March 23, 1954 E. M. FLINT 2,672,844

APPARATUS FOR TREATING FLEXIBLE WEBS

Filed June 21, 1951 3 Sheets-Sheet 1

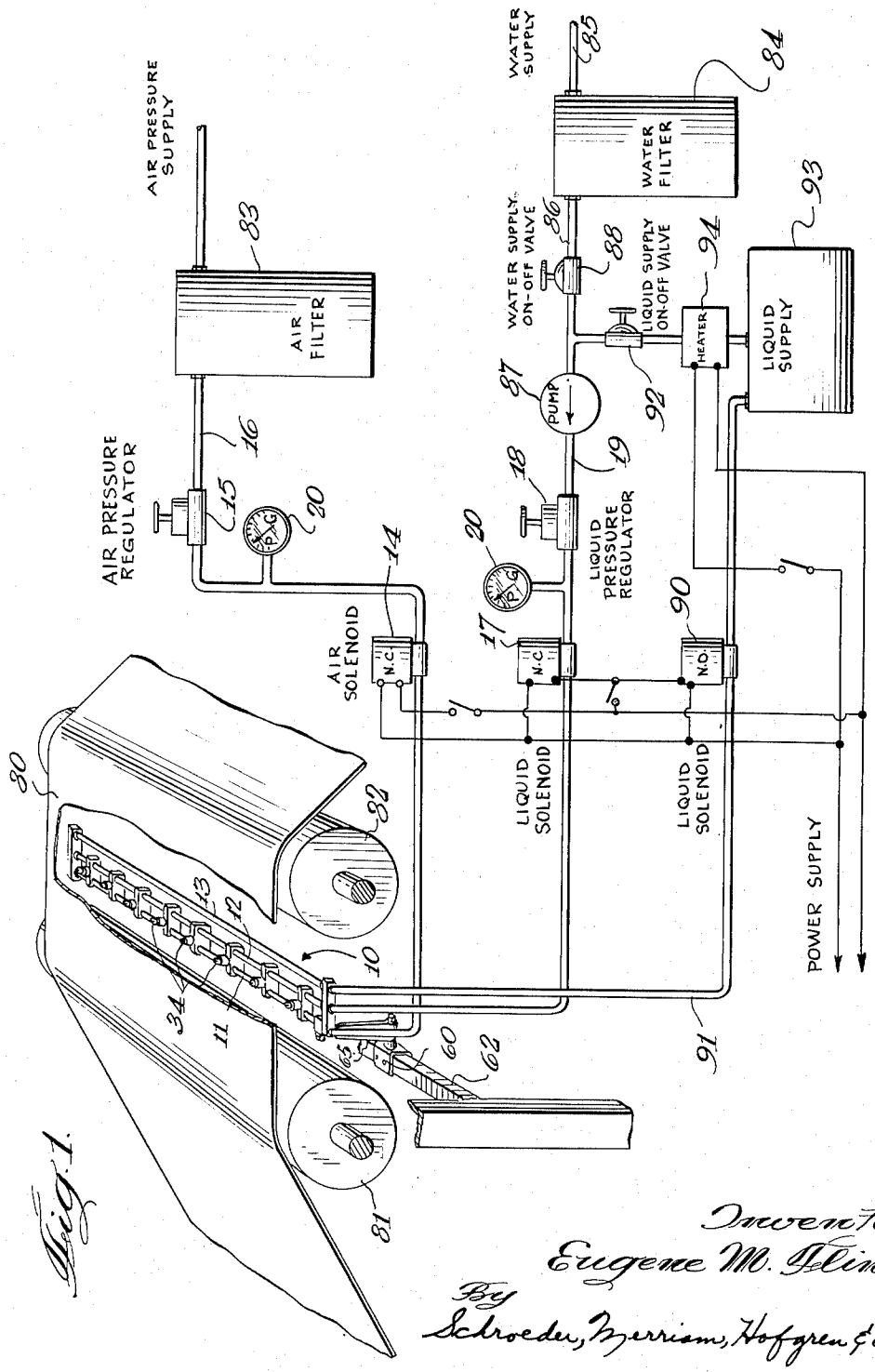


Fig. 1.

Inventor
Eugene M. Flint
By
Schroeder, Berriman, Hofgren & Brady
Attorneys

March 23, 1954 E. M. FLINT 2,672,844

APPARATUS FOR TREATING FLEXIBLE WEBS

Filed June 21, 1951 3 Sheets-Sheet 2

Fig. 3.

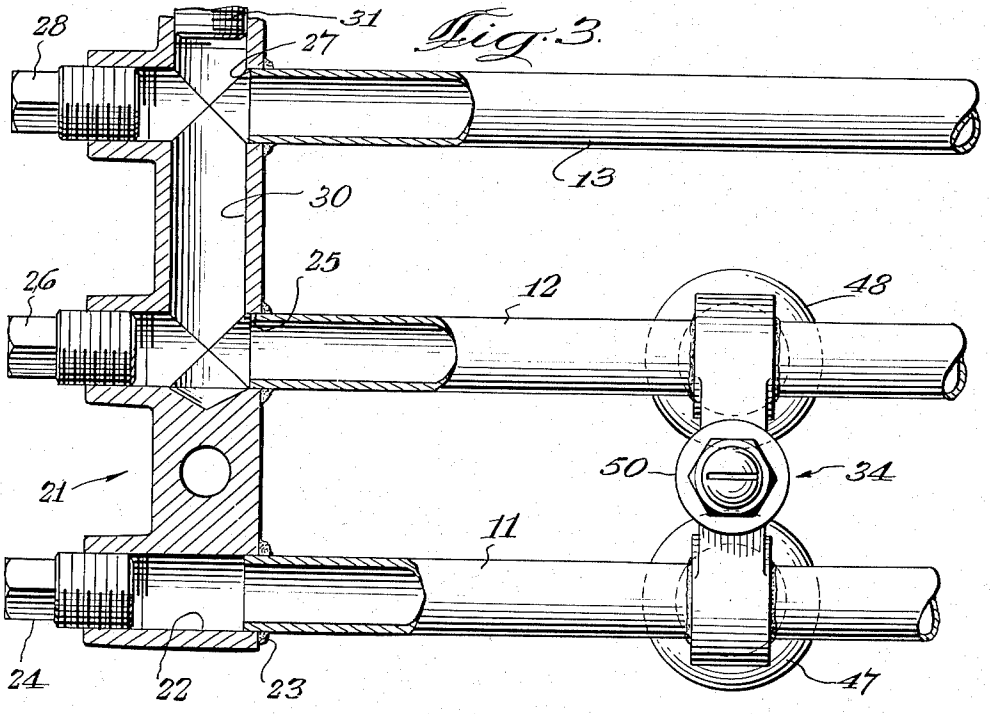
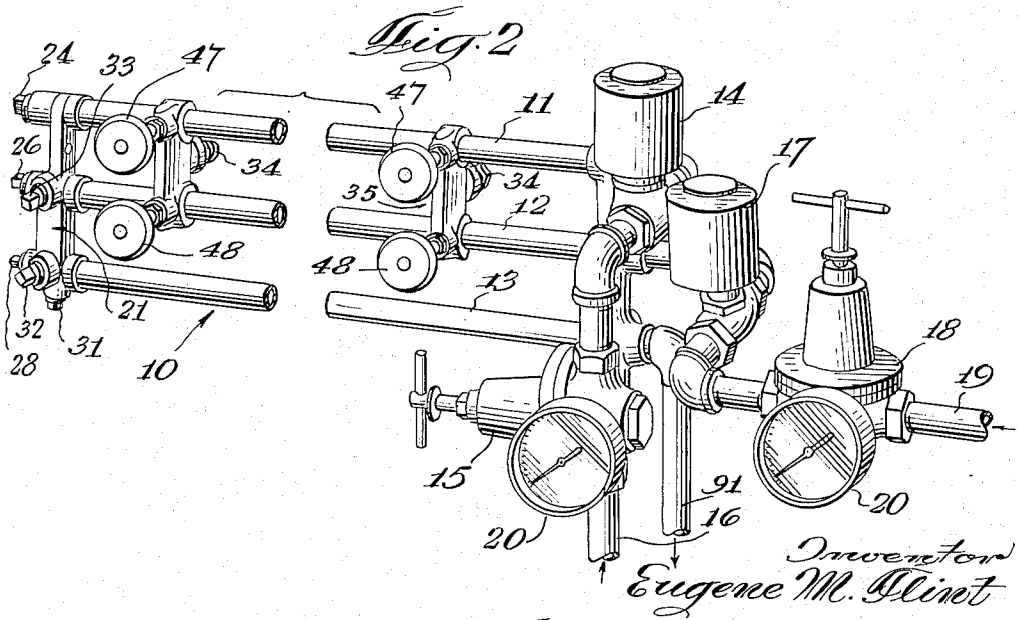


Fig. 2



Inventor
Eugene M. Flint

By
Schroeder, Merriam, Hofgren & Brady
Attorneys

March 23, 1954 E. M. FLINT 2,672,844

APPARATUS FOR TREATING FLEXIBLE WEBS

Filed June 21, 1951 3 Sheets-Sheet 3

Fig. 4.

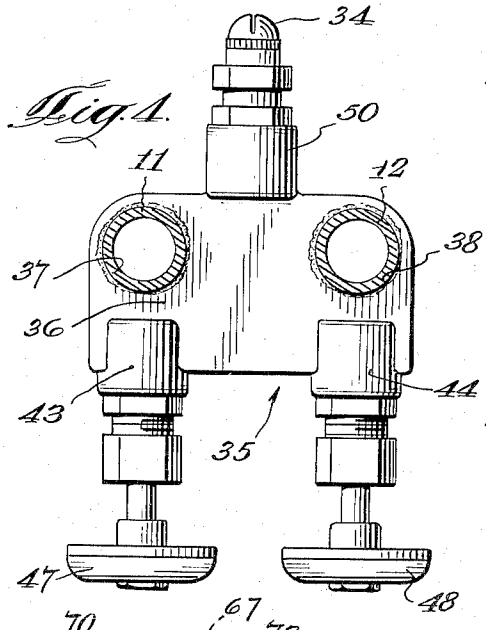
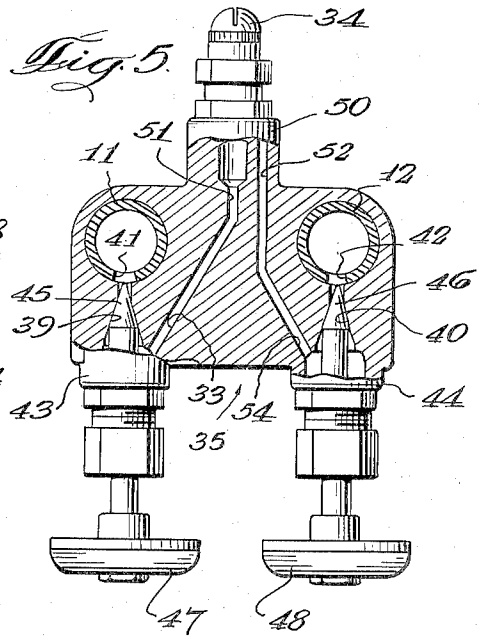


Fig. 5.



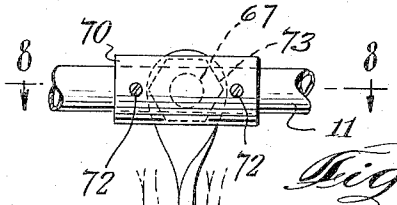


Fig. 7.

Fig. 6.

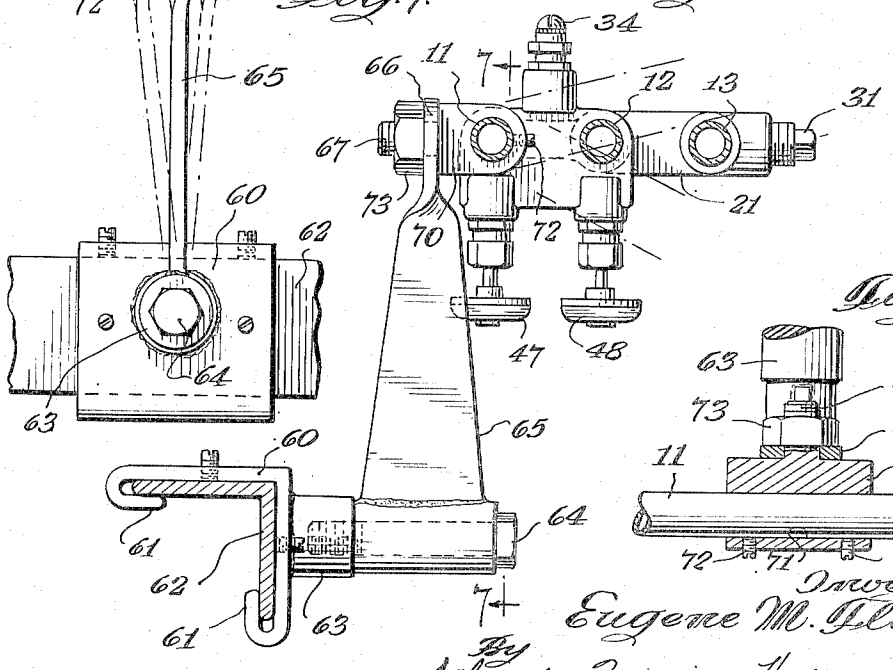


Fig. 8.

Inventor
Eugene M. Flint

By Schroeder, Merriam, Hoffman & Brady
Attorneys

Patented Mar. 23, 1954

2,672,844

UNITED STATES PATENT OFFICE

2,672,844

APPARATUS FOR TREATING FLEXIBLE WEBS

Eugene M. Flint, Maywood, Ill., assignor to Vapo Systems Company, a corporation of Illinois

Application June 21, 1951, Serial No. 232,721

4 Claims. (Cl. 118—315)

1

This invention relates to a conditioning means and more particularly to an apparatus for applying a conditioning liquid to a moving web.

It is the general object of this invention to produce a new and improved web conditioning apparatus.

One of the features of this invention is the provision, in a web conditioning apparatus, of a plurality of parallel pipes, one to supply compressed air and another to supply conditioning liquid to a plurality of atomizing nozzles adapted to apply the liquid in spray form to a moving web of paper or the like.

Another feature of the invention is the provision, in a web conditioning apparatus of the type described above, of a third pipe parallel to the first two and connected to the liquid supply pipe to act as a return line to provide a recirculation system whereby the liquid may be maintained at predetermined temperatures or concentrations.

An additional feature of the invention is the provision, in a web conditioning apparatus, of three parallel pipes mounted to extend transversely to the direction of movement of the web, with one of the pipes being adapted to supply liquid and another compressed air to a plurality of spray nozzles spaced along the pipe, and which includes a third pipe connected to the first two by means of a bracket, with the third pipe being adapted to act as a return line and being connected to the liquid supply pipe through the medium of a passage formed in the bracket.

A further feature of the invention is the provision of a novel unitary valve means for drawing off liquid and air from liquid and air supply pipes and supplying them to an atomizing nozzle, the valve means including metering valves operable to regulate and adjust the relative supply of air and liquid to the atomizing nozzle.

Another feature of the invention is the provision of mounting means for the supply and air pipe unit which is so constructed and arranged as to be easily secured to a support, such as an angle iron, and which, while serving firmly to hold the pipe unit in position relative to the web, is adjustable to shift the pipe unit transversely of the web accurately to position the same.

Other and further features of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a schematic diagram of a complete system for supplying a conditioning liquid to a moving web;

Fig. 2 is a side elevation of the pipe unit of this invention showing the means for supplying air and liquid to a number of atomizing nozzles;

2

Fig. 3 is an enlarged view, partially in section, of the left-hand portion of Fig. 2 and rotated approximately 180° about a horizontal axis;

Fig. 4 is a side elevation of the valve means of this invention and showing the attachment of the atomizing nozzle thereto;

Fig. 5 is a view like Fig. 4, partially in section, to illustrate the interior construction of the valve unit;

Fig. 6 is a side elevation of the supporting means for the pipe unit;

Fig. 7 is a vertical view taken along line 7—7 of Fig. 6; and

Fig. 8 is a horizontal section taken along line 8—8 of Fig. 7.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

This invention, while readily adapted to supply a conditioning fluid to flexible webs of any nature, is particularly useful for supplying conditioning liquid, such as water, to webs of paper. Dryness in a sheet of paper causes it to become brittle and is the cause of numerous breaks on printing presses, coating machines and the like, and thus it is often advisable to supply moisture to a paper web prior to the printing or coating operation in order to insure that the paper possesses the requisite strength to pass through the apparatus. In addition, it is often desired to supply a conditioning liquid, consisting not solely of water, to a web in order to improve certain desired characteristics to the web. For example, it may be desired to apply a sizing fluid to a web of paper or textile, or to apply a coloring matter or surface treating solutions of various sorts to the moving web.

Referring now to Figures 2 and 3 of the drawings, the pipe unit 10 includes an air supply pipe 11, a liquid supply pipe 12 and may include a third pipe 13. The pipes 11—13 extend parallel to each other and are adapted to be positioned transversely of the moving web which is to be treated. Air under pressure is supplied to the air pipe 11 through a normally closed solenoid controlled shutoff valve 14, a pressure regulating valve 15 and a supply line 16. Liquid is supplied to the liquid pipe 12 through a solenoid controlled valve 17, a pressure regulating valve 18 and a

supply line 19. Suitable gauges 20 may be provided in each of the lines to indicate the pressure of the fluid supplied therein. The pipes are maintained in parallel spaced relationship by a number of brackets connected thereto including an end bracket 21 which serves not only to maintain the pipes in their proper relative relationship, but also serves to afford communication between the liquid pipe 12 and the return pipe 13. As best seen in Fig. 3, the bracket 21 is provided with an opening 22 into which the air pipe 11 extends, a seal being maintained between the pipe and bracket by the soldered connection 23 as illustrated. The opening 22 extends completely through the bracket, its outer end being closed by a plug 24. The bracket is provided with a second opening 25 whose outer end is closed by a second plug 26 and into which the liquid line 12 extends. A third opening 27 is also provided in the bracket 21 into which the return line 13 extends and a third plug 28 is threaded into the outer end of the opening to seal off the interior of the bracket. Extending through the bracket and serving to connect together the pipes 12 and 13 is a passage 30. The passage 30, like the other openings in the bracket, extends to the exterior thereof, the outer end being closed by a fourth plug 31.

The return line 13 is designed to be used when the conditioning liquid to be applied to the web must be maintained under certain operating conditions. Thus, for example, if the liquid must be maintained within a specific temperature range or at a certain concentration, the valve means, hereinafter to be described, which controls the line 13, is opened to permit a portion of the liquid introduced into the pipe 12 to be returned to the source. By this means a rather rapid circulation of conditioning liquid through the pipes 12 and 13 may be achieved. If temperature or concentration of the liquid is of no consequence, the valve means may be used to shut off the return line 13 and hence no flow through that line or through the passage 30 occurs. If it is contemplated that recirculation of the conditioning fluid will never be necessary in any particular installation, the return line 13 may be omitted in its entirety.

The plugs 24, 26 and 28 are provided not only to facilitate the cleaning of the pipes and passages but also to adopt the unit for "right-hand" or "left-hand" installations. Thus, the air line may be connected to the pipe 11 by removing the plug 25 and connecting it to that end of the pipe rather than to the other end as illustrated in Fig. 2 should the location of the apparatus to which the unit is attached be such as to require it. The return line and the liquid line may be similarly reversed. Again to facilitate connection of the various supply lines to the pipe unit additional plugs 32 and 33 are provided in the bracket member 21 in order that the connection may come from either the side, top, or the bottom of the liquid and return pipes.

Air in the air pipe 11 and liquid in the liquid pipe 12 are supplied to a plurality of atomizing nozzles 34 spaced at regular intervals along the pipes through the medium of mixing and metering valve means 35, each associated with a single atomizing nozzle. As best shown in Figs. 4 and 5, the valve means 35 includes a thin flat substantially rectangular integral casing 36 provided with a pair of aligned openings 37 and 38 through which the pipes 11 and 12, respectively, extend, the openings being such as to engage the exterior surfaces of the pipes in fluid-tight relationship. The casing 36 is preferably formed of a solid piece of brass in which there has been drilled a pair of substantially parallel passages 39 and 40, the passages being connected at one end with openings 41 and 42 formed in the pipes 11 and 12. Bosses 43 and 44 formed on the casing support a metering valve means which includes needle valves 45 and 46 which extend respectively into the passages 39 and 40 and are movable therein by operating the handles 47 and 48. On the opposite side of the casing there is provided another boss 50 which is adapted to support the atomizing nozzle 34. Connected to the nozzle 34 are a second pair of parallel passages 51 and 52 which extend through the casing in the direction of the opposite edge. Connection between the passages 39 and 40 and the passages 51 and 52 is afforded by means of angularly arranged drilled passages 53 and 54 as shown.

Preferably, in forming the various passages just described, a suitable jig may be constructed so that all of the passages may be drilled in the casing in a manner to insure their meeting at the proper positions. Thus the bulk of the entire valve structure 35 may be reduced considerably while maintaining complete metering control over the supply of air and liquid. It is, of course, understood that the liquid in the passage 51 is conducted into a rotation chamber provided in the atomizing nozzle and expelled therefrom by air in the passage 52 in the usual manner to provide a thin fan-like spray from the nozzle. The pressure of air and liquid and the relative amounts of each metered to the nozzle are such as to provide a spray which is almost steam-like in character, that is a spray in which the droplet size is extremely small.

To achieve the proper spray, the air pressure and its flow in cubic feet per minute must be correlated with the liquid pressure and its flow in gallons per hour. Thus, for example, if the liquid pressure is 30 p. s. i. and it is desired to pass approximately 2 gallons per hour through each spray nozzle, the air pressure should be at approximately 42 lbs. p. s. i. and its flow should be 1¾ cubic feet per minute. Various other pressures and flow rates may be used depending upon the conditions under which the device is operated.

In order to provide an apparatus which will require the minimum of maintenance during its lifetime, I prefer to construct all piping of brass and all valve parts of brass. The spray nozzles may be either of brass or stainless steel as desired. In the entire pipe unit the only non-brass members are the handles for the spray nozzle valves, which latter items may be of steel or any other suitable construction.

The pipe unit, which includes the air and liquid pipes together with the plurality of spray nozzles spaced along the pipes, may be installed to extend transversely of the web either above the web or below, or, should at the particular point of installation the web be travelling other than horizontally, the unit may be installed on either side of the web.

In initially installing the unit it may be necessary to shift the same transversely of the web slightly or to raise and lower it. Again, after the unit has been installed should, for any reason, the width of the web be changed, it again may be desired to shift the unit laterally, that is transversely of the web, in order to effect complete coverage. To provide for such adjustment

of the pipe unit, the bracket means illustrated in Figs. 6–8 may be employed. The bracket includes an L-shaped fitting 60 provided along each edge with lips 61 adapted to overlap the edges of an angle iron 62 firmly fixed in a position extending transversely of the web to be treated. The fitting 60 is provided with a circular boss 62 provided with internal threads to receive a bolt 64 which rotatably carries a supporting arm 65. It will be noted that the axis of rotation of the arm 65 about the bolt 64 is at right angles to the pipes 11—13 and, as will hereinafter be noted, substantially parallel to the direction of movement of a horizontally travelling web.

The supporting arm 65 is shown in the form of a substantially flat web which is twisted approximately 90° at its upper end to provide a flat surface 66 having a central opening therein through which a bolt member 67 extends. The bolt 67 is fixed in a block 70 having an opening 71 extending therethrough which embraces the pipe 11 and is held in fixed relationship to the pipe by means of the set screws 72. Thus the upper end 66 of the supporting arm 65 may, by loosening the nut 73, be rotated relative thereto to shift the pipe unit transversely of the web. Thus in effect the arm 65, one of which is provided at each end of the pipe unit, forms with the pipe unit and circular bosses 62, a parallelogram arrangement, which permits lateral adjustment of the pipe unit.

This adjustment is valuable even after the pipe unit has been installed. Thus, for example, should a narrower web be undergoing conditioning, one of the spray nozzles may be shut off by closing the valve means associated therewith and the entire unit shifted laterally to provide complete coverage of the web by the remaining spray nozzles. Normally this lateral shift will not be of distance greater than one-half the distance between adjacent spray nozzles.

A complete system for utilizing the conditioning apparatus of which invention is shown in Fig. 1 in which a web of paper 80 is led over the pipe unit 10 by means of a pair of rotating rolls 81 and 82. The rolls 81 and 82 may be part of the paper making machine, a paper coating machine, a printing press or the like and it is usually not necessary to rearrange any of the rolls of any such machines in order to incorporate the conditioning unit of this invention. Compressed air from a source is directed into an air filter 83 and thence into the air supply line 16 to the air pipe 11, previously described. In the liquid supply system there is provided a water filter 84 connected by means of a first pipe 85 to a source of water and by means of a second pipe 86 to a pump 87 for moving the water under pressure. The line 85 is controlled by a shutoff valve 88. If water only is being supplied to condition the web, the solenoid 90 which controls the return line 91 connected to the return pipe 13 is left open to shut off the return line. Similarly another shutoff valve 92, which connects to a supply tank 93, is also closed and water is directed only from the source through the filter through the pipe 86 to liquid supply line 19. If a conditioning fluid including ingredients in addition to water is to be used, such as size and the like, it may be desirable to maintain either the temperature or the concentration or both of such solution within a desired range. When such a condition prevails the solenoid 90 is energized to open the return line 91 to the liquid supply tank 93 which contains the supply of sizing or other conditioning material and the valve 88 is closed while the valve 92 is open to provide circulation between the tank 93, the pump 87 and the supply line 19.

When so operated, it is contemplated that an excess of liquid will be pumped to the pipe unit, the excess being returned by the return line to the liquid supply tank to be remixed with the conditioning fluid therein. To maintain the conditioning fluid at the proper temperature a heater 94 may be installed between the supply tank and the pump. Suitable electrical circuits are provided for supplying heat to the water and for operating the various solenoids as shown.

I claim:

1. A system for supplying a conditioning liquid to a moving web comprising an air pipe, a liquid pipe and a return pipe, bracket means supporting the pipes in spaced parallel relationship including a bracket at one end of the pipes having a pair of spaced openings therein in the first of which said liquid pipe is supported and in the second of which said return pipe is supported and said bracket having a liquid passage therein communicating with said openings thereby connecting the liquid pipe to the return pipe, a plurality of atomizing nozzles supported in spaced relationship on the air and liquid pipes, a pair of valves for each nozzle, one valve means being connected to the air pipe and the other being connected to the liquid pipe to meter air and liquid to the nozzle associated therewith, means for adjustably supporting the pipes closely adjacent to the web for movement transversely of the direction of movement of the web, means associated with said supporting means for fixing said pipes in adjusted position a source of air under pressure, means connecting the source to the air pipe, a source of conditioning liquid, means connected to the last mentioned source for supplying conditioning liquid to the liquid pipe, means for regulating the pressure of air and liquid delivered to the air and supply pipes, and means connecting the return pipe to the source.

2. Apparatus of the character described in claim 1 in which said adjustable supporting means includes a fixed support, a pair of supporting members, mounting means on the support mounting said members for pivotal movement about an axis parallel to the direction of movement of the web with the supporting members being connected to one of the pipes at opposite ends thereof for pivotal movement about an axis parallel to the direction of movement of the web whereby the pipes may be adjustably positioned transversely of the web.

3. In a system for supplying a conditioning liquid in spray form to a moving web including a first pipe connected to a source of air under pressure and a second pipe connected to a source of conditioning liquid under pressure, means for metering air and liquid to an atomizing nozzle comprising a flat, thin generally rectangular one piece casing, means along one side of the casing for supporting the atomizing nozzle, a pair of aligned openings in the casing each adapted to be secured in fluid-tight relationship to a different one of the pipes, a first pair of drilled passages in the casing each connecting into a different one of the openings and adapted to coincide with an opening in each pipe at the location thereof, a metering valve in each passage, a second pair of drilled passages in the casing parallel to the first pair of passages and opening into a portion of the nozzle supporting means, and a third pair of drilled passages in the casing angu-

larly displaced relative to each other and to the other passages with each of the third passages connecting a different one of the first passages to a different one of the second passages.

4. In a system for supplying a conditioning liquid in spray form across the width of a moving web including a plurality of atomizing nozzles, a plurality of parallel pipes supporting the nozzle in spaced relationship with one of said pipes being connected to a source of air under pressure and another of the pipes being connected to a source of conditioning fluid for conducting air and liquid to said atomizing nozzles, means for adjustably supporting the pipes transversely of the direction of movement of the web comprising a pair of L-shaped fittings each adapted to be secured to an angle iron support extending transversely of the web, each of the fittings being provided with a supporting arm having one end secured to the fitting for pivotal movement about an axis at right angles to the pipes, a pair of brackets each

secured to opposite ends of one of the pipes, and means for securing the other end of each of the arms to a different one of the brackets for pivotal movement about an axis at right angles to the pipes, whereby the pipes may be moved transversely of the web correctly to position the atomizing nozzles relative thereto.

EUGENE M. FLINT.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,850,238	Maynard	Mar. 22, 1932
1,987,046	Bergner	Jan. 8, 1935
2,111,761	Eckert	Mar. 22, 1938
2,118,212	MacLaurin	May 24, 1938
2,146,809	Flint	Feb. 14, 1939
2,366,150	Yount	Dec. 26, 1944
2,439,157	Chavannes	Apr. 6, 1948
2,489,445	Benzuly	Nov. 29, 1949