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PHOTOGRAPHIC PRINTING BY PHOSPHORESCENT PLATES

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This invention relates in general to photographic printing or copying by means of light emitted from a phosphorescent body. Such printing has been employed for many years for the making of either direct or indirect copies of printed sheets. The usual procedure is to first expose the glass plate, provided with the phosphorescent emulsion, to strong daylight for a few seconds, to store light energy therein, and then to expose the photographic printing paper to the light emanated from this energized phosphorescent plate either by transmission through the subject to be copied or by reflection from the surface of the subject. The paper or subject, of which a copy is to be made, may be, for example, a letter, check, bill, blueprint, or other document, or it may be a page of a book or folder, and it may have printing or other subject matter on but one face or on both faces of the sheet. Where the subject matter appears on only one face of the sheet or page, the printing may be accomplished by interposing the subject to be copied between the phosphorescent plate and the sensitive photographic printing paper so that the light energy from the phosphorescent plate is transmitted to the printing paper through the sheet, of which a copy is being made. Where the sheet has printing or other subject matter on both faces, or where sufficient light cannot be transmitted through the sheet, as in the case of metal or certain colors of thickness of paper, the printing is accomplished by reflected light energy. In such cases the printing paper is interposed between the phosphorescent plate and the subject matter to be copied, the image being thereby obtained in the printing paper by the light reflected from the subject. The printing paper, however exposed, is afterward subjected to photographic development. In the case of copies obtained by transmitted light, they may be either negative or positive as to position, according to whether the subject matter being copied faced toward or away from the printing paper. In the case of printing by reflected light, the print first obtained is always a negative as to position. In either case, the original print, whether positive or negative, may be utilized in the manner of a negative to obtain additional copies.

In the procedure as practiced for a great many years, the phosphorescent plate employed has always been one which radiated a violet or greenish blue light. The particular improvement contemplated by the present invention resides in the employment of a yellow or yellow green phosphorescent radiation, which has not heretofore been utilized in the making of photographic prints, but which I find gives superior results in the copying of most of the subjects which occur in this particular branch of commercial photography, and enables the copying of many subjects which could not be satisfactorily copied in the old way. The improvement also enables the making of copies by artificial light much more readily than has been possible in the use of the old and standard violet or greenish blue phosphorescent light.

The invention is applicable to copying by phosphorescent light either by transmission or by reflection, and in general the operations may follow the well recognized procedure in this art. As the invention makes use of a different type of phosphorescent plate, however, a special type of printing paper, which is sensitive thereto, must be employed in place of the printing paper heretofore commonly used.

The new phosphorescent plate may be produced by various compositions of material, the essential requirement being that it be capable of readily absorbing light energy either from daylight or from ordinary artificial light, and radiating a strong yellow or yellow green light.

For simplicity I shall hereinafter use the term "yellow" as including either a pure yellow or a yellow green.

Typical formulæ for the production of a satisfactory yellow phosphorescent plate are, for example, the following:—

Example 1

	Per cent
Boric acid	20
Fused borax	30
Silicate of soda	10
Zinc oxide	20
Calcium oxide	10
Zinc sulphide (luminous)	10

Example 2

	Grains
Zinc ammonium sulphate	100
Sodium chloride	20
Magnesium chloride	1
Manganese sulphate	.02

Example 3

	Grains
Zinc ammonium sulphate	100
Sodium chloride	20
Magnesium sulphate	1
Cadmium sulphate	.02

These compositions, in powdered form, can be suspended in lacquer, oil or gelatin, and applied to the glass plate, screen or other suitable surface serving as a source of phosphorescent or fluorescent light, in well-known manner. If desired, the suspension may be thinned with white turpentine to obtain a consistency of the material which will permit of its being sprayed.

The photographic printing paper to be employed when the yellow phosphorescent plate is used must have good sensitivity to the yellow light radiated by the plate. Such a paper, is—

Example

	Grams
Gelatin	200
Potassium bromide	80
Potassium iodide	.6

To this is added a solution which contains exactly 100 grams silver nitrate in 1,000 cubic centimeters of water. A further addition is then made of 200 grams of gelatin swelled in water and hardened with chromalum, and containing a little saponin and 5½ liters of water. Small quantities of erythrosin are included to make the emulsion sensitive to yellow green. The resulting potassium nitrate is washed out and the emulsion then applied to the paper in the usual way.

I have found in the practice of phosphorescent photography that a great deal of the paper on which letters are written and books and other papers are printed, is highly absorptive of violet or green blue light, whereas a great deal of the ink employed in printing, typewriting or handwriting is not totally opaque to or absorptive of violet or green blue light. These two conditions frequently combine to reduce the amount of contrast and to destroy half tone values. The copy obtainable either by transmitted light or by reflected light when employing the violet or green blue phosphorescence is thus very flat or a total failure. In an extreme case, such as a yellow sheet having violet printing, it is often quite impossible to make a legible print by transmission of violet or blue green light. In such a case, the print obtained by reflection printing with violet or green blue light is very poor in contrast. With the use of a yellow phosphorescent plate, such subjects may be printed in strong contrast by reflected light. The examples given are selected not so much to represent the typical conditions encountered but rather to make clear the principle involved. I find that with most paper and most ink, much better contrast and half tones can be produced by printing with the yellow phosphorescent light than with the violet or blue green, either by transmission or by reflection. Particularly important are the improvements thus obtained in making photographic copies from violet and blue ink so common in typewriting and rubber stamp impressions, the blue ink so much used in handwriting, and the thin carbon impressions in typewritten carbon copies. In many of these cases, the yellow phosphorescent light will produce excellent high lights, half tones and shadows where a copy made by violet or blue green light is poor, or even a total failure.

Printing with yellow phosphorescent light on yellow sensitive emulsions is faster than printing with violet or blue green on the old and usual type of emulsion. The activity of the yellow phosphorescent plate, however, is of shorter duration than that of the usual violet or blue green phosphorescent plate. Photographic printing papers, when used as negatives, usually cannot be reproduced by transmission of yellow phosphorescent light with sufficient rapidity, and such reproductions from photographic negatives on paper are therefore much better made with the longer active violet or blue green light on printing paper sensitive thereto, such as now commonly used.

I claim:—

1. Method of making photographic copies of papers and the like, which comprises exposing a yellow sensitive printing emulsion to plate emitting a yellow phosphorescent light regulated in intensity by the lights and shadows of the subject being copied, placed in proximity to said plate.

2. Method of making photographic copies of papers and the like, which comprises transmitting yellow phosphorescent light from a plate through the subject being copied to a

yellow sensitive printing emulsion, placed in proximity to said plate.

3. Method of making photographic copies of papers and the like, which comprises reflecting yellow phosphorescent light emitted by a plate from the subject being copied to a yellow sensitive printing emulsion in proximity to said subject and plate.

4. Method of making photographic copies of papers and the like, which comprises energizing a yellow phosphorescent plate from a source of light, applying the face of a yellow sensitive printing emulsion on a suitable backing to the face of the paper to be copied, applying the energized yellow phosphorescent plate to the backing of said yellow sensitive printing emulsion to obtain a latent image by reflection from the subject, and thereafter developing the latent image.

5. Method of making photographic copies of papers and the like, which comprises exposing a yellow sensitive printing paper to yellow phosphorescent light regulated in intensity by the lights and shadows of the subject being copied, completing the print thus obtained and reproducing said print by phosphorescent light within the range of violet and blue green.

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