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Aug. 7, 1934. A. B. HURLEY 1,969,707

PAPER OF INCREASED OPACITY

Original Filed Feb. 21, 1929

Fig. 2.

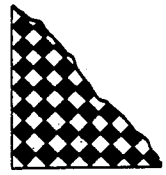


Fig. 1.

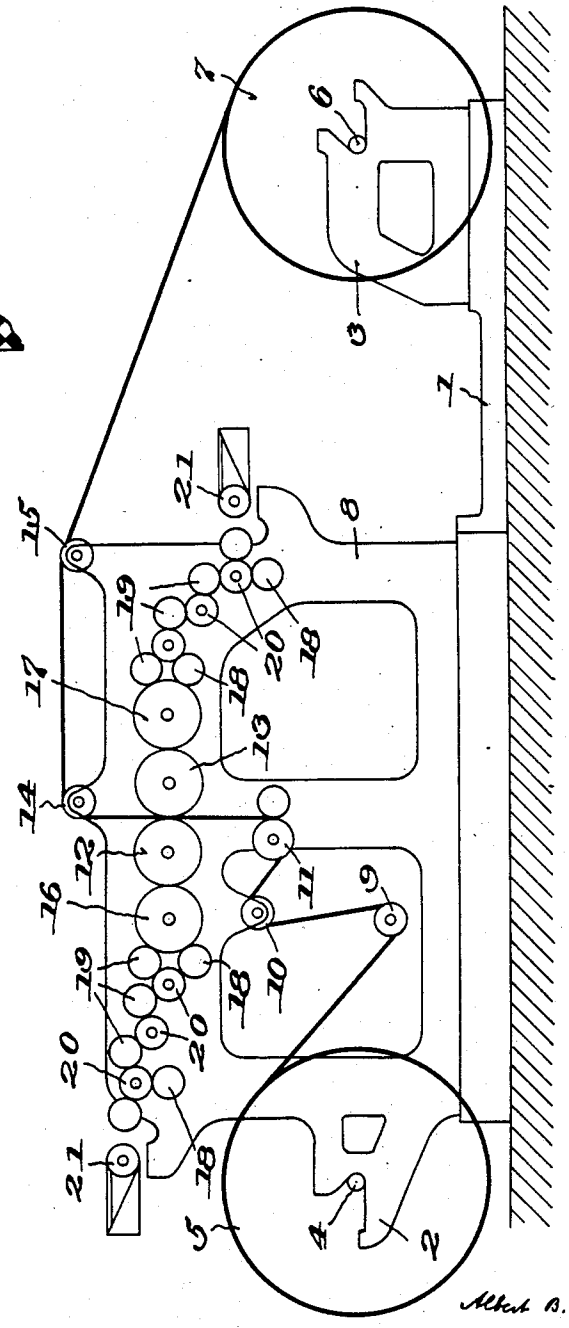
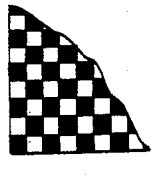


Fig. 3.



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Search Room

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1,969,707

UNITED STATES PATENT OFFICE

1,969,707

PAPER OF INCREASED OPACITY

Albert B. Hurley, New York, N. Y., assignor to National Paper Process Company, New York, N. Y., a corporation of Delaware

Original application February 21, 1929, Serial No. 341,758. Divided and this application June 27, 1929, Serial No. 374,242

1 Claim. (Cl. 88—1)

My invention relates to methods of and apparatus for the regulation and composition of light, and is closely related to the inventions described and claimed in U. S. Letters Patent heretofore granted to me as follows: No. 1,659,734, granted February 21, 1928; No. 1,659,952, granted February 21, 1928; and No. 1,715,759, granted June 4, 1929. The present application is a division of my prior copending application, Serial No. 341,758, filed February 21, 1929, on which Letters Patent No. 1,877,512 were granted to me on September 13, 1932.

In my prior patents I have disclosed a method of modifying the light reflected from a surface by applying thereto a filter in such manner as to suppress a part of the light rays which would normally be reflected from the surface, and uniformly mingling the remaining rays, which for simplicity may be referred to as tinted rays, with a certain proportion of white light or the light that is normally reflected from the surface which light is also uniformly distributed and remains unmodified. I have shown that not only the composition of the light reflected from the filter surfaces, but also the percentage of white light unmodified and the percentage of tinted rays reflected from the filter surfaces, are important. In these disclosures, a limited focal distance of the reflecting surface from the eye is assumed, as for example, fourteen (14) inches more or less, for book or ledger paper, playing cards, and the like. In such cases the filter or screen may conveniently have dimensions similar to those of the photo-lithographer's screen of sixty-five to one hundred mesh per inch. These dimensions are obviously based upon a certain visual angle.

In addition to thus regulating the amount and intensity of the light, my invention has a second most important function, in regulating the quality or character of the light, commonly referred to as the color.

Ordinarily, it is assumed that so called "white papers" reflect the full hue and value of the incident light, but if a number of white papers were directly compared a difference in hue would be easily noticed. By means of a spectro-photometer white papers and surfaces can be compared with magnesium which is supposed to reflect blue-green and red in quantities to give the sensation of pure white. Contrary to the general belief a test shows that almost all commercial white papers reflect a greater percentage of the longer wave lengths. Eighteen white papers examined by the U. S. Bureau of Standards, "Technologic Paper #224", showed that the average reflection of the red-green and blue was about 36—34 and 32 respectively, as compared with equal quantities reflected by magnesium. They describe a method of taking the color characteristics of white paper in terms of its capacity for diffusely reflecting red—(0.62μ) green (0.55μ) and blue (0.46μ) and all papers were found deficient in the proportion of blue light reflected. Artificial lights radiate an abundance of red and yellow rays and are deficient in radiation of blue and green rays. The above papers viewed under artificial light as the tungsten light, would show a decided yellowish tinge, due to a preponderance of red and yellow rays in the light and to the paper capacity for reflecting a greater percentage of the red and yellow rays.

In the application of the process to one or both sides of a paper I have found that there is a decided increase in the opacity which will permit the use of a thinner sheet of the same quality paper. The paper will be less transparent and copy of printed matter does not easily show through from the reverse side, which provides an economic feature.

In applying the filter I regulate and correct the proportions of the light reflected from such surfaces, so as to produce a surface that when being viewed or read under either daylight or artificial light, will give the eye harmonious light rays for normal functioning, especially under artificial light where I make the blue and green rays more effective and stimulating by reducing the glare and over-intensity caused by the relative greater percentage of red and yellow rays in the light.

My invention is illustrated in the accompanying drawing, in which

Fig. 1 is a diagrammatic side view of a machine designed to process paper according to this invention.

Figs. 2 and 3 are fragmentary views on an enlarged scale showing two surfaces treated by particular applications of this method.

Referring to Fig. 3 this represents an enlarged fragment of a surface treated by one particular application of this method. The dimensions of each of the pigment squares, spots or figures are within certain defined limits of size, according to the reflection factor and other characteristics of the surface to be treated, and the number of these to a unit of surface determines the amount of the background surface exposed which may reflect the full hue and value of the incident light. By regulating the pigment mixture

and the relative sizes of the pigment figure and the exposed surface in a unit of surface, we can regulate the amount and quality of the light reflected, and the stimulation of the eye can be increased or reduced to any desired degree, while giving perception of white light.

In Fig. 2, I have shown a fragment of a color filter or screen somewhat similar to that shown in Fig. 3 but with the points of the figures turned vertically and horizontally, so as to form diamond shaped figures standing on their points. The purpose of this is to provide a greater lateral transmission of light rays, the white light passing at an oblique angle being apparently increased in amount.

It is to be understood that the small squares, spots or figures, shown in black in Figs. 2 and 3 are not really black, but are coated with the pigment which constitutes the color filter in any particular case. For the present purpose of increasing the opacity of the paper, I am not limited to any one particular pigment or color or depth of tone, and the particular pigments employed as set forth in my Patent No. 1,877,512, are determined in part by reference to the wave absorption properties or color of the paper, and in part by reference to the light under which it is to be viewed. Furthermore, I am not limited to the particular patterns or figures shown herein, as any arrangement of uniformly distributed filtering points, spots, squares or lines or the equivalent within and among which are uniformly distributed exposed portions of the paper surface, will satisfy the requirements of the invention. The main point is that the arrangement and distribution of colored and uncolored surfaces are such that the eye receives the impression of normal light giving a normal stimulus and good definition, while the amount of light that passes through the body of the paper is reduced and the effect of opacity is increased.

Figs. 2 and 3 may be taken also as representing the figures etched on the shells of the plate cylinders 16—17, which produce corresponding impressions upon the offset cylinders 12—13, which are transferred to the paper.

Referring to Fig. 1 of the drawing, I have therein shown a machine designed to process paper according to the present invention. The base 1 carries vertically supported brackets 2 and 3, the first of which is provided with horizontal bearings for the shaft ends 4 carrying the mill roll of paper 5; and the second of which carries horizontal bearings for the shaft ends 6 of the rewind roll 7. The paper web passes from the roll 5 to the roll 7 through the machine, and is printed or processed in its passage with the color filter or screen heretofore described. The figure is a side view of the machine, hence all the rolls are shown in end elevation, and the side frames 8 and the brackets 2—3 are shown in outline, so as to leave the rolls clear, whereby the passage of the paper may be traced. 9 is an equalizer roll around which the paper passes to a guide roll 10 and from this roll to a feed roll 11, whence it passes between the two offset cylinders 12 and 13; thence over the guide rolls 14 and 15 and to the rewind roll 7. It will be understood that power is applied by suitable gearing, shafting and belts, as usual, to the different rolls. As shown, the offset cylinders 12 and 13 produce the impression on both sides of the paper. These offset cylinders are of rubber or surfaced with rubber and receive their impressions from the plate cylinders 16—17 respectively. These plate cylinders have etched shells, showing the figures which are to be imprinted on the paper, as for example those illustrated in Figs 2 and 3. They are inked through pigment rolls 18 and 19 which receive their pigment through distributing rolls 20 from the pigment vessels 21. The etched steel shells having received the ink or pigment on their surfaces transfer the same to the offset cylinders 12 and 13, which in turn as the paper passes between them, produce the requisite impressions thereon. In the machine as illustrated, if both shells 16 and 17 are supplied with pigment, the paper will be processed on both sides, which as heretofore mentioned renders it more opaque, weight for weight, than paper which has not been processed, and so enables print paper of a lighter weight to be used with great economy. It is also possible to use this machine for processing paper on one side only, by throwing out of gear the rolls 19 and 20, and removing the pigment vessel 21 or closing the same on one side. It will be understood that a white pigment mixture can be imposed as the filter, or this mixture can be tinted by a selection of colored pigments or dyes according to the capacity of the paper for reflecting red, blue and green and according to the radiant energy of the incident light, so that the surface will reflect approximately an even percentage of the red, blue and green and be a pure white surface. The pigment mixture applied to the rolls 19 and 20 and the shells 16 and 17, is carried through to the paper without change. However, it is possible to regulate this in another way. By a slight change in the machine, some or all of the rolls 19 and 20 may be supplied with pigment from different sources, the mixing of the same being done on the surface of the rolls themselves. This and other changes in details which will readily occur to those skilled in the art are within the scope of my invention. which is not limited to the specific form of machine or in fact to the specific form of grid or mixture of colors heretofore described. It is quite possible that new lights such as neon lamps or the like, may have to be taken into consideration.

What I claim is:

As an improved product, a web of white print paper completely covered on both sides from edge to edge and in continuity of pattern lengthwise with a normally invisible but light resisting tinted screen or checkerboard with interposed uniformly distributed white areas sufficient in their aggregate area to preserve the appearance of a white surface while the absorption of light by the screen is sufficient to substantially increase the opacity of the paper, substantially as described.

ALBERT B. HURLEY.