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BLUE PRINT COATING

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This invention relates to blue print coatings and more particularly to blue print coatings having improved printing characteristics with respect to speed and latitude.

This application is a continuation in part of Serial No. 219,599, filed July 16, 1938, now Patent No. 2,165,166, July 4, 1939.

Blue print coatings in general consist of a light sensitive ferric salt, a ferricyanide, and other substances which may be necessary to produce the desired solution pH. In general in the past, potassium ferricyanide has been standard as the ferricyanide component of blue print coatings, and ferric ammonium oxalate has been used where fast printing coatings have been desired, other ferric salts such as the citrate being used where slower speed is unobjectionable.

According to the present invention, certain sensitizers are added to the blue print coating which increase the printing speed of the coating and do so without any sacrifice in latitude but with an actual increase in latitude so that in spite of very greatly increased printing speeds, practically pure white backgrounds can be readily obtained which is an important factor in the reproduction of line drawings, the most important single use for blue print paper. These sensitizers are compounds of strong organic bases consisting of quaternary ammonium compounds. Among the quaternary ammonium compounds included in the invention, two have proven to be of particular effectiveness, namely, tetramethylammonium hydroxide and trimethylbenzylammonium hydroxide.

I have found that the effectiveness of the sensitizers of the present invention varies to a considerable extent with the relative amount of sensitizer and ferricyanide component in the coating. The improved effect does not continue to increase with increased amounts of sensitizers but passes through a maximum, thereafter declining so that both very small amounts of sensitizer and very large amounts of sensitizer give results which are relatively poor as compared to those obtainable within the optimum range. This range is not critical. Good results are obtained with an amount of the sensitizer stoichiometrically corresponding to the total ferricyanide present. Results are improved with the addition of somewhat larger amounts of sensitizer, and a maximum is reached in most cases when the amount of sensitizer is stoichiometrically equivalent to twice the total ferricyanide present in the coating. Additional amounts of sensitizer result in a lowering of activity and therefore, while the invention in its broader aspects is not limited to a particular proportion of sensitizer, in more specific aspect a proportion of sensitizer approximately twice the stoichiometrical equivalent of ferricyanide component is included as a specific preferred modification of the invention.

When blue print coatings containing a ferrocyanide, to replace a portion of ferricyanide generally employed, and used with a sensitizer the printing speed and latitude are increased but the keeping qualities of the paper are decreased.

I have not as yet been able to determine the mechanism by which the sensitizers operate, and the present invention is not intended to be limited to any theory of action. I do believe, however, that there is some chemical relationship between the sensitizer and the iron-cyanogen complex, and this is advanced as a probable explantion of the operation of the present invention without in any way limiting it thereto.

It is an advantage of the present invention that the addition of sensitizers increases both speed and latitude of blue print coatings containing either potassium or sodium ferricyanide alone, or mixtures of sodium ferricyanide and sodium ferrocyanide. I have found that optimum results are, however, obtained when strongly basis sensitizers such as the quaternary ammonium hydroxides or their salts with weak acids are used. Other quaternary ammonium compounds such as the quaternary ammonium sulfates, alkyl sulfates, chlorates, nitrates, halides, etc., may be used as sensitizers in blue printing compositions as the hydroxyl group does not appear to be the essential group. The increase in latitude is particularly effective in cases where otherwise the printing speed sometimes results in slightly colored backgrounds. I have not as yet been able to determine the reason for the extraordinary latitude combined with high speed which is obtained with the best of the sensitizers of the present invention. This is an unusual result since normally factors which increase printing speed decrease latitude and cause trouble with backgrounds and, while we have at present no proven explanation for this extraordinary behaviour of the sensitizers of the present invention, it constitutes one of their most important advantages since all of the desirable results of high speed printing are obtained without any compromise on background quality.

The invention will be described in greater detail in conjunction with the following specific examples which illustrate typical embodiments of the present invention which, however, is not limited

to the details therein set forth and particularly is not limited to the illustrative compounds of the strong organic bases therein described.

Example 1

Two solutions are prepared as follows:

Solution A

	Parts
Water	50
Ferric ammonium oxalate	20
Potassium oxalate or citrate	2.5

Solution B

Water	50
Potassium ferricyanide	2.5
Potassium ferrocyanide	3.0

Solution B is added to Solution A at a temperature of approximately 35° to 40° C., the addition being in the absence of actinic light and with sufficient agitation to ensure thorough mixture. 11 parts of trimethylbenzylammonium hydroxide are then added and the entire solution cooled to 25° C., whereupon 0.5 part citric acid is introduced. The final solution has a pH of approximately 7.6 and may be used for coating paper at room temperature or slightly elevated temperatures, all steps, of course, being in the absence of actinic light. The paper was compared with a premium paper of high speed printing characteristics using conditions of machine printing corresponding to the CF Pease #20 continuous blue printing machine. The blue intensity at 6 seconds exposure (15 feet per minute) was almost of the same depth as on the premium paper at 42 seconds exposure (2 feet per minute). Normal fast running is 10 feet per minute. Pure white backgrounds were obtained, and the coating showed high quality for the reproduction of line drawings and was also suitable for contact printing from negatives giving pictures of good detail. At the highest machine speeds at which the above machine can run (about 19 feet per minute), the blues were still of satisfactory depth for good reproduction of line drawings and were notably deeper than the premium grade commercial paper at the same speed.

Example 2

Two solutions were prepared as follows:

Solution A

	Parts
Water	50
Ferric ammonium oxalate	20
Potassium oxalate	2.5

Solution B

Water	37
Sodium ferricyanide (in liquor)	8
Sodium ferrocyanide	2.83

In Solution B the normal ferricyanide liquor which contains approximately 1.33% sodium ferrocyanide has been enriched with additional sodium ferrocyanide. Solution B is added to Solution A as described in Example 1, then 24 parts of a 10% solution of tetramethylammonium hydroxide is introduced, the solution cooled and 1 part of citric acid added to give a pH of approximately 6.85. The solution is then ready for coating paper at room temperature or slightly elevated temperatures. All operations are, of course, carried out in the absence of actinic light. The paper produced showed approximately the same characteristics as that of Example 1.

Example 3

A solution was made up as in Example 2 except the amount of citric acid was reduced by 50%.

The paper produced was not materially affected by the reduction of acid and the results obtained compare favorably with those of Examples 1 and 2. In direct comparison with other coating formulae, it is definitely shown to be superior for intensifying the blues and increasing the latitude.

Example 4

Two solutions were prepared as follows:

Solution A

	Parts
Water	100
Ferric ammonium oxalate	25
Potassium citrate	1

Solution B

Water	75
Sodium ferricyanide in liquor (21.5 g./100 ml.)	19.2

Solution B is added to Solution A as described in Example 1, then 2 parts of trimethylbenzylammonium hydroxide is introduced, the solution cooled and 1 part of citric acid added.

The paper produced, using this coating composition, was not quite as fast as that of Example 1, but the keeping qualities are much better, and otherwise compares favorably with the better grades of commercial paper.

What I claim is:

1. A blue print coating composition comprising a light sensitive ferric salt, a soluble ferricyanide, and a quaternary ammonium compound in an effective amount.

2. A blue print coating composition comprising a light sensitive ferric salt, a soluble ferricyanide and trimethylbenzylammonium hydroxide in an effective amount.

3. A blue print coating composition comprising a light sensitive ferric salt, a soluble ferricyanide and tetramethylammonium hydroxide in an effective amount.

4. A blue print coating composition according to claim 1 in which the quaternary ammonium compound is stoichiometrically equivalent to approximately twice the ferricyanide.

5. A blue print coating composition comprising a light sensitive ferric salt, a soluble ferricyanide and a strongly basic quaternary ammonium compound in an effective amount.

6. A blue print coating composition according to claim 2 in which the trimethylbenzylammonium hydroxide is stoichiometrically equivalent to approximately twice the ferricyanide.

7. A blue print coating composition according to claim 3 in which the tetramethylammonium hydroxide is stoichiometrically equivalent to approximately twice the ferricyanide.

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