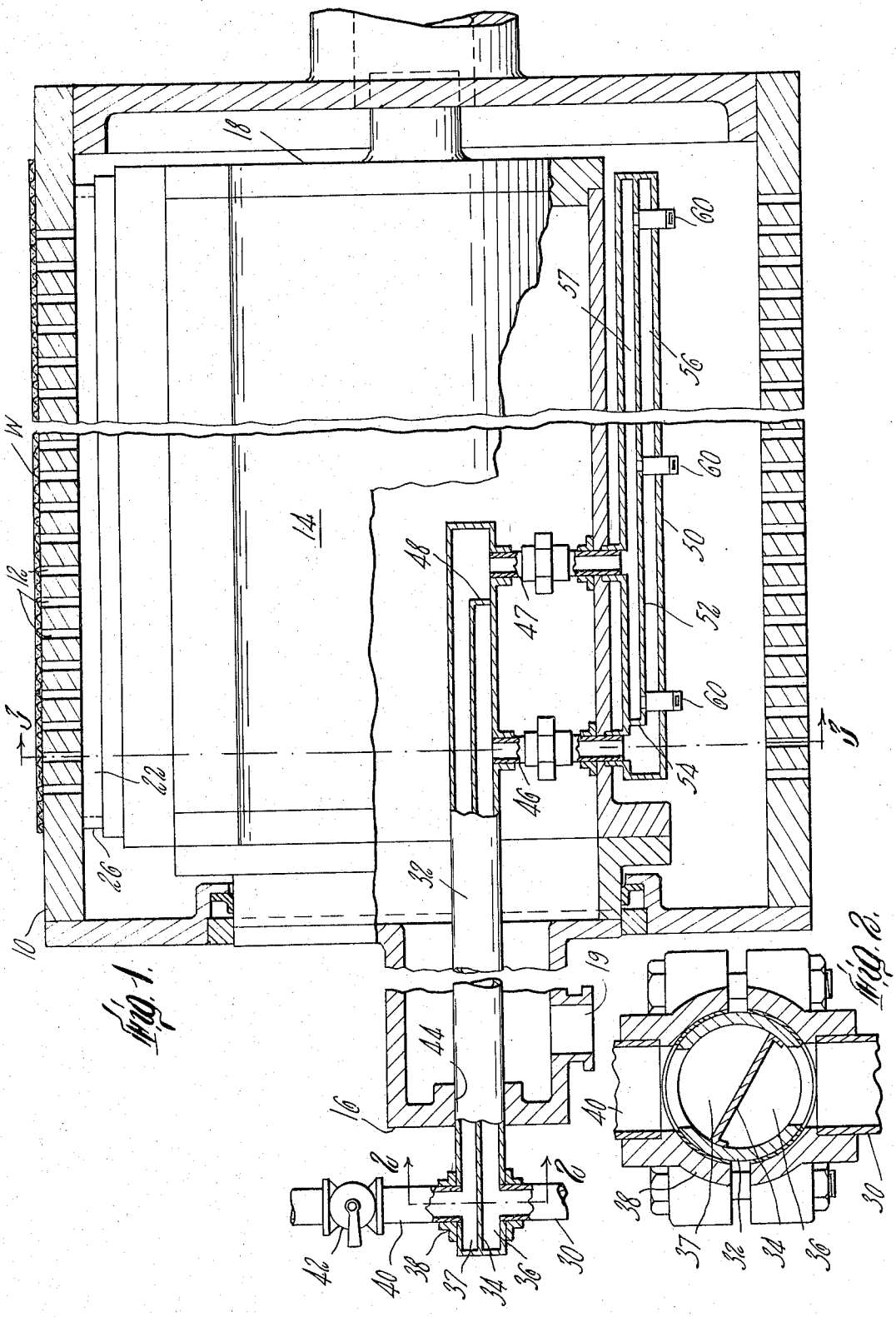
Jan. 24, 1967 D. B. BAKER ET AL 3,300,374

SUCTION ROLL WITH LUBRICATING AND WASHING SHOWERS

Original Filed April 23, 1963 3 Sheets-Sheet 1



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SUCTION ROLL WITH LUBRICATING AND WASHING SHOWERS

Original Filed April 23, 1963 3 Sheets-Sheet 2

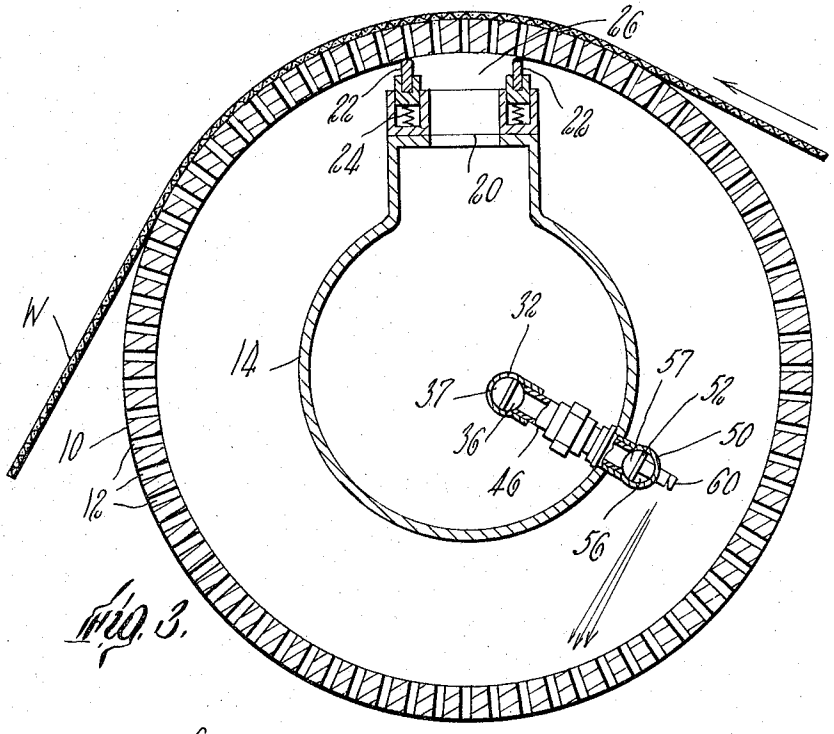


Fig. 3.

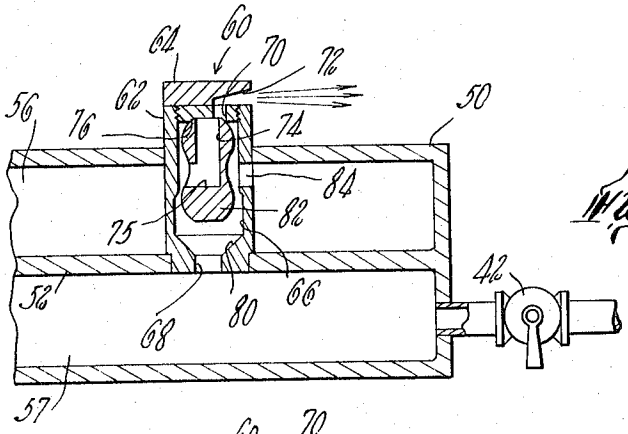


Fig. 4.

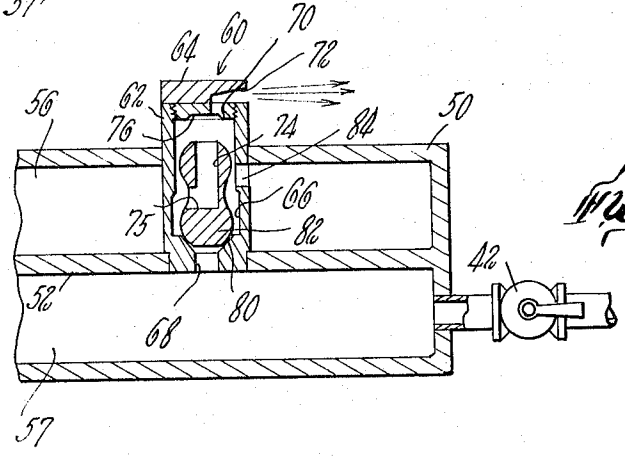


Fig. 5.

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SUCTION ROLL WITH LUBRICATING AND WASHING SHOWERS

Original Filed April 23, 1963 3 Sheets-Sheet 3

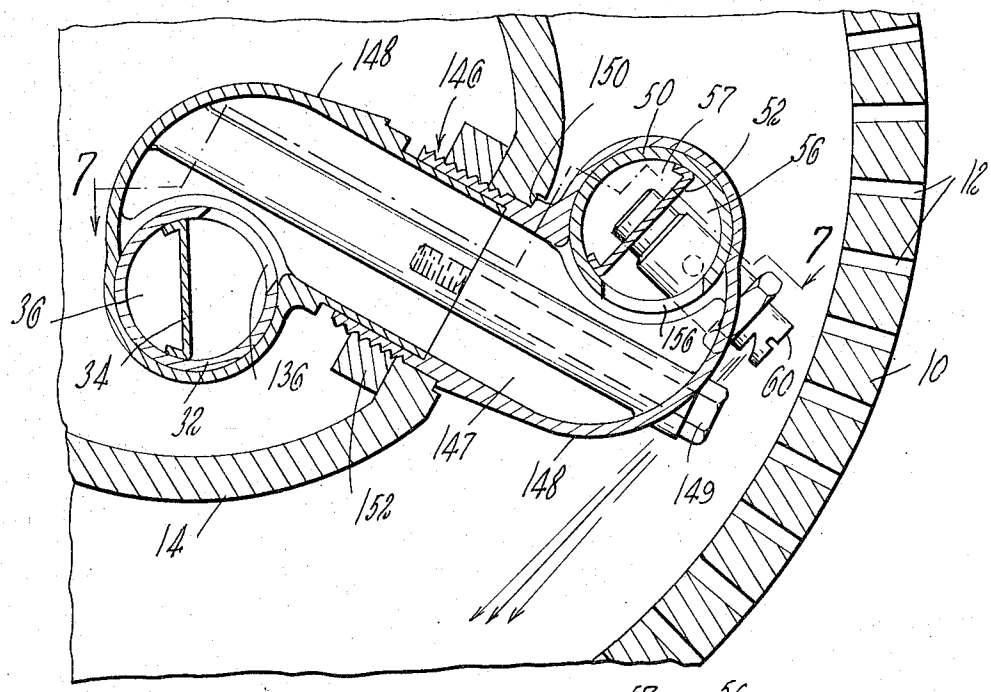


Fig. 6.

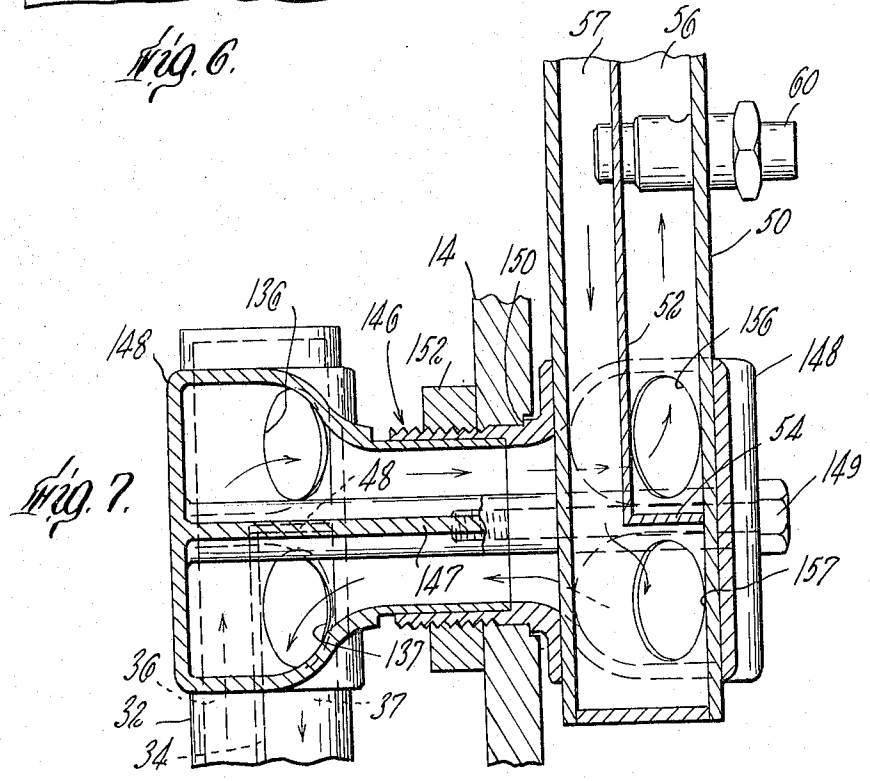


Fig. 7.

United States Patent Office

3,300,374

Patented Jan. 24, 1967

3,300,374

SUCTION ROLL WITH LUBRICATING AND WASHING SHOWERS

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Continuation of application Ser. No. 275,149, Apr. 23, 1963. This application Sept. 8, 1965, Ser. No. 485,750

3 Claims. (Cl. 162—276)

This application is a continuation of our copending application Serial No. 275,149, filed April 23, 1963, now abandoned.

This invention relates to improvements in what are known to the paper making trade as suction rolls and more particularly relates to an arrangement of equipment fo supplying lubricating water at one rate of flow to the interior of such rolls, and to devices for washing or flushing the inner surfaces of the rolls with water supplied at a greater rate of flow whenever desired.

Suction rolls are used in many places in paper making machinery, for example, where a web of paper is transferred from the wire to the press section of a machine or in suction presses where a felt or felts carry the sheet of paper through the press. The tremendous water removal capacity of these rolls makes fast modern machines possible. However, increased machine speed requires keeping the rolls clean at all times for uniformity of paper being produced. The high speeds also introduce problems of adjustment and wear on the seals between the roll and the edges of the suction slots in the suction boxes of these rolls. Therefore, lubrication of the interior of the rolls is provided. For lubrication, a steady but limited supply of lubricating water is sprayed or spread on the interior surfaces of the rolls in order to minimize friction between the rolls and the sealing strips at the sides and ends of the slots in suction boxes within the rolls. This lubrication also improves the sealing action between the rolls and sealing strips. Such lubricating arrangements must provide an even distribution of the lubricating water across the entire width of the machine, and therefore the usual arrangements include piping and supporting structure for the piping extending across the length of the interior of the roll and supported by the suction box.

At intervals of time the interior of the suction rolls must be cleaned or washed to remove accumulated deposited material, and for this purpose the roll should be flushed with a quantity of water considerably larger than that used for lubricating, preferably applied in a manner so that a scouring or scrubbing action takes place. In prior known suction roll washing devices this has required a separate source of washing water, also with appropriate piping and supports inside the roll, supported by the suction box. Thus the usual washing arrangement will take up more of the space in which the lubricating piping and its supporting structure are already located and will impose an additional weight and mechanical load between the ends of the suction box.

These two piping systems and their supports furthermore add unwanted friction to impede the large flow of air and water desired in the suction box, and thus reduce the effective vacuum available for water removal in the roll.

Another problem in prior suction roll lubricating water systems has been the tendency, after long continued periods of use, for the water-spreading nozzles to become plugged or blocked by accumulations of solid particles from the comparatively low-velocity of the water flowing therethrough, unless the water used is first finely strained or filtered.

One object of the present invention is to improve the

operation of suction rolls in maintaining uniform suction across the entire width of a roll for comparatively long periods of continuous use. Another object is to provide in a suction roll a lubricating system and a washing system together occupying less space within the roll than is usual and therefore offering substantially less friction to flow of air and water in the suction box. A further object is to improve the action of the spray nozzles lubricating the sealing strips on a suction box and to use unfiltered water without plugging the nozzles. A still further object is to improve and simplify both the lubricating and washing systems used within a suction roll and the control of lubricating and washing water fed thereto.

The objects of the present invention are met by providing a single piping system inside a suction roll adapted to supply a lubricating water showed in the quantities needed, but having special spray nozzles thereon each with an internal flow control element movable automatically to discharge a much larger quantity of water when washing is desired, the automatic change-over of water volume from the nozzle being obtained in the nozzles by the simple opening of a single valve. Closing of the valve will move the internal elements to restore the flow of water from all the nozzles automatically to the lubricating rate of flow. As the nozzles change their flow rate, accumulated deposits will be dislodged and flushed away. The single piping system occupies less space and has less weight to be supported by the suction box than would two separate systems. Flow of air and water in the suction box will be hampered less, and greater water removal can be obtained because of the higher effective vacuum in the roll. Maintenance of uniform sealing is facilitated over longer periods and replacement of sealing strips is less frequent. The self-cleaning properties of the nozzles, flushing them whenever the flow is changed from lubricating to washing flow, keep them from becoming plugged so that evenly distributed lubrication can be sustained. In addition, the nozzles can be flushed at any time desired by the operator of the equipment.

Other objects and further details of that which is believed to be novel and included in this invention will be clear from the following description and claims, taken with the accompanying drawings in which is illustrated an example of suction roll embodying the present invention and incorporating the improved combination of lubricating and washng devices in a single piping system set forth generally above.

In the drawings:

FIG. 1 is a side and partial sectional view longitudinally through a suction roll with combined lubricating and washing shower according to this invention;

FIG. 2 is an enlarged sectional view substantially on the line 2—2 of FIG. 1 showing a detail of a portion of the piping;

FIG. 3 is a vertical sectional view transversely of the suction roll of FIG. 1, substantially on the line 3—3 thereof;

FIG. 4 is a diagrammatic sectional view of a shower nozzle showing the nozzle flow-control element in lubricating flow position;

FIG. 5 is a view like FIG. 4 but showing the flow-control element in washing flow position;

FIG. 6 is an enlarged sectional view like a part of FIG. 3 showing a modified form of pipe connection through a suction box wall, and

FIG. 7 is a section substantially on line 7—7 of FIG. 6.

In carrying out the objects of this invention, the exemplary embodiment here disclosed is shown in connection with a typical or usual suction roll 10 in the form of a hollow cylindrical body or shell through which

regularly spaced perforations or holes 12 are provided throughout its periphery to present as large a vacuum area as possible. Inside the roll an elongated stationary suction box 14 is fixedly supported at its ends by bearings in the roll of the usual kind, not shown. One end of the suction box is extended outside the confines of the roll and is provided with an end wall 16. The other end of the box has an end wall 18 closing it. Suitable bearings, supports and driving arrangements are provided for the roll so that the box is held against the inner circumference of the roll while the roll rotates about it. The customary vacuum or suction connections are provided through the usual outlet 19 for liquid and air leaving the box. These details are not explained further here because they are of a conventional nature and not directly concerned with the present invention.

At one side of the box, extending along its length and for substantially the length of the roll, a suction slot or opening 20 is provided, and at the edges of this slot flexible packing or sealing strips 22 are mounted, these being urged and held against the shell by springs 24 as shown, or by other conventional pressure producing means. End packings 26, spanning the width of the slot, are used at the ends of the suction box to provide the desired vacuum seal at those points. In the manner of operation of such suction rolls, moisture in a paper web passing over the suction roll outside of the location of the slot 20 in the suction box will be removed through the perforated roll by suction and drawn into the box. The packing strips define the edges of the area to which suction is applied. Liquid and air will be removed from the box in the usual fashion through outlet 19. In the drawings, the letter "W" indicates a web of paper passing over the roll, or a wire or felt carrying a sheet of paper from which moisture is being removed.

For most efficient operation the packing or sealing strips 22 not only must be uniformly pressed against the inner circumference of the suction roll shell 10 but be capable of sliding with relation thereto as the roll rotates. Therefore, packing strip lubricating water must be applied evenly against the entire length of the inside of the shell in order to assure the desired slippage while maintaining the necessary seal. Otherwise the packing would soon become worn, the seal would not be maintained, and adjustment or replacement of the packing strips would have to be made frequently. According to this invention, lubricating water is supplied from a suitable source under suitable pressure to an inlet pipe 30 leading to one side of a single duplex feed pipe 32, feeding water in the manner and for the purposes described hereafter. The duplex feed pipe is provided with a central partition 34 throughout most of its length, the space 36 on one side of the partition serving as an inlet passageway for water and the space 37 on the other side of the partition serving as a drain passageway according to this invention. A single fitting 38 at the end of duplex pipe 32 serves to connect the inlet pipe 30 to the inlet passageway and at the same time connects a drain pipe 40 to the drain passageway. Although shown in a different position for clarity in illustration, as a practical matter the drain pipe 40 is preferably mounted to slope downwardly so that water can drain easily out of this section of the system.

In the drain pipe 40, a manually or automatically controlled drain valve 42 is provided for purposes which will later appear. In FIG. 1 this valve is shown in closed position. In the diagrammatic showings of FIGS. 4 and 5 this valve is also indicated in the operative position it will occupy during different conditions of use, i.e., closed in FIG. 4 and open in FIG. 5.

The duplex feed pipe 32 enters through the outside end wall 16 of the suction box at an appropriate vacuum tight joint 44 so that the desired differential of pressure between the outside of the suction box and the inside of the suction box is not destroyed at that point. Inside of the box, the pipe 32 extends a distance sufficient only to provide connection of an inlet branch pipe 46 extending from the inlet passageway 36 and a drain branch pipe 47 extending from the drain passageway 37 of the duplex feed pipe. Between the points of connection of the inlet branch 46 and the drain branch 47 the inlet passageway 36 is terminated as by bending or otherwise forming the end of the partition 34 at right angles as at 48, and sealed against the inside of one-half of the pipe 32. By holes of suitable size in partition 34 or in end 48 or by not quite sealing this right angle partition 48, a small space is left intentionally which will allow a small amount of leakage or seepage of water between the drain passageway and the inlet passageway at that point for a pressure-equalizing purpose that will later appear.

By suitable fittings and connections both the inlet branch and drain branch pipes 46 and 47 are passed through the wall of the suction box 14 in sealed relation therewith and are connected to respective interior sections of a single duplex spray nozzle manifold pipe 50, supported from the box as by brackets, clamps, or other known structures, not shown. This elongated manifold is on the outside of the suction box and extends opposite substantially the entire length of the suction roll shell. The spray nozzle manifold 50 is, like the feed pipe 32, provided with a central partition 52 extending for substantially its entire length, provided with a right angle partition 54 similar to the partition 48 in pipe 32. Instead of providing the pressure-equalizing leakage openings between the inlet and drain sides of the system in the feed pipe 32, as above described, this may be done in the manifold 50, by holes through partition 52 or through or around end 54.

At intervals along the spray manifold pipe 50, spray control nozzles 60 are mounted. These nozzles are preferably of the character covered by United States Patent No. 3,073,529, "Spray Nozzle," issued January 15, 1963 to Donald B. Baker. The improved form here shown includes a generally cylindrical body 62 having a removable outlet plug 64 at one end. This provides an elongated valve chamber 66 which has a drain port 68 communicating with the nozzle drain manifold 57 and a main spray outlet 70 in the plug 64. This outlet permits a jet of liquid to pass through it and impinge against the inclined surface of a spray deflector 72 on the plug. An annular valve seat 76 is provided in the plug at this end of the valve chamber. An annular valve seat 80 is also provided at the inner end of drain port 68. Confined within the valve chamber and free to move from one end to the other therein is a valve or flow control member 82, which is arranged to seat against either the valve seat 76 or 80 as the case may be, in order to block the main outlet 70 partially or to close the port 68 entirely. When the valve member is seated against 76 it only partly closes the outlet 70 because the valve member is provided with an interior bore 74 opening at that end and overlapping the outlet 70 in part. The interior bore 74 has a sidewise extension 75 opening into the valve chamber 66 at all times. There is also provided a side port 84 in the wall of the valve chamber 66, this port communicating with the nozzle inlet manifold section 56 and serving as the principal inlet to the nozzle as will later appear.

According to the relative pressures in inlet section 56 and in drain section 57, the valve member 82 will be shifted in one direction or another, but at least a portion of the opening 70 will remain clear at all times for the passage of water. For purposes of clarity in understanding the valve action in the nozzles, FIGS. 4 and 5 show the nozzle body and some cooperating parts in artificial position and sizes with respect to other parts of the apparatus. For example, in use, the nozzle spray heads usually will be turned to discharge a fan-like spray downwardly at an angle and away from the duplex manifold 50 as shown in FIG. 3, and not in the upstanding horizontal discharge position lengthwise of the manifold as shown in FIGS.

4 and 5. Furthermore, the drain valve **42** is shown in an artificially small scale and connected directly to the drain manifold **57** in FIGS. 4 and 5, whereas in actual practice this valve is of much larger size with respect to manifold **50** and connected in drain pipe **40** leading from drain passageway **37** of the duplex pipe **32** and is thus connected indirectly to the nozzle drain manifold section **57** as indicated in FIG. 1 of the drawing. With this understanding, the spray nozzles each operate in the following fashion:

As water under suitable pressure is introduced through the inlet pipe **30**, it passes through inlet passageway **36** of the duplex feed pipe **32**, is directed through inlet branch **46** and into nozzle inlet manifold section **56**. There will be some leakage into drain section **57** or **37** by the leakage openings described above so that, with the drain valve **42** closed, pressure will be substantially equalized in the system between the inlet and outlet sides, that is to say, between the manifold sections **56** and **57** on either side of the partition **52**. Therefore hydraulic pressure will force the valve member **82** to occupy the position shown in FIG. 4 and water will enter through the side port **84** into the valve chamber **66** where it can enter the port **68** into manifold **57**, locally further equalizing the pressure between the sides of the system. At the same time, water will flow through the interior bore **74** of the valve member and, in spite of the seating of the member **82** in the valve seat **76**, water will pass outwardly through the main outlet and be deflected by the inclined surface of **72** into a fan-like spray directed against the inner circumference of the suction roll **10**. As long as the drain valve **42** is maintained in closed position and water under pressure is supplied to the manifold section **56**, the nozzle control member **82** will continue to occupy this position and the valve outlet **70** will remain in partially blocked or restricted condition to regulate flow at a desired low rate for lubrication.

When it is desired to introduce a larger quantity of water as for washing, the drain valve **42** is opened and the resulting drop in pressure in manifold section **57**, combined with the flow velocity of water then passing through the port **68**, will move the nozzle valve member **82** to the position shown in FIG. 5, where valve seat **80** is closed by the valve member and main outlet **70** of the nozzle will be fully opened to water entering the valve chamber **66** through the port **84**. Shifting of the control member and complete opening of the outlet **70** will flush the nozzle clear of debris which may have become deposited therein during lubricating flow. The quantity of water then being supplied by the nozzles to the interior of the suction roll will be increased accordingly and if desired, the rate of flow or pressure of water coming into the system may be increased still further for the washing operation. The leakage provided from the inlet to the drain side of the system will not build up enough counter-pressure to shift valve members **82** back again as long as the drain valve **42** remains open. The size of the leakage openings between inlet and drain sides in so restricted that they are incapable of supplying enough flow for equalization of pressure while the drain valve is open. However, when the washing operation is completed, the nozzles may be restored to their original limited-output lubrication-spraying condition simply by closure of the valve **42**. The leakage provided between the inlet and drain sections of the system will soon build up substantially equal pressure in the manifold section **56** and **57**, and this, combined with the flow through the main outlet **70** which is continuing at all times, will lift the valve member **82** from the annular seat **80** and move the member back again until it seats at **76**, partially blocking outlet **70** for restricted spray flow while opening port **68**.

The valve **42** may be actuated manually or automatically, at timed intervals or whenever occasion requires. Manual or automatic control of liquid entering the inlet pipe **30** also may be established in any desired fashion.

The position and angle of mounting the manifold **50** with its nozzles is preferably such that the fan-like spray from each nozzle strikes the interior of the roll at a low angle on a line located about 180° from the suction box slot, as seen in FIG. 3. Therefore the roll may rotate in either direction and substantially the same lubrication will be obtained. Spacing between nozzles is preferably such that the edges of adjoining fans of spray will intersect or overlap to insure complete wetting of the entire suction length of the roll for either lubrication or washing.

The suction box can be located with its suction slot at any angle and the shower pipe will function properly.

By directing the spray against the roll at a low angle and rotating the roll counterclockwise as shown in FIG. 3, a scouring or scrubbing effect will at first be provided when the increased volume of water is discharged in the roll for washing. Of course, if the washing water is not rapidly drawn off, the quantity of water collected in the roll will increase and this scrubbing effect will be lost. However, by that time the spray jets will agitate the washing water collected in the roll to keep solids from settling in the water in the roll. Excess lubricating or washing water is removed in any convenient manner after passing through the perforated roll.

FIGS. 6 and 7 show an improved and preferred manner of connecting the duplex pipes **32** and **50** and supporting and sealing the connection where it passes through the wall of the suction box **14**. This modified construction eliminates the two separate connection branch pipes **46** and **47** of FIG. 1, and overcomes difficulties of accurate spacing and alignment of a pair of holes and corresponding parts fitting within them. The modified construction uses a single pipe connection or fitting **146** with a central partition **147**, and consists of two identical castings or parts **148**, one being machined for a male fit into the other, machined for a female fit. The ends of this fitting may be held together as by a bolt **149**, threaded from the outside of one piece into a screw socket in the partition **147** of the other piece.

The assembled fitting is secured to the wall of the suction box **14** through an appropriate hole by means of an annular shoulder **150** on the outer one of the castings, engaged in a counterbore surrounding the hole, and a check nut **152** threaded on the fitting inside the suction box and engaging against the wall on that side around the hole.

In this form of connection the ends of pipes **32** and **50** extend through and are sealed within opposite ends of the fitting **146**. In spray pipe **50**, the central partition **52** terminates in the right angle partition **54** as in the other form, but this will be located in a plane coincident with the plane of central partition **147** in the fitting. A side hole **156** opens from inlet manifold section **56** into the fitting on one side of partition **147**. Another side hole **157** opens beyond the end partition **54** from drain section **57** in pipe **50** into the fitting on the other side of partition **147**.

The other end of the fitting is provided with similar formations so that side holes **136** and **137** in pipe **32** lead from inlet passageway **36** and drain passageway **37** respectively on either side of central partition **34** and its right-angled end **48**, completing the flow connections on opposite sides of partition **147**.

Suitable sealing is made between the outside of pipes **32** and **50** and the ends of partition **147** within the fitting. Thus, the separate flow and drain passages are maintained through a single connection requiring but a single hole for mounting and sealing through the suction box wall.

It will thus be seen that, by combining the lubrication and washing systems in a single pipe with special nozzles according to this invention, a substantial reduction in space and weight required for this equipment is made, there is less restriction to the free flow of air and water, the nozzles clean themselves whenever a change in flow is made, the controls are simplified and the interior of the suction roll is provided with an even distribution of lubri-

cating water which permits continuous use of the suction roll over comparatively long periods of time. Efficiency of suction rolls using the present invention is thereby increased, there is less "down" time for adjustment or replacement of worn sealing strips, and washing can be done whenever desirable or necessary with the added advantage of flushing the nozzles.

As will be evident from the foregoing description, certain aspects of this invention are not limited to the particular details set forth as an example and it is contemplated that various and other modifications and applications of the invention will occur to those skilled in the art. It is therefore intended that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of the invention.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. In a suction device for paper making machines comprising a rotatable hollow roll having perforations in its periphery, a suction box in said roll having a slot therein next to said roll and sealing means for said slot slidably engaging the inside of said roll as it rotates;

that improvement for supplying lubricating water for said sealing means at one rate of flow and for supplying washing water for the inside of said roll at a greater rate of flow, comprising,

pipe means supported inside said roll,

a source of water under pressure connected to said pipe from outside said roll,

a series of nozzles carried by said pipe positioned to spray water therefrom against the inside of said roll, and

control means associated with said nozzles and operable between a first position to provide restricted nozzle openings for spraying of water from said nozzles at said one rate of flow for supplying lubricating water and a second position to provide enlarged nozzle openings for spraying of water from said nozzles at said greater rate of flow for supplying washing water.

2. The improvement according to claim 1 in which said control means comprises a control member in each nozzle movable between said first and second positions in response to changes in water pressure and flow in the nozzle.

3. The improvement according to claim 2 in which said pipe means comprises a two chamber manifold, connected to said source of water, said nozzles are provided with two spaced ports opening into said manifolds respectively, and said control means comprises a drain connected to one of said manifold chambers and valve means operable from outside said roll for periodically opening said drain.

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