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METHOD OF DESIGN FORMATION ON COLORED PAPER

Herman C. Orchard, St. Louis, Mo., assignor to Orchard Paper Company, a corporation of Missouri

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This invention relates to printing generally, and more particularly to printing on already finished colored paper stock, and is directed to a printing process wherein some of the color already in the stock is removed to produce the desired design formation on the original color background.

One of the principal objects of my invention is to form said imprint design by applying a quick-acting but sufficiently gentle bleach to one face only of the web of dry, colored paper, without penetration through to the opposite face, so that only a surface bleaching and resultant imprint will be accomplished.

Another object of this invention is to produce said one-face design rapidly and continuously as the web of paper unrolls at one end and is wound again into a roll at another end, so as to be a speedy, simple and extremely economical manner of printing, and done in one step.

An added object of my invention is to so perform the method aforesaid that there will be no washing or similar extraneous moisture or liquid treatment of the sheet required, after said imprint material has been applied to the sheet.

A further object of the invention is to use as a printing bleach, a chlorite and a hypochlorite in combination, so that the advantages of each of said bleach materials may be retained, while their individual disadvantages in use minimized and repressed, so as to insure that proper bleach printing results on the paper being treated, even though it is recognized that this must be done in the comparatively short time that elapses between the application of said bleach and the re-winding of the roll of paper, and all must be accomplished without impairing the strength or ordinary use of the paper.

A still further object of my invention is to form said bleach compound in a relatively thickened condition so that upon its application to the sheet it will be retained in place thereon without blurring or spreading, but with all of its original sharpness and delineation in outline and design, even when the pattern is small and intricate.

The invention has among its other objects the production of printed paper of the kind described, resulting from the use of the method of printing herein set out, and the method employed, which shall be extremely reliable, economical, rapid, neat and attractive as to finished product, and efficient and satisfactory for use wherever deemed applicable.

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To this end, my invention consists in the novel method herein described, as will be more clearly pointed out in the claims hereunto appended.

In producing papers having designs imprinted thereon after the finished but unimprinted sheets or rolls have been distributed to the printing trade and others, various methods have been employed for such printing operation, but in many instances such methods have not been satisfactory.

It must be remembered that in any printing operation, various factors must be kept in view, as for instance costs of ingredients and operations, speed of production, complexity of the method or in the equipment, room space required, clearness of the finished design, the resultant strength of the paper, and various other and as equally important factors.

Further, it is important that the designs so imprinted on the paper should not be easily erased therefrom, smudge, or be marred in usual handling and storage, and this printed paper ought not require any special handling in service.

With these objects in mind, and with the retaining of all of the aforesaid desirable characteristics of the finished printed paper in view, I will now describe my novel manner of producing a contrast type design area on one face or surface only of an originally color-impregnated or tinted sheet or roll of paper, so that the maximum of favorable results are obtained, this novel method being accomplished by surface bleaching predetermined design areas or portions of said sheet or roll so as not to extend to the opposite face of the paper, and while the roll travels continuously in the same manner as printing is now accomplished with rollers.

Hypochlorite, as for example sodium hypochlorite, is a well-known oxidant employed in making paper, the same being incorporated into the pulp stock at some suitable stage, but the paper as thus bleached is unsatisfactory because of impaired strength, and this bleach is relatively difficult to control in its action.

Chlorite, such as sodium chlorite for example, is fairly well suited to the purpose, the resultant paper being well whitened and relatively strong, but its bleaching is relatively slow as compared with the hypochlorite. A slight acidity given to the chlorite, such as by the addition of the required amount of a suitable acid, such as acetic acid or hydrochloric acid, hastens the bleaching action, and is recommended.

However, it is to be stressed herein that although said oxidants singly or together have here-

tofore been used as an additive to the pulp in some stage of the making of the paper, such bleach necessarily acted upon each particle and fiber of the pulp and was incorporated more or less homogeneously throughout the resultant paper; but no method of printing was ever intended by such bleaching, especially in a manner to re-act with only one surface of a paper sheet. The instant invention resides in a treatment of the paper after it has been completed and dried ready for consumer use, and is a printing art, and such printing is a surface printing, without any of the design so imprinted extending to the reverse side of the paper so treated.

It is to be further noted that the papers intended to be treated according to the teachings of my invention are already colored or tinted as they come from the mills ready for use, and that I afterwards treat this paper so that on one surface only of the same there will be formed a predetermined printed design formation, accomplished with a printing ink made of a bleach.

Although I prefer to make the printing bleach compounded of the chlorite and the hypochlorite, as will be hereinafter more particularly set forth, the chlorite form may be employed without the added hypochlorite, if so desired.

The oxidizing agent may be sufficiently moistened with an aqueous carrier, and as it has been found that a slight acidity will hasten the period of bleaching, I prefer to add the required amount of a suitable acid, such as acetic acid or hydrochloric acid, and a degree of acidity or pH that I have used successfully ranges from about 3 to 6 pH.

The bleach compound must not be too thin, as it would then run and interfere with the sharpness of delineation of the imprinted design, and in order to reduce any tendency to run or spread, the same may be thickened by incorporating into the same some body thickeners, such as a dextrine, synthetic or natural resins, various gums such as British gum or gum karaya, etc., and said thickeners are preferably water-soluble so as to blend perfectly with the aqueous carrier of the bleach. To shorten the time of action of the bleach, and reduce weakening of the fibers through over-soaking, any suitable wetting agent may be used in the bleach compound, but again it is to be stressed that it should be used sufficiently sparingly to avoid carrying the bleach through the paper. Some of the wetting agents found suitable are sulfates or sulfonates of organic compounds, or hydrocarbons, but many more may be used.

The designs that are to be formed on the paper or similar cellulose-derivative fibrous sheet amenable to the bleach herein set forth, are applied to the roll or web of the paper while the latter is dry, and in the same manner as surface printing is currently done.

To said purpose I provide suitable means whereby what may be termed the printing roll or roller or its equivalent, is provided with raised or depressed portions in a predetermined design formation or pattern at intervals across the width of said roller, so that the bleach compound may be carried by said printing roller to the face of the roll or web of the paper. This treatment by bleaching, removes the color from the face of the colored paper stock in exact conformity with the intricacies of the design, but to a depth less than the full thickness of the paper, while the rest of the paper, including the original coloration of the face so treated, remains unaffected and unchanged.

For any one of a number of good reasons it may not be desirable to use the alkali chlorite as the sole bleaching ingredient, and I have found that hypochlorite may be advantageously used to supplant a portion of the chlorite. Although it is true that the hypochlorite used alone is difficult to control, and tends to weaken the fibers of the paper, yet the objectionable characteristics are reduced or repressed when intermixed with the chlorite, and especially good results are obtained from the intermixture. Various proportions of such intermixture have shown good results, even up to a substitution of fifty (50%) percent of the hypochlorite for the chlorite in the mixture.

The range of proportions of the ingredients in the printing compound is wide, and the operating conditions immediately at hand is the best guide for the proportioning. There are many variables that must be observed and taken into account, such as for example, type and weight of stock, especially as to finish, intensity or deepness of original coloration, degree of bleaching desired, type of imprint design itself, speed of travel of the web, temperatures of the room and the bleach compound, etc. Close control may be manipulated rather easily through adjustments in temperature or pH, or both.

Successful results were had with runs at mixture temperature at about the same as the room temperatures, with tests ranging between temperatures of 60° F. to 100° F., and with the following proportions of the intermix:

Water	From about 27 to 42 pounds
Acetic acid	From about 227 to 540 C. C.
Sodium chlorite (or up to 50% of sodium hypochlorite substituted for the chlorite)	From about 3½ to 10 pounds
Wetting agent	About 5 oz.

As previously pointed out, up to one-half of the sodium chlorite may be substituted for with sodium hypochlorite, and the required amount of thickener varied to provide the desired consistency of mixture.

The bleach composition, prepared as hereinbefore set forth to best meet the conditions at hand, is then applied in a predetermined design or pattern directly to one face of the web or sheet as the latter is fed continuously over the bleach-imprinting roller or other means of applicator of the bleach ink, while the web is preferably re-wound at the far end, passing through a dryer between said points if found desirable and the conditions warrant. The color originally present in the stock will be wholly or partially bleached out in said predetermined pattern, and will have the same effect on the observer as if printing with a color had been employed, and in the same way as with ordinary printing, the design formation will appear only on the surface treated and will not extend to the opposite face of the web.

By applying the bleach so as to imprint on one face of the sheet without penetration through to the opposite face, many advantages are present. For example, less material need be employed for the slight penetration for forming the design on one face, as compared with complete penetration. Again, blurring and fuzziness in design delineation would be increased materially by the heavier application of the bleach and the longer time in which it dries. Further, the entire pro-

duction rate would have to be slowed down, as the one-face imprint as compared to full-depth penetration of design, makes for the faster run. All of these factors, and others, make it expedient and advisable to use my method wherein the design forms on the one face only of the sheet, and inasmuch as this printing is especially intended to be used on such papers as wrapping material, carry-out bags, etc., where only the outermost face of the sheet need carry the advertisement or other printed embellishment, the imprint on the hidden face would be a waste of money, time and material.

This bleach printing has obvious advantages over regular ink printing, where the ink forms an overlay over the background of the paper, and there will be no smudging, smearing, chalking, caking, etc., in the designs by the aforesaid method of "spot" bleaching, and the designs will be practically permanent, so that they have substantially the advantages of watermarking, and are even in greater contrast to the background than the latter.

Paper that has been bleach-printed in the manner and with the materials hereinbefore described has been stored for as long as between four and five years, and upon inspection and test shows substantially the same brightness of color contrast as paper so printed within the past several days, and with the same sharpness of delineation of design, and the strength and other physical characteristics of the paper can not be distinguished from colored but unprinted paper of the same age as the bleach-printed samples.

This has indicated that colored paper may be bleach-printed, on a commercial scale and on a production basis, with an alkali chlorite containing and preferably acidized bleach that may have up to 50% of hypochlorite substituted for the chlorite of the compound, the compound being preferably in an aqueous carrier. Further, and as will be controlled by the test runs preceding the work run, sufficient thickener may be added so that the bleach link as deposited, will retain its shape without spreading, until dry. In addition, the penetrant assistant hereinbefore mentioned, may be used principally to speed up operation, as the bleach will then more rapidly break through the "skin" of the face being treated, but not enough used to increase the depth of penetration to the other face.

For each type of paper, and for that matter, for different temperatures that may be encountered in operation, tests should be had so as to find the best speed of run and make-up and consistency of the bleach that will insure merely surface printing, without full penetration, through the sheet, and to make the design suitably visible in its new color, or rather its lack of color.

The method of printing by bleaching the one face only of the sheet, in the manner herein set forth, is substantially a one-step-method, except for perhaps any drying that might be necessary, but it is to be firmly stressed that there is no washing or wetting of any kind given to the sheet between the bleach imprint and the rewinding of the sheet, and that at all times in the carrying out of this process, the bleach is deposited only in the predetermined design pattern, without penetration to the reverse face of the sheet, and while maintaining the undeposited areas of the sheet perfectly dry.

Having thus described my invention, it is obvious that various immaterial changes may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, arrangement or combination of the ingredients or steps as hereinbefore set forth, or the product thereby obtained, except as limited by the state of the art to which this invention appertains, and the claims hereunto appended.

What I claim as new and desire to secure by Letters Patent is:

1. The method of imprinting designs on one face only of a sheet of colored cellulose-containing stock, consisting of permanently depositing on said face while the latter is dry, a thickened printing composition containing a chlorite-containing bleaching agent, in a predetermined pattern, and limiting the penetration of said composition to less than the full thickness of said sheet, and drying said sheet.

2. The method of imprinting contrasting design areas on one face only of a colored paper web without affecting the opposite face, consisting of continuously advancing said web while permanently depositing on only predetermined areas spaced across the web a thickened printing composition containing a mixture of chlorite with up to an equal amount of hypochlorite without penetration to the opposite face of said web.

3. A method of producing bleached areas on one face only of a sheet of colored cellulose-containing stock, consisting of depositing on predetermined design areas of said face without penetration to the other face, a thickened aqueous printing composition containing an intermixture of sodium chlorite and hypochlorite so that said deposit will remain fixed in delineation until dry.

HERMAN C. ORCHARD.

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