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PLANOGRAPHIC PLATE

William T. Hagelin, Chicago, Ill., assignor to Davidson Manufacturing Corporation, a corporation of Illinois

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In planographic or offset printing one of the most important considerations is the preparation of the plate. The plates are commonly made of zinc or aluminum as distinguished from stone used in true lithographic printing. Aluminum has a decided advantage over zinc in that it may be formed into an extremely thin sheet while still retaining sufficient strength. It is highly desirable to provide an aluminum surface on a paper sheet to form a very flexible plate which is not only suitable for the planograph press but may also be run through a typewriter to apply a typed image directly to the plate.

In spite of its advantages in flexibility and strength, aluminum in the form of thin flexible sheets which can be used in a typewriter has never been entirely satisfactory. Such flexible sheets have usually, if not always, been completely unsatisfactory for photographic image application. For direct image work some forms have had too little affinity for the ink and others have caused the ink to spread slightly. Although heavy plates (which could not be put in a typewriter) have had a grain which was considered satisfactory for both photographic image work and direct manually-applied image work, such plates have been very expensive, partly because of the methods of imparting the grain thereto as by thorough sand blasting or abrasion with marbles and an abrasive such as sand quartz or the like, and also because of the thickness of the aluminum which may have been necessary in part to withstand the thorough abrasion. The present invention not only provides a graining which is believed to be even better than the expensive abrasion of the past but it also provides a plate which is very flexible and both because of the thinness of the aluminum and the method of graining is very inexpensive. Such plates are particularly advantageous for cheaper classes of duplicating for which the abrasively grained plates of the past were out of the question both on account of their expense and rigidity.

The aluminum with the surface of this invention is suitable for both direct image work and photographic image work in spite of the fact that it may be very inexpensive. In direct image work the inks or other image material have great affinity for the surface of the aluminum and may be applied to it with exceptional ease. Furthermore, proper materials seem to have no tendency to spread and, once they have been applied, they are not readily displaced. The result is that plates thus treated make cleaner and more exact prints and may be used for a much longer run than has heretofore been possible with equivalent image forming materials. In photographic methods the sensitizing film likewise has great affinity for the surface of the aluminum with the result that it may be applied to the aluminum with complete satisfaction.

Additional advantages and objects of the invention will be apparent from the following description. Although various embodiments of the invention are described in detail as required by Section 4888 of the Revised Statutes, the invention may take numerous forms and the claims are to be interpreted as broadly as may be consistent with the prior act.

In the preferred form of the invention, which involves both the method of treating the plate and the resulting product, an aluminum plate is first abrasively grained and subsequently chemically (or electrochemically) grained. The abrasive graining need not be of the expensive nature heretofore necessary. The chemical graining is an extremely fine graining or true etching as distinguished from the abrasive graining which is only medium fine. The extremely fine graining of the chemical action is superimposed on or added to the medium fine graining produced by the abrasive.

The plate which is initially used may be a plain aluminum plate or an aluminum foil backed with paper or other highly flexible reinforcement. It may be initially abraded in any one of a variety of methods, including sand blasting, marbling with an abrasive, or wire brushing. The wire brushing is preferred because it may be performed safely on very thin foil and is a very inexpensive method, and also because it has been found to produce just the right graining for combination with the subsequent chemical graining.

The molecular graining, whether electrochemical or purely chemical, may be performed by a variety of methods, or, more specifically, by the use of a variety of baths. The term, "molecular," as used herein is intended to designate graining of various types, which is produced by the movement of molecules or atoms, as distinguished from abrasive graining, which removes relatively large pieces of material from the surface. Any method which attacks the aluminum in a manner corresponding to a true etch may be used. If a paper backing is used, it should first be waterproofed with a material which will withstand the chemicals, although this might be avoided by making the electrochemical treatment fast enough to make the protection of the paper unnecessary.

The preferred treatment is the electrochemical treatment commonly given to aluminum in making electrolytic condensers of the type called the etched plate type in the condenser art. The term "etched" as here used means true chemical etching and should not be confused with planographic etching as commonly known in the planographic industry, in which the etching is of a different nature, comprising a treatment which may be performed on the plates of this invention after they have been grained in accordance with the invention and after the image has been applied thereto in any conventional way. An example of the preferred treatment of a plate which has already been wire-brushed or otherwise abrasively grained, and which has had its paper backing (if any) waterproofed, is the following:

First, the plate should be thoroughly cleaned as by immersion in a 5% solution of caustic soda (NaOH) at 95° C. This removes all grease and the oxide film as well as any other foreign matter on the surface.

Next, the plate is washed with cold tap water to remove this cleaning solution.

The third and most important step is the electrochemical step. It is immersed in a 4/10 normal solution of sodium chloride to which has been added some hydrochloric acid. The plate is made the anode, and a suitable voltage (preferably between 25 and 40 volts) is applied between the plate and the cathode, which may be another aluminum plate. The material is subjected to this treatment for a time which is found to give approximately the maximum graining effect. When the maximum graining effect is approximated, the increase is likely to fall off rapidly and the treatment need not continue into this inefficient stage. It is believed that the function of the electric current is simply to release chlorine in contact with the plate. The chlorine has a chemical reaction with the aluminum, forming aluminum chloride which goes into solution in the path. Thus this method is a special form of chemical treatment.

Subsequent to this treatment the plate will be washed with cold tap water, then with warm nitric acid, again with cold tap water. Then it may be washed with cold distilled water, followed by hot distilled water acidified with boric acid, and finally it may be dried. It need not be treated with the well known anodic process for forming a heavy oxide film, but it may be so treated if desired.

According to the purely chemical method the plate is cleaned as stated above and then immersed in a bath of hydrochloric acid made by mixing water with 12% to 25% by volume of concentrated HCl. The bath should be approximately 65° C. The time of immersion will be from 45 to 90 seconds or until approximately the maximum graining effect is obtained. The content of HCl should of course be carefully controlled for uniformity of grain. The plate may again be washed as described in connection with the electrochemical treatment.

The plate formed by either of these methods is characterized by the combination of a medium fine graining with a superimposed superfine graining which gives a great deal more surface area than would be possible with either of the grains alone. Furthermore, combination of the two types of graining gives a much wider variety of angularity of the directions of penetration of the minute recesses. It is believed that a large proportion of them are undercut with respect to the plane of the surface of the sheet, although the correctness of this theory is not vital, the results having been found to be exceptional regardless of the reasons for the results. In short, this combination of two types of graining has been found to be exceptionally good, both for the direct application of the image to the plate and for photographic application of the image to the plate. The plate has great affinity for both the ink or other direct image forming material and for the sensitizing film used for photographic application of the image. Furthermore, it is not only easy to apply these materials but they seem to be much more permanently and securely retained than heretofore. During long runs the image seems to undergo substantially no change or sharpening. As an example, it has been found that a plate on which the image has been applied by a certain pencil commonly used for the purpose can be run upwards of 10,000 impressions if the plate of this invention is used, instead of a mere 200 to 2000 impressions, which is all that was possible with previous aluminum plates.

Furthermore, the plate, after being desensitized, has the attribute of avoiding the effect known as toning. This is apparently because of the better retention of the dampening and desensitizing media due to the extremely large number of minute recesses resulting from the combination of abrasive graining and chemical graining.

Although wire brushing is the preferred form of abrading because of its economy and because it does not require a thick plate of aluminum, sand blasting and marbling may also be used, and may even be commercially practical for cheaper grades of plates if the cost can be reduced as by not carrying the abrasion as far as has been customary. Any such treatment may be distinguished from the normal complete sand blasting, etc., by reference to incomplete abrasive graining. Wire brushing comes within this term as well as the broader terms "abrasive graining" or "abrasion."

Although the combination of the two grainings is preferred, this invention also contemplates the use of wire-brushed almuinum without chemical etching, although in using the plate with just this wire brushing it is important that it be thoroughly cleaned, as by immersing it for a suitable length of time in a 5% solution of caustic soda. Of course, if some cleaning solution should be chosen which has a decided etching effect, or if the immersion in the solution named should be continued long enough to produce such an effect, the result will be still better and, if the etching effect is sufficiently great, the product will be the preferred form of plate.

An aluminum plate which has merely been electrochemically grained may also be used. The treatment is the same as described above for electrochemical graining of an abraded plate, including the preliminary cleaning and the subsequent washing. It is desirable, however, to carry the electrochemical graining a little closer to the maximum graining effect than is necessary when the plate has been preliminarily grained by abrasion. Although electrochemically etched aluminum has been known before for other uses, it is believed that no one has ever used it for planographic printing before.

When a plate has been grained according to any of the above methods, it may have the image applied thereto in any conventional way.

Thereafter, the non-imaged portion of the plate is de-sensitized by swabbing it with any conventional solution, such solutions being well known in the lithographic industry where they are called etching solutions, though the etching is different from the graining etching referred to above.

After thus de-sensitizing the plate, the printing is performed conventionally.

So far as is now known, the plate grained in the manners set forth above, particularly plates grained with the combination of an inexpensive abrasion method, such as wire brushing, and chemical graining, are the first inexpensive plates that have been satisfactory, or even approached satisfaction, for both direct and photographic application of the image thereto. This treatment, furthermore, is one which can be applied to extremely thin aluminum such as .002 inch foil backed by suitable flexible reinforcement such as paper of approximately .003 inch thickness. Thus, it is seen that an inexpensive plate has been provided which is satisfactory for all purposes. It is better for use in typewriters than all-aluminum plates which do not feed into the typewriter as well and which have an undesirable "set" or curl when they have been removed.

The preferred form of plates is also free to a surprising degree from the tendency to retain and print the images of fingerprints accidentally applied thereto in handling the plates. This is especially true of plates which, after the two grainings, have had a heavy aluminum oxide coating formed thereon, either by the anodic treatment referred to previously or otherwise, as by immersion in an oxidizing bath.

I claim:

1. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the steps of first uniformly wire brushing the surface to produce a relatively coarse lithographic grain, and subsequently dissolving portions of the grained surface whereby a fine lithographic grain is superimposed on a relatively coarse lithographic grain.

2. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the steps of first uniformly wire brushing the surface to produce a relatively coarse lithographic grain, dissolving portions of the resulting surface, and subsequently removing all non-aluminum compounds from the surface.

3. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the steps of first uniformly wire brushing the surface to produce a relatively coarse lithographic grain and subsequently dissolving portions of the resultant surface by momentarily subjecting the surface to a solvent for aluminum, and then successively washing the surface with water, then with an acid, and finally with water.

4. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the steps of first uniformly wire brushing the surface to produce a relatively coarse lithographic grain, dissolving portions of the resulting surface with dilute hydrochloric acid, and subsequently washing the surface with water.

5. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the steps of first uniformly wire brushing the surface to produce a relatively coarse lithographic grain, cleaning the surface of the plate with an alkali, dissolving a portion of the resultant surface by treatment with dilute hydrochloric acid and subsequently washing the resultant surface with water.

6. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the successive steps of uniformly wire brushing the surface, dissolving portions of the resultant surface by momentarily subjecting the surface to the action of warm dilute hydrochloric acid, washing the surface with water, washing the surface with dilute nitric acid, and finally washing the plate with water.

7. The method of forming a thin aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellant to a greasy ink when dampened with a lithographic etch, including the successive steps of uniformly wire brushing the surface, dissolving portions of the resultant surface by subjecting the resultant surface to the action of warm dilute hydrochloric acid for substantially 90 seconds, washing the surface with dilute nitric acid, and finally washing the surface with boric acid.

8. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 1.

9. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having meen treated according to the method claimed in claim 2.

10. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 3.

11. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 4.

12. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 5.

13. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry

and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 6.

14. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics resulting from its having been treated according to the method claimed in claim 7.

15. An aluminum lithographic plate having a surface highly receptive to a greasy ink when dry and highly repellent to a greasy ink when dampened with a lithographic etch, said surface having the characteristics corresponding to those resulting from first brushing such a surface to produce a relatively coarse lithographic grain and subsequently dissolving portions of the grained surface whereby a fine lithographic grain is superimposed on the relatively coarse lithographic grain.

WILLIAM T. HAGELIN.