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WEB COATING AND DOCTORING APPARATUS

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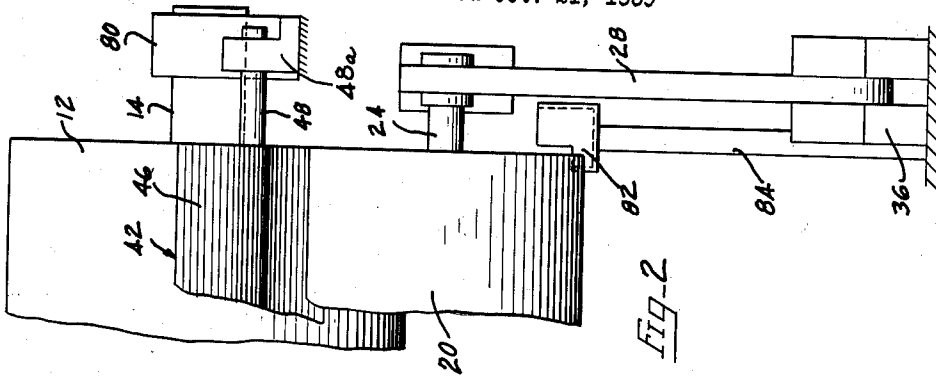


FIG. 2

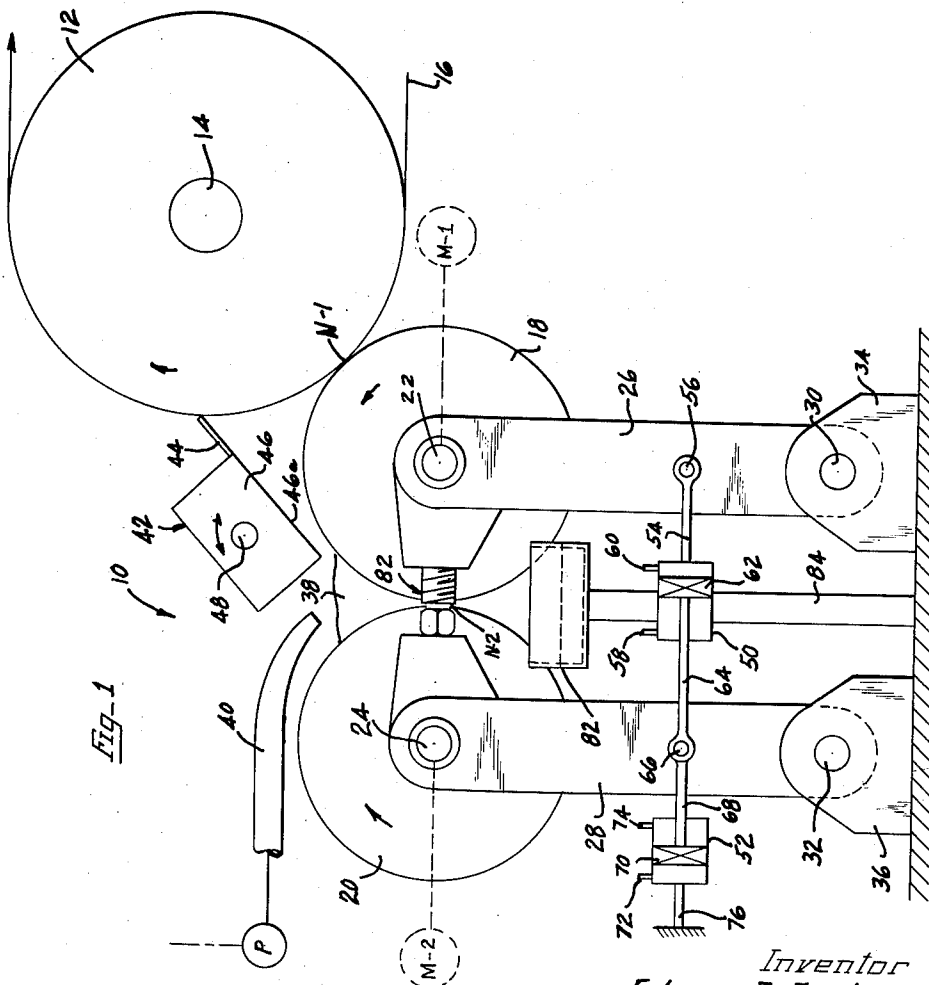


FIG. 1

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1

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WEB COATING AND DOCTORING APPARATUS
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The present invention relates broadly to the production of coatings on paper and related web materials, and is more especially directed to novel structures and procedures by means of which coating materials are applied in relatively wide ranges of controlled weights to paper immediately in advance of doctor blade means bearing thereagainst.

Coatings are of course applied to paper and other webs for any one or a number of different reasons, which may be improvements in feel, printability, brightness, gloss, opacity, smoothness, and in order to hide the surface of the paper. A machine well known to the art is termed the "Trist" or "trailing blade" coater, by means of which a paper web wrapped about a rubber covered roll has coating emulsion applied thereto by a stationary trailing scraper blade angularly arranged relative to the surface of the roll and forming a duct or fountain, the width of which is determined by dykes, side walls or marginal restrictors mounted on the blade and adjustable therealong.

It is further now recognized that the trailing blade coater has certain inherent disadvantages, and one of these is that the dams or dykes result in an unnecessarily complicated construction. Then too, it is required that the doctor blade be replaced by a blade having a different degree of resiliency, if the doctor is to be used to obtain coating weight control to supplement solids content or viscosity variations, for purposes of control of coating weight. Additionally, if a machine break occurs, it is necessary to retract the doctor blade, after performing the time consuming step of either draining or dumping the reservoir. Persons skilled in the paper coating art are now aware of other disadvantages lying in utilization of the trailing blade coater, generally speaking the difficulties named are among those discussed in any consideration of present coating methods.

It is accordingly an important aim of the instant invention to provide coating apparatus devoid of dam, fountain and related structure, and incorporating therein means carefully controlling the coating weight applied over a relatively wider range than normally obtained by devices known to the art.

Another object of this invention lies in the provision of a method of coating paper and like materials, featuring among the steps thereof removing excess coating material from a point closely adjacent its point of application, and discharging said excess coating directly to the coating applicator means.

Still another object of the present invention is to provide apparatus for coating a traveling web moving in wrapping relation with a platen roller, and which comprises a plurality of applicator rollers in nip-defining relation one with the other, one of said applicator rolls defining a nip with the platen roller whereat coating material held by the applicator rolls is transferred to the traveling web, and blade means immediately adjacent said nip at which the coating material is applied and positioned with respect to the supply of coating material to return thereto excess coating material removed from the traveling web.

Other objects and advantages of the invention will become more apparent during the course of the following description, particularly when taken in connection with the accompanying drawings.

2

In the drawings, wherein like numerals designate like parts throughout the same:

FIGURE 1 is a more or less schematic view of apparatus constructed in accordance with the principles of this invention, and constituting one structural embodiment especially suited to practice the method of this invention; and

FIGURE 2 is a fragmentary end elevational view of the apparatus of FIGURE 1, and showing particularly trough means which may be employed at opposite ends of the applicator rolls to collect any overflow.

Referring now to the drawings, there is shown coating apparatus generally designated by the numeral 10 and comprising a platen roll 12 supported by a shaft means 14 and receiving a paper web or related sheet material 16 in wrapping relation therewith. The platen roll 12 is in nip-defining relationship at N-1 with an applicator roll 18, which defines a nip N-2 with another applicator roll 20, the rolls 20 and 18 being hereinafter referred to as first and second applicator rolls, respectively.

The applicator rolls 18 and 20 are supported by shaft means 22 and 24, said shafts being received at both ends in generally upright supporting arms 26 and 28 pivotally connected at 30 and 32 to bracket means or the like 34 and 36 attaching with fixed structure, which may be the floor.

The applicator rolls 18 and 20 may be seen to be in general horizontal alignment, and held in the valley defined by said rolls is a supply of coating material 38 in solution or emulsion form delivered to the nip N-2 by one or more nozzle means 40, communicating with pump means or the like P in the manner known to the art. In most applications, the rolls 18 and 20 are counter-rotating, and during said rotation the coating material 38 is split at the nip N-2 into substantially two film portions, one-half of said film being carried by the surface of the applicator roll 18 in a counter-clockwise direction to the nip N-1, whereat said film is transferred to the traveling web 16. As will be described in detail later, the amount of coating material delivered by the applicator roll 18 to the nip N-1 is controlled by the relative surface speeds of the rolls 18 and 20, and by control of the pressures at the nip N-2.

Coating material transferred to the paper web 16 at the nip N-1 is immediately subsequent to application contacted by smoothing means generally designated by the numeral 42. Such smoothing means may comprise a doctor blade 44 mounted by holder means 46 pivotally supported at 48 by suitable structure 48a, so that said holder 46 may be tilted or swung in the directions indicated by the arrow thereon to vary the amount of pressure applied by the doctor blade 44, thereby controlling the amount of excess coating material removed by the doctor blade 44. While the amount of coating material removed by the blade 44 of course depends upon the coating mix and the base stock used, generally speaking the blade may be adjusted to remove either a negligible amount of coating, or up to about 40% or more of the coating weight applied at the nip N-1.

It is to be observed that the doctor blade 44 is located closely adjacent the nip N-1 at the off-running side thereof, and is positioned sufficiently close to the point of application of coating material to avoid dewatering of the coating color. In addition, by reason of close proximity of the doctor blade 44 to the nip N-1, any grit or hardened particles which may be present in the coating material as applied are immediately and effectively removed prior to drying of the coating on the paper web. As is appreciated, undue exposure of the coating material to air reduces the flow properties thereof, rendering difficult grit removal, as well as removal of

3

tracks and ridges caused by surface tension effects from film splitting at the nip N-2.

The blade holder 46 may be seen in FIGURE 2 to have a wall portion 46a cooperating with the doctor blade 44 to bridge the gap between the point of contact of the doctor blade 44 with the applied coating and to a point closely adjacent the level of the coating material 38. The continuous surface provided by the blade 44 and the wall portion 46a is thereby effective to discharge or flow the removed excess coating material back to the valley between the applicator rolls 18 and 20, so that there is essentially no coating material wasted. If desired, a curved guide or deflector could be attached to the wall portion 46a and extending relatively more closely to the coating material 38 in the defined valley.

As noted, one measure of control over the final coating weight on the paper web 16 is provided by adjustment of the doctor blade 44. Further control is obtained in accordance with the novel concepts of this invention by control of the surface speeds of the applicator rolls 18 and 20, and control over the nip pressure or loading at N-2. To adjust or vary the relative surface speeds of the applicator rolls 18 and 20, the shaft means 22 and 24 therefor may be connected to suitable drive means, diagrammatically shown and indicated as motor means M-1 and M-2. Specifically, if a greater coating weight is desired on the paper web 16, the relative surface speed of the applicator roll 18 may be increased over the surface speed imparted to the roll 20.

In addition, by reducing the nip loading or pressures at the nip N-2, greater coating weights are obtained, and vice versa. One means of varying the nip pressures at N-2 may comprise a pair of cylinders 50 and 52, the cylinder 50 being connected to a link 54 pinned to the supporting member 26 at 56. The cylinder 50 is passaged with ports 58 and 60 communicating with opposite sides of a piston head 62 having an arm 64 thereon connected to the supporting member 28 at 66. The point of connection 66 further receives a piston arm 68 connected to a piston 70 reciprocal within the cylinder 52, which is apertured to provide ports 72 and 74. The cylinder 52 is stationary, being connected to fixed structure as shown by means of an arm or the like 76.

It is believed now apparent that upon the admission of fluid to the cylinder 52 through the port 72 that the supporting member 28 and connecting applicator roll 20 are moved to a particular position, and that to vary or increase the nip pressure at N-2, fluid is admitted to the cylinder 50 through the port 58 therein to drive said cylinder to the left. On the other hand, by maintaining a fixed fluid pressure on either of the pistons 62 or 70, the nip pressure at N-2 may be decreased by actuating one of the pistons to move one applicator roll away from the relatively fixed applicator roll.

As noted, relatively lighter weight coatings are obtained by increasing the nip loading between the applicator rolls 18 and 20, and if desired there may be no significant loading at the nip N-2, whereas the nip N-1 can be loaded to generally line pressure of between 20 to 60 p.s.i. Under these circumstances, and with the rolls 12, 18 and 20 rotating in the directions shown at generally the same relative surface speeds, approximately one-half of the coating film split at the nip N-2 is carried by the applicator roll 18 to the nip N-1 for transfer to the traveling web 16. Of course, the applicator rolls 18 and 20 may turn at substantially lesser surface speeds than the platen roll 12, and the nip pressure at N-1 either increased or decreased to provide a particular coating weight. And in addition, as was noted, coating weight control is even further obtained by adjustment of the doctor blade 44. As well, to produce a relatively high coating weight, the rotational direction of the applicator roll 18 may be reversed.

The particular compositions of the platen roll 12 and

4

the applicator rolls 18 and 20 will vary, depending upon the coating weight desired, as well as upon other factors. As for example, the applicator rolls 18 and 20 may be covered with a medium to relatively hard rubber, or may be constructed entirely of metal, if this is compatible with the coatings selected. On the other hand, if it is desired to apply a greater coating weight, as by a squeegeeing action, the applicator rolls 18 and 20 may be covered with a very soft rubber. Generally speaking, the platen roll 12 is covered with rubber of 32 to 50 P. and J. hardness.

It is believed and now quite apparent that applicant has provided a relatively simple and versatile apparatus for applying a coating to the surface of paper, which produces a relatively wide range of coating weights with effective weight control, while eliminating the earlier requirements of relatively elaborate pans, fountains, dams and related structure. The coating apparatus herein disclosed has the advantage of delivering an excess of coating to the doctor blade 44 without color contamination due to dehydration of high viscosity or high solids content colors, such contamination being a long existing problem in the pond and fountain arrangements previously utilized. The coater of this invention is effectively utilized in the application of essentially all relatively high viscosity thixotropic coating formulations, which do not flow in the conventional color pans or fountains used in trailing blade coating.

In addition, the instant apparatus has the advantage of permitting rapid and convenient removal of worn coating blades 44. The applicator rolls 18 and 20 may be rapidly moved away from the platen roll 12, which is stationarily supported at opposite ends by bracket means or the like 80, the blade holder 46 is then relieved, the blade 44 replaced, the blade holder returned to its proper position, and the applicator rolls 18 and 20 returned to operation. As is known in the art, the roll set is controlled by adjusting means generally designated at 82, and upon returning the rolls 18 and 20 to position after blade changing, it may be necessary to re-set the relative spacing of said rolls.

It may upon occasion be found that a certain amount of coating material 38 will overflow from the nip N-2 at opposite ends thereof, and for this purpose the instant invention contemplates provision of trough means 82 supported by uprights 84 to receive said overflow. The overflow may then be returned to the valley between the applicator rolls 18 and 20 in any suitable manner. Particular applications may, however, render use of the trough means unnecessary, and an exemplary situation would arise with use of relatively high solids content coating materials.

Various alternative means have been described hereinabove, and it is therefore apparent that various modifications and changes can be effected in the structure and method herein disclosed without departing from the novel concepts of the present invention.

I claim as my invention:

1. Apparatus for coating a traveling web comprising, a pair of parallel rolls in horizontally opposed nip-defining relationship to form a first nip for containing a puddle of coating on the upper side of the nip, means for supplying coating to said puddle, means for rotating said rolls with their nip-defining surfaces traveling downwardly, a web supporting backing roll positioned above and in nip-defining relationship with one of said parallel rolls to form a second nip and rotatable with the nip side traveling in an upward direction, and a doctor blade means close to said second nip positioned to be in doctoring engagement with a web carried on the uprunning side said backing roll and positioned above said first nip so that the excess coating removed from the web will flow downwardly and directly into said first nip.

2. Apparatus for coating a traveling web comprising,
 a pair of parallel rolls in horizontally opposed nip-
 defining relationship to form a first nip for contain-
 ing a puddle of coating on the upper side of the nip,
 means for supplying coating to said puddle, 5
 means for rotating said rolls with their nip-defining sur-
 faces traveling downwardly,
 a web supporting backing roll positioned above and in
 nip-defining relationship with one of said parallel
 rolls to form a second nip and rotatable with the nip 10
 side traveling in an upward direction,
 a doctor blade means close to said second nip posi-
 tioned to be in doctoring engagement with a web
 carried on the uprunning side said backing roll and
 positioned above said first nip so that the excess coat- 15
 ing removed from the web will flow downwardly
 and directly into said first nip,
 and means controlling the speed of at least one of said
 parallel rolls to vary its speed relative to the other
 parallel roll whereby the weight of the coating ap- 20
 plied to the web on the backing roll can be varied.

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