

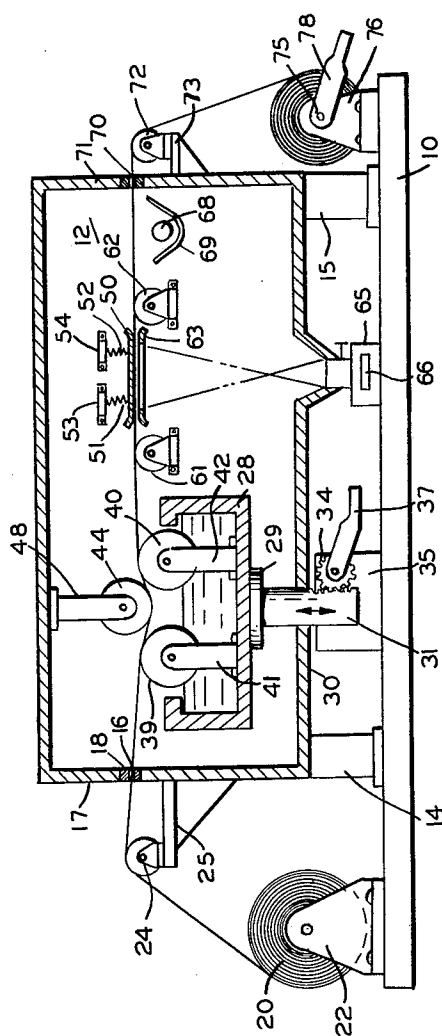
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PHOTOGRAPHIC REPRODUCTION PROCESS AND APPARATUS THEREFOR

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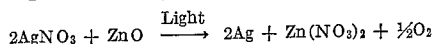
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10 Claims. (Cl. 96-27)

This invention relates to photographic reproduction and, more particularly, to a self-stabilizing reproduction process and apparatus therefor.

It has long been known that a finely divided suspension of zinc oxide in the presence of a small quantity of silver nitrate darkens when exposed to white light. The reaction is presumed to be



The present invention has for its primary object to make practical use of the above phenomenon and provides a print-out photographic process utilizing a copy material which is insensitive to light until activated by a suitable agent.

It is a particular feature of the invention that by virtue of the process and simple apparatus for its application, photographic material may be manufactured and distributed which is insensitive to light and may be stored without deterioration for an unlimited time.

It is a further object of the invention to provide a simple apparatus which utilizes the above type of material and will make print-out copies of any translucent original, particularly for line copy or continuous tone photographs.

Other objects and features will be apparent from the following description of the invention, pointed out in particularity in the appended claims, and taken in connection with the accompanying drawing in which:

FIG. 1 is a simplified schematic representation of a photographic reproduction apparatus suitable for employing a roll of light-insensitive copy material.

I have found that a thin coating of zinc oxide on a suitable support, in combination with various silver compounds, can be used as a self-stabilizing reproduction system for line copy or continuous tone photographs. This is a negative-positive system which may be used for contact printing of negatives or for enlarging by projection, e.g., from microfilm. In its elementary form, the zinc oxide and silver compound may be combined and the support coated with this composition. This is relatively insensitive to light, but when moistened with water, it becomes light-sensitive and can be so used. However, while such a coating in a dry state is relatively insensitive to light, it will, nevertheless, discolor in storage. This is presumed to be due to a gradual conversion of the silver compound to the oxide by virtue of the pH of the system (an aqueous slurry of zinc oxide has a pH in the range of 7.0-7.3). Therefore, in accordance with the invention, I propose the use of a copy material which is photochemically inert, such as a coating of zinc oxide or titanium dioxide in an appropriate binder, and activate this material prior to its use by means of an aqueous activating agent containing a silver compound. This can be accomplished in the following manner.

A coating of zinc oxide with an appropriate binder, such as gelatin, is first made on a suitable support. This may or may not contain a sensitizing dye. Such a coating can be made in the presence of light and may be stored in light indefinitely without adverse effects. This coating can then be sensitized in the printer immediately prior to exposure by moistening it with an aqueous solution of a silver compound. The latter may contain a

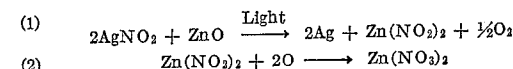
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wetting agent and may or may not contain a sensitizing dye as desired.

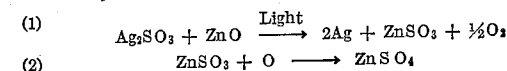
The activating solution may be any aqueous solution of a soluble silver salt. Illustrative of such silver salts operable to obtain a print-out image upon exposure are silver acetate, silver benzoate, silver fluoride, silver lactate, silver nitrate, silver nitrite, silver phenolsulfonate, silver picrate, silver selenate, silver selenite, silver sulfate, silver sulfite and silver thiosulfate.

With reference to the earlier observation hereinabove mentioned, it is noted that active or nascent oxygen is evolved as one of the reaction products. It is proposed that this reaction may be accelerated by the rapid removal of the evolved oxygen. This may be accomplished either by selecting for the activating agent a silver compound which can be further oxidized, e.g., silver nitrite or silver sulfite, or adding a small amount of zinc sulfite or zinc nitrite to the zinc oxide coating composition.

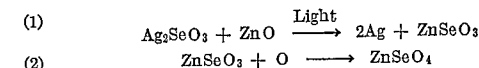
If silver nitrite, silver sulfite or silver selenite are used, the reactions would be as follows:



Similarly:



and



As an alternative, certain oxidizable organic compounds, such as sodium formate, may be added to the zinc oxide coating.

The apparatus for the production of enlargements or contact prints may have various forms. It is essential, however, that the embodiment contain means for activating the copy material by applying an aqueous solution of silver compound. In a schematic form, as shown in the drawing, the apparatus consists of a base 10 on which is mounted a light-tight enclosure 12. This may be of a simple rectangular cross-section, resting on legs 14 and 15. An entrance opening 16 in the side 17 of the enclosure may be in the form of a slit lined with any suitable padding for light-tightness, such as a velvet liner 18, through which the light-insensitive copy material may enter. Although the material is photochemically inert until activated, the enclosure 12 must be light-tight inasmuch as the material will become actinically reactive therewithin.

The coated material may be in the form of a roll held on a spool journaled in frame member 22 affixed to the support 10. A roller 24 mounted on bracket 25 affixed to the side 17 is arranged to guide the material through the entrance opening 16. Inside the enclosure 12 and near the entrance opening 16 is a tank 28 which is mounted on a platform 29 supported on a rack 31 extending from the bottom 30 of the enclosure 12.

A pinion 34 journaled in frame 35 engages the rack 31 and may be actuated by the handle 37 so as to lower or raise the tank 28. Within the latter are wetting rollers 39 and 40 rotatably arranged in suitable frames 41 and 42, respectively, attached to the bottom of the tank 28. A guide roller 44 is mounted on the inner top side of the enclosure by a suitable bracket 48 extending downwardly between rollers 39 and 40.

In close proximity to the tank 28 is located the exposure area consisting of a platen 50 which is resiliently held by the springs 51 and 52 and secured to suitable

mounting brackets 53 and 54, respectively. Guide rollers 61 and 62 are placed alongside the platen and mounted in suitable frames which may be secured to the side walls of the enclosure. A frame member 63 in contact with the platen 50 may provide space for a negative for contact printing or, as shown here by way of example, has an exposure opening to permit the projection of an image onto the copy material by means of a projector 65. A slit 66 of the projector 65 accommodates the translucent material of which an enlargement is desired. The projector 65 is merely schematically indicated and may be of any suitable type, including a light source, not shown here.

Adjacent the roller 62 is a heating element 68 placed in a parabolic reflector 69 for the purpose to be described in connection with the operation of the device.

The exit opening 70 in the side 71 of the enclosure 12 is located near the heating element 68 and is similar in construction to the entrance opening 16.

A roller 72 mounted in a bracket 73 affixed to side wall 71 guides the material onto the windup roller 75. The latter is mounted on a frame member 76 attached to the support 10. A handle 78 is provided for windup of the exposed copy material.

The operation of the reproduction apparatus is as follows. As outlined above, the copy material used consists of a support, such as paper—or film if a transparency is desired, coated with zinc oxide in a suitable binder, such as gelatin. The roll is placed onto the spool frame 22 and the material threaded through the entrance opening 16 under roller 44 and over rollers 61, 62 and 72 onto the windup spool 75. The tank 28 is normally in the "down" position so that the wetting rollers 39 and 40 do not touch the material until it is desired to activate it for the making of copies. To do so, the tank 28 is raised by the lever 37 so that the material firmly contacts the rollers 39 and 40 by virtue of the intermediate roller 44. The handle 78 of the windup spool 75 is turned, whereby the material riding over rollers 39 and 40 is activated by being moistened with the aqueous silver compound. A sufficient length of material is thus moved past the wetting rollers to enter between the platen 50 where it is held flat, ready for exposure. Upon exposure by means of the projector 65, the handle 78 is turned again so that the exposed portion of the material passes over roller 62 and past the heating element 68 where the material is dried.

It is characteristic of this material that in a dry state it is photochemically inert. Therefore, after exposure, the fixing of the image requires only heat so as to evaporate water from the moist surface. The heating element 68 and reflector 69 serve this purpose.

The advantage of rapid drying is to increase the reaction in that the print-out image, which is usually dark, will absorb heat rays, whereas the unexposed or white

areas reflect heat rays. Consequently, a differential heating is produced. As the temperature of the image increases, the reaction can be expected to proceed at an accelerated rate.

I claim:

1. A process of photographic reproduction utilizing a copy material consisting of a support having a coating comprising a photographically inert amphoteric metal oxide selected from the group consisting of titanium dioxide and zinc oxide which comprises placing said material, prior to sensitization and exposure, in a light-tight enclosure and applying as the sole activating agent to said coating an aqueous solution of a water-soluble silver salt which, in contact with said amphoteric metal oxide, forms an actinic reaction product, exposing said activated coating while in a moist state to light through a translucent original to be reproduced, thereby producing a print-out image and fixing the image by evaporating water from the moist surface, thus rendering said coating photographically insensitive to light prior to leaving said enclosure.

2. A process in accordance with claim 1 wherein said photographically inert metal oxide is zinc oxide.

3. A process in accordance with claim 1 wherein said coating comprises a mixture of zinc oxide and zinc sulfite.

4. A process in accordance with claim 1 wherein said coating comprises a mixture of zinc oxide and zinc nitrite.

5. A process in accordance with claim 1 wherein said coating comprises a mixture of zinc oxide and an oxidizable compound selected from the group consisting of sodium formate and sodium oxalate.

6. A process in accordance with claim 1 wherein said activating agent consists essentially of an aqueous solution of silver nitrite.

7. A process in accordance with claim 1 wherein said activating agent consists essentially of a solution of silver sulfite.

8. A process in accordance with claim 1 wherein said activating agent consists essentially of a solution of silver selenite.

9. A process in accordance with claim 1 wherein said silver salt is silver nitrate.

10. A process in accordance with claim 1 wherein the rendering of said coating photographically inert after exposure consists of evaporating the water by the application of heat.

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