Aug. 7, 1928. 1,679,598

E. E. BERRY

SUCTION ROLL

Filed Oct. 5, 1925 4 Sheets-Sheet 1

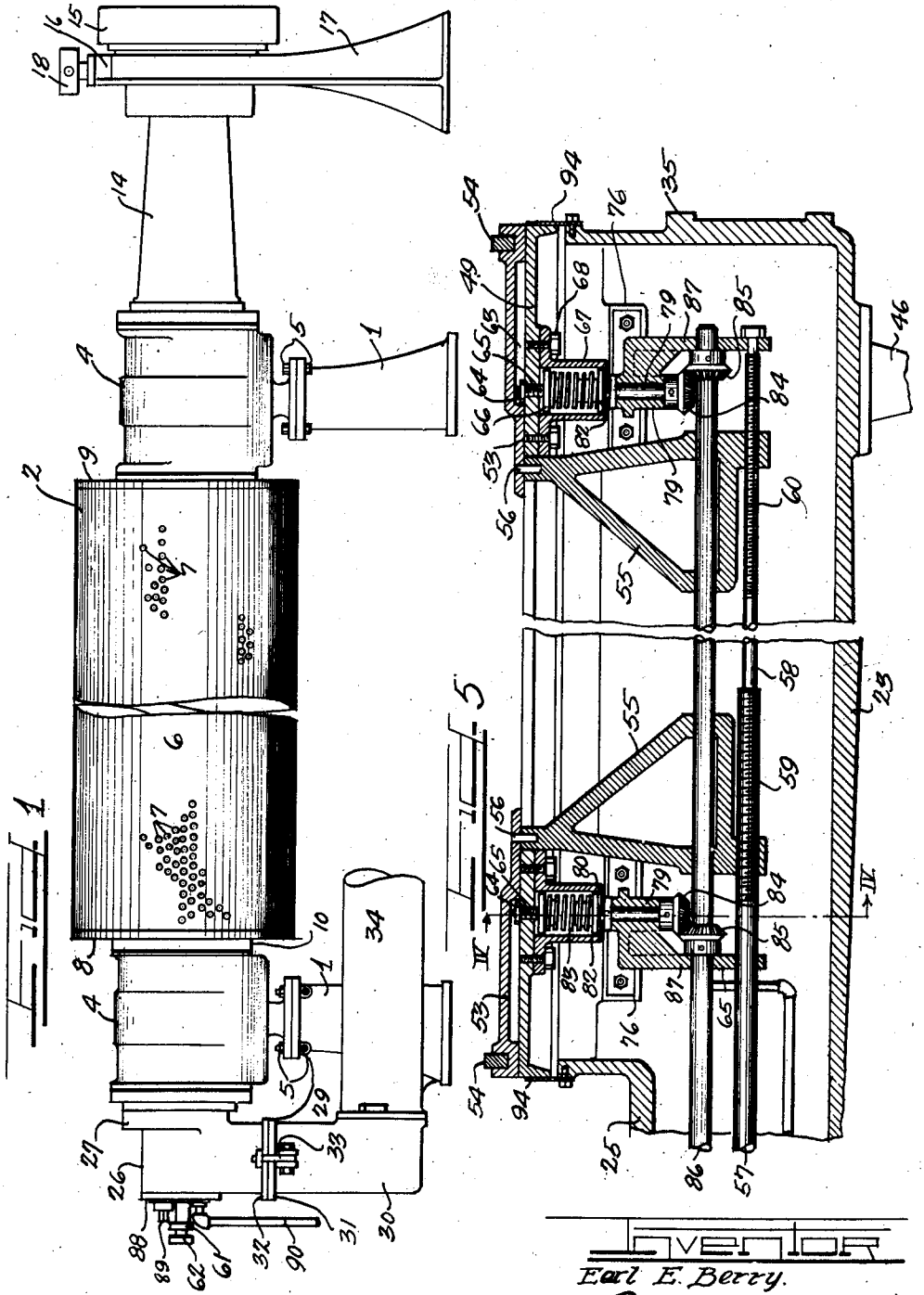


Fig. 1

Fig. 5

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1,679,598

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SUCTION ROLL

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4 Sheets-Sheet 2

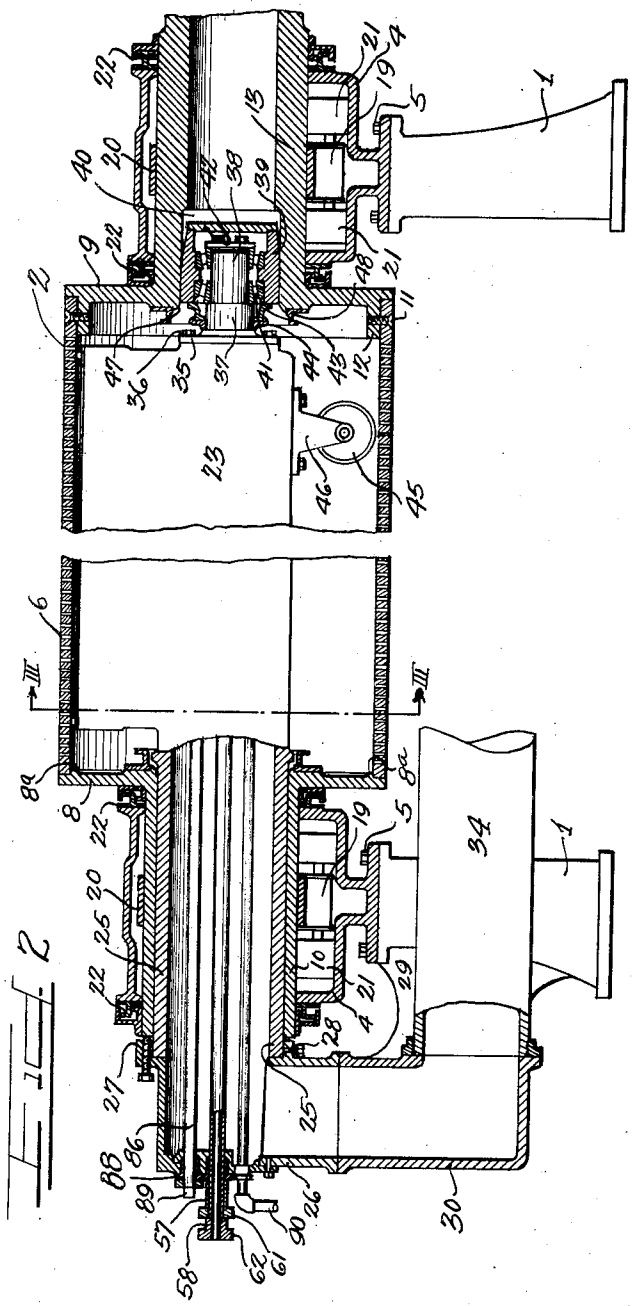


Fig. 1

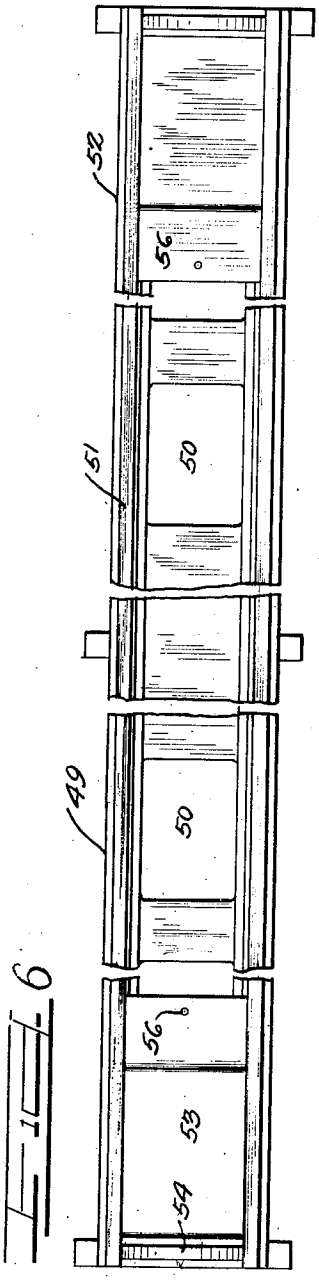


Fig. 6

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SUCTION ROLL

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FIG. 3

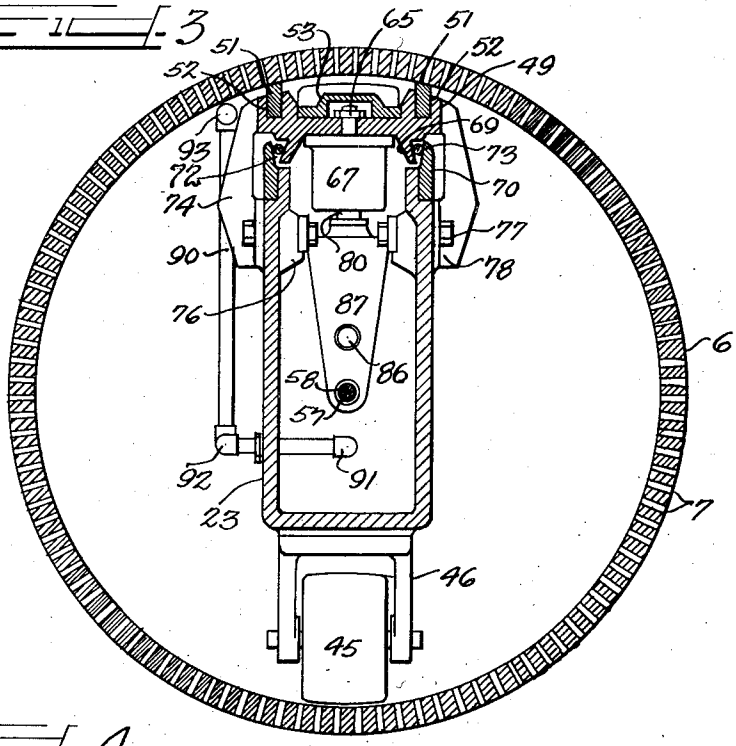
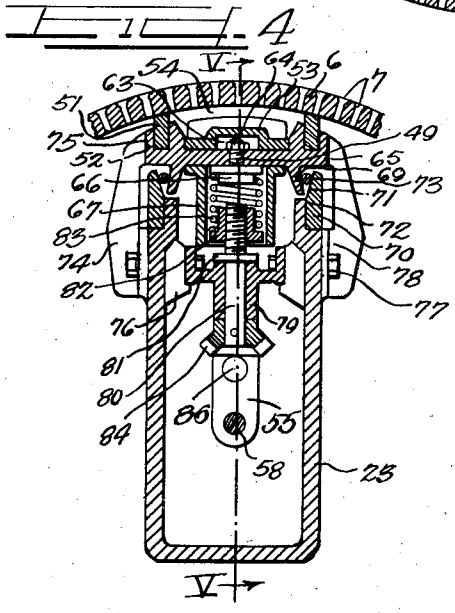


FIG. 4



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SUCTION ROLL

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FIG. 7

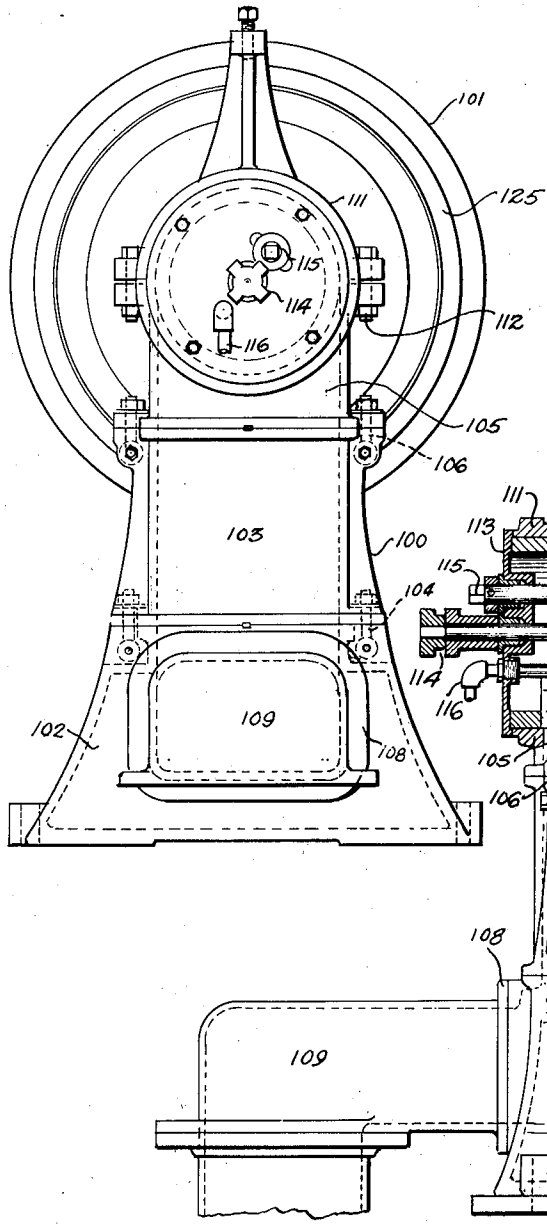


FIG. 8

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Patented Aug. 7, 1928. 1,679,598

UNITED STATES PATENT OFFICE.

EARL E. BERRY, OF BELOIT, WISCONSIN, ASSIGNOR TO BELOIT IRON WORKS, OF BELOIT, WISCONSIN, A CORPORATION OF WISCONSIN.

SUCTION ROLL.

Application filed October 5, 1925. Serial No. 60,409.

This invention relates to improvements in suction rolls and more particularly in suction couch rolls adapted for use in paper making machines of the Fourdrinier type.

The great difficulty in suction roll construction is to provide efficient sealing means between the stationary suction box and the rotating interior surface of the foraminous or perforated shell of the suction roll. The tendency is for the packing head or other sealing means either to bind against the shell and cause excessive friction and wear, or else to sag away from the shell and cause a loss of vacuum. As it is practically impossible to secure an absolutely true and round surface on the inside of the shell or even to maintain such surface, if obtained, due to the changing of the shape of the metal with time and use, it is very desirable to provide a packing head for the suction box that will follow the inside of the roll without the necessity of creating excessive friction to accomplish this.

Another feature of suction roll construction that presents difficulties is the support of the suction box within the roll. Heretofore, suction rolls have been formed with two bearing surfaces between the suction box journals and the foraminous shell. This construction makes it difficult if not impossible to take up the wear on the various parts to maintain an efficient vacuum.

It is an object of this invention to provide a suction roll and suction box therein having a flexible packing head adapted to be resiliently balanced throughout its length.

It is a further object of this invention to provide a packing head for a suction box in which the sealing means therefor are wedgingly held by the differential of pressures inside and outside of the box.

It is a further object of this invention to provide a suction box, a flexible packing head therefor, and roll sealing means for said box and head adapted to allow free floating moving of said packing head while at all times maintaining an air tight joint.

It is a further object of this invention to provide a flexible packing head for the suction box, said head being so constructed and supported as to practically balance the atmospheric pressure on both sides thereof, whereby the contact pressure between the head and the interior face of the foraminous shell may be independently adjusted to any desired degree.

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

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a broken side elevational view of a suction couch roll embodying the principles of my invention.

Figure 2 is an enlarged, fragmentary and broken longitudinal sectional view showing parts in elevation.

Figure 3 is an enlarged sectional view taken substantially on line III—III of Figure 2.

Figure 4 is a fragmentary sectional view similar to Figure 3 taken substantially on line IV—IV of Figure 5.

Figure 5 is a broken fragmentary sectional view taken on line V—V of Figure 4, showing parts in elevation.

Figure 6 is a broken enlarged top plan view of the head of the suction box.

Figure 7 is a front end elevational view of a modified form of my invention.

Figure 8 is a fragmentary side elevational view of the same with parts broken away and in section.

As shown on the drawings:

The reference numeral 1 in Figures 1 to 6, inclusive, indicates a pair of pedestals for supporting a suction roll 2 embodying the principles of my invention as applied to suction couch rolls for Fourdrinier paper machines. The roll 2 is journalled in bearing boxes 4 secured by bolts 5 to said pedestals 1. Said roll 2 comprises an outer cylindrical shell 6 of brass or other suitable metal having spaced perforations 7 through which suction may be applied, when the roll is in use on a paper machine, to extract water from a wet web of paper as it passes over the couch roll. The ends of the shell 6 are capped by heads 8 and 9 on the front and back sides of the roll respectively. As best shown in Figure 2 the head 8 is provided with an inner annular shoulder 8ª against which the edge of the shell 6 abuts. Said head 8 is further provided with a journal 10 which extends through the front

bearing box 4 and is rotatably supported therein. The head 9 is secured to the shell 6 by screws 11 countersunk in said shell and extending into an annular inner flange 12 on said head 9. An elongated journal 13 formed on the head 9 extends through the rear bearing box 4 and is provided at its reduced end 14 with a coupling head 15 through which the roll is driven. The head 15 extends through a collar 16 on a stand 17; said collar being slightly larger in diameter than the head portion. A screw jack 18 is threaded through the top of the collar 16 and is adapted to be turned down against the head 15 to tilt the roll as will later be explained.

The bearing boxes 4 (Figure 2) each house a pair of flanged rollers 19 bearing against guiding bands 20 on the journals 10 and 13. The journals of the rollers 19 are rotatably mounted in roller bearings 21 immersed in oil. At each end of the bearing boxes 4 is a pair of interlocking flanged oil rings 22 sealing the joint between said boxes and the journals 10 and 13.

A suction chamber or box 23, is mounted within said foraminous shell 6. The suction box 23 comprises a relatively deep, narrow, trough-like member, having at the front end an elongated journal 25 extending through the front journal 10 without contacting the same. A head 26 is provided with flanges 27 adapted to fit over the end of the journal 25 and to be secured thereto by bolts 28. To adjust the position of the suction box 23 with respect to the circumference of the shell, it is not necessary to alter the position of the head 26. The head 26 supports the front end of the suction box journal 25 in stationary position and in turn is supported by an integral portion 29 of the front pedestal 1. A suction pipe 30 having a flanged end 31 is secured to the lower flanged edge 32 of the head 26 by lugs 33 passing through said flanges. Said suction pipe 30 is carried over to one side of the pedestal 1 where it joins a section of piping 34 leading to a suction fan or any source of vacuum.

It will be noted that the construction above described permits the front end of the suction roll to be quickly disconnected from the suction pipe 30 and the pedestals 1 by merely unfastening the lugs 33 and removing the bolts 5. This is done whenever changing a wire. The jack screw 18 is then turned down against the head 15, thereby depressing the rear end of the suction roll. At the same time, the front end of the roll is elevated above the suction pipe 30 and the front pedestal 1 sufficiently to permit a loop of the endless Fourdrinier wire to be slipped between and over the roll. The rear pedestal 1 serves as a fulcrum for the cantilever action of the roll.

On the rear end of the suction box is formed an annular boss 35 to which is secured by bolts 36 a shaft 37 terminating in a reduced journal 38. Said journal 38 is provided with a tapered bearing 39 adapted to seat in a recess 40 in the rear journal 13. Said bearing 39 is provided with conical bearing races 41 in which the journal 38 is adapted to rotate. The rear end of the bearing 39 is closed by a plate 42 and the other end has a sealing ring 43 which interlocks with a sealing ring 44 on the shaft 37 to form a closed housing for lubricating oil.

A roller 45 is rotatably mounted in a dependent bracket 46 from the bottom of the suction box 23. This roller permits the suction box to be rolled into the foraminous shell 6 for assembly, said roller 45 rolling along the interior face of the shell 6 until the tapered bearing enters the recess 40 and is seated therein. The edges of the recess 40 are bevelled as at 47 to facilitate the seating of the tapered bearing 39. When said bearing 39 is seated the roller 45 is sufficiently elevated above the interior surface of the shell 6 to clear the same and thus to allow free rotation thereof. It will be noted that the bearing 39 revolves with the journal 13, so that all of the friction of rotation is confined to the conical bearings and journal 38, where it is reduced to a minimum. A flanged ring 48 is secured to the inner face of the head 9 to prevent water from dripping directly against the sealing rings 43 and 44.

Referring now to Figures 3 to 6, inclusive, there is shown a flexible packing head 49 adapted to be resiliently mounted above the open side of said suction box, between said box and the interior surface of the shell 6. Said packing head 49 serves to confine the suction effect to the limited area of said shell where such effect is required. The packing head 49 comprises a flexible metallic plate substantially the width of the suction box and formed with a plurality of slots 50. The size of the slots 50 is sufficient to practically eliminate any differential of pressure between the upper and lower sides of said head. Longitudinal packing strips 51 are adapted to fit in recessed side rails 52 formed on the packing head. In the space between said rails 52 are slidably mounted a pair of end plates 53 which carry transverse packing strips 54. Said transverse strips 54 closely abut the longitudinal strips 51 and serve to define the area of suction on the shell 6 by sealing said area from the rest of the interior of the shell.

As best shown in Figure 5, the inner ends of the plates 53 are secured to brackets 55 by means of pins 56. Said pins 56 are secured to the plates 53 but slidably held in sockets in the brackets 55 to permit relative radial movement of said plates. An adjust-

ing means comprising two concentric rods 57 and 58 is provided for slidably moving said plates 53 to constrict the length of the area subjected to the vacuum, said rods having threaded portions 59 and 60 extending through the brackets 55 and handles 61 and 62 at the front end of the roll for turning the same. It will be noted that it is thus possible to move either plate 53 at will and independently of the other.

The under side of each plate 53 is provided with a recess 63 to allow clearance for a nut 64 on the end of an adjusting screw 65. Said screw 65 extends through the floating packing head 49 and is anchored to a floating spring seat 66 on the under side of said head 49. Said seat 66 is enclosed by a spring box 67 secured by bolts 68 to the underside of the packing head.

A depending, outwardly and downwardly flared flange 69 extends on each side of the spring box 67 along the length of the packing head 49 and integral therewith. A plate 70 secured to each of the upper edges of the suction box 23 presents an outwardly and upwardly tapered face 71 to said flange 69, forming therewith a wedge-shaped space 72. A metallic, cylindrical packing or sealing rod 73 is confined within said wedge-shaped space 72 to afford roll sealing means between the floating packing head 49 and the suction box 23. The rods or rolls 73 permit free floating movement of the packing head 49, the seal remaining tight at various radial positions of the head. The differential of air pressure between the outside and inside of the suction box tends to force the rods 73 into the V of the wedge and to effect efficient sealing no matter what the relative radial position of the head to the suction box. A plurality of guide plates 74, however, are secured along the sides of the suction box 23 to provide guiding surfaces 75 for the head 49 against lateral displacement due to friction between the packing strips and the revolving shell.

A bracket 76 is secured directly below each box 67 to the interior sides of the suction box 23 by bolts 77 extending into bolt flanges 78 in the guide plates 74. Each bracket 76 is formed with a vertically bored bearing 79 centered with the adjusting screw 65. A second adjusting screw 80 extends through each bearing 79 and is held for rotation therein by a collar 81. The upper end of said screw 80 is threaded to receive a spring seat 82. A spring 83 is held in compression between the two spring seats 66 and 82. The compression of the spring 83 is adjustable through both the adjusting screws 65 and 80. The lower extended end of the screw 80 carries a bevel gear 84 rigidly secured thereto and meshing with a second bevel gear 85. Said gear 85 is secured to a rod 86 extending from an arm 87 of the rearmost bracket 76, in which it is journalled, out through the front end of the roll. At the front end, the rod 86 extends through a packing gland 88 in the head 26 and is provided with a squared end 89 adapted to receive a wrench. By turning the end 89 in either direction the adjusting screws 80 may be moved radially through the bevel gears 84—85.

A small pipe 90 also extends through the packing gland 88 and into the suction box 23. Said pipe 90 is carried by a bend 91 through one wall of the box 23 and by a second bend 92 up to a point near the shell 6, alongside the packing head 49, where it ends in a nozzle 93. The purpose of the pipe 90 is to supply air under pressure to blow the web of paper off of the wire after it has passed over the suction box.

In assembling the suction box, the flexible packing head 49 is placed on the supporting springs 83 and the adjusting screws 65 set so that the springs 83 just support the weight of the head 49 and at the same time the springs are adjusted so that the head is level, allowing the packing strips 51 to fit the entire length of the shell 6. The joints at the ends of the packing head and of the suction box are sealed by flexible strips 94, which are held tightly against the ends of the packing head by the atmospheric pressure. The small rods or rolls 73, extending the full length of the suction box and in contact with both the suction box and packing head are spaced in such a position that the atmospheric pressure on both sides of the flexible head is absolutely balanced. Due to this balanced state of the flexible head, it can be readily seen that, by actuating and adjusting shaft 86 from the front end of the roll, the packing strips 51 and 54 can be brought into any desired contact pressure with the inside periphery of the perforated roll 6 and maintained in this position independent of the vacuum pressure in the inside of the suction box.

This is an important improvement over former types of suction box construction, since it makes it possible to adjust the packing so that it is barely in contact with the inside of the roll or sufficiently to maintain a nearly air tight joint. Any deflection of the suction box is not transmitted to the contact pressure, except for the very slight amount of pressure required to compress the springs to correspond with such deflection. Even if the interior surface of the shell is somewhat uneven or out of round, the packing carried in the flexible head will necessarily follow the surface without the necessity of creating excessive friction to accomplish this.

Another improvement of my invention over former construction is the elimination of the internal bearing on the front journal

of the roll. In my construction it will be noted that there is only the one internal bearing which is in the rear journal and which supports the rear end of the suction box, while the front end is carried through the front journal without contacting the same.

In Figures 7 and 8 there is shown a modified form of my device in which the front supporting pedestal for the suction roll forms a part of the suction line and in which the front end of the shell is rotatably mounted on ball bearings supported from an elongated end of the suction chamber.

The reference numeral 100 indicates a supporting pedestal for the front end of a suction roll 101. Said pedestal 100 is built up in a plurality of cast sections including a flanged base section 102, a middle section 103 adapted to be secured to said base by means of pivoted bolts 104, and an upper section 105, similarly secured to the middle section by means of pivoted bolts 106. Each of said sections is formed with a passage which registers with the adjoining one to provide a continuous path for air and water passing from a suction chamber 107 in the suction roll 101. The base section 102 is further provided with a flanged face 108 to which suction piping 109 may be connected.

This construction of the pedestal in several sections is of great advantage in changing a wire. All that it is necessary to do in changing a wire is to swing out the bolts 104 and 106 and remove the middle section 103. The rear end of the suction roll may be operated as previously described to support the front end while the section 103 is being removed. The loop of new wire is then slipped over the front end of the suction roll, the section 103 then replaced and bolted in position.

The suction roll 101 is in general the same as the roll previously described, except in the construction of the front bearing. The suction box 107 is formed with an elongated cylindrical end 110, which rests in a trough-shaped portion formed in the section 105 and is provided with a passage 127 registering with the opening in said section. A curved plate 111 fits over the end 110 and is secured to the upper section 105 by bolts 112. A head 113 fits over the end of the suction box. Through this head extend the usual adjusting rods 114 and 115 and air pipe 116.

Adjacent to and inside of the section 105 and plate 111, there is built up on the suction box end 110 a bearing 117. Said bearing comprises a ring 118 secured around the end 110, an inner ball race 119 fitted in said ring 118, an outer ball race 120 and balls 121 therebetween. Said ball races 119 and 120 are enclosed by oil rings, or housings 122 and an outer ring 123 having a crowned surface 124. A narrow trunnion ring 125 is secured to the end of the shell 126 of the suction roll 101 and bears on said crowned surface 124 to form a tight joint. There is no relative rotational movement between the trunnion 125 and the ring 123 since the ball bearings provide the least frictional resistance to rotation between the shell 126 and suction box 107. The crowned surface 124, however, serves the purpose of allowing for non-axial alignment between the suction box and the shell.

While I have described my invention as applied to suction couch rolls for use in paper making machines of the Fourdrinier type, it will be understood that my invention may be applied as well to suction rolls for use on any type of paper and pulp making machines or to any type of machine in which a moving perforated or foraminous surface is used in conjunction with a suction box.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. The combination with a suction roll having a perforated shell, of a suction chamber mounted within said shell, a floating packing head for said chamber adapted to contact the interior surface of said shell to confine an area thereof, self adjusting sealing means movably positioned between said floating head and said chamber and a plurality of longitudinally spaced resilient means adapted to balance the weight of said head.

2. The combination with a suction roll having a foraminous shell, of a suction chamber mounted therein, having tapered upper edges, a packing head adapted to form with said edges wedge shaped spaces therebetween and roll sealing means positioned in said spaces to allow free radial movement of said head.

3. The combination with a suction roll having a foraminous shell, of a suction box mounted therein, a flexible head mounted between said box and the interior face of said shell, roll sealing means between said box and said head to allow free radial movement of said head, resilient means adapted to balance the weight of said head and means for adjusting said resilient means to afford the desired contact pressure between said head and the interior face of said shell.

4. The combination with a suction roll having a foraminous shell, of a suction box mounted therein and having an opening toward said shell, an inwardly tapered edge

along the longitudinal sides of said opening, a flexible head having oppositely tapered flanges extending into said box to form a wedge shaped space with said tapered edge, roll sealing means contained within said wedge shaped space, guides secured to said box to prevent lateral movement of said head and resilient means for adjustably holding said head against the interior face of said shell.

5. The combination with a suction roll having a foraminous shell, of a suction box mounted therein and having an opening toward said shell, an inwardly tapered edge along the longitudinal sides of said opening, a flexible head having oppositely tapered flanges extending into said box to form a wedge shaped space with said tapered edge, and roll sealing means contained within said wedge shaped space.

6. The combination with a suction roll having a foraminous shell, of a suction box mounted therein, tapered edges formed along parallel longitudinal sides of said box, a flexible packing head mounted between said box and the interior face of said shell, depending oppositely tapered flanges on said head extending into said box to form a wedge shaped space with said tapered edges, and roll sealing means confined within said space.

7. The combination with a suction box, of a packing head and non-compressible roll sealing means adapted to automatically seal said packing head with said suction box.

8. A suction box having a head associated therewith and subjected to higher external than internal pressure, resilient means associated with the cover for maintaining said head in a predetermined position against the differential of pressures acting thereon, and movable pressure actuated sealing means between the box and head.

9. A suction box having a head resiliently supported thereon, and sealing means wedgingly engaged between said box and head.

10. A suction box having a head and sealing means wedgingly engaged between said box and head.

11. A suction box having a head and a plurality of longitudinally spaced resilient spring supports for said head.

12. A suction box having a head and a plurality of longitudinally spaced resilient spring supports for said head, and means for simultaneously adjusting said supports.

13. In combination with a moving perforated surface, a suction box, a head for said box adapted to contact said surface and sealing means between said box and said head forming rolling contact therewith.

14. In combination with a moving perforated surface, a suction box, a flexible packing head for said box adapted to contact said surface and sealing means between said box and said head forming rolling contact therewith.

15. In combination with a moving perforated surface, a suction box, a head for said box adapted to contact said surface and sealing means wedgingly held between said box and said head forming rolling contact therewith.

16. In combination with a moving perforated surface, a suction box, a head for said box adapted to contact said surface and metallic roll sealing means wedgingly held between said box and said head forming rolling contact therewith.

17. A supporting pedestal for a suction roll comprising a plurality of hollow sections through which suction may be applied to the roll.

18. In a suction roll, a supporting pedestal therefor comprising a plurality of hollow sections, means for readily removing one of said sections when changing a wire and a suction box supported by said pedestal and having a passage connecting therewith.

19. The combination with a suction roll having a perforated shell, of a suction chamber mounted within said shell, a fully floating packing head separate from said suction chamber and self-adjusting roll sealing means between said suction chamber and packing head.

20. The combination with a suction roll having a perforated shell, of a suction chamber mounted within said shell, a fully floating packing head separate from said suction chamber, self adjusting roll sealing means between said suction chamber and packing head, and flexible sealing means between the ends of said suction chamber and of said packing head.

21. The combination with a suction roll having a perforated shell, of a suction chamber mounted within said shell, a fully floating packing head separate from said suction chamber, self adjusting roll sealing means between said suction chamber and packing head, and spaced resilient means adapted to be individually and collectively adjusted for regulating the pressure of said packing head against the inner surface of said shell.

22. The combination with a suction roll having a perforated shell, of a suction chamber mounted within said shell, a fully floating packing head separate from said suction chamber, self adjusting roll sealing means between said suction chamber and packing head, and spaced helical springs supporting said packing head and adapted to be individually and collectively adjusted for regulating the pressure of said packing head against the inner surface of said shell.

In testimony whereof I have hereunto subscribed my name.

EARL E. BERRY.