W. D. HARPER.

WATER MARKED OR SAFETY PAPER.

APPLICATION FILED MAR. 13, 1915.

1,281,951. Patented Oct. 15, 1918.

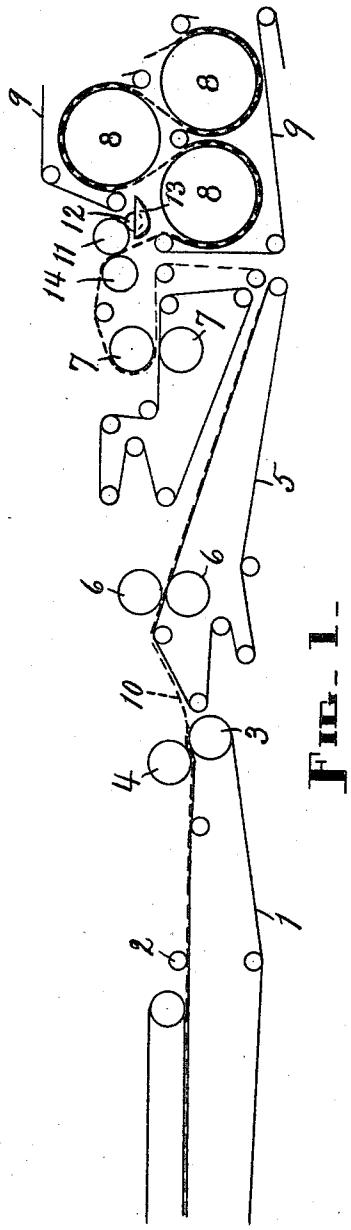


FIG. 1.



FIG. 3.

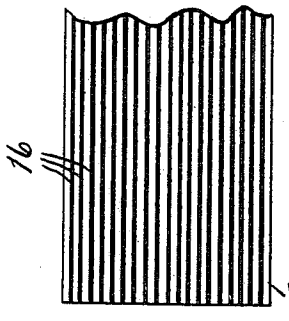


FIG. 2.

WITNESSES:

A. C. Fairbanks.

H. G. Cutter

INVENTOR.

William W. Harper,

BY

Webster & Co.,

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM D. HARPER, OF NEW YORK, N. Y.

WATER-MARKED OR SAFETY PAPER.

1,281,951. Specification of Letters Patent. Patented Oct. 15, 1918.

Application filed March 13, 1915. Serial No. 14,245.

To all whom it may concern:

Be it known that I, WILLIAM D. HARPER, a citizen of the United States of America, residing at New York, in the county of New York and State of New York, have invented a new and useful Water-Marked or Safety Paper, of which the following is a specification.

My invention relates to improvements in water-marked or safety paper, and consists in applying coloring material to the pulpy paper web, during the manufacturing process and while such web is in a moist condition, but not until a considerable amount of the water has been extracted therefrom, such coloring material being applied without compressing the web or disturbing its fibers, and being of a nature which insures penetration of the web structure uniformly and evenly, that is, without running or spreading in said structure, so that the integrity of the color design is maintained beneath the surface upon which such design is impressed, as well as on such surface, whereby a paper is produced that has therein a distinct color design or a color body having depth as well as superficial area.

The color design penetrates and permeates the interior fibers of the paper, and extends entirely through so as to show on both sides of the paper.

In a Fourdrinier paper-making machine, which is the type of machine best adapted for carrying out my method and producing the new paper, the coloring material is applied to the web at some point between the couch-rolls and the calenders and preferably ahead of the first drier, in order that said web shall have passed one or more sets of press-rolls and thereby had removed therefrom the required amount of surplus water, before receiving said coloring material.

The object of my invention is to produce, in an economical and practical manner, paper of uniform thickness throughout, with which is incorporated or in which is present a clearly and plainly defined water-mark or design that extends entirely through the paper, so that imitation of the paper is rendered practically impossible, and alteration of either surface of the paper can be easily detected.

By the method which I employ I am able to produce a safety paper that is especially useful for checks, coupons, certificates, and the like, wherein the safety element is a necessary feature in order to prevent successful alteration or imitation.

Other objects and advantages will appear in the course of the following description.

Ordinary water-marks are merely uncolored or plain depressions made in the paper pulp, while on the Fourdrinier wire, by the dandy-roll which bears the particular design to be pressed into the pulp, or by another roll located near the dandy-roll and bearing such design. The pulp is very plastic at this time and the fibers are displaced and the paper is made thinner wherever the water-marking members come into contact with said pulp.

The above water-marking process has been supplemented by applying coloring material to the dandy-roll and by that to the paper pulp, or through the medium of an additional roll or roller, but always in advance of the first press-rolls, so that the pulp is acted on while in such a soft condition that the displacement of the fiber and the thinning of the web, wherever the design appears, is insured. The color, in this case, spreads or "runs" to a very great extent, and satisfactory results can not well be obtained.

Another water-marking method is to carry the paper pulp between steel rollers, upon one of which is engraved the device, mark, or design that subsequently appears in the finished paper. Here, again, displacement of the fibers occurs, the paper is made thinner wherever the design appears, and there is no distinction of color.

Rubber type have also been employed for water-marking purposes, and have been applied to the paper web after it has passed one or more sets of press-rolls, but while still moist and plastic, so that the type marks or impressions are pressed into the paper as in the other cases, and there is no color mark.

Surface marks in color have been applied to paper pulp by means of a water-mark-printing roller, the coloring material being sucked into the pulp as the latter is carried over a suction-box, but this can not be done without fiber displacement which makes the finished paper uneven, and the design or mark must necessarily be more or less irregular.

Still another method of producing color markings is to displace the fibers of the pulp with a drag, and discharge, through cocks located adjacent to the furrowed portions

of the pulp, coloring matter into said furrowed portions.

Again, finished or calendered paper has been marked in color by the ordinary printing process. The markings thus imposed or impressed on the paper are, of course, superficial, since they do not penetrate the texture, and can be removed without much difficulty.

There are obvious objections to all of the methods briefly set forth above, and to the papers produced by such methods, and it had been my aim to avoid such objections. This I have done and am now able to furnish a color marked paper which is uniform both in thickness and design, with the latter extending into the texture or body of the paper, as hereinbefore stated.

In the accompanying drawings, in which similar numerals designate similar parts throughout the several views—

Figure 1 is a diagrammatical side elevation of parts of a Fourdrinier paper-making machine, which I may employ in producing my paper, and with which the color-applying roller is associated; Fig. 2, a plan of a fragment of paper marked with one of the numerous, not to say innumerable, designs that may be used, and Fig. 3, an enlarged cross-section through said fragment of paper.

In carrying out my method, it is necessary that the paper web be moist enough to draw into itself the coloring matter, yet not so wet that the coloring material will not spread unevenly, either on the surface to which such material is directly applied, or within the texture beneath such surface, and the web must be of the right consistency, so far as moisture is concerned, to receive the impression of the design and the coloring material, from the medium that imposes said material on the web, without displacement or detachment on the part of the web fibers. It is on this account that the coloring material is applied to the web after it leaves the Fourdrinier wire, and usually not until said web approaches the driers.

Not only must the coloring matter be applied to the paper web while the latter is in the condition with regard to moisture described above, but such matter must be of such a nature that it will not spread or run on or in such web. To this end and as at present advised, the basic colors or coloring materials, most suitable for use in my method to produce the new paper, consist of acid anilins. These are saturated with water until reduced to about the consistency of cream, and are then applied to copper or other metal plates, to stereotypes or half-tones, or to metal, wood or rubber type, from which the transfer to the paper web is made. I do not, however, restrict myself to the use of the above-mentioned basic colors or materials, provided there be other colors or materials which are not acted on by the moisture in the web in such a manner as to break up the outline of the coloring matter as defined by the medium by which said matter is applied to said web.

The parts of the paper-making machine, with which my invention is more particularly concerned, are represented in Fig. 1 of the drawings, wherein the wire is indicated at 1, the dandy-roll at 2, the couch-rolls at 3 and 4, the felt at 5, the first pair of press-rolls at 6, a second pair of press-rolls at 7, and a set of driers at 8 with the drier felts at 9. The paper web is represented by the broken line 10. In addition to the aforesaid paper-making machine parts and members, an impression roller is represented at 11, a color-applying roller at 12, and a color pan at 13. The impression roller 11 is here shown in operative relation to a web-supporting roller 14 which is located between the second press rolls 7 and the driers 8, but the position of said impression roller might be changed and said roller arranged in operative relation to some other supporting or guide roller. The pan 13 contains the coloring material, and the roller 12 transfers such material from said pan to the roller 11 or to the design on said last-mentioned roller, in the usual manner. The web 10, on its way from the couch-rolls to the driers, passes over the roller 14 and between it and the roller 11, and it is at this time that said roller 11 impresses the color design on said web and the design is taken up or drawn in, as it were, by the web. The penetrative nature, quality, or capacity may depend upon the amount of moisture in the web, the consistency of the coloring matter, and the quantity of the latter which is deposited on the web, any or all of these factors entering into the case, although the most important is probably the first. Very much of the success of my method depends upon the degree of dampness of the paper web. If the web be not sufficiently damp or moist, the color is liable not to penetrate far enough to show clearly and sharply on the side opposite to the one to which it is applied.

It will now be seen that my method, in detail, consists in applying to a damp or moist sheet or web of paper material, without compressing said material or otherwise disturbing or disarranging the fibers thereof, a sharp, even, and clearly defined design in coloring material, which coloring material is adapted to penetrate or be drawn in to said paper material, to the end that said design is reproduced on both sides of the finished paper and within the structure or body of the same with exactitude or as the exact counterpart of the original design. The product of this method is a paper of uniform thickness and bearing within and

without a colored design in regular or even outline.

In Fig. 2 a fragment of paper 15 is shown, which has incorporated therewith a series of wide parallel lines 16, such lines being of a color, tint, or shade that contrasts with the body of the paper or the other portions of the paper.

The section in Fig. 3 is greatly enlarged, or, more properly speaking, exaggerated, in order to show how the color penetrates the paper without spreading or running, so that the design is presented within as well as without with practically absolute accuracy, the same design, that is, the wide parallel lines, being retained in this view that is shown in the preceding view. The lines 16 of color extend entirely through the paper 15 from side to side.

The term color with its derivatives, as employed herein, is used to designate and denote any color, whether a true color or not, tint, or shade which is capable of contrasting with the complexion or hue of the pulpy material into which the color or coloring material is introduced.

The term design, as herein employed, is to be understood as meaning any letter, figure, or other character, line, outline, configuration, or any combination of the same, in short, anything of a designating character that is suitable for the purpose. It is evident that the number of available designs is very large.

I reserve the right to use other than rotary means with which to apply the coloring material to the surface of the paper web.

I expressly disclaim any method or step whereby the fibers of the paper material are displaced or the paper thinned in places, and any process of printing on finished paper, or the use of coloring material or matter that runs or spreads when applied to a paper web having a reasonable amount of moisture therein.

What I do claim as my invention, and desire to secure by Letters Patent, is—

As an improved article of manufacture, paper, of uniform thickness throughout, having a contrasting design delineated thereon and extending through from one side to the other, said design beneath the surface and on the side of the paper opposite to that to which said design is applied having clearly defined edges like the edges of said design on said surface where applied, substantially as described.

WILLIAM D. HARPER.

Witnesses:
J. H. MEINKE,
GEO. H. WARREN.