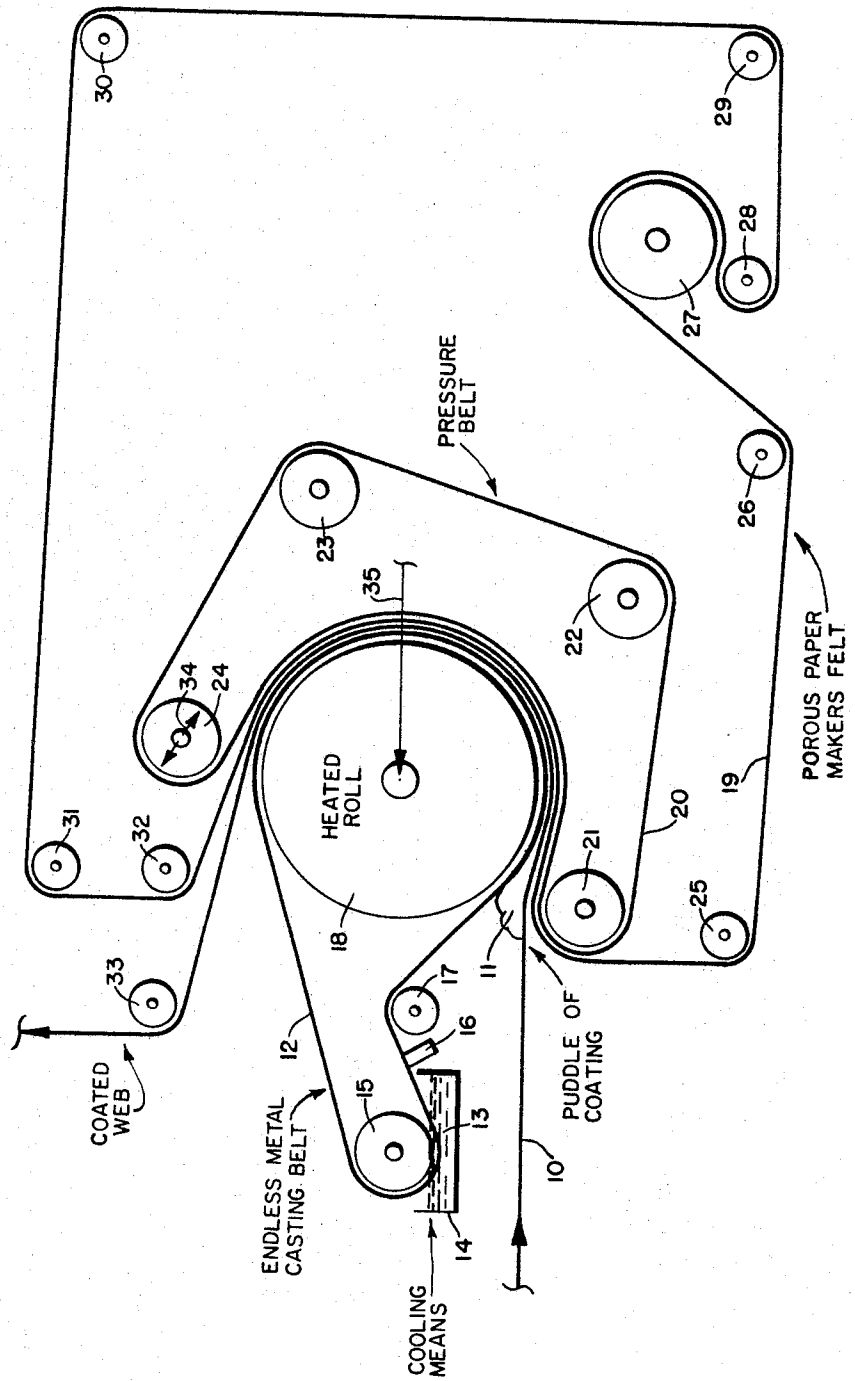
July 11, 1967 B. S. HALSEY ETAL 3,330,688

CAST COATING PROCESS

Filed Oct. 29, 1963



United States Patent Office 3,330,688 Patented July 11, 1967

3,330,688

CAST COATING PROCESS

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Filed Oct. 29, 1963, Ser. No. 319,768
9 Claims. (Cl. 117—64)

This invention relates to an improved method and apparatus for cast coating a continuous web. More specifically, this invention relates to an improved method and apparatus for cast coating a paper web when employing a liquid coating composition which is cast at temperatures exceeding the boiling temperature of the liquid contained in the coating.

The method of cast coating which comprises heating a web to a temperature of around 212° F. or more is generally referred to as pressure-cast coating since sufficient pressure must be applied to the web during its heating to prevent the web from being separated or blown away from the dryer drum before its coating is dried or cast, otherwise an imperfect coating will result. In conducting that process, it is desirable to maintain an excess or puddle of the liquid coating material at the entrance nip which is that area defined by the paper web as it comes into contact with the casting surface. While not absolutely essential to achieve high quality cast coatings, this technique of operating serves as an obvious indicator to the machine operator that he is maintaining a suitable coating consistency in relation to other operating parameters.

To increase production rates, the above described type of casting operation can be readily speeded up by increasing the temperature and speed of rotation of the dryer drum upon which casting is effected, viz. increasing the temperature above 212° F. In this manner, the whole operation is speeded up and the web being coated naturally moves through the casting unit at a greater linear speed. It has been found when cast coating a web by the above described procedure that as the temperature of the dryer drum is increased considerably above 212° F. (e.g. 280° F.), maintenance of the proper puddle of coating material in the entrance nip by the machine operator becomes more and more difficult inasmuch as the liquid in the coating material begins to boil away. This not only results in the coating becoming more viscous which at times will cause sticking of the coating to the drum, but additionally causes spattering of the coating. Spattering is undesirable since the distinct and discrete particles of coating material upon contacting the casting surface of the heated drum coalesce and become dried. These discrete particles of dried coating material upon subsequent contact with the puddle and the wet coated web are not absorbed thereby but rather remain separate and distinct and at times will cause additional coating material to be pulled away from the web and cohere to the casting surface. This results in an imperfect cast coated web having a mottled and distorted surface.

While the above problem can be overcome by having the machine operator adjust the coating viscosity in proportion to any changes in the temperature of the dryer drum, there are intervening factors that must also be correlated simultaneously by the machine operator. The net result is that this extent of operating complexity introduces a wide margin of human error which has proven difficult to control. It can be appreciated that failure to maintain this required degree of control results in high waste and loss of operating time in order to cut back the production rate and establish exactly the proper or right operating conditions.

An object of this invention is to eliminate this close

degree of operational control. Specifically, an object of this invention is to provide an improved pressure-cast coating method and apparatus whereby a puddle of coating material can be maintained at the entrance nip in a simplified manner without necessitating an extremely close degree of operational control, especially when pressure-cast coating at high pressures and temperatures. These and further objects will come to light as the discussion proceeds.

The drawing depicts a schematic elevational view of the apparatus of this invention wherein the process of this invention can be practiced.

The above objects are accomplished pursuant to the practice of this invention which provides a method of coating a web with a mineral coating which method comprises: passing the web through an entrance nip between a pair of turning rollers, one of said rollers being maintained at a temperature at least equivalent to the boiling temperature of the liquid in a wet thermosettable mineral coating; simultaneously passing a cooled endless metal belt through said nip; and maintaining a puddle of said wet thermosettable mineral coating within the nip defined by said belt and said web. In conducting the above process, it is preferred to employ a metal belt having an extremely smooth surface, especially a chromium plated extremely smooth surfaced flexible metal belt. Moreover, the improved method of cast coating made possible by way of this invention is especially applicable to pressure-cast coating with vapor receiving means in combination with pressure means for urging the paper web against the dryer drum which can be heated to temperatures well above 212° F., e.g. on the magnitude of 350° F. When pressure-cast coating in this manner, it is preferred to heat the dryer drum **18** to a temperature within the range of from about 220° F. to about 350° F., especially at about 240° F. to about 280° F. Moreover, it is preferred to exert a pressure upon the web by pressure means **20** within the range of from about 5 p.s.i. to about 50 p.s.i., particularly from about 10 p.s.i. to about 35 p.s.i. By this embodiment and operating under these conditions, cast coated paper having optimum properties is produced at lowest cost

The basic apparatus constituting a part of this invention is depicted in the drawing which further illustrates the preferred type of cast coating operation to which the present invention is especially adaptable. Referring to the drawing, the improved cast coating means of the instant invention comprises the rotatable drum means **18** which means further comprise heating means **35**, the latter preferably comprising steam injection and condensate discharge means. A system of roller means, for example the rollers **15** and **17**, is provided for conveying the endless metal belt **12** around a portion of the surface of the drum **18**, the outer surface of the belt **12** being adapted to serve as a drying and casting surface. The web conveying means **21** is positioned and adapted (a) to bring a wet coated web **10** into contact with the outer surface of the belt **12** at least by the point at which the belt first meets the drum **18**, (b) to define at the point of said contact a nip capable of receiving a puddle **11** of the coating composition, and (c) to maintain contact beyond the point at which the belt **12** first meets the drum **18**. In combination with the metal belt **12**, which as brought out above is preferably a chromium plated extremely smooth surface flexible metal belt, is cooling means **13** which is preferably water maintained at about room temperature within container means **14**.

Thus it can now be appreciated that among the advantages and features of the present invention is that the belt **12** keeps the puddle **11** away from the hot drum **18** and thus minimizes the amount of heat picked up by the

puddle of coating material **11**. This coupled with the fact that the belt **12** is additionally cooled by cooling means **13** makes it possible to operate with a very liquid flooded nip **11** while avoiding spattering of the coating composition. As indicated above, spattering of the coating composition at the entrance is extremely undesirable inasmuch as the distinct particles of coating materials will coalesce and adhere to the casting surface and upon subsequent contact with the wet coated web undergoing drying, will not blend in and form an integral part of the coating but rather will remain a separate entity the configuration of which is assumed and reflected in the cast coating, viz. an imperfect cast coated web having mottled surface. Even if spattering should occur in the practice of this invention, the above effect is minimized since the distinct particles of coating material do not contact the casting surface when it is hot. Consequently, the particles of coating material are not dried upon the casting surface and hence absorbed by the puddle maintained in the entrance nip. Additional advantageous features of the instant invention is that the metal belt **12** serves as a casting surface unlike the conventional smooth surface dryer drum as presently employed in the art. This minimizes the cost of operation inasmuch as in the event of damage to the casting surface, the metal belt need only be replaced in lieu of the rather expensive dryer drum. The amount of down time is also minimized since the metal belt can be more quickly replaced than the dryer drum. Moreover, employing the same production line, it is possible to produce economically coated products having various degrees of surface smoothness or embossing thereon by merely substituting a flexible metal belt having the desired surface finish. Otherwise, it is necessary to change the dryer drum, a practice which is obviously cumbersome, or at least have different production lines which is obviously more expensive.

As brought out above, the drawing depicts the preferred method and means wherein the practice of this invention can be conducted. The wet coated paper stock **10** as fed to the casting unit has thereon a coating composition which is applied at about 8 to about 25 pounds per 3,000 square feet of base stock. The coating contains a heat-vaporizable liquid, e.g. water as employed in conventional pigmented coatings, e.g. clay, titanium, dioxide, and the like based coatings which further comprise an adhesive, e.g. starch, casein, and the like. It is understood of course that the coating composition can contain other materials, for example waterproofing agents, defoamers, wetting agents, release agents, and the like. In fact, an ancillary feature of the present invention is that the loss of volatile additives by vaporization occurring at the flooded nip is similarly greatly reduced or eliminated by operating in this manner. In terms of our preferred embodiment, the wet coated paper **10** is fed to the casting unit comprising the chromium plated smooth surfaced flexible metal belt **12** in combination with the dryer drum **18** and heating means **35**. The wet coated paper web **10** is fed into the nip defined by the position of the drum **18** and roller **21** wherein the puddle **11** is maintained between the wet coated web **10** and metal belt **12**. The metal belt **12** is cooled by conveying it over roller **15** into contact with a source of cooling water **13** within the container means **14**. Wiping means **16**, such as conventional papermaker's felt, is provided to remove excess water from the flexible metal belt which is then conveyed over roller means **17** into contact with the flooded nip **11** and the heated dryer drum **18**. The web **10** is pressure-cast by being compressed by the pressure belt **20** over the area defined by the extent or degrees of wrap of the pressure belt **20** around the casting surface **12** which conforms to the shape of the dryer drum **18**. The degrees of wrap of the casting surface area is determined by the position of the rollers **21** and **24** which together with rollers **22** and **23** constitute a conveying system for the pressure belt **20**. Operating in combination with the

pressure belt **20** is vapor receiving means **19**, generally conventional papermaker's felt. The vapor receiving means **19** receives moisture emanating from the coating formulation which is driven therefrom during the course of casting it upon the paper web **10**. The vapor receiving means **19** can be separately dried if desired by such means as the heated drum **27** which together with rollers **25**, **26**, and **28–32** constitute the conveying system for means **19**. After casting, the cast coated paper then leaves the heated dryer drum over the roller means **33**.

By way of example, employing the apparatus arrangement depicted in the drawing a paper web **10** comprising an uncalendered board having a density of 7 lbs./ream/mil and 18 mils thick as prepared from 50 percent Kraft and 40 percent Groundwood is first given a wet coating composed of 100 parts clay, 18 parts protein, and sufficient water to make a 55 percent solid solution which is applied to the web **10** in sufficient quantity to produce a coating of 20 lbs./ream. The wet coated web **10** is fed into the casting unit comprising the dryer drum **18** which is heated to a temperature of about 350° F. A puddle **11** of the coating material is easily maintained at the entrance nip at all times. The pressure belt **20** by virtue of tensioning means **34** is caused to exert a pressure of about 33 p.s.i. continuously and uniformly upon the paper web **10** during its contact with the metal belt **12**. The vapor receiving means **19** comprises ¼ inch thick conventional papermaker's felt. The temperature of the cooling water **13** is maintained at essentially room temperature. By means of this procedure employing a dryer drum of 6 foot diameter, production rates exceeding 400 feet per minute are easily attained without entailing excessive attention on the part of the machine operator to maintain a cool flooded nip or puddle **11** of the coating material. Moreover, rapid changes in production rates can be readily accomplished, viz. from 450 f.p.m. to 550 f.p.m. in a matter of minutes without adjusting the consistency of the coating composition but still having the same number of machine operators in attendance. Operating in this manner produces a cast coated paper having an extremely smooth finish and high gloss.

What is claimed is:

1. A process for pressure cast coating a web with a thermosettable mineral coating comprising, in combination,

(a) passing said web through an entrance nip into a pressure area defined by the contact of at least two moving endless belts one of which is metal and one of which is a porous material,

(b) maintaining a puddle of liquid solution of unset said thermosettable mineral coating at said entrance nip between said web and the one moving endless metal belt, said porous belt contacting the uncoated web surface,

(c) heating the moving endless metal belt after contact with said puddle at said entrance nip to a temperature at least equivalent to the boiling point of the liquid of said liquid solution,

(d) maintaining the coated web within said pressure area for a period sufficient to cause said thermosettable mineral coating to become pressure-cast on said web,

(e) separating said at least two moving endless belts to release the pressure on said web,

(f) recovering the resulting thermoset pressure cast-coated web, and

(g) cooling the separated said one moving endless metal belt to a temperature at least below the boiling point of said liquid prior to its contact with said puddle.

2. The process of claim **1** further characterized by the heating of the moving endless metal belt being accomplished by contacting the belt with a rotating heated drum.

3. The process of claim **1** further characterized by

said heating being to a temperature of from about 220° F. to about 350° F. and said pressure area between said at least two moving endless belts being sufficient to compress the moving web there between at a pressure of from about 5 p.s.i. to about 50 p.s.i. in excess of ambient pressure.

4. The process of claim 3 further characterized by said temperature being from about 240° F. to about 280° F. and said pressure being from about 10 p.s.i. to about 35 p.s.i.

5. The process of claim 1 further characterized by said one moving endless metal belt being chromium plated at least on the side in contact with said puddle.

6. The process of claim 1 further characterized by said cooling being accomplished by water.

7. The process of claim 1 further characterized by said moving endless metal belt being smooth on the side in contact with said puddle.

8. The process of claim 1 further characterized by said moving endless metal belt having an embossing pattern on the side in contact with said puddle.

9. The process of claim 1 further characterized by said liquid comprising water.

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