United States Patent

Rosenberger

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[54] **CONVERSION OF ELECTROSTATIC LITHOGRAPHIC MASTERS AND COMPOSITION**

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[21] Appl. No.: **39,502**

[52] **U.S. Cl.** ....**106/2,** 101/451, 148/6.15 R

[51] **Int. Cl.** **C09k 3/00**

[58] **Field of Search** 106/2; 101/451, 452, 455, 465, 101/466; 148/6.15

[56] **References Cited**

UNITED STATES PATENTS

3,081,146	3/1963	Boies et al.	148/6.15 X
3,522,062	7/1970	Shimizu et al.	106/2

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[57] **ABSTRACT**

A conversion solution for electrostatic lithographic masters wherein the conversion solution is formulated to contain ferrocyanide in solution and which is stabilized by the presence of dissolved sulfite.

6 Claims, No Drawings

CONVERSION OF ELECTROSTATIC LITHOGRAPHIC MASTERS AND COMPOSITION

This invention relates to the production of copy by electrophotographic technique, using an electrostatic planographic master having a coating of photoconductive zinc oxide or other photoconductive particulate material in an organic resinous binder and it relates more particularly to a conversion solution for treatment of the surface of the imaged master to convert the non-imaged portions of the coated master to a water insoluble, ink repellent, hydrophilic surface.

As described in U. S. Pat. No. 2,987,395 **and** and U.S. Pat. No. 3,001,872, a master sheet is fabricated of a base sheet of metal, plastics, paper or the like having a photoconductive zinc oxide - resinous binder coating which has the desired photoconductive properties for the development of a latent electrostatic image by electrostatic technique. When such images are developed by an ink receptive, water repellent developer, the surface still requires treatment to convert the non-imaged portions of the master surface from an organophilic surface to a water receptive, ink repellent lithographic surface in order to enable use of the imaged master in the production of copies by offset or lithographic technique. Such solution for treatment to convert the non-imaged portions is hereinafter referred to as a conversion solution.

For the most part, as in U. S. Pat. No. 3,001,872, such conversion solutions have been formulated with potassium ferrocyanide, either alone or preferably in combination with a humectant, such as glycerine or glycol. Such conversion solutions have also often included buffers for proper pH adjustment, such as monobasic ammonium phosphate, sodium phosphate or sulfuric acid.

It has been found that the ferrocyanide decomposes rapidly in solution with the resultant formation of unstable ferricyanide and hydronium ions. The rate of decomposition is accelerated by exposure to light and/or air. The decomposition rate is further accelerated with increased acidity, and decomposition is significant at the acidity required for effective use of the solution for conversion to a hydrophilic surface. For this purpose, it is desirable to make use of a conversion solution having an acidity below a pH of 5 and preferably at a pH within the range of 4.0 to 4.5. Decomposition is accompanied by a rapid and continuous darkening of the solution and precipitation of insoluble products.

In use, the conversion solution is applied as a thin film to the surface of the imaged master to convert the non-imaged portions. When used as a thin film, decomposition becomes even more rapid and the resulting decomposition products that are formed on the surface of the master appear to be detrimental to the proper and effective conversion of the master surface and further limit the storage life of the imaged master.

One of the major problems faced by electrostatic masters of the type described is the very narrow latitude within which the process must be practiced for the production of a successful imaged master. The instability of the conversion solution represents one of the factors important to the narrowing of the latitude of the electrostatic master and the method for producing a satisfactory imaged master from which multiple copies of good quality can be produced.

Thus, it is an object of this invention to produce a conversion solution for use with electrostatic masters which is not subject to rapid decomposition during storage and use; which permits greater latitude in the choice of masters and conversion technique; which maintains a stabilized condition at effective levels to provide uniform results for image development and for the production of copies of good quality from the imaged master; and which remains stable when applied as a thin film onto the surface of the imaged master thereby to improve the copy quality and storage life of the imaged master.

In the commonly assigned copending application of Ort, Ser. No. 652,689, filed July 12, 1967, now abandoned and entitled "Conversion Solution for Electrophotographic Offset Master," description is made of a conversion solution formulated of potassium ferrocyanide and a chelating agent which is adapted to sequester the Fe^{++} and Fe^{+++} ions without their removal from solution so as to enable the inactivated ions to remain and maintain equilibrium conditions believed to retard the continued decomposition of the ferrocyanide.

It has now been found that improved stabilization of the conversion solution based upon the use of a ferrocyanide, in acidic aqueous medium, can be achieved by formulation of the solution to contain a dissolved alkali metal sulfite, such as potassium sulfite, sodium sulfite, ammonium sulfite and the like.

The desirable results can be secured when the dissolved sulfite is present in the solution in an amount within the range of 0.1 to 5 percent by weight but it is preferred to make use of the sulfite within the range of 0.25 to 2.5 percent by weight of the conversion solution.

As the ferrocyanide component, use can be made of ammonium or alkali metal ferrocyanides and preferably potassium ferrocyanide in amounts ranging from 0.5 to 5 percent by weight and preferably in an amount within the range of 1 to 2.5 percent by weight. As previously described, such conversion solution based upon ferrocyanide will usually, but not necessarily, contain a buffer such as monobasic ammonium phosphate, and pH adjustment to the desired level below 5 and preferably within the range of 4.0 to 4.5 can be achieved with an acidic medium, such as phosphoric acid.

The mechanism which results in the improved stabilization of the conversion solution has not been definitely established. It is believed that the sulfite retards conversion of the ferrocyanide to the more highly unstable ferricyanide which readily decomposes to reduce the effectiveness of the conversion solution. Whatever the reason, it is known that the presence of the sulfite ion as a dissolved alkali metal sulfite in solution markedly increases the stability of the conversion solution to the end that it can be exposed to direct sunlight over extended periods of time without becoming ineffective.

Having described the basic concepts of the invention, the following examples of formulations of conversion solution, embodying the features of this invention, are given by way of illustration, but not by way of limitation, with the amounts set forth representing per cent by weight:

EXAMPLE 1

2.0	potassium ferrocyanide
8.0	monobasic ammonium phosphate
0.1	disodium ethylene diamine tetraacetate
1.0	potassium sulfite
88.9	water

The solution is adjusted to a pH of 4.5 with phosphoric acid.

EXAMPLE 2

2.0	potassium ferrocyanide
8.0	monobasic ammonium phosphate
0.5	potassium sulfite
89.5	water

The solution was adjusted to a pH of 4.0 with phosphoric acid. After 30 hours of exposure, the solution remained clear and pale yellow in color and gave a negative test for ferricyanide.

EXAMPLE 3

1.5	potassium ferrocyanide
6.0	monobasic ammonium phosphate
0.1	disodium ethylene diamine tetraacetate
1.5	sodium sulfite
91.9	water

The solution was adjusted to a pH of 4.0 to 4.55 with phosphoric acid. After 30 hours of exposure the solution remained clear and pale yellow in color and gave a negative test for ferricyanide.

The solutions of Examples 1 to 3 were swabbed onto a photoconductive zinc oxide coated lithographic master after image development with a liquid electrostatic toner which deposited hydrophobic particles in the imaged areas of the plate. After swabbing with the conversion solution, the imaged master was mounted on a lithographic press and copies of good quality were secured by conventional lithographic technique of first wetting the imaged master with an aqueous repellent and then with an oleaginous ink followed by transfer of the inked image onto copy sheets.

Each of the solutions of Examples 1 to 3 had good stability and shelf life and conversion of the non-imaged portions of the plate to render the non-imaged areas uniformly highly hydrophilic could be achieved even after the solutions had been exposed to sunlight for 30 hours.

EXAMPLE 4

2.0	potassium ferrocyanide
8.0	monobasic ammonium phosphate
90.0	water

The pH was adjusted to 4.3 with phosphoric acid. After 30 hours of exposure the solution was dark brown in color and a considerable amount of precipitate was present. The solution gave a positive test for ferricyanide. Conversion with the resulting solution was unsatisfactory.

EXAMPLE 5

The composition of Example 5 was the same as that of Example 4 except that the pH adjustment with phosphoric acid was to a pH of 4.01. After 30 hours of exposure, the solution appeared dark brown and was heavy with precipitate. It gave a positive test for ferricyanide and conversion with the resulting solution was unsatisfactory.

EXAMPLE 6

The composition was the same as that of Examples 4 and 5 but pH adjustment with phosphoric acid was made to 4.9. After 30 hours exposure, the solution was orange-yellow in color with a slight precipitate. It gave a positive test for ferricyanide and conversion was unsatisfactory.

It will be apparent from the foregoing that I have provided an improved conversion solution for use with electrostatic masters wherein the conversion solution has increased stability and shelf life thereby to permit increased latitude in the selection of masters which can be used and in the processing of the master into an imaged plate from which multiple copies of good quality can be produced.

It will be understood that changes may be made in the details of formulation and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In a stabilized conversion solution for electrostatic offset masters having a surface in the form of a resinous bonded coating containing a photoconductive component to render the non-imaged portions hydrophilic comprising an aqueous solution of a ferrocyanide present in an amount within the range of 0.5 percent and a phosphate salt, said solution having a p H below 5; the improvement comprising a soluble sulfite salt, in said solution, in an amount within the range of 0.1 to 5 percent by weight.

2. A conversion solution as claimed in claim 1 in which the sulfite is an alkali metal or ammonium sulfite.

3. A conversion solution as claimed in claim 1 in which the sulfite is present as a salt in an amount within the range of 0.25 to 2.5 percent by weight of the solution.

4. A conversion solution as claimed in claim 1 in which the solution has a pH within the range of 4.0 to 4.5.

5. A conversion solution as claimed in claim 4 in which the pH is adjusted with phosphoric acid.

6. The method for converting the non-imaged portions of an electrostatic lithographic master to a surface which is hydrophilic comprising wetting the surface of the imaged plate with the aqueous conversion solution of claim 1.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,661,598 Dated May 9, 1972

Inventor(s) Helen M. Rosenberger

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

column 4, lines 24-25, cancel "present in an amount within the range of 0.5 percent".

Signed and sealed this 12th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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