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METHOD OF PREPARING PLATES FOR ELECTRO-MECHANICAL ENGRAVING

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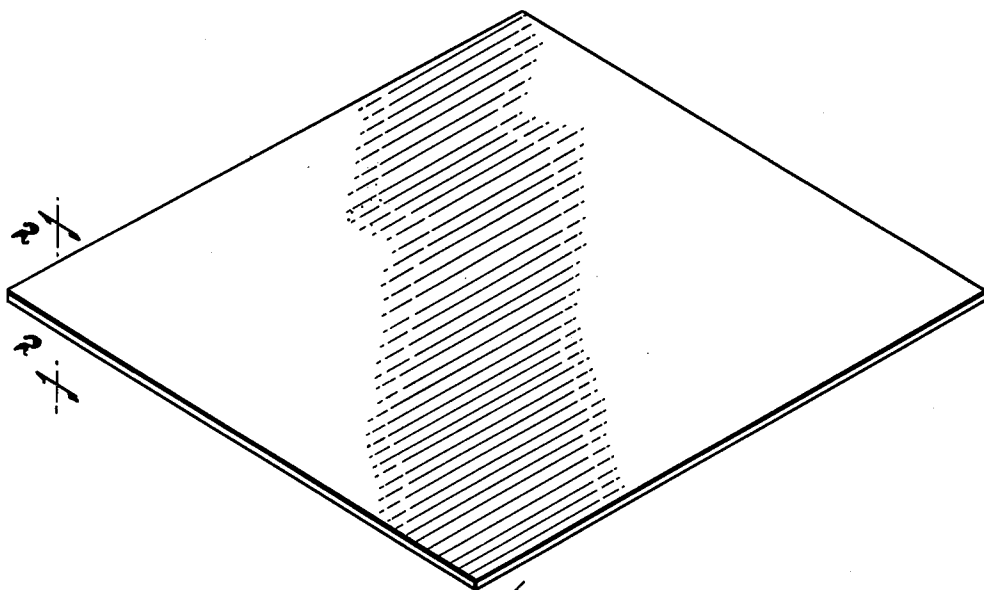


Fig. 1

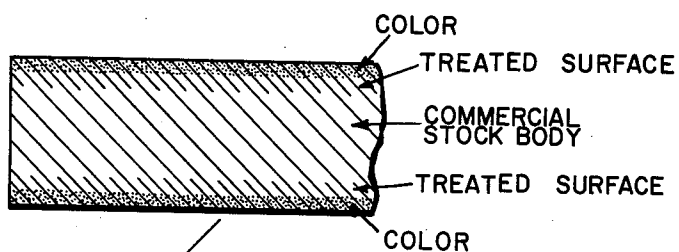


Fig. 2

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METHOD OF PREPARING PLATES FOR ELECTROMECHANICAL ENGRAVING

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3 Claims. (Cl. 204—35)

This is a continuation in part of my co-pending application No. 561,172, filed January 24, 1956, now abandoned.

This invention relates to the method of treating the surface of aluminum plates to adapt the plates to be engraved for use in letter press printing. More particularly, the invention is directed to a method of oxidizing aluminum plates to provide a porous, skin hard surface which is readily receptive to a dye and which can be easily engraved in an electronic-mechanical engraver.

The plates to which the present invention is directed are screen processed, that is, the plates are provided with regularly spaced dots, the dots being formed by cutting conical depressions in the surface of the plate. The depressions each vary in size depending on the varying gradations of light and dark of the photograph or the like to be reproduced so as to permit sharp half-tone reproduction.

The plates, prepared in accordance with the invention, are screen processed in an electronic-mechanical engraver. An engraver of this type is known as the Klischograph and is disclosed in Patent No. 2,863,000.

To prepare an engraved plate from a photograph, the Klischograph provides a photo-electric scanner which passes back and forth across the photograph to be reproduced and a stylus which passes back and forth over the plate to be engraved. The photo-electric scanner receives signals of varying amplitude depending upon the gradations of light and dark in the photograph being scanned. These signals are transmitted to the stylus and the stylus in turn pierces the surface of the plate to varying depths in accordance with the amplitude of the signal received from the photo-electric scanner.

The Klischograph and other like machines were originally developed to be used with plastic plates. As such the usefulness of the machine is limited. Plastic plates do not have the lasting qualities for good reproduction. Although the sharpness and tone quality may be satisfactory in reproduction from plastic plates, the number of acceptable reproductions that can be made is limited. Plastic tends to absorb ink so that after 30,000 to 40,000 reproductions, substantially all the detail is lost and the reproduction becomes more of a black smear. A plastic plate is of no use in producing mats for stereotypes or for similar adaptations of this character wherein impressions are required from the engraved plates. Such plastic plates are only good for a short run but will not stand the pounding and pressure. Furthermore, such plates cannot be routed or corrected as are metal plates.

The principal difficulty in adapting the machine for use with metal plates is the difficulty in providing an inexpensive metal which can be engraved without wearing out the stylus of the engraving machine. As a consequence, the electro-mechanical engravers have continued to be used for plastic plates and metal plates are still being processed by expensive chemical engraving processes.

An object of the present invention is to provide a metal plate for use with electro-mechanical engraving machines. Aluminum is a desirable metal in that it is comparatively inexpensive and generally has the physical characteristics necessary for use in electro-mechanical engraving. Aluminum, in its untreated state, however, is soft and, when mechanically engraved, results in the production of burrs.

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On the other hand, when the surface of the aluminum is oxidized by conventional methods, the resultant surface is so hard that the stylus or engraving tool tends to wear out before a single plate can be engraved. The coating is too hard and stressed so that it chips rather than cuts.

It is, therefore, another objective of the invention to provide a method of treating aluminum for use in electro-mechanical engraving machines, the process imparting a comparatively soft, porous oxide surface to the aluminum so that the complete plate can be engraved without wearing out the stylus.

In the engraving process it is necessary for good engraving results and end products to provide plates having a colored surface. With a colored surface the operator of the engraving machine may determine at a glance the desired quality of the reproduction he is developing. The operator can from such an inspection of a colored surface make whatever adjustments are necessary in the machine to correct or overcome the deficiency, such as controlling the depth of cut.

It is still another objective of the invention to provide a process of forming an oxide on the surface of an aluminum plate to provide a porous surface that is readily receptive to a coloring dye. The surface of the aluminum prepared in accordance with the present invention will satisfactorily receive the dye up to five times as fast as conventional dyeing processes.

Other objectives of the invention will become more readily apparent from the following detailed description of the invention taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a plate prepared in accordance with the invention, and

FIG. 2 is a cross-sectional view taken along lines 2—2 of FIG. 1.

The principal feature of the process by which the desired characteristics of the surface of an aluminum plate are obtained are the comparatively high current density and short time of applying the current during the formation of the oxide on the aluminum plate. According to conventional anodizing processes, the anodizing current density is normally in the range of 10 to 20 amps. per square foot, the current being applied from between 15 to 60 minutes. In accordance with one form of the applicant's process, an alternating current of 180 amps. per square foot is applied for 60 seconds to produce the desired surface characteristics. In another form of the applicant's invention a direct current of approximately 50 amps. per square foot is applied for 8 minutes.

Broadly, the process comprises the following steps:

- (1) Clean the surface of the aluminum plate.
- (2) Rinse.
- (3) Form an oxide on the plate using a high current density applied for a comparatively short time in a sulfuric acid solution.
- (4) Rinse.
- (5) Immerse in a dye solution for approximately 5 minutes, at 150° F. to 165° F.
- (6) Rinse in cold water.
- (7) Immerse in water maintained at a temperature of at least 180° but below the boiling point.

More specifically, the process comprises the forming of an oxide coating and dyeing of 3S H 14 alcan designation aluminum which has been rolled, scalped and homogenized.

These plates in the first instance are cut to oversize dimensions and are then individually set out and/or supported upon racks and are held by one or more spring clips constructed of aluminum material that engage an excess plate section. The thus supported plates are then immersed in a cleaning and degreasing solution or other

means adapted for the removal of all surface held dirt or impurities and more specifically to remove all the grease or drawing compound that may be present on the raw sheet stock.

The cleaning step may be carried out in one of several procedures, but the present method contemplates the use of non-etching chlorinated solvents or non-etching hydrocarbon solvents. As an example, a cold bath is prepared with carbon tetrachloride to remove all surplus oils or greases together with other foreign materials. An immersion time of sixty seconds is normally adequate for this operation and if necessary, the work may be wiped with a cloth to remove marking ink that still remains upon the surface of the plates. Ordinary commercial carbon tetrachloride is employed in this cold soak. While the minimum time of a minute is given above for the immersion time, the plates may be soaked for two or three minutes in the carbon tetrachloride bath, but the temperature of this bath is held at 70° F. during the cleaning cycle.

In place of the above solvents there are other non-etching cleaners and cleaning agents (used hot or cold) that may be employed to clean the metal. Primarily, however, it is preferable to use any of the chlorinated or hydrocarbon solvents that can be formulated into soaking baths or that may be permissibly used as vapor cleaning media in instances where the work is supported in vapors that are being driven out of the solutions through the application of heat. Petroleum solvents can be used as a cold soak bath, but these latter solvents are not too desirable because of the fire hazards that such solvents create.

Upon removal of the cleaned plates from the degreasing bath, the racked articles or plates are then rinsed in cold running water 2 or 3 seconds together with agitation of the work. This rinse is to remove any foreign matter that may still cling or adhere to the metal plate surfaces. The time of rinse is not critical and actually the step consists of an in and out operation in subjecting the work or plates to this rinse.

The work is now taken and immersed with the racks into an electrolytic oxidizing tank. The electrolyte consists of a 50% aqueous solution by weight of sulphuric acid operated and maintained at a temperature of 70° F. The solution is gently agitated by an air agitation system. In this bath the work or plates are made one electrode of an A.C. current source and the other electrode is a graphite member. A current density of 180 amperes per square foot is utilized, while the operating voltage may vary from 12 to 18 volts as may be determined by the surface area being subjected to the load and its relative location in the tank. The time required for this operation is 60 seconds.

Should aluminum be used for both electrodes, and the graphite electrode is omitted, the voltage is increased to approximately twice the value that was being impressed with the aluminum graphite combination of electrodes. The first method is preferred although the latter can be used if desired, depending upon conditions of operation.

While the preferred current density is 180 amps. per square foot, a current density in the range of 225 a.s.f. to 135 a.s.f. will be satisfactory. The time for application of the current should be correspondingly reduced to 45 seconds or increased to 90 seconds as the current density is increased or decreased.

In an alternative form of the oxidizing process, the plates are immersed in an 18% solution of sulfuric acid maintained at a temperature of 110° F. A direct current of 50 amps. per square foot is applied for approximately 8 minutes at a voltage of 12 volts. The current could be decreased to 40 a.s.f. or increased to 60 a.s.f. and produce a satisfactory surface. If the current is decreased below 50 amps. per square foot or increased above 50 amps. per square foot, the time of application of the

current should be correspondingly increased or decreased within the range of 12 minutes to 5 minutes.

The rack with its plates is now transferred from the electrolytic bath into a rinse bath by immersion into cold running water to remove sulphuric acid. This is a straight immersion step and need only take 2 to 5 seconds. More than one water rinse is advisable.

After rinsing, the rack and its plates are then immersed into a dye tank as a single dip operation to apply color to the surfaces of the sheet plates. The dye tank solution utilized is prepared with suitable dye color selected from one of the water soluble aniline dye groups. For example, if a violet color is to be applied, the dye used may be an "Eloxan Violet 5 BL," a product so specified under dyes produced by Geigy Dyestuffs. Dye concentrations vary, but with the dye named, the solution concentration is made with 5 grams of this dye used per liter of water. The dye solution is heated and maintained at a temperature ranging from 150° F. to 165° F. A minimum immersion time of 5 minutes is maintained, while gentle air agitation is provided for the dye tank solution. If a darker color is desired, more dye concentration can be employed or the work or plates may be left longer in the dye tank solution.

Another example of a dye tank color solution is to provide five (5) grams of water soluble aniline dye, such as anthraquinone blue selected from the group of water soluble anthraquinone dyestuffs, or Colour Index No. 246 selected from the group of water soluble disazo dyestuffs, or Colour Index No. 758 selected from the group of water soluble xanthene dyestuffs, dissolved in one litre of water and with the solution being operated and maintained at a temperature of 150° F. to 165° F. with a minimum sheet immersion period of 5 minutes. The Colour Index numbers given are those found in the Colour Index of the Society of Dyers & Colourists.

The plates will take on the color over the surfaces thereof and when the color concentration or tone blend desired is reached, the rack and plates are withdrawn from the dye tank and rinsed. The rinse step here is conducted by a dip or immersion into a bath of cold running water over a period of several seconds to wash away and to remove all excess dye from the surfaces of the aluminum plates.

A second final rinse step is then used by transferring the plates into a rinse tank having water heated to at least a temperature of 180° F. but not to the boiling point. This rinse is carried on for 15 to 20 seconds so as to prevent streaks and spots, and also, to dry the plates upon removal from this bath as brought about through the inherent latent heat taken on by the metal plates during the immersion rinse. This last rinse solution must not be heated to the boiling point, since this would tend to seal the coating developed under the treatment previously given to the plates.

When this last step has been brought to conclusion, the racked plates are removed from the racks and they may be finally trimmed and packaged for shipment in 25 piece lots in boxes or in cartons with 100 plates to the carton and in selected size lots of 5" x 6", 6" x 8", or 8" x 10" or greater for engraving purposes. An individual plate treated according to this method is illustrated on the accompanying drawing forming a part of this specification.

Having described my invention, I claim:

1. The process of reproducing indicia having gradations of light and dark on an engraving plate for letter press printing purposes, comprising the steps of forming an oxide coating on the surface of an aluminum sheet to produce a surface having the soft, porous characteristics of an aluminum surface produced by immersing the sheet as one of two electrodes in a 70° bath of 50% by weight solution of H₂SO₄ and applying a voltage of 12-18 volts for one minute between electrodes to provide 180 am-

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peres per square foot at the surface of said sheet, mechanically piercing the surface of said sheet at regularly spaced positions throughout the surface of said sheet to provide regularly spaced dots throughout the surface of said sheet, and electronically varying the depth of each cut in accordance with the gradations of light and dark of the indicia to be reproduced.

2. The process of reproducing indicia having gradations of light and dark on an engraving plate for letter press printing purposes, comprising the steps of electrolytically forming an oxide on the surface of an aluminum sheet to produce a soft, porous surface by immersing the sheet as one of two electrodes in a 70° F. bath of a 50% by weight solution of H_2SO_4 and applying an alternating current voltage of 12 to 18 volts for one minute between electrodes to provide 180 amperes per square foot at the surface of said sheet, mechanically piercing the surface of said sheet at regularly spaced positions throughout the surface of said sheet to provide regularly spaced dots throughout the surface of said sheet, and electrically varying the depth of each cut in accordance with the gradations of light and dark of the indicia to be reproduced.

3. The process of reproducing indicia having gradations of light and dark on an engraving plate for letter

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press printing purposes, comprising the steps of electrolytically forming an oxide on the surface of an aluminum sheet to produce a soft, porous surface by immersing the sheet as one of two electrodes in a 110° bath of 18% by weight solution of H_2SO_4 and applying a direct current voltage of 12 volts for approximately eight minutes between electrodes to provide approximately 50 amperes per square foot at the surface of said sheet, mechanically piercing the surface of said sheet at regularly spaced positions throughout the surface of said sheet to provide regularly spaced dots throughout the surface of said sheet, and electronically varying the depth of each cut in accordance with the gradations of light and dark of the indicia to be reproduced.

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