METHOD OF SIMULTANEOUSLY BLEACHING AND COATING PAPER

Robert L. McEwen, Williamsonville, and Charles W. Raleigh and Carl E. Price, Snyder, N. Y., assignors to Food Machinery and Chemical Corporation, San Jose, Calif.

No Drawing. Application March 17, 1955
Serial No. 495,044
5 Claims. (Cl. 117—152)

This invention pertains to the manufacture of a coated bleached paper sheet and more particularly to a method of manufacturing such a sheet wherein the coating and bleaching operations proceed simultaneously.

The paper industry produces large quantities of coated printing paper which must meet certain standards of brightness. Ordinarily this paper is produced by applying a suitable coating with a conventional paper coating machine. If such a coating is relatively heavy, the brightness of the coating will determine the brightness of the finished coated sheet. However, large quantities of papers are coated with a relatively light coating. In this case the light-weight coating will not effectively obscure the color, or lack of brightness, of the base paper sheet itself. If a bright but light-weight coating is applied to a sheet of unbleached or insufficiently bleached paper, the overall brightness of the coated paper will be unsatisfactory because the low brightness of the base sheet will be visible through the light-weight coating and the overall effect will be a reduction of brightness of the coated paper below commercially acceptable levels. In other words, if paper is to be coated but lightly, the paper or the base fibrous stock must be bleached to a relatively high brightness level to obtain coated paper of acceptable brightness.

At present, such coated papers are produced by first bleaching the paper furnish, or the individual pulps which go into the furnish, forming the fibrous sheet and applying the desired coating on a paper machine coater. Multiple bleaching plant equipment is often required for the production of a given tonnage of a satisfactorily bleached and coated paper. This is an expensive technique requiring costly equipment.

Heretofore, no means were known to simplify the production of bleached and coated paper. The most desirable simplification would, of course, be a method to combine the bleaching and coating step. This, however, is not feasible with the commonly used pulp bleaching chemicals and procedures. These are incompatible or inoperable because of the properties and process requirements of the coating materials or method employed. This is true for bleaching procedures using the well known active chlorine bleaching agents or peroxide bleaching agents such as hydrogen peroxide and others.

We have now found that there exists a class of bleaching agents which are fully compatible with the coating materials commonly employed and which permit simultaneous paper bleaching and coating using techniques suitable for both operations. This class of bleaching agents suitable for use in the process of this invention comprises reducing agents. These reducing agents, although having practically no bleaching effect on the coating materials, will effectively bleach the paper or fibrous base stock to be coated. They will do so under the same conditions with the same equipment and the same technique, commonly used for coating papers containing prebleached pulps on a paper machine coater. They thus permit efficient, simple and economical bleaching and coating of the paper to be carried out simultaneously.

This novel method of simultaneous bleaching and coating of paper achieves the desired results in a single operation. No separate or additional bleaching plant for pulps is necessary. This is a very important advantage, particularly because bleaching equipment is often unavailable in mills producing coated papers or paperboard. As a matter of fact, this one-step bleaching and coating process is carried out on coating equipment readily available in such paper or paperboard mills and utilizes the paper coater substantially without modification. Moreover, the process does not require modification of the normal operating procedure by which paper coating is ordinarily carried out.

The process of this invention, therefore, does not require the availability of particular bleaching equipment and may be carried out using many varieties of pulp or paper types in any mill having a paper coater. The process, furthermore, makes possible efficient bleaching of the fibrous base stock to unusually high brightness while simultaneously applying the desired coating.

The process of this invention is carried out in a very simple manner by incorporating into the normally used coating mixture, a reducing agent which will bleach paper stock. The paper furnish is then coated in a standard fashion on standard coating equipment with the coating mixture containing the reducing agent. Upon drying, which is a normal step when coating paper, a coated sheet of substantially increased brightness is obtained. The brightness level produced is often equivalent to and can be, in some cases, even greater than the brightness level produced by coating paper prepared from bleached pulps and this result is obtained as described above in a very much simplified and highly efficient manner.

This method of simultaneous bleaching and coating may be applied to any paper furnish ordinarily used for the production of coated papers or paperboard. It may be applied to furnish comprising bleached or unbleached pulps as well as mixtures of bleached and unbleached pulps. Such pulps may comprise groundwood, semi-chemical, sulfite, kraft, soda, or other pulps. The pulp or pulp mixture may also contain clay, alum, rosin, tints, etc., as frequently encountered in normal practice.

Conventional coatings may be used, for instance, coatings comprising clay, calcium carbonate, titanium dioxide, talc, blanc fixe, calcium silicate, starch, proteinaceous materials, gums, wax, and others.

As a bleaching agent, a variety of reducing agents may be used comprising sodium hydrosulfitc, zinc hydrosulfitc, sodium sulfite-formaldehyde, zinc sulfite-formaldehyde, sodium bisulfite and others, the main requirement being that the reducing agent must be water soluble and an inorganic oxygen compound of sulfur wherein the valence of sulfur is less than six.

If required, minor amounts of a mild alkali such as sodium carbonate, borax, ammonium hydroxide, phosphate, etc., may be added to adjust the pH of the coating mixture to the preferred range of pH 6-10, depending on the type of coating to be applied. These alkalis, if used, are added to the coating mixture.

The complete coating mixture is then applied in the customary manner on a paper coater in exactly the same way in which a "nonbleaching" coating would be applied. The coated paper is then dried in a conventional manner.

The paper coater is used in the sense of this invention is ordinarily an integral part of the paper machine. However, it is also possible to apply the process to dry paper using a paper coater not connected with a paper-making machine.

The principle of the process of this invention is illustrated by the following examples. These examples make
it clear that the process, while simultaneously bleaching and coating the paper, produces essentially a bleaching effect only on the paper or furnish without appreciably affecting the brightness of the coating itself. The basis weight figures in the examples represent the dry weight of 3000 square feet of paper.

Example 1

A sheet prepared from a paper furnish comprising a mixture of equal parts of unbleached groundwood and bleached sulfite pulp, having a consistency of approximately 90% and a basis weight of 32 pounds, was coated on one side with a coating mixture containing, by weight, 49% clay, 15% starch, 34% calcium carbonate and 2% sodium carbonate. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 3.7 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of the coated paper side was 67.5 G. E. units and the brightness of the uncoated side was only 61.7 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above with the same type of clay slip which, in addition, contained 7.8% of zinc hydrosulfite based on the weight of the slip solids. This corresponds to approximately 0.9% of zinc hydrosulfite based on the weight of the fibrous pulp. After drying, this bleached and coated paper had a brightness of 72.7 G. E. units on its coated side and a brightness of 66.8 G. E. units on the uncoated side.

Example 2

A sheet prepared from a paper furnish comprising a mixture of equal parts of unbleached groundwood and bleached sulfite pulp, having a consistency of approximately 90% and a basis weight of 32 pounds, was coated on one side with a coating mixture containing, by weight, 24% clay, 10% casein and 65% titanium dioxide. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 5.2 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of the coated paper side was 68.7 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above, with the same type of clay slip which, in addition, contained 8% of sodium hydrosulfite based on the weight of the slip solids. This corresponds to approximately 1.5% sodium hydrosulfite based on the weight of the fibrous pulp. After drying, this bleached and coated paper had a brightness of 73.8 G. E. units on its coated side.

Example 3

A sheet prepared from a paper furnish comprising a mixture of equal parts of unbleached groundwood and bleached sulfite pulp, having a consistency of approximately 90% and a basis weight of 32 pounds, was coated on one side with a coating mixture containing, by weight, 48% clay, 15% starch, 35% calcium carbonate and 2% sodium carbonate. This clay slip was applied to the sheet so as to give a coating on the fiber corresponding by weight to 3.7 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of this coated paper was 67.5 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above with the same type of clay slip which, in addition, contained 12.2% sodium hydrosulfite based on the weight of the slip solids. This corresponds to approximately 1.4% sodium hydrosulfite based on the weight of the fibrous pulp. After drying, this bleached and coated paper had a brightness of 71.1 G. E. units.

Example 4

A paper furnish comprising a mixture of equal parts of unbleached groundwood and bleached sulfite pulp and having a consistency of approximately 90% and a basis weight of 32 pounds, was coated with a coating mixture containing by weight 32% clay, 5% carboxymethyl cellulose, 53% titanium dioxide and 10% sodium tripolyphosphate. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 3.6 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of the coated side of the paper was 75.8 G. E. units and the brightness of the uncoated side was 62.4 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above with the same type of clay slip which, in addition, contained 6.8% of zinc sulfamate formaldehyde based on the weight of the slip solids. This corresponds to approximately 1.2% zinc sulfamate formaldehyde based on the weight of the fibrous pulp sheet. After drying, this bleached and coated paper had a brightness of 81.9 G. E. units on the coated side and a brightness of 67.2 G. E. units on the uncoated side.

Example 5

A paper furnish comprising a mixture of equal parts of unbleached sulfite pulp and having a consistency of approximately 90% and a basis weight of 100 pounds, was coated with a coating mixture containing by weight about 25% clay, 10% casein and 65% titanium dioxide. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 7 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of this coated paper was 73.3 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above, with the same type of clay slip which, in addition, contained 14.3% of zinc hydrosulfite based on the weight of the slip solids. This corresponds to approximately 1.6% zinc hydrosulfite based on the weight of the fibrous pulp sheet. After drying, this bleached and coated paper had a brightness of 80.0 G. E. units.

Example 6

A sheet prepared from a paper furnish comprising unbleached Kraft pulp and having a consistency of approximately 90% and a basis weight of 45 pounds, was coated with a coating mixture containing by weight about 25% clay, 10% casein and 65% titanium dioxide. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 6.0 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of this coated paper was 68.8 G. E. units.

Another portion of the same paper furnish was coated in the same way as described above with the same type of clay slip which, in addition, contained 9% of zinc hydrosulfite based on the weight of the slip solids. This corresponds to approximately 1.2% zinc hydrosulfite based on the weight of the fibrous pulp sheet. After drying, this bleached and coated paper had a brightness of 80.1 G. E. units.

Example 7

A sheet prepared from a paper furnish comprising unbleached semi-chemical pulp and having a consistency of approximately 90% and a basis weight of 100 pounds, was coated with a coating mixture containing by weight about 25% clay, 10% casein and 65% titanium dioxide. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 8.0 pounds of dry coating per 3,000 square feet of paper. After drying, the brightness of this coated paper was 69.0 G. E. units.

Another batch of the same paper furnish was coated in the same way as described above, with the same type of clay slip which, in addition, contained 11.3% of zinc hydrosulfite based on the weight of the slip solids. This corresponds to approximately 0.9% zinc hydrosulfite.
based on the weight of the fibrous pulp sheet. After drying, this bleached and coated paper had a brightness of 79.9 G. E. units.

**Example 8**

This example shows that the method of this invention produces a bleaching effect essentially only on the fibrous sheet. A sheet prepared from a mixture of equal parts of unbleached groundwood and bleached sulfite pulp having a consistency of approximately 90% and a basis weight of about 32 pounds, was coated on one side with a coating mixture containing by weight 25% clay, 10% casein and 63% titanium dioxide. This clay slip was applied to the sheet so as to give a coating corresponding by weight to 19.8 pounds of dry coating per 3,000 square feet of paper.

Another pulp sheet of the same composition was coated with the same type of coating, containing enough sodium hydroxide to incorporate 1.7% sodium hydrosulfite based on the weight of the fibrous pulp.

Both sheets were dried in the same manner and then measured for surface brightness with the following results:

<table>
<thead>
<tr>
<th>Brightness in G. E. Units</th>
<th>Coated Side</th>
<th>Uncoated Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Coating</td>
<td>85.5</td>
<td>63.7</td>
</tr>
<tr>
<td>Coating Containing Sodium Hydrosulfite</td>
<td>88.1</td>
<td>68.9</td>
</tr>
</tbody>
</table>

The clay used for coating in this example had a brightness of 80.3 G. E. units. After treating the clay with 1% by weight of sodium hydroxide and drying, the clay had a brightness of only 78.3 G. E. units.

This example clearly shows that the process of this invention has a pronounced bleaching effect primarily on the pulp sheet and when using a coating heavy enough to obscure the brightness of the base sheet itself, only a negligible improvement in coating brightness can be observed.

What is claimed is:

1. The method of bleaching a fibrous sheet composed essentially of cellulose fibers while simultaneously applying a coating to said sheet, which comprises applying to said sheet an aqueous mixture having a pH of about 6 to 10 comprising (a) a conventional paper coating composition and (b) a reducing agent, said mixture containing on a dry basis about 6% to 30% by weight of a reducing agent consisting of a water soluble salt of an oxy acid of sulfur wherein the sulfur possesses a valence of less than six, and thereafter drying the sheet and applied mixture.

2. The method of bleaching a fibrous sheet composed essentially of cellulose fibers while simultaneously applying a coating to said sheet, which comprises applying to said sheet an aqueous mixture having a pH of about 6 to 10 comprising (a) a conventional paper coating composition and (b) a reducing agent, said mixture containing on a dry basis about 6% to 30% by weight of zinc sulfonate formaldehyde, and thereafter drying the sheet and applied mixture.

3. The method of bleaching a fibrous sheet composed essentially of cellulose fibers while simultaneously applying a coating to said sheet, which comprises applying to said sheet an aqueous mixture having a pH of about 6 to 10 comprising (a) a conventional paper coating composition and (b) a reducing agent, said mixture containing on a dry basis about 6% to 30% by weight of zinc hydrosulfite, and thereafter drying the sheet and applied mixture.

4. The method of bleaching a fibrous sheet composed essentially of cellulose fibers while simultaneously applying a coating to said sheet, which comprises applying to said sheet an aqueous mixture having a pH of about 6 to 10 comprising (a) a conventional paper coating composition and (b) a reducing agent, said mixture containing on a dry basis about 6% to 30% by weight of sodium hydrosulfite, and thereafter drying the sheet and applied mixture.

5. The method of bleaching a fibrous sheet composed essentially of cellulose fibers while simultaneously applying a coating to said sheet, which comprises applying to said sheet an aqueous mixture having a pH of about 6 to 10 comprising (a) a conventional paper coating composition and (b) a reducing agent, said mixture containing on a dry basis about 6% to 30% by weight of sodium sulfoxylate formaldehyde, and thereafter drying the sheet and applied mixture.

References Cited in the file of this patent

**UNITED STATES PATENTS**

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Invention Date</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,873,924</td>
<td>Aug. 23, 1932</td>
<td>Hirschkind</td>
<td></td>
</tr>
<tr>
<td>2,071,305</td>
<td>Feb. 16, 1937</td>
<td>Hirschkind</td>
<td></td>
</tr>
<tr>
<td>2,370,266</td>
<td>Feb. 27, 1945</td>
<td>Smith</td>
<td></td>
</tr>
<tr>
<td>2,647,069</td>
<td>July 28, 1953</td>
<td>Streicker</td>
<td></td>
</tr>
</tbody>
</table>