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METHOD OF WAXING PAPER AND PAPER BOARD AND APPARATUS

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FIG. 1

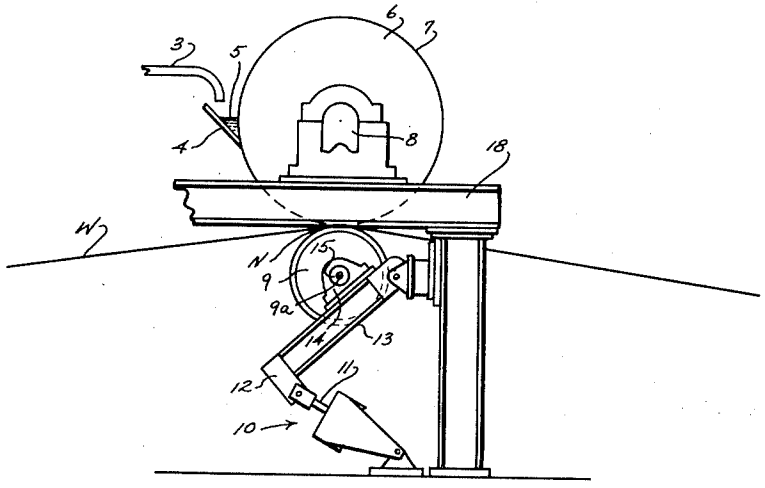
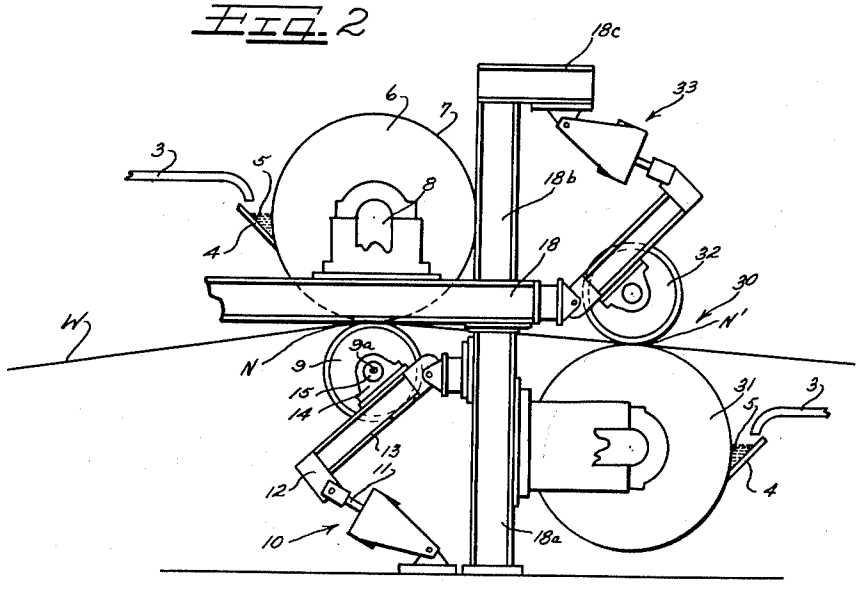


FIG. 2



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METHOD OF WAXING PAPER AND PAPER BOARD AND APPARATUS

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The present invention relates broadly to the production of paper and related web materials, and is more particularly concerned with improved methods and means for waxing and finishing paper and related web materials.

Heretofore, waxes have been applied to paper and paper products in various blends and of various compositions for the purpose of primarily excluding moisture but also to enhance appearance and to provide a degree of self-sealing. Tissue and lightweight papers are waxed for food service to prevent such food products as meat, cheese, bread and the like from sticking to the paper. The wax employed for this purpose is usually "dry" wax and the wax is applied to the fibers of the paper web rather than to the surface thereof. This waxed product carries the smallest quantity of wax relative to the weight of the paper. Household waxed papers and bread-wrap are required to have an unbroken film of wax for preventing penetration of moisture and vapors. It is also desirable to provide a high gloss finish to such waxed papers. Recently, paper board for the food industry is primarily surfaced with a wax moisture barrier.

For purposes of the present application, the term "wax" is to be understood as designating paraffin, emulsions of paraffin, and any mixture of paraffin and solvent, and similar wax materials employed for waxing of paper and related web materials.

The present invention permits greater production speeds, requires the use of less wax to obtain a continuous waxed surface, permits uniform application of the wax to the web surface, and provides improved appearance to the waxed web surface.

It is therefore an object of the present invention to finish a waxed surface of a paper web and related web materials.

It is another object of the present invention to provide improved methods and means for imparting a high gloss finish to a waxed surface of a paper web and related web materials.

It is still another object of the present invention to provide improved methods and means for impregnating wax into the surface of a paper web and related web material by the application of controlled amounts of heat and pressure while simultaneously imparting a finish to the waxed surface.

It is a further object of the present invention to provide improved methods and means for applying a uniform layer of wax to at least one surface of a paper web and related web material and for imparting a finish to the layer.

A still further object of the present invention is to provide improved methods and means for waxing one or both sides of a paper web and related web material and for finishing one or both sides of waxed surfaces of the paper web or related web material.

Other objects, features and advantages will become apparent from a consideration of the following detailed description and accompanying drawing illustrating preferred embodiments of the present invention wherein like reference numerals and characters refer to like and corresponding parts throughout the several views.

On the drawing:

FIGURE 1 is a partially diagrammatic view in side elevation of apparatus for waxing and finishing surfaces

of paper web and related web materials constructed in accordance with the concepts of the present invention.

FIGURE 2 is a diagrammatic view in side elevation of apparatus for waxing and finishing both sides of a web material.

As shown on the drawing:

Briefly stated, the present invention involves the application of a film of wax to a hard, hot polished surface, pressing the web material firmly against the hot polished surface and removing the web material from contact with the solid surface while simultaneously releasing the pressure applied thereagainst.

As appears in FIGURE 1, apparatus constructed in accordance with the present invention for waxing and finishing one side of a paper web or paper board may include a wax supply conduit 3 for delivering wax to a conventional flexible blade applicator 4 confining a puddle of the wax 5 in contact with a driven roll 6 having a highly polished finishing surface 7. The finishing roll 6 is heated to provide a heated surface, and for this purpose, a heating medium may be supplied to the interior of the roll 6 through a conduit 8. It will be appreciated that the size of the finishing roll 6 is much smaller relative to the size of a Yankee drum.

A web W is fed by conventional means (not shown) through a narrow width and hard nip N defined by the finishing roll 6 and a hard surface but resilient backing roll 9.

The finishing roll 6 may have a surface plating, as with chrome or nickel, and the resilient backing roll 9 may comprise a metal core having a rubber cover of the desired hardness.

In order to minimize the operating pressure loading of the respective finishing and backing roll, it is desirable that the resilient roll 9 be quite hard, i.e., less than 30 P. and J. (⅛" ball). Employment of a hard surface roll permits concentration of total uniform pressure loading on a relatively narrow nip, in the direction of travel of the web, and, excellent results have been obtained when the nip is of a cross-sectional width less than 1" and preferably about ½". The development of high unit pressures in a narrow nip is desirable only below the crushing point of the web fibers. The hard and narrow nip assures uniform loading across the entire width of the sheet. It will be appreciated, of course, that continued use of the nip will tend to cause the resilient or hard rubber surfaced roll 9 to soften slightly due to the temperature conditions existing at the nip and due to the effects of working engagement with the web during operation. In order to maintain the backing roll at a desired high hardness level and thereby the nip width within the desired limits, means may be employed, if desired to cool the resilient rolls. For this purpose, a cooling agent may be introduced into the interior of the backing roll through a conduit 9*a*.

The temperatures maintained at the nip in conjunction with the other nip conditions must be controlled to prevent evaporation of the waxes employed. The temperature limits of the waxes presently employed for paper-making purposes are well known in the art. Generally, the temperature at the nip is maintained above the boiling point of water or other vehicle of the web and no known upper temperature limits exist other than the decomposition temperatures of the particular wax, size and web materials involved. Experience has indicated that the transversely and uniformly distributed high intensity unit pressure at the nip is preferably within the range from about 240–250 lbs. per sq. in. to about 2400 lbs. per sq. in., depending primarily upon the particular wax and paper web material involved.

Thus in the nip, the surface of the paper board to be waxed is pressed firmly against the finishing surface 7

carrying the waxed film by means of the backing roll 9. It will be appreciated that the waxing and finishing steps occur almost simultaneously in the nip. The temperature and pressure conditions in the nip result in a smooth and even application of wax which forms thereby a continuous wax film on the surface of the web. Additionally, the weight distribution of the wax is even, and less wax is required to obtain a continuous film for sealing the wax and/or obtaining the level of finish desired. It is often desirable, particularly to achieve heavier applications of wax, to apply sufficient wax to the surface 7 to form a small pool of liquid wax at the entrance to the nip N. It will also be appreciated that the present invention is distinguishable from the calendering apparatuses employing high unit pressures which tend to press the web and require extended contact of the web with the rolls.

Satisfactory finished results are obtained at any practical operating speed and, therefore, finishing operation speeds are limited only by the operational speeds of the paper machine itself or the web supply means and of the finishing and backing roll. It will also be appreciated that finishing temperatures are generally in direct relation to operating speeds. For example, satisfactory finishing of waxed board in the above manner which was supplied at the rate of 500 ft. per minute was obtained with finishing roll and nip temperatures of approximately 300° F. and nip pressures of 400 lbs. per linear inch. Similarly, satisfactory finishing results were obtained with a waxed lightweight paper running at 2000 ft. per minute through a pressure nip of approximately ½" width maintained at a temperature of 350° F. and pressures between 400 and 500 lbs. per square inch.

The waxed and finished web may be immediately removed from the nip and fed to a winding reel (not shown).

On lightweight pre-waxing stock, the present invention permits sufficient control of weight so that the dry waxed grade of paper may be produced while an improved appearance attributable to a brighter and glossier finish is provided. It is also possible to drive sufficient wax into the sheet to provide a waxed paper product having two waxed surfaces. Of course the waxing of both sides of a paper web in this manner depends upon the thickness of the paper web being treated.

To vary the pressure applied at the nip for finishing of particular waxed surfaces, means therefore may take the form of a hydraulically or pneumatically operated piston assembly 10 having its piston rod 11 connected to a cross arm 12 of a pair of support members 13 which carry brackets 14 for mounting the shaft 15 of the backing roll 9. The support members 13 may be pivotally mounted to the support stanchion 18. Pneumatic or hydraulic operating pressures of the piston arrangement need only be increased or decreased in order to produce a corresponding pressure on the finishing roll and web.

Thus, in operation, the web is introduced into the nip N, preferably in such a manner that the web first contacts the backing roll 9 and wax in a continuous film is applied to the surface of the web in contact with the finishing roll 6. The thickness of the wax is easily controlled by the waxing apparatus 4 as well as the cross-sectional width of the film of wax to be applied to the web. In the nip, the heat and pressure conditions established therein cooperate to assure the application of a continuous wax film on the web surface in contact with the finishing roll and to simultaneously finish the surface of the web in contact with the finishing roll. The now waxed web material is removed from the nip simultaneously with the release of pressure by the backing roll and may be thereafter wound on a reeler (not shown). The web upon leaving the nip has a dry waxed surface exhibiting a high finish or gloss. By regulating the pressure applied by the backing roll 9 the wax may be applied to the web in the nip in such a manner that the wax penetrates and impregnates the web, depending upon web thickness, so that both sides of the web are provided with a waxed surface.

The method and apparatus in the present invention are efficient and provide neat and clean operating conditions as contrasted with the usual gloss waxing arrangements or water waxing arrangements. The quantity of wax applied to the web per unit area may be completely and accurately controlled by the nip loading conditions imposed. As aforementioned, there are many different grades of waxes employed for papermaking purposes as well as many different grades of paper and board to produce as many different grades and qualities of waxed paper product and board product as is commercially desirable. Thus, temperature, pressure, speed and similar operating conditions will vary depending upon the particular results desired. Furthermore, the apparatus of the present invention is so compact and simple and the adjustments required to produce varying grades of waxed paper and board so simple and so completely under the control of the apparatus operator that but a brief period of experimentation is all that is required to permit those skilled in the art to employ the method and apparatus of the present invention to produce the best results and obtain the desired waxed paper or board product.

Because, unexpectedly, the wax immediately solidifies and has provided thereon a finish when it leaves the nip, a similar waxing and finishing apparatus may be located immediately adjacent the first finishing arrangement for waxing and finishing the other side of the web material. For this purpose, the second finishing roll and second backing roll are reversed as shown in FIGURE 2. In this arrangement the apparatus of FIGURE 1 is employed in conjunction with a second waxing and finishing apparatus, generally indicated by the numeral 30, which includes a finishing roll 31 similar in construction and operation to finishing roll 6 mounted on frame stanchion 18*a*. A hard surface but resilient backing roll 32, mounted on frame stanchion 18*b* and similar in construction and operation to backing roll 9, cooperates with the finishing roll 31 under the nip and pressure conditions similar to those outlined herein in connection with the operation of the first waxing and finishing arrangement to define a finishing nip N', preferably of the same cross-sectional width as the finishing nip N. With this arrangement 30, the opposite side of the web may be waxed and finished in the same manner and under the same conditions as the web finishing treatment occuring in the nip N. The finishing of the second side of the waxed web does not materially reduce the finish on the previously finished surface of the web nor are the other desirable characteristics of the web materially affected while finishing the second side of the web. Means 33 for varying the pressure loading on the web in the nip, similar in construction and operation to the hydraulically or pneumatically operated piston assembly 10 may be provided and mounted on a frame cross arm 18*c*.

Preferably the paper web or board is brought in contact with the backing roll for positioning of the web for delivery to the nip. The web in the nip is provided with a continuous waxed film and the conditions at the nip including the heat and pressure applied, are sufficient to provide a gloss finish to the waxed surface. The web remains in the nip but a short time depending upon the operational speed of the web supply means. Upon leaving the hard and narrow width nip N' the newly waxed and finished surface of the web immediately sets and may be then wound on a reeler (not shown).

Waxed paper finished in accordance with the present invention produces a finish comparable to commercial finishes for waxed paper now considered acceptable in the trade. Satisfactory finishing results have been obtained for various waxed papers and board with the finishing surface of the finishing roll heated to a temperature within the range from about 220° F. to about 400° F., while I prefer to employ temperatures within the range from about 280° F. to 360° F. depending upon the end product desired.

In general the heat and pressure in the hard, narrow nip should be controlled to conform the surface being finished to the surface of the finishing roll without crushing the web and under conditions which accommodate removal of the web without disturbing the conformed web surface. Usually, tolerable moisture contents are lessened with increases in either nip temperature or nip pressure and enlarged with increases in basis web weight.

Conventional calendering operations, it will be appreciated, wherein high pressures are applied to the web, have an effect on web density and thickness which differs from the effects of the nip conditions of the present invention which permit lower pressures to be applied to the web in the hard narrow width nip. Lesser web deformation therefore occurs and results in a more uniformly finished web surface.

Various waxing apparatus may be employed for applying the wax to the finishing roll and the products obtained in accordance with the present invention may be employed for a variety of purposes, such as wax paper, frozen food boxes, frozen food wrap and related applications.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. The method of wax-finishing surfaces of paper web materials and related web materials which comprises: applying wax to a finishing surface cooperating with a resiliently yieldable backing surface of a hardness less than 30 P. and J. (⅛" ball) to define a hard and narrow width finishing nip, maintaining the nip at a pressure within the range of from about 240–250 p.s.i. and about

2400 p.s.i. and at a temperature within the range from about 200° F. to about 400° F. to thereby finish a waxed surface in the nip, and passing a web material through the nip whereby the surface of the web material adjacent the finishing surface is waxed and finished in the nip.

2. Apparatus for wax-finishing surfaces of paper web materials and related web materials comprising: a finishing roll, means for applying a wax film to the finishing roll, a resiliently yieldable backing roll having a hardness less than 30 P. and J. (⅛" ball) cooperating with the finishing roll to define a hard and narrow width nip of a cross-sectional width less than 1", means for maintaining the nip at a temperature within the range of from about 200° F. to about 400° F., means for maintaining the nip at a pressure within the range of from about 240–250 p.s.i. to about 2400 p.s.i., whereby a paper web material passed through the finishing nip is provided with a waxed surface in the nip which is finished in the nip.

3. Apparatus as claimed in claim 2 wherein the temperature maintaining means comprises means for supplying heated fluid to the interior of said finishing roll.

4. Apparatus as claimed in claim 2 wherein the nip pressure maintaining means comprises resilient fluid pressure actuated means.

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