April 27, 1954 W. J. MONTGOMERY ET AL 2,676,563

APPARATUS FOR COATING PAPER

Filed Feb. 5, 1949 3 Sheets-Sheet 1

Fig. 1

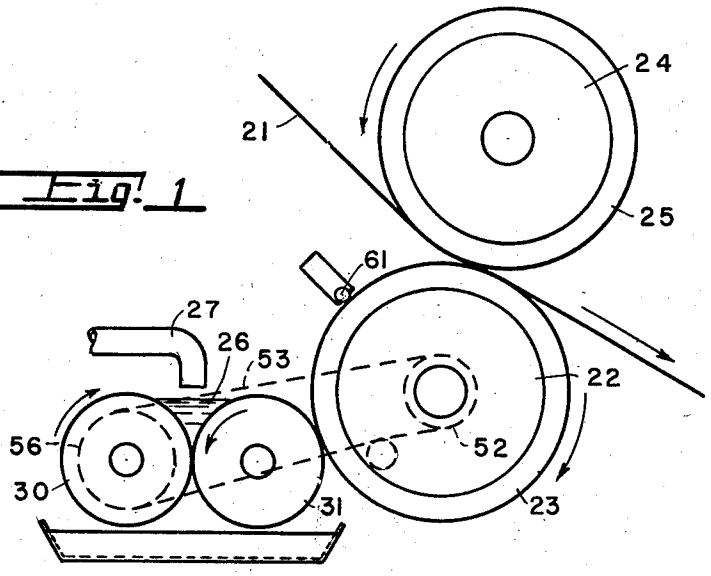
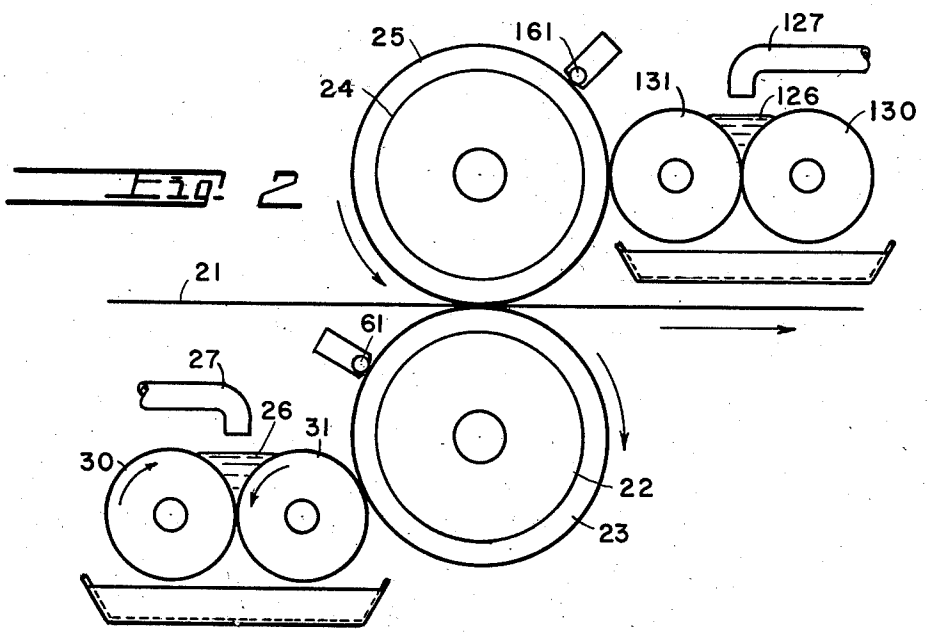


Fig. 2



INVENTORS
William J. Montgomery
BY William P. Taylor
Frederick P. L. Boyce
ATTORNEY

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Filed Feb. 5, 1949 3 Sheets-Sheet 2

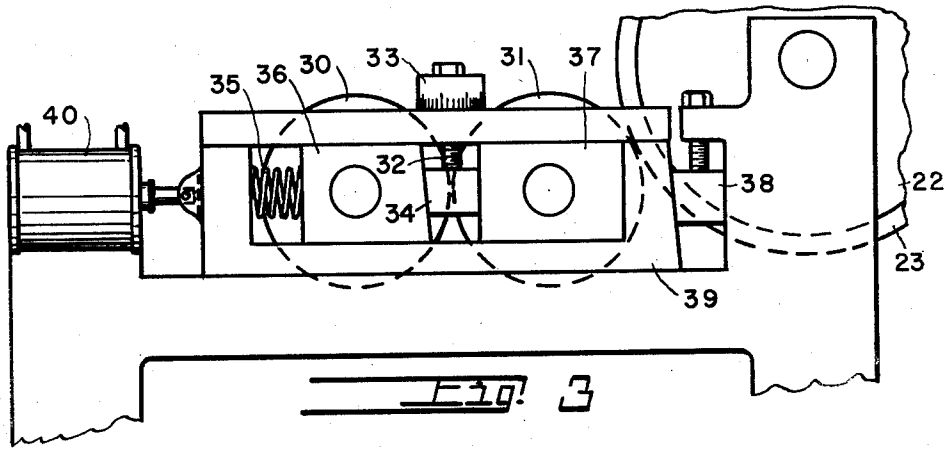


Fig. 3

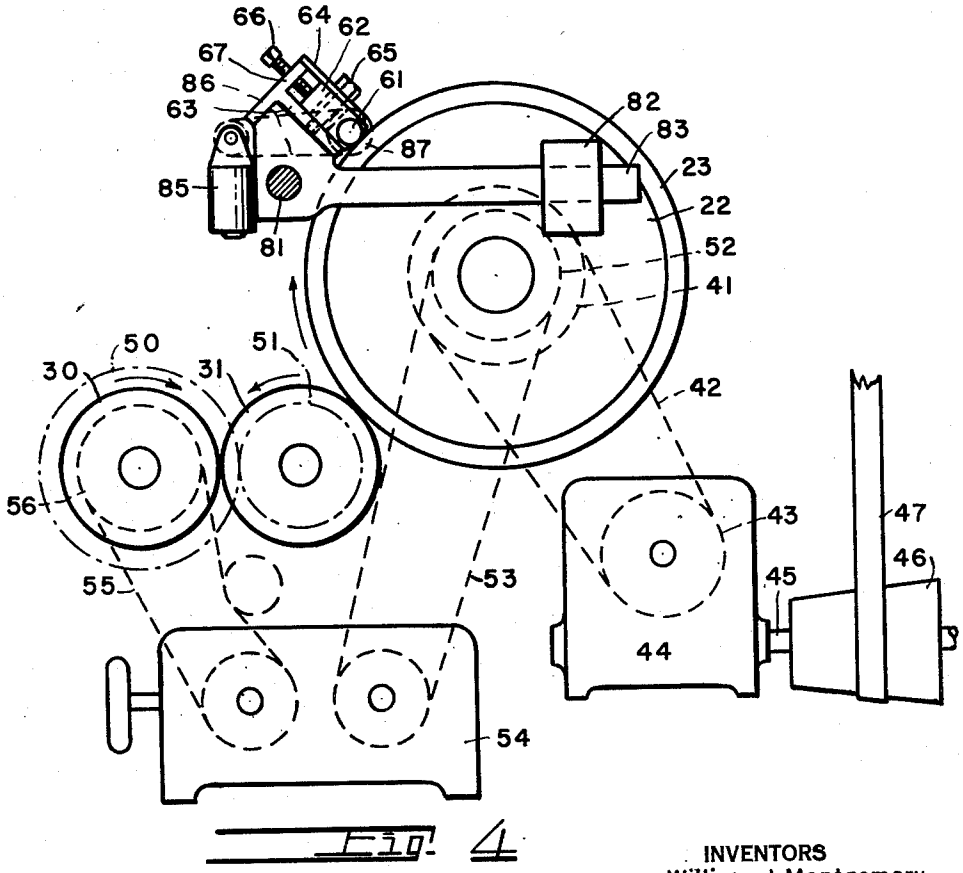


Fig. 4

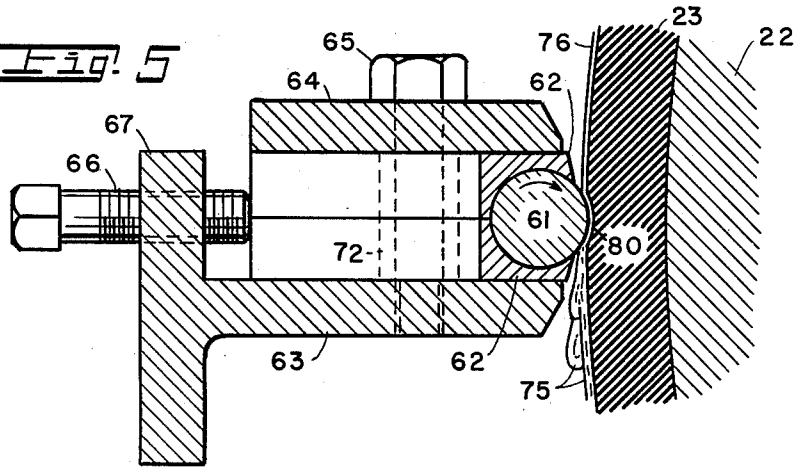
INVENTORS
William J. Montgomery
BY William P. Taylor
Frederick L. Borgia
ATTORNEY

April 27, 1954 W. J. MONTGOMERY ET AL 2,676,563

APPARATUS FOR COATING PAPER

Filed Feb. 5, 1949 3 Sheets-Sheet 3

Fig. 5



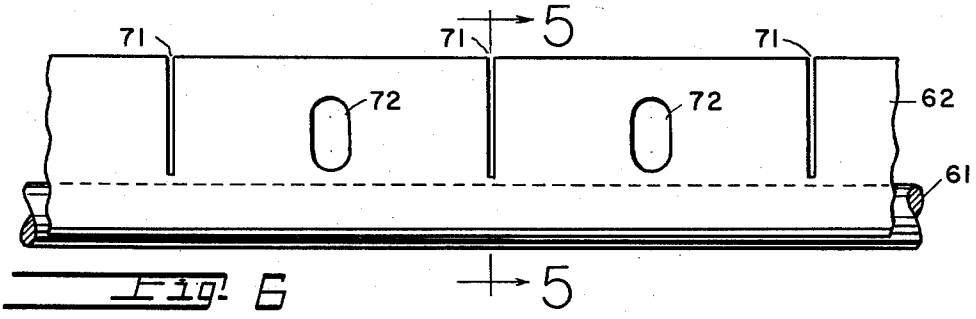


Fig. 6

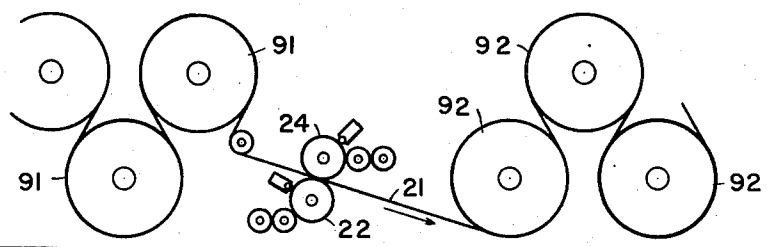


Fig. 7

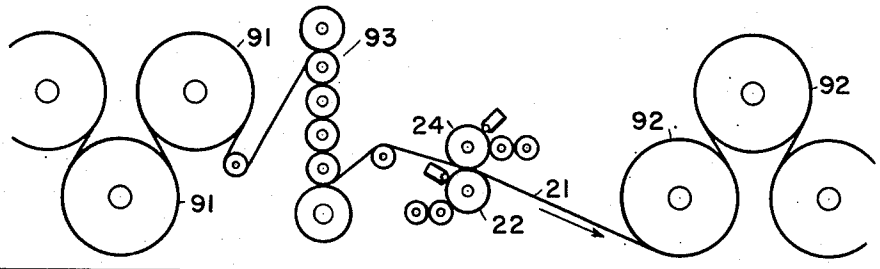


Fig. 8

INVENTORS
William J. Montgomery
BY William P. Taylor
Frederick G. L. Boyce
ATTORNEY

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UNITED STATES PATENT OFFICE

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APPARATUS FOR COATING PAPER

William J. Montgomery and William P. Taylor, Hamilton, Ohio, assignors to The Champion Paper and Fibre Company, Hamilton, Ohio, a corporation of Ohio

Application February 5, 1949, Serial No. 74,766

8 Claims. (Cl. 118—227)

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The present invention relates to apparatus for coating paper.

In recent years a considerable proportion of the paper made for printing purposes has been coated with some composition of pigment and adhesive in order to give the paper an improved printing surface. Such coatings have commonly been applied to paper for this purpose, by one or the other of two well-known processes. In one of these processes the coating material is applied to the surface of the paper web and is then spread or smoothed into a smooth-surfaced layer of the required dry weight by any of a variety of instrumentalities such as brushes, rollers, air jets, etc., the smoothing and/or spreading action being in some cases accompanied by removal of surplus coating material which in those cases is applied to the paper in excess of the amount required to give a layer of the desired dry weight. The coated paper is then dried and calendered in a customary manner.

In the other of these well-known processes, a layer of coating material is formed on the surface of an applicator roll and is then transferred to the surface of a travelling paper web as a layer of the same dry weight and the same degree of uniformity found in the coating on the finished paper. The coated paper is then dried without any smoothing operation, without removal of any of the applied coating, and without any other treatment carried out subsequent to application of the coating to the surface of the paper.

This second-named process, as commonly used, is roughly analogous to that by which ink is fed, distributed and printed onto a paper web by a rotary press when printing a solid color. In this process, coating material, usually having a solids content of about fifty per cent, is fed by a suitable fountain, in the exact amount to be applied to the paper, to a series of distributor rolls and by them is worked out and applied as a thin film to an applicator which in turn transfers or "prints" this film onto the surface of the paper.

One object of the present invention is to provide in said second-named process, improvements in apparatus which shall make possible successful use of a wide variety of coating compositions comprising pigment and adhesive, and which shall largely counteract the strong tendency of certain types of coating compositions to form ridges or stipples in the coated surface of the paper, when applied thereto by said process. Another object of the invention is to provide

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apparatus in which bits of coating material and/or foreign matter shall be prevented from being carried around on the surface of the applicator roll to leave recurrent defects in the coated surface of the paper. Still another object is the provision of means and methods for accurately controlling and maintaining the thickness of the coating film at all points across the width of the web. A related object is the provision of such means which shall be independent of any sagging of, or crown or other variations in diameter of, any of the rolls used. A further object is the provision of a method and an apparatus adapted to apply coating compositions of higher solids content and/or higher viscosity than customarily used. A still further object is the simplification of apparatus over those previously available for the application to a moving paper web of a preformed film of coating comprising pigment and adhesive. Other objects and advantages of the invention will be apparent from the following more detailed description.

The present invention involves the use of novel means in order to form on the surface of an applicator roll for transfer to the paper web, a film of coating material of accurately controlled thickness throughout, and substantially free from ridges, stipples, and the like.

In accordance with the present invention and in contrast to the prior art, no attempt is made either to apply the coating material to the applicator roll in the exact amount required for transfer to the paper or to apply it as a uniformly thick or smooth surfaced film. Instead, it is applied in excess and without regard for uniformity or smoothness of application, directly to the surface of the applicator roll. The surplus coating material, over and above that required for application of the desired amount to the paper web, is then removed from the surface of the applicator roll and the residual film of coating material is smoothed out into a condition of substantially uniform thickness and freedom from ridges, stipples, and the like, by a backward wiping action. We have now discovered that, by carrying out this wiping action as hereinafter described, we are able to dislodge and remove from the surface of the applicator roll any adherent bits of coating material or foreign matter before they have opportunity to leave recurrent marks on the coated surface of the paper. By this same wiping action we are also able to prevent accumulation of coating material on the roll beyond the edges of the web, where

it is not continuously carried away by the paper.

The preferred instrumentality for accomplishing this wiping action is a rotating doctor which is pressed firmly and uniformly against the rubber or rubber-like surface of the applicator roll. This doctor, particularly when rotating counter-directionally, is preferably wiped at each revolution, thereby preventing coating material removed from the surface of the applicator roll from being carried around the doctor and redeposited on the surface of the applicator. We have found that we can substantially eliminate all visible ridges, stipples, etc. from the coating film by making the rotating doctor of small diameter, but that when such a small diameter rotating doctor is of any substantial length it can only be made effective to leave a film of uniform thickness on the applicator roll by supporting it throughout its working length, against deflection. A support for this purpose, if of suitable form, will, we find, also serve to accomplish the above-described wiping of the doctor at each revolution thereof.

The means for applying the excess of coating material to the surface of the applicator roll can be varied as desired and in accordance with the type of coating composition to be applied. The means which is adaptable to a wider variety of coating compositions than any other we have tried, comprises two rolls closely spaced in a predominantly horizontal direction so that a pool of coating material can be maintained in the nip between them, one of said rolls being substantially in contact with the applicator roll. Said rolls are advantageously rotated at speeds differentially controlled in such manner that there is a continuous more or less violent agitation of the coating material in the nip, and that the one roll continuously withdraws a metered excess of coating material from the pool and transfers it to the surface of the applicator roll.

One embodiment of the invention will be further described with reference to the accompanying drawing, in which:

Figure 1 is a diagrammatic elevational view of a coating device for applying coating material to one side of a paper web in accordance with the present invention.

Figure 2 is a similar diagrammatic view of a coating device for applying coating material simultaneously to both sides of a paper web, in accordance with the present invention.

Figure 3 is a detail showing means of adjusting the fountain rolls.

Figure 4 is a diagrammatic view showing means for rotating the rolls and for mounting and driving the rotating doctor.

Figure 5 is a detail view to a considerably larger scale, showing, in section partly taken on line 5—5 of Figure 6, the rotating doctor, the supporting and adjusting devices therefor, and the relationship of the doctor to the surface of the applicator roll.

Figure 6 is a fragmentary detail showing a portion of the rotating doctor and its flexible support.

Figures 7 and 8 are diagrammatic views to a much smaller scale, showing the application of coating in accordance with the present invention as a part of the papermaking operation on the paper machine.

One illustrative embodiment of the present invention is shown in Figure 1 in which the paper web 21 is moving in the direction indicated by the arrow and is passing, and being lightly and advantageously adjustably pressed, between the applicator roll 22 with its surface layer 23 of semi-soft rubber or rubber-like material and the backing roll 24, which may if desired be provided with a similar surface layer 25. The most advantageous hardness of surface layer 23 has in general been found between densities of about 60 and 150 as measured by the Pusey and Jones plastometer (using a ⅛ inch ball), and has more frequently been found between 100 and 120 on the same scale.

A pool 26 of coating material, supplied through a pipe 27, is maintained in the nip between rolls 30 and 31 which rotate at controlled differential speeds in the directions indicated by arrows in the drawing. If needed to prevent the coating in pool 26 from overflowing at the ends of the rolls, end dams (not shown) of any suitable type may be provided, as is well understood in the art. These rolls are spaced closely together and the spacing between them is regulated to control the amount of coating material carried through the nip by each revolution of roll 31 for transfer to applicator roll 22. This regulation of the spacing may be accomplished, as illustrated in Figure 3, by means of a screw 32 at each end of rolls 30, 31, which may if desired be provided with a micrometer dial 33. Each screw 32 serves to adjust the position of a wedge 34 between bearing blocks 36 and 37 in which are journaled rolls 30 and 31 respectively. A spring 35 serves to hold bearing block 36 against wedge 34 and thus maintain the width of nip between rolls 30 and 31 at the setting for which it is adjusted. Spring 35 also serves as a safety device to prevent damage in case some foreign object should get between the rolls.

Roll 31 is herein described as being "substantially in contact" with the rubber or rubber-like surface 23 of applicator roll 22. This term is used in the present specification and claims to define the degree of contact required to pass through the nip and apply to the surface 23 of roll 22, the desired excess of coating material. The degree of contact required for this purpose depends on a number of factors such as the amount of coating material to be transferred, the viscosity and flow properties of the specific coating material being applied, the hardness or softness of the rubber-like cover 23, the relative and absolute speeds of the rolls, etc. It may vary from a slight positive spacing or clearance to a slight negative spacing such that the metallic roll 31 slightly indents the yielding resilient surface of the cover 23 on roll 22. An adjustable degree of contact between rolls 22 and 31 is accordingly advantageous as is also the ability to remove roll 31 from contact with roll 22 when desired. The adjustment may be made by an adjustable wedge 38 at each side of the machine, in the manner described for adjusting the spacing between rolls 30 and 31. The fountain roll-carrying structure 39 is illustrated in Figure 3 as held against wedge 38 or withdrawn therefrom to separate rolls 31 and 22 by any suitable means such as hydraulic cylinder 40. In practice it is not necessary to know whether there is positive clearance, contact without pressure, or a definite indentation of rubber surface 23 by the roll 31. It is only necessary to see that wedges 38 are so adjusted that roll 31 completely covers the surface 23 of roll 22 with the coating composition and leaves on it an amount such that there is, at all points across the width of surface 23 and at all times, a definite excess to be wiped back to leave on surface 23 a continuous uniform smooth film of the exact

thickness required for transfer of the specified dry weight of coating to the surface of the paper web.

Means by which rolls 22, 30, and 31 may be driven is illustrated more particularly in Figure 4. The roll 22 is driven at a surface speed substantially equal to paper speed (which may vary in different machines from less than 100 to more than 1000 feet per minute) by any suitable means such as a sprocket 41, chain 42, and sprocket 43, which may be on the output shaft of a speed reducer 44, the input shaft 45 of which is driven at a speed which advantageously may be adjusted slightly with reference to the speed of the paper in order to properly synchronize the surface speed of roll 22 with the speed of the paper web, as is customary between different elements in papermaking machines. This slight speed adjustment may be accomplished in any manner desired, as for example by the conventional cone pulley 46 and belt 47 which is driven from another cone pulley (not shown) which may be on the main drive shaft of the machine.

The rolls 30 and 31 are advantageously geared together, as by gears 50 and 51, in any desired speed ratio, as for example 1 to 2, or 2 to 3. Roll 30 may be conveniently driven from roll 22 by any suitable means such as sprocket 52, chain 53, variable speed device 54, chain 55, and sprocket 56. In cases where speed adjustment between rolls 22 and 31 is not desired, the variable speed device 54 may be omitted and chain 53 passed directly from sprocket 52 to sprocket 56 as indicated in Figure 1. The actual speeds of these rolls do not appear to be critical, but permit of wide variation. We have, for example, successfully used a surface speed equal to paper speed, for roll 22; two-thirds of this speed for roll 31; and from one-third to one-half paper speed for roll 30.

The surface speed of roll 22 should be substantially the same as the paper speed. It may be observed, however, that due to a slight deformation of the rubber covering 23 by contact with roll 24 and a consequent indeterminate elongation of the surface of roll 22 where it is in contact with the paper web 21, the actual exact surface speed at that point is unknown. In practice, however, this is a matter of no concern since it is only necessary to adjust the speed, as by shifting belt 47 on cone pulley 46, to provide the proper "draw" on the paper web, in the manner familiar to operators of paper machinery.

The surface speed of roll 31 may vary from a minimum which is just adequate to carry a sufficient excess of coating material from pool 26 to the surface of roll 22 without opening the nip between rolls 30 and 31 sufficiently to permit drainage of pool 26, up to a speed equal to or greater than that of the roll 22. When the paper speed is high, the surface speed of roll 31 is advantageously materially less than paper speed. The surface speed of roll 30 is advantageously materially different from and usually less than that of roll 31 in order to provide shear on the coating material as it passes through the nip. Furthermore, it is well known that a standing body of coating material of the types used for the present purposes should, in general, be continuously agitated. We have now discovered that by increasing the surface speeds up to the order of 300 feet per minute or more, the rotation of rolls 30 and 31 is itself usually adequate to provide all of the agitation normally needed in the pool 26.

The means by which the surplus coating material is removed from the surface 23 of roll 22 is most clearly shown in Figures 4, 5, and 6. This means comprises a rotating doctor 61 which advantageously rotates counterdirectionally as indicated by the arrow in Figure 5. It is preferably formed of a corrosion-resistant and wear-resistant material such, for example, as chromium-plated steel or any of the suitable known alloys containing material proportions of chromium, nickel, cobalt, tungsten, molybdenum, or similar hard and corrosion resistant alloying elements. It is held throughout its working length against deflection by any suitable means such as the split support 62 which may be made of laminated phenolic resin, corrosion resistant metal, or other suitable material. The support 62 is held in place on a rigid mounting bar 63 by a cover plate 64 and a plurality of screws 65. The doctor 61 is adjusted into the desired degree of contact with the surface 23 of roll 22 by adjusting screws 66, which are threaded through a flange 67 on the bar 63 and press against the support 62 for doctor 61.

Even when the doctor 61 is perfectly straight, differences in coating thickness have been found to occur across the width of the paper web, particularly when this width is as great as that of many modern papermaking machines. These have generally been found to be caused by corresponding differences in pressure or degree of contact between doctor 61 and the rubber surface 23 of roll 22 along the length of these parts. Such differences in pressure may be due to any of a variety of causes such as sagging of roll 22, a crown on its surface, or other variation in diameter along its length, soft or worn portions of cover 23, or the like. We have now found it possible to compensate for any such unevenness and secure coatings of uniform thickness (or when desired, of any specified variation in thickness) across the width of the paper web, by locally adjusting the doctor 61 to give it the required pressure on, or degree of contact with, rubber surface 23 on roll 22, at suitable intervals along its working length. In order to make possible this local adjustment, the support 62 for doctor 61 is rendered flexible as by providing slots 71 which reach almost to the doctor 61 at suitably close intervals throughout its length. The adjustment is then made by means of the necessary number of suitably spaced adjusting screws 66. To permit this adjustment, the holes 72 through which clamp screws 65 extend, are suitably slotted as indicated in Figures 5 and 6.

In order that the device shall function properly in uniformly wiping off surplus coating material 75 and smoothing the remaining film 76, and in dislodging any bits of coating material or foreign matter which may adhere to surface 23, the rotating doctor 61 must be pressed with a firm but light and regulatable pressure against the rubber or rubber-like surface 23 on roll 22. Because of the yielding nature of the surfacing material 23 on roll 22, this pressure causes the rotating doctor 61 to indent the surface 23 to a greater or lesser extent as indicated at 80 in Figure 5. This pressure may be applied by any of the known methods such as weights, springs, hydraulic devices, etc., but for purposes of illustration the mounting bar 63 which carries support 62 for doctor 61, is shown in Figure 4 as arranged to swing around a fixed pivot 81 and to be pressed against cover 23 of roll 22 by ad-

justable weights 82 slidably mounted on arms 83 which are rigidly attached to the opposite ends of mounting bar 63. The actual degree of pressure to be used depends on a variety of factors such as the diameter of the doctor 61, the density of the rubber cover 23 on roll 22, the speed of operation, the viscosity of the coating material used, and the weight of coating to be applied. When using doctors of from ¾ inch to one inch in diameter and rubber coverings of the specified density on roll 22 at speeds of the order of 600 feet per minute, pressures of from one to four pounds per linear inch have usually been found satisfactory, though greater or lesser pressures may be desirable under specific circumstances. We have, for example, applied about nine pounds, dry weight, of coating per ream (500 sheets 25 x 38 inches) by using a pressure of about two pounds per linear inch on a ⅞ inch diameter doctor pressing against a rubber roll surface having a density of about 110 (P. & J.) when using a coating composition of about 62% solids at a viscosity of about 8 poises.

Rotation of the doctor 61 may conveniently be secured by means independent of that for rotating rolls 22, 30, and 31. Convenient for this purpose is a geared-head motor 85 mounted on an extension of one of the arms 83 and operatively connected by chain 86 to a sprocket 87 which is in turn operatively connected to the end of doctor 61. In most cases we prefer to rotate this doctor in a direction counter to the direction of travel of the roll surface thereunder, as indicated in Figure 5, though it may if desired be rotated co-directionally with the roll surface since, because of its slow surface speed, a change in direction of rotation makes little difference in relative speeds of applicator and doctor. The backward wiping action by which the surplus coating material is removed from the applicator is thus accomplished regardless of direction of rotation of the doctor. The speed of rotation of doctor 61 is not critical. It needs to be great enough to prevent lodgement of dirt or coating lumps and is advantageously low enough to avoid throwing of the coating and undue wear on the parts. We have also found, when rotating doctor 61 counterdirectionally, that the useful life of doctor holder 62 can be greatly increased by making the surface speed of the doctor 61 very slow in relation to the speed of the paper. This not only means fewer revolutions of the doctor and therefore less wear on the holder, but it also means that any reasonable amount of coating material which leaks around doctor 61 due to wear of holder 62 and is redeposited on the surface 23 of applicator roll 22, becomes spread so thinly thereover that it cannot be detected after being transferred to the surface of the paper. With a doctor of from ¾ ot one inch in diameter, speeds of from 5 to 60 R. P. M. have been found to give satisfactory results, though we normally prefer speeds in the lower portion of this range. However, in appropriate circumstances, speeds above or below the stated range may be used.

The doctor 61 may be of any desired diameter from a minimum of about ⅛ inch up to several inches or more. The smallest diameters are difficult to use successfully because of the difficulty in securing sufficiently light and even pressures to prevent undue indentation of the rubber cover 23 on roll 22, whereas the larger diameters require more fluid coatings than are often otherwise desired, in order to limit the coating weight to the degree commonly required. Also local adjustment of the doctor 61 by the screws 66 becomes more difficult as the diameter increases. For these reasons we generally prefer to use doctors between ½ inch and 1¼ inches in diameter. We have found ⅞ inch diameter suitable for use when roll 22 has a rubber covering 23 with a density of about 110 as measured by the Pusey & Jones plastometer. Accordingly, the term "small diameter" is used in the present specification and claims to define a diameter of the rotating doctor of not over about 1½ inches, and will in general be understood not to refer to diameters of less than ⅛ inch.

The term "rubber" as used in the present specification and claims with reference to the covering 23 on applicator roll 22, is to be understood as including compositions of suitable synthetic rubber-like materials as well as compositions of natural rubber.

If it is desired to coat both sides of the paper simultaneously, it is only necessary to duplicate the above-described apparatus above the web as shown in Figure 2, in accordance with which coating material is applied in excess to the rubber or rubber-like surface 25 of roll 24 by the rolls 130 and 131. The excess is then removed and the remaining film of coating material is leveled and smoothed by rotating doctor 161 in the manner already described. The means for driving and controlling the speeds of the rolls 24, 130, and 131, and for rotating the doctor 161, are advantageously identical with the means illustrated in Figure 4, in which they are viewed from the end of the rolls opposite to that from which these rolls are viewed in Figure 2.

The coating device described can be used to coat paper either in or apart from the papermaking machine. It is, however, of particular value as a part of a papermaking machine. One such arrangement of the device is illustrated diagrammatically in Figure 7. The paper after at least partial drying on driers 91, passes between the coating rolls 22 and 24, as described, and the coated web 21 then passes on and around another set of driers 92 and after drying passes to calenders, reels, etc. (not shown) in the usual manner.

If desired, the paper web 21 can be passed through a calender 93 after it leaves driers 91 and before it passes between coating rolls 22 and 24, as illustrated in Figure 8.

Although the application of the excess of a wide variety of coating materials to the rubber covering 23 on roll 22 (or rubber covering 25 on roll 24) is advantageously accomplished by the two-roll fountain described, any other means which will continuously and dependably apply an excess of the particular coating material being used, at all points across the working width of roll 22, may be used if desired.

By the process and apparatus described, we have found it possible to apply a wide variety of coating compositions to paper at paper machine speeds by a "printing" operation, without leaving any visible sign of the ridges and stipples frequently found on paper coated by the "printing" process, and to apply the coating in this manner either to a dried paper web separate and apart from the papermaking machine, or to a partially or fully dried web on the papermaking machine itself. We have further found it possible, by the means and methods herein described, to utilize successfully not only such coating compositions as have heretofore been used on "printing" type coat-

ing devices, but also other types of coating compositions which, so far as we are aware, have never been successfully used in practice on coating devices of that type. We have additionally found that the herein described method and apparatus make it possible to apply coating to paper which possesses to an unusual degree the defect known as "fuzziness" (i. e. the presence on the surface of large numbers of projecting and of loose or easily detached fibers) and to produce therefrom a highly satisfactory grade of coated paper without the necessity of frequent stops to wash up the coating devices and/or to remove coating material which has become contaminated with detached fibers.

We claim:

1. A device for applying coating material to a moving web of paper in a papermaking machine, comprising: a pair of rubber covered rolls, between which the paper web is lightly pressed, for applying a predetermined amount of coating to each side of the web at the same time; means for rotating said rolls at surface speeds approximating that of the paper web; means associated with each of said applying rolls for metering an excess of coating material onto the surfaces of the respective applying rolls; a small diameter reversely rotating cylindrical doctor associated with each of said applying rolls for removing the surplus coating material and smoothing the remainder into a substantially smooth and uniform film; means for independently supporting and wiping each of said doctors throughout its working length; and independent means, acting through said supporting and wiping means, for holding each of said doctors against the coating film on the surface of the corresponding applicator roll under pressure sufficient to indent the rubber surface thereof.

2. The device of claim 1 wherein said doctor supporting means and doctors are slightly flexible and independent adjusting means is provided for flexing each of said supporting means to flex the doctor supported thereby to regulate the thickness of the film of coating material left on the surface of each applicator, along the working length thereof, and to compensate for variations in diameter and for variations in hardness of the rubber cover of the corresponding applicator roll, along the length thereof.

3. In combination with a rubber-surfaced film-applying roll in a paper coating device: a small diameter cylindrical doctor; a flexible support which substantially continuously supports said doctor throughout its working length and around substantially more than half of its circumference; means for exerting pressure on said support to press said doctor against and indent said roll; adjusting means for flexing said support to adjust said doctor to compensate for variations in diameter and hardness of the rubber surface of said applying roll and equalize the pressure exerted thereon by said doctor, throughout the working length thereof; and means for rotating said doctor in said support.

4. In a paper coating device: a resilient surfaced film-applying roll; means for applying a metered excess of coating material to the surface of said roll; a reversely rotating small diameter cylindrical doctor for removing the surplus coating material from said surface and smoothing the remaining coating into a film thereon; flexible means for supporting said doctor throughout its working length and around substantially more than half its circumference, whereby flexure of said supporting means correspondingly flexes said doctor; means, associated with said supporting means, for continuously wiping the surface of said doctor throughout its working length; and means for pressing said doctor against said surface.

5. A device for applying coating material to a moving web of paper in a paper making machine, comprising: a rubber covered applicator roll for applying a preformed film of coating material to the surface of the moving paper web; means for driving said applicator roll at a surface speed substantially the same as that of the moving paper web; means for applying coating material to the surface of said applicator roll, in excess of the amount required for transfer to the paper web; means for removing the surplus coating material from the surface of said applicator roll and leaving on said surface a substantially uniform film of coating material of the thickness required for transfer to the paper web; said means comprising a small diameter rotating cylindrical doctor, means for supporting said doctor continuously throughout its working length, and means for exerting pressure on said supporting means to press said doctor against the coating material on the surface of said applicator roll; said doctor supporting means being flexible and adjusting means being provided for flexing said supporting means to flex the doctor to regulate the thickness of the film of coating material left on the surface of the applicator roll, along the working length thereof, and to compensate for differences in diameter and differences in hardness of the rubber cover of the applicator roll along the length thereof.

6. The device of claim 5 wherein the doctor supporting means encloses and fits closely around said doctor throughout substantially more than half of its circumference and leaves exposed that portion of the doctor surface which is adjacent the applicator roll.

7. A device for applying coating material to a moving web of paper in a paper making machine by continuous transfer of a preformed film of coating material to the moving paper web from a rubber surfaced applicator roll rotating at a surface speed approximately equal to that of the moving web, the combination with the rubber surfaced applicator roll of means for continuously applying to its surface a film of coating material of metered, substantially uniform thickness, materially greater than the thickness required for transfer to the surface of the paper web, and means for removing the excess coating material from said film to reduce said film to the thickness required for transfer to the paper web and leave it smooth and of substantially uniform thickness; said means for removing the excess coating, from the film metered onto the surface of the applicator roll, comprising: a small diameter cylindrical doctor; means for rotating said doctor in a direction reverse to that of the applicator roll surface adjacent thereto; means for supporting said doctor continuously throughout its length; wiping means, continuous throughout the working length of said doctor, for continuously wiping coating material from said doctor during its rotation; and means for holding said doctor against the coating film on the surface of said applicator under pressure sufficient to indent the rubber surface of said applicator.

8. A device for applying coating material to a moving web of paper in a paper making machine by continuous transfer of a preformed film of

coating material to the moving paper web from a rubber surfaced applicator roll rotating at a surface speed approximately equal to that of the moving web, the combination with the rubber surfaced applicator roll of means for continuously applying to its surface a film of coating material of metered, substantially uniform thickness, materially greater than the thickness required for transfer to the surface of the paper web, and means for removing the excess coating material from said film to reduce said film to the thickness required for transfer to the paper web and leave it smooth and of substantially uniform thickness; said means for removing the excess coating from the film metered onto the surface of the applicator roll, comprising: a small diameter reversely rotating cylindrical doctor; flexible means for supporting said doctor continuously throughout its working length; means for continuously wiping said doctor throughout its working length, as it rotates; means for holding said doctor against the coating film on the surface

of said applicator under pressure sufficient to indent the rubber surface of said applicator; and means for flexing said supporting means to compensate for variations in diameter or hardness of the rubber surface of said applicator, along its length.

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