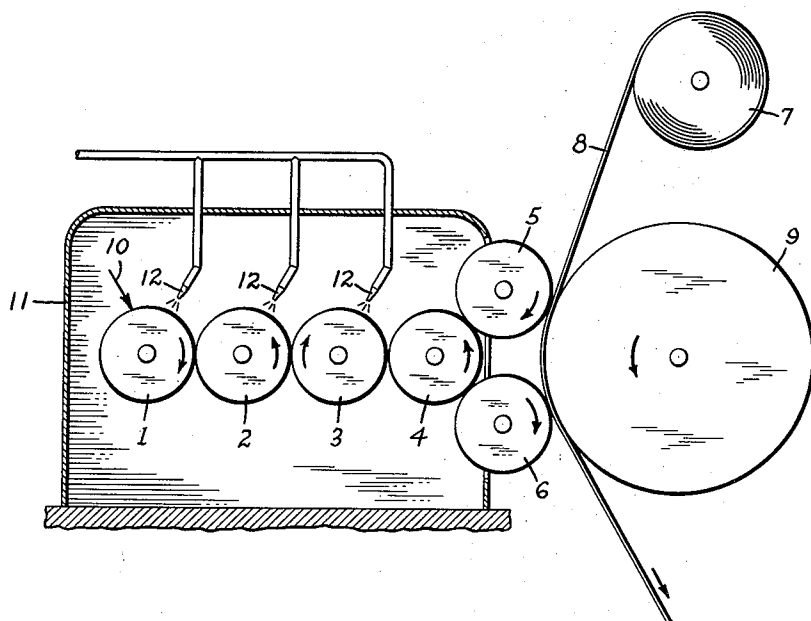


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METHOD OF COATING PAPER

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## UNITED STATES PATENT OFFICE

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## METHOD OF COATING PAPER

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The present invention relates to a method of coating paper with a suitable coating composition to produce thereon a coating surface that will require a minimum of drying subsequent to the application of the coating material and at the same time insure the application of a uniformly distributed coating. The method of this invention may be used to apply a coating to one side or to apply simultaneously or successively coatings to both sides of a web of paper.

Some efforts have already been made to control the moisture content of coating materials at the time they are applied to the web. It has been proposed, for example, to evaporate a certain amount of moisture from the coating material as it is passed from the fountain to the web over a series of distributing rollers so that when it is applied to the web it will have the desired consistency. Such methods require the expenditure of additional energy in the form of heat supplied to at least some of the distributing rollers and are furthermore difficult to control with the required degree of accuracy.

It has now been found that the viscosity or consistency of coating compositions when applied to the web can be controlled more easily and accurately by supplying the fountain with coating material having very nearly or precisely the viscosity with which it is desired to apply said material to the web and maintaining the vapor pressure of the atmosphere adjacent to or surrounding the coating material substantially equal to the vapor pressure of the coating material so that the initial viscosity of the coating material will be maintained substantially constant during the travel of said material from the fountain to the web.

It is well known in the art that coating material to be applied to a web of paper is transferred from a roller rotating in a fountain to the web by means of a series of distributing rollers, the principal purpose of which is to spread the coating material uniformly and smoothly so that when it is applied to the web a smooth and uniform coating will result. It is the usual practice to arrange each series of distributing rollers so that their surfaces are alternately of steel or other heat conductive material, and of a relatively resilient and relatively non-conductive material so as to insure good contact between all of the distributing rollers. The art has furthermore advanced to the point where at least some of the rollers, usually the steel rollers, are made to vibrate endwise as they rotate to further aid the uniform distribution of the coating ma-

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terial thereover. Such rollers have also been constructed with hollow shafts and siphon pipes permitting the introduction of steam into the interior of the rollers and the withdrawal of the condensate by means of the siphon pipes. Rollers of this type are well known and are available on the market.

One way in which the process of the present invention can be carried out is by cooling one or more of the conductive distributing rollers in the conventional paper coating machines to a temperature approximately equal to or slightly below the dew point temperature of the surrounding atmosphere. This is accomplished by introducing cool water into one or more conductive distributing rollers through rotary, watertight joints, such as the "Johnson Joint," withdrawing water from a point close to the interior surface of the rollers by means of the conventional siphon pipe attached to the outlet connections of such watertight joints, and regulating the temperature of the conductive surfaces of said rollers by regulating the rate of introduction of cool water.

The temperature at which the surfaces of the conductive distributing rollers are maintained in accordance with this embodiment of the present invention depends upon local atmospheric conditions and may be determined very easily by the use of a psychrometer or, if the relative humidity and sensible temperature of the air are already known, by consulting a psychrometric table.

Another way in which the process of the present invention can be carried out is by regulating the relative humidity, and thereby the vapor pressure, of the air with which the coating material comes into contact as it passes from the fountain to the web. This can be accomplished in any suitable manner, such as by housing the paper coating machine in an air conditioned enclosure or by simply introducing steam into the air surrounding the rollers.

It is, of course, also quite possible to carry out the process of this invention by combining a cooling of one or more of the conductive rollers with a regulation of the humidity conditions in the atmosphere surrounding the machine. This has the advantage, in instances where there would otherwise be a wide disparity between the vapor pressure of the coating material and that of the surrounding atmosphere, of overtaking neither the cooling capacity of the rollers nor the humidifying capacity of a source of steam or other air conditioning equipment.

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The method is illustrated in the accompanying drawing wherein reference numerals 1, 2, 3 and 4 represent a series of transfer rollers, numerals 5 and 6 designate a pair of form rollers, 7 refers to a supply roll of paper or other web material, 8 and 9 refer to a backup roller for the web 3. The coating composition may be applied by any suitable means, represented schematically by the arrow 10, to the distributor roller 1 and is transferred from one roller to the next for distribution thereover until it is applied to the web 8. One or more of the rollers 1, 2, 3 and 4 are cooled by well-known means and a hood 11 may, if desired, be provided to assist in maintaining a predetermined humidity in the atmosphere immediately surrounding rollers 1 to 4, the relative humidity of said atmosphere being controlled in part by one or more steam nozzles 12.

The advantages and utility of applying coating material to a web of paper or the like, while maintaining the vapor pressure of the coating material substantially about equal to the vapor pressure of the surrounding atmosphere, are obvious because it is unquestionably easier and more desirable to control the moisture content of the coating material in the fountain than it is to control the quantity of moisture evaporated from the coating material as it passes over a series of heated distributing rollers. Tests have shown that for optimum results, the coating material should consist of about 70% by weight of solids when it is applied to the web under pressure and that coating material having such consistency can be conducted from the fountain, over the distributing rollers, and to the web without difficulty.

This process may be used in a paper making plant as one step in the process of making coated paper or it may be used to apply an additional coating or several additional coatings to paper that has already been coated. When used in a paper making plant the web need not be dried thoroughly or completely before the coating material is applied by means of the present process, inasmuch as the moisture content of the coating material when applied to the web is comparatively low and is insufficient to affect detrimentally the paper passing through the coating unit.

The process employing cooled rollers is particularly suitable for use in paper mills because such plants usually have available a supply of cool water that is, for all practical purposes, unlimited. The discharge water can be discarded

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or used in other portions of the plant. The process is also, however, eminently suitable for plants that have limited water supply because it would be a simple matter to cool the discharge water and recirculate it to the distributing rollers.

I claim:

1. A method of continuously coating an advancing web of paper with a coating composition of constant viscosity which comprises supplying to the first of a series of transfer rollers a coating composition having a given moisture content and viscosity, transferring said coating composition from one roller to the next thereby uniformly distributing said composition over the moving surfaces of the rollers, regulating the temperature of at least one of said rollers and the relative humidity of the surrounding atmosphere to maintain the temperature of the coating composition on said rollers at substantially the dew point temperature of the surrounding atmosphere whereby any substantial transfer of moisture between the coating composition and the surrounding atmosphere is prevented and whereby said given moisture content and viscosity of said coating composition is maintained constant, and bringing the uniformly distributed composition into contact with the advancing web to transfer the coating composition to the web.

2. The method defined in claim 1 in which the temperature of the coating composition on the rollers is maintained at substantially the dew point temperature of the surrounding atmosphere by cooling at least one of the rollers.

3. The method defined in claim 1 in which the coating composition on the rollers is maintained at substantially the dew point temperature of the surrounding atmosphere by adding moisture to the surrounding atmosphere.

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