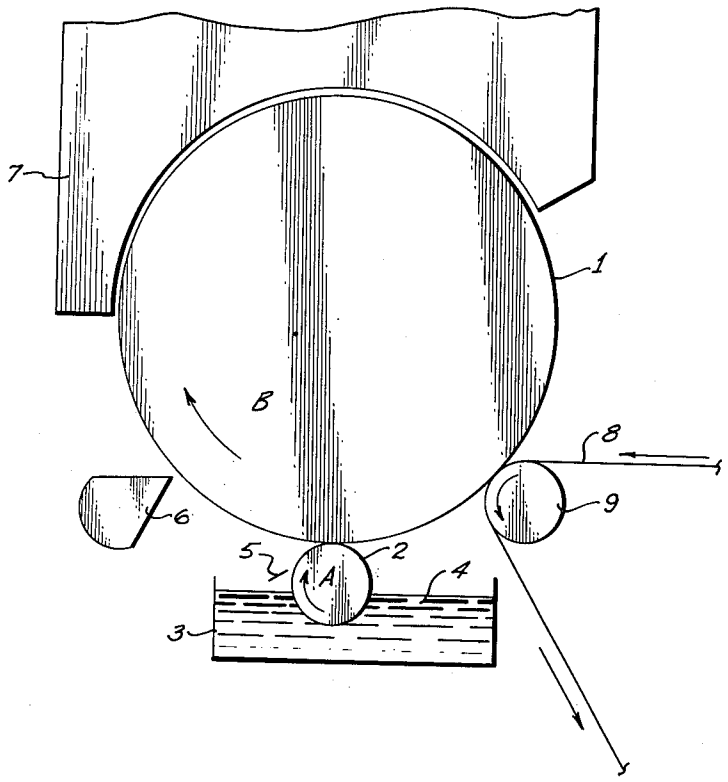
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METHOD FOR CASTING CLAY COATING

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METHOD FOR CASTING CLAY COATING

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This invention relates to the cast coating of mineral coating compositions and more particularly to the formation of a thin, uniform film or layer of mineral coating material on a casting surface, such as a polished drum, the mineral film or layer so formed being adapted, upon drying, to be transferred intact to the surface of a paper or board web to form a clay surface for such web.

In the copending application of Frank D. Bergstein, Serial No. 638,680, filed February 7, 1957, and entitled Dry Gloss Pre-Cast Laminated Paper and Method of Making It, now Patent No. 2,934,467, procedures are taught whereby a cast coated product can be formed by precasting the mineral coating composition on a casting surface and thereafter bodily transferring it to the paper or board web by means of an interposed layer of adhesive, the web being adhesively secured to the dried mineral layer and thereafter utilized to strip the mineral layer from the casting surface. Prior to the teachings of the said copending application, cast clay papers and board were formed by applying the mineral coating composition directly to the paper or board and the wet layer so formed brought into contact with a casting surface, such as a revolving drum, the layer of mineral material being maintained in tight contact with the surface of the drum until it had dried, thereby causing the surface of the coating to assume the characteristics of the casting surface. In a procedure wherein the mineral layer is precast against the casting surface from a mineral slurry, a number of advantages are realized among which is a substantial reduction in the amount of coating material required to surface the supporting web. While, as taught in the aforementioned copending application, conventional applicator means may be utilized to apply the mineral coating composition to the drum or other casting surface, we have now found that the techniques and apparatus to be hereinafter discussed provide unusually uniform and thin mineral coatings which, by reason of their uniformity in thickness, have a far superior appearance and uniformity in opacity. That is, we have found that unless the layer of mineral coating material is made as uniform as possible, the variation in thickness, even though minute, tends to present a streaked or striped appearance in the finished product. While such streaking is not objectionable for many uses, particularly where the board is printed, there are nevertheless many uses for such coated board which require uniform opacity and the highest possible surface finish.

Consequently, a principal object of the instant invention is the provision of techniques whereby a uniform, thin film of mineral coating composition can be applied to the casting surface and dried thereon for subsequent transfer to the paper or board supporting web.

Still a further object of the invention is the provision of a coating technique by means of which a thin uniform film of a mineral coating slurry may be applied to a rotating casting drum, the coating so formed being tempered to uniformity after application to the drum without disturbing its interface, thereby providing a uniform surfacing layer which, when stripped from the drum displays the surface characteristic of the casting drum.

The foregoing, together with other objects of the invention which will appear hereinafter or which will be apparent to the skilled worker in the art upon reading these specifications, we accomplish by that construction

and arrangement of parts and by those procedures of which we shall now describe an exemplary embodiment.

Reference is now made to the accompanying drawing wherein the FIGURE is a diagrammatic elevational view of coating and smoothing apparatus in accordance with the invention.

Briefly, in the practice of the instant invention, we have found that the mineral coating slurry must be initially applied to the casting surface under conditions such that the applying instrumentality does not touch the casting surface at any time. If contact is made—even slight contact—the polished surface of the drum will be impaired. We have found, however, that the coating slurry can be successfully applied by means of a reverse roll coater which is set to lie in near contact with the drum but which does not actually contact the surface of the drum. The coating slurry will, however, contact and adhere to the drum to form a continuous filml or layer thereon. While such mineral layer as applied is generally too thick and irregular for the formation of a uniformly smooth, high gloss finish, we have found that the mineral coating can be tempered subsequent to its application to the casting surface so as to produce the desired uniformly thin coating. To this end, we employ an air knife arranged to impinge upon the coated surface of the drum along a line spaced from the point of application of the coating, the air knife being so located and operated that it will smooth and even the exposed surface of the coating without disrupting the surface thereof in contact with the casting drum.

While we do not wish to be bound to theory, it is our belief that the coating slurry will begin to set substantially immediately upon contact with the casting drum, which may be internally heated to a temperature of from between 160–200° F., and that a thin, essentially dry film of coating material forms at the interface of the coating layer and the casting surface, which film cannot thereafter be disrupted without impairing the cast finish. We have discovered, however, that the smoothness and uniformity of the mineral coating can be greatly enhanced by utilizing an air knife to temper the remainder of the coating subsequent to its application to the drum but prior to its drying to the extent that the body of the coating is immobilized. In using the air knife, care must be exercised in its location and also in the pressure utilized, for otherwise the thin film of coating material in contact with the drum may be displaced and the cast surface thereof disrupted.

Referring now to the drawing, we have therein illustrated a casting drum **1**, the cylindrical surface of which is preferably chromium plated and polished to provide a high gloss casting surface. The size of the drum does not constitute a limitation on the invention, and its diameter may be varied in accordance with the operating speed desired. Preferably, the drum will be of a diameter of from 4 to 8 feet so that it may be operated at speeds commensurate with the speeds of a conventional paper making machine, the coating unit being adapted to be installed at the end of the paper or board making machine, if so desired, so as to provide on-the-machine coating. The coating applicator roll **2** is located beneath the casting drum where it dips into a receptacle **3** to which the mineral coating composition **4** is supplied from any convenient source. Preferably, the applicator roll **2** is a reverse roll coater driven in the direction of the arrow A, whereas the coating drum B is driven in the opposite direction, as indicated by the arrow B. We have found that a rubber covered applicator roll produces excellent results; and the coating material may be initially metered on the roll by means of a doctor blade **5**. As already indicated, the applicator roll **2** will be so positioned that the coating composition thereon will make

contact with the drum, but the spacing will be such that the applicator roll itself at no time contacts the polished surface of the drum.

The mineral coating composition will be in the form of a slurry, a non-limiting example of such slurry comprising 100 parts pigment, such as clay, calcium carbonate, titanium dioxide or combinations thereof, together with 20 parts binder, the slurry containing sufficient water or other vehicles to bring the overall solids content to about 55%. In formulating the slurry, the pigment is first dispersed in water to form an initial slurry having from 50–65% solids, whereupon the binder solution, preferably a vinyl acetate emulsion, is added together with sufficient water to bring the overall solids content to approximately 55%. Such a slurry is readily flowable and yet is readily picked up by the applicator roll for transfer to the casting surface. The casting drum may be internally heated to a temperature of about 150–200° F. to assist in the setting and drying of the coating.

The smoothing and leveling of the applied coating is effected by means of the air knife **6** which is positioned to impinge upon the applied coating along a line traversing the casting drum.

The position of the air knife **6** is important, as is the pressure of the air as it contacts the exposed surface of the coating layer. The air knife must be sufficiently close to the point of application of the mineral coating to the drum so that the body of the coating is capable of being tempered, i.e., capable of being displaced, and yet the air knife cannot be sufficiently close to the point of application to disrupt the coating at its interface with the casting surface. As already stated, it is our belief that the coating will begin to dry substantially immediately upon contact with the heated casting surface and that a relatively thin skin or film of essentially dry coating composition will form against the casting surface, whereupon the coating will continue to dry from the inside out. Consequently, for the air knife to be effective, it must be positioned to contact the coating subsequent to the formation of the thin skin or film and prior to the time the body of the coating has set sufficiently so as to be no longer displaceable. In an exemplary embodiment, we have found that excellent results are obtained where the air knife is positioned approximately 16 inches from the point of contact of the applicator roll with the casting surface. It will be understood, however, that the exemplary position given may be varied depending upon operating conditions.

The pressure at which the air is applied to the coating is also important in that it must be sufficiently low so that it will not displace or otherwise disrupt the skin formed at the interface. To this end, we have found it preferable to operate the knife at about ½ lb. pressure or less. We have found that at such greatly reduced pressure, the air knife is effective in smoothing and leveling the coating to a substantially uniform thickness throughout—usually about 1 mil. We have also found it desirable to incline the air knife with respect to the surface of the drum so that a slight back-flow is produced. The angle of inclination may be varied, although for most purposes it has been found that a rearward inclination of but a few degrees is sufficient.

Following the smoothing of the coating by means of the air knife **6**, the coating then passes beneath an air drier **7** which acts to completely dry the coating. Preferably, the drier **7** is a forced air drier in which heated air is caused to impinge upon the exposed surface of the coating. The coating is thus subjected to heat both from the surface of the drum and from the drier, so that complete drying from both sides is rapidly effected.

Following drying, the coating is then contacted by an adhesively coated web of paper, board, or the like, which is pressed into intimate contact with the mineral coating by means of the pressure roll **9**. The adhesive coating on the base web will be tacky at the time of contact with the mineral layer and yet it will be sufficiently free from solvents and the like so that it will be non-saturating with respect to the dried mineral layer. As the web **8** passes around the roll **9**, it will act to strip the mineral layer from the drum thereby surfacing the web with a mineral coating layer having an exposed cast surface corresponding to the surface of the drum. As the drum continues its rotation, its now clean surface will again be presented to the applicator roll **2** for recoating.

With the arrangement just described, we have found that a uniform, thin and continuous layer of mineral coating composition can be applied to a casting surface without in any way impairing the casting surface or the cast surface of the mineral layer itself. At no time is the casting surface contacted by either the applying or smoothing instrumentalities. The outer or exposed surface of the mineral layer is smoothed to a uniform and level condition, the opacity of the mineral layer is uniform throughout and free from streaks and the like.

Having thus described the invention in an exemplary embodiment, and with the understanding modification may be made in the invention without departing from the spirit and purpose of it, what we desire to secure and protect by Letters Patent is:

1. A method for forming a smooth continuous layer of mineral-binder coating composition on a casting surface which comprises providing a rotatable drum having a casting surface, rotating said drum and continuously applying thereto a fluid coating of mineral-binder composition, applying heat to the surface of said coating in contact with said drum so as to commence drying of said coating at the surface thereof in contact with said casting surface so as to form a film of dry coating at its interface with said drum, and as said coating is advanced by said drum and at a time when the external surface at least of said coating is still fluid, contacting the external surface of said coating with a stream of air under sufficient pressure to smooth said external surface but insufficient to displace the said film of dry coating at its interface with said drum, and thereafter applying heat directly to the external surface of said coating, whereby to effect drying thereof in the smoothed condition.

2. In the manufacture of paper and paperboard sheets having a cast mineral layer bonded to one surface thereof, wherein a thin layer of aqueous mineral coating composition is first applied to a heated casting surface and dried in contact therewith, and wherein a paper or paperboard web the contacting surface of which is coated with a continuous film of bonding adhesive is fed into contact with the dried mineral layer and adhered thereto under pressure, and the web thereafter utilized to strip the mineral layer from the casting surface as a discrete layer bonded to the web, the exposed surface of the mineral layer having a cast finish corresponding to the finish of said casting surface, the improved method for applying a slurry of aqueous mineral coating composition to the casting surface and forming it into a thin, uniform layer, which method comprises applying a slurry of mineral coating composition to the casting surface to form an initial layer thereon, and while the body of said initial layer is still fluid but at a time when the surface thereof in contact with the heated casting surface has begun to dry, subjecting the exposed surface of the layer to an air smoothing operation in which the exposed surface of the layer is smoothed and reduced to uniform thickness throughout, said air smoothing operation being performed at an air pressure sufficient to displace and smooth the exposed surface of said layer but of insufficient magnitude to displace the surface of the layer in contact with the casting surface, and immediately following the air smoothing operation subjecting the exposed surface of the smoothed layer to a current of heated air to effect the rapid drying of the layer in the smoothed condition.

3. The method claimed in claim 2 wherein said air

smoothing operation is conducted at an air pressure substantially no greater than ½ lb. per square inch.

4. The method claimed in claim 3 wherein said casting surface comprises a rotating drum, wherein the drum is heated to a temperature at its casting surface of from 150–200° F., wherein said slurry of mineral coating composition is initially applied to said rotating drum by means of a roll applicator positioned to be free from physical contact with the casting surface of said drum, and wherein said air smoothing operation is conducted along a line traversing the casting surface of said drum and lying in spaced relation to the point at which the layer of coating composition is initially applied to said drum.

5. A method for forming a smooth, continuous layer of casting composition on a casting surface which comprises providing a rotatable drum having a cylindrical casting surface, rotating said drum and continuously applying thereto a coating of a liquid casting composition capable, when dried, of forming a continuous layer having a cast surface in contact with the cylindrical surface of said drum, applying heat to the surface of said coating in contact with said drum so as to commence drying of said coating at the surface thereof in contact with the said cylindrical casting surface so as to form a skin of dry coating at its interface with said drum, and as said coating is advanced by said drum and at a time when the external surface at least of said coating is still fluid, contacting the external surface of said coating with a stream of air under sufficient pressure to smooth said external surface but insufficient to displace the said skin of dried coating at its interface with said drum, and thereafter applying heat directly to the external surface of said coating, whereby to effect drying thereof in the smoothed condition.

6. The method claimed in claim 5 wherein said air smoothing operation is conducted at an air pressure substantially no greater than ½ lb. per square inch.

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