

July 17, 1928.

1,677,128

A. ALDRICH

OSCILLATING SUCTION BOX

Filed Dec. 5, 1927

5 Sheets-Sheet 1

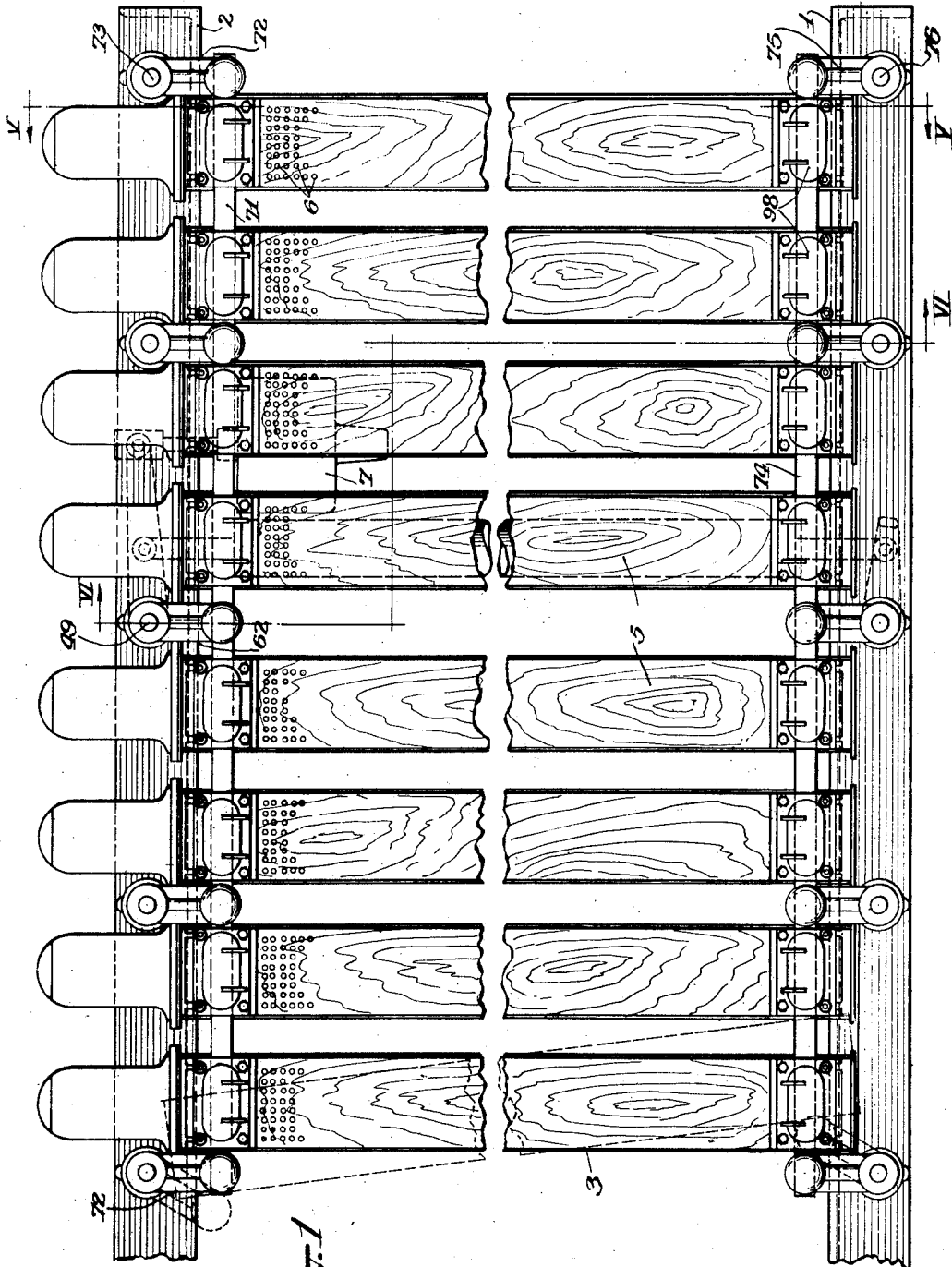


Fig. 1

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July 17, 1928.

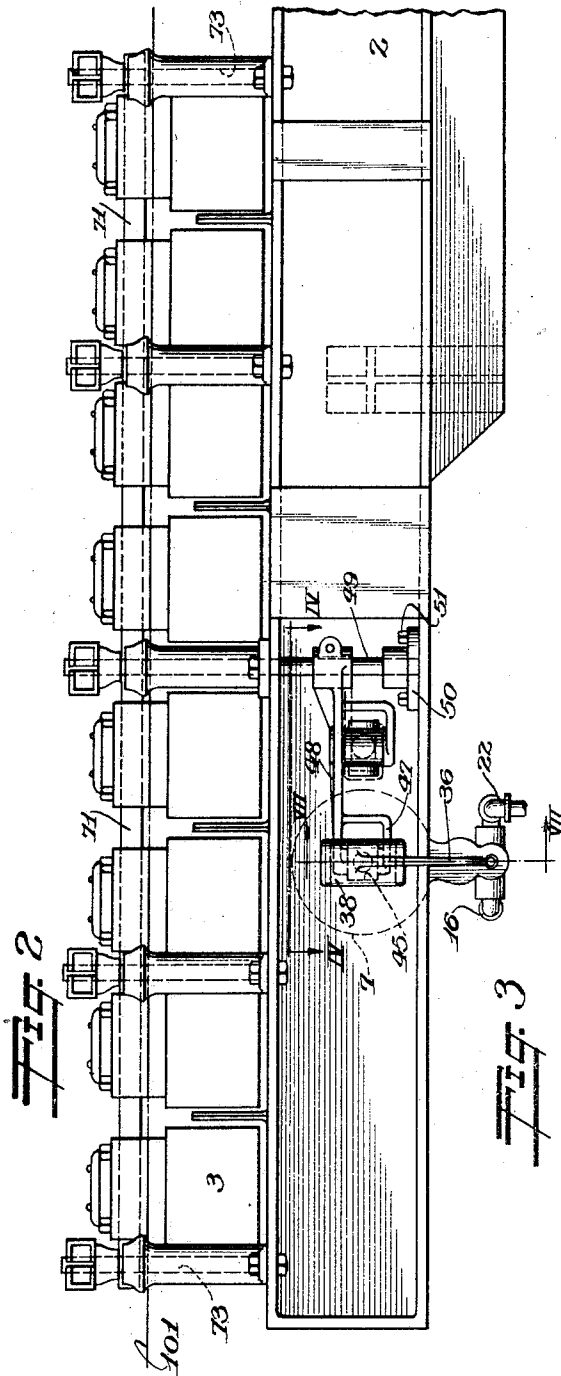
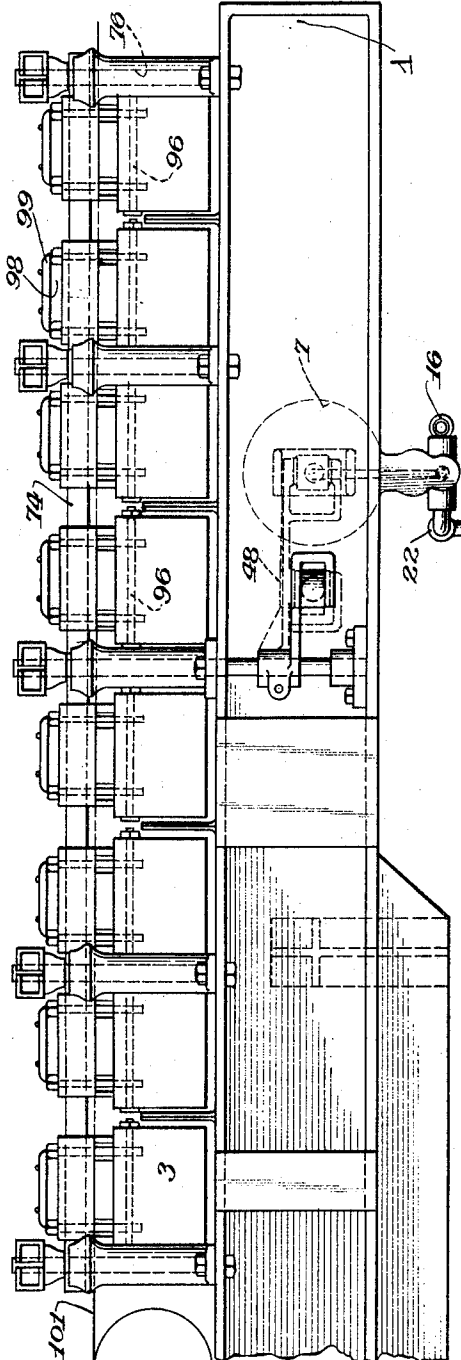
1,677,128

A. ALDRICH

OSCILLATING SUCTION BOX

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5 Sheets-Sheet 2



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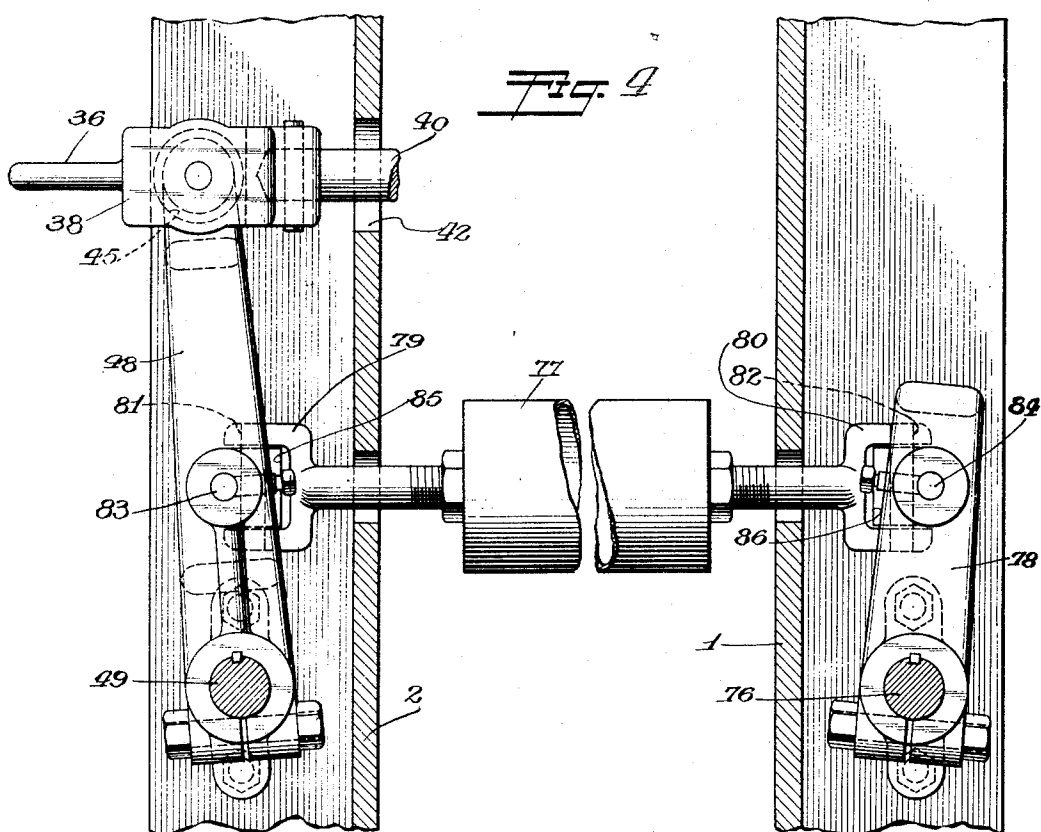
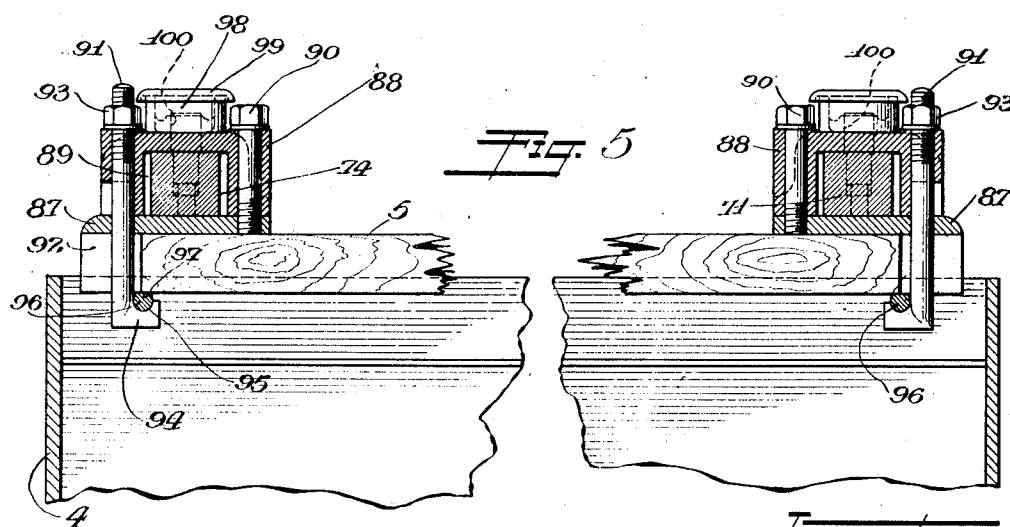
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OSCILLATING SUCTION BOX

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5 Sheets-Sheet 3



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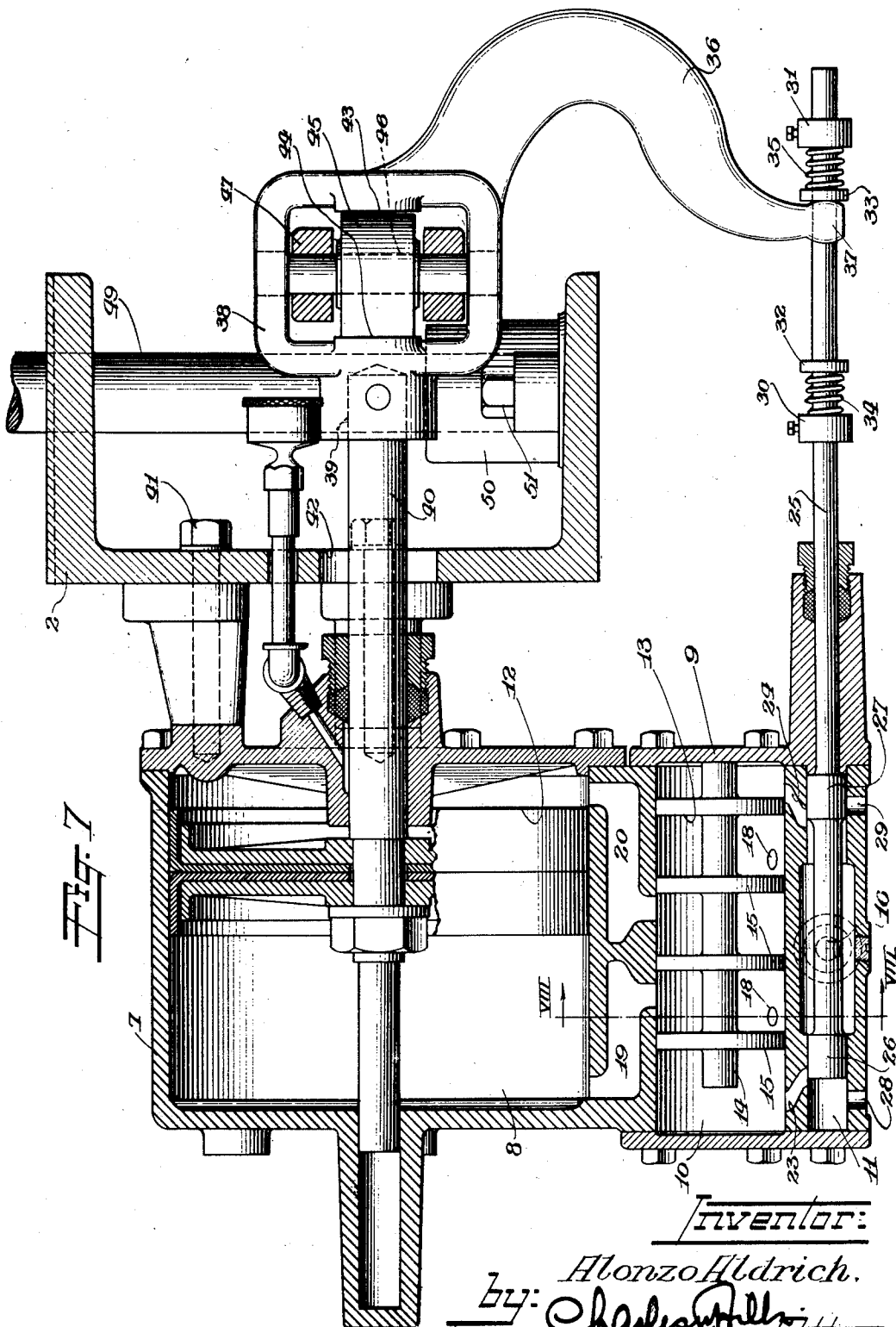
1,677,128

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OSCILLATING SUCTION BOX

Filed Dec. 5, 1927

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

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OSCILLATING SUCTION BOX.

Application filed December 5, 1927. Serial No. 237,802.

This invention relates to oscillating suction boxes for Fourdrinier paper machines.

Heretofore, suction boxes used in the Fourdrinier section of a paper machine have generally been provided with reciprocating mechanism for moving the suction boxes either longitudinally or transversely of the direction of the moving wire. The principal purpose of so reciprocating the suction boxes is to prevent uneven wear of box tops and the scoring of these tops by the moving wire. As is readily apparent, simple reciprocating movement longitudinally of the wire is not entirely effective in preventing scoring of suction box tops. On the other hand, a transverse reciprocating movement has a tendency to shift the wire laterally, thus putting a strain on it.

It is therefore an object of this invention to provide mechanism for oscillating the ends of the suction boxes lengthwise and cross-wise of the wire in a plane parallel to the plane of the wire to prevent uneven wear or scoring of the suction box tops.

It is a further object of this invention to provide means for oscillating a plurality of suction boxes in unison, each box being oscillated about a substantially fixed central axis and in a plane parallel to the plane of the wire.

It is a further important object of this invention to provide simple and rugged mechanism for automatically accomplishing the oscillation of the suction boxes at a readily variable speed.

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 top plan view of a suction box unit for Fourdrinier paper making machines, embodying the principles of my invention;

Figure 2 is an elevational view of the rear side of the suction box unit;

Figure 3 is an elevational view of the front side of the suction box unit;

Figure 4 is an enlarged fragmentary sectional view taken substantially on line IV—IV of Figure 2;

Figure 5 is a broken enlarged sectional view taken on line V—V of Figure 1 with parts in elevation;

Figure 6 is an enlarged sectional view taken on line VI—VI of Figure 1 with parts removed and parts in elevation;

Figure 7 is an enlarged sectional view taken on line VII—VII of Figure 1, with parts in elevation; and

Figure 8 is an enlarged fragmentary sectional view taken on line VIII—VIII of Figure 7 with parts in elevation.

The reference numerals 1 and 2 indicate front and rear channel beams respectively forming a part of the Fourdrinier structure. In accordance with the principles of this invention, a plurality of suction boxes 3 are mounted from said channel beams 1 and 2 in such a manner as to permit oscillation of the ends of the suction boxes both lengthwise and crosswise of the Fourdrinier wire 101 in the plane parallel to the plane of said wire. While, as here illustrated, said suction boxes are of substantially standard type, comprising a lower box portion 4 and a top 5 therefor having perforations 6, it will be understood that any type of suction device may be arranged in a manner similar to that illustrated and also that the invention is equally applicable to suction devices used in connection with wet felts.

A suitable reciprocating mechanism for effecting oscillation of the suction boxes 3 is illustrated in Figures 7 and 8. Said reciprocating mechanism comprises a casing 7 forming a main cylinder chamber 8, an auxiliary casing 9 providing a valve cylinder 10 and a plunger cylinder 11. A piston 12 is adapted to be reciprocated in the main cylinder 8 by means of hydraulic pressure regulated by a floating valve 13 in the valve cylinder 10. Said floating valve 13 comprises a stem 14 having a plurality, in this case four, discs 15 secured thereto at spaced intervals. A fluid under pressure, such as water, enters said valve cylinder 10 through an intake pipe 16, a chamber 17 and openings 18 in said valve chamber wall. With the floating valve 13 in the position shown in Figure 7, the water entering through one of the ports 18 passes between adjacent discs 15 through an inlet port 19 and thus up into the main cylinder 8. In the position illustrated, the pressure of the water entering

the cylinder 8 has forced the piston 12 over to extreme right-hand position. The water on the right hand of the piston 12 is being discharged from said cylinder 8 through an outlet port 20 into the valve cylinder 10 and out through an outlet passage 21 communicating with a discharge pipe 22. The pressure of the water entering through the intake port 18 next forces the floating valve 13 to the left to provide communication between the right-hand intake port 18, the port 20 and the right-hand end of the cylinder 8. The pressure of the incoming water through the port 20 will now force the piston 12 over to its extreme left-hand position; at the same time discharging water on the left hand of the piston 12 through port 19 into cylinder 10 and out through the discharge port 21 and discharge pipe 22. Bleeder ports 23 and 24 connect the extreme ends of the cylinder 10 with the ends of the plunger cylinder 11 to allow displacement of the water between the ends of the floating valve 13 and the ends of said cylinder 10.

A plunger stem 25 is reciprocally mounted in said cylinder 11 and is provided with a pair of spaced plunger heads 26 and 27, adapted to fit snugly within the cylinder 11. A pair of bleeder ports 28 and 29 are positioned adjacent the ends of cylinder 11 to allow for displacement of water trapped between said plunger heads 26 and 27 and the ends of said cylinder 11. On the extended end of said plunger stem 25 are adjustably positioned a pair of spaced collars 30 and 31 having associated therewith slidably mounted discs 32 and 33 respectively. Coiled springs 34 and 35 are positioned between said collars 30 and 31 and the respective discs 32 and 33. An arm 36 is provided with a lower passaged end 37 adapted to receive said plunger stem 25. At its upper end said arm 36 is formed with a box 38 having a threaded socket 39 for receiving the outer end of the piston rod 40. It is thus apparent that reciprocation of the piston 12, effected as above described, results in reciprocating movement of the plunger stem 25. The spacing of the discs 32 and 33 is so calculated with respect to the stroke of the piston 12 as to effect the necessary amount of reciprocation of the plunger stem 25 to control properly the bleeder ports 23, 24, 28 and 29. The springs 34 and 35 serve to afford the necessary degree of resiliency to absorb the force of the blows against the discs 32 and 33 struck by the reciprocating end 37.

The reciprocating mechanism illustrated may obviously be replaced by any other type of mechanism adapted for the purpose. Said reciprocating mechanism is suitably fastened to the rear channel beam 2 by means of stud bolts 41, said channel beam

being provided with an aperture 42 (Fig. 7) through which the piston rod 40 is adapted to pass. The box 38 on the arm 36 is provided with oppositely positioned bearing surfaces 43 and 44 adapted to form a guideway therebetween for a roller 45. Said roller 45 is rotatably mounted upon a pin 46 secured in a forked end 47 of a lever arm 48. The other end of said lever arm 48 (Figs. 1 to 4 inclusive) is splined to a driving stand or post 49. Said post 49 is rotatably mounted in a base socket 50 secured by means of bolts 51 to the lower web of the channel beam 2, said post extending through the upper web of said channel beam 2 as best shown in Figure 6.

The portion of said post 49 above the channel beam 2 is partly enclosed within a tubular housing 52, secured by means of bolts 53 to the upper web of said channel beam 2. The upper end of said tubular housing 52 supports a ball race 54, housed within a cap 55. Said ball race 54 comprises a lower ring 56 supported by the tubular housing 52 and an upper ring 57 resting upon balls 58 positioned between said rings. Said cap 55 rests directly upon the upper ring 57 and is secured against relative rotation with respect to the post 49 by means of a pin 59 passing therethrough. It is thus apparent that the bearing race 54 serves as a thrust bearing to support the weight of the post 49 and to permit it to swivel freely within the tubular housing 52. A cylindrical channel 60 is formed throughout a part of the length of the tubular housing 52 for receiving a lubricant adapted to be introduced through a passage 61 in the wall of the housing 52. The reciprocating movement of the piston 12 and attached box 38 is thus translated by means of the roller 45 and lever arm 48 into limited swivelling movement of the post 49.

A bracket arm 62 is keyed to the upper end of said driver post 49. Said bracket arm 62 extends inwardly and is provided at its inner end with a vertical bore 63 for receiving a pin 64. Said pin 64 is provided with an annular shoulder 65, between which and a seat 66, formed in the bracket end, is adapted to be positioned a bearing race 67. A cap 68, secured to the upper end of said pin 64 by a nut 64^a, encloses said bearing race 67 to protect the same from dust and moisture. Said pin 64 is thus free to rotate within the bore 63 upon the bearings in the bearing race 67. The lower end of said pin 64 is provided with a reduced cylindrical portion 69 terminally threaded to receive a nut 70. Said reduced end 69 is adapted to pass through a hanger bar 71, which is thus supported thereon by means of the nut 70. Said hanger bar 71 extends the full length of the suction box unit and

is similarly supported at spaced intervals from bracket arms 72 mounted upon swivel posts 73, constituting intermediate stands.

A similar hanger bar 74 is supported by means of bracket arms 75 from posts 76 mounted on the front channel beam 1. Means for driving said front hanger bar 74 comprise a cross bar 77 (Figure 4) connected at one end to said lever arm 48 and at its other end to a lever arm 78, which in turn is keyed to one of the posts 76 (Figure 4). The connections are afforded by means of clevises 79 and 80 formed on the ends of said cross bar 77 and provided with pins 81 and 82 for receiving tongues 85 and 86. Said tongues 85 and 86 in turn are pivotally mounted upon pins 83 and 84 extending between spaced portions of the respective lever arms 48 and 78. There is thus provided limited freedom of pivotal movement of the cross bar 77 in two planes.

Swivelling movement imparted to the driver post 49 is accordingly translated into similar swivelling movement of the posts 73 and 76, all of these posts turning the same way and through the same fraction of a revolution. Because of this, the movement of the bracket arms 75 and therefore of the front hanger bar 74 will be opposed in direction to the movement of the bracket arms 72 and rear hanger bar 71, as indicated in dotted lines in Fig. 1.

The suction boxes 3 are adapted to be suspended at their respective ends from the hanger bars 71 and 74 by means that will now be described. A plate 87 is positioned adjacent each end of each suction box top 5 (Figure 5). To each plate 87 is secured a block 88 having a substantially square or rectangular passage 89 extending lengthwise of the machine for receiving the hanger bars 71 and 74. Said blocks 88 are secured to said plates 87 by means of bolts 90 terminating flush with the under surface of the plates 87. Other bolts 91 extend through said blocks 88 and plates 87 and through slots 92 formed in the ends of the suction box tops 5. The upper ends of said bolts 91 are threaded to receive nuts 93. The lower ends of said bolts 91 are inwardly turned as at 94, said ends 94 being provided with cylindrical seats 95 for receiving rods 96 extending crosswise of the suction box tops 5. Said rods 96, which extend the full width of the tops 5 through the walls of said suction boxes 3, are each provided with flattened faces 97 adapted to bear against the under surface of the tops 5. The tops 5 are thus clampingly held between the under surfaces of the plates 87 and the flat faces of the rods 97, the amount of clamping pressure being adjustable by means of the nuts 93 to permit free, relative movement between the contacting surfaces.

On each of said blocks 88 is mounted a

grease box 98 having a hinged cover 99. A pin 100 extends vertically through the bottom of each of said grease boxes 98 and through the upper wall of the block 88 into the hangers 74 or 71. The portions of said pins 100 passing through the hangers 74 or 71 are cylindrical to permit relative turning movement between said pins and said bars. The passages 89 in the blocks 88 provide sufficient clearance for the sides of the hanger bars 71 and 74 to prevent binding of the hanger bars, so that said hanger bars may remain at all times parallel to each other and longitudinally of the machine.

As a result of the operation of the mechanism above described, the suction boxes 3 are oscillated in unison, each suction box oscillating about a substantially fixed central point and the ends of each of said suction boxes moving in an arc of a circle, the opposite ends of each suction box moving in opposite directions. The plane in which the suction boxes oscillate is of necessity parallel to the plane of the wire, indicated by the reference numeral 101, which travels over the surfaces of the suction box tops 5. It will be appreciated therefore that the oscillatory movement of the suction boxes 3 prevents the wire from forming scores or grooves in the surface of said tops 5, since contacting points on said surfaces are constantly changing their relative positions with respect to points on the wire. The movement of the ends of the suction boxes may be resolved into a component longitudinal of the machine and a second component transverse of the machine, but these components as between opposite ends of the suction boxes being in opposite directions, the result is that there is no tendency of the suction box to drag the wire to one side or the other. It will therefore be apparent that suction boxes arranged in accordance with my invention for oscillating movement possess certain very distinct advantages over types of suction boxes wherein the movement is solely transverse or solely longitudinal of the machine.

It will be appreciated that the clamping means for the ends of the suction box tops, comprising the blocks 88, plates 87, hook bolts 93 and transverse rods 97, afford simple and ready means for supporting the suction boxes from the hanger bars in such a way as to maintain the suction box tops in a plane always parallel to the plane of the wire. In practice, the vibrating hanger bars are erected in such a manner that the undersides of the plates 87 are in the same plane as the wire. Consequently, merely by drawing the suction boxes up until the top surfaces of their covers are in contact with the undersides of said plates, the suction boxes are automatically brought into perfect alinement with the wire. Furthermore, said

clamping means permit any of the boxes to be removed for repairs during operation of the machine.

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. A device of the class described, comprising a plurality of suction boxes having perforated tops, means engaging the ends of said tops adapted to allow relative movement between the engaging surfaces and means associated with said engaging means for effecting oscillation of said tops.

2. A device of the class described, comprising a plurality of suction boxes, hollow clamping means for engaging and supporting the respective ends of said boxes, bars mounted in said clamping means and connecting said boxes, swivelly mounted members associated with said bars, and means for swivelling said members to move said bars through a curvilinear path to thereby effect oscillation of said suction boxes in unison.

3. A device of the class described, comprising a plurality of suction boxes, perforated tops therefor having slotted ends, hollow clamping means for the ends of said tops having clamping portions extending through said slots to frictionally engage the under side of said tops, bars mounted in said hollow clamping means, and mechanism for moving said bars through a curvilinear path to thereby effect oscillation of said suction boxes.

4. A device of the class described, comprising a plurality of suction boxes, perforated tops therefor having slotted ends, hollow clamping means for the ends of said tops having portions extending through said slots to frictionally engage the under side of said tops, bars mounted in said hollow clamping means and adapted to have limited pivotal movement relative thereto, swivel posts having arms pivotally connected to said bars and mechanism for swivelling said posts to effect oscillation of said suction boxes through movement of said bars in curvilinear paths.

5. A device of the class described, comprising a plurality of suction boxes, perforated tops therefor having slotted ends, hollow clamping means for frictionally engaging the ends of said tops having portions extending through said slots, bars mounted in said hollow clamping means for limited pivotal movement relative thereto, swivel posts having arms pivotally connected to said bars, reciprocating mechanism having transversely slotted guides and arms splined

to said swivel posts having rollers adapted to extend into said slotted guides for swivelling said posts to effect oscillation of said suction boxes through movement of said bars.

6. Clamping means for a suction box top, said top being provided with longitudinal end slots, comprising plate adapted to be positioned upon one end of said top, a hollow member secured to said plate, bolts secured to said member and extending through said slots, said bolts having lower inturned ends and a rod adapted to be clampingly held by said inturned ends against the under surface of said top.

7. Clamping means for a suction box top, comprising plate adapted to be positioned upon one end of said top, said top having longitudinal end slots, a hollow member secured to said plate, bolts passing through said member and extending through said slots, said bolts being formed with inturned ends having cylindrical seats, a circular bar positioned in said seats having a flattened face adapted to contact the under surface of said top and means for adjusting the clamping pressure exerted upon said top by said plate and bar to permit relative movement of said top therebetween.

8. In a device of the class described, a pair of longitudinally extending vibrating hanger bars adapted to remain in parallel relation during vibration, a plurality of suction boxes and means for suspending said boxes from said hanger bars to permit relative movement between adjacent surfaces of said boxes and said bars.

9. The combination with the wire of a Fourdrinier paper machine, of a suction device comprising a pair of vibrating hanger bars extending longitudinally of the wire and adapted to remain at all times in parallel relation to each other, suction boxes and means for suspending said suction boxes from said bars to permit relative movement therebetween with the tops of said boxes lying in the plane of said wire.

10. The combination with the wire of a Fourdrinier paper machine, of a suction device comprising a pair of vibrating hanger bars extending longitudinally of the wire, suction boxes, means for suspending said suction boxes from said bars with the tops of said boxes lying in the plane of said wire, and means for vibrating said bars longitudinally and crosswise of the direction of travel of said wire while maintaining said bars at all times in parallel relation to the direction of the wire.

11. The combination with the wire of a Fourdrinier paper machine, of a suction device comprising vibrating hanger bars, hollow members for receiving said hanger bars having under surfaces lying in the plane of said wire, suction boxes, and means for

clamping the tops of said suction boxes against said under surfaces for suspension. 10
from said bars. ably suspending said suction boxes from said bars with the tops of said boxes in the plane

12. The combination with the wire of a of said wire.
5 Fourdrinier paper machine, of a suction device comprising vibrating hanger bars, means for vibrating said bars in a plane parallel to the plane of the wire, suction boxes provided with tops having slotted ends and

In testimony whereof I have hereunto subscribed my name at Beloit, Rock County, 15
Wisconsin.

ALONZO ALDRICH.