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PROCESS OF COPYING PRINTED OR WRITTEN MATTER

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The invention relates to copying and has as an object the provision of a process for producing copies of printed or written matter, either pictures or type, and is applicable to reproduction of matter written with a pen, providing certain sorts of ink are used, and to pencil marks from ordinary lead pencils.

Further objects of the invention are to reproduce pictures, reading matter, maps, etc., made by printing, upon P. O. P., developing out paper, non-sensitized dyed paper, or photographic plates or films, either as positives correct or reversed as to right and left or as negatives capable of use in contact or projection printing in the usual manner; to produce copies as referred to selectively colored in portions thereof.

A characteristic of the ink to be copied from, that seems necessary, is that the ink shall cause a change in the water absorption by the paper upon which the ink has been applied, that is, the absorptive character must be varied by the presence and amount of the ink. Ink comprising only a water solution of dye will not copy nor will stamp pad ink. It is now believed that it is the presence of varnish, gum, resin, linseed oil, or the like, in the ink that determines its operativeness.

In general the process comprises applying a coating or film of material to the surface of the subject matter to be copied and contacting the surface with either the medium upon which the copy is to be produced or with a transfer medium, the latter to then be contacted with the copy-receiving medium. The action is due to a selective transfer of the film material to the said medium or transfer medium caused apparently by the variations in absorption of the coating material produced in the paper carrying the matter which variation is due to presence or variation in intensity of the print.

The material applied to the subject matter to be copied or reproduced may be a bleach, as H_2O_2 or dilute sulphuric acid, or it may be a pigment carrying fluid as white ink.

The invention can best be understood by the following examples:

Example 1.—Production of copy upon P. O. P. using H_2O_2 as a bleach

The hydrogen peroxide preferred is that in use by beauticians having 20 volumes of oxygen, rather than the usual medicinal preparation having 3% H_2O_2, although the latter is operative.

The paper carrying the material to be copied is laid on a flat surface and given an even coating of the bleach as by brushing in both directions with a pledget of cotton saturated with the bleach. Excess material may be removed as by blotting or brushing with a non-saturated pledget of cotton.

The paper to bear the copy, which has preferably been prepared in advance by allover exposure to light sufficient to darken the whole to a color a little deeper than the desired shadows, is then placed into contact with the wetted matter and pressure applied.

Pressure may be by using a flat surface squeezed to the work or may be by the flat of the hands and should be substantial. It will be seen that relative movement between the contacting surfaces would be fatal to results.

Progress may be observed by lifting a corner of the applied sheet for inspection and the contact should be continued until the copy is substantially as wanted, which will require but a few moments.

When taken from the original the copy must at once be treated to prevent spread of the bleaching action. This may be done by 1st fixing in plain hypo solution, preferably a weak solution or 2d by treatment with a bath of solution of tannic acid. This solution should be saturated, fresh and of as pure tannic acid as is procurable. The tannic acid bath is preferred to the hypo since it produces more pleasing color of print. The print will obviously be reversed as to left and right.

The removal of the print from the original and subsequent treatment should be in the dark room, by orange or ruby light, or other non-affecting light if the tannic acid treatment is to be given. The tannic acid bath will cause some development of the print which should be carried a little further than desired in the finished print, after which the print is fixed thoroughly in the hypo bath above, washed and dried.

The prints subjected to this tannic acid treatment should be such as contain gold chloride. Such a paper as Gaevert proof paper which is called self-toning gives very good results.

Example 2.—Prints on D. O. P. paper

Any chloride or chloro-bromide paper may be used—or bromide paper which will give a negative instead of a positive may be used.

The paper is given a general exposure to light as with P. O. P. but a test strip should first be exposed and printed to determine the times of treatment. The general exposure to light may

however be given after the bleach contact with substantially the same results as before contact.

The bleach contact is carried out as with P. O. P., the print developed in any usual paper developer, fixed, washed and dried.

Example 3.—Copies not reversed left to right

The original is treated with the bleach and then contacted with a transfer medium which latter is then contacted with the P. O. P. or D. O. P. paper as in Examples 1 and 2. The transfer medium may be a sheet of P. O. P. or D. O. P. paper, a fixed out or fresh film or plate or it may be any non-sensitized paper which is not excessively absorbent. The treatment of the final print paper is as in Examples 1 and 2.

Example 4.—Sulphuric acid bleach

The paper carrying the matter to be copied should be such as is permeable by or absorbent of the dilute sulphuric acid. A satisfactory strength of acid is one part sulphuric acid to six parts of water based on strong acid, C. P. being preferable.

The paper used may be the same as in use of hydrogen peroxide and the transfer of bleach to copy paper the same. The application of the dilute acid to the original may be as described for H_2O_2 and the contact of the copy paper the same.

When P. O. P. is used as a copy paper the stripped print will be of an unpleasing color. To improve the color the wet print is subjected to radiant heat, as by holding it near an open flame, electric light bulb or the like when the high lights will promptly bleach to a white, producing a print of great contrast. Heating should be gradually increased until and only until the desired bleaching occurs. Fixing of these prints is not essential although it may be done. However they should be thoroughly rinsed in cold water before drying.

A print made in this manner may be used for the production of a washout relief to be used for selective coloring in the manner described and claimed in my Patent No. 2,236,417, granted March 25, 1941, for a Process of producing colored photographs.

Example 5.—Production of acid bleach copies on dyed paper

A non-sensitized dyed paper such as is sold for construction paper and which has been dyed by a dye that will undergo a color change in the presence of sulphuric acid is utilized, the transfer of acid from the original to the print being made as above. After the paper has been contacted with the acid treated original it may be subjected to the heat treatment applied either locally or generally, depending upon whether certain parts or all of the acidified image is desired to be darkened. In this way two color or three color (including black) effects may be secured.

Local black retouching or spotting in this procedure may be performed as by use of a burning glass. Such prints are somewhat susceptible to atmospheric effect and are preferably varnished or mounted or framed behind glass for protection.

GENERAL CONSIDERATIONS

Those skilled in the art of photography will understand that certain emulsions as upon P. O. P. paper if not pre-hardened or if treated at too high a temperature are liable to stick to the original, therefore the room temperature should be preserved as low as convenient. It will be obvious that any pools of bleach lying upon the original and transferred to the copy will result in defeating the local character of the transfer of bleach from each minute area of the original, thus resulting in blurring. This is the reason for the blotting off of the bleach from the original or of awaiting its sinking into the original paper.

The bleach may be applied to the original from the back and allowed to soak through to the surface and this practice is preferred for use with the sulphuric acid bleach. The acid bleach or solvent will not damage the original particularly if promptly washed off after the transfer is made. This washing is only important in connection with the acid bleach. Obviously it cannot be carried to such an extent as to damage the original by soaking if preservation of the original is desired.

Many other forms of bleach are possible of use, among which may be mentioned dilute solutions of ammonia, hydrochloric acid, sodium thiosulphate, tannic acid, potassium bromide, etc. However the results with the latter substances have to date been found to be inferior to those secured by either solution of H_2O_2 or dilute sulphuric acid.

The matter to be copied may be printed upon almost any kind of paper. The fact that the original is printed in colored inks does not affect the process because of the color although some colored inks per se cannot be successfully copied.

Example 6.—Production of combined acid transfer and added pigment

A copy or transfer of dilute acid is made upon either photographic film or paper and before drying the copy is dusted with particles such as chemically precipitated iron or dye powder. The unacidified parts of the copy must be perfectly dry when the particles are applied and the application may be by brushing or rubbing the particles upon the surface. When the dye powder is water soluble, any necessary fixation or clearing and washing of the film is preferably, though not necessarily, performed before the transfer of the acid to the copy.

Example 7.—Production of two-color prints

The acid transfer film or paper copy may be treated by rubbing an oil pigment thereon. Desirable pigments are the so-called transparent oil paints commonly used for tinting of photographs used as they come from the tube without thinning. These colors will not take on the unacidified parts therefore the prints may next be flooded with a colored ink or dye solution in water which due to the antipathy of oil and the water will only take in the unacidified parts which were not colored with the oil pigment. It is preferable that the soluble dyes thus used be such as are not affected by sulphuric acid to produce a change in the color thereof.

Production of negatives.—A preferably transparent base, as a fixed out unexposed plate or film, may be used as a vehicle for a negative.

The original to be copied is treated with white ink, desirably an ink containing lead. A small pool of ink being placed upon the original and led over the surface as by dipping an object into the surface of the pool and leading it around until it covers the surface of the original, the excess ink is blown off from the original as by a blast from

the breath or a squeezed rubber bulb upon which the vehicle is placed in contact with considerable pressure. The white ink will when stripped be found to be distributed upon the resulting copy in accordance with the depth of the printing of the original. Because of the opacity of the pigment in the white ink the copy may be used for contact or projection printing in the manner of a usual photographic negative. Originals having paper and ink such as those of the pulp magazines are especially suitable for copying.

The single transfer procedure will produce a negative reversed right for left. By using the double transfer process wherein a piece of paper or a temporary support of a second gelatin coated plate or film for the original contact and which in turn is contacted with the permanent negative, a negative may be had which is correct as to right and left. Obviously the vehicle for the negative may be paper or other material but as is well known usual photographic papers when used as negatives affect the results by the grain of the paper. The fact that a photographic plate or film for the above use has been sensitized has no bearing upon the final result.

Other negative processes.—Negatives may also be produced by transfer of bleaching material to bromide papers or to plates or film sensitized by a bromide emulsion. The negative may be produced by the acid bleach and then developed by application of particles, either black or colored, as described in the preparation of print copies.

An acid transfer of bleach may be made to an uncoated paper and the acidified portions may be caused to produce a black image by application of heat.

A high contrast paper such as No. 4 or 5 Azo produces the best results and such a developer as Eastman's D–72 gives good results.

I claim:

1. The process of copying matter, printed, written or drawn on a water absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present, which process comprises: applying a film of a water solution of bleaching, development inhibiting material to the surface bearing the matter to be copied; transferring to the surface upon which the copy is to be produced, by contact and pressure, portions of the bleaching, development inhibiting material; the amount of said portions selectively determined by the variable absorption of the solution caused by the intensity present at various points of the medium in which the original matter is produced.

2. The process of copying matter printed, written or drawn on a water-absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present which comprises moistening the surface of the material to be copied with a solution of a material adapted to bleach the surface of the material to receive the copy; transferring to the surface upon which the copy is to be produced, by contact and pressure, portions of the copy producing material; the amount of said portions selectively determined by the variable absorption of the solution caused by the intensity present at various points of the medium in which the original matter is produced.

3. The process of claim 2 in which the copy receiving material is a photographic emulsion.

4. The process of claim 2 in which the copy receiving material is a photographic printing paper.

5. The process of claim 2 in which the copy receiving material is a photographic printing paper and is given a general and substantially uniform exposure to light at some time during the process.

6. The process of claim 2 in which the copy receiving material is a photographic printing paper emulsion which is given a general and substantially uniform exposure to affecting light at some time before it is used to receive a copy by the process.

7. The process of claim 2 in which the transferred copy producing material effects a selective image-forming color change in a dye carried by the copy receiving material.

8. The process of claim 2 in which the copy receiving material is a photographic paper in whose emulsion previous exposure to light has effected a photographic color throughout of the type characteristic of gelatino-chloride papers.

9. The process of claim 2 in which the copy receiving material is a photographic developing-out paper.

10. The process of claim 1 in which the copy producing material is solution of hydrogen dioxide (H_2O_2).

11. The process of claim 1 in which the material transferred is dilute sulphuric acid.

12. The process of copying matter printed, written or drawn on a water-absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present which comprises applying a water solution of hydrogen peroxide to the surface bearing the matter to be copied; bringing said surface into intimate contact with a surface carrying photographic material chemically affected by hydrogen peroxide in proportion to the amount thereof applied; whereby to transfer to different portions of the last named surface an amount determined by the density of the ink deposit of the original matter, and treating the last named surface to develop a photographic image.

13. The process of copying matter printed, written or drawn on a water-absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present which comprises applying a water solution of hydrogen peroxide to the surface bearing the matter to be copied; bringing the surface moist with hydrogen peroxide into contact with a surface coated with material bleachable by hydrogen peroxide in proportion to the amount of peroxide applied; separating the surfaces and treating the copy surface to make the bleach visible.

14. The process of copying matter printed, written or drawn on a water-absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present which comprises applying hydrogen peroxide to the surface bearing the matter to be copied; bringing said surface moist with the peroxide into intimate contact with a surface coated with a light sensitive emulsion; and fixing the emulsion against further change by light; said coated surface being subjected to a general exposure to light at some time before fixing.

15. The process of copying matter printed, written or drawn on a water-absorbing material, with a medium causing variation of the absorptive characteristics in proportion to the amount of medium present which comprises applying hydrogen peroxide to the surface bearing the matter to be copied; by surface contact transferring por-

tions of said hydrogen peroxide from the said surface to a surface coated with a photographic printing paper emulsion; the quantity transferred to various portions of the latter determined by the density of ink deposit on corresponding portions of the first named surface; said emulsion having general exposure to light before fixing; and fixing the photographic emulsion.

16. The process of claim 15 which includes development of the photographic emulsion before fixing.

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