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SURFACE-FINISHED PAPER

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1 Claim. (Cl. 91—68)

This invention relates to papers which by virtue of a special surface finishing have been improved in many important respects and are better adapted for various purposes, including use as wrappers for wet foods or other wet objects, and service as currency, checks, notes and the like.

In accordance with my invention, the body portion of the paper is preferably sized with a water-resistant agent like rosin, wax, and glue, and at least one face, for instance, the face which is to undergo printing and/or writing with ink, is surfaced with regenerated cellulose which is preferably deposited as a pellicle in situ thereon. The sizing of the body portion of the paper may be effected as usual by adding the sizing agent to the aqueous suspension of bulk pulp in the beater engine and then precipitating the agent on the pulp fibers before they are run off on the paper machine. Sufficient rosin size, glue, or aqueous wax dispersion may be disseminated throughout the beaten pulp in the beater engine and then fixed on the pulp fibers by the use of alum or equivalent precipitant to produce a water-resistant paper say one containing about 2½% to 5% sizing agent based on the weight of dry fiber. The dry, pre-sized paper may then be coated on either or both faces with a viscose solution and the cellulose regenerated as a pellicle in situ either as a separate step by the use of the usual cellulose-regenerating chemicals like sulphuric acid and/or niter cake solution, or during the redrying of the paper. The film of regenerated cellulose is so intimately bonded with the main body of the paper as to constitute in effect a single ply or integral structure. The regenerated cellulose so deposited on the paper may vary, although as little as from ½% to 3% has been found to improve the paper vastly in many of its qualities, some of which will presently be noted.

Thus the finished paper is not only possessed of high water resistance, i. e., the property of retarding the penetration of water therethrough by virtue of the sizing agent present in its body portion, but the regenerated cellulose on its surface imparts high wet strength thereto; greatly enhances its strength, tear resistance, folding endurance, crispness, and rattle; and prolongs the useful life or effectiveness of the sizing agent. For instance, it is well known that rosin-sized papers deteriorate when exposed to atmospheric oxygen and sunlight, probably on account of oxidation of the rosin. When such papers are protected by or enveloped in a film of regenerated cellulose, the action of atmospheric oxygen and sunlight is retarded so that the papers do not depreciate so

quickly by taking on what is known as a slack-sized condition. The film of regenerated cellulose permits of printing and writing as usual with inks, being penetrated rapidly by inks despite its impartation of high wet strength to the paper. Suitable dyes or dye fibers e. g., silk or rayon fibers may advantageously be added to the viscose solution especially when the finished paper is to be used for currency, check purposes, or the like. The viscose solution may be applied at a cellulose content of say 1% to 3% to the paper, at which cellulose content the viscose solution is comparatively fluent and permits of the deposition of a smooth comparatively thin film on the paper, which after conversion into regenerated cellulose may increase the weight of the paper comparatively slightly. As already indicated, the cellulose may be regenerated from the viscose as by drying under heat and/or by the use of suitable cellulose-regenerating chemicals. The addition of a small amount of boric acid to the viscose solution promotes the regeneration of the cellulose by the mere application of heat; and the addition of a small amount of ammonium carbonate to the viscose solution fosters a heat-volatilization of residual sulphur impurities probably as ammonium sulphide.

The surface treatment may be advantageously applied to papers intended for currency, checks or the like, in which case the enhancement of such qualities as feel, crispness and rattle are most desirable in addition to the improvement of such physical qualities as high wet and dry strengths, tear resistance and folding endurance. The treatment may, if desired, be effected after the desired matter or designations have been imprinted on the paper. I am using the word "imprint" in a collective sense to mean printing, engraving, lithographing, or the like. The film of regenerated cellulose deposited over the printed matter is especially resistant to removal by abrasion, and when removed is easily detected, especially when it is dyed or contains dyed fibers of a color shade different from that of the main body of the paper. The film in such case thus serves to prevent the removal of the printed matter through repeated handling or creasing of the paper currency, checks, or the like. The treatment may also be applied advantageously to so-called "safety" papers containing a suitable chemical which by color changes indicate tampering through the use of chemical eradicators with the imprint or writing made with ink on the paper. These so-called safety papers are now being used widely for bank checks, notes, or the

like. Only the main body of the paper need contain the color-changing chemical as the printing or writing with ink penetrates to the main body when made on the film of regenerated cellulose, wherefore the main body of the paper and the color-changing chemical would have to be reached by the chemical eradicators in order to destroy the printing or writing. This sort of tampering would therefore be immediately discerned and detected. The film of regenerated cellulose or both the film and the main body of the paper might advantageously contain the color-changing chemical. Typical chemicals which become colored upon contact with the ordinary ink eradicators such as the hypochlorite solutions, are diphenyl derivatives, e. g., diphenyl guanidine, which undergoes change from colorless condition to a dark brown, but which does not become colored on exposure to the atmosphere. Diphenyl salts like the hydrochloride are exemplary of chemicals which undergo color change by contact with ink eradicators of both acid and alkaline character and at the same time retain their color under normal conditions. In making the safety paper, one may start with the paper in pre-sized condition either before or after it has been surfaced with regenerated cellulose as hereinbefore described. The paper may be subjected to the action of a pair of rolls, one of which is resilient and the other of which is provided with the desired pattern in relief and which acts to condense or compact the paper locally in such pattern. The paper may then be impregnated with a dye solution containing the chemical which undergoes color change upon contact with a chemical ink eradicator and the impregnated paper dried. Those portions of the paper which have been condensed absorb less dye solution than the uncondensed portions and so are dyed less deeply than the uncondensed or more absorptive portions, with the result that the paper shows the impressed pattern.

Currency, check, note papers or the like, made

in accordance with my invention have such good wet strength that they can be washed or laundered especially when the printed matter is protected by the film of regenerated cellulose and are thus kept from direct contact with the washing or laundering water. Wrapping papers produced as hereinbefore described have such good wet strength that they are eminently useful for wrapping wet foods, such as fish and meats, without danger of being ruptured under stress. At the same time, they are resistant to the passage of water therethrough.

I am using the expression "pre-sized paper" to mean paper whose body portion has been sized by the beater-sizing method, to mean paper which has been surface-sized with glue, gelatine or the like, after fabrication, by the so-called tub-sizing method, or water-resistant paper prepared by the use of both the beater-sizing and tub-sizing methods. The formation of a film of regenerated cellulose in situ on either or both surfaces of papers thus pre-sized may involve flexibilizing the film especially when they are comparatively thick. Thus glycerine or the like may be included either in the viscose solution or in an after-treating solution to enhance the flexibility of the regenerated cellulose film deposited on the paper.

What I claim is:—

A paper whose fibrous body portion is sized and made water-resistant by the dissemination therein of about 2½% to 5%, based on the weight of dry fiber, of a water-resistant sizing agent, and at least one face of which is surfaced with a pellicle of regenerated cellulose receptive of and penetrable by printing and writing inks, said pellicle being developed in situ from a smooth, thin film of solution deposited on said paper base and being so intimately bonded with the main body of the paper as to constitute therewith in effect a single ply of integral structure.

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