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## METHOD OF PREPARING HIGH-GLAZE WAXED PAPER

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This invention relates to a method of preparing high-glaze waxed solid fibrous products, particularly paper or cardboard.

It is well known to use paraffin wax or other waxy materials for coating or impregnating paper, cardboard or other fibrous products, in order to make the product impervious to water vapor. Paper products, or the like, provided with such a coating, are particularly suitable as packaging materials for various food-stuffs, the moisture content of which must remain constant during storage or transport. A waxed paper with as high a glaze as possible is often required.

Heretofore, paper products have been coated or impregnated with paraffin wax either by passing the web of paper over a roll partially immersed in molten wax, or by actually submerging the web of paper in the molten wax, the resulting waxed paper being then immediately subjected to a chilling (cooling) operation, either by passing it through cold water or by conducting it over cooling rolls, in order to impart a glaze to the surface of the coated paper. By using the aforementioned chilling methods, however, it is possible to impart only a moderate glaze to the waxed paper. Furthermore, the waxed paper prepared by the known processes often shows the undesirable "crow's-feet" effect. This effect particularly occurs when the paper is passed at a relatively high speed through the molten wax and through the cooling water or over the cooling roll.

Other disadvantages of the prior art processes arise from the ultilization of direct contact with cold water during the chilling step. For example, this chilling technique is suitably only when both sides of the paper have been waxed. Where only one side of the paper has been waxed, this chilling technique is not suitable as the uncoated side would be moistened by the water. Furthermore, it is necessary to keep the temperature of the water relatively low, preferably at about 4° C., in order to obtain a glazed surface. Another disadvantage is the adherence of the water to the surface of the wax-coated product. The removal of this adhering water from the surface of the waxed paper necessitates the use of costly special equipment, such as scraping knives or vacuum producing installations.

It is, therefore, a principal object of the present invention to provide an improved method for imparting a high glaze to the surface of waxed fibrous products. It is a further object of the present invention to provide a method of preparing high-glaze waxed paper products, only

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one side of which has been waxed. Still another object is to provide an improved method of preparing high glaze waxed paper products which are apparent from the following detailed description.

It has now been found that the above-mentioned and other objects can be achieved by rapidly cooling the wax-treated solid fibrous product by direct contact with mercury maintained at a temperature of not above 30° C. More specifically stated, the present invention comprises applying, for example, by coating or by impregnation, a moisture-proofing wax or waxy substance to a solid fibrous material, such as a web of paper, and rapidly cooling the treated fibrous material from a temperature of about or above the melting point of the waxy substance, i. e., a temperature at which the waxy substance is in the molten state, to a temperature substantially below the melting point of the waxy substance, by contacting it with mercury maintained at a temperature of not over about 30° C., preferably between about 0° C. and about 20° C.

The waxy substance is preferably applied to the fibrous material in the molten state. For example, the paper or cardboard can be actually submerged in the molten wax, or the paper can be passed over a roll partially immersed in molten wax, the roll picking up the wax and transferring it to the paper. The thickness of the wax film can be adjusted by means of scraper bars or by the pressure of a set of squeeze rolls. Other well known methods of applying the wax to the fibrous material can obviously be used in the present process. The paraffin wax can, for example, also be applied in the form of a solution in a volatile solvent to the fibrous material. After the solvent has been removed, as by evaporation, the waxed product is then heated to a temperature of at least the melting point of the wax and subsequently chilled (cooled) according to the present invention. It is also possible to add the wax, preferably in the form of an emulsion, to the fibrous mass from which the paper or cardboard is prepared. The resulting waxed product is then heated to melt the wax and is then immediately cooled, using mercury as the cooling medium.

The wax content of the resulting product may vary within wide limits. The wax content depends upon the density of the paper, the time allowed for penetration while the wax remains molten, the temperature of the wax, the type of wax, the pressure on the squeeze rolls, etc. In general, the wax content is preferably at least 10% by weight, calculated on the fibrous material to be treated.

Any wax or waxy substance capable of moisture-proofing can be used. The most satisfactory materials are the paraffin waxes. Either macrocrystalline or microcrystalline wax, or mixtures of the two can be used. The microcrystalline paraffin waxes are generally more effective water- and moisture-proofing agents than the macrocrystalline type. The macrocrystalline waxes are, however, preferred for hot impregnation of paper because of their lower viscosities in the molten state. Generally, blends of the two waxes will be found to be the most satisfactory. Although the paraffin waxes are preferred, ceresins and some of the hard synthetic or manufactured waxes, as, for example, derivatives of the montan waxes or montanic waxes, can also be used, either instead of or in combination with the paraffin waxes. In general, the waxes which, relatively speaking, produce the best glaze in the conventional methods, will produce the highest glaze possible with the present invention.

If desired, modifying agents can be incorporated in the waxy material used. The particular agents used for this purpose depend upon the properties desired in the final coating. For example, certain resins, both natural and synthetic, such as ester gum (i. e., esters of polyhydric alcohols, particularly glycerol, and resin acids), hydrogenated ester gum, rosin, polyethylene, oil-soluble alkyd resins, and the like, can be added to even further improve the brilliancy and gloss of the final coating. Other modifying agents which can be added include refined carnauba wax, Candelilla wax, the montan waxes or synthetic derivatives of montan wax, beeswax, Japan wax, ozokerite, and the like.

The temperature of the mercury cooling bath should not be above about room temperature, that is, above about 30° C. Although a very high glaze can be obtained when the mercury bath is maintained at room temperature, most favorable results are obtained when the temperature of the mercury bath is between about 0° and 20° C. In general, the lower the temperature of the mercury bath, the higher is the glaze of the waxed product.

Any suitable cooling system can be used for maintaining the mercury at the proper temperature. For example, the mercury bath can be cooled by indirect heat exchange with water, as by passing water through a cooling coil disposed in the mercury bath. This method of cooling is particularly suitable when maintaining the mercury at the relatively higher temperatures.

Mercury does not adhere to paper or cardboard as does water, and, therefore, it can be used as a cooling medium for paper that has been waxed on only one side, whereas water cannot. The use of mercury has the further advantage that mercury does not adhere to the surface of the waxed product. Consequently, such costly equipment as scraping knives or vacuum installations, which equipment is generally associated with water cooling, is not necessary in the practice of the present invention.

It has also been found that the surface of the waxed products prepared according to the method of the present invention is, generally, much more uniform than the surface of the waxed products glazed according to known methods of operation. For example, such irregularities as "crow's feet" which frequently occur with the known processes, do not occur when using mercury as a cooling medium, even when the web of paper is passed through at a relatively high speed.

The use of mercury as a cooling medium has the further unexpected advantage that the resulting waxed paper or cardboard has a greater imperviousness to water vapor than the waxed products obtained by cooling in air or by direct contact with water.

The following example illustrates the advantages of the present invention.

## EXAMPLE I

Strips of paper weighing 40 grams per square meter, were passed through a vessel containing molten paraffin wax which was maintained at a temperature of 90° C. The paraffin wax applied was a macrocrystalline paraffin wax having a melting point of 60° C. The paper was passed through the molten wax at a speed of 10 meters per minute so that it became impregnated with about 50% by weight, based on the paper, of paraffin wax. The resulting waxed paper was immediately cooled. Four different tests were carried out using different cooling methods as follows:

In test No. 1, cooling was effected by passing the waxed paper through atmospheric air;

In test No. 2, cooling was effected by immersing the waxed paper in water maintained at 4° C.;

In test No. 3, cooling was effected by contact with mercury maintained at 30° C., and

In test No. 4, cooling was effected by contact with mercury maintained at 0° C.

The glaze of the waxed paper obtained in each test was determined by measuring the reflection in a gloss meter. The glaze measured is expressed as a percentage of reflected light.

The results obtained are set forth in Table I.

*Table I*

| Test No. | Measured Reflection, percent |
|---|---|
| 1 (cooling in air) | 20 |
| 2 (cooling with water at 4° C.) | 58 |
| 3 (cooling with mercury at 30° C.) | 65 |
| 4 (cooling with mercury at 0° C.) | 95 |

It will be noted that by cooling with mercury, even at a temperature of 30° C., a better glaze is obtained than by cooling with water at 4° C., or by cooling in air. Best results are obtained by cooling with mercury at 0° C.

The same strips of paper were also measured for their permeability to water vapor. The permeability to water vapor is measured as the amount of water vapor (in grams) which, in 24 hours, passes from a vessel containing an atmosphere saturated with water vapor at 20° C. through 1 square meter of waxed paper into a vessel containing no water vapor. The results are set forth in Table II.

*Table II*

| Test No. | Permeability to Water Vapor (gr./sq. m.) |
|---|---|
| 1 (cooled in air) | 5 |
| 2 (cooled with water at 4° C.) | 4 |
| 3 (cooled with mercury at 30° C.) | 3 |
| 4 (cooled with mercury at 0° C.) | 2.5 |

From the foregoing results it can be seen that waxed paper prepared according to the method of the present invention is considerably less permeable to water vapor than waxed paper which has been cooled in air or by contact with water at 4° C.

We claim as our invention:

1. In the method of preparing a waxed paper product wherein a web of paper is passed through molten paraffin wax and wherein the resulting wax-impregnated paper is immediately cooled to a temperature substantially below the melting point of the paraffin wax, the improvement comprising effecting said cooling by immersing said wax-impregnated paper in mercury maintained at a temperature of from about 0° C. to about 20° C.

2. The method according to claim 1, wherein the paraffin wax is a mixture of macrocrystalline paraffin wax and microcrystalline paraffin wax.

3. In the method of preparing a waxed paper product wherein a waxy substance is applied to the paper product and wherein the resulting wax-treated paper product is rapidly cooled from a temperature at which said waxy substance is in the molten state to a temperature substantially below the melting point of the waxy substance, the improvement comprising effecting said cooling by passing the wax-treated paper product through mercury maintained at a temperature of not more than 30° C.

4. The method according to claim 3, wherein said waxy substance is a paraffin wax.

5. The method according to claim 3, wherein the mercury is maintained at a temperature of from about 0° C. to about 20° C.

6. In the method of preparing a waxed solid fibrous product wherein a solid fibrous material is passed through a waxy substance in the molten state and wherein the resulting wax-impregnated solid fibrous material is immediately cooled to a temperature substantially below the melting point of the waxy substance, the improvement comprising effecting said cooling by immersing said wax-impregnated solid fibrous material in mercury maintained at a temperature of from about 0° C. to about 20° C.



7. The method according to claim 6, wherein the waxy substance is a paraffin wax.

8. In the method of preparing a waxed solid fibrous product wherein a waxy substance is applied to a solid fibrous material and wherein the resulting wax-treated solid fibrous material is cooled from a temperature at which the waxy substance is in the molten state to a temperature substantially below the melting point of said waxy substance, the improvement comprising effecting said cooling by passing said wax-treated solid fibrous material through mercury maintained at a temperature of not more than 30° C.

9. The method according to claim 8, wherein said waxy substance is a paraffin wax.

10. The method according to claim 8, wherein the mercury is maintained at a temperature of from about 0° C. to about 20° C.

11. A method of preparing a waxed solid fibrous product which comprises contacting said solid fibrous material with a waxy substance in the molten state whereby said solid fibrous material is coated with the molten waxy substance, and passing the resulting wax-treated solid fibrous material through mercury maintained at a temperature of not more than 30° C. whereby said wax-treated solid fibrous material is cooled to a temperature substantially below the melting point of said waxy substance.

12. The method according to claim 11, wherein said solid fibrous material is paper and said waxy substance is a paraffin wax.

13. The method according to claim 11, wherein the mercury is maintained at a temperature of from about 0° C. to about 20° C.

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