

Sept. 7, 1943.

A. W. BUCK ET AL

2,329,034

APPARATUS FOR COATING PAPER

Filed Jan. 15, 1941

2 Sheets-Sheet 1

Fig. 1,
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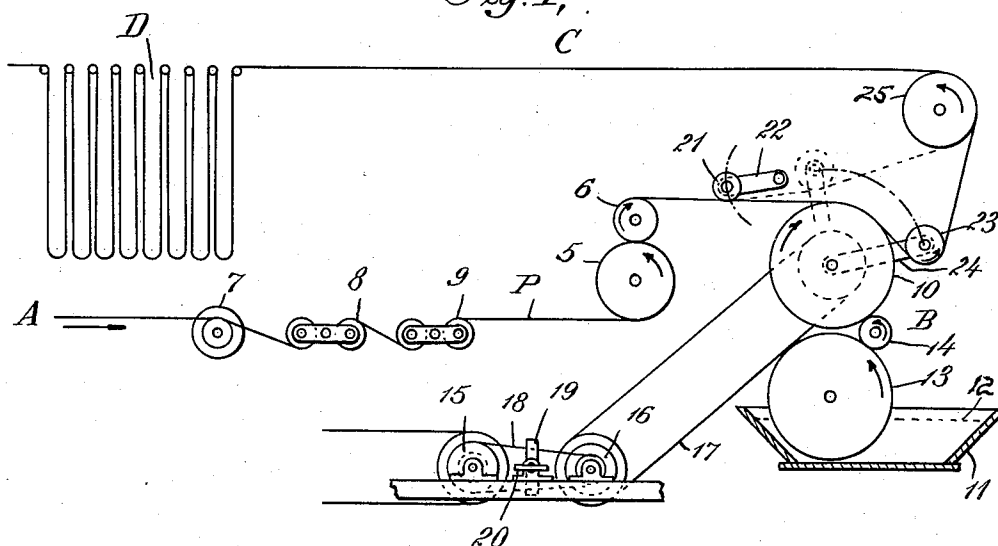
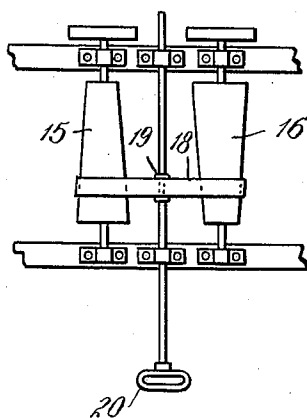


Fig. 2,



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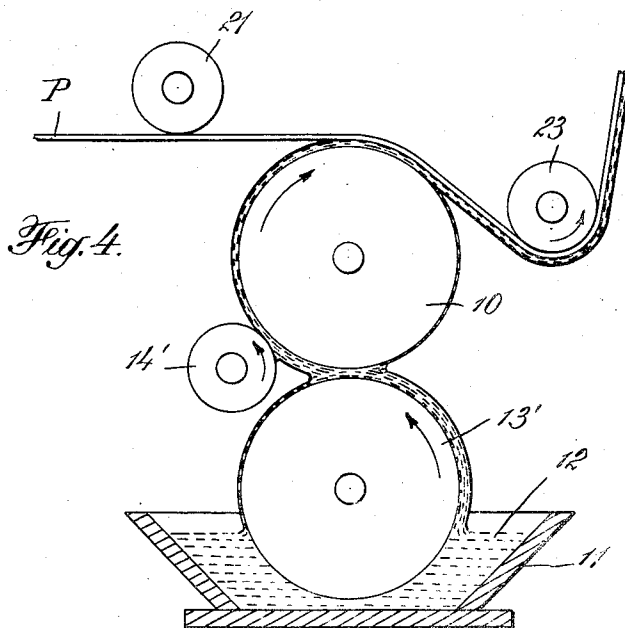
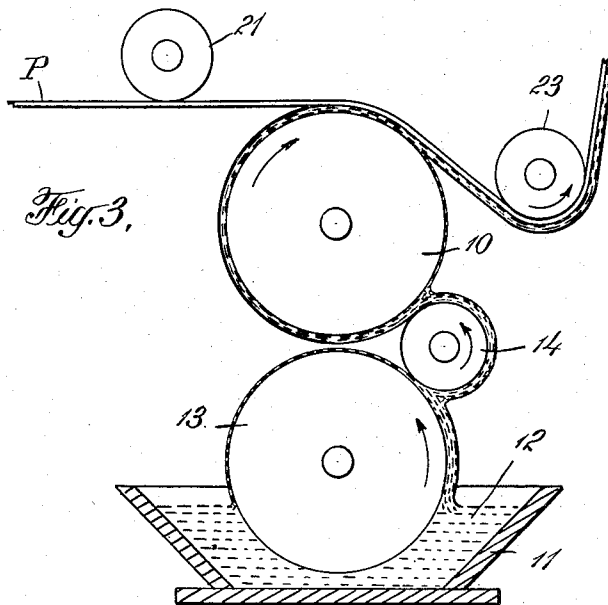
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UNITED STATES PATENT OFFICE

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APPARATUS FOR COATING PAPER

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Application January 15, 1941, Serial No. 374,480

4 Claims. (Cl. 91—50)

This invention relates to the coating of paper and the like, and has for its object the provision of certain improvements in an apparatus for coating paper. More particularly, the invention contemplates an improved apparatus for accurately applying and controlling the application of a reliable, definite and consistently uniform quantity of any kind of liquid coating material to a continuously traveling sheet or web of paper or the like. Throughout this specification and the appended claims, the invention is described and defined as applied to the coating of paper, but paper is to be understood as generically representative of any equivalent material in sheet or web form, such as fabric, cloth, wallpaper, etc.

Paper has heretofore been commonly coated by passing it between two cylindrical rolls, one of which (the applicator roll) applies the coating material to the adjacent contacting side of the paper while the other acts as a platen roll. The path of travel of the paper is substantially tangential to the surface of the applicator roll, and consequently the traveling paper and coating material have only a "line" contact. The peripheral speed of the applicator roll is usually the same as the speed of travel of the paper, but sometimes is faster or slower. When a web of paper is drawn between two such rolls, the quantity of coating material it receives depends directly upon the clearance or gap between the rolls and varies directly with the variation in the thickness of the web passing between them. Accordingly, in order to control the quantity of coating material applied to the paper the clearance between the two rolls is changed, an inconvenient and frequently difficult manipulation. Moreover, variations in the thickness of the paper causes objectionable variations in the thickness of the applied coating material. Another disadvantage of the operation is that, due to the weave of the web passing between the two rolls, coating material becomes deposited between the platen roll and the edges of the uncoated side of the web. Coating material is thus not only applied to the edges of the uncoated side of the web, but the deposited coating material gradually builds up on the platen roll by drying, and reduces the amount of clearance between the two rolls at the edges of the web resulting in what is known in the art as "bare-edges." This condition can be avoided by washing and doctoring each successive turn of the platen roll, but the disadvantages of this procedure are obvious.

The apparatus of the invention overcomes the afore-noted disadvantages of the heretofore commonly used roll type of coating apparatus, and in addition possesses several advantageous and desirable features. In accordance with the invention the paper is moved or drawn over a rotating transfer cylinder or applicator roll in in-

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timate contact with coating material on the surface thereof, and the cylinder or roll is rotated at a peripheral speed substantially less than the speed of travel of the paper. Preferably, the paper is maintained in contact with the coating material over a substantial arc of the surface of the transfer cylinder. Suitable means are provided for applying to the surface of the transfer cylinder a predetermined and uniform quantity of the coating material. The apparatus may advantageously be provided with a pivotally mounted roll adapted to rest transversely on and to apply a uniform tension across the width of the paper as it moves into contact with the layer of coating material on the transfer cylinder, to compensate for any variation in the uniformity of the web of paper such as warping of the web or slack edge. By varying the relative speed of the surface of the transfer cylinder with respect to the speed of travel of the paper, the quantity of coating material applied to the paper can be varied at will over a wide practical range, without upsetting the adjustment which determines the uniformity of the thickness of the coating material across the width of the transfer cylinder or the width of the paper web to which it is applied. The degree of the arc of contact which the paper makes with the coating material on the transfer cylinder may be changed if desired. The transfer cylinder preferably receives the coating material from one roll or a train of rolls feeding from a pan or reservoir or other suitable source of the fluid coating material. The thickness and uniformity of thickness of the coating material transferred onto the transfer cylinder may advantageously be determined by a doctor blade, or a doctor roll, which may, if desired, be one of the coating material conveying or transfer rolls. After the application to the paper of the coating material, the coated paper may pass through one or more finishing stages to smooth out the coated surface.

The invention will be better understood from the following description taken in conjunction with the accompanying drawings, in which

Fig. 1 diagrammatically illustrates a paper coating apparatus embodying the invention;

Fig. 2 is a plan view of the variable speed cone drive for the transfer cylinder of the apparatus;

Fig. 3 is an enlarged fragmentary view of the paper coating portion of the apparatus, and

Fig. 4 illustrates a slight modification in the paper coating portion of the apparatus.

Referring to the drawings, there is illustrated a continuously travelling sheet or web of paper P, supplied from any suitable source, such as a reel or "rolling-out" stand, designated generally by A. The paper is drawn through the paper coating portion B of the apparatus, and is then passed through an after-treatment stage C,

where any suitable means of finishing the coating takes place, such as brush finishing, roller finishing, air brush finishing or the like. The paper then passes onto a conventional festooning and drying arrangement D.

The paper is drawn from the supply source A by a pair of feed rolls 5 and 6, which maintain a uniform rate of feed of the paper to the paper coating portion B. As the paper leaves the source A, it is centered by a pair of guide flanges 7, and then passes over tensioning rolls 8 and 9, for imparting sufficient tension to the paper to hold it flat against and around the feed rolls 5 and 6.

The paper coating portion B of the apparatus comprises a rotatable transfer cylinder or applicator roll 10. A pan or trough 11 (see Fig. 3) holds a reservoir 12 of the fluid coating material. A rotating feed roll 13 dips into the reservoir 12 and transfers a surplus of the coating material to a rotatable doctor roll 14. The doctor roll 14 transfers a definite and consistently uniform thickness of the coating material from the feed roll to the surface of the transfer cylinder 10. The surfaces of the feed and doctor rolls are substantially in contact, while the doctor roll and transfer cylinder are separated by a predetermined gap or clearance capable of close adjustment and control. The thickness of coating material transferred to the cylinder 10 is determined by the gap or clearance between the cylinder 10 and the doctor roll 14. This gap or clearance is fixed with respect to any one type of coating material, and may be varied, if desired or required, to meet the various inherent characteristics of the many types and varieties of coating materials adapted to be used in the practice of the invention.

The transfer cylinder 10 rotates in the same direction as the travel of the paper, but at a peripheral speed substantially less than the speed of travel of the paper. The quantity of coating material applied to the paper is dependent upon the relative speeds of the transfer cylinder 10 and the paper, the faster the peripheral speed of the cylinder at any uniform and predetermined speed of travel of the paper the greater will be the amount of coating material applied to the paper. Thus, by varying the relative speeds of the transfer cylinder 10 and the paper, the quantity of coating material applied to the paper can be varied over a wide range. To this end, it is advantageous to provide suitable adjustment of the peripheral speed of the cylinder from about 0.1 to 0.9 the speed at which the paper is fed over the cylinder. In the apparatus of the drawings, this is accomplished by a pair of cones 15 and 16, one of which (15) is driven at constant speed by any suitable source of power (not shown), while the other (16) drives the cylinder 10 by a belt 17. The cones are operatively connected by a belt 18 passing over a movable flanged guide 19 having a cooperating handle 20. The handle 20 serves to move the guide 19 and hence the belt 18 across the faces of the two cones 15 and 16 and in this way varies the relative speeds of the two cones, and hence the peripheral speed of the cylinder 10. Any other suitable variable speed arrangement may be used to drive the transfer cylinder 10.

The paper is fed over a substantial arc of the surface of the transfer cylinder 10. In order to compensate for and take up the slack that may be present in an uneven web of paper, an idler roll 21 is provided. The roll 21 is carried at

the ends of two pivoted arms 22 and is thus free to move through the arc shown. By riding on the paper and conforming to any irregularity of the paper, the roll 21 applies a uniform tension on the paper throughout its width as the paper passes over the arc of contact with the layer of coating material on the transfer cylinder 10.

The degree of the arc of contact between the paper and the transfer cylinder 10 is determined by an adjustable contact roll 23, carried at the ends of two arms 24 pivotally mounted along the axis of the transfer cylinder. This roll determines the amount of "troweling" that the coating material receives as it is being applied to the web of paper. This is accomplished by adjusting the roll to regulate the amount of contact or wrap of the paper on or around the transfer cylinder 10. As illustrated in the drawings, the arc of contact between the paper and the transfer cylinder is about 35-40°. Ordinarily, the arc of contact should be at least 10° and may be enlarged to 45° or even more if desired.

The roll 23 can be swung up and above the transfer cylinder 10, to the dotted line position shown in Fig. 1, whereby the paper is raised out of contact with the transfer cylinder. When the apparatus is stopped, it is particularly desirable to raise the roll 23 to its uppermost position, in order to prevent sticking of the paper to the transfer cylinder by drying on it.

After passing around the contact roll 23, the paper passes over a driven roll 25 whose surface travels at a peripheral speed greater than that of the travel of the paper and whose purpose is to provide tension on the paper as it passes over the transfer cylinder 10. From the contact roll 25, the paper passes through the after-treatment stage C onto the festooned drying rack D.

Fig. 4 of the drawings illustrates a slightly modified arrangement of the means for applying to the surface of the transfer cylinder a predetermined and uniform quantity of the coating material. In the arrangement of Fig. 4, the rotating feed roll 13' transfers a surplus of the coating material directly onto the transfer cylinder 10. The doctor roll 14' removes the surplus of the coating material to leave on the surface of the transfer cylinder the desired predetermined and uniform layer or film of coating material. What is herein said with respect to the gap or clearance between the transfer cylinder 10 and the doctor roll 14 applies equally to the gap or clearance between the transfer cylinder and the doctor roll 14' in Fig. 4. In some cases the doctor roll may be dispensed with by bringing the feed roll 12 into closer proximity to the transfer cylinder 10 and by providing means for adjusting the gap or clearance between the transfer cylinder and the feed roll as herein described in connection with the gap or clearance between the transfer cylinder and the doctor roll.

In the operation of the apparatus, the paper is fed by the rolls 5 and 6 at a uniform speed over the predetermined arc of contact of the surface of the transfer cylinder 10 and in intimate contact with the layer of coating material thereon. Suitable tension is given the paper as it passes over the transfer cylinder by the roll 25 driven at a peripheral speed greater than the speed of travel of the paper. The coating material is picked up from the reservoir 12 onto the feed roll 13 and transferred therefrom onto the doctor roll 14. The peripheral speeds of the rolls 13 and 14 are constant relative to the speed

of travel of the paper. This insures a surplus of coating material available for transfer to the cylinder 10 at all production speeds. The gap or clearance between the transfer cylinder 10 and the doctor roll 14 is uniform across the face of the rolls and remains fixed for any one type of coating material. However, the clearance between the cylinder 10 and roll 14 may be adjusted when desired or necessary to meet the various characteristics inherent to the many varieties of coating materials that might be used. Micrometer adjustment of the clearance between the cylinder 10 and the doctor roll 14 determines the uniform thickness of the film of coating material transferred onto the surface of the cylinder 10 and controls the uniformity of the thickness of coating material across the entire surface of the cylinder. The amount of coating material applied by the transfer cylinder 10 to the web of paper is directly determined by varying the peripheral speed of the surface of the cylinder 10 with respect to the speed at which the web of paper is fed to the cylinder by the rolls 5 and 6. This variation in speed of the transfer cylinder 10 is effected by manipulation of the handle 20 of the variable speed cone-drive, as hereinbefore explained.

The paper to be coated makes a substantial arc of contact with the layer or film of coating material on the transfer cylinder. The transfer cylinder may be driven at a peripheral speed of from 10% to 90% of the speed of travel of the paper, depending upon the amount of coating material which it is desired to apply to the paper. The quantity of coating material applied to the transfer cylinder is controlled by the doctor roll 14. By avoiding an excess of coating material in contact with the paper, the possibility of getting coating material on the back edges of the paper is substantially eliminated. In addition to the difficulties hereinbefore mentioned, coating material on the back edges of the paper causes trouble in making rolls of paper and in embossing paper.

Other advantages of the apparatus of the invention may be briefly summarized as follows: The possible range in the quantity or weight of coating material applied to the paper is so great that it is rarely necessary to change the setting of the doctor roll. Changes in the quantity of coating material applied to the paper can be made simply and quickly, by varying the speed of the transfer cylinder 10, without upsetting the balance of coating on opposite edges of the paper web. The apparatus, when once adjusted, continues to deliver a definite and consistently uniform quantity of coating material to the web of paper. The apparatus can be washed up and prepared for another color of coating material, or another type of coating material, very easily and quickly. No coating material is applied to the edges of the uncoated side of the paper to cause trouble in later processing steps. The coating of the paper is so uniformly distributed that a minimum of smoothing is necessary to produce an excellent final coating.

The aforementioned advantages of the invention are particularly important in the manufacture of wallpaper, where the opposite edges of the paper must match, and paper made at the beginning of a run must match that made at the end of a run, and changes in the applied quantity and color of the coating material are usual with each new run.

We claim:

1. An apparatus for coating paper and the like which comprises a rotatable transfer cylinder for applying a coating material to the paper, means for applying to the surface of the transfer cylinder a predetermined and uniform quantity of the coating material, means for drawing the paper under tension over a substantial area of the transfer cylinder in intimate contact with the coating material on the surface thereof, means for applying a uniform tension across the width of the paper as it moves into contact with the coating material, means for adjusting the arc of contact between the paper and the coating material on the transfer cylinder to from 10° to about 45°, and means for rotating the transfer cylinder in the same direction as the travel of the paper and at a peripheral speed substantially less than the speed of travel of the paper.

2. An apparatus for coating paper and the like which comprises a rotatable transfer cylinder for applying a coating material to the paper, means for applying to the surface of the transfer cylinder a predetermined and uniform quantity of the coating material, means for drawing the paper under tension over a substantial arc of the surface of the transfer cylinder and in intimate contact with the coating material thereon, a roller in pressed engagement with the paper which is positioned just ahead of the transfer cylinder for applying a uniform tension across the width of the paper as it moves into contact with the coating material, a second roller in adjustable pressing engagement with the paper positioned after the transfer cylinder to vary the arc of contact of the paper with the coating material, and means for rotating the transfer cylinder in the same direction as the travel of the paper and at a peripheral speed substantially less than the speed of travel of the paper.

3. An apparatus for coating paper and the like which comprises a rotatable transfer cylinder for applying a coating material to the paper, means for applying to the surface of the transfer cylinder a predetermined and uniform quantity of the coating material, means for drawing the paper under tension over a substantial arc of the surface of the transfer cylinder and in intimate contact with the coating material thereon, means whereby the arc of contact of the paper with the coating material on the transfer cylinder may be varied, and means for rotating the transfer cylinder in the same direction as the travel of the paper and at a peripheral speed substantially less than the speed of travel of the paper.

4. An apparatus for coating paper and the like which comprises a rotatable transfer cylinder for applying a coating material to the paper, means for applying the coating material to the surface of the transfer cylinder, means for drawing the paper under tension over a substantial arc of the surface of the transfer cylinder and in intimate contact with the coating material thereon, said arc being at least 10°, means for adjusting the arc of contact between the paper and the transfer cylinder, and means for rotating the transfer cylinder in the same direction as the travel of the paper and at a peripheral speed substantially less than the speed of travel of the paper.

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CERTIFICATE OF CORRECTION.

Patent No. 2,329,034.

September 7, 1943.

ASHLEY WALLACE BUCK, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 8, for "area" read --arc--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of October, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.