Feb. 25, 1936. L. HORNBOSTEL 2,032,211

PAPER COATING APPARATUS AND METHOD

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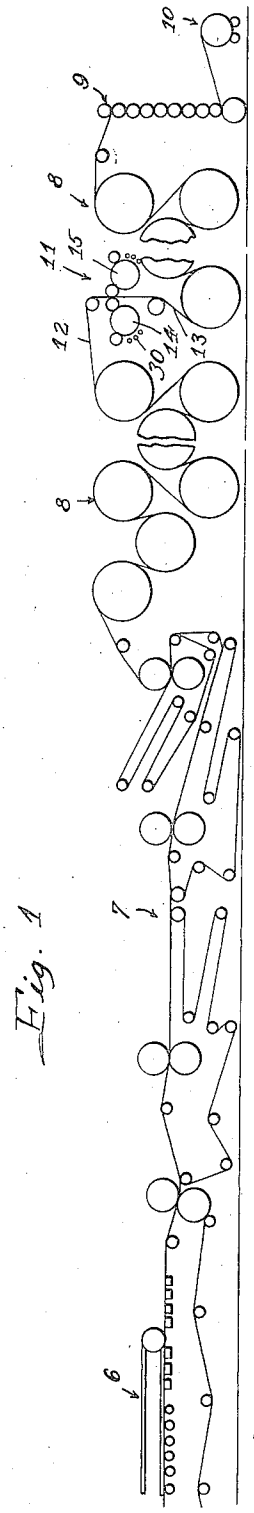


Fig. 1

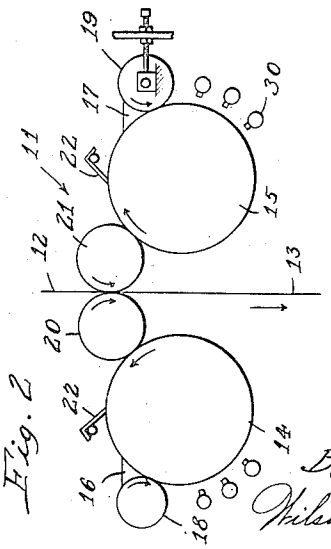


Fig. 2

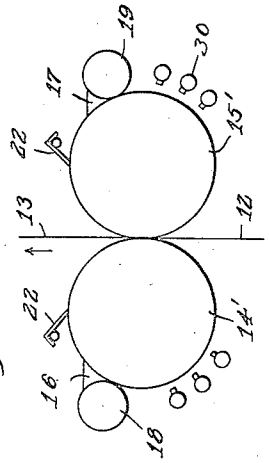


Fig. 3

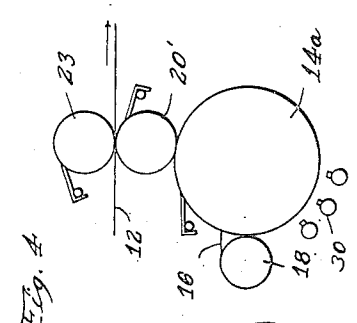


Fig. 4

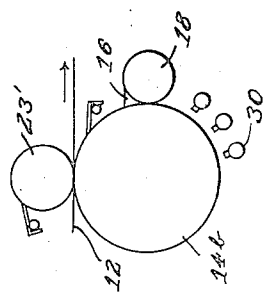


Fig. 5

Inventor.
Lloyd Hornbostel

By Wilson, Dowell, McCanna & Winterrowd
Attys.

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PAPER COATING APPARATUS AND METHOD

Lloyd Hornbostel, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

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8 Claims. (Cl. 92—68)

This invention relates to the manufacture of coated paper suitable for printing, and is concerned with the forming, coating and drying of paper in one continuous operation in a paper making machine.

In the past, there were two accepted methods of coating. The earlier method involved the application of the coating in liquid form first to one side of the paper, then drying the paper sufficiently to permit coating the other side, and ultimately coating the other side and drying again. The objection to this was that it required large driers and, because of the number of passes of the paper, a large amount of machinery taking up considerable floor space. Then, too, the coating applied in this manner had a tendency to peel. The later method consisted in applying fairly dry coating material, about 60% dry, to the web of paper when about 80% dry, but this method had the objection that such coating material is of plastic consistency and difficult to handle and distribute uniformly. As a consequence, the paper coated by this method would show up in printing as not having uniform glossiness, due to the fact that the coating material was either not applied over the entire surface, or else not uniformly. It is, therefore, the principal object of my invention to apply coating by a different method which involves using coating material in liquid form and partially drying this coating material before applying it to the surface or surfaces of the web of paper. This permits even distribution of the coating material by a nip to get a uniform film of the desired thickness, which is then partially dried before application to the paper, so that complete and uniform coating is assured.

Another object consists in the use of a small rotary cylinder, first for the formation thereon of a uniform film of coating material with a nip, and then the partial drying thereon of the film, either by heat of the cylinder alone, or by hot air blasts played thereon, or by both. The cylinder thereafter is used for directly applying the coating to the web of paper, or an intermediate transfer roll may be used.

The invention is illustrated in the accompanying drawing, in which—

Figure 1 is a diagrammatic view of a paper making machine embodying my invention;

Fig. 2 is an enlargement of the apparatus of my invention included in the machine of Figure 1;

Fig. 3 is a view similar to Fig. 2 showing a modified or alternative construction in which the intermediate or transfer rolls are omitted, and

Figs. 4 and 5 are two other views bearing the same relationship as Figs. 2 and 3 showing another form of apparatus embodying my invention.

Similar reference numerals are applied to corresponding parts throughout the views.

Referring to Figure 1, the numeral 6 designates the Fourdrinier end of a paper making machine, 7 the presses, 8 the driers, 9 the calender, and 10 the reel. I illustrate the coating apparatus 11 of my invention in the latter half of the drier 8, that is, at about the two-thirds point, it being contemplated by this invention to apply the coating to the web 12 when it is approximately 80% dry. However, it should be understood that I do not limit my invention to this specific location; the only essential point is that the web of paper must be partially dried at the time the partially dried coating material is applied, the coated web being subjected to a final drying afterward. The coated web is numbered 13 to distinguish it from the uncoated web 12.

The coating herein referred to is the kind known as a "mineral" coating, used on paper intended for magazines or books, or any other high grade printing, such paper having a glossy finish as a result of the working into its surface of the finely divided clay, casein, and starch of the coating material. When this coating material was applied in aqueous solution to the paper web in accordance with the earlier method mentioned above, brushing and smoothing was necessary to distribute the coating uniformly. However, due to the fact that the coating was applied to the web while it was still only about 50% dry, there was a tendency toward streaking and the subsequent drying gave rise to a tendency for the coating material to peel. Moreover, the necessity for brushing and smoothing of the coating material in its application to the web gave rise to danger of damaging the surface. By coating in accordance with the present method when the web is about 80% dry, the objections to the method just referred to are avoided, and a uniform coating is secured by reason of the novel method of application which I shall later describe in detail. Aside from the poor results secured with this earlier method, it had the objection that it required large expensive driers, taking up considerable floor space. Now, the later method above referred to, while not subject to the objections of the earlier method, had its own serious drawbacks as I before indicated. This meth-

od gave doubtful results so far as evenly distributing the coating material on the web is concerned, with the result that the paper would not have the desired glossiness, and this would show up quite clearly in the printing by the presence of specks in solidly inked areas. Aside from the results secured with this later method, there was the objection that the apparatus required in the carrying out of the method involved the use of numerous kneading rolls, all turning at different speeds and in different directions, with complicated gearing to drive the same, all of which meant expense and the need for constant supervision of the machine in operation. The apparatus used in the present method, as will soon appear, is of simple and economical construction and will give uniform good results without the exercise of more than ordinary care in operation.

Referring to Fig. 2, the coating apparatus comprises two small rotary cylinders 14 and 15 turned in the directions indicated with nips 16 and 17 of coating material in liquid form provided between the cylinders and companion rolls 18 and 19. Any suitable means may be provided for feeding coating material to the nips at about the same rate as it is being used. The rolls 18 and 19 are adjustably mounted, as indicated at roll 19 in Fig. 2, so as to enable fine adjustment thereof so that the thickness of the film of coating material passing between the rolls can be accurately controlled. The coating material will, of course, be uniformly distributed on the full width of the cylinders and as a result the paper to which the coating is ultimately applied will accordingly receive a uniform coating. The coating material before application to the web of paper 12 is partially dried in its travel from the point of application to the point where transfer rolls 20 and 21 take the films from the cylinders and apply the same to the paper. The partial drying may be accomplished entirely by heating the cylinders, in the usual drier cylinder manner, or entirely by the application of hot air blasts, from pipes 30, or by the simultaneous action of heat in the cylinders and hot air applied externally. Provision will, of course, be made so that variable pressure can be applied where the transfer rolls 20 and 21 come together and also where the transfer rolls contact the drier cylinders. Doctors 22, working on the periphery of the drier cylinders beyond the point of contact with the transfer rolls, clear off any coating material that may remain, so that the cylinder surfaces are perfectly clean at the point of entry into the nips. The paper coated by passage between the transfer rolls is numbered 13. The drier cylinders 14 and 15 may be of iron or other metal and the rolls 18, 19, 20 and 21 may be rubber covered.

The operation is, no doubt, clear from the above description. The coating solution is of fairly low consistency and can, therefore, be evenly distributed by means of nips, as above described, thus getting away from the difficulties of the later method previously referred to. The uniform film of coating material is then simply partially dried in its travel on the periphery of the drier cylinder before application to the paper. Since the paper is itself about 80% dry at the time the partially dried coating material is applied, there is no danger of peeling, which was one of the principal objections to the earlier method. The present method, in other words, avoids the most serious objections to either of the previous methods.

While I prefer the use of an intermediate transfer roll between the drier cylinder and the web of paper, it is, nevertheless, possible to carry out the present method without these intermediate rolls, as shown in Fig. 3, where the drier cylinders 14′ and 15′ are shown in direct contact with the web to apply the coating material thereto.

Furthermore, while I disclose in Figs. 2 and 3 the simultaneous coating of both surfaces of a web of paper, it should be understood that the apparatus might take the form shown in Fig. 4, in which the coating of one side is attended to using a drier cylinder 14*a* and transfer roll 20′ in combination with an idler roll 23, and in which the coating of the other side will be attended to by a similar combination of cylinder and rolls (not shown). Fig. 5 shows an apparatus similar to that of Fig. 4 but omitting the transfer roll 20′, the drier 14*b* being in direct contact with the web and cooperating directly with the idler roll 23′.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn with a view to covering all legitimate modifications and adaptations.

I claim:

1. Apparatus for coating paper with a thin film of mineral coating comprising a drier cylinder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, the cylinder being arranged to be heated to dry the film, and means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for transferring the partially dried film directly from the surface of the cylinder to a moving surface to be coated.

2. Apparatus for coating paper with a thin film of mineral coating comprising a drier cylinder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, the cylinder being arranged to be heated to dry the film, and rotary means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for directly transferring the film by contact and pressure to a moving web of paper to be coated, said rotary means operating at the same lineal speed and in the same lineal direction as the moving web.

3. Apparatus for coating paper with a thin film of mineral coating comprising a rotary cylinder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for directly transferring the partially dried film from the surface of the cylinder to a moving surface to be coated, and means for subjecting the film of coating material to a hot air blast during its travel from the nip to the transfer point, sufficient for the partial drying thereof.

4. Apparatus for coating paper with a thin film of mineral coating comprising a rotary cyl-

inder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, and means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for directly transferring the partially dried film from the surface of the cylinder to a moving surface to be coated, said cylinder being heated sufficiently to accomplish, in part, the partial drying of the film in its travel from the nip to the transfer point, and means for applying a hot air blast to the cylinder to do the balance of the partial drying of the film.

5. Apparatus for coating paper with a thin film of mineral coating comprising a rotary cylinder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for directly transferring the film by contact and pressure to a moving web of paper to be coated, and means for subjecting the film of coating material to a hot air blast during its travel from the nip to the transfer point, sufficient for the partial drying thereof.

6. Apparatus for coating paper with a thin film of mineral coating comprising a rotary cylinder, roller means forming with the cylinder a nip containing fluid coating material for applying said material evenly to the surface of said cylinder at one point, and means at a point circumferentially spaced from the first point, a distance sufficient to enable partial drying of the film of coating material in its travel therebetween, for directly transferring the film by contact and pressure to a moving web of paper to be coated, said cylinder being heated sufficiently to accomplish, in part, the partial drying of the film in its travel from the nip to the transfer point, and means for applying a hot air blast to the cylinder to do the balance of the partial drying of the film.

7. A continuous method of producing uniform mineral coated paper, which consists in forming a continuous wet web of paper, partially drying the moving web, forming a uniform thin film of coating material on a transfer surface without working the material to such condition, by wetting the surface with the material in a fluid, flowable and self-distributing form, supporting the film so produced on a transfer surface moving in the same direction and at the same lineal speed as the moving web, transferring the film to the web by contact, and finally drying the coated web.

8. A continuous method of producing uniform mineral coated paper, which consists in forming a continuous wet web of paper, forming a uniform thin film of coating material on a transfer surface without working the material to such condition, by wetting the surface with the material in a fluid, flowable and self-distributing form, supporting the film so produced on a transfer surface moving in the same direction and at the same lineal speed as the moving web, transferring the film to the web by contact, and finally drying the coated web.

LLOYD HORNBOSTEL.