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G. D. MUGGLETON
INC. PAPER, WEB, WET LAMINATES

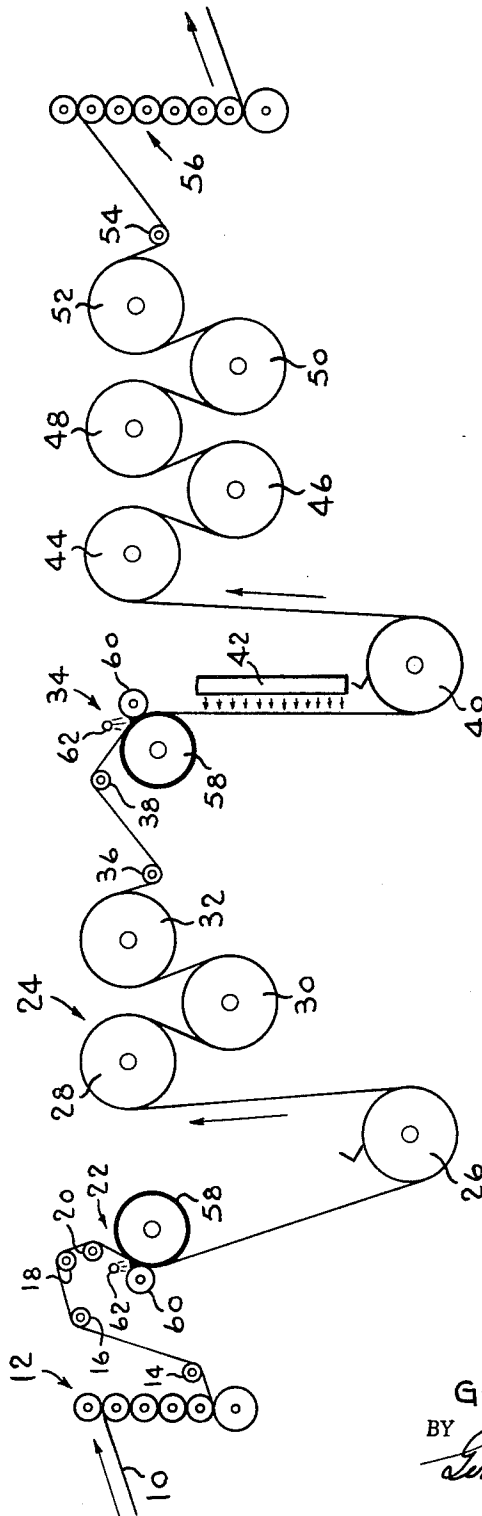
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COATING A MOVING PAPER WEB WITH A COATING ROLLER
HAVING LOWER PERIPHERAL SPEED THAN WEB

Original Filed Sept. 29. 1961

2 Sheets-Sheet 1

FIG. 1



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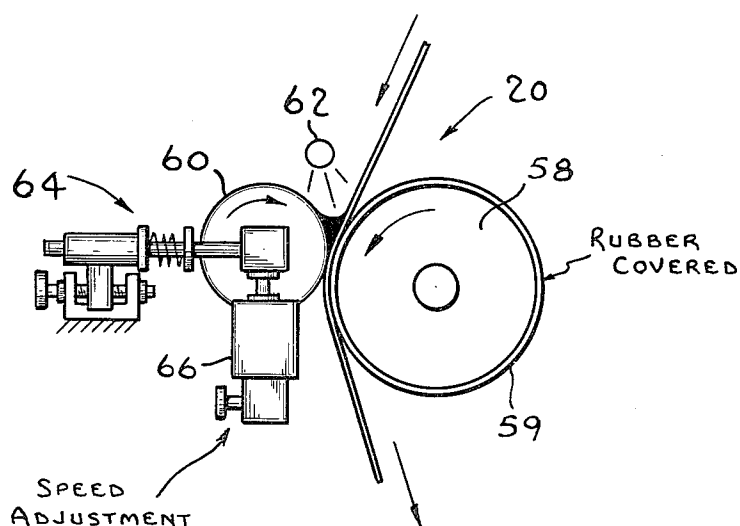


FIG. 2

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1

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COATING A MOVING PAPER WEB WITH A COATING ROLLER HAVING LOWER PERIPHERAL SPEED THAN WEB**Gerald D. Muggleton, Appleton, Wis., assignor to Combined Locks Paper Co., Combined Locks, Wis., a corporation of Delaware****Continuation of application Ser. No. 141,740, Sept. 29, 1961. This application May 5, 1964, Ser. No. 365,083****The portion of the term of the patent subsequent to Aug. 25, 1981, has been disclaimed****4 Claims. (Cl. 117-111)**

This is a continuation of my application Serial No. 141,740, filed September 29, 1961.

This invention relates to an improvement in the roll coating of a travelling web of paper and particularly to applying such coating to one or both sides of the web in a coating machine or at the dry end of a continuously operating paper making machine by a sliding roll coater. The patent application for the present invention was co-
pendent with the application for my invention entitled "Method of Coating Paper with High Solids High Viscosity Coating in the Wet End of the Paper Making Machine," Patent No. 3,146,159, filed August 1, 1960.

As used herein: a "normal amount of coating" means 2 to 12 pounds of coating per ream (500 sheets 25 x 38); "coating" refers broadly to a suspension of starch, casein or other adhesives, clay, pigment or minerals, and additives; "light weight paper" refers to paper weighing less than 45 pounds per ream; "publication paper" refers to paper weighing from 35 to 60 pounds per ream; and "dry end" refers to the air dry end of the paper making machine, after the first breaker stack where the web is about 92% dry. The coating may be applied to the web, which in current commercial practice is traveling at speeds ranging from 400 f.p.m. to 2,000 f.p.m.

One object of this invention is to provide a coater which will apply a normal amount of coating to the web as it travels in the coater or in the paper making machine in an efficient and economical manner.

Another object of this invention is to provide a coater which can be applied to existing coaters or paper making machines with a minimum of installation cost and used at low operating and maintenance expense.

Another object of this invention is to provide a coater which will apply a normal amount of coating to light weight papers without an uneconomical amount of web breakage.

A further object of this invention is to provide a means for coating a web of paper which: (1) operates with a minimum of power and is resistant to wear thus insuring uniformity of surface from reel to reel and day to day; (2) effects smoothing, leveling and even distribution of the coating from high to low spots in the web; (3) operates with a low application of pressure insufficient to injure the fibres of the web of paper; (4) does not create a hazard to uninterrupted continuous travel of the web; and (5) is economical to install and maintain.

These objects are obtained by a coater which comprises a large rubber covered web supporting roll, a small controlled variable speed roll in nip forming relationship to the supporting roll at adjustable relative pressure, and means for continuously supplying a pond of coating between the small roll and the web as it passes through the nip.

The large roll is driven at a peripheral speed equal to the speed of the web traveling through the paper making machine. The small roll at the start is driven at a peripheral speed equal to the speed of the web and in the same direction. Almost instantaneously with the establishment of a pond of coating from end to end of the

2

small roll its speed is first reduced and then adjusted to a speed determined by the characteristics of the web and the coating and desired weight of coating to be applied. This type of start prevents breakage and undue wetting of the web.

The pressure of the small roll with respect to the large roll may vary as hereinafter set forth. However, it is best operated at the lower efficient pressure to keep the area of contact to a minimum to lessen friction and cut down power losses. By driving the small roll at a reduced speed the stippling pattern at the split between such roll and the web is avoided. At the same time this slide or relative slip under pressure between the small roll and the web, now having one side slippery from coating, will smooth and level the high spots caused by web cockle and evenly distribute the coating over the web including areas of varying tensions. Furthermore, the reduction of peripheral speed of the small roll with respect to the speed of the web will reduce and practically eliminate splashing and turbulence in the pond between the web and such roll.

The coater for the wire side of the web is positioned after the first breaker stack in the dry end of the paper making machine. After leaving this coater the web travels over more drying rolls in the dryer section. When it is required to coat both sides of the web, a second coater may be placed in the dryer section with the large rubber covered roll supporting the now coated and dried wire side. The controlled variable speed small roll then forms a nip with the uncoated top side of the web and a pond of coating is maintained. The second coater operates in the same manner as heretofore described with respect to first coater.

Depending upon the available space within the dryer section and span of the run from the first coater to the next web engaging roll, it may be advisable to have a hot air application to dry the coating on the top surface of the web sufficiently to prevent adherence to such next roll or injury to such coating upon contacting such next roll.

One example of the embodiment of this invention and its operation as applied to a roll coater will be described in connection with the accompanying drawings in which:

FIG. 1 shows a diagrammatic view in side elevation of the dry end of a Fourdrinier paper making machine having incorporated therein a roll coater embodying the present invention; and

FIG. 2 shows a diagrammatic view in the side elevation of the sliding row coaters including variable drive means and means for varying the pressure between the small roll and the supporting roll.

In this exemplification the web of paper 10 is shown as it continuously advances (from left to right as viewed in the drawing) through a standard paper making machine. In this instance the first sliding roll coater for coating the wire side of the web is stationed in the so-called dry section of the machine immediately after the first breaker stack 12. The web of paper 10 at the station shown in this example is traveling at a speed approximately within the range of 400 to 2,000 f.p.m. and its moisture content varies from approximately 16% to 8%.

As the web 10 leaves the breaker stack it passes under a guide roller 14 and over three guide rollers 16, 18, and 20 spaced and positioned as shown to guide the web downwardly into the first sliding roller coater indicated generally at 22. The roll coater 22 is positioned between the breaker stack 12 and dryer section indicated generally at 24. In order to provide sufficient time for the setting of the coating applied by the first sliding roll coater, a drying roll 26 is placed a convenient distance from such coater.

and below the customary drying rolls 28, 30 and 32. This setting is necessary because in passing over drying rolls 28 and 32 the wire side of the web to which the coating is applied comes into direct contact with the surfaces of such rolls and the coating must be dry enough to prevent sticking.

When both sides of the web are to be coated a second sliding roll coater 34 is placed in the dryer section following the dryer roll 32. The web 10 is guided to it under guide roll 36 and over guide roll 38 downwardly into the second roll coater as shown.

Since this second coater applies the coating to the upper side of the web 10 and such side first makes engagement with a drying roll 40, it may be necessary to add a hot air dryer 42 to set the coating and prevent sticking. From the dryer roll 40 to the web 10 passes over and under customarily placed dryer rolls 44, 46, 48, 50 and 52, under guide roll 54 through a machine calender 56 and thence to a machine reel.

An essential feature of this invention resides in the construction and operation of the sliding roll coaters designated generally 22 and 34. In this embodiment both sliding roll coaters consist of identical elements which will be given the same reference numeral. The sliding roll coaters have a supporting roll 58 approximately 36" in diameter having a rubber cover 59, a small roll 60 approximately 12" in diameter, and coating supply means 62. The large supporting roll is mounted in the usual manner and is driven at the same peripheral speed as the other web supporting and driving rolls of the paper making machine. The small roll is mounted in adjustably positionable bearings 64 in the usual manner is driven by variable speed driving means 66 and is separately controlled as to speed, direction of rotation, radial movement toward and away from the supporting roll, and the pressure to be applied to the web. It is desirable to keep the diameter of the small roller small enough to minimize the area of contact with the web and large enough to apply pressure evenly throughout its length and form with the web and end pans of customary design (not shown) a space for a sufficient size pool of coating.

The coating with characteristics set forth above is continually supplied to such space by the conventional supply means which is controlled with respect to web speed, paper absorption, and desired coating weight to maintain a pool down through which the web travels while supported on the surface of roll 58. The small roll 60 is positioned to engage the supporting roll above the horizontal plane passing through the axis of the supporting roll. The nip thus is placed having regard to the space requirement of an existing paper making machine, the angle at which the web travels toward the supporting roll, and the angle at which the web must leave the supporting roll. The web must come into supporting contact with roll 58 before it enters into the pool of coating. It should leave the supporting roll as close as practical after passing through the nip in order to prevent the coating from being absorbed through the web and deposited in part on such roll and in order to start the setting and drying at the earliest possible time.

When the web 10 is being threaded through the paper making machine, the small roll 60 is automatically rotated at the same peripheral speed and in the same peripheral direction as roll 58 and the other rolls of the machine. No strain should be placed on the web due to any slippage between it and small roll 60 until the web has been supplied with coating to create a slippery surface on both roll and web. Almost simultaneously with the formation of a pool of coating along the length of the nip, the speed of the small roll 60 is automatically reduced to a predetermined speed. This reduced speed sets up a slippage between the small roll and the web which meters the coating (somewhat in the manner of a leveling or trailing blade) to prevent the application of excess coating and undue wetting of the web. The speed of the small

roller may be further reduced depending upon the required weight of coating and the elimination of unacceptable stippling pattern. The final speed of the small roll is regulated and, depending upon the foregoing circumstances and the pressure applied by the small roll to the web as it passes through the nip, may be as low as 10% of the speed of the web.

The small roll 60 is urged toward the supporting roll with a controlled pressure and is maintained by conventional means at a preset distance from the supporting roll. It has been found that roll pressures of from 5 to 15 pounds per lineal inch are satisfactory. However, best results are obtained by keeping the pressure low enough to keep the area of contact between the small roll and the web to a minimum. This cuts down friction and lessens power losses. But enough pressure must be maintained to have the small roll meter, level and evenly distribute the coating even to those areas of the web which may have different thickness and compactness of fibre due to varying tensions.

This sliding roll coater can be easily incorporated with existing coating devices not on paper making machines or with existing paper making machines. If the machine does not have any coating appliances, there is usually room enough on the frame to mount and carry these sliding coaters in the positions described. However, it may be necessary to move one of the standard dryer rolls to accomplish the travel needed for setting the coating. If the paper making machine includes conventional roll type coaters in the dry end, the second one may be used to apply coating to the top side of the web or its lower or upper roll removed or withdrawn and a small roll placed in contact with the remaining roll to form a sliding roll coater made in accordance with the foregoing description. It is also feasible to rearrange the first of the conventional roll type coaters by dropping the lower roll and placing a small roll in engagement with the upper roll to form a sliding roll coater, also made in accordance with this description. In such case it will be necessary to place a sweat roll or other water moistened roll adjacent the lower roll to guide the web as it leaves the upper coater roll over and spaced from the lowered roll.

In the case of off the machine coaters the sliding roll replaces the customary trailing blade or air knife.

I claim:

1. A method for coating one side of a traveling web of paper in a machine having a supporting roll which rotates in the direction of web travel and supports the web, comprising the steps of: placing an adjustable speed controlled applicator roll in contact with one side of the web in a place at which the web is supported on its other side by the supporting roll, driving said applicator roll in the direction of and at a peripheral speed equal to the web travel as the applicator roll is placed in contact with the web, furnishing a supply of liquid coating to form a liquid pond between said applicator roll and said web, thereafter reducing the speed of said applicator roll yet maintaining the same direction of rotation to set up slippage between said applicator roll and the web and to substantially eliminate the turbulence and splashing of the coating in said pond, and continually furnishing a supply of coating to said pond.

2. A method of coating a traveling web of paper in the dry end of a paper making machine having supporting rolls which rotate in the direction of and at a peripheral speed of the web travel and support the web, comprising the steps of: providing an adjustable speed controlled applicator roll in contact with one side of the web in a place at which the web is supported on its other side by one of the supporting rolls of the machine, continually furnishing a supply of liquid coating consisting of a suspension of starch, adhesive, clay and additives to form a pond between said applicator roll and said web, driving said applicator roll independently of said supporting roll in the direction of web travel at a lower peripheral speed

C

of not less than 10% of the web speed to set up a slippage between said applicator roll and the web, and varying said lower peripheral speed during rotation of said applicator roll to control turbulence and splashing of the coating in said pond.

3. A method according to claim 2 wherein one side of the web is coated by the steps recited in claim 2, and wherein the web is passed through a drying section in the dry end of the paper making machine and wherein the other side of the web is thereafter coated in the dry end of the paper making machine by the steps recited in claim 2.

4. In a paper coating process in which a traveling web of paper enters the nip formed between an applicator roll and a supporting roll which rotates in the direction of web travel and supports the web and in which coating is applied to the web from a pond of liquid coating provided between the applicator roll and the web at said nip; the method of controlling the turbulence and splashing of the pond by providing driving means for the applicator roll which means is capable of driving said applicator roll in the direction of web travel and which is capable of being adjusted during rotation of the supporting roll to drive said applicator roll at peripheral speeds below the web travel, and by adjusting the driving means during rotation

C

of said driving means to rotate the applicator roll at a peripheral speed below the web travel which is 10 or greater percent of the web speed and at which objectionable turbulence and splashing within the liquid pond is substantially eliminated.

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