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PAPER AND METHOD OF MAKING SAME

Lloyd L. Dodge, Rhinelander, Wis., assignor to Rhinelander Paper Company, Rhinelander, Wis., a corporation of Wisconsin

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This invention relates to the method of preparing paper with properties adapted for conversion of the paper into a waxed sheet of enhanced transparency and pliability.

In my U. S. Patent No. 1,992,996, dated March 5, 1935, I have described and claimed a method of preparing a paper for waxing to produce a non-greaseproof sheet possessing superior qualities over the more expensive greaseproof sheets, such as glassine. The greaseproof papers, such as glassine and the like, produced from well hydrated stock, lack the desired pliability for wrapping papers and possess an inherent springiness when waxed which precludes their satisfactory use on automatic wrapping machines. These automatic wrapping machines fold portions of the waxed paper on itself and seal the fold around the wrapped article by melting the wax on the sheet and causing it to serve as an adhesive. The greaseproof papers, however, tend to spring apart due to their lack of pliability.

Furthermore, greaseproof papers cannot be rendered sufficiently pliable by the incorporation of plasticizers without rendering the paper objectionably limp. In order to overcome the inherent springiness of greaseproof papers, it is necessary to add such a large amount of plasticizers to the paper that the paper will lack strength and body.

Therefore, according to my patented method above referred to, I prepare a sheet from bleached chemical pulp, preferably sulphite pulp, which is insufficiently hydrated to form a greaseproof sheet. This pulp is then formed into a web on a Yankee Fourdrinier machine. The web is dried on the Yankee drier and plasticized with from two and a half to ten percent of a plasticizer, such as glycerine, glycols, sugars, deliquescent salts or the like. The plasticized sheet is then supercalendered while in a moist condition.

The fiber formation of the stock on the Yankee Fourdrinier machine, the nature of the fibrous stock and the plasticizers, each contributes to reduce the tendency of the waxed paper made from this type of sheet to spring apart on automatic wrapping machines during the sealing operation. One of the reasons for the lack of springiness is that most of the fibers of the sheet lie in the machine direction and are folded along lines parallel to the machine direction.

I have now found that a superior sheet having a high degree of transparency and pliability can be obtained if the non-greaseproof web is treated with an aqueous emulsion of wax prior to the final waxing operation. The emulsion may be applied to one or both sides of the web by means of coating rolls, a dipping tank or sprays, which are positioned on the paper machine at a point after the web has been formed and partially dried. The wax emulsion impregnated web is then dried on the usual driers where the wax is raised above its melting point and is fluxed thoroughly into the web. The so treated sheet is then moistened and supercalendered to produce a non-greaseproof sheet which is well adapted for receiving a coating of wax thereon to form a waxed sheet of enhanced transparency and pliability.

It is therefore an object of this invention to form a non-greaseproof paper adapted to produce a waxed sheet of increased transparency and pliability.

A further object of this invention is to prepare a wax impregnated non-greaseproof paper capable of being further waxed by the usual waxing processes to form a sheet of enhanced pliability adapted for use on automatic wrapping machines.

A still further object of this invention is to so treat a web formed from comparatively "free", non-greaseproof stock with an aqueous emulsion of wax to increase the transparency of the resulting sheet.

Other and further objects of this invention will be apparent from the following detailed description and annexed claims.

The following example will serve to illustrate a preferred embodiment of the process of this invention:

A chemical pulp, such as bleached spruce sulphite pulp or other types of bleached or partially bleached sulphite, sulphate, or soda pulp may be used as the furnish from which the paper of this invention is formed.

The pulp is beaten only sufficiently to separate and comb out the fibers and produce what is usually referred to as "free" stock, not carrying the hydration sufficiently far to produce a greaseproof paper. A greaseproof paper may be defined as a paper which resists the penetration of spirits of turpentine for at least one minute, while the non-greaseproof paper shows almost instantaneous penetration of turpentine and seldom resists the penetration of turpentine for a period of time exceeding 3 to 5 seconds.

The penetration test is performed by placing a pile of sand of not more than one inch diameter on the paper to be tested, covering the sand with sufficient turpentine so that it spreads at

least one-eighth inch outside of the sand pile and placing a highly enameled book paper beneath the paper being tested. The book paper is then removed at intervals for inspection. When a spot shows on the book paper, the time from the application of the turpentine to the paper is noted. If the time is over one minute, the paper is classed as a greaseproof paper.

After the stock has been properly beaten, it is converted into paper on a Yankee Fourdinier machine which, due to the shorter forming wire and lack of lateral shake, forms a sheet in which the fibers of the pulp lie mainly in the direction of the machine. Since the paper goes through the automatic wrapping machine also in the machine direction and is folded generally along lines parallel to the machine direction, the Yankee Fourdrinier formed sheet has less tendency to spring apart during the sealing operation on the wrapping machine than other sheets formed on other types of paper machines.

From the forming wire of the paper machine, the web is directed around a large diameter drier drum where it is partially dried. The partially dried web is then treated with the aqueous emulsion of wax by either directing the web through a tank of the wax emulsion, by coating the emulsion on one or both sides of the web by means of coating rolls, or by spraying either one or both sides of the web with the wax emulsion. If desired, the wax emulsion may be applied to the bottom side of the web by dipping a fountain roll into a trough of the emulsion and contacting the web with the top of the roll by means of a top press roll, thereby transferring the film of the emulsion on the coating roll to the lower side of the web. The top side of the web may be sprayed, by means of a shower pipe, with the wax emulsion and then the web may be directed between the press rolls to squeeze out the excess amount of emulsion.

The emulsion applied to the web is a mixture of water and paraffine wax and an emulsifier of the soap type. The paraffine wax preferably has a melting point of around 124 to 126° F., although other waxes of higher or lower melting points may be used without materially affecting the properties of the final product. The emulsifier may be of any of the known emulsifying agents, such as ethanolamine esters of higher fatty acids, saponified fatty acids and the like. Suitable emulsifiers are known to the trade under the trade names of "Paracol"; "Gardinol", and the like.

The emulsions may vary widely in concentration and any emulsion falling within the following range is operative:

Constituents	Maximum percent by weight	Minimum percent by weight
Paraffine wax	51.6	0.50
Emulsifier	6.9	0.06
Water	41.5	99.44

The following formula has been used with very satisfactory results:

Constituents	Percent by weight
Paraffine wax	3.1
Emulsifier	0.4
Water	96.5

The emulsions used are very stable with the wax particles therein having a maximum diameter of about 5 microns and a minimum diameter of about 1 micron. 80% of the particles average from 2.5 to 3.0 microns in diameter.

The emulsion is capable of being infinitely diluted without separation and is broken down by acid solutions. In the maximum concentration indicated above, the emulsion has a pH of 7.8 to 8.2.

After the paper has been treated with the wax emulsion it is directed through a series of driers which remove the moisture that has been added by the application of the emulsion. During this drying operation, the sheet is raised to a temperature above the melting point of the wax and the wax is thoroughly fluxed into the sheet.

The dried paper is next dampened with from 20 to 30% of water and supercalendered while in the moistened condition in the same manner in which greaseproof and glassine papers are supercalendered. The usual type of supercalenders comprise a stack of alternate chilled steel and compressed fiber rolls operated under tremendous pressure. The supercalenders impart a high finish to the paper and render it more dense so that in the subsequent waxing operation, a more highly transparent sheet can be obtained. Because wax is already impregnated into the sheet by the application of the aqueous emulsion to the paper sheet, the transparency of the sheet is still further enhanced and the pliability of the sheet is also increased. If desired, plasticizers may be added to the sheet either before or after the wax emulsion application, although the incorporation of plasticizers is ordinarily not necessary.

After the supercalendering operation, the sheet is preferably moistened again and passed through a bath of molten wax, wound into a roll and maintained at a temperature above the fusing point of the wax for a short period of time. The waxed sheet is then unwound from the roll and passed through a second wax bath which serves to level off and smooth the surface of the waxed sheet. The second waxing step may be omitted if desired.

The increased transparency and pliability of my paper is due to the incorporation of the wax in emulsion form into the paper before it is thoroughly dried on the Yankee Fourdrinier machine. By incorporating wax into the sheet before it leaves the machine, the time required for saturating the sheet with wax in the final waxing operation is materially decreased. Furthermore, the wax is more thoroughly fused into the fibers of the sheet and uniformly distributed through the sheet by the supercalender. All of these features producing the increased transparency and pliability are based upon the incorporation of the wax emulsion in the web on the paper machine.

I am aware that numerous details of the process may be varied through a wide range without departing from the principles of this invention and I, therefore, do not purpose limiting the patent granted hereon otherwise than is necessitated by the prior art.

I claim as my invention:

1. In the method of making a waxed paper of enhanced transparency and pliability from relatively free, only partially hydrated paper stock by successively forming the stock into a paper web having its fibers lying largely in the machine direction, drying, moistening and super-calender-

ing said web, the steps which comprise subjecting said web a plurality of times to treatment with wax; first applying an aqueous wax emulsion to said web during said drying step and thereafter completing the drying of said web; secondly, passing the once waxed and super-calendered web through a bath of molten wax, winding said waxed web into a roll and maintaining the same at a temperature above the fusing point of the wax for a short time, and thirdly passing said waxed web from said roll into a second molten wax bath to level off and smooth the surface of said waxed web.

2. In the method of making a waxed paper of enhanced transparency and pliability from relatively free, only partially hydrated paper stock by successively forming the stock into a paper web having its fibers lying largely in the machine direction, drying, moistening and super-calendering said web, the steps which comprise subjecting said web a plurality of times to treatment with wax; first applying an aqueous wax emulsion to both sides of said web while in a heated condition during said drying step and thereafter completing the drying of said web at a temperature sufficiently high to fuse the wax in said web; secondly, passing the once waxed and super-calendered web through a bath of molten wax, winding said waxed web into a roll and maintaining the same at a temperature above the fusing point of the wax for a short time, and thirdly passing said waxed web from said roll into a second molten wax bath to level off and smooth the surface of said waxed web.

3. In the method of making a waxed paper of enhanced transparency and pliability from relatively free, only partially hydrated paper stock by successively forming the stock into a paper web having its fibers lying largely in the machine direction, drying, moistening and super-calendering said web, the steps which comprise subjecting said web a plurality of times to treatment with wax; first applying an aqueous wax emulsion to said web during said drying step and thereafter completing the drying of said web, said emulsion having a pH of between 7.8 and 8.2 and containing paraffin wax of a particle size not over about 5 microns diameter; secondly, passing the once waxed and super-calendered web through a bath of molten wax, winding said waxed web into a roll and maintaining the same at a temperature above the fusing point of the wax for a short time, and thirdly passing said waxed web from said roll into a second molten wax bath to level off and smooth the surface of said waxed web.

LLOYD L. DODGE.