ETCHING COMPOSITION AND METHOD

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ABSTRACT OF THE DISCLOSURE

This invention concerns an additive for an etching bath which includes sulfated castor oil, an organic solvent, and a fatty acid sulfonated surfactant. The invention also relates to an etching bath including the additive and, too, a method of etching utilizing such bath.

This is a continuation of application Serial No. 367,192, filed May 13, 1964, which application in turn was a continuation-in-part of application Serial No. 98,015, filed March 24, 1961, now abandoned.

This invention relates to a novel etching composition and method and more particularly relates to a new and improved etching composition for use in the powderless etching of printing plates and relates to a novel method of powderless etching using such composition.

Various types of powderless etching compositions have been proposed in the past but none of the compositions previously suggested have proven to be completely successful. For example, Patent No. 2,828,194 discloses an etching composition in which a sulfated castor oil is employed in combination with nitric acid and an organic liquid. This etching bath did not produce the degree of etching quality required by the printing industry due to undercutting and roughness of shoulder. In addition, the bath was inconsistent, unpredictable and uncontrollable in its etching performance. Furthermore, the etching performance of the bath deteriorated rapidly with age. For example, a plate etched in a bath one hour after the bath was prepared would be markedly inferior in etching quality to a plate etched immediately after the bath was prepared. After 24 hours, the bath would be worthless.

In view of the above and other deficiencies of etching compositions heretofore employed, it was completely unexpected and surprising to discover the new and improved etching composition and etching method of the present invention. Etching baths prepared from the etching compositions of the invention have substantially improved resistance to deterioration and are capable of producing plates of satisfactory etching quality even after the baths have been used for several days. Moreover, engraved plates produced by using the composition and method of the invention have a smoothness of shoulder which was not heretofore obtainable. Also, the etched image is not undercut but has an acceptable shoulder angle. Furthermore, the speed of etching is increased. In addition, the etching composition of the invention provides greater flexibility in the formulation of the etching bath. Moreover, the etching composition of the invention is useful both with plates having line work exclusively and also plates having image areas as well.

The etching composition of the present invention comprises a sulfated castor oil, a fatty acid sulfonate surfactant and an organic solvent.

The sulfated castor oil advantageously has a combined organic SO₃ content, between about 6% and 9% by weight and a total acid value of about 55 and 130 milligrams of KOH per gram, all on a dry basis. Total acid value is the sum of the free and neutralized acid values.

Preferably, the sulfated castor oil is made up of a mixture of two or more sulfated castor oils which are substantially similar except for their combined organic SO₃ content. One sulfated castor oil may have a combined organic SO₃ content in the lower range, e.g., 6% to 7.5% and a second in the higher range, e.g., between about 7.5% and 9%. Preferably, the castor oil combination has a combined organic SO₃ content in the lower range, e.g., about 6% to 8% and a total acid value in the upper range, e.g., 80 to 130 mg.

The fatty acid sulfonate surfactant employed in the etching composition of the invention is advantageously a fatty acid taurate such as sodium N-methyl-N "tallow acid" taurate, sodium N-methyl-N"coconut oil acid" taurate, sodium N-methyl-N-palmitoyl taurate, sodium N-cyclohexyl-N-palmitoyl taurate, sodium N-methyl-N-oleyl taurate, etc.; or one of the other fatty acid sulfonates such as coconut acid ester of sodium isethionate, etc.; or combinations of such surfactants with each other or with other surfactants.

The organic solvent advantageously is a petroleum solvent and preferably contains at least about 20% by weight of an aromatic solvent such as, for example, Solvesso 150, sold by Esso Standard Oil Co., Modcol 52 sold by American Mineral Spirits Co., etc.

The proportion of the sulfated castor oil in the etching composition is advantageously between about 25% and 40% by weight and preferably between about 30% and 35%. The surfactant is advantageously present in a percentage between about 2% and 6% by weight and preferably between about 3% and 5%. The proportion of solvent preferably is between about 60% and 72% by weight and particularly between about 69% and 70%.

The remainder of the composition is advantageously water.

The above composition is mixed with nitric acid and water to form an etching bath advantageously containing between about 12% and 16% by weight of nitric acid and at least about 0.5% and particularly between about 2.4% and 4.5% by weight of the etching composition of the invention. Preferably, the proportion of the nitric acid is between about 13% and 14.5% and the etching composition between about 3% and 4.5% by weight.

While bath solutions made according to the present invention can be used to good advantage in etching plates composed of a variety of metals such as zinc and magnesium, excellent results have been achieved with zinc alloys.

The invention will be described in greater detail with reference to the following examples which are intended to be illustrative of the invention and not restrictive thereof. In the examples, parts and percentages are by weight.

EXAMPLE I

An etching bath was formulated using about 13.8 parts of 42% Baurné nitric acid, 82.6 parts of water and 3.6 parts of an etching composition containing about 68.3% of an aromatic petroleum solvent having a mixed aniline cloud point of about 69° F., a specific gravity of about 0.893 and a Tag closed-cup flash point of about 150° F.; 26.7% of a sulfated castor oil; 5% of a sodium salt of the oleic acid amide of methyl taurine sold as Igepon T33. The sulfated castor oil had a total acid value of about 85 milligrams of KOH per gram and a combined organic SO₃ content of about 7%, all on a dry basis.

The above bath was used to etch a zinc alloy plate containing about 0.1% aluminum, 0.06% magnesium and less than about 0.005% of other metals. The etching was conducted for about 20 minutes and produced a depth of etch of about 0.04 inch, a half-tone depth of about 0.006 inch in 65 screen half-tones and a bowl depth

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The fatty acid sulfonate surfactant employed in the etching composition of the invention is advantageously a fatty acid taurate such as sodium N-methyl-N "tallow acid" taurate, sodium N-methyl-N"coconut oil acid" taurate, sodium N-methyl-N-palmitoyl taurate, sodium N-cyclohexyl-N-palmitoyl taurate, sodium N-methyl-N-oleoyl taurate, etc.; or one of the other fatty acid sulfonates such as coconut acid ester of sodium isethionate, etc.; or combinations of such surfactants with each other or with other surfactants.

The organic solvent advantageously is a petroleum solvent and preferably contains at least about 20% by weight of an aromatic solvent such as, for example, Solvesso 150, sold by Esso Standard Oil Co., Modcol 52 sold by American Mineral Spirits Co., etc.

The proportion of the sulfated castor oil in the etching composition is advantageously between about 25% and 40% by weight and preferably between about 30% and 35%. The surfactant is advantageously present in a percentage between about 2% and 6% by weight and preferably between about 3% and 5%. The proportion of solvent preferably is between about 60% and 72% by weight and particularly between about 69% and 70%.

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While bath solutions made according to the present invention can be used to good advantage in etching plates composed of a variety of metals such as zinc and magnesium, excellent results have been achieved with zinc alloys.

The invention will be described in greater detail with reference to the following examples which are intended to be illustrative of the invention and not restrictive thereof. In the examples, parts and percentages are by weight.

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An etching bath was formulated using about 13.8 parts of 42% Baurné nitric acid, 82.6 parts of water and 3.6 parts of an etching composition containing about 68.3% of an aromatic petroleum solvent having a mixed aniline cloud point of about 69° F., a specific gravity of about 0.893 and a Tag closed-cup flash point of about 150° F.; 26.7% of a sulfated castor oil; 5% of a sodium salt of the oleic acid amide of methyl taurine sold as Igepon T33. The sulfated castor oil had a total acid value of about 85 milligrams of KOH per gram and a combined organic SO₃ content of about 7%, all on a dry basis.

The above bath was used to etch a zinc alloy plate containing about 0.1% aluminum, 0.06% magnesium and less than about 0.005% of other metals. The etching was conducted for about 20 minutes and produced a depth of etch of about 0.04 inch, a half-tone depth of about 0.006 inch in 65 screen half-tones and a bowl depth
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of about 0.015 inch. The shoulders were very smooth and no undercutting of the images was observable upon inspection of the plate with a 10X power magnifying glass.

When the sodium salt of the oleic acid amide of methyl taurine is omitted from the etching bath above, it is found that a plate etched with such a bath is completely unsatisfactory for printing due to undercutting of the etched images and excessive depth in the half-tones (0.009 inch). Also, the shoulders are rough and have a bad appearance as compared with the plate prepared above employing the bath of the invention.

EXAMPLE II

The procedure of this example was the same as that of Example I, except that a mixture of sulfated castor oils was used instead of a single castor oil. 6.7% of a first castor oil having an SO₃ content of 9% and 20% of a second castor oil having an SO₃ content of 7.7% were employed. Plates etched with the above bath showed superiorities similar to the bath of the invention in Example I.

EXAMPLE III

The procedure of this example was the same as that of Example I except that the etching bath of Example I was allowed to stand without use for approximately 24 hours and then a second zinc alloy plate was etched in the bath. The resulting etched plate was compared with the plate etched in Example I employing the bath of the invention. No significant difference in etching quality was observable and the plate etched after the bath had been allowed to stand for 24 hours showed the same high quality etch with smooth shoulders and without undercutting of the images as the plate of Example I.

The bath without the sodium salt of the oleic acid amide of methyl taurine was also permitted to stand for 24 hours. Etching of a second plate in this bath was attempted but the bath had deteriorated to such a degree that the plate could not be etched properly.

EXAMPLE IV

The procedure of this example was the same as that of Example I except that the surfactant employed was coconut acid ester of sodium isethionate. Plates etched with the above bath showed the same superiority of etch observable with the plates formed in Examples I, II and III.

The above description and examples show that the present invention provides a novel etching composition and method of etching. The etching composition of the invention produces engraved plates having an improved smoothness of shoulder without undercutting, which combination was heretofore unobtainable. Furthermore, the etching operation may be performed at higher speeds than previously attainable with a bath containing only sulfated castor oil and a solvent. In addition, improved flexibility in the formulation of the etching bath is achieved, and a wider range of sulfated castor oils may be employed.

Moreover, the etching bath of the invention possesses substantially improved stability and thereby achieves high quality etching after periods of time which heretofore rendered baths worthless.

It will be apparent from the above description that various modifications in the composition and method described may be made within the scope of the invention. Therefore, the invention is not intended to be limited to the specific formulations and procedures set forth in detail herein except as may be required by the following claims.

What is claimed is:

1. An additive etching composition comprising by weight on the basis of 100 parts, between two parts and six parts of a surfactant selected from the group consisting of sodium N-methyl-N-tallow acid taurate, sodium N-methyl-N-conocut oil taurate, sodium N-methyl-N-palmityloyl taurate, sodium N-cyclohexyl-N-palmityloyl taurate, sodium N-methyl-N-oleyl taurate, coconut acid ester of sodium isethionate and a mixture of two or more thereof, 60 to 75 parts of a petroleum solvent comprising at least 20 percent aromatic constituents and the remainder a sulfated castor oil containing an average of 6 percent to 9 percent by weight of combined SO₂ and a total acid value of between 55 and 130 milligrams of KOH per gram.

2. An aqueous etching mix comprising by weight on the basis of 100 parts, 0.8 part to 4.5 parts of the additive defined in claim 1, and 12 parts to 16 parts of nitric acid.

3. A composition as set forth in claim 1 wherein the surfactant is included in amounts between 3 and 5 parts and the solvent is included in amounts between 62 and 67 parts.

4. An aqueous etching mix comprising by weight on the basis of 100 parts 3 to 4.5 parts of the additive defined in claim 1 and 13 to 14.5 parts of nitric acid.

5. A method of etching a metal plate selected from the group consisting of zinc and magnesium alloys having portions of its surface covered with an acid-resistant coating to define a design with, said method comprising applying to the exposed surface an etching bath containing by weight based upon 100 parts, between 13 parts and 14.5 parts of nitric acid, between 2.5 and 4.5 parts of the additive defined in claim 1 and the remainder water.

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MAYER WEINBLATT, Primary Examiner.

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