

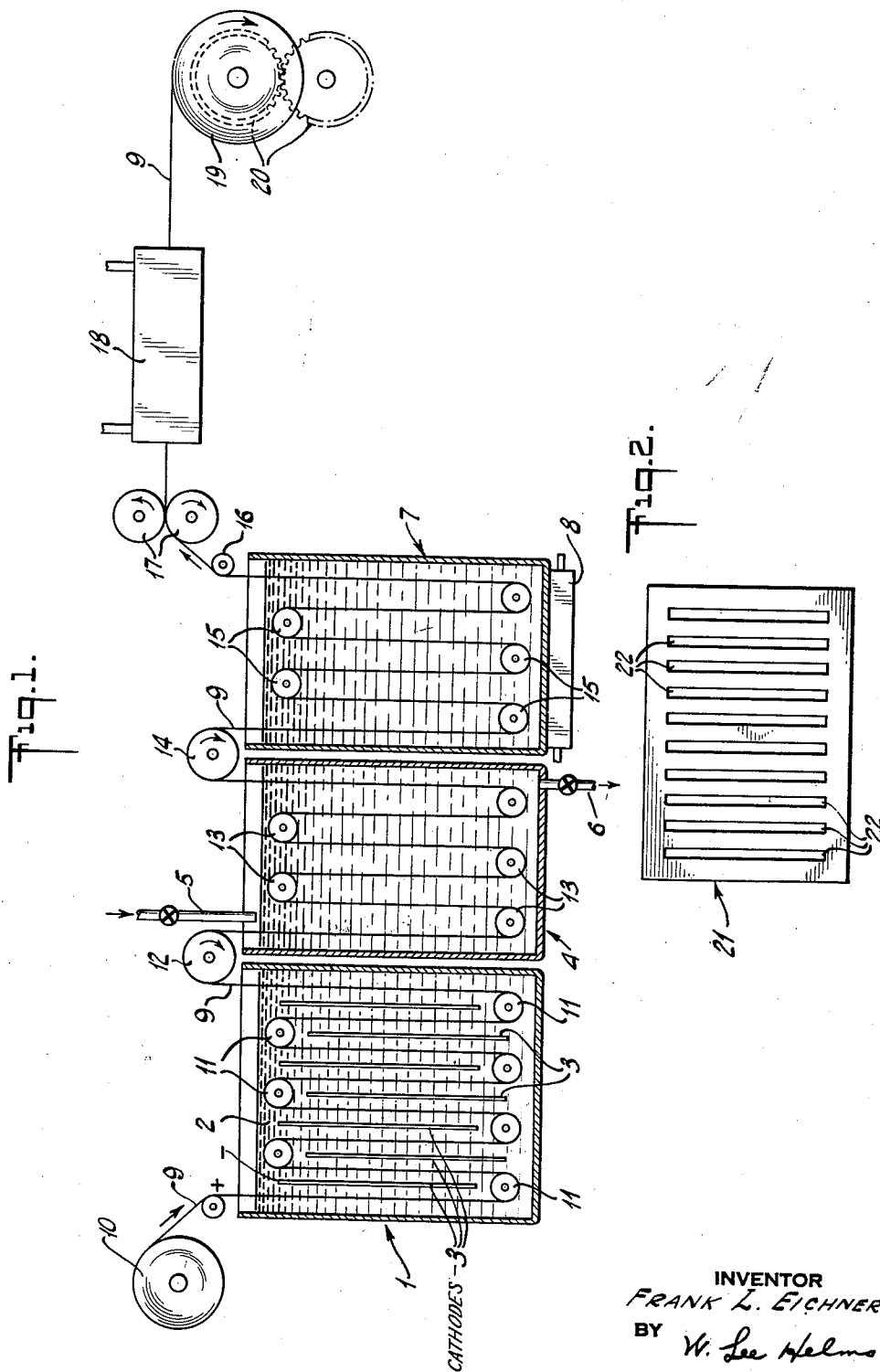
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PROCESS OF PREPARING PLANOGRAPHIC PRINTING PLATES

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PROCESS OF PREPARING PLANOGRAPHIC
PRINTING PLATES

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This invention relates to the treatment or preparation of aluminum sheets or strips for planographic printing and to the product of said treatment.

The art of planographic printing from metal, and more particularly from aluminum, depends upon the immiscibility of oil or oil-like substance and water, and the preferential retention of this oil-like or greasy substance by the desired image areas and a similar retention of an aqueous dampening fluid by the non-image areas. Planographic printing depends upon so conditioning the metal surface of the printing plate that these preferential retentions may be satisfactory and sharp in their outline.

The treated surface must be so sensitized that it will take ink, typewriter ribbon or carbon paper ink, pencil marks, etc., without "feather edging" or "spreading" the image made thereon with said pencil, ink, etc., over undesired areas. It is just as necessary that the non-image areas be made completely adaptable for hydrophilic absorption or to render the surface lyophilic.

There are a number of different methods to produce a surface on aluminum whereby said surface will retain water or hydrophilic solutions and also satisfactorily retain an image thereon. However, the methods heretofore have been somewhat complicated; the surfaces are extremely sensitive to fingerprints and do not always form sharp images. Quite often the coatings placed on aluminum tend to lose their water-retention properties and also to gradually become blurred in image reproduction. My process eliminates these difficulties.

Accordingly, an object of my invention is to provide an improved planographic printing plate having a printing surface which will take ink, typewriter ribbon or carbon paper ink, pencil marks and other oil-like or greasy writing, printing or marking substances without "feather edging" or "spreading" the image made thereon by the image depicting substance, and so conditioned that the preferential retention of the images are satisfactory and sharp in their outline and the non-image areas are completely adaptable for hydrophilic absorption or the surfaces rendered lyophilic; and a further object of this invention is to provide aluminum printing plates in which the printing image gives sharp, clear and strong prints or reproductions over an extended period and for an extended number of prints or reproductions, and without the printing image becoming "feather-edged" or "spread" or the image fading.

Another object of this invention is to provide a process for making these improved aluminum planographic printing plates, and a process which is certain, efficient and economical and which may be applied to aluminum in the form of separate sheets or plates or to sheet aluminum supplied in roll form; and a further object is to provide a process whereby the depth of the electrolytic etching may be controlled and the plates so conditioned for photographic image forming or otherwise as desired.

Other objects of this invention will be in part obvious and in part pointed out hereinafter.

In accordance with my invention, the process contemplates the preliminary electrolytic treatment of the aluminum sheets or strips and a subsequent treatment without the use of electricity in order to form surfaces adaptable for planographic printing. The term "aluminum" as used herein and in the appended claims includes aluminum in every degree of purity, that is, aluminum in its chemically pure sense, or in its various technical or commercial grades, or in its various alloy forms. In the alloy forms it may be combinations of aluminum with copper, manganese, iron, silicate, magnesium, etc. Both aluminum of commercial purity and the various aluminum alloys are adaptable to my purpose. Although the alloy sheets or rolls may require some manipulation of solutions, current densities and time periods, the basic principle for the treating of the commercial aluminum and aluminum alloys is within limits easily workable by one skilled in the art.

The process comprises two main steps, the first being the electrolytic step. For purpose of practice, I place approximately 12 lbs. of sodium chloride or other suitable metal chloride in 80 gallons of ordinary water and fill an electrolyzing tank with this solution. The metal chloride solution alone will give a satisfactorily etched aluminum sheet, but there is considerable frothing or foaming of the bath which is objectionable and which occasionally may form unetched surfaces on the aluminum due to gas formation. This objectionable feature is overcome by the addition of a froth or foam inhibitor such as aluminum chloride or hydrochloric acid. When hydrochloric acid is used it apparently forms aluminum chloride in the solution by reaction with the aluminum. The amount of aluminum chloride or technical grade hydrochloric acid is approximately 2 lbs. to the 80 gallons of water. The aluminum chloride crystal is preferred to the hydrochloric acid because it is not objectionable to work with.

The hydrogen ion concentration or pH is preferably from 2 to 4 although circumstances and working conditions may alter these values.

If, upon starting the etching process I find the solution to be too dense or too weak, I build the solution up with a saturated solution of the metal chloride or weaken it by the addition of water. I prefer to use approximately 9 volts in my salt solution. If, when operating, the electromotive force goes below 9 volts, there is indication that the salt is in excess of the required amount, and water should be added. If the solution becomes too weak the voltage will rise and this will be an indication that more salt or saturated salt solution must be added. I preferably subject the sheet aluminum to an amperage of from 150 to 175 amperes for each inch of width of aluminum being treated regardless of the length of the aluminum sheet in the tank. As for example, when a 20 inch sheet is being placed in or run through the etching tank, I must use 20 times 150 or approximately 3000 amperes in order to have the proper current capacity to give the necessary etched surface.

The aluminum is permitted to remain in the electrolytic bath for approximately 5½ minutes; however, this period of time is optional and may be varied as the occasion requires. The etching of the plate in the soluble metal chloride is variable as to depth. Thus a deeper tooth may be produced as is frequently required when it is desired that a photographic image be reproduced on the plate and when a photographic reproduction plate is desired. After subjecting the aluminum to the above solution and current and time requirements, it is caused to be removed and run through a rinsing step. The rinsing tank is preferably placed adjacent to the electrolytic bath and may consist of a tank with constantly running ordinary tap water or the aluminum sheet may be subjected to a system of sprays.

After the rinsing, the aluminum sheet is caused to be subjected to an aqueous medium and preferably run through or left in boiling water for a period from 3 to 5 minutes, after which the metal is passed through squeeze rolls and dried, preferably over strip heaters, in drying tunnels or by other means of drying.

The phase which comprises subjecting the metal to boiling water is as important as the electrolytic phase. While subjecting the aluminum to a hot aqueous medium, boiling water being preferred, there is a violent evolution of gas coming from the previously etched metal, the color of the aluminum gradually darkens from a whitish grey to a deep brown. For the want of a better identification of this reaction it will herewith be called the "hydrolization step" and may be in part explained by assuming that there is a reaction between the oxygen in the boiling water and the relatively porous surface of the freshly etched sheet or strip. The result of the reaction is the formation of a peculiar oxide deposit on the etched aluminum. Inasmuch as there is no electrical contact in the boiling tank or container, the reaction cannot be called electrical, nor does there appear to be any difference between distilled water or ordinary tap water, both giving the same result. Boiling water is preferred, since temperatures slightly under the boiling point give results which are not satisfactory as when boiling water is used. The time element is also subject to slight changes. It is also believed that the chlorides that may be

formed on the aluminum have little to do with the reaction in the boiling water, as said chlorides being soluble in water, are removed in the rinsing step which follows the electrolytic etching process. The oxide is formed in situ in what I have called the "hydrolization step" and apparently by hydrolysis. The oxide coating is immiscible and insoluble in aqueous repellent media and also is unaffected by the image deposit or media. The tendency for demulsification is decreased due to the particular nature of the oxide formed and which does not emulsify or saponify with the aqueous water repellent or image forming media employed; these latter including those usually used for the purpose in the preparation of planographic printing plates.

The aluminum sheets so made or severed from a roll strip so prepared not only retain the wetting liquid when planographic reproductions are made, but also make most desirable surfaces for image forming deposits. It has been found that images placed upon aluminum sheets made according to my invention and using the usual lithography image forming composition are quite permanent and make many thousands of reproductions without materially changing in form or clarity of the image. It has been further found that sheets made according to my process are not appreciably sensitive to fingerprints which often cause smudge marks on reproductions due to slight absorptions of ink in the printing process.

Further advantages of my invention lie in the ability and ease in making corrections without smudging the image. The etching and subsequent reaction in the boiling process makes a surface that is not easily disturbed by erasures of the image, and makes a grain surface so fine and uniform that inadvertent accumulations of grease or other contaminations may be readily removed without spoiling the surface of the plate.

While sodium chloride has been specifically mentioned as the electrolyte in the etching process, other metallic chlorides may be used, chief among these being potassium chloride, magnesium chloride, lithium chloride and calcium chloride. Due to the increased strength of potassium chloride or to the decreased strength of other soluble chlorides, allowance must be made for their different molecular activity and weights.

The hardness or temper of the aluminum is also subject to variation. Dead soft aluminum may be used, but I prefer the half hard or full hard aluminum because of its workability and "spring or verve" in handling.

The particular image making substance is a matter for the operator or the particular end use to determine as I have found that pencil marks, waterproof writing ink, greasy or waxy color media and more particularly inks of the fatty acid type are within the scope of my invention. The plates are also suitable for photographic production of a planographic image in the usual way.

Most planographic plates are treated on both sides, but means can be taken to print only on one side if desirable.

One possible set-up of apparatus and one suitable type of cathode plate for use in connection with applying the process to aluminum are shown in the drawings and in which:

Fig. 1 is a diagrammatic illustration of the various tanks and the aluminum material running therethrough, and

Fig. 2 is a plan view of one possible form of cathode plate.

In the drawings, 1 indicates the electrolytic tank adapted to be filled with the electrolytic bath solution 2, and having spaced cathodes 3 suitably supported therein, the supporting means not being shown. 4 indicates the rinsing tank with which is associated a water inlet pipe 5 and water outlet pipe 6. Adjacent tank 4 is another tank 7 adapted to contain water and provided with suitable means, such as a steam jacket 8 whereby the water in the tank may be heated to a controlled temperature. The aluminum material 9 passes from a suitable unwind roll 10, under and over guide rolls 11, suitably supported in tank 1, over transfer roll 12 which passes the material into rinsing tank 4, the material then passing under and over guide rolls 13 suitably supported in tank 4, over transfer roll 14 and into tank 7 in which the material passes under and over guide rolls 15 suitably supported therein and thence over a guide roll 16 and between a pair of squeeze rolls 17 and through a suitable drier 18 and to a rewind roll 19 adapted to be driven at a predetermined speed by suitable mechanism indicated at 20.

The cathode plate 21 is shown in Fig. 2 as having a plurality of parallel slits or apertures 22. However, cathode plates of other forms may be used and they may be plain or serpentine in shape; or the cathodes may be comprised of a plurality of spaced bars or rods, if desired. The advantage of having a cathode which exposes a goodly number of edges is well understood in the art, and it is understood my invention is not limited to any particular form of cathode. Any suitable means may be provided for supporting the cathodes in proper spaced relation in the electrolytic tank, and it is deemed unnecessary to illustrate such means in connection with the purely diagrammatic showing in the drawing.

As stated, my invention comprises the placing of aluminum sheet material in single sheet form in or passing aluminum in continuous roll form through an electrolytic bath. If I treat my aluminum in the form of separate sheets, suitable anchorage and electrical contact is provided for the sheets. If I use the material in roll form, which is preferable from a speed and economical standpoint, I place an untreated roll on an unwind apparatus and thread it through the electrolytic bath over properly placed and spaced rolls, said rolls being of such a nature that the aluminum passing over them will not be injured, and then rewind the material on a rewind roll driven at a predetermined speed. The electrolytic tank may act as the cathode but a special cathode plate construction is preferably provided. I have found it preferable to place sheets of copper or brass between the vertically placed sheets or roll segments of aluminum. The sheets of

brass or copper being the cathodes and spaced about 1 inch from the aluminum so as to form equal distributed surface for ion transmission. The aluminum being the anode, and the sheets of brass or copper being the cathode, the current travels from the aluminum to the copper. While the tank may be the cathode, it might not properly etch the aluminum due to the lack of cathode surface.

Obviously the practice of my process of preparing planographic printing plates from separate sheets of aluminum or from aluminum in roll form, is not limited to the use of any particular apparatus or equipment; a wide choice of apparatus and equipment and arrangement thereof being possible as is readily apparent, so that further detailed elaborations as to suitable apparatus and equipment is believed to be unnecessary here.

I claim:

1. The process of preparing aluminum planographic printing plates which includes electrolytically etching a surface of sheeted aluminum in an electrolytic etching bath comprising an aqueous solution of a chloride selected from the group consisting of sodium, potassium, magnesium, lithium and calcium chlorides, and having a hydrogen ion concentration of pH from about 2 to about 4 produced by hydrochloric acid, and then forming an oxide deposit on said etched surface by subjecting said surface to the action of boiling water for a period of about 3 to about 5 minutes whereby the aluminum surface turns brown.

2. The process of claim 1 wherein the chloride is sodium chloride used in the ratio of about 12 pounds per 80 gallons of water, said pH being attained by the use of hydrochloric acid.

3. The process of claim 2 wherein the amperage is 150-175 amperes per inch width and wherein said hydrogen ion concentration is produced by the use of hydrochloric acid.

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