Nov. 13, 1934. S. LEBEL 1,980,923

METHOD OF AND APPARATUS FOR COATING PAPER

Filed Aug. 18, 1931 2 Sheets-Sheet 1

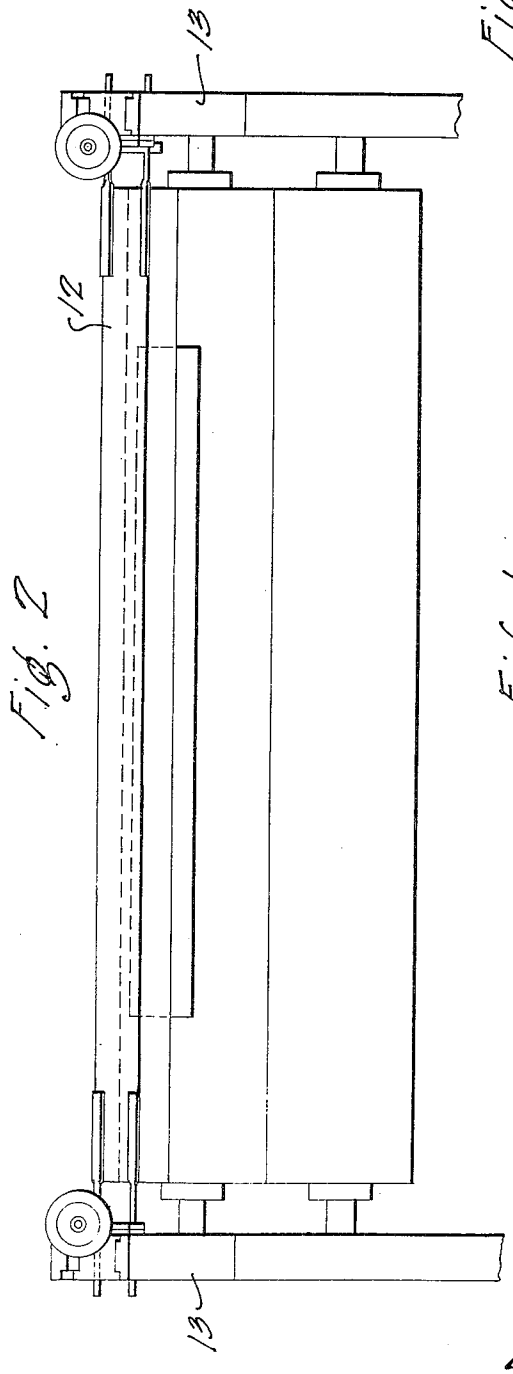


Fig. 2

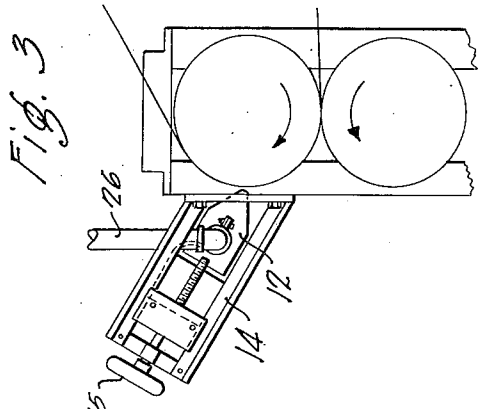


Fig. 3

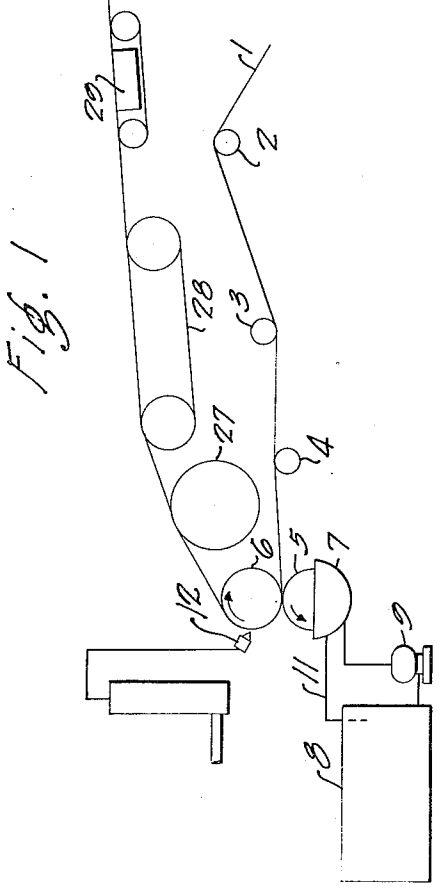


Fig. 1

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Fig. 5

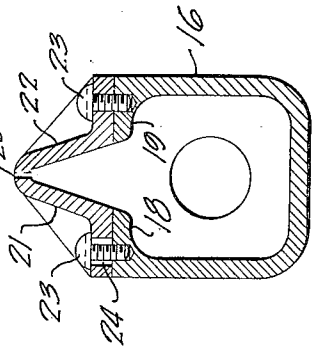


Fig. 4

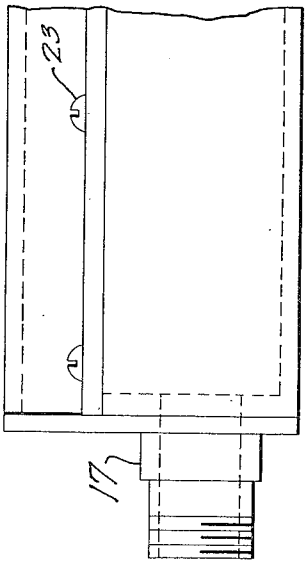


Fig. 7

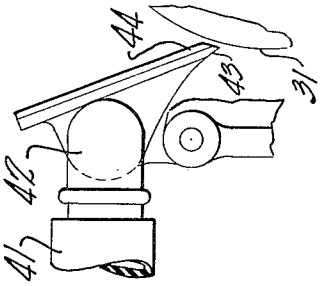
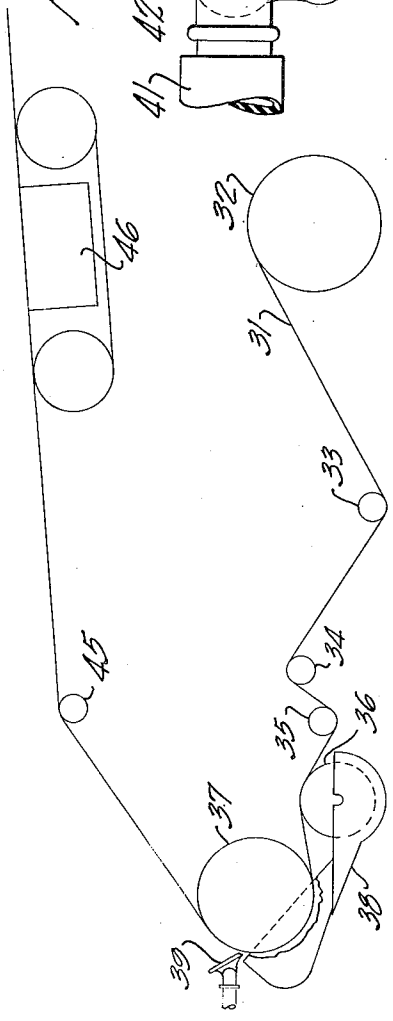


Fig. 6



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METHOD OF AND APPARATUS FOR COATING PAPER

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Application August 18, 1931, Serial No. 557,782

9 Claims. (Cl. 91—68)

This invention relates to a method of and apparatus for applying coating compositions to paper and similar sheet materials.

In the manufacture of certain kinds of paper, it is common practice to apply a layer or coating to the paper web, usually in the form of a fluid suspension of extremely finely divided solid particles. Such coating compositions may also include an adhesive in solution or suspension in water and appropriate dissolved solvent materials, or other compatible substances, as desired. Such coating compositions are well known and do not require description. However, it is ordinarily desirable to apply them in relatively concentrated form and to provide a substantially uniform and continuous layer. In order to get such uniformity of distribution of coating compositions and a smooth surface on the finished sheet, it is customary to subject the coated surface to a number of rotating or oscillating brushes, and then allow the coating to smooth out by virtue of its own fluidity, and finally to dry and set.

Such operations are not easily regulated and are subject to variations in operation and in the uniformity of the coated surface produced.

Accordingly it is an object of the present invention to provide a method of applying such coating materials to paper which shall be uniform in operation and easily controlled, and to produce a coated sheet of reliable and satisfactory quality. It is also an object to provide apparatus wherewith the process may be carried out automatically. Other objects will appear from the following disclosure.

The process according to the present invention comprises briefly the steps of applying a substantially continuous and more or less uniform layer of such a fluid suspension or solution of coating material upon the surface of a sheet of paper, conducting the coated sheet through a suitably defined path, and directing a jet of compressed air, disposed transversely of the sheet and in the direction opposite to its direction of travel, at an angle thereto.

In such procedure, the jet of air may be assisted by the force of gravity and act in the same direction. It may also, however, be substantially horizontal or vertically upward. In any case, the impact of the air jet forces the fluid coating against the surface of the sheet to form an intimate impregnation and/or contact therewith. It also distributes the fluid coating composition uniformly over the surface of the sheet and strips any surplus overlying liquid from the more firmly adhering contacting layer immediately adjacent to the sheet which consequently acquires a continuous, uniform surface, without the formation of wavy surfaces and striae, and also without setting up strains in the applied coating, either while liquid or during subsequent drying and setting. Moreover, by virtue of such even distribution, and the liquid-solid characteristics of the coating compositions, if and when the solids tend to segregate and collect adjacent to the surface of the paper and the residual liquid to form a definitely supernatant layer standing above it, the free surface smooths out, dries quickly, and ultimately deposits such dissolved components as it may contain upon and between the solid particles.

A typical instance of carrying out the invention, and an embodiment of the apparatus therefor, will be described with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevation of the apparatus as a whole;

Fig. 2 is an end view of the applicator rolls and air brush;

Fig. 3 is an enlarged side view of the air brush as seen in Fig. 1;

Fig. 4 is an enlarged view of the mounting for the air brush;

Fig. 5 is a cross section of the air brush;

Fig. 6 is a side elevation of a modification of the apparatus; and

Fig. 7 is an enlarged view of the air brush therein.

In a typical instance of carrying out the invention, a sheet of the paper 1 may be drawn over guide rolls 2, 3, 4, and thence between an applicator roll 5 and squeeze roll 6. Applicator roll 5 dips into a tank 7 containing a coating suspension of suitable fluidity, which may be prepared in known ways and is supplied from storage tank 8 by means of pump 9, any surplus therefrom returning to the tank through overflow 11.

As the wetted roller 5 contacts with the sheet 1, it applies a relatively uniform layer of the coating liquid thereto. This layer is rendered still more uniform, and of the thickness desired by regulating the space between squeeze rolls 5 and 6. The applied layer of coating composition is thus distributed evenly over the sheet, preferably somewhat in excess of what is ultimately required, and may also be forced into intimate contact and adhesion with the sheet as the latter passes between the rolls.

As the coated sheet continues over roll 6 it passes through a jet of compressed air from the nozzle or air brush 12, which is mounted between uprights 13 in guideways 14, and is also adjustable

toward and away from the sheet 1 by means of a screw 15.

The air brush 12 may consist of a substantially rectangular chamber 16 (Figs. 4 and 5) having trunnions 17 at the ends upon which it may be rotated to any angle desired. The compressed air chamber 16 may be composed of three enclosed sides, the fourth side having lugs 18, 19 along the opposite sides thereof to receive flanges 21, 22, respectively, which are secured in position by means of screws or bolts 23. One of the flanges (21) may be provided with slotted bolt or screw openings 24 which permits suitable adjustment of such flange toward and away from the other, thereby to determine the width of the space 25 which is left therebetween and which constitutes the outlet of the compressed air jet. This outlet may be continuous (as shown) extending from one end of the chamber 16 to the other and may be of uniform width (as when a relatively large chamber 16 is provided) or may be of varying widths so as to provide an air jet of relatively uniform velocity from one end to the other, in case differential air pressure is encountered.

The supply of compressed air may be introduced into the chamber 16 at any convenient point or points, or at both ends, or at one end only, as shown, as by means of a rubber hose connection 26.

The air jet issuing from the opening 25 extends transversely throughout the width of the sheet and impinges on the coating which has been applied to the paper. The angle of impingement of the jet is adjustable, and is preferably oblique to the sheet, in a direction opposed to the direction of translatory movement of the coated paper, so that the effect of the jet is to detain surplus coating material, thereby evening the thickness of the coating material longitudinally of the sheet as it passes the line of impingement of said jet. The evened coating is subsequently dried in any suitable manner.

By suitably adjusting the thickness of the air brush or jet of compressed air, the pressure and the angle at which it strikes the sheet, it is found that the superficial portion of the layer of fluid coating material is uniformly wiped back and distributed over the width of the sheet, leaving a free, continuous "coating" surface of uniform consistency and characteristics and of the desired depth or thickness. While the initial thickness of the layer applied may be approximately controlled by the applicator roll 5 and the spacing of the same from roll 6, the thickness may be further reduced by employing a more rapid air jet and/or directing the same at a more acute angle of contact with the coated sheet, and conversely. For example, an instance of satisfactory operation of the apparatus described was obtained with a jet of air 0.020" thick, having an air pressure of four lbs. per square inch and directed at an angle of 35° to the surface of the paper. For varying compositions and thicknesses of coating and different types of paper, speed of the sheet, etc., operating conditions may be altered accordingly, within the invention.

When the sheet passes the air jet (which, as shown, is located adjacent to the horizontal diameter of the roll 6), it passes upwardly over conveyor roll 27, conveying belt 28 and suction apron 29, if desired, and thence to a take-up roll or other apparatus (not shown).

In addition to forming a squeeze roll, the roll 6 performs another important function. It also constitutes a support for the sheet as it travels past the air jet and by reason of the fact that the roll is positioned directly opposite the jet, any vibration of the sheet at this point is prevented.

That portion of the fluid coating composition which is stripped from the coated sheet by the air blast may be removed from the sheet in the form of a fine mist or spray, while that which remains is not sufficiently great to flow downwardly in streams over succeeding areas. The latter may, however, accumulate sufficiently to form an upraised fluid ridge transversely of the sheet which thus equalizes the distribution of the coating throughout the width of the sheet and also serves as a reserve supply of coating, adequate to flow into and cover any subsequent areas or spots on the sheet which for any reason have failed to acquire a sufficient layer of the coating from the applicator roll 5.

The free surface of the resulting sheet is left with a characteristically uniform consistency throughout its area, inasmuch as this liquid ridge serves locally to relieve the surface tension and, as it is forced back by the air brush, to carry with it all but that portion of the coating layer, which is either too firmly adherent to the sheet to be removed or of too great viscosity or surface tension to be squeezed out.

The coated and stripped sheet, upon drying, or setting, is found to exhibit a marked degree of uniformity of texture and appearance, and its properties generally are more definitely controllable than heretofore in several respects, such as thickness of coating, smoothness of surface, etc. The application of the invention also makes possible the use of an initially denser coating composition than was heretofore practicable.

A modification of the apparatus above described is shown in Figs. 6 and 7, in which the paper sheet 31 is drawn from roll 32 over guide rolls 33, 34, 35, and thence over applicator roll 36 and under a breast roll 37. In this apparatus the sheet receives a free application of the coating composition from tank 38, into which the lower portion of the applicator roll 36 dips. The air brush 39 is supplied by an air line 41, and is rotatable upon the hose connections 42. It is also to be noted that the lower lip 43 of the nozzle projects a little beyond the upper lip 44, so that it directs the effluent jet of air first against and then along the surface of the sheet 31. This overcomes the tendency of the air jet to rebound from the sheet and thus to introduce an upward component of force upon the liquid coating away from the sheet which is, of course, undesirable. The thickness and air pressure of the jet may be adjustable in this case the same as before. The sheet is then passed over guide rollers 45 and suction apron 46, if desired, or to other apparatus (not shown) as may be desired. This modification will generally be employed where it is not required to squeeze the coating against or upon the sheet of paper or where a flowing deposit of the composition is desired, in contrast to a positively limited thickness of layer which is effected by the roll 6 in Fig. 1.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Method of coating paper comprising maintenance of the sheet in translatory motion, application of fluid coating material to the moving

sheet, subjection of the coating to a jet of air extending transversely across said sheet and impinging thereon at an oblique angle, adjusted to oppose the movement of translation of said coating material with the movement of the sheet while supporting the sheet opposite the jet to prevent vibration of the sheet, thereby evening the thickness of the coating material which passes the line of impingement of said jet, and subsequently drying the evened coating.

2. Method of coating paper comprising maintenance of the sheet in translatory motion, application of fluid coating material to the moving sheet, subjection of the coating to a jet of air extending transversely across said sheet in a substantially straight line and impinging thereon at an oblique angle, adjusted to oppose the movement of translation of said coating material with the movement of the sheet while supporting the sheet opposite the jet to prevent vibration of the sheet, thereby forming a substantially transverse ridge of surplus coating material on the sheet in front of said jet and evening the thickness of the coating material over the width of the sheet as it approaches the line of impingement of said jet, and subsequently drying the evened coating.

3. Method of coating paper comprising maintenance of the sheet in translatory motion, application of fluid coating material to one face of the moving sheet, subjection of the coating to a jet of air extending transversely across said sheet and impinging thereon at an oblique angle adjusted to oppose the movement of translation of said coating material with the movement of the sheet while supporting the sheet at the opposite face of the same to prevent vibration of the sheet at the area of impingement of the air jet, thereby evening the thickness of the coating material which passes the line of impingement of said jet, and subsequently drying the evened coating.

4. Method of coating paper comprising maintenance of the sheet in translatory motion, application of fluid suspension of finely divided coating material to the moving sheet, subjection of the coating to a jet of air extending substantially perpendicular to the movement of said sheet and impinging thereon at an oblique angle, adjusted to oppose the movement of translation of said coating material with the movement of the sheet while supporting the sheet opposite the jet to prevent vibration of the sheet, thereby evening the thickness of the coating material which passes the line of impingement of said jet, and subsequently drying the evened coating.

5. Method of coating paper comprising maintenance of the sheet in translatory motion, application of fluid suspension of finely divided solid coating material to the moving sheet, subjection of the coating to a jet of air extending transversely across said sheet and impinging thereon at an oblique angle, adjusted to oppose the movement of translation of the more fluid portion of said coating material with the movement of the sheet while supporting the sheet opposite the jet to prevent vibration of the sheet, thereby evening the thickness of the coating material which passes the line of impingement of said jet, and subsequently drying the evened coating.

6. Method of coating paper comprising maintenance of the sheet in a translatory motion upwardly, application of fluid coating material to the moving sheet, subjection of the coating to a jet of air extending transversely across said sheet and impinging thereon downwardly at an oblique angle adjusted to oppose the movement of translation of said coating material with the movement of the sheet while supporting the sheet opposite the jet to prevent vibration of the sheet, thereby evening the thickness of the coating material which passes the line of impingement of said jet, and subsequently drying the evened coating.

7. Apparatus for coating paper comprising means for applying a layer of a liquid coating composition to the paper sheet, a compressed air jet extending transversely of the sheet, means for conducting the sheet of paper past said air jet, means for supporting the sheet opposite the air jet and means for directing said air jet at a predetermined angle of 45° or less and closely adjacent to the coated paper sheet and in opposite direction to the movement thereof.

8. Apparatus for coating paper, comprising means for applying a layer of a liquid coating composition to the paper sheet, a compressed air jet, at a predetermined angle to and extending transversely of the sheet, means for supporting the sheet opposite the air jet, means for conducting the sheet of paper past said air jet, and means for controlling the width of said air jet in respect of differential pressures of air to render the speed of air in said air jet substantially uniform.

9. Apparatus for coating paper, comprising means for applying a layer of a liquid coating composition to the paper sheet, a compressed air jet, at a predetermined angle to and extending transversely of the sheet, a roll supporting the sheet opposite to the air jet, means for conducting said sheet past said jet, a lip adjacent to said air jet and extending therefrom substantially parallel to the paper sheet and in the opposite direction to the movement of the paper sheet.

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