APPARATUS FOR AND METHOD OF COLORING PAPER

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This invention relates to an apparatus for and method of coloring paper.

Various devices and processes have been proposed for coloring paper during the process of manufacture, particularly devices to be attached to a Fourdriner machine for this purpose, but these have been designed largely for the purpose of producing a solid, uniform color over the surface of the sheet or for producing printed or watermark effects.

I have now invented means whereby I can produce a decorated paper having colored lines running lengthwise and passing completely through it. These decorative lines differ from printed lines in that they do not have sharp and distinct edges but fade gradually into the natural color of the paper at each edge, producing a unique decorative effect.

It is therefore an object of my invention to provide a machine for producing paper having decorative lines thereon.

It is a further object of my invention to provide a process whereby such a paper may be produced.

It is a further object of my invention to provide a process for coloring paper by means of vacuum so formed.

Other and further objects of my invention will be evident from the following specification and the accompanying drawings.

On the drawings:

Figure 1 represents a side elevation of a portion of a Fourdriner machine with my invention attached.

Figure 2 illustrates an end elevation of the same machine illustrated in Figure 1.

Figure 3 represents a top plan view of a portion of the machine illustrated in Figures 1 and 2.

Figure 4 represents a cross section taken along the line IV—IV of Figure 2.

Figure 5 represents a section taken along the line V—V of Figure 2.

As shown on the drawings:

A frame of a Fourdriner machine shown at 6 supports the suction boxes 7 over which runs a Fourdriner wire 8. Rollers 9, 10, and 11 support the wire at their respective points along its line of travel. A suction couch roll 12, a section of which is shown in Figure 4, comprises an outer shell 13 which revolves about an inner stationary suction chamber 14, the interior of which is connected to any suitable vacuum pump through the open end 15. The vacuum so formed in the interior of the cylinder 14 causes air and water to be sucked through perforations 16 in the shell 13, as they pass over an operative portion 17 of the said suction chamber 14. Two series of nozzles 18 and 19 are positioned above said suction couch roll 13 so as to direct a color solution against the wet web of paper 20 while the web is subjected to the suction effect of said suction couch roll.

Nozzles 18 are supplied with colored liquid from tank 21 by means of a pump 22 which is operated by a motor 23 and connected to tank 20 by a pipe 24. The pump 21 forces the colored liquid through a pipe 23 and into a manifold 24 to which the nozzles 18 are connected by means of flexible hose 25. In a similar manner, colored liquid from tank 26 enters the pump 17, operated by a motor 28, through pipe 29. The color solution is then forced through pipe 30 into a manifold 34 from which it passes to the nozzles 19 by means of flexible connectors 31. The pressure placed on the liquid at the nozzles 19 may be regulated by the valve 32. Any liquid in excess of that which escapes through the nozzles 19 will pass through the flexible tube 33 and up through the rigid tube 34 finally flowing back into the tank 26. The pipe 34 is adjustable in the clamp 35 by means of a set screw 36. On releasing this set screw 36, the pipe 34 may be raised or lowered to effect any desired adjustment of the pressure on the liquid at the nozzles 19. A similar adjustment of the pressure at the nozzles 18 may be made by means of the valve 37 and the pipe 38. I prefer that nozzles 16 and 19 be placed very close to the surface of the paper pulp so that the streams of colored liquid therefrom will not be broken by air resistance before contacting with the paper pulp.

The series of nozzles 18 and 19 are supported by a bar 41 which is mounted at any point desired along slot 46 and held in place by the bolt 45. Slot 44 in bar 41 permits said bar to slide laterally of the Fourdriner machine. When desired, a suitable mechanism may be attached to bar 41 to give it an oscillatory movement. This will cause wavy color lines on the paper.

Bar 41 may be set at different points along the slot 46 to produce different types of lines on the paper. For example, if the bar is set so that the colored solution is sprayed upon the paper pulp before it is exposed to the suction of the couch roll 12, the color will run, making a wide and more or less irregular line, while if the bar is so placed that most of the water has been removed from the pulp a much narrower and more definite line will be produced. The bar 41 may be moved along the slot 46 until a point is
reached where the paper pulp is exposed to the right amount of suction before and after application of the colored solution so that the most desirable type of line will be secured. The exact point will be different for various operating conditions such as the amount of vacuum in the suction boxes 7 and the suction couch roll 12, the amount of water in the pulp and various other factors.

Figure 5 represents a section of the nozzles 18 and 19 which are especially designed to produce a solid stream rather than a spray. Each nozzle is provided with a long straight hole at the end, as at 47, which reduces the tendency of the stream to scatter or spray. A clamp 49 holds the flexible tubular connector 25 firmly in place on the large end of the nozzle 18. Nozzle 18 is loosely held in the bar 47 so that it may be easily removed for cleaning without disconnecting the flexible tube 25.

In operation, some of the water is extracted from the web during its formation on the wire 8 by the suction boxes 7 and a considerable portion of its water content is removed before the coloring matter is applied by my device at the suction roll 12. In general, the wet web of paper after leaving the suction couch roll will have an air-charge water content of about 5%. One of the reasons for the distinctive features of the paper produced by my process is that the web is already comparatively free of surplus water at the time of application of the color solution. If the coloring solution were applied over the suction boxes 7 or before them, the water content of the pulp would be so great that the coloring solution would tend to run and blend with the wet pulp so that distinct lines would be impossible.

If the coloring solution were applied to dry paper it would hardly run at all and the resulting lines would have distinct edges and the effect would not be the same as the one obtained with my process. At the suction couch roll the amount of water in the pulp is insufficient to cause a running or flowing of the coloring solution through the pulp, but it is sufficient to prevent a distinct edge on the lines. The color on my finished sheet blends into the natural color of the paper so that there is no distinct edge. Further, the color does not have a chance to run when applied at the suction couch roll since the color solution is sucked through the paper web along with other excess liquid by the suction action. The degree of vacuum under which the suction couch roll is operated is from 10 to 20", which is a much higher vacuum than is possible at the flat suction boxes.

It will be understood that I contemplate the use of either one or several manifolds containing liquids of various colors used in combination with one or more movable bars holding the nozzles to produce various decorative effects.

Thus it will be seen that I have provided a process and an apparatus for making a novel type of decorated paper having either straight or wavy lines or bands running lengthwise thereof.

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

I claim as my invention:

1. In combination with a suction couch roll of a Fourdrinier machine, a manifold and a bar mounted parallel with and above said couch roll, a series of nozzles carried by said bar and adapted to project a solid stream of liquid, and flexible tubes connecting said nozzles with ports on said manifold to convey a coloring liquid to said nozzles for application to a web of paper passing over said suction roll, a manifold and a bar mounted parallel therewith, nozzles carried by said bars adapted to project a solid stream of liquid, flexible tubes connecting each said nozzle with ports on said manifolds, and means whereby colored solutions are supplied to each of said manifolds.

2. In combination with a suction couch roll of a Fourdrinier machine, manifolds and bars mounted parallel therewith, nozzles carried by said bars having a round, unobstructed opening adapted to project a solid stream of liquid, flexible tubes connecting each of said nozzles with ports on said manifolds, and means whereby colored solutions are supplied to each of said manifolds.

3. In combination with a suction couch roll of a Fourdrinier machine, manifolds and bars mounted parallel therewith, nozzles carried by said bars having a round, unobstructed opening adapted to project a solid stream of liquid, flexible tubes connecting each of said nozzles with ports on said manifolds, and means whereby colored solutions are supplied to each of said manifolds.

4. In combination with a suction couch roll of a Fourdrinier machine, a series of bars, nozzles carried by said bars adapted to project a solid stream of liquid, a series of manifolds, flexible connectors whereby each nozzle is connected to one port of the manifold and ports of the manifold are connected to one side of a moist paper web substantially free from excess water and simultaneously applying suction to the other side of said web to suck said liquid rapidly through said web without permitting a substantial lateral spreading of said coloring liquid.

5. In a Fourdrinier machine, a suction couch roll, nozzles positioned over that portion of the surface of said couch roll to which suction is applied, and in close proximity with said surface, and said nozzles being adapted to throw a substantially continuous stream of liquid onto the surface of a paper web passing over said couch roll.

6. In a Fourdrinier machine, a suction couch roll, nozzles positioned over that portion of said couch roll to which suction is applied, and in close proximity with said surface, and said nozzles being adapted to throw a substantially continuous stream of liquid onto the surface of a paper web passing over said couch roll.

7. In a Fourdrinier machine, a suction couch roll, nozzles positioned over that portion of said couch roll to which suction is applied, and in close proximity with said surface, and said nozzles being adapted to throw a substantially continuous stream of liquid onto the surface of a paper web passing over said couch roll.

8. A process for producing decorative effects on paper which comprises the steps of applying coloring liquid in fine, substantially continuous solid streams to one side of a moist paper web and simultaneously applying suction to the other side of said web to suck such liquid rapidly through said web without permitting a substantial lateral spreading of said coloring liquid.

9. In combination with a suction couch roll of a Fourdrinier machine, brackets attached to said machine at each end of said roll, a manifold, an oscillatable bar supported by said brackets, a series of nozzles carried by said bar and flexible tubes connecting said nozzles with ports of said bar.
manifold to convey a coloring fluid to said nozzles for application to a web of paper passing over said suction roll, said nozzles being adapted to project a solid, continuous stream of liquid.

10. In combination with a suction couch roll of a Fourdrinier machine, brackets attached to said machine at each end of said roll, manifolds and bars supported by said brackets, nozzles carried by said bars, flexible tubes connecting each of said nozzles with ports on said manifolds, said bars being slidable mounted on said brackets, said nozzles being adapted to project a substantially solid stream of liquid.

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