

UNITED STATES PATENT OFFICE

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FILLED SURFACE PAPER AND PROCESS OF MAKING SAME

No Drawing.

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This invention relates to filled surface paper and processes of making same; and it comprises a paper carrying in the surface of one or both sides sufficient of a composition consisting of mineral matter and adhesive to fill, more or less completely, interfiber depressions, but not sufficient to produce a coating on the surface, nor to penetrate appreciably into the body of the paper; said mineral matter commonly including calcium carbonate and ordinarily amounting to a pound or less per side per 1000 square feet and said paper possessing a novel combination of valuable properties, namely printing qualities and color similar to those of coated paper, the bulk and other desirable properties of uncoated paper and an opacity usually greater than that of either coated or uncoated paper of the same weight; and it further comprises a process of making such surfaced paper wherein paper is made of ordinary materials and by the ordinary routine with the usual apparatus, save that after at least partial drying and advantageously before winding, there is intercalated a step of incorporating a composition consisting of mineral matter and adhesive into the surface depressions of one or both surfaces, the amount of mineral matter being ordinarily about a pound or less per side per 1000 square feet; all as more fully hereinafter set forth and as claimed.

Coated paper, as generally understood in the paper industry, refers to paper and similar stocks to which have been applied a layer of an aqueous dispersion of mineral pigment, such as clay, satin white, calcium carbonate and the like, and adhesive, such as casein, starch and the like; this layer being dried in place to form a continuous layer of coating on the surface and over the fibers for the purpose of improving the color and printing qualities.

The surface of coated paper, when properly super-calendered, is much smoother than uncoated paper. Besides, printer's ink is more quickly and uniformly taken by coated paper. Consequently, even an ordinary grade of coated paper permits a more faithful reproduction of the subject printed than the

best grades of uncoated super-calendered paper. On the other hand, the heavy weight of books and periodicals printed on coated paper is a well known objection to its use, and the greater opacity of uncoated papers, especially in the lighter weights, makes them generally preferred.

It has always been assumed that it was necessary to bury the fibers under a continuous layer of coating composition, no fiber appearing in the plane of the surface, in order to obtain the printing results and other desirable properties of coated paper. I have discovered that this is in fact not necessary, and that a new product combining many of the desirable properties of both coated and uncoated paper is produced by filling in the minute surface depressions with a composition of mineral matter and adhesive, but without covering over the fibers in the outer plane of the paper. In other words, I concentrate in the surface fiber interstices ink receptive mineral matter bound to the paper with adhesive to produce a paper of better printing quality, improved color, and higher opacity.

Moreover, I have found that these results may be accomplished with a remarkably small quantity of material and a more faithful reproduction of printing or lithography is possible on the new paper than on any grade of uncoated book paper. At the same time the new paper retains the greater bulk and other advantages of uncoated paper.

In a specific embodiment of this invention, a web of paper is made in the usual manner, of the usual materials and in the usual apparatus; and at one stage in the operation, after passing to driers, the traveling web of paper is treated with an excess of a suitable coating composition containing mineral matter. After applying the coating composition, which may be done by roller mechanism or by a bath, etc., the freshly coated web is subjected to the action of a wiper blade or scraper and residual coating composition is then dried in place. The scraper element is so adjusted as to remove practically all the coating from and above the fibers lying in the general plane of the surface, while leaving

the coating composition in the interfiber surface depressions. The removed coating material is collected for re-use.

In lieu of using a scraper mechanism in levelling the surface and removing the excess coating, the excess can be blown off by a suitable jet of air. Good results can be obtained in this way in a simple manner. Squeeze roll mechanisms which force the coating down into the body of the paper are not adapted for the present purposes; they interfere with the particular localization of mineral matter and adhesive which I desire.

The quantity of coating composition left on the web on removal of the overlying excess by the scraping mechanism, blower, etc., is very little. As a rule I leave in the paper an amount of mineral matter corresponding to a pound or less per 1000 square feet of the side treated. A pound per 1000 square feet per side is equal to about 3.3 pounds per standard ream of 500 sheets 25x38 inches. With paper weighing 50 pounds per standard ream, an addition of 1 to 3 pounds on each side increases the mineral matter of the finished paper roughly 4 to 12 percent on the dry weight; a quantity insufficient to interfere materially with the normal properties of the paper.

Any of the usual coating compositions employed in coating paper can be used, such as a suspension of clay in casein solution. In treating, it is advisable for the present purposes to use a fluid material of relatively high viscosity, this being to reduce penetration, and thereby to have the mineral matter and bonding adhesive localized in the face of the paper. A good coating composition for the present purposes can be made with 100 parts dry clay, 70 parts of a 20 percent casein solution and sufficient water to give a solid content of about 44 percent. But, while these clay compositions can be used, better results for the present purposes are obtained by using a mineral matter or pigment containing at least 20 percent of finely divided calcium carbonate. The proportion may be greater. Calcium carbonate has a refractive index sufficiently different from that of cellulose to give a good opacity and its white color compensates for more or less yellow color in the stock. Besides, it does not easily blacken on the calenders. Finely divided barium sulfate can also be used but on the whole I find calcium carbonate the best.

There has long been a desire to use calcium carbonate more extensively in making paper, because of its opacity and whiteness. The difficulties are largely chemical; reaction with rosin size, aluminum sulfate, etc. In the present invention, however, where a composition containing calcium carbonate in a finely divided form is deposited in the surface irregularities, these difficulties largely vanish and calcium carbonate can be success-

fully utilized without interfering with the sizing. A suitable composition for the purpose consists of 100 parts by weight of finely divided calcium carbonate, 73 parts by weight of a 20 percent casein solution and additional water to give a total solids of 44 percent, and having the consistency of thick cream.

As stated, it is the object to have mineral matter or pigment localized, as far as possible, in the surface and calcium carbonate mixtures seem unusually well adapted for this purpose, because of their little tendency to penetrate into the sheet, as compared with clay mixtures. This may be due to a more pronounced tendency on the part of calcium carbonate mixtures to stay in the surface irregularities. Calcium carbonate, further, has an incidental advantage in that the amount of the deposit in the paper can readily be followed by titrimetric examination of the paper.

In general it is advantageous to use coating compositions of relatively high viscosity in order to reduce penetration into the sheet, although in some cases more fluid coatings may be satisfactorily employed.

The proportions stated are not limiting and, in any case, the exact amount left on the web, in evening off the applied layer as described, depends on the nature of the paper surface. Between very wide limits of blade pressure, the weight of mineral matter left in the paper is independent of the pressure applied to the blade; the blade planes off the composition to the fiber level and the result does not vary much with the pressure. On the other hand, the roughness of the paper surface exerts an important influence on the weight of the mineral matter and adhesive as a surface filler. Thus a rough surfaced paper will retain more than a smooth surfaced paper, and the wire side, being rougher than the felt side, retains a heavier weight than the felt side.

After the surface filling treatment, which is accomplished after the paper is at least partially dried, the paper is dried and may be calendered in the usual ways, and if desired it may be supercalendered.

While filled surface paper under the present invention may be made from any of the usual stocks, utilizing any of the commercial fibers, there are certain advantages in using paper stock of the type ordinarily employed for making uncoated book paper. However, because of the improved color imparted to the paper by my treatment, it is possible to use a higher percentage of unbleached fibers and thereby produce a cheaper, stronger and more opaque paper.

In a particular embodiment of the present invention, making a light-weight filled surface paper with a dry weight of 50 pounds per ream, a book paper stock consisting of

soda pulp and sulfite pulp, clay, rosin size and alum, was made into a paper web in the usual way and the web was partially dried; drying being to about a 20 percent moisture content. To the surface of this web was applied a layer of a composition consisting of 68 parts by weight of finely divided calcium carbonate, 12 parts by weight of satin white made into a slurry with water and 90 parts by weight of a 22 percent solution of starch, the whole being thoroughly mixed and containing about 32 percent total solids. A rather thick layer of coating was applied and this wiped off with a metal scraper, so as to leave the coating composition mainly in the depressions. The dry weight of the material left was about a pound per 1000 square feet. The web was next dried and then calendered as usual. The whole process was run as a continuous operation and as part of the paper making routine.

In making a paper surface filled on both sides, the same procedure was followed, save that both sides of the paper were given the above treatment.

While I have described the present invention as a surface filling treatment of a paper web after partial drying on a paper machine, the treatment may of course be performed on the paper after complete drying at the end of the paper machine before the paper is wound into rolls, or as a separate operation using dry roll paper and as a batch process.

The term "paper" as herein used includes also postcard, cardboard and the like.

What I claim is:

1. As a new manufacture, uncoated paper containing mineral matter and adhesive concentrated in the surface depressions, the amount of such mineral matter being not greater than about 1 pound per side per 1000 square feet of surface.

2. As a new manufacture, uncoated paper containing a surface filling comprising mineral matter and adhesive, said surface filling material being substantially entirely located in the minute surface depressions of the paper.

3. As a new manufacture, paper particularly adapted for printing purposes and containing a surface filling comprising between 0.3 and 1.0 pound mineral matter and adhesive per side per 1000 square feet of paper surface, said surface filling material being substantially entirely located in the minute surface depressions of the paper.

4. The paper of claim 2 wherein the mineral matter comprises calcium carbonate.

5. The material of claim 2 wherein the mineral matter contains at least 20 per cent calcium carbonate.

6. The material of claim 2 wherein the paper is a sized material and the mineral

matter contains at least 20 percent calcium carbonate.

7. As a new manufacture, uncoated paper particularly adapted for printing purposes, comprising uncoated book stock weighing not more than 50 pounds per ream of 500 sheets 25x38 inches, and containing as a surface filling between 0.3 and 1.0 pound mineral matter and adhesive per 1000 square feet of paper surface, said surface filling material being substantially entirely located in the minute surface depressions of the paper.

8. In the manufacture of uncoated paper having a filled surface, the process which comprises applying a thick layer of mineral matter and adhesive to at least one surface of the web of paper after it has been at least partially dried and removing the layer down to the level of the surface fiber without substantially forcing the mineral matter and adhesive into the body of the paper, and drying.

9. In the process of claim 8, removing the mineral matter and adhesive by scraping off the excess down to the level of the surface fiber without substantially forcing the mineral matter and adhesive into the body of the paper, and drying.

10. In the process of claim 8, removing the mineral matter and adhesive by blowing off the excess down to the level of the surface fiber without substantially forcing the mineral matter and adhesive into the body of the paper, and drying.

11. In the manufacture of surface filled paper, the process which comprises making and at least partially drying the web of paper, placing on at least one surface of the paper a layer of fluent composition containing mineral matter and adhesive, removing substantially all the composition above the plane of the surface fibers and leaving in the surface an amount of mineral matter not more than 1 pound per 1000 square feet without substantial penetration of the mineral matter into the sheet, and drying, as a continuous operation.

12. The process of claim 8 wherein the mineral matter contains at least 20 per cent calcium carbonate.

13. In the process of claim 11, removing the fluent composition by scraping off excess composition down to the outer plane of the fibers.

14. In the process of claim 11, removing the composition by blowing off excess composition down to the outer plane of the fibers.

15. In the manufacture of uncoated paper having a filled surface, the process which comprises applying to the surface of dried paper a layer of a fluent, aqueous composition containing mineral matter and adhesive and removing enough of the applied material to leave in the surface depressions an amount of mineral matter not exceeding about 1 pound per 1000 square feet without substantial penetration of the mineral matter into the sheet.

16. In the process of claim 15 removal of the excess of composition by scraping off the composition down to the outer plane of the fibers.

5 17. In the process of claim 15 removing excess composition by blowing off the composition down to the outer plane of the fibers.

In testimony whereof, I have hereunto affixed my signature.

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