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G. D. MUGGLETON

3,485,209

APPARATUS FOR COATING A TRAVELING WEB OF PAPER

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2 Sheets-Sheet 1

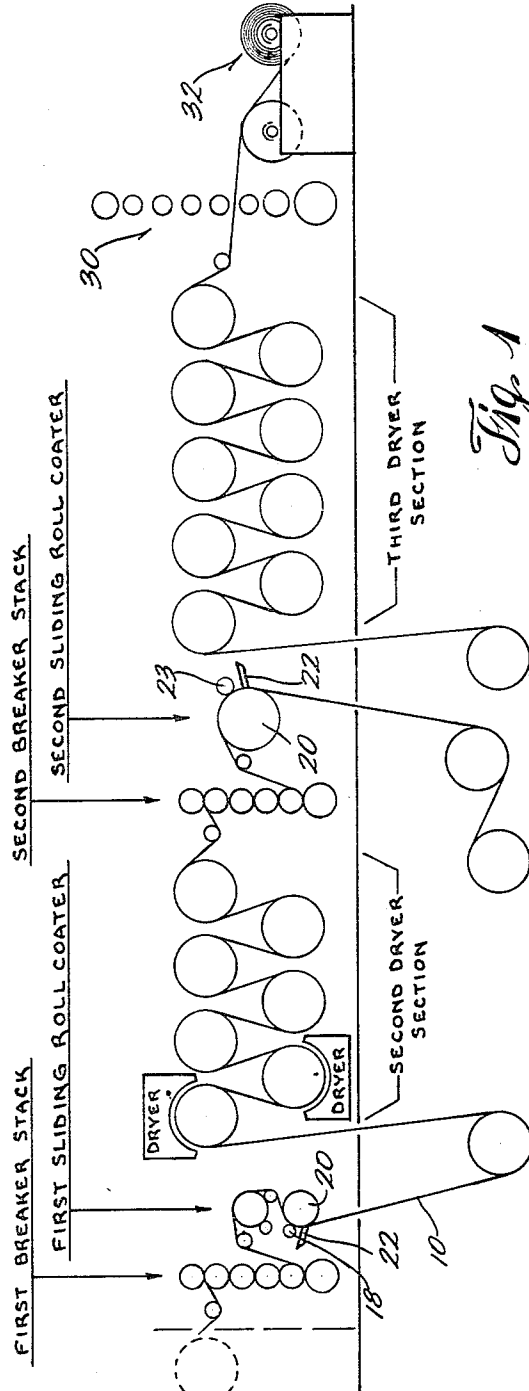
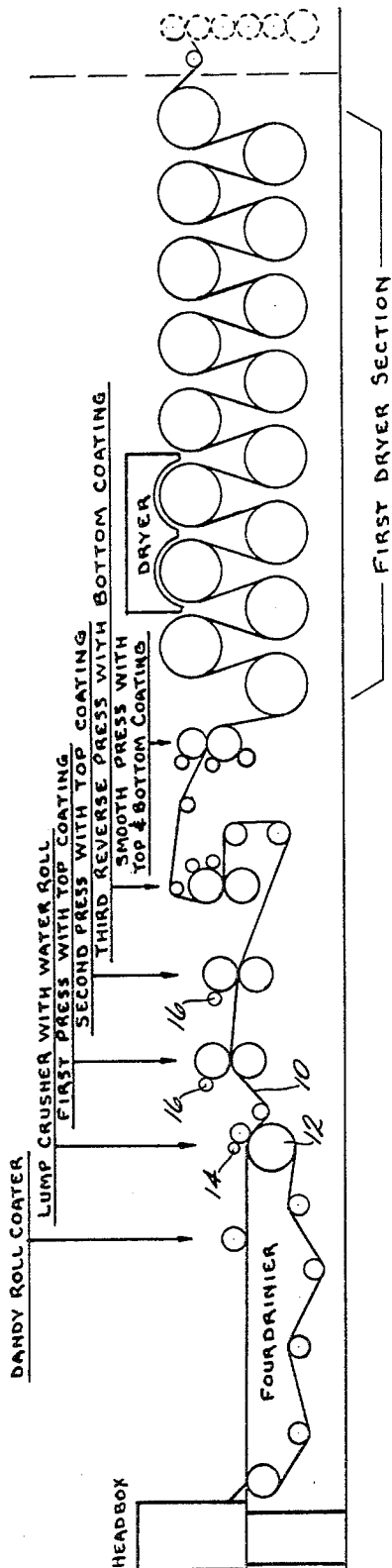


Fig. 1

Inventor
Gerald D. Muggleton
By *Charles D. Rife*
Attorney

Dec. 23, 1969

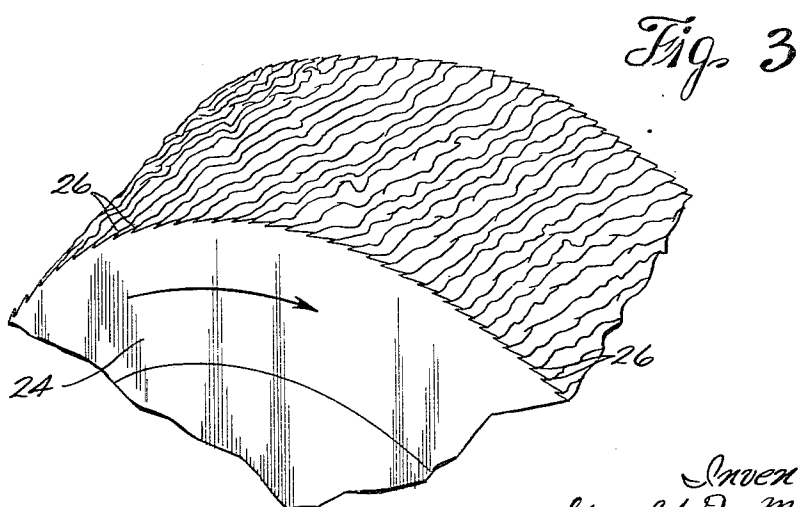
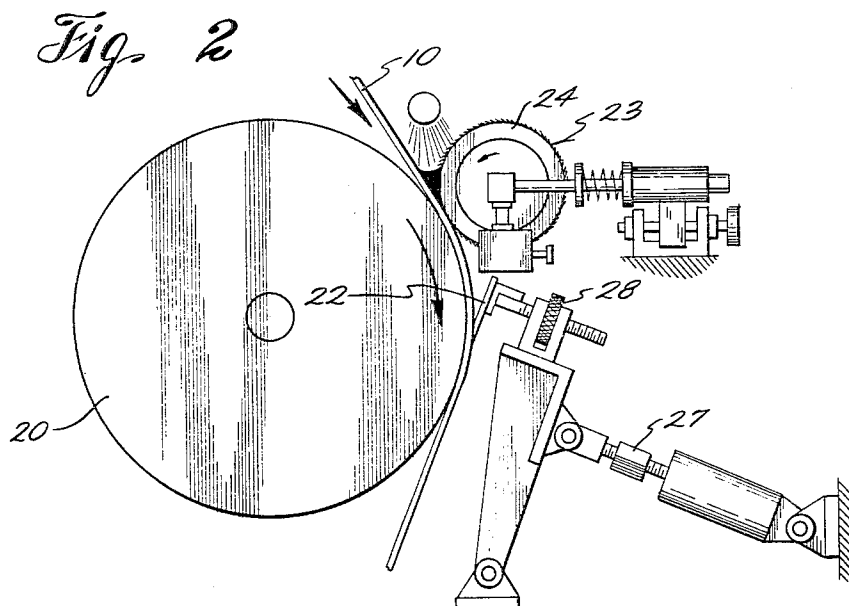
G. D. MUGGLETON

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APPARATUS FOR COATING A TRAVELING WEB OF PAPER

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2 Sheets-Sheet 2



Inventor
Gerald D. Muggleton
By *Richard O. R. R. R.*
Attorney

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3,485,209 APPARATUS FOR COATING A TRAVELING WEB OF PAPER

Gerald D. Muggleton, Appleton, Wis., assignor to Combined Locks Paper Co., a corporation of Delaware
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U.S. Cl. 118—414

5 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for coating a traveling web of paper with an emulsion which includes dispersed liquid-contained microscopic solids, the emulsion being applied by a roll having a resilient and serrated surface which in cross section forms a slanted saw-tooth contour with the teeth slanting in the direction of rotation of the roll.

BACKGROUND OF INVENTION

The present invention pertains to an applicator roll which rotates in contact with a traveling web of paper and which is particularly suited for applying an emulsion which contains dispersed liquid-contained microscopic capsules.

Emulsions of this type are most commonly used in making copying paper. The capsules are contained in a transfer film coating on one side of the paper and are ruptured upon the application of writing pressure to thereby release the liquid contained in the capsules and cause it to transfer the image to an underlying sheet. The presently best known paper of this type is that marketed by the National Cash Register Company under the trademark NCR Paper.

The microscopic capsules and emulsions of this type are well known in the art and typical examples are described in the Green Patent Nos. 2,800,457 and 2,800,458. For the purposes of understanding the present invention it suffices to appreciate that the capsules are several microns in diameter and are comprised of a liquid filled center which is surrounded by an encapsulating wall which may be ruptured upon the application of writing or printing pressure. The capsule wall is usually of gelled colloidal material.

Several alternative copying or transfer methods are suggested in the Green patents. In presently used commercial practice two specially coated paper sheets are required. The first sheet is generally referred to as CB (coated back) paper and its back side is coated with the emulsion having dispersed microscopic capsules. The second sheet is generally referred to as CF (coated front) paper and its front is coated with a composition containing an absorbent. To make a copy, a sheet of CB paper is placed over a sheet of CF paper with the coated surfaces of the sheets being in contact. Under impact, friction or pressure, the microscopic capsules of the CB paper will be ruptured and their liquid will be squeezed out and transferred to the coating of the CF paper. The liquid will be absorbed by the absorbent and be polarized to a colored form to provide a visible mark. If more than one copy is desired, the intermediate sheet or sheets have to have an absorbent front coating and an emulsion back coating to thus produce as well as transfer the images made on the top sheet.

From a paper making standpoint it is imperative that the capsule containing emulsion be applied evenly and without rupturing or damaging the capsules. It is also very important that the emulsion as well as absorbent coatings be maintained as much as possible on the top surface of the paper, since significant penetration of either coating

into the web of the paper will, of course, impede the necessary transfer of the liquid.

SUMMARY OF INVENTION

In view of the above, the principal object of the present invention is to provide a coating apparatus which will permit economical and technically satisfactory application of the capsule containing emulsion to a traveling web of paper.

A further object of the present invention is to provide a coating apparatus which will permit satisfactory application of the emulsion in the paper making machine during the manufacture of the paper.

These objects are attained by applying the emulsion with a sliding roll coater in which the rubber surface of the applicator has been roughened to provide a multitude of miniature slanted saw-tooth serrations. A roll coater, except for the roughened applicator roll surface, is disclosed in the Muggleton Patent No. 3,231,418 and is essentially comprised of a relatively small applicator roll which is in nip forming engagement with the traveling web of paper while the latter is supported by a supporting roll. The applicator roll rotates in the direction of, yet at a slower peripheral speed than the web travel. The coating to be applied is supplied to the nip formed by the applicator roll and the traveling web. One of the principal advantages of a sliding roll coater of this type is that it minimizes coating penetration. This, of course, is of prime importance in the present case. Further, the contact pressure between the applicator roll and the web is sufficiently small to avoid rupture or damage of the capsules.

The roughened surface of the applicator roll has been found to be essential for consistently uniform pick up and deposition of the capsules. Smooth surfaced rubber rollers are not consistent in pick up and deposition. Further, the roughening of the applicator surface provides a softer and more cushioned roll surface than the smooth surface of a comparable rubber covered applicator roll and thus is instrumental in avoiding rupture of the capsules as they are applied to the traveling web. In experiments with a smooth covered applicator roll the pressure between the roll and the web seemed at times too high to assure consistent rupture free application of the capsules.

The required roughened roll surface, of course, produces a pronounced pattern on the web which, if allowed to remain, would leave an undesirable surface appearance on the finished paper. In order to eliminate this pattern a leveling bar or pattern eliminator has to be provided immediately after the applicator roll. In the preferred embodiment, a leveling blade, as disclosed in the co-pending Muggleton application, S.N. 333,083, filed on Dec. 24, 1963, now abandoned, is placed in contact with the freshly coated surface immediately after the applicator roll. A leveling blade of this type smooths the coating surface without adding or removing any coating, but merely serves to level the coating by filling in the minute valleys with material from the peaks of the liquid coating without building up a trailing coating pool behind the blade. This type of leveling does not create sufficient pressure to rupture or damage the capsules of the coating.

The particular significance of employing the above described sliding roll coater and the leveling bar is that this combination permits the emulsion to be applied in the dry end of a paper making machine in which the paper is being manufactured. Prior to this invention it was thought impossible to apply the emulsion while the paper is being manufactured and all commercially known operations were limited to coating on already fabricated paper.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as

will obvious modifications of the single embodiment shown in the drawings, in which:

FIG. 1 is a diagrammatic representation of the dry end of a paper making machine;

FIG. 2 is a diagrammatic side view of the sliding roll coater and the pattern eliminator;

FIG. 3 is a perspective view of a fragment of the applicator roll's roughened surface, the surface being enlarged four times.

Referring to the drawings, the web 10 is shown as it continually advances (from left to right as viewed in the drawings) through a standard paper making machine. As the web leaves the Fourdrinier machine its moisture is partly removed by the pressure between the lump crusher roll and the couch roll 12. At this point some coating might be applied to the top surface of the web by the lump crusher applicator roll 14 which rotates in nip forming contact with the descending side of the lump crusher roll, with the coating being supplied to the upwardly facing nip between these rolls. A method and apparatus of this type is disclosed in the Muggleton Patent No. 3,214,328.

After leaving the wire of the Fourdrinier machine, the web is of sufficient consistency to be self supporting and it is passed through first and second presses in which the top surface of the web is further coated. In both presses the coating may be applied by a roll coater which has its applicator roll 16 in nip forming relationship with the upper press roll 18 of the press. Coating of this type is known, and some of the methods which may be employed are shown in the Muggleton Patent Nos. 3,146,159 and 2,772,604. After leaving the second press the web passes to a reverse press at which coating is applied to the bottom side of the web. Thereafter it passes through a smooth press at which further coating is applied to both sides of the web. After leaving the last press the web passes through a dryer section and enters the first breaker stack. At this point the web has been coated with coatings containing the necessary clay, starch, mineral, and other additives which are not peculiar to or necessary for the application of the capsule containing coating composition. Essentially the coating performed so far is for the purpose of providing the desired body and surface finish of the web.

The rolls of the first breaker stack are adjusted to provide a high or super calendering. This is done for the purpose of obtaining a highly smooth web surface and thus aid in reducing the penetration of the special coatings which are to be applied subsequently.

After the first breaker stack the top of the web is coated by a sliding roll coater in which a rubber covered applicator roll 18 is in nip forming relationship with the web which at that point is supported by a rubber covered supporting roll 20. Both rolls rotate in the direction of the web travel, with the applicator roll rotating at a peripheral speed below the web travel and with the supporting roll rotating at a peripheral speed equal to the web travel. The liquid coating composition is supplied to the upwardly facing nip between the applicator roll 18 and the web and is applied to the web in a metered predetermined amount which is dictated by the contact pressure between the applicator roll and the web as well as by the speed of the applicator roll. The pressure and speed can be adjusted during operation of the paper making machine to thereby change the application of the emulsion if changes are desired. As mentioned, sliding roll coaters of this type have been described in the Muggleton Patent No. 3,231,418.

Immediately after the coating has been applied it is smoothed by a pattern eliminator which is comprised of a blade 22 which extends across the surface of the web and smooths the still wet coating by leveling off the high points of the coating surface and moving the material into the valleys or lower surface areas. The best results have been obtained by apparatus as disclosed in the co-pending

Muggleton application, Ser. No. 333,083, filed on Dec. 24, 1963, now abandoned.

In the embodiment illustrated in FIG. 1 the paper making machine is equipped for making CFB paper, in which the front surface is coated with the special absorbent material and the back surface is coated with the capsule containing emulsion. In such case the former coating is applied with the first roll coater as illustrated. However, even if only CB paper were to be manufactured, it might be desirable to apply a suitable regular coating at this point in order to further improve the quality of the top surface of the paper to be produced.

After passing through the first sliding roll coater, the web passes through a second dryer section in which the applied coating is dried. Thereafter it passes through a second breaker stack in which again the rolls have been adjusted to provide high or super calendering. The purpose for this again is to minimize the penetration of the coating which is to be applied subsequently.

Thereafter the web passes through the second sliding roll coater in which the capsule containing emulsion is applied to the back surface of the web. This sliding roll coater operates in principle identically as the first sliding roll coater except that the surface of its applicator roll 23 is provided with a roughened resilient surface as shown in FIGS. 4 and 5. The covering 24 of the applicator roll is of relatively softer rubber and its surface has been roughened to provide an irregular serrated surface which in cross section forms a slanted sawtooth contour. As shown in FIG. 5, the tips 26 of the teeth face generally in the direction of rotation of the roll. The disclosed surface has been thought to be preferable since the contact between the tips of the teeth and the web provides some cushioning and thus provides assurance against rupturing the capsules during application. If less cushioning were to be provided at this point, the pressure adjustment between the applicator roll and the traveling web might well be more critical than in the present case.

Due to the roughened applicator roll surface, the applied coating has a distinct rough pattern which is clearly unacceptable for the finished product. In order to correct this pattern a leveling blade type pattern eliminator is provided immediately after the applicator roll 23. As described with the first roll coater, the pattern eliminator is a blade 22 which smooths the surface of the still liquid coating from the surface of the web. The blade 22 is at an acute angle in respect to the direction of web travel and its angular position and contact pressure may be adjusted by suitable adjustment mechanisms 27 and 28. This type pattern eliminator also minimizes the coating penetration as well as requires sufficiently low contact pressure to create no danger to the capsules contained in the coating.

After passing through the second roll coater, the web is dried in the third dryer section and passes through the calender stack 30 without being calendered. It is wound on a center wind reel 32 which avoids excessive contact pressures between successive layers of the paper reel. The by-passing of the calender stack and the particular winding method are, of course, employed to avoid excessive pressures which might rupture the capsules of the coated paper.

I claim:

1. Apparatus for coating a traveling web of paper with an emulsion which includes dispersed microscopic solids, the apparatus comprising:

an applicator roll positioned to rotate in contact with a traveling web of paper and having a resilient outer periphery which is roughened to provide serrations which form, in cross section, a slanted saw-tooth contour;

means for rotating said applicator roll; and

means for supplying the emulsion to the outer periphery of said applicator roll.

2. A coating apparatus according to claim 1 wherein said serrations extend generally longitudinally in respect

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to the axis of said applicator roll and wherein the teeth of said slanted saw-tooth contour slant in the direction of rotation of said applicator roll.

3. A coating apparatus according to claim 1 including a supporting roll positioned in an upwardly open nip forming relationship with said applicator roll, and including means to guide the web so that it enters the upwardly open nip while it is supported by said supporting roll, and further including means for supplying the emulsion in said upwardly open nip between said applicator roll and the traveling web.

4. A coating apparatus according to claim 3 wherein said serrations extend generally longitudinally in respect to the axis of said applicator roll and wherein the teeth of said slanted saw-tooth contour slant in the direction of rotation of said applicator roll.

5. A coating apparatus according to claim 4 wherein

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the tip of each tooth of said slanted saw-tooth contour extends over the root of its adjacent tooth.

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WALTER A. SCHEEL, Primary Examiner

ROBERT I. SMITH, Assistant Examiner