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Busch

[11] **3,767,451**

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[54] **METHOD FOR MANUFACTURE OF MANIFOLDING PAPER COATED WITH PRESSURE RUPTURABLE MATERIALS**

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[*] Notice: The portion of the term of this patent subsequent to Oct. 27, 1987, has been disclaimed.

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[21] Appl. No.: **197,455**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 795,663, Jan. 31, 1969, Pat. No. 3,632,378.

[52] **U.S. Cl.**..... **117/36.2,** 117/64 R, 117/119.8, 117/156

[51] **Int. Cl.**..... **B41m 5/22**

[58] **Field of Search**..... 117/36.2, 36.1, 68, 117/64 R

[56] **References Cited**

UNITED STATES PATENTS

3,632,378	1/1972	Busch	117/36.2
3,186,861	6/1965	Smith et al.	117/156
3,311,499	3/1967	Busch et al.	117/119.8
2,999,787	9/1961	Downs et al.	117/60
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[57] **ABSTRACT**

Paper coated on or off the paper machine with pressure rupturable materials which includes calendering the paper immediately before application of the aqueous emulsion coating containing the pressure rupturable materials.

3 Claims, 2 Drawing Figures

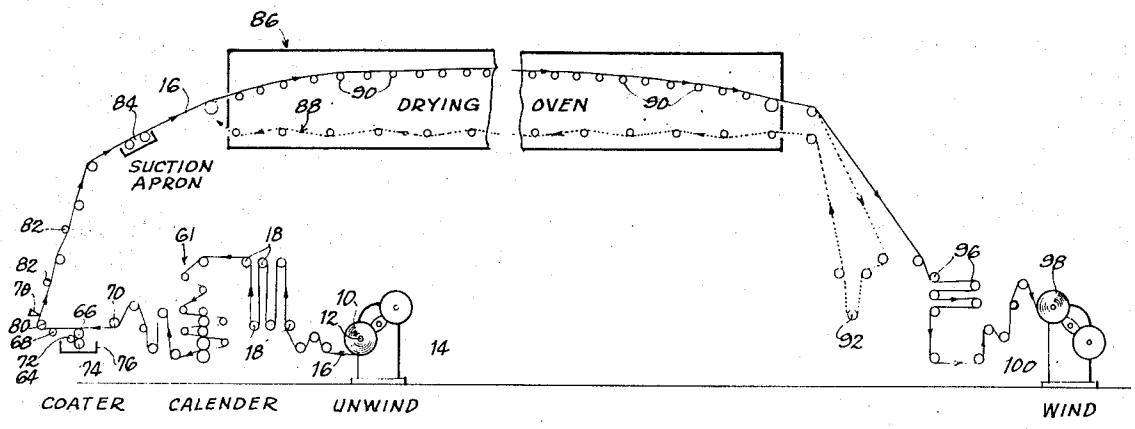


FIG. 1

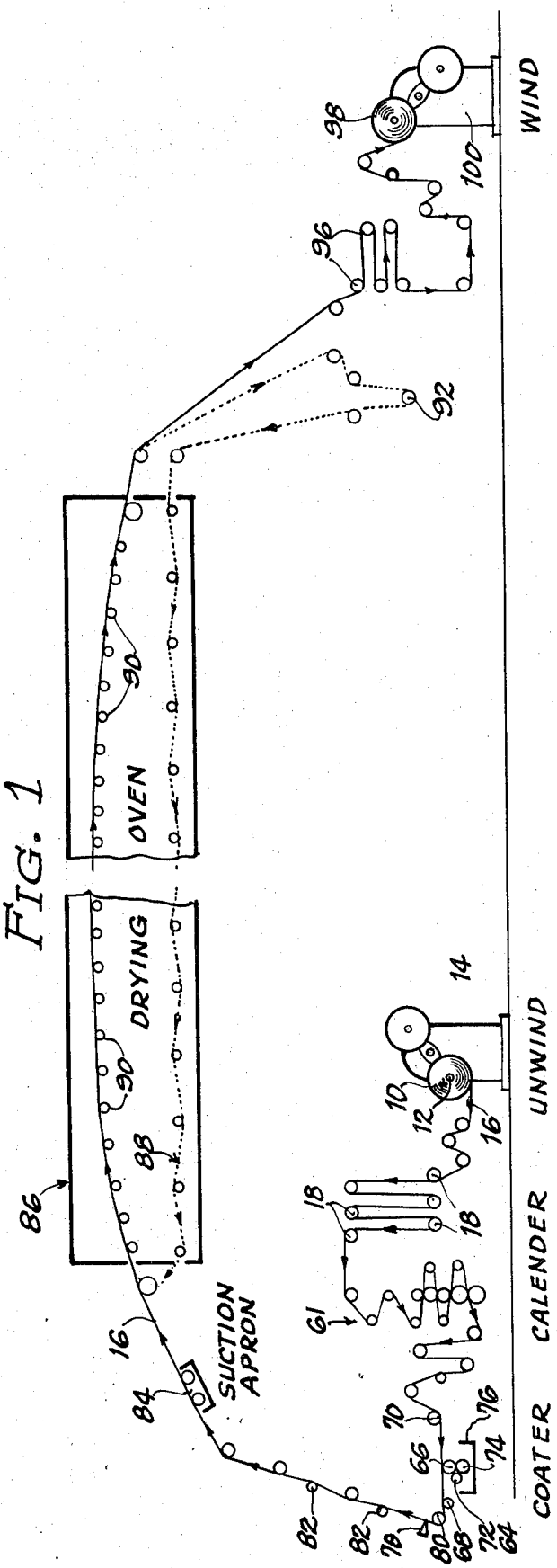
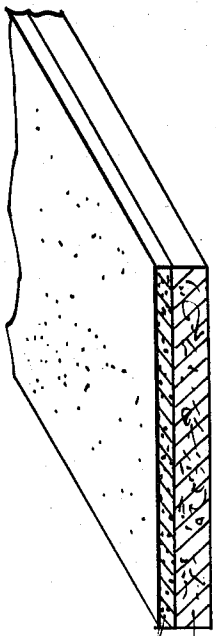

OVEN
DRYING
SUCTION APRON
COATER
CALENDER
UNWIND
WIND

FIG. 2


EMULSION - 60
PAPER WEB - 16

METHOD FOR MANUFACTURE OF MANIFOLDING PAPER COATED WITH PRESSURE RUPTURABLE MATERIALS

This is a continuation-in-part of my copending application Ser. No. 795,663, filed Jan. 31, 1969, and entitled "Method and Apparatus for Manufacture of Dual Coated Sheet with Pressure Rupturable Materials", now U.S. Pat. No. 3,632,378.

This invention relates to the coating of paper with an aqueous composition containing pressure rupturable materials whereby the pressure rupturable materials are concentrated at the surface of the paper without subjecting the capsules to rupture.

In my aforementioned copending application, description is made of the "off the paper machine" manufacture of a two side coated paper, in which one coating applied to one side of the paper is a clay coating and the coating applied to the opposite side is formulated of rupturable encapsulated materials, in which the first coating applied is the aqueous clay coating composition applied to one side of an endless sheet of relatively non-absorbent bond paper. Thereafter the clay coating is dried and then calendered immediately prior to the application of the aqueous composition containing the pressure rupturable encapsulated materials, followed by drying for removal of water while the coated sheet is supported on a relatively porous vapor permeable conveyor surface or belt which travels at substantially the same linear speed as the paper so as not to subject the paper to stresses while the moisture is being removed from the applied coating and so that the moisture can be removed from both sides of the paper while being supported so that the dual coated sheet will not cockle, buckle or curl during drying.

In the manufacture of the sheet with the coating of encapsulated pressure rupturable materials, it has been found that often times the pressure rupturable coating composition, or aqueous emulsion coating, is required to be applied other than as a continuous operation in conjunction with the application of the clay coating on the opposite side, such as when the clay coating has previously been applied in a separate "on the paper machine" operation or when the paper is to be formed only with a coating of the pressure rupturable materials.

It is an object of this invention to provide a method and means for the efficient coating of paper with a composition containing pressure rupturable encapsulated materials wherein a smooth and uniform coating is obtained with a minimum amount of penetration into the coated paper, whereby the coated sheet can be produced at less cost and at higher speed without cockle or curl.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing in which

FIG. 1 is a schematic elevational view of apparatus employed in the practice of this invention, and

FIG. 2 is a perspective view in section of the coated sheet produced in accordance with the practice of this invention.

It has been found, as described in the aforementioned copending application, that considerable benefit is derived when, immediately prior to the application of the aqueous coating composition containing the pressure rupturable materials, the paper sheet is subjected to a hard calendering step. It has been found that calendering the sheet immediately prior to coating with the aqueous emulsion of encapsulated materials operates (1) to improve the smoothness of the surface to which the coating is applied thereby to enhance the smoothness of the emulsion coating to maximize contact between the emulsion coating and adjacent surfaces for duplicating purposes; (2) to improve the resistance to distortion or wetting since the compacted paper is made more resistant to wetout through the thickness of the paper by the aqueous emulsion; (3) to reduce porosity of the paper whereby a desirable capsule coating can be obtained on the paper with less of the expensive capsule coating composition thereby to achieve the desired concentration and distribution of capsules at the surface with considerable savings in the amount of capsules supplied to form a satisfactory coating. Precalendering immediately prior to coating not only results in considerable savings in cost of materials, but wetout occurs more as a surface phenomenon as distinguished from penetration. As a result, higher coating speeds can be obtained with less degree of curl or cockle in the coated sheet.

The invention will be described with reference to the manufacture of a manifold sheet in the form of a colorless carbon sheet, sometimes referred to as NCR paper.

In U.S. Pats. Nos. 2,299,693; 2,374,862; 2,548,366; 2,712,507; 2,730,456; 2,730,457; 2,800,457; 2,929,736; 2,932,582; 3,020,171; 3,104,980; and 3,129,103, description is made of a copy process and materials for use in the practice of same in which separate coatings are provided on suitable carrier sheets in which one of the coatings is formulated to contain a liquid reactant such as a colorless dye component dissolved in a liquid solvent and which is encapsulated in microscopic capsules uniformly distributed throughout the coating (hereinafter referred to as the emulsion coat), while the other coating is formulated of clay or other particulate substance which is adapted to react with the liquid in response to release from the capsules to form a colored image (hereinafter referred to as the clay coat). When the coating containing the encapsulated liquid is positioned in surface contact with the clay coating, no color develops until pressure is applied by pen, pencil, stylus, typewriter key, die impression or the like, or by heat to rupture the capsules in the imaged areas whereby the liquid released from the ruptured capsule wets out the adjacent receptive material in the clay coating to develop the image.

In a manifold assembly, the top sheet in the assembly will be fabricated with only its underside coated with the emulsion coat, while the bottom sheet in the assembly will be coated on its top side with only the clay coating. All of the sheets in between will be coated on the underside with the emulsion coat and on the top side with the clay coat in a two side coated sheet.

The invention is addressed to the manufacture of such top sheet with the emulsion coating only on one side but the concept of the invention has application also to the preparation of dual coated sheets wherein the emulsion coating is to be applied off of the clay coating machine or as an operation completely separated from the clay coating process. It will be understood that the invention has application also to emulsion coating of rupturable encapsulated materials for use other than in duplicating processes, wherein an

emulsion coating of encapsulated materials is applied without a clay coating on the opposite side, such as in wall paper, perfumed paper, and the like.

Referring now to the drawing, the paper, preferably a manifolding bond paper, is supplied in the form of roll **10** mounted for free rotational movement on a spindle **12** supported on an unwind stand **14.** The paper web **16** is passed from the roll **10** over a series of idler rollers and guide rollers **18** first through a multiple stack calender **61,** immediately before it is advanced continuously from the calender to the coating station **64** where application is made of the aqueous coating composition of the encapsulated materials, hereinafter referred to as the emulsion coating. This coating station comprises an applicator roll **66** in contact with the uncoated side of the paper web **16,** a metering roll **72** and a pickup roll **74,** having its lower portion inserted in a bath of the emulsion coating composition in pan **76.** The coating composition transfers from the periphery of the pickup roll to the periphery of the applicator roll. Before the applicator roll engages the underside of the paper web **16,** it is engaged peripherally by the side of the paper web **16,** it is engaged peripherally by the metering roll **72** which operates to smooth the layer of coating composition on the surface of the applicator roll and to meter the layer before contact for transfer to the paper. Application is made while the web is supported between the guide rollers **68** and **70.** The emulsion composition is applied in coating weights of about two to six and preferably three to four pounds per 3000 square feet of surface area.

From the coating station **64,** the coated web is advanced to an air knife **78** and over-roller **80** which operate together to meter the amount of coating composition allowed to remain on the web and to distribute the coating uniformly across the web. Following the air knife, the emulsion coated surface is engaged by one or more reversing smoothing rolls **82** to smooth the coating by the reverse rolling technique. While such reverse rolls are preferred to improve the smoothness of the coating, they are not essential to the emulsion coat.

From the smoothing rolls **82,** the web is turned about the roller **80** to position the wet emulsion coating uppermost for advancement over a suction apron **84** and then through a drying oven **86** while it is carried on the surface of a supporting endless belt **88.** The upper run of the belt is supported on longitudinally spaced apart crosswise extending rollers **90,** arranged in an arcuate path through the dryer and the belt continues to support the web for a short distance beyond the exit of the dryer whereafter the belt turns downwardly and back for return through the oven. A takeup roller **92** is provided outside of the dryer for adjusting the tension of the belt. It is preferred to make use of a vapor permeable belt to enable the escape of vapors therethrough during passage of the coated web through the dryer. It is also important to operate the belt at a linear speed corresponding to the speed of the coated paper web so that the coated paper will rest on the belt in a relaxed state without relative movement or tension during passage through the drying oven.

The web **16,** coated on one side with a dry emulsion coat **60,** is now passed over a series of guide rollers and tensioning rollers **96** to a windup roll **98** mounted on a winder stand **100** and powered to wind the coated web onto the roll. The web is drawn through the coating and drying stations by the windup roll. In the preferred practice illustrated, removal of moisture from the coating, during travel through the drying oven, is effected by hot air jets which are addressed onto the coated side of the sheet as described in U. S. Pat. No. 3,311,499.

From the standpoint of economy, it has been found that when the paper web is calendered in the manner described, immediately prior to wetting the paper with the aqueous emulsion coating, the amount of emulsion coating applied to the paper can be materially reduced with corresponding reduction in the cost and the weight of the coated paper, but without loss in performance characteristics.

From the standpoint of performance, it has been found that the improved smoothness and reduced porosity,which is introduced by calendering immediately prior to coating, is retained even when the coated sheet is wet with the aqueous emulsion coating by reason of the lesser amount of penetration of the aqueous emulsion coating into the base paper. As a result, less moisture is required to be driven out of the paper with the result that higher speeds can be achieved in manufacture with less wrinkle or cockle in the dried sheet.

It will be understood that numerous changes may be made in the details of formulation and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In the method for high speed production of a capsule coated carbonless paper having a uniform pressure sensitive capsular coating on one side, the steps of calendering the sheet of paper and metering an aqueous emulsion coating of pressure rupturable capsules onto one side of the sheet as a continuous operation immediately following the calendering step, and advancing the coated sheet continuously through a drying section while the sheet is supported, with the emulsion coated side uppermost, on a supporting surface traveling at about the same linear speed as the paper for removal of moisture from the coating.

2. The method as claimed in claim **1** in which the moisture is removed from the coated sheet during travel through the drying section by directing hot air jets onto the coated side of the sheet while the sheet is supported in a relaxed state.

3. The method as claimed in claim **2** in which the support for the coated sheet of paper, during travel through the drying section, comprises a vapor permeable endless belt which enables moisture to be removed from the sheet through the belt.

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