealing strips is suggested, 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 packing strip is equipped with an extension diverging from the inner periphery of the shell at the offrunning side of the packing 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. This device is operative for the use shown in the Abbott et al. disclosure, namely for use with an assembly wherein a felt carrying the web is trained over the entire suction area and beyond on the offrunning side of the suction area. Recently, however, suction roll arrangements have been devised for the purpose of gaining one advantage or another wherein either the felt or the wire with the web thereon is removed from the surface of the suction roll just beyond the offrunning side of the suction area. In such arrangements, it has been found that the Abbott et al. device is much less effective or substantially ineffective. 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 extends from the offrunning side of the suction area flush against the shell inner periphery for a substantial distance, substantially greater than the customarily used sealing strip thickness of up to 1 inch. Instead, such sealing means extends flush against (rather than diverging from) the shell inner periphery to the point at which the web carrying felt or wire is removed from the suction roll surface. Although it would be expected at first blush that such an enlarged sealing strip would be no more effective than the regular size sealing strip, it has been found that the instant large sealing strip has unusual silencing powers, particularly at the very high speeds now used in paper machines.

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 comprising a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a belt resistant to air flow throughout travelling over the suction area of the shell and away from the shell surface along a line just beyond the offrunning side of the suction area, first sealing means on the suction box urged against the shell inner periphery at the onrunning 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 extending therefrom flush against the shell inner periphery to beyond the line at which the belt moves away from the shell.

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 an essentially diagrammatic view of a paper machine comprising suction rolls embodying the instant invention;

Figure 2 is an enlarged detail view in sectional elevation of the sealing means of the instant invention, showing fragmentarily associated structure;

Figure 3 is a fragmentary elevational view showing the instant sealing means in a suction couch roll structure;

Figure 4 is a fragmentary elevational view showing the instant sealing means in a suction pickup roll structure;

Figure 5 is a fragmentary elevational view showing the instant sealing means in a felt drier press;

Figure 6 is a fragmentary elevational view showing the instant sealing means in one type of suction press;

Figure 7 is a fragmentary elevational view showing the instant sealing means in another type of suction press;

Figures 8 and 9 are fragmentary elevational views showing different embodiments; and

Figure 10 is a chart showing the vacuum loss against distance in Figures 8 and 9.

As shown on the drawings:

In Figure 1 the reference numeral 10 indicates gen-
erally a paper machine of the instant invention, which is provided with a forming wire F trained over a suction couch roll 11 with suction box 12 (which will be described in detail hereinafter) and a turning roll 13. The forming wire F carries a web W thereon over the suction box 12 of the couch roll 11. A suction pickup roll 14 with suction box 15 is lapped by a pickup felt 16 and urges the felt 16 against the web W on the wire F so as to pick the web W from the wire F at the suction box 15 and transfer the web W to the suction felt pickup 16. The felt 16 is mounted on a plurality of guide rolls 17, 18, 19, 20, 21 and 22. The pickup felt 16 passes between a plain press roll 23 and a suction press roll 24 with suction box 25 (which will be described in detail hereinafter) to assist in drying the pickup felt 16 before it passes out around the suction pickup roll 14. From the pickup roll 14 the pickup felt 16 carries the web W to a first press nip N-1 defined by a press roll 26 within the loop of the pickup felt 16 and a suction press roll 27 with suction box 28 (which will be described in detail hereinafter) covered by a lower press felt 29. The press felt 29 is mounted on a plurality of guide rolls 30, 31, 32, 33 and 34; and the press felt 29 is carried between the web W to a second press nip N-2 defined by a bore upper roll 35 and a lower suction roll 36 with suction box 37 (which will be described in detail hereinafter) covered by the felt 29. As the offrunning side of the suction area 37 the web W is pulled over a guide roll 38 to separate the web W from the felt temporarily and then return the web W to the offside of the felt 29.

A third press nip N-3 is defined by an upper bore roll 39 and a lower suction roll 40 with suction area 41 straddling the nip N-3 and covered by felt 42 mounted on guide rolls 43, 44, 45 and 46. The web W travels along the top of the felt 29 until the end of the felt run 29 and thereafter the felt 29 turns about the guide roll 34 and the web is fed theretofrom the third press nip N-3 where the web is maintained out of contact with the felt 42 until the nip N-3 and is then again separated from the felt 42 by a guide roll 47 at the off running side of the nip N-3.

The general character of the structures for the suction boxes 12, 15, 25, 28, 37 and 41 of Figure 1 will be discussed separately hereinafter, after a consideration of Figure 2 which shows details features of a sealing strip S of essential importance in the instant invention.

Referring to Figure 2, it will be seen that a roll shell 50 is shown fragmentarily with bore or perforations 51-60, inclusive, shown therein. A suction area A is shown extending from its oncoming side 61 to its off running side 62. At the oncoming side 61 a normal sealing strip 63 mounted for slight radial movement in a packing gland 64 is resiliently urged against the inner periphery of the shell 50 by a spring 65 or other suitable means. The packing gland 64 is, of course, mounted on the suction box 66 indicated only fragmentarily. As is well known, the suction box or gland is permanently mounted within the roll shell 50 and connected through axially aligned conduits to a vacuum pump or similar device for creating a vacuum in the suction area A. Reducing the pressure in the holes 51a and 51 exposed to the suction area A.

As will be appreciated, the normal sealing strip 63 has a relatively short peripheral dimension d (or width) in the nature of from about 5% to about 1 inch and this is a sufficient width to effect a seal between the inner periphery of the shell 50 and the strip 63 per se.

In contrast, a sealing strip 67 of the sealing strip assembly S embodying the instant invention has a peripheral dimension D of from about 2 to about 5 times the width d that is required on top of which it is desired that the sealing strip 67 shall be mounted on the suction box 66 where the width d is 3½ inches for a typical embodiment of the instant invention. Although it would be expected that the use of the much wider sealing strip 67 would result in nothing more than a more perfect seal between the strip 67 and the inner periphery of the roll shell 50 and also result in a greater amount of wear on both members, the actual result is a very substantial and unique silencing effect. The sealing strip 67 has its top surface 67a maintained flush against the inner periphery of the roll shell 50 throughout the entire length of the sealing strip 67. As will be appreciated, Abbott (Patent No. 2,274,641) has suggested spacing the offrunning surface of a sealing strip away from the shell periphery so as to form a divergent path which permits air to enter between the sealing strip and the roll shell from a restricted path along the offrunning side of the packing. It has been suggested that the Abbott structure may be used with effect in a suction box such as the suction box 28 shown at the first press nip N-1; but the Abbott structure is not effective in any of the other suction boxes shown in Figure 1. The reason for this is now believed to be that in the suction box 28 the felt 29 with the web W thereon is urged against the outer periphery of the roll 27 until substantially beyond the suction box 28.

In contrast, in the arrangement shown in Figure 2, it will be noted that the web W carried on a felt F is trained over the roll shell 50 and then away from the shell surface along a line LI, just beyond the offrunning side 62 of the suction area A. Also, it will be noted that the sealing strip 67 is urged against the shell inner periphery at the off-running side 62 of the suction area A and extends therethrough flush against the shell inner periphery to beyond the line L at which the felt F moves away from the shell 50. This results in a unique silencing effect.

Although it is not desired to limit the invention to any particular theory, it is believed that the reduced pressures created in the suction area A is retained in the holes 52, 53, 54, 55, 56, and 57 that the forward portion 67b of the sealing strip 67 functions substantially as the sealing strip 63, merely to effect the desired seal. However, the felt F is then directed away from the surface of the shell 50 at approximately along the line L (which extends axially of the roll). As the felt F breaks away from the surface of the shell 50, it will be appreciated that air will start to enter through the holes of the shell, such as at 58. Mere regulation of the rate at which the felt separates from the shell 50 in order to control the flow of air into holes such as the holes 56 and 57 would probably be effective, if such were possible as a matter of material considerations. However, the resiliently of the felt (or of a wire carrying the wet web) made it impossible to exercise control here a practical impossibility. Instead, extremely high vacuum is, in particular, for example, the hole 56 will tend to hold the felt F thereagainst or perhaps to distort the felt F as indicated in the drawing to a limited extent. In this way substantial volumes of air cannot flow rapidly into a hole such as the hole 56 which has a very high vacuum; whereas after some initial leakage of air into a hole such as the hole 57 the vacuum may have been reduced and the entrance of the remaining air into the hole 57 will not cause any appreciable noise.

In this way it will be seen that the traveling felt F (or the wire W) may coact with the shell 50 because of the resilient character of the felt F so as to function as its own check valve in preventing substantial quantities of air from entering holes having a high vacuum. As has been noted, the small number of revisions and limitation to any particular theory, it is believed that the going explanation which has been developed primarily by hindsight describes generally the phenomena here involved which will account for the superior performance here obtained.

It will be noted that Abbott (Patent No. 2,274,641) does not have this flexible type of "check valve" arrangement, but rather must rely upon the accurate positioning of the diverging portion of his packing gland. Wearing of the Abbott packing gland will, of course, create a
need for constant adjustment and Abbott provides for such adjustment. The instant sealing strip structure S is, however, also provided with automatic means for compensating for wear. As will be noted, the suction box (shown fragmentary at 65) mounts a packing gland 68 which provides for limited radial movement of the sealing strip 67. The sealing strip 67, which is formed of any of the usual sealing strip materials which include hard resins, wood, layers of packing, or the like is provided with an oncoming 67c and an offrunning 67d leg or ridge. The legs 67c and 67d extend radially inwardly from the main body of the sealing strip 67. Guide walls 68a and 68b are provided in the packing gland 68 for receiving the oncoming leg 67c and permitting limited axial movement therebetween. In similar manner, walls 68c and 68d slidingly receive the offrunning leg 67d of the packing strip 67. (For convenience, arrows are shown in the instant Figure 2 and each of the remaining figures to show the direction in which the shell 59 rotates.)

Resilient means in the form of a resilient pneumatic tube 69 made of rubber or suitable flexible material and connected to a source of air (not shown) under pressure is seated between the guide walls 68a and 68b for resiliently urging the oncoming packing strip 67c toward the inner periphery of the shell 59. In like manner, similar pneumatic means 70 are provided between the walls 68c and 68d for resiliently urging the offrunning sealing strip leg 67d against the inner periphery of the roll 59. In this way, any wear at either the forward or the rear end of the working surface 67a of the sealing strip 67 will not cause separation between the sealing strip surface 67 and the shell 59. Instead, the spaced resilient means 69 and 70 functioning to urge opposite ends of the sealing strip 67 against the roll shell 59 will compensate for any wear on the sealing strip surface 67a and continuously maintain the sealing strip surface 67a against the inner periphery of the shell 59. It will be appreciated that the resilient means 69 and 70 positioned in spaced relation from each other and coating with the oncoming and offrunning sides, respectively, of the sealing strip 67 serve to maintain constant accurate adjustment automatically.

The sealing strip legs 67c and 67d are slightly smaller than the space between the walls 68a and 68b, and the walls 68c and 68d, 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 67a would wear faster than the other. In order to prevent excessive leakage of air between the sealing strip 67 and the forward gland wall 68, a small pneumatic sealing device 71 is provided in the wall 68a in the form of a rubber tube which connects to a source of air and is urged against the sealing strip 67 to form a seal. A similar pneumatic member 72 is mounted in the rear wall 68d for cooperation with the offrunning packing strip leg 67d.

As shown in Figure 2, the suction area A is covered with a belt that is resistant to air flow therethrough which is shown in the form 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; but the forming wire and the usual lightweight felts will function in a different manner if the paper web is removed therefrom before or during travel over the sealing strip assembly S. These distinctions will be explained hereinafter. In general, however, the instant invention may be used to the greatest advantage if the belt (in the form of a web or a wire with the paper web thereon) is removed from the shell surface along a line L which is within the middle one-half of the sealing strip 67.

Referring now to specific embodiments of the instant invention, in Figure 3, it will be seen that the suction couch roll 11 is shown (fragmentarily) with the suction box 12 shown partially therein. The suction box 12 mounts a first sealing strip 12a urged against the inner periphery of the shell 11a at the oncoming side of the suction area A-11. The traveling forming web W is trained over the suction area A-11 and away from the surface of the shell 11a along a line L-11 just beyond the offrunning side of the suction area A-11 (which is defined by the oncoming edge of the sealing assembly S-11). As will be noted, the sealing assembly S-11 has the same structure as the sealing assembly S of Figure 2 and the sealing assembly S-11 extends from the offrunning side of the suction area A-11 flush against the inner periphery of the shell 11a to the line L-11 at which the wire F and the web W move away from the shell 11a. The line L-11 is aligned approximately with the middle of the sealing strip assembly S-11. The use of the sealing strip assembly S-11 in the suction couch roll 11 has been found to result in very superior silencing of the noise ordinarily created by the suction roll 11. As will be appreciated, there is a distinct advantage in being able to remove the wire F from the surface of the shell 11a along a line L-11 just beyond the offrunning side of the suction area A-11, and before exposure to atmospheric pressure beyond a sealing strip (not shown) at the offrunning side of the suction area A-11. This is because the suction couch roll 11 tends to retain droplets of water in the perforations 11b therein and once the full atmospheric pressure is available in the instant invention, centrifugal force will tend to throw the droplets of water back out onto the forming wire F. The instant invention permits the removal of the forming wire at the desired location without causing excessive noise.

Referring now to Figure 4, it will be seen that Figure 4 shows fragmentarily a shell 14a of the suction pickup roll 14, as shown in Figure 1, having a suction box 15 shown fragmentarily therein for the purpose of defining a suction area A-14. Actually, the suction area A-14 is divided into a high vacuum area H defined by a peripherally spaced pair of sealing strips P, and wherein maximum vacuum is applied for the purpose of picking up the web W from the forming wire F. The web W is picked up on the pickup felt 16 which is trained over the suction area A-14. As mentioned, the suction area A-14 includes a first oncoming high vacuum suction area H and then a second low vacuum suction area L, which employs a vacuum suction area L-14 just beyond the offrunning side of the suction area A-14 which is defined by the oncoming edge of a sealing strip assembly S-14. The sealing strip assembly S-14 has the same structure as the sealing strip assembly S of Figure 2 and S-11 of Figure 3 and functions in the same manner.

The felt 16 with the web W retained thereagainst (on the bottom side) is trained away from the shell surface along the line L-14 which is aligned approximately with the middle of the sealing strip assembly S-14. Again, a superior silencing effect is obtained by the use of the sealing strip assembly S-14 and the additional operating advantage of separating the felt 16 and the web W from the shell 14a just beyond the suction area A-14 is obtained. As here shown fragmentarily, a save-all pan 73 is conveniently interposed between the shell 14a and the felt 16 at the offrunning side so as to prevent droplets of water from being shown off the shell 14a and onto the felt after atmospheric pressure is obtained at the inside of the shell 14a and the offrunning side of the sealing strip assembly S-14. Referring now to Figure 5, which shows fragmentarily the press roll 23 urged against the suction press roll 24 for the purpose of dewatering the suction pickup felt 16, as shown in Figure 1 diagrammatically, it will be seen.
that a suction area A-24 is defined by a first sealing means 25a on the suction box 25 (shown fragmentarily) at the oncoming side of the suction area A-24 and a sealing strip assembly S-24 also mounted on the suction box 25 at the offrunning side of the suction area A-24. In this further assembly, the suction area A-24 is mounted above the press nip N-4 which is its maximum point of pressure substantially along the line L-24 at which the felt 16 is carried from the surface of the suction roll 24 and transferred onto the surface of the plain press roll 25. The line L-24 is aligned approximately with the felt line 42 of the sealing strip assembly S-24, this has the same structure as that shown by S in Figure 2. The general principles here are the same as those heretofore set forth, with the exception that the felt 16 is backed by the roll 23 rather than carrying a web W thereon. Superior silencing is obtained using this structure.

Referring now to Figure 6, which shows the cooperation between the press rolls 35 and 36 at the press nip N-2, it will be seen that the press felt 29 with the web W thereon is passed through the nip N-2. At the nip N-2 it is desired to retain the web W plus the felt 29 against the surface of the upper bare roll 35, so that the web W and the felt 29 are separated from the surface of the suction roll 36 along a line L-36 at approximately the line of maximum nip pressure. In the suction roll 36 there is provided a suction area A-36 defined by a first sealing strip 37a carried by the suction box 37 at the oncoming side of the suction area A-36 and a sealing strip assembly S-36 at the offrunning side of the suction area A-36, also mounted on the suction box 37 which is shown fragmentarily. Again, the sealing strip assembly S-36 has the same structure as that shown in Figure 2 and the sealing strip assembly S-36 extends substantially an equal distance on either side of the line L-36. Here again, a superior silencing effect is obtained.

Referring now to Figure 7, which shows the cooperation between the upper bare roll 39 and lower suction roll 40 to define the press nip N-3 as shown in Figure 1, it will be seen that the web W is placed on the surface of the bare roll 39 before it reaches the line of maximum pressure at the nip N-3 and is retained on the bare roll surface 39 at the offrunning side of the nip N-3, so that the web contacts the felt only along the line of maximum pressure L-39. In the suction roll 40 the suction box 41 mounts the first sealing means 41a on the felt assembly S-41 to define therebetween a suction area A-41. The suction area A-41 straddles the nip N-3 or the line of maximum pressure L-39, so that the felt 42 which is traversed over the entire suction area A-41 may be dewatered on opposite sides of the line of pressure L-39. The felt 42, as here shown, is separated from the suction roll 40 along the line L-40 which is intermediate the oncoming and offrunning edges of the sealing assembly S-41. As here shown, the line L-40 is near the offrunning edge 74 of the sealing assembly S-41, and this is advantageous because the felt 42 without the web W thereon is much more permeable to air and permits a slight amount of air to pass through the felt 42 and into the holes at 40b passing over the sealing assembly S-41 before separation between the felt 42 and the roll 40 takes place along the line L-40. In fact, using the presently employed felts having a reasonably high permeability, it has been found that actual separation between the felt and the roll not take place until after the sealing assembly S-41 has been passed (as long as the sealing assembly S-41 is of sufficient peripheral width) and the paper web W has been separated from the felt during substantially all of its travel across the sealing assembly S-41. The sealing assembly S-41 should be from about 2 to about 5 times the peripheral width that is required to make a seal and in the special instance just mentioned it is preferably 3 to 5 times this width. The essence of the instant invention being the substantial sealing of the bottoms of the holes in the shell for an appreciable amount of travel so that an initial amount of air can be slowly forced into these holes through the top, preferably through the automatic "check valve" which a resilient wire or web tends to form with the outer surface of the roll, but also through a generally permeable felt which has no paper web on the outer surface of the shell 60.

Referring now to Figures 9 and 10, it will be seen that a suction roll shell 50 is indicated in cooperation with a sealing strip assembly S-50 of the same type as that hereinafore described, for example, in Figure 2, which separates a high vacuum area A-50 from an atmospheric pressure area B-50 by a width D-50 that is comparable to the distance D of Figure 2. It will also be seen that both the web W-50 and the felt F-50 are separated from the surface of the shell 50 before the perforation 50a in the shell 50 which is closed at the bottom by the sealing assembly S-50 can pass over the sealing assembly S-50. Actually a vacuum loss occurs continuously in each of the perforations or holes 50a, 50b, up to 50c and Figure 10 shows generally the rate at which the vacuum loss occurs by the line 51. The line 51 plots the vacuum V against the distance D which the shell 50 has traveled over the sealing assembly S-50. As shown in Figure 10 an initial relatively high vacuum is maintained in the hole 50e just as it crosses on to the sealing assembly S-50 and the vacuum in each hole decreases to substantially atmospheric pressure Vp by the time the hole reaches the position of the hole 50a at the offrunning side of the sealing assembly S-50.

It will be appreciated that the curve 51 shows an ideal rate of vacuum loss which is sufficiently slow to prevent the creation of noise. This also involves starting with an initial vacuum V1 in the suction area A-50 which is a sufficiently low vacuum to be effectively lost in the distance D-50 of the hole 50a, of course, separates a high vacuum area A-50 from an atmospheric pressure area B-50 in the manner hereinafore described. The vacuum area A-50 imparts an initial vacuum Vp (Figure 10) in a hole 60a exposed thereto that is greater vacuum and the sealing assembly S-50 of the sealing assembly S-60. The relatively shorter sealing assembly S-50 as employed with the shell 60 under the conditions indicated in Figure 8, the vacuum rate of drop would be indicated by the curve 61 down to the point V2, at which point the hole 60a would break over the end of the sealing assembly S-50 and the vacuum loss would take place abruptly along the dotted line 61a, with the result that noise would be created. Such noise would, of course, be much less noise than that ordinarily created, because the vacuum Vp has been reduced to at least about 30% of the initial vacuum Vp. For this reason, a definite silencing effect is obtained by the use of a sealing assembly S-50 which has a length or dimension D-50 within the range specified for D of Figure 2. On the other hand, the sealing assemblies cannot have excessive distances and it has been found that a slightly increased distance D-70 can be added to the portion D-70 of the sealing assembly S-50 so as to obtain a sealing assembly S-60 which would in function serve the purpose. This additional dimension D-70 limits a more rapid rate of vacuum loss than a sealing assembly wherein the sealing strip is flush against the inner periphery of the shell 60 for its entire dimension, because the portion D-70 of the sealing assembly S-60 provides an extension diverging from the inner periphery of the shell 60 at the offrunning side of the sealing strip assembly S-60 so as to provide a slender tapering vent passage to control the flow of air entering into perforations in the roll shell 60. In this way the vacuum drop follows the
curve 61b. The curve 61b drops relatively abruptly to atmospheric pressure \( V_0 \), but only for approximately the last 30% of the vacuum drop. The tapering vent 62 shown in Figure 8 is, of course, exaggerated; but its function is clear. Essentially, the main body of the sealing assembly S-60 which is flush with the inner periphery of the shell 60 is maintained thereagainst for a sufficient distance to control the vacuum loss through about 70% thereof. After the vacuum loss has reached the point \( V_0 \), an abrupt vacuum loss may be permitted without the creation of noise. This is done using a tapering vent 62. Although the vent is formed structurally along the lines indicated in said U.S. Patent No. 2,274,641, the vent 62 used in the present invention differs substantially from the vent of said U.S. Patent No. 2,274,641 in that the sealing assembly S-60 is provided initially with a sealing portion D-80 of substantial length flush against the inner periphery of the shell 60 to control the loss of at least about 70% of the vacuum \( V_0 \).

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

I claim as my invention:

1. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a traveling felt trained over the entire suction area of the shell and away from the shell surface along a line just 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 said 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 extending therefrom flush against the shell inner periphery at the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

2. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a belt resistant to air flow therethrough traveling over the entire suction area of the shell and away from the shell surface along a line just 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 said 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 extending therefrom flush against the shell inner periphery to beyond the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

3. In a paper machine, a rotary perforate suction couch roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a forming wire carrying a wet web trained over the entire suction area of the shell and away from the shell surface along a line just 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 said 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 extending therefrom flush against the shell inner periphery to beyond the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

4. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a press roll defining a press nip with said shell, a suction box within the shell defining a suction area on the shell at the press nip at which reduced pressure is applied to the holes, a traveling felt carrying a web through said press nip and trained over the entire suction area of the shell and away from the shell surface along a line just 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 said 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 extending therefrom flush against the shell inner periphery to beyond the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

5. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a traveling felt trained over the suction area of the shell, a web carried on said felt over the entire suction area, means guiding the web away from the shell along a line just 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 said 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 extending therefrom flush against the shell inner periphery to beyond the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

6. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a traveling felt trained over the suction area of the shell, a web carried on said felt over the entire suction area, means guiding the web away from the shell along a line just 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 said 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 extending therefrom flush against the shell inner periphery to beyond the line at which the felt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

7. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a traveling felt trained over the entire suction area of the shell, a web carried on said felt, means defining a press nip at the suction area to press the web thereat and remove the web from the felt before 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 said 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 extending therefrom flush against the shell inner periphery to two or five times the peripheral distance of ¾ to 1 inch required to effect the seal between the shell and the sealing means, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell.

8. In a paper machine, a rotary perforate suction roll shell having a plurality of holes, a suction box within the shell defining a suction area on the shell at which reduced pressure is applied to the holes, a belt resistant to air flow therethrough traveling over the entire suction area of the shell and away from the shell surface along a line just 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 said suction area, second sealing means on the suction box urged against the shell inner periphery at the offrunning side of said suction area, and second sealing means on the suction box urged against the shell inner periphery at the offrunning side of said suction area.
2,911,042

suction area and extending therefrom flush against the shell inner periphery to beyond the line at which the belt moves away from the shell, and for such a distance as to effect a substantial reduction in noise caused by rotation of the shell, and spaced resilient means urging the oncoming and offrunning sides of said second sealing means against the shell inner periphery.

References Cited in the file of this patent

UNITED STATES PATENTS

1,718,574  Millsapugh ------------ June 25, 1929

2,274,641

2,292,634

2,369,674

2,669,912

2,732,772

2,772,606

12

Berry et al. ---------------- Feb. 8, 1938
Abbott et al. --------------- Mar. 3, 1942
Goodwillie et al. ----------- May 9, 1944
Hornbostel --------------- Feb. 20, 1945
Goodwillie et al. ----------- Feb. 23, 1954
Hornbostel ---------------- Jan. 31, 1956
Kelly ------------------ Dec. 4, 1956

FOREIGN PATENTS

Germany ------------ June 30, 1909
Germany ------------ June 27, 1939