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PROCESS FOR WAXING PAPER

Samuel Bergstein, Cincinnati, Ohio, assignor to Robert Morris Bergstein and Frank David Bergstein, trustees

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My invention relates to the application of waxes or waxlike compounds in molten condition to packages or to packaging materials. Packaging materials are customarily fibrous sheet stocks such as paper or paperboard; and the primary purpose of a coating or application of a wax or waxlike composition is to provide protective qualities such, for example, as moisture-vapor proofness. Because fibrous sheet stocks are absorbent in nature, waxy materials when applied to them in molten form tend to be absorbed or partially absorbed and to this extent fail to provide the desired protective characteristics. For optimum results it is necessary that the wax remain on the surface of fibrous sheet stocks in the form of a continuous, and therefore imperforate and impervious, film. Any absorption of the coating tends to disrupt the continuity of such a film and to increase the quantity of coating substance required to secure proofness.

For example, on an impenetrable surface approximately 7 pounds of wax will cover an area of 1000 square feet with a film approximately $^1/_{1000}$ of an inch thick. I have found that a uniform continuous surface film of wax which is only $^1/_{1000}$ of an inch thick is sufficient to provide moisture proofness. But the ideal continuity of the film has not hitherto been obtainable in applying wax to the surfaces of fibrous stocks. So much of the wax penetrates or soaks into the fibrous structure that a reasonable degree of moisture proofness is normally obtainable only through the application of two or three times the amount of wax mentioned above, and in some instances is not obtainable at all with commercial amounts of wax.

Also, as is well known, the penetration of wax into the surface of paper or paperboard produces an undesirable discoloration of it, as will be discussed more at length hereinafter.

The principal objects of my invention are the provision of a mode of enhancing film formation with wax or waxlike substances applied in molten form, without increasing the cost of the product or its manufacture in any significant way and with consequent economy of coating material and the avoidance of discoloration and other disadvantages.

These and the more specific objects of my invention which will be set forth in the ensuing disclosure or will be apparent to one skilled in the art upon reading these specifications, I accomplish by that procedure of which I shall now describe certain examples.

I have discovered that by wetting the surface

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of fibrous material, as by a light spray of water, immediately prior to the application of the molten waxy compositions, and by applying the compositions in molten form in a manner coordinated with the wetting as hereinafter set forth, I am able very greatly to lessen or to eliminate altogether the penetration of the wax substances into the surface of the fibrous sheet stock. I have found further in the practice of my process that inherent film forming characteristics in the waxy compositions employed become very much less important and that it is entirely possible to form continuous films from substances which inherently possess poor film forming characteristics as applied to absorbent surfaces.

The bare presence of water in or on the surfaces of paper or paperboard is not sufficient for the purposes of my invention. Instead, both the quantity and disposition of the applied water must be controlled at the time the molten coating composition is applied. It is possible to add too much water to fibrous sheet stocks so that the surface becomes too wet to permit the formation of an adequate film even with coating compositions having strong film forming characteristics. The addition of too much water to fibrous sheet stocks, or the provision of too much water on their surfaces prevents the proper anchorage of any film which is formed. It is undesirable also in that it tends to weaken the sheets and may entail a subsequent drying operation. With too little water or where the water, irrespective of its quantity, is substantially wholly absorbed into the body of the fibrous sheet stock, adequate films will not be formed unless excess quantities of coating substances having strong film forming characteristics are employed.

I have found, however, that excellent results may be obtained by wetting the surfaces of fibrous sheet stocks with a relatively very small quantity of water uniformly and quickly applied and then immediately coating the surfaces with the molten waxy materials. In my process the effect is as though at the instant of the application and chilling of the molten waxy substance the water itself formed a barrier film at the surface of the fibrous material, preventing penetration of the waxy substance while permitting a good bond of the coating with the fibrous material. Yet the quantity of water applied is so small that the sheet stock does not require subsequent drying operations nor is there any tendency for vaporized water to blow holes in the applied coating.

The condition of the water film is an evanescent one, requiring that the coating be done im-

mediately after the application of the water. After a very brief interval of time the quantity of water applied soaks into the fibrous sheet stock to the extent of failing to serve the purpose of this invention. While I do not desire to be limited to any one mode of applying the water, I have found that it is most conveniently done through the provision of one or more adjustable spray heads, depending upon the width of the sheet. By adjusting the spray heads as they uniformly apply moisture to the surface of the sheet just before the sheet passes into or beneath the surface of a bath of molten waxy composition, or just before the composition is applied to the fibrous sheet surfaces by roller coating or printing means, a condition of operation can readily be arrived at and maintained which will result in the production of a continuous and imperforate film with minimum penetration of the sheet stock by the waxy substance. The precise quantity of water employed will vary somewhat with the nature and surface of the fibrous sheet stock; but successful operating conditions can readily be arrived at and maintained in the ways set forth above.

I now give certain examples of forms which the practice of my invention may take, it being understood that these are illustrative merely.

Example 1

One of the most widely used grades of paperboard for folding boxes is made entirely or in large part of waste paper and is known as chip board. In the manufacture of many types of packages, particularly for the food industry and for such materials as meat products, bakery goods and the like, it is desirable to wax one or both surfaces of this sort of paperboard. When a molten wax or waxy composition is applied to chip board by procedures customary in the industry, the penetration of the molten and flowing wax causes a decided darkening and discoloration of the board, which is unsightly and undesirable, particularly for packages containing food products. Some chip boards are made with a liner or surface layer of higher grade stock, but even here the penetration of wax as applied in the usual way is such as to cause what is known as a strike-through. The wax tends to make the surface liner more transparent and the darker color of the body of the board shows through it. Indeed, with lined boards waxing has a tendency to cause uneven or splotchy darkening of the surface which is additionally undesirable. Hence for food products, it has been the practice in the past to use a solid board made of expensive and virgin bleached pulp where the board was to be waxed.

To manufacture packages from paperboard where the protective characteristics of wax are desired, one practice has been to wax bulk paperboard in sheets or rolls from which a number of units of individual carton blanks are thereafter cut. Another practice has been to form the carton blanks themselves and thereafter wax them individually by passing the blanks between a pair of rollers, one or both of which carry a surface film of the molten wax, supplied to the rolls from a heated fountain. The thickness of the wax film on the surfaces of the rolls is controlled by a doctor blade.

When paperboard in either of these forms is waxed, in addition to the undesirable darkening or discoloration previously noted, the porous nature of the stock causes a large amount of the wax to be absorbed by the sheet, making it difficult to achieve a continuous surface film of the wax unless excessively large quantities are applied. But in the practice of the present invention, I can eliminate these difficulties and still follow the same general procedures in waxing blanks or bulk paperboard providing that, immediately prior to the application of the molten wax by coating rolls, dipping or otherwise, I spray the surfaces of the board from one or both sides, as the case may be, with a controlled amount of water. I have found that I can secure continuous and imperforate films with very much smaller quantities of wax than have hitherto been required to achieve proofness, and that I can do this without any real staining or discoloration of the board. Hence I may not only use lined boards instead of the more expensive virgin pulp boards of high quality, but I may also employ chip boards and other cheap fibrous materials, the uncoated surfaces of which would be acceptable commercially for the intended uses.

I have hereinabove discussed the application of the water. The manner of application of the wax is not limiting excepting that it should preferably permit control of the quantity applied to effect the economies possible in my operation, and except that it should not be so applied as to involve heating of the paperboard to a high temperature for a relatively prolonged period of time. The wax may, if desired, be applied by spraying. But if the paperboard or blanks are passed through a bath of molten waxy substance, it is desirable that their path of travel be a short one so that the applied waxy coating can begin to congeal and attain a non-saturating consistency before the characteristics of the water film described above are destroyed. For this reason I prefer a roller coating operation of the kind described.

Example 2

In my copending application Serial No. 549,480, entitled Grease- and moistureproof coated paperboard and method of making it, filed August 14, 1944, I have disclosed waxlike compositions which are mixtures within certain ratios of microcrystalline and paraffin waxes with or without other components such as resins. These compositions when applied within certain temperature ranges, provide not only a surface film which is moisture and vaporproof but also one that is greaseproof, providing protection against vegetable fats and oils, shortening, and the like. I have found that the application of my present process in the formation of boards coated with these moisture and greaseproof compositions provides a product markedly improved in several respects.

To provide the maximum protective characteristics, the surface coating should be a film that is as continuous as possible, without perforations or pinholes and without interruptions produced by underlying fibers extending through the coating and above its surface. By spraying water upon the boxboard or blanks in the manner herein described just prior to coating, and otherwise following the teachings of my copending application, a temporary barrier is provided against penetration by the molten wax compounds, and the desired result is augmented in that a superior degree of proofness may be obtained with a smaller quantity of coating substance. It may also be noted that in my copending application the temperature at which the composition is applied to the paper or paperboard surface must be carefully controlled within a given range. I find that when the paper or paperboard is first treated with water as herein described, there is

a substantial broadening of the temperature ranges at which successful results are achieved.

Example 3

My present process is also of value in the waxing of papers, including light weight papers. In such materials, when used for providing protective wrappers or bags for food products and the like, it is often desired to print one surface with advertising matter, instructions and the like while the reverse side of the sheet is the one treated with a waxy composition for protective purposes. When a light weight sheet, such as an 18 or 24 pound sulphite paper is waxed in the customary way, any substantial absorption of the wax is likely to cause it to penetrate entirely through the paper. In some instances this tends to increase the transparency of the paper, which is undesirable, and in other instances a mottled appearance is produced. In any event, a striking of the waxy substance through the paper tends to interfere with printing upon the opposite side.

Paper is customarily waxed while in the form of a continuous web. It is unwound from a parent roll and is passed over a coating roller which is partially submerged in a fountain containing molten paraffin or other waxlike substance. After the wax has been thus applied, the web is either cut apart into sheets or rewound preparatory to further processing.

In accordance with my invention, I can follow the same general procedure in applying wax to the web but immediately prior to its application by the coating roll I treat the web with a spray of water as has been described. Penetration of the wax into the paper is very substantially lessened or is eliminated entirely, preserving the appearance of the paper, as will be evident. Also in my practice, it is possible to obtain a light weight paper bearing a uniform protective waxlike film upon one surface while the other surface remains sufficiently free from wax to present a suitable surface for printing or other decorative processes. I am also enabled, in accordance with my invention, to apply much heavier coatings of wax to one side of thin paper without harming appearance or the ability of the other side to accept printing inks.

Example 4

It is a practice in certain branches of the packaging industry to dip finished, filled and closed cartons or containers into a bath of molten wax or waxy substance so as to secure an all over external protective film on the finished package. This may be done for moisture proofness or to prevent the infiltration or escape of external or internal gases.

My invention is suitable for use in conjunction with such treatments. I find that if a suitably sealed paperboard carton is first passed through a fine spray or mist of water vapor and is thereupon immediately immersed in a molten bath of waxy substance under the conditions hereinabove set forth, the wax treatment becomes very much more effective for essentially the same reasons as have been pointed out in connection with my other examples. Since the wax is unable to penetrate the surface barrier formed by the water under the conditions taught above, it forms a more uniform and continuous external film, providing the maximum protection with the minimum of coating material. Again, undesirable staining or discoloration of the package is avoided.

I have further discovered that it is possible, without interfering with the obtaining of the effects described above, to add other materials to the water so as to obtain additional advantages. The water may thus be used as a vehicle to introduce into the sheets materials which, remaining after the dispersion or evaporation of the water, produce secondary or residual effects. For example, a percentage of glycerin may be added to and mixed with the water. This does not interfere with the formation of the desired barrier to the penetration of molten waxy substances; but the glycerin remaining in the sheet acts as a plasticizer and imparts added flexibility to the finished product. This is of especial importance in connection with light weight papers.

Again, a small percentage of a water soluble, grease-proof resin such as polyvinyl alcohol may be added to the water which is to be sprayed upon the paper or paperboard. The pressure of the resin does not adversely affect the action of the water in preventing penetration of the wax; but the grease proofness of the sheet is augmented by the residual resin so introduced.

Excepting for the actual cost of additives, there is no extra operation or additional labor in providing such secondary advantages since no additional step or operation is involved.

By my invention as herein described, I have provided a simple and highly effective mode of insuring the formation of a uniform and continuous surface film of wax or waxlike compounds on fibrous or other normally highly absorbent materials. Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in certain exemplary embodiments, what I claim as new and desire to secure by Letters Patent is:

1. A method of waxing a web of paper stock to provide on a surface thereof an imperforate superficial film of a coating wax, solid at room temperatures, with a minimum amount of such coating wax, which comprises applying to the said surface a light superficial film of water no more than sufficient to form an imperforate film on said surface, and immediately thereafter applying said coating wax in a molten state to said surface before said water film is absorbed into said surface.

2. A method according to claim 1 in which said water contains polyvinyl alcohol.

3. A method according to claim 1 in which a plasticizer for said coating wax is mixed with said water.

4. A method according to claim 3 in which said plasticizer is glycerin.

5. In a process of applying to a surface of paper stock a coating of a wax, which is solid at room temperatures, the steps of quickly and uniformly applying to said surface a light superficial film of water no more than sufficient to form an imperforate film on said surface, and immediately applying thereto a molten coating wax before substantial absorption of said water into the surface of said paper stock can take place, under conditions to promote immediate chilling thereof.

6. In a process of applying to a surface of a web of paper stock a wax coating, solid at room temperatures, the steps of producing a continuous movement of said web, continuously spraying water evenly over said whole surface in an amount no more than sufficient to form an initial imperforate film of water substantially wholly superficially thereon, and immediately applying a molten coating wax to said surface and

against said film prior to the substantial absorption of the film of water into the web.

7. A process of coating paper stock webs with a coating wax, solid at room temperatures, so as to produce continuous and imperforate superficial coatings of said wax, said process comprising applying to the surface of the webs a temporary but continuous film of water no more than sufficient to form an imperforate film on said surface, and applying the coating wax in molten condition to said film so rapidly that the coating wax commences to congeal prior to the breaking of the said film of water by absorption into the said web.

SAMUEL BERGSTEIN.

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