

April 23, 1946.

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2,398,843

APPARATUS FOR COATING PAPER

Filed July 11, 1942

Fig. 2.

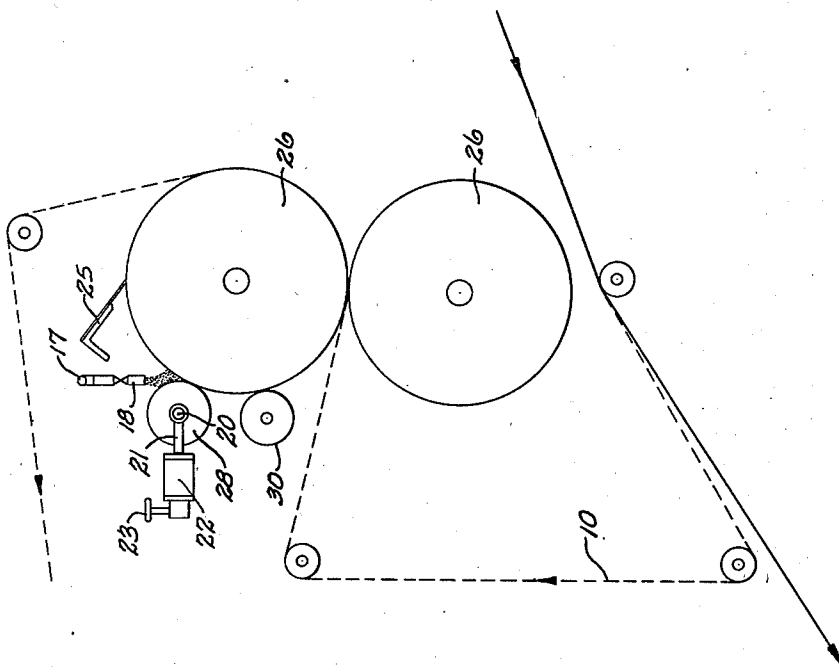


Fig. 1.

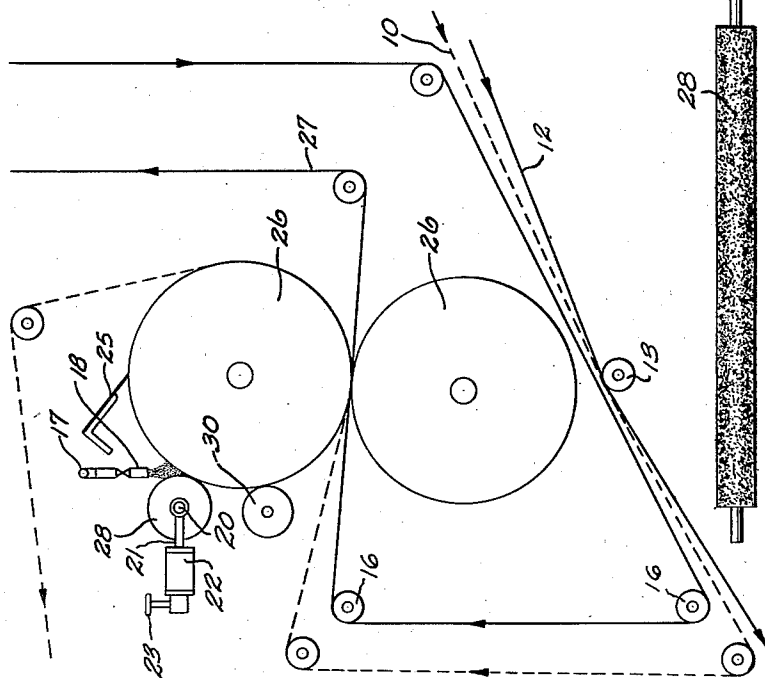
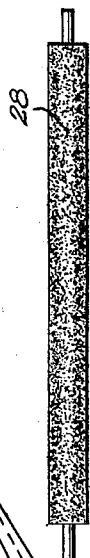


Fig. 3.



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UNITED STATES PATENT OFFICE

2,398,843

APPARATUS FOR COATING PAPER

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Application July 11, 1942, Serial No. 450,550

5 Claims. (Cl. 91—49)

This invention relates to apparatus for coating paper, and while particularly advantageous in connection with the coating of paper made of ground wood pulp, is also applicable to other types of paper products.

One of the objects of the invention is to provide apparatus of this character, which will produce a paper having a smooth, plane surface, appropriately bright or white, suitably opaque, possessed of the desirable printing properties, and yet retaining its tensile strength.

Another object of the invention is to provide apparatus of this character capable of producing paper having the desirable properties mentioned and of accomplishing this in a simple, practical, and economical manner and in a way entirely compatible with high speed production by means and facilities practically available.

Other objects and advantages reside in certain novel features which will be hereinafter described and particularly pointed out in the appended claims.

The present invention will be described in the following specification in connection with preferred embodiments of the apparatus employed for carrying out the same. The apparatus in its various forms is disclosed in the accompanying drawing, wherein:

Figure 1 is a diagrammatic view in side elevation of the third press of the paper-making machine and showing the same equipped with one form of apparatus embodying the present invention for applying coating to the web of paper;

Figure 2 is a diagrammatic view in side elevation showing the third press of the paper-making machine equipped with a modified form of apparatus embodying the present invention and adapted for applying coating to heavier papers or boards without the use of a felt;

Figure 3 is a detail view in elevation illustrating diagrammatically the indented or knurled roll employed for distributing certain types of coating material in such manner as to avoid surface tension ridges.

Referring to the drawing, it will be seen that in both embodiments of the invention the web of paper is designated generally at 10, and it is shown as being advanced through the press section of a paper making machine.

In Figure 1 the web 10 is shown as being supported by an endless felt 12, the latter, in turn, being trained about felt rolls, one of which is shown at 13. In this embodiment of the invention the web 10 is coated on one side as it passes through the press rolls 26—26 of a paper making

machine, and while it is still supported on a felt 27, the latter again being supported by felt rolls 16. The coating material is applied to the surface of the web of paper in this form of the invention by the upper press roll 26 of the machine. At this time the web 10 has a high moisture content. The coating material is an aqueous dispersion of suitable pigments, such as China clay or titanium dioxide, including adhesives, etc., or the coating material may be only sizings, such as starch, casein, or such other materials in solution or suspension, or any color, coating or pigment that is applied to paper for special purposes. Usually the mineral pigments are preferred but the invention is not restricted to the application of mineral pigments. The aqueous suspension of the coating is supplied from the header or manifold 17 through suitable orifices or nozzle 18 to the nip between an applicator or a distributing roll 28 and the upper press roll 26.

The applicator or distributing roll 28 is supported for rotation in suitable bearings 20 carried on piston rods 21 of hydraulic motors 22. Only one such bearing 20, piston rod 21, and motor 22 are illustrated in the drawing, but it is to be understood that there is one such set of instrumentalities at each end of the applicator roll, and, of course, that the trunnions at the ends of the rolls are rotatably fitted in the bearings 20. The hydraulic motors 22 are equipped with an adjusting screw 23 so that they may be regulated to place within the control of the operator the distance obtaining between the applicator roll and the upper press roll and also the pressure that is set up between these two elements.

A doctor 25 coacts with the upper part of the upper press roll 26 to maintain the surface of the roll in proper condition.

After leaving the press rolls 26—26 the paper web 10 passes on to the drier section of the machine not shown.

The present invention is particularly advantageous in applying mineral coating in limited amounts to the web when it contains more than fifty per cent moisture and usually before it has come into contact with any drying cylinder whatever. Applied in this way, the absorbency of the surface is not reduced to nearly the same extent that any coating containing starch or protein adhesive will reduce the absorbency of the sheet when applied to a web containing twenty per cent moisture. Furthermore, the mineral coating requires less adhesive applied before the drier than when applied to the subsequently dried paper.

When coating is applied to the paper before

drying, there is a definite limit to the weight of the web that can be coated without some support on account of low strength of the wet web. This limitation is overcome by the present invention in the case of light weight papers by virtue of the fact that the coating is applied while the wet web is supported by felt. The use of a felt to support the wet web as it passes into the nip of the press rolls prevents stretching and distortion because the force necessary to disengage the coated web from the ascending surface of the press roll, so as to conduct it on to the smoothing press and driers, is much less than when the bare rolls are used.

The metering and applicator roll or rolls serve to measure and distribute the coating, and it has been found that when such a roll is provided, with an indented or knurled surface, it tends to prevent the formation of surface tension ridges in the applied coating. In Figure 3 there is shown a desirable form of roll surface which is indented or knurled to provide a uniform design having indentations or intaglio formations staggered with respect to perpendicular planes parallel to the machine direction so as to avoid the surface tension ridges referred to, in the film or coating of the coating material which is carried downwardly by the descending surface of the upper press roll 26. However, heavier coatings and coatings of greater uniformity may be obtained by employing a smooth surfaced roller for metering and applying the coating material to the press roll followed by a nip roll 30 with an indented surface as described. The present invention also contemplates that the nip roll 30 may be cloth-jacketed to produce a similar effect. In this arrangement the smooth surfaced applicator roll serves mainly to meter or volumetrically measure the film that is applied to the descending surface of the upper press roll. Final distribution of the film of coating material applied to the roll 26 is effected by the nip roll 30 which has the indented or intaglio surface previously described, or, as suggested, the nip roll 30 may be cloth jacketed. The metering and distributing action of the applicator roll or rolls is further supplemented by the redistribution of the coating which occurs in the nip of the press rolls, but there is a limit as to the magnitude of irregularity that can be corrected by the press rolls. There are some coatings, however, with characteristics so favorable that the redistribution in the nip of the press rolls is sufficient to meet commercial requirements.

In the nip of the press rolls the web is pressed against the coating which is present as a film on the smooth roll surface of one of the press rolls, and since the felt is on the opposite surface of the web as it passes through the nip, the web is not crushed as it would be if the felt were not used, and, furthermore, adhesion of the coated surface of the web to the smooth, bare surface of the upper press roll is so reduced that the web can be conducted therefrom without stretching or distortion, and safer operation results even though the web is lighter weight than is possible to coat in a nip without the felt.

Another advantage of the present invention is that there is little if any loss of pigment, all of it being retained in the web. This is a substantial advantage when using expensive pigment such as titanium dioxide.

Where the coating is applied to the web, and the web contains fifty per cent of moisture, the water of the coating suspension and the water

on the web commingle and are removed together. This results in a better and more uniform penetration of the coating material and an effective bonding of the material with the fibres of the web.

While the application of the coating to a wet web is of substantial advantage, certain features of the invention, such as the metering and applicator rolls, may be advantageously employed to coat a web that has been dried or partially dried.

The form of the invention shown in Figure 2 is similar to that shown in Figure 1, but in this form of the invention the felt 27 for supporting the web 10 at the point of application of a coating thereto is omitted as this type of construction is adapted for use on a board machine or a machine making heavy papers without a felt. This apparatus is also suitable for applying coating or sizing to a dry or partially dry sheet of paper since such a sheet of paper has a greater amount of strength than one which has a high moisture content.

This apparatus is operable on the wet end of a paper machine as well as after drying has taken place, and has therefore particular use for applying initial or priming applications to be followed by subsequent applications of the same or different color or coating to produce better or cheaper results.

The method embodying the present invention in its broadest aspects resides in applying a metered film of liquid coating material to one of a pair of cooperable rolls through which the paper to be coated is passed, and then transferring the film from the bare surface of said roll to a surface of the web of paper in the nip of the rolls.

Where the web is wet, and is of low strength or of light weight, the transfer of the film from the roll to the web must be somewhat varied in that the film is not only transferred in the nip between the pair of rolls but it is applied to the web while the web is supported by the felt.

Then, again, when the nature of the operation or of the coating material makes it advisable, the application of the film to one of the rolls is modified, in that the film must be so worked as to preclude the formation of surface tension ridges. This may be accomplished by roughening or indenting either the metering roller in the manner described, or by providing in addition to the metering roller the second distributing roller. From the method aspect of the case, therefore, this type of operation involves applying a measured or metered film to one of a pair of rolls and treating the film to avoid surface tension ridges.

Finally, it should be noted that the invention, as disclosed herein, in any of its aspects may be used to coat either one or both sides of a web of paper, the operation merely being repeated where both the top and wire sides are to be coated.

It is to be understood that the particular examples indicated above are illustrative rather than restrictive and that various changes may be made without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. An apparatus for coating paper comprising a pair of rolls, a metering roll cooperable with the descending side of the upper of said pair of rolls, means for supplying liquid coating material to the nip between the metering roll and the upper of said rolls, whereby a measured film of liquid coating material is applied to the descend-

ing side of the upper of said rolls and a distributing roll also cooperable with the descending side of the upper of said rolls below the metering roll, the periphery of the distributing roll having a multiplicity of indentations of uniform design with the indentations staggered with respect to perpendicular planes parallel to the machine direction so as to avoid surface tension ridges in the film of coating carried by the descending side of the upper of said pair of rolls.

2. An apparatus for coating paper comprising a pair of rolls between which a web of paper to be coated is passed, means for applying a measured film of liquid coating material to the surface of one of said rolls, and a distributing roll in cooperative relation to said roll and disposed to roll upon the film deposited thereon, the periphery of the distributing roll having a multiplicity of indentations defining a substantially uniform design with the indentations lying in adjacent planes perpendicular to the roll surface and parallel to the machine direction being staggered with respect to each other so as to break up surface tension ridges in the film prior to transfer thereof to said paper.

3. Coating apparatus comprising a pair of cooperable rolls revolving in contact with a web of paper, means for applying a measured film of a liquid suspension of the coating material upon the surface of one of said rolls, and means for thereafter and prior to transfer of the film from said roll to the paper working the film to remove surface tension ridges therefrom, said means

comprising a cloth jacketed roll engaging and rotating in contact with said film.

4. Coating apparatus comprising a pair of cooperable rolls revolving in contact with a web of paper, a smooth surfaced metering roll for applying a measured film of liquid coating upon the surface of one of said rolls, and a cloth covered roll following the metering roll engaging the film on said first named roll for breaking up surface tension ridges therein prior to transfer to the paper.

5. A paper making machine including a press section having a press made up of a pair of rolls through the nip of which a web of paper is adapted to pass, a smooth surfaced metering roll cooperable with one of said press rolls, means for supplying liquid coating material to the nip between the metering roll and said press roll whereby a measured film of liquid coating material is applied to the latter, and a distributing roll having an intaglio surface disposed between said metering roll and the press roll nip the said intaglio surface being provided with a multiplicity of spaced indentations defining a substantially uniform surface pattern with the indentations of axially adjacent portions of said pattern parallel to the direction of machine travel, staggered with respect to each other and cooperable with the film bearing press roll to work the film and free the same of surface tension ridges formed therein by the metering.

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