Aug. 2, 1955 E. D. BEACHLER 2,714,342

SUCTION ROLL

Filed Nov. 2, 1950 3 Sheets-Sheet 1

Fig. 1

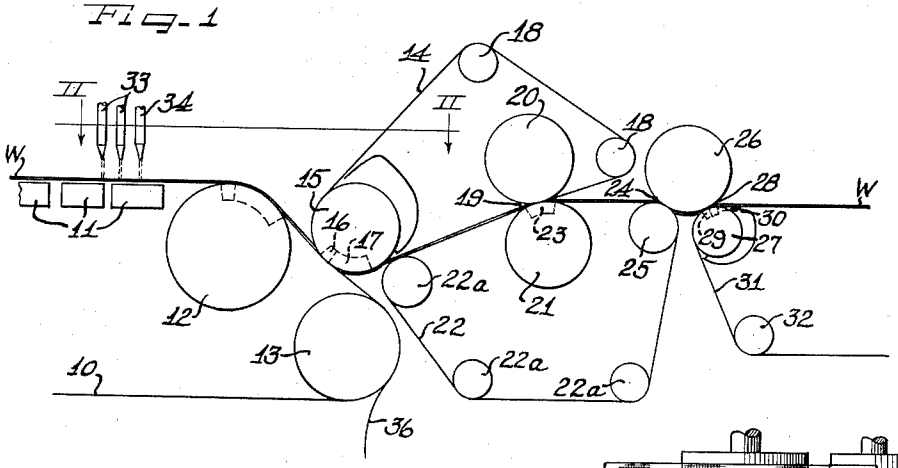


Fig. 2

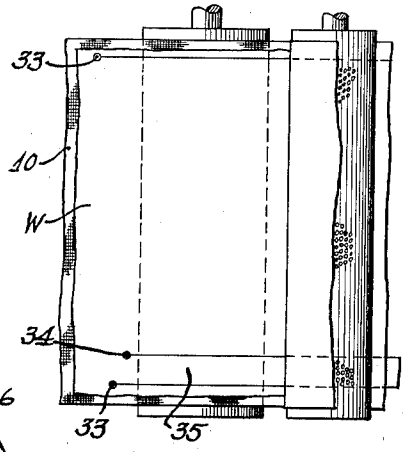
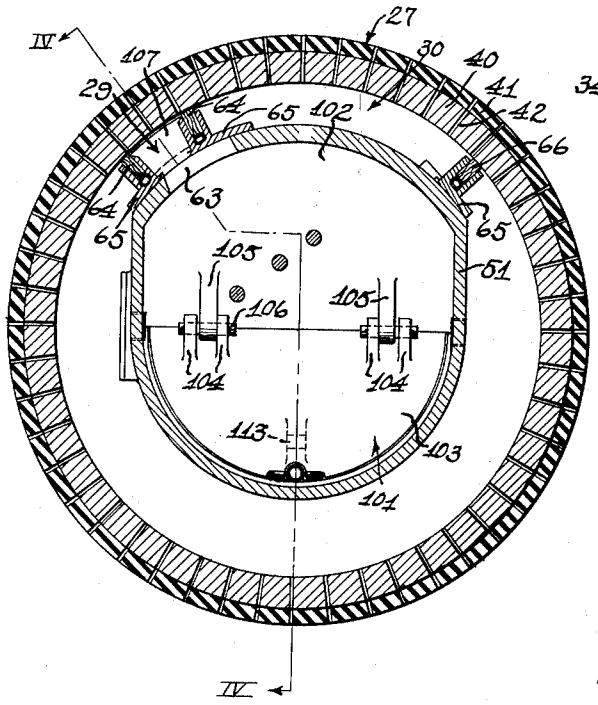


Fig. 3



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SUCTION ROLL

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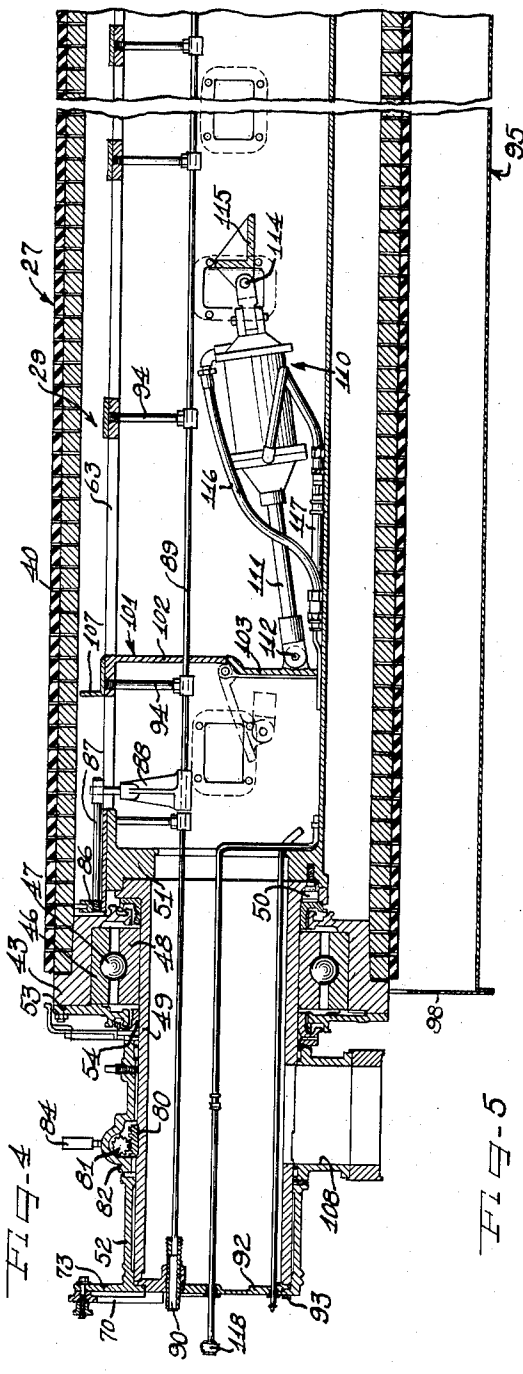

FIG-4

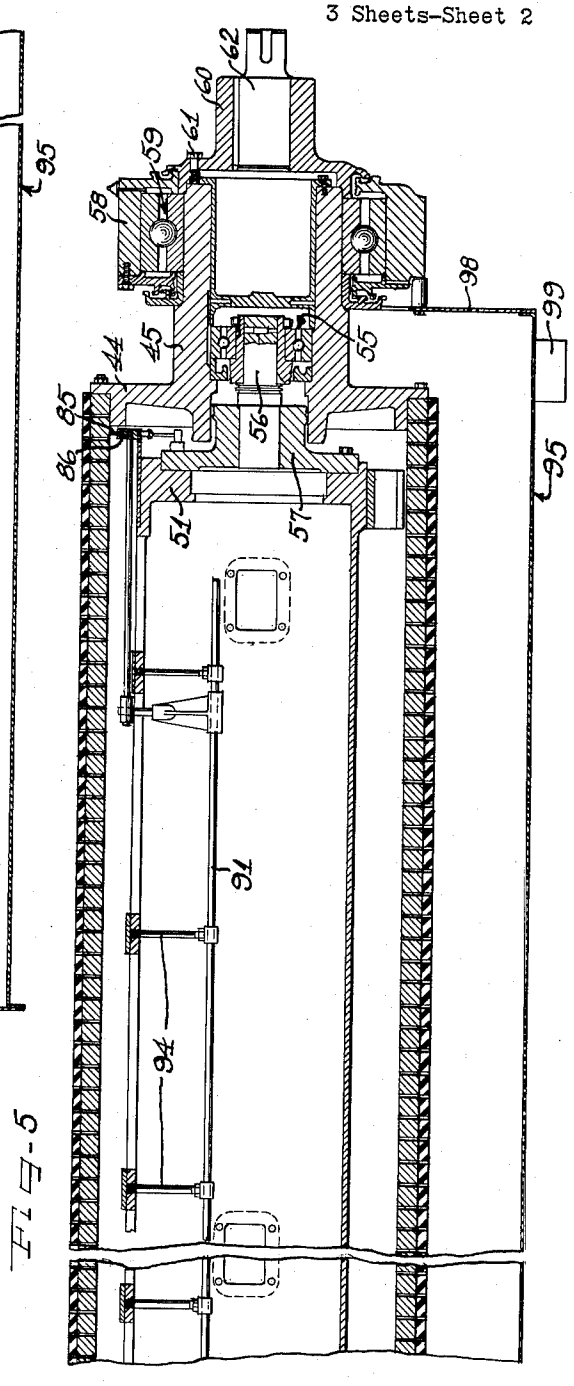

FIG-5

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SUCTION ROLL

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Fig. 7

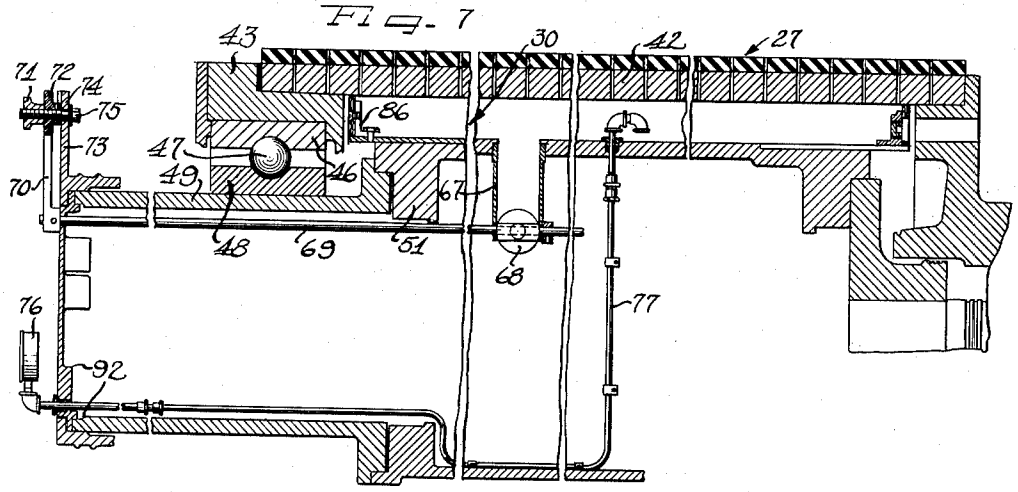
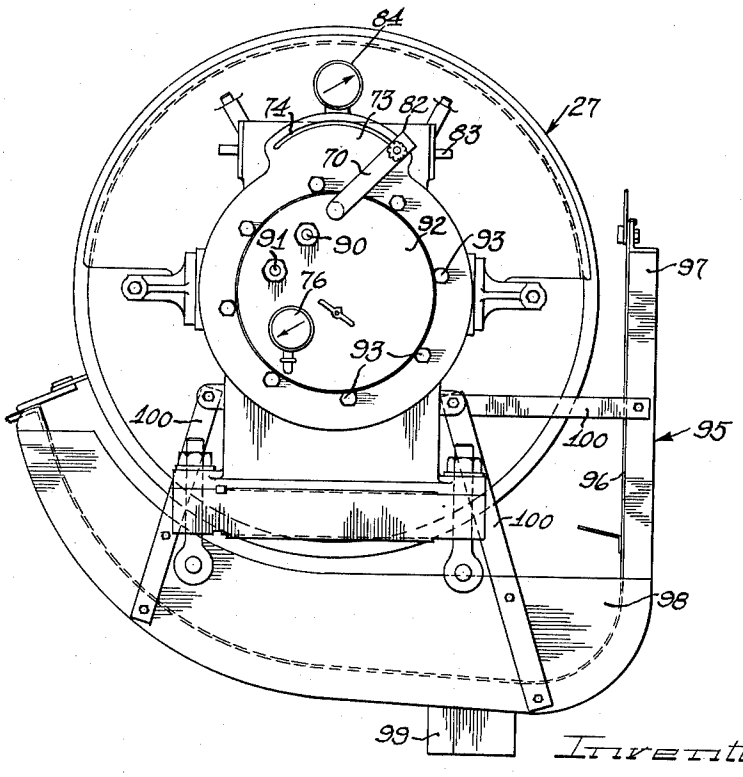


Fig. 6



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United States Patent Office 2,714,342 Patented Aug. 2, 1955

2,714,342

SUCTION ROLL

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Application November 2, 1950, Serial No. 193,679

2 Claims. (Cl. 92—53)

The present invention relates to a paper-making machine suction roll and more particularly to a suction roll having axial vacuum areas of varying suction capacity for transferring a paper web, or portions thereof, through a paper-making machine.

In the manufacture of paper, it is necessary to initially thread the web formed upon the forming surface, such as upon the foraminous Fourdrinier forming wire, through the remainder of the machine, including the press part, in order that later portions of the web may follow a predetermined path through the machine. In order to facilitate this threading of the web through the machine press part, it has been conventional practice to form from the web, as by cutting the web with a "tail jet" directed against the web supported on the forming surface, a relatively narrow web "tail" of about 10 to 20 inches width for passage through the press part, while the remainder of the web is returned as broke for reconversion to pulp. In the utilization of suction transfer means, particularly in the machine press section, difficulty has been encountered in the training of the tail inasmuch as the major portion of the suction areas of the transfer rolls is uncovered when the tail is threaded therethrough. This uncovering of the suction areas results in serious losses of vacuum, the remaining vacuum being ineffective to cause adequate and clean transfer of the web tail.

The present invention now provides a novel form of suction roll, preferably having a pair of peripherally adjacent suction areas, which is provided with means for the exertion of high vacuum upon the web tail alone without any serious loss of vacuum through those portions of the suction areas uncovered by the tail.

More specifically, the present invention utilizes a valve located in the interior of a suction gland of the roll and movable to a closed position for dividing the gland into two axially aligned portions, one portion of which is subjected to vacuum by the vacuum pump and the other portion of which is not subjected to this vacuum. Thus, the entire vacuum effect of the pump is exerted on a relatively small axial dimension of the roll to give a localized high vacuum area, and when this localized high vacuum area is covered by the web tail, the tail is effectively transferred by means of the roll. After the web tail has been threaded through the press section by utilization of the suction roll, the valve may be opened so that the entire suction area of the roll gland is subjected to the vacuum effect of the pump, thus reducing the effective suction within the high vacuum tail-transfer area and making this area a portion of the complete transfer area for exertion upon the entire width of the web.

The tail is generally cut from the web while the web is retained upon the forming surface and following threading of the tail, the tail cutting jet is moved transversely across the width of the web so that an increasing width of web is transferred to the press section. Preferably, opening of the high vacuum portion valve in the

interior of the roll is correlated with transverse movement of the tail cutting jet so that an effective suction area of increasing width exerts differential pressure conditions upon the web as its transverse area increases.

It is, therefore, an important object of the present invention to provide a suction roll having axially separable vacuum areas of varying suction capacity for exertion upon a paper web of varying transverse dimensions to transfer the web through a paper-making machine press part.

Another important object of the present invention is to provide a suction roll provided with means for exerting a high vacuum upon a web tail initially threaded through a paper machine press part without a loss of vacuum through portions of the roll uncovered by the tail.

It is a further important object of the present invention to provide a suction roll provided with a relatively small high vacuum suction area operable upon the paper web tail alone to transfer the tail through a paper-making machine by the exertion of the entire vacuum effect of the roll suction means thereon.

Still another important object of the present invention is to provide a suction roll having an interior suction gland divisible into axial vacuum areas of varying suction capacity by means of a valve located in the interior of the gland, the valve being operable to one position to exert a high vacuum upon a relatively small axial dimension of the roll and being operable to a second position to exert a relatively lower vacuum effect upon substantially the entire transverse dimension of the roll.

Yet another object of the present invention is to provide a paper-making machine suction roll having an interior suction gland which is divided by valve means into axially adjacent suction areas of varying vacuum capacity, with the valve being operable to an adjusted position to equalize the vacuum capacity of the areas.

An additional object of the present invention is to provide a paper-making machine suction roll divided both radially and axially into vacuum areas of varying suction capacity for effectively transferring a paper web, or a relatively small portion thereof, through a paper-making machine.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is a diagrammatic representation of a paper-making machine, utilizing a suction roll of the present invention;

Figure 2 is a plan view taken along the plane II—II of Figure 1, illustrating the formation of a web tail for threading through the paper-making machine of Figure 1;

Figure 3 is an enlarged radial sectional view of a paper-making machine suction roll of the present invention;

Figure 4 is a partial sectional view of the roll of the present invention taken along the plane IV—IV of Figure 3;

Figure 5 is a partial sectional view completing the axial section of Figure 4;

Figure 6 is an enlarged end elevational view of the roll of the present invention; and

Figure 7 is a fragmentary sectional view similar to Figures 4 and 5, illustrating an additional portion of the roll of the present invention.

As shown on the drawings:

In Figure 1, reference numeral **10** refers generally to a paper-making machine foraminous forming surface, such as the forming wire of a Fourdrinier-type paper-making machine which passes over a plurality of aligned suction boxes **11** and about a suction couch roll **12** to a wire turning roll **13**.

The forming wire, or surface **10**, supports a moist paper web W formed by the deposition of a fibrous pulp suspension upon the wire, and web is removed from the forming surface through the medium of a pickup felt **14** trained about a suction pickup roll **15** into contact with the web W. The suction pickup roll **15** is provided with a relatively high vacuum suction area **16** for removing the web from the wire and a peripherally adjacent relatively low suction area **17** for retaining the web W upon the undersurface of the felt **14**. The felt **14** is trained, as by a plurality of guide rolls **18**, about the periphery of the pickup roll **15** and through the nip **19** of a press assembly defined by an upper press roll **20** and a lower press roll **21**. The lower press roll **21** is a suction press roll having lapped thereabout a press felt **22** covering the suction area **23** of the roll **21** and passing through the nip **19**. The press felt **19** receives the web W from the undersurface of the pickup felt **14** due to the exertion of vacuum within the suction area **23** upon the web, and the press felt **22** conveys the web W to a first nip **24** defined by a lower press roll **25** disposed within the loop of the press felt **22**, a superimposed plain press roll **26** defining the nip **24** with the roll **25**, and a second lower press roll **27** defining with the roll **26** a second nip **28** in peripherally spaced relation to the nip **24**. The press roll **27** is preferably a suction roll having a relatively high suction area **29** and a relatively low suction area **30**.

The web W is transferred from the press felt **22** to the plain uncovered surface of the press roll **26** at the nip **24**, and the relatively high vacuum area **29** of the roll **27** is effective to transfer the web from the surface of the roll **26** to a second press felt **31** trained about the suction area **29** by a guide roll **32**. The second suction area **30** of the roll **27** is effective to retain the web on the felt **31** after the same has been removed from the plain press roll **26**.

As best shown in Figure 2, the web W, while supported upon the foraminous forming surface **10** and while still in moist condition, has its lateral parallel edges severed by means of deckle edge nozzles **33** issuing a jet of water therefrom for severing the edges of the web W to define a clear-cut web edge. Also, during initial starting of the machine, a tail jet **34** is utilized to sever a relatively narrow longitudinally extending web tail **35** which is subsequently threaded through the paper-making machine press part in order to initiate travel of the web therethrough, while the remainder of the web is allowed to fall from the web turning roll **13**, as at **36** (Figure 1), into a broke pit (not shown).

The difficulties of training the web tail through the machine press part have hereinbefore explained, and accordingly, it is desirable that the suction rolls **15** and **27** be provided with means for limiting the suction effect of their respective vacuum pumps to the web tail to prevent a serious loss of vacuum through uncovered portions of these rolls. A suitable roll construction is illustrated in Figures 3–7, inclusive, and although the roll structure will be particularly described as embodied in the suction press roll **27**, it will be appreciated that a quite similar construction may be utilized for the roll **15**.

As best illustrated in Figures 3–7, inclusive, the roll **27** includes a cylindrical outer shell **40** peripherally enclosed within a conforming rubber casing **41**, both the shell and the casing being radially perforated, as at **42**, to provide a perforate drum construction. Actually the roll shell, as best illustrated in Figures 4 and 5, includes the central perforated drum **40** which is open at each end, one end being closed by an annular shell ring **43** and the other end enclosed by a radially enlarged flange **44** formed upon a roll hub **45**.

The shell ring **43** carries at its inner end an outer bearing race **46** contacting bearing members **47** interposed between the outer race **46** and an inner race **48** which is carried by a suction gland sleeve **49** which is fixedly secured, as by screws **50**, to one open end of the suction gland **51**. The outer end of the sleeve **49** is peripherally enclosed by a fixed journaled sleeve **52** which is adapted to be clamped within a roll supporting structure (not shown). It will thus be seen that the shell **40** is rotatably supported at one end by the bearing elements **46—48** upon the fixed gland **51**, the gland sleeve **49** and the journal sleeve **52**. Cooperating seal elements **53** and **54** are carried by a shell ring **43** and the sleeve **49**, respectively.

The shell **40** is rotatably supported upon the gland at its other end by means of a bearing **55** interposed between the shell sleeve **45** and a fixed gland axle **56** carried by a gland end closure plate **57** contacting that end of the gland opposing the gland sleeve **49**. A journal housing **58** peripherally encloses the free end of the shell sleeve **45** and bearing elements **59** are interposed therebetween to rotatably support the shell sleeve **45** within the journal housing **58**. The shell sleeve **45** carries an end closure plate **60** fixedly secured thereto, as by screws **61**, and having keyed therein a shell-driving axle **62** for connection to a suitable source of power to rotatably drive the shell about the fixed gland **51**.

The gland **51** extends axially of the shell in the interior thereof for the entire length of the shell, the gland **51** being generally cylindrical in form, as best seen in Figures 3, 4 and 5. The gland is provided with an elongated slot **63** running substantially the axial length thereof for establishing communication between the interior of the gland and the shell **40**. The elongated slot **63** defines the relatively small, high vacuum suction area **29**, with the arcuate limits of this area being determined by gland packing strips **64** (or peripherally spaced sealing means) retained within packing strip holders **65** (Figure 3) and contacting the inner periphery of the shell at peripherally spaced points. The relatively larger low suction area **30** is defined by an additional elongated packing strip **66** contacting the inner periphery of the shell in spaced relation to the strips **64** hereinbefore described, the strip **66** being retained by a holder **65** substantially identical with those hereinbefore described.

However, it will be noted that the relatively larger area **30** does not communicate with the interior of the gland through a slot, such as the slot **63**, but rather that communication of the area **30** with the interior of the gland is established through a suction conduit **67** (Figure 7) provided with a circular butterfly valve **68** adapted to be rotated about a longitudinal axis by means of a valve-actuating rod **69** pinned to an indicating arm **70** projecting beyond the gland sleeve **49**. The free end of the arm **70** carries an arm tightening handle **71** threaded upon a bolt **72** received by the arm **70** and projecting through an indicator plate **73** having an arcuate guide slot **74** formed therein. The head **75** of the bolt **72** lies on the reverse side of the indicator plate **73**, and it will be seen that loosening of the handle **73** will permit movement of the arm **70** in an arcuate path determined by the slot **74**, with corresponding movement of the valve **68** to control the flow of fluid under differential pressures from the suction area **30** into the gland **51**.

An indication of the degree of vacuum, or air pressure, within the suction area **30** is given by a pressure gauge **76**, also projecting beyond the indicator arm **70** and communicating with the area **30** through an indicator manifold conduit **77**.

It is also desirable to radially adjust the position of the gland relative to its fixed support, so that it is possible to displace the roll suction areas to vary the operating conditions of the paper-making machine. Such an adjustment may be carried out by means of a worm gear segment **80** fixedly secured to the gland sleeve **49** exteriorly of the shell (Figure 4), the worm gear segment being in mesh with a transversely extending worm **81** contained within a housing **82** journalling the worm shaft **83** (Figure 6). The worm may be rotated upon its horizontal shaft **83** by rotating the shaft, as by engage-

ment with a suitable tool. An angular deflection gauge **84** is provided upon the casing to give a visual indication of the arcuate positioning of the gland within the shell.

The axial limits of the suction areas **29** and **30** (i. e., the primary roll suction area) are determined by the positioning of deckle edge seals **85** carried by seal holders **86** threadedly retaining a movable deckle seal rod **87**. The deckle seal rod **87** is carried by a bracket **88** threadedly retained by an axially extending deckle adjustment rod **89** projecting beyond the gland sleeve **49**, as at **90**. The other end of the roll is provided with an identical deckle seal **85** and supporting structure indicated by identical reference numerals to those hereinbefore described, this end deckle being adjustable by a second adjusting rod **91** also projecting beyond the gland sleeve **49**. The open outer end of the gland sleeve is closed by a cover plate **92** secured to the indicator plate **73** at the end of the journal sleeve **52** by suitable means as by bolts **93** and this end plate journals each of the rods **89** and **91** adjacent their free ends. The rods **89** and **91** are each supported by a plurality of dependent bracket arms **94** spaced along the axial length of the gland and depending into the interior thereof.

The roll **27** is provided with an arcuate save-all pan **95** (Figures 1, 4, 5 and 6) comprising a metal or other suitable sheet **96** enclosing a portion of the periphery of the roll **27** and provided with a plurality of transversely spaced strengthening ribs **97** projecting from the outer edges thereof. End plates **98** are provided at each axial end of the pan, and a drain outlet **99** is also provided for draining moisture therefrom. Bracket irons **100**, bolted to the roll support and to the channels **97**, or the end plates **98**, are provided to maintain the save-all in proper relation to the roll. The purpose of the save-all pan will be evident to those skilled in the art inasmuch as it protects adjacent portions of the press felt **31** from water centrifugally thrown from the surfaces of the roll **27** during rotation of roll shell.

As hereinbefore explained, the roll of the present invention is particularly adapted for the exertion of a high degree of vacuum upon a relatively narrow tail initially threaded through the paper machine during starting of web production. The means for accomplishing this result are best shown in Figures 3 and 4. More specifically, the means include a seal plate **101** carried by the gland and extending transversely thereacross in closely spaced relation to the end deck seal **85** at the rear, or non-driven, end of the roll. The seal plate is formed in two portions, an upper portion **102**, which is fixedly secured to and is in engagement with the upper portion of the gland **51**, and a lower valving portion **103**, which is movable relative to the gland and to the fixed upper plate portion **102**.

The valving portion **103** is provided with two pairs of spaced lugs **104** receiving therebetween corresponding lugs **105** formed on the upper plate portion **102**, the associated lugs **104—105** receiving therethrough a pivot pin **106** about which the valving portion may be pivoted from its solid line position in Figure 4 to its dotted line position. It will be seen that, when the valving portion **103** is in its solid line position (Figure 4), a relatively tight seal is presented across the interior of the gland. An additional arcuate seal plate **107** is carried by the seal plate **101** and projects upwardly therebeyond within the relatively high suction area **29** into closely spaced relation to the inner shell periphery.

Inasmuch as the interior of the suction gland is adapted to be evacuated through the hollow bore of the gland sleeve **49** which communicates with a vacuum passage **108** adapted for connection to a vacuum pump, or other suitable source of less than atmospheric pressure, it will be appreciated that the seal plate **101** will substantially prevent the formation of sub-atmospheric pressure within those portions of the gland axially beyond the seal plate. Also, the seal plate **101** is interposed between the

low vacuum area butterfly valve **68** (i. e., a suction control valve) and the vacuum passage **108** to prevent drawing a vacuum in the low vacuum area **30** whenever the valve **103** is closed, regardless of the position of the valve **68**. Although running clearance between the additional seal plate **107** and the inner periphery of the shell **40** is necessary, such running clearance will not interfere materially with the efficiency of the vacuum drawn within the restricted arcuate area defined by the seal plate.

It is preferred that the actuation of the valving portion **103** to and from its dotted position (Figure 4) be carried out by means of a fluid pressure operated cylinder, or motor, **110**. The cylinder is provided with a conventional reciprocable piston in the interior thereof (not shown) connected to a valve actuating rod **111** projecting beyond the cylinder and pivotally attached, as at **112**, to a lug **113** (Figure 3) formed on the valving portion **103**. That end of the cylinder **110** remote from the actuating rod **111** is pivotally attached, as at **114**, to an angle support **115** projecting across the interior of the gland **51**. The cylinder is vented to a suitable source of pressure different from atmosphere through fluid pressure conduits **116** and **117** connected to the rearward and forward portions of the cylinder. These fluid pressure lines project axially through the gland sleeve **49** for connection to a suitable source of pressure and are connected to a suitable valve **118** of conventional design for actuating the cylinder.

The operation of the invention will be readily apparent to those skilled in the art, particularly with respect to the means for subjecting a relatively small axial dimension of the roll **27** to the entire vacuum capacity of a pump or other vacuum-producing means attached to the fluid pressure passage **108**. The seal plate, when the valving portion thereof is closed, divides the gland into separate axially aligned compartments or sections and effectively prevents the drawing of any vacuum within the relatively low vacuum area **30**, and the provision of the seal plate projecting across the interior of the gland and, as at **107**, in closely spaced relation with the inner periphery of the roll shell, limits the effective vacuum area of the high suction area **29** to a relatively small axial dimension (i. e., the secondary suction area). Inasmuch as the high suction area **29** accomplishes the actual web and/or tail transfer, the absence of vacuum in the low suction area **30** does not effect the transfer of the sheet to the web.

It will also be appreciated that upon opening of the valve **103**, the formerly active high vacuum restricted area becomes a portion of the general high vacuum area **29**, so that a uniform suction area **29** is available along substantially the entire effective length of the gland, while at the same time vacuum efficiency is restored within the low vacuum area **30** of the roll.

The construction of the roll **27**, hereinbefore described in detail, lends itself to the utilization of this roll at several points in a conventional paper making machine press part. For example, the roll may be utilized as the pick-up roll **15**, or as the lower suction roll **21** of a conventional press assembly, as shown in Figure 1. Of course, if the roll is employed as a suction pick-up roll **15**, the rubber cover **41** is not utilized, as is well known in the art. In most cases, as in the manufacture of paper of average weight, the transfer of the paper web to the pick-up felt at the transfer roll **15** is accomplished without too much difficulty, so that a concentrated vacuum effect upon a web tail, as per the present invention, may not be necessary. However, in the manufacture of extremely light weight papers, such as tissue paper, such a construction may prove highly desirable as the pick-up roll.

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

I claim as my invention:

1. In a suction transfer roll for a paper making machine, a stationary suction gland, a cylindrical perforate shell carried by and rotatable about said gland, packing means carried by said gland defining arcuate peripherally adjacent relatively high and low vacuum suction areas at the inner periphery of said shell, a vacuum conduit at one end of said gland for evacuating said high vacuum suction area, a suction control valve in said gland and axially spaced from said vacuum conduit for controlling vacuum communication between said vacuum suction areas, and a seal plate having a valve as a portion thereof extending substantially radially of said shell across the interior of said gland intermediate said vacuum conduit and said control valve, said valve when closed dividing said high vacuum area into axial compartments and interrupting vacuum communication between said high vacuum area and said low vacuum area.

2. In a suction transfer roll for a paper making machine, a stationary suction gland, a cylindrical perforate shell carried by and rotatable about said gland, packing means carried by said gland defining arcuate peripherally adjacent relatively high and low vacuum suction areas at the inner periphery of said shell, a vacuum conduit at one end of said gland for evacuating said high vacuum suction area, a suction control valve in said gland and axially spaced from said vacuum conduit for controlling vacuum communication between said vacuum suction areas, a seal plate having a valve as a portion thereof extending substantially radially of said shell across the interior of said gland intermediate said vacuum conduit and said control valve, said valve when closed dividing said high vacuum area into axial compartments and interrupting vacuum communication between said high vacuum area and said low vacuum area and power means for controlling movement of said valve means.

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