United States Patent Office

3,193,423
Patented July 6, 1965

3,193,423

ETCHING PRINTING PLATES

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No Drawing. Filed Sept. 25, 1962, Ser. No. 226,154
6 Claims. (Cl. 156—14)

This invention relates to a new and improved method and bath for etching metal, and more particularly to an improved method of making photoengraved plates.

The conventional photoengraving processes involve the coating of metal plates, such as magnesium or zinc, with a light-sensitive coating. The coated surface is exposed to light through a negative bearing the image to be reproduced. The exposed coated surface is developed and forms the image in an acid resistant coating. The acid resistant image on the surface of the metal plate is heated to further harden it and increase its acid resistance. This image surface is then subjected to the action of a strong mineral acid, such as a twelve percent solution of nitric acid. As the etching into the surface of the metal proceeds, the acid, also, begins to etch laterally and undercuts the acid resistant coating and thus distorts the image. The conventional method of preventing or reducing the undercutting is to manually brush a resin powder against the sides of the image area with a technique that is known as "powdering" by the photoengraving trade. This is a very time consuming and tedious operation. Also, the nitric acid presents a very serious health hazard to the industry. Its fumes are very toxic and the solution causes painful skin and eye burns.

It is the object of this invention to provide an improved method for etching metal and more particularly printing plates that eliminates or reduces the need for "powdering." Another object is to provide an improved and less hazardous etching bath for carrying out this improved etching process.

These and other objects and advantages are provided by the etching process of this invention which comprises impinging a solution of persulfate compounds against the surface of the metal to be etched. It has been discovered that by controlling the direction and impact of the persulfate etchant against the metal the amount of lateral etching can be reduced. It has been found that by the addition of salts of metals lower in the electromotive force series than the metal being etched that the amount of lateral etching can be further reduced. It has also, been found that the addition of surface active agents has a further beneficial effect on reducing the lateral etching. And it has been found that the addition of a water-immiscible organic liquid can even further reduce the amount of lateral etching. The etching rate can be increased by the addition of acids.

The practice of this invention will be specifically described in the etching of a magnesium photoengraving.

The acid resistant image is placed upon the magnesium metal in the conventional manner. The magnesium plate is placed face down in an etching chamber. A spray nozzle is placed a predetermined distance from the magnesium plate. For optimum results, the distance between spray nozzle and magnesium plate is dependent upon the hydraulic line pressure and the etchant's composition. For example, at a distance of six inches between spray nozzle and magnesium plate, and at a hydraulic line pressure of 20 centimeters of mercury; a ten percent solution of ammonium persulfate will etch magnesium metal at the rate of one half thousandths of an inch per minute and cause the amount of lateral etching to be significantly reduced. Etching at higher hydraulic pressures tends to increase the lateral etching. Etching at lower pressures tends to stop the etching. Hence, there is an optimum impact condition for etching magnesium metal

with ammonium persulfate solutions for reducing the amount of lateral etch.

This optimum impact condition is dependent upon the composition of the ammonium persulfate bath. The presence of a trace to a few percent of salts of metals that are lower than magnesium in the electromotive force series will have a considerable effect on the range of optimum etching conditions and in reducing the amount of lateral etching. For example, the addition of one percent copper sulfate to a ten percent ammonium persulfate solution allows a greater latitude in etching conditions to achieve the optimum results. As a result, the hydraulic line pressure can be reduced to 16 centimeter of mercury while the etching rate increases to two thousandths of an inch per minute, but more significantly the amount of lateral etching becomes even further reduced.

The characteristics of this protection from lateral etching shows in the development of shoulders projecting from the image areas down into the metal as it is etched. The characteristics of these shoulders for a set of etching conditions can be changed by the addition of 0.01 to 0.4 percent of a surface active agent such as the anionic type; and the addition of 1 to 10 percent of a water-immiscible organic liquid such as a petroleum distillate. The rate of etch can be increased by the addition of 0.5 to 10 percent of an acid, such as sulfuric acid.

The following are formulas suitable for etching magnesium.

Example I

	Gr.
Ammonium persulfate	800
Copper sulfate	40

Water to make 4.0 liters.

Example II

Ammonium persulfate	400
Copper sulfate	40
Dioctyl sodium sulfosuccinate	12

Water to make 4.0 liters.

Example III

Ammonium persulfate	400
Copper sulfate	30
Dioctyl sodium sulfosuccinate	16
Sulfuric acid	50
Aromatic solvent with a flash point of 150 degrees Fahrenheit	200

Water to make 4.0 liters.

Example IV

Ammonium persulfate ---gr--	500
Copper sulfate ---gr--	40
Dioctyl sodium sulfosuccinate ---gr--	16
Aromatic solvent with a flash point of 150 degrees Fahrenheit ---ml--	120

Water to make 4.0 liters.

From the foregoing description it will be seen that the aims, objects and advantages of the invention are fully accomplished by the improved process of the invention.

While this invention has been fully described with reference to spray etching magnesium photoengravings, it is apparent that other controlled means of applying the etchant can be used, such as paddles. The etchant described has comprised a solution of ammonium persulfate but it is evident that other persulfate compounds could be used, such as sodium persulfate or potassium persulfate. It is, also, apparent that this method can be used in the making of devices other than photoengraving, e.g. for the "chemical milling" of parts for the mechanical, electronic, and aircraft industries. This

method can, also, be modified to reduce the lateral etching of zinc and other metals by selecting and balancing the concentration of the disclosed components in an aqueous solution of a persulfate compound.

I claim as my invention:

1. The method of making etched plates comprising an etch resistant image on a metal selected from the group consisting of magnesium, magnesium base alloys, zinc and zinc base alloys and thereby impinging an etching solution against the printing plate with controlled velocity at a predetermined angle wherein the etching solution consists of an aqueous solution of a water soluble persulfate compound, whereby a deposit forms from the solution and adheres to the edges of the etched surfaces and protects them from undercutting while etching down into the metal.

2. The method of making etched plates according to claim 1, wherein the etching bath, also, contains a trace to a few percent of a salt of a metal lower in the electromotive series than magnesium.

3. The method of making etched plates according to claim 2, wherein the etching bath, also, contains 0.01 to 0.40 percent of a surface active agent.

4. The method of making etched plates according to claim 3, wherein the etching bath, also, contains 1 to 10 percent of a water-immiscible organic liquid.

5. The method of making etched plates according to claim 4, wherein the etching bath, also, contains 0.5 to 10 percent of an acid selected from the group of acids consisting of sulfuric, nitric and hydrochloric acid.

6. The method of making etched plates according to claim 3, wherein the etching bath, also contains 0.5 to 10 percent of an acid selected from the group of acids consisting of sulfuric, nitric and hydrochloric acid.

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