July 10, 1962 J. STRAUSS 3,043,693

METHOD AND APPARATUS FOR MAKING PRINTING PLATES

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FIG. 1

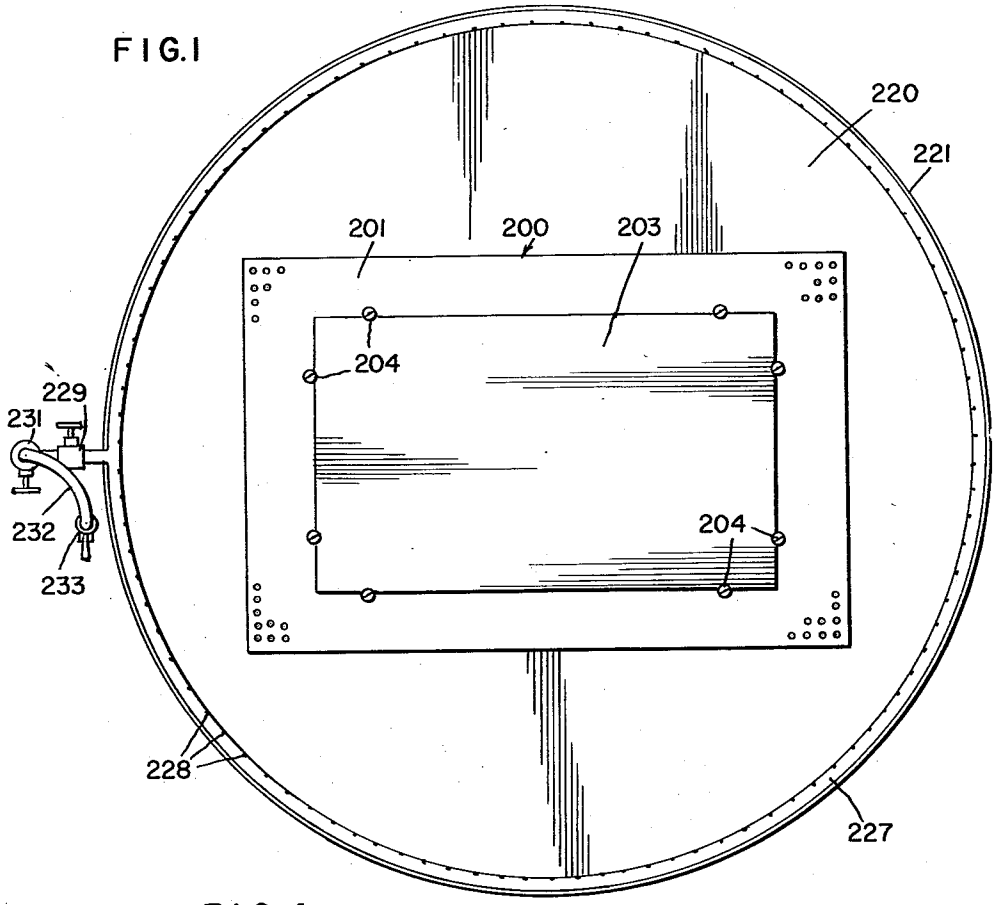
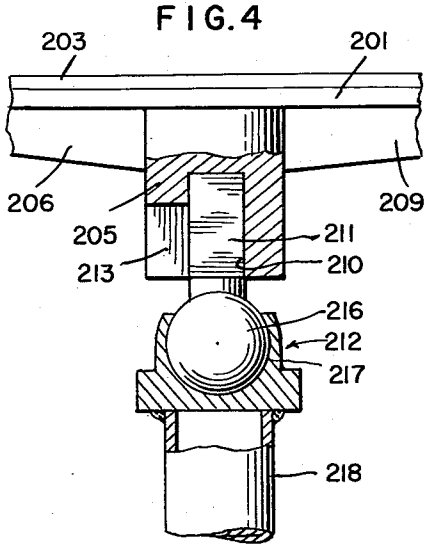


FIG. 4



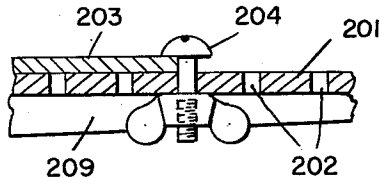


FIG. 5

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FIG.2

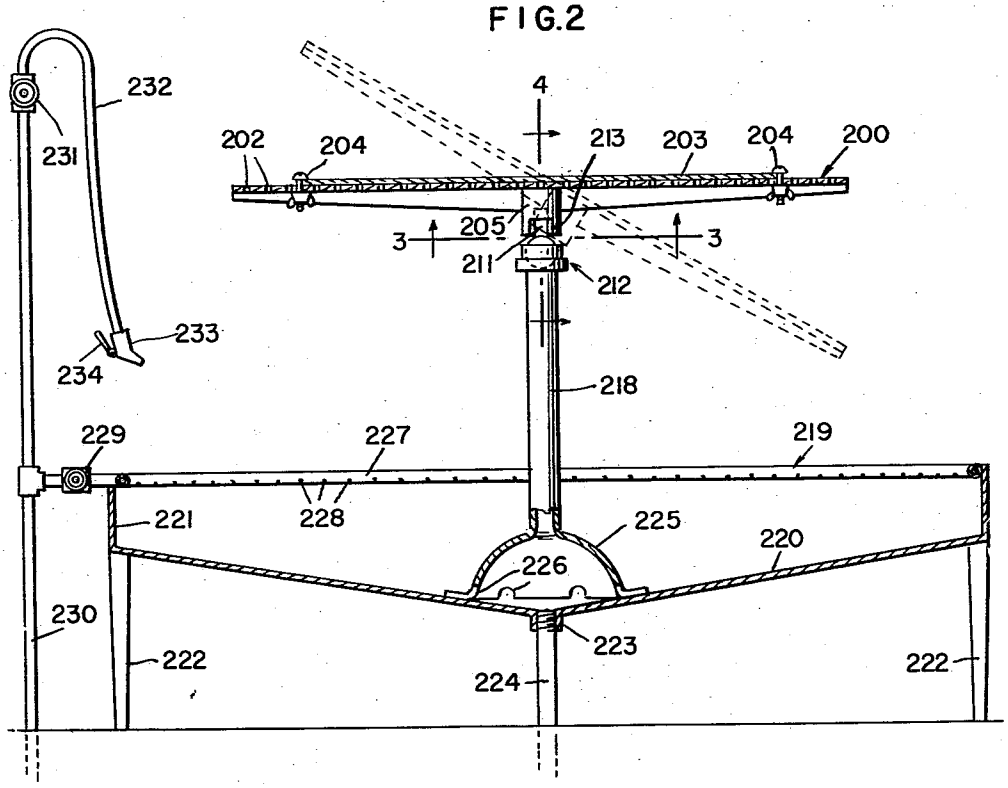
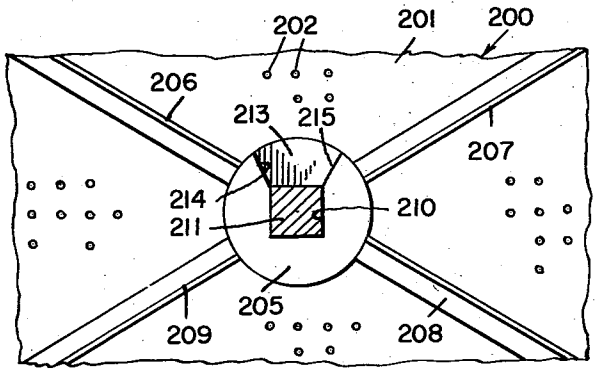


FIG.3



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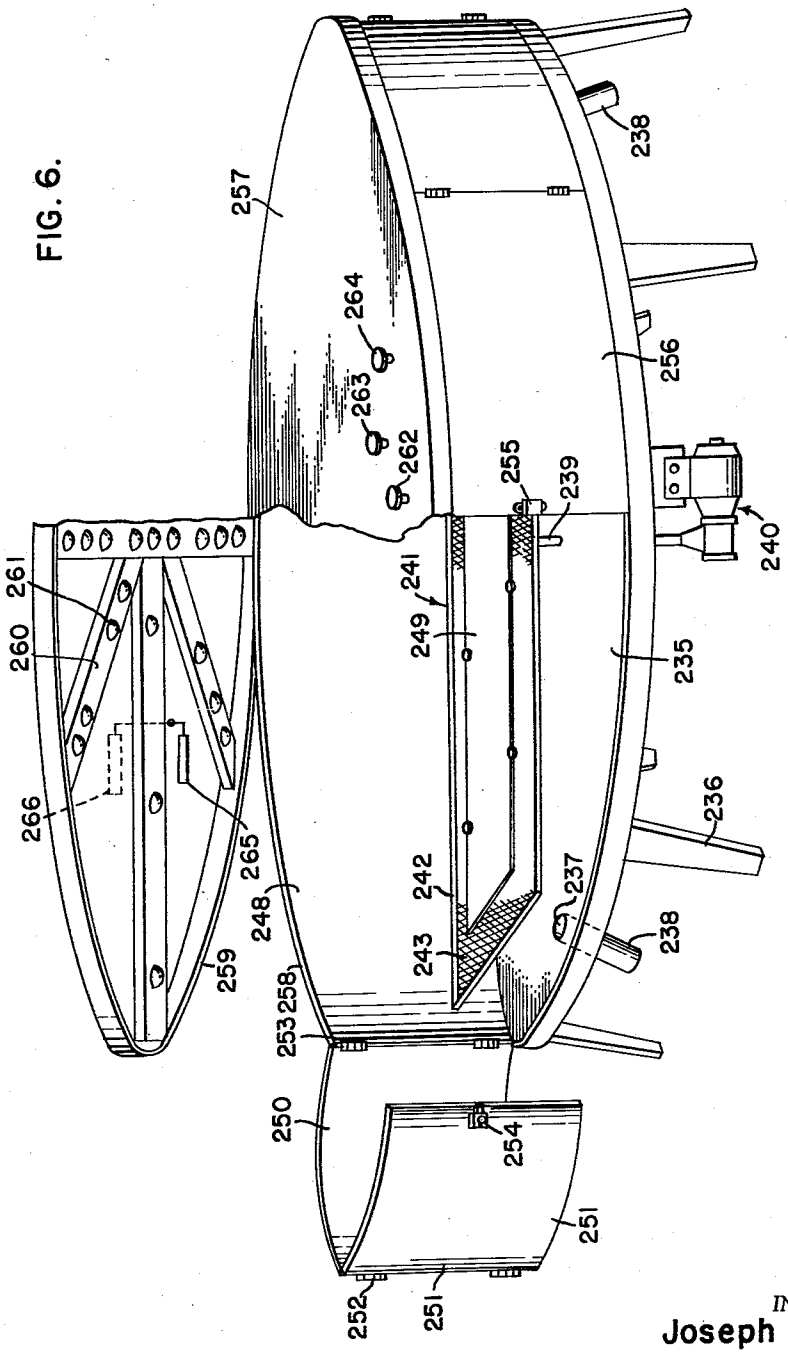
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METHOD AND APPARATUS FOR MAKING PRINTING PLATES

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FIG. 6.



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FIG.7

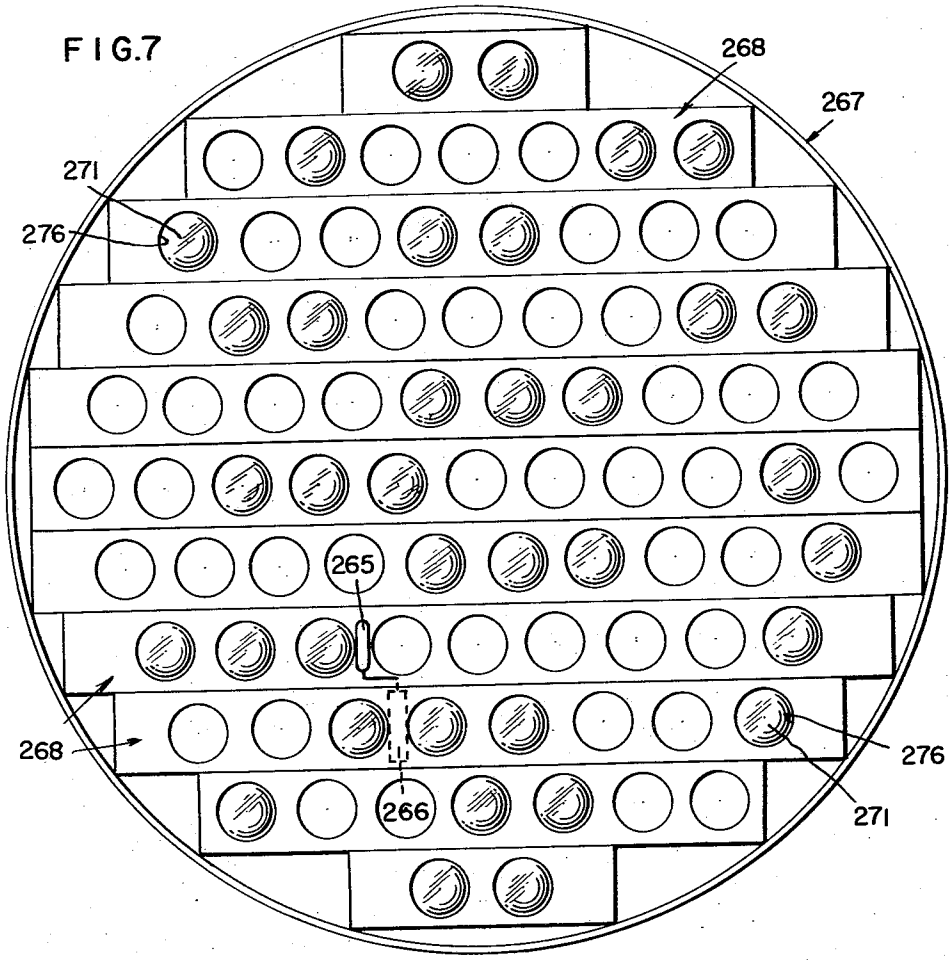


FIG.8

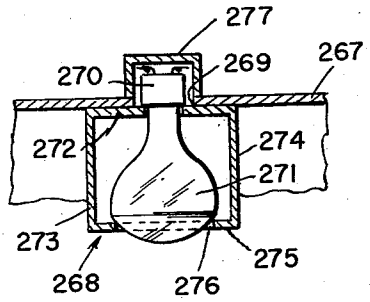
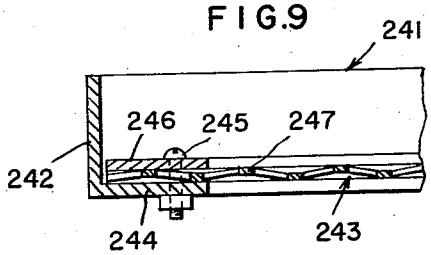


FIG.9



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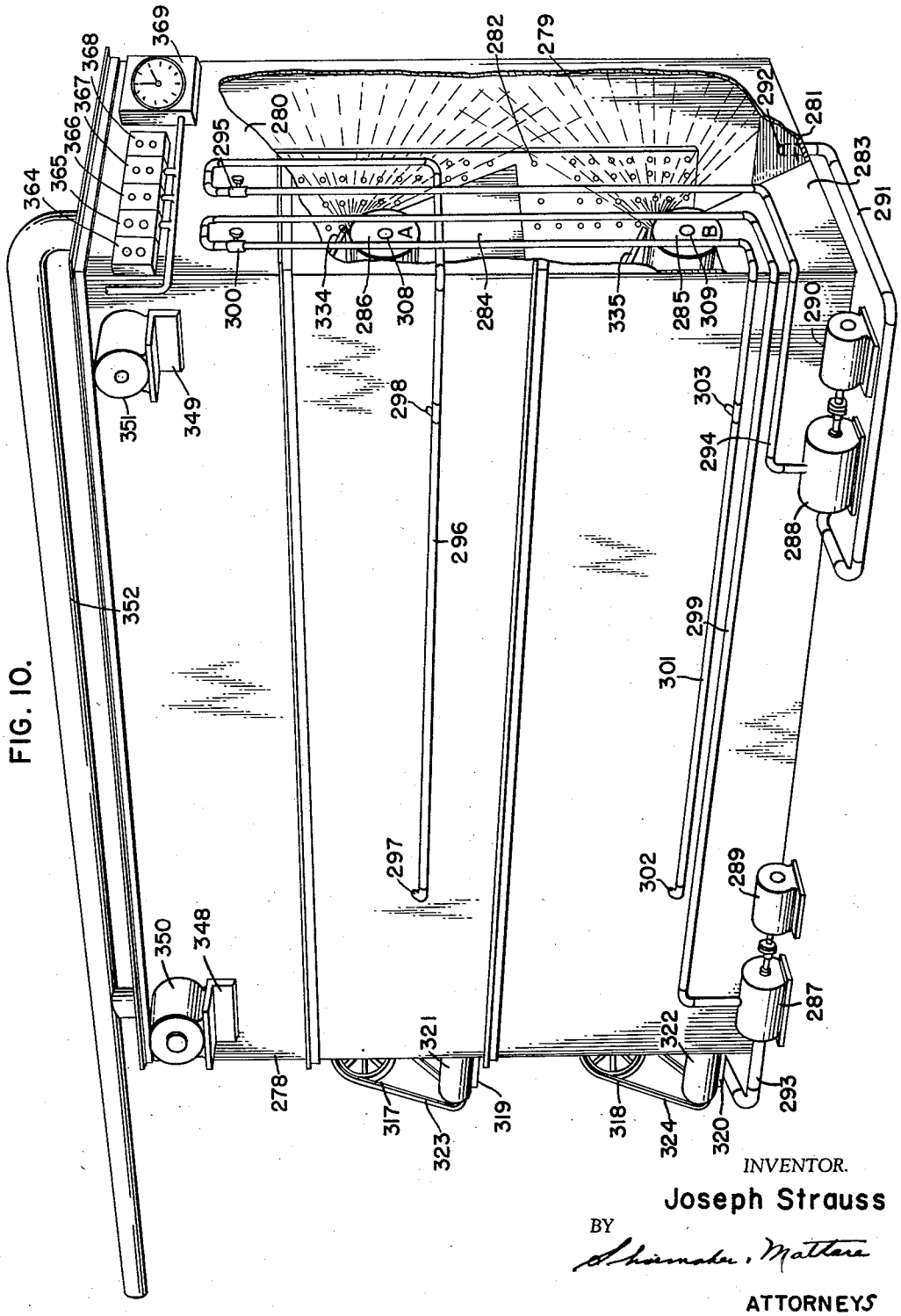


FIG. 10.

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FIG. 11

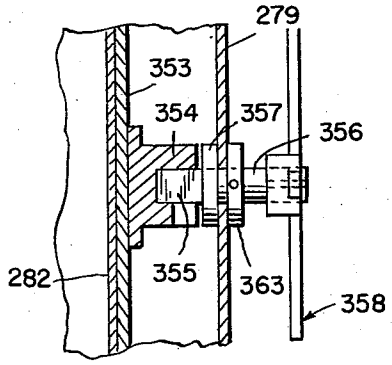


FIG. 12

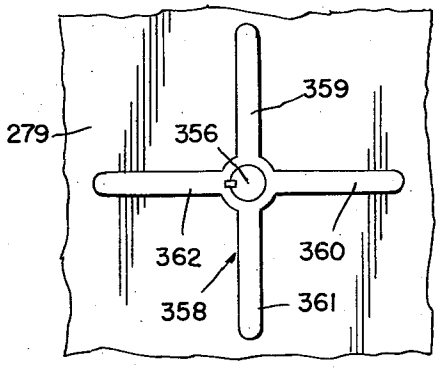


FIG. 13

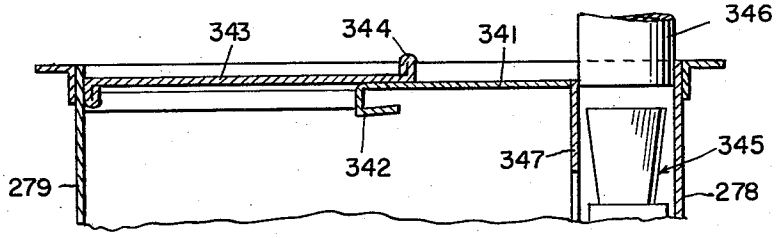


FIG. 14

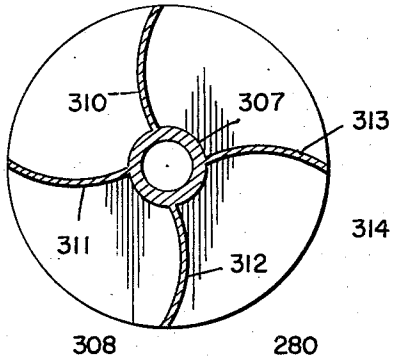
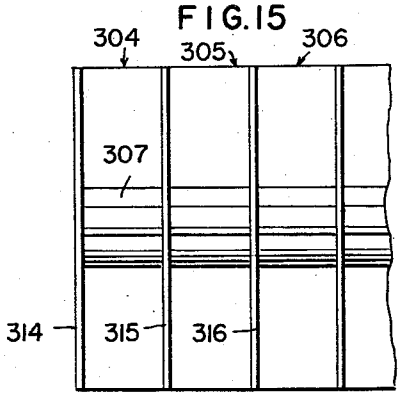


FIG. 15



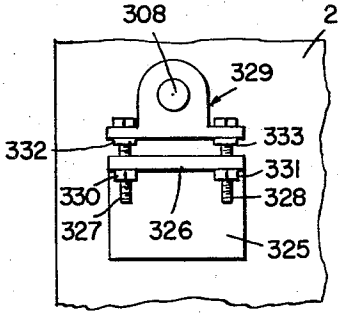
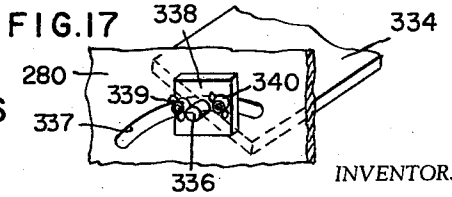


FIG. 16

FIG. 17



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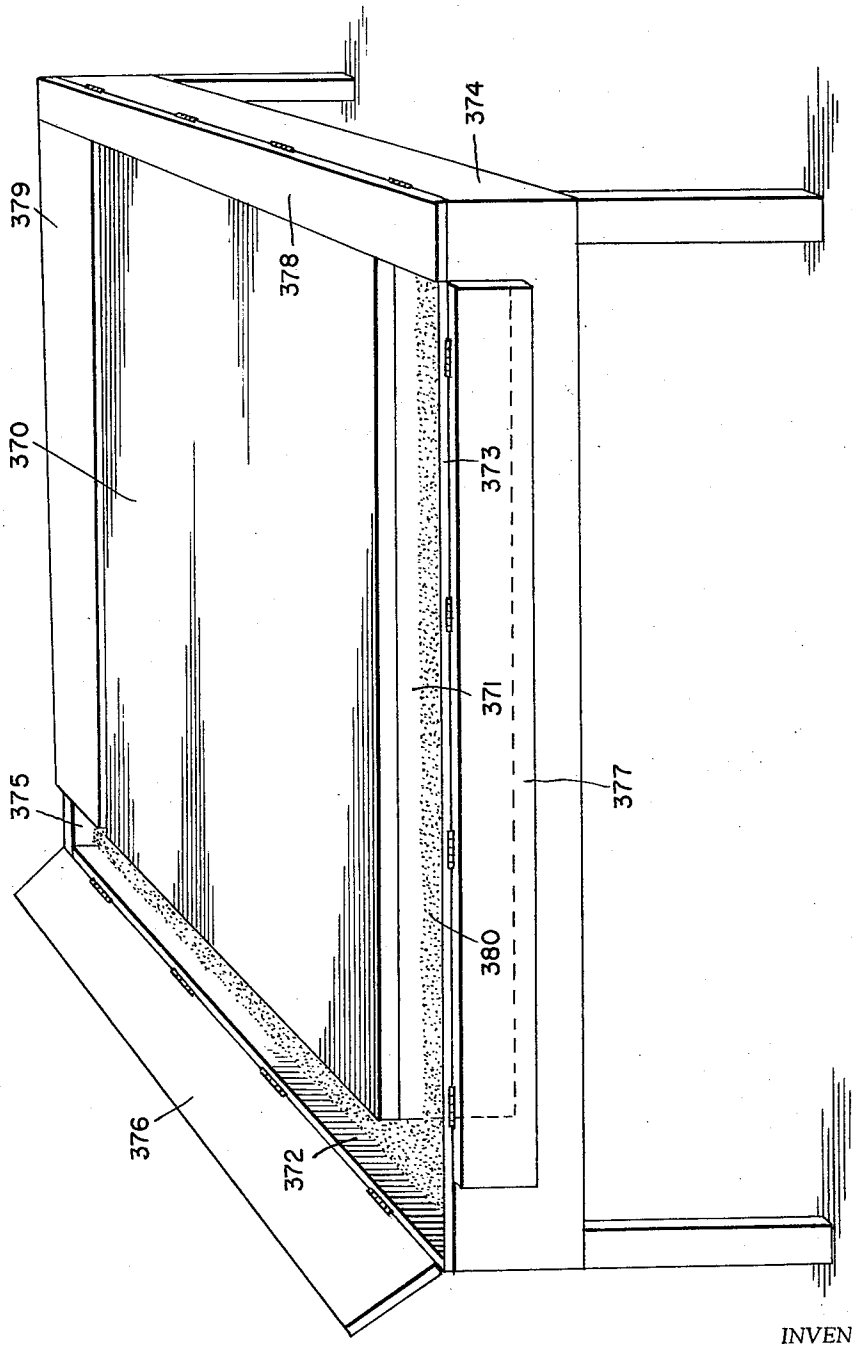


FIG. 18

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July 10, 1962 J. STRAUSS 3,043,693

METHOD AND APPARATUS FOR MAKING PRINTING PLATES

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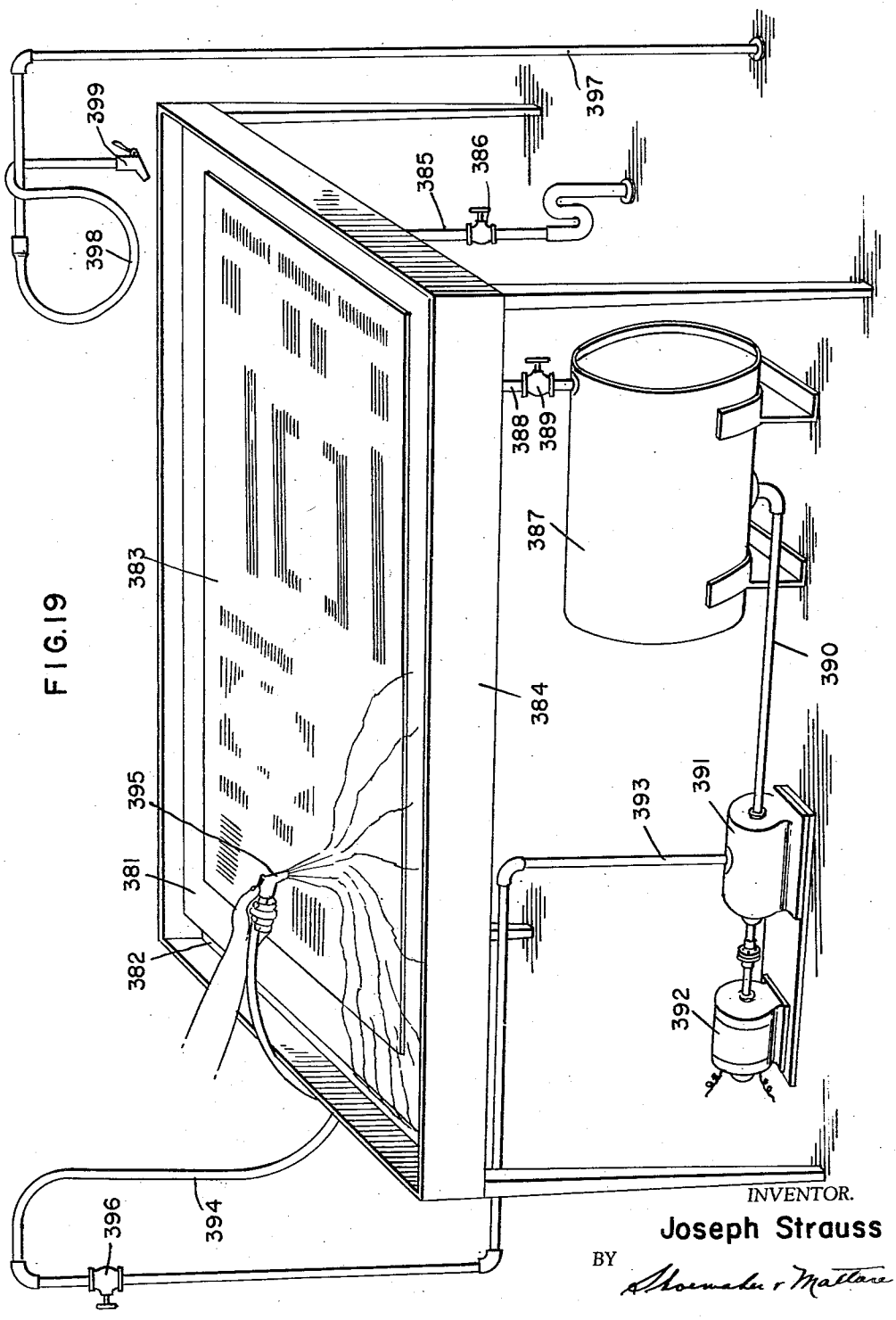


FIG.19

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United States Patent Office 3,043,693 Patented July 10, 1962

3,043,693

METHOD AND APPARATUS FOR MAKING PRINTING PLATES

Joseph Strauss, Hopewell, N.J., assignor to Trenton Times Corporation, Trenton, N.J., a corporation of Delaware

Filed Feb. 6, 1957, Ser. No. 638,509
6 Claims. (Cl. 96—36)

This invention relates in general to improvements in the use of magnesium plates in the graphic arts and more particularly has to do with a more economical, uniform and rapid method for producing ornamentations or the like in magnesium plates, such as in the production of printing plates.

The use of magnesium plates in the graphic arts and more specifically in photoengraving work is a relatively recent development. The main reason why magnesium plates are desirable in the graphic arts is that magnesium is much tougher and stronger than the conventional zinc plates commonly used and among other things, lends itself much more readily to laying up on cylinders due to its resistance to stretch which has, of course, been a primary detriment particularly in regard to zinc plates. It is possible, by using magnesium printing plates, to employ very large plates on large press cylinders while at the same time obtaining a very good contact at all points between the plate and the cylinder without producing bulges, buckles or the like. That is to say, the magnesium hugs the cylinders very well. Likewise, magnesium lends itself readily to use on small diameter cylinders without any detrimental effects as are usually encountered with zinc plates.

Presently, there are four grades of magnesium plate available, for example as supplied by the Dow Chemical Corporation. Of these grades, it is desirable, for the purpose of practicing this invention, to use the most economical grade, usually identified as FS1–0, annealed grade magnesium plate. This particular grade of plate possesses not only the requisite mechanical properties which lend it readily for adaptation for the purposes intended but it also is characterized by being of low cost inasmuch as no special or peculiar treatments are followed in its manufacture. A special grade of magnesium plate has been developed particularly for photoengraving work. However, this special grade, although it embodies many desirable features, is also characterized by certain other undesirable features. Of these, perhaps the most objectionable is the tendency of the special plate to corrode rapidly even in the presence of air and more particularly it corrodes very rapidly when contacted by ordinary tap water. This is due primarily to the design of this special metal plate wherein it is enabled to be etched very rapidly so as to attain maximum etching depth in the shortest possible period of time. Another specific objectionable feature of this special metal plate is its brittleness and because of this, it is not uncommon for printing plates made from the special photoengravers' alloy to break during use. In fact, it is not at all uncommon for minute portions of the plate to break away during the printing operation, especially where fine work is involved, with consequent loss of definition.

Furthermore, the special alloy plate for photoengravers' work is relatively expensive due in part to the necessity of specially protecting this plate from corrosion during shipping and storage. In this respect, the special photoengravers' alloy magnesium plate is provided with a plastic protective film by the manufacturer.

Consequently, it is preferable to use the annealed grade of magnesium plate, although it is to be understood that this invention is not limited to use of the same. The annealed grade possesses sufficient toughness without being brittle and at the same time is easily enough deformed

so as to permit a finished printing plate to accurately hug the cylinder. Also, the annealed grade is considerably less expensive than the special photoengravers' alloy grade, representing approximately one-fourth of the cost of the latter.

However, even though the benefits which can be derived from magnesium plate has long been recognized, its use has not become widespread primarily because it is exceedingly difficult to apply the usual resist image material. That is to say, the use of cold-top enamel has not, insofar as it is known, been successfully used on magnesium plates for the purpose of commercially producing the same. Hot-top material can be used rather successfully particularly on smaller plates. However, since the application of hot-top material requires a relatively high drying temperature, it can be used only on relatively thick and small plates and cannot be used successfully on thin plates and more particularly to thin plates having a large area since the heat required to bake the hot-top material will buckle and distort the thinner plates to such an extent that the hot-top coating is not uniformly distributed over the surface of the plate and, consequently, when the image is applied and developed, it will not possess good characteristics as far as definition, etc., are concerned.

Therefore, at least in theory, the cold-top material would be much more desirable for use on magnesium plates since cold-top material requires only a relatively low temperature for drying and the heat necessary will not cause buckling or distortion even of very thin or very large plates. However, it has been found to be impractical to utilize cold-top material with magnesium plates primarily for the reason that the cold-top material does not properly adhere to the magnesium metal and the resultant film of resist image material is of rather poor quality.

The above defects with regard to magnesium plate are well recognized in the art and numerous attempts have been made to overcome the difficulties involved. For example, in Patents 2,704,512 and 2,768,076, the difficulty of applying a resist image material to the magnesium itself has been overcome by utilizing a printing plate having a base portion of magnesium or magnesium alloy so that the resultant plate attains substantially all the beneficial characteristics of magnesium, while at the same time employing a thin skin or surface coating of zinc so that the resist image material may be easily applied and thus retaining this desirable characteristic of zinc. However, such bimetallic plates are necessarily of considerable expense since their manufacture requires special techniques to produce good results and from a commercial standpoint, it would be much more desirable to use a homogeneous metal plate.

It is, therefore, of primary concern in connection with this invention to provide a method by which a magnesium or magnesium alloy plate can be utilized for photoengraving work and means by which the conventional cold-top material or enamel can be applied successfully directly to the magnesium.

It is another object of this invention to apply cold-top enamel to magnesium plates in particular and to incorporate therewith a superimposed ink top on the image whereby the ink top and the underlying cold-top cooperate to provide the acid resistant image coating.

Still another object of this invention is to provide a method of the character described wherein much of the skill heretofore necessary in photoengraving processes is substantially obviated as a direct result of the novel steps of the method. In this respect, it is of primary concern to do away as much as possible with the skill required in powdering the image as is conventionally done with etching powders such as "dragon's blood" or synthetic

etching powder. In the present method, the powdering operations require a minimum of skill and yet produce the proper results.

A further object of this invention is to provide a method, as above outlined, in which the actual etching may be carried to much further depths without the necessity of a great number of intermediate powdering operations, due to the incorporation of the ink top over the resist image, the ink serving to slightly enlarge the resist image in all directions so that a slight amount of undercutting is permissible without destroying or altering the image itself and thus enabling the etching to progress deeper without necessitating an intermediate powdering operation.

In the drawings:

FIG. 1 is a top plan view of the coating table assembly;

FIG. 2 is a vertical section taken through the assembly shown in FIG. 1 showing details of construction;

FIG. 3 is an enlarged view taken along the plane of section line 3—3 in FIG. 2 and showing details of the central portion of the support plate assembly;

FIG. 4 is an enlarged sectional view taken along the plane of section line 4—4 in FIG. 2;

FIG. 5 is an enlarged sectional view showing one corner portion of the support plate assembly;

FIG. 6 is a perspective view of the drying oven with a portion of the top broken away and elevated to more clearly illustrate details of internal construction;

FIG. 7 is a plan view of the heating element system embodied in the burning-in oven top;

FIG. 8 is an enlarged sectional view illustrating details of the oven heating elements;

FIG. 9 is an enlarged sectional view showing a portion of the supporting bed for the burning-in oven;

FIG. 10 is a perspective view of the etching machine with portions thereof being broken away to illustrate the principle of operation;

FIG. 11 is an enlarged sectional view illustrating the plate rotating means embodied in the etching machine;

FIG. 12 is a front elevational view of the assembly shown in FIG. 11;

FIG. 13 is a transverse sectional view through the etching machine illustrating the cover construction and details of the exhaust ducting system;

FIG. 14 is a transverse sectional view taken through one of the paddle assemblies;

FIG. 15 is an elevational view showing an end portion of one of the paddle assemblies;

FIG. 16 is an elevational view illustrating the mounting assembly of one of the paddle shafts;

FIG. 17 is a partial perspective view of an end portion of one of the deflecting boards and illustrating adjustable mounting means associated therewith;

FIG. 18 is a perspective view of the dusting table;

FIG. 19 is a perspective view of the re-etching and scumming table.

Before specifically describing the structure by which the particular method embodied in this invention is carried out, the broader aspects of the method will now be described.

In performing the novel method, it is preferred that the magnesium plate be initially treated in such a manner as to permit its storage for long periods of time without the detrimental effects of oxidation as is usually encountered. For this purpose, the metal as it arrives from the mill, is cleaned on both sides with suitable solvent to remove the oil normally used to protect the metal surface, and thereafter the rougher face or side of the sheets are coated with back-coating enamel, as is the usual practice. Preferably a medium strength alkali solution is used to remove the last vestige of grease from the plates before the back-coating enamel is applied. For this purpose, four ounces of caustic soda in one gallon of water is suitable. It is also preferred that the rougher surface be swabbed with alcohol soaked cotton immediately prior to applying the back-coating enamel. After the enamel has been applied, it is allowed to stand for a sufficient length of time, say approximately one hour, and it is then baked for 15 minutes at 350° F. or thereabout. Of course, the backcoating enamel is applied conventionally and as is directed by the manufacturer of the particular enamel and the back coating, as such, forms no part of this invention.

The smooth surface of the metal plate to which the image will ultimately be applied, is then cleaned by scrubbing it with a pumice paste consisting of a mixture of pumice and dilute ammonium bichromate. The ammonium bichromate preferably consists of approximately 2½ ounces of ammonium bichromate dissolved in one gallon of water. The smooth surface of the plate is scrubbed vigorously either with a hand brush or power driven rotary brush and the pumice-bichromate paste serves to remove the metal scale which has been deposited on the plate when rolled at the mill. When the surface is reasonably clean, it is rinsed with a suitable quantity of water and preferably then placed in an etching machine to lightly etch the surface thereof for approximately 5 seconds, and thereafter removed from the machine and rinsed well with plain water. It is preferred to repeat the bichromate-water-pumice scrubbing action again and to follow this with another rinse with plain water. At this point, the smooth surface of the magnesium plate is swabbed with the previously mentioned alkali solution. The alkali solution serves to protect the surface of the magnesium from oxidation and it has been found that it is in fact sufficient to prevent oxidation for indefinite periods of time. After swabbing with the alkali, the plate is rinsed and preferably placed in a whirler and sprayed with water while whirling and then dried. The smooth face of the sheet may then be covered with paper to prevent damage and stored in a dry place.

The above process for preparing the metal sheets serves to hold the thickness of the metal substantially uniform and with very little tolerance throughout the area thereof which is, of course, extremely beneficial in achieving a good quality printing plate.

The magnesium plate as prepared in the described manner, is now ready for receiving a coating of resist material and in this respect any conventional cold-top, shellac base enamel can be used, although it is preferred to add approximately 15 drops of ammonium hydroxide, 26° USP, with each gallon of the cold-top enamel used, whereafter the solution is filtered into another bottle to assure an even flow during the subsequent whirling operation. Immediately prior to applying the resist coating, it is preferred that the surface of the magnesium plate be scrubbed with the pumice and bichromate water paste mentioned above and then rinsed. The plate is then swabbed with the ammonium bichromate water, since this serves as a sealing medium to seal hydrogen bubbles which might form from the action of chlorine in the water used acting upon the magnesium metal. The plate may then be placed in a whirler and spun at about 80 r.p.m. and while whirling, sprayed with water for approximately 15 seconds to assure that all of the ammonium bichromate water has been removed and the whirling continued to whirl off the rinse water.

The cold-top enamel solution above mentioned is now applied in any conventional manner to the surface of the plate and when a uniform distribution or coating of the enamel has been achieved, the enamel is dried, but with less heat than is normally utilized in drying such enamels. For example, it has been found that the final drying of the cold-top enamel by placing the plate in a whirler having a heat control set at approximately 95° F. produces very good results and under no circumstances should too much heat be used in drying the cold-top enamel since this has a tendency to bake the enamel. It is extremely important that the drying of the enamel take place under such conditions as described above so

as to prevent its baking and permit it only to dry, whereby it is still slightly soft. This permits the hereinafter described ink top to be applied to the enamel and if the enamel is baked, or if under any circumstances too much heat is applied during the plating with the cold-top enamel, the ink top will, at best, be applied only with great difficulty.

With the plate now prepared with the cold-top enamel, any conventional method of printing is utilized as, for example, with a Lanstron-Monotype Step and Repeat Machine with a single arc lamp, or any other conventional printing machine. After printing, the plate is developed, but in the developing process it is important to prevent undue hardening of the image top and for this purpose, it is preferred not to use the commercial developers but to use substantially pure commercial alcohol having a suitable amount of dye dissolved therein. By utilizing the commercial alcohol the image top is maintained substantially as soft as it was originally applied, due to the fact that it was dried rather than baked on the plate. It is preferred that the temperature of the developing solution be maintained between 70° and 80° F.

At this point, with the resist image developed, the image is provided with a superimposed ink top. First of all, however, the plate is placed in a sink and rinsed vigorously with a stream of water to remove all resist material from the unexposed areas and a final scumming step is then performed by lightly scumming the plate with web cotton, no pressure being used except the weight of the cotton itself. The plate is then dried at a temperature of approximately 98° but not appreciably greater than this temperature and when dried, the plate is removed for superimposing the ink top.

For the purpose of applying the ink top, two separate solutions are utilized, one of which is a gum arabic solution, commercially prepared, and the other is a mixture of approximately 1 pint of gum arabic solution, commerically prepared, to which is added ½ pint of conventional type fountain solution and ⅛ ounce of nitric acid, 42° Baumé. The latter solution is utilized initially by applying it locally and gently rubbing the surface of the plate with means such as a bristle carpet or any suitable means having fine and closely spaced agitating fingers or projections. The reaction of the fine bristles and the weak acid in the gum arabic solution will remove the scum on the bare metal surface, particularly between half-tone dotted formations. After a localized area of the plate has been thus scummed, it is rinsed with water and when the entire area is clean, the gum arabic solution may be applied thereto by utilizing a synthetic sponge or the like. Once the gum arabic solution has been applied, the ink top may be superimposed upon the image. This is accomplished by utilizing cotton upon which is daubed a quantity of ink such as roll up or litho ink. Roll up or litho ink may be generically termed etching ink and as used herein, etching ink is intended to include these types of ink. Etching ink has good acid resistant characteristics and accordingly provides a more acid resistant image. The ink is then applied gently with the cotton and the image rubbed until it picks up a coating of ink. The action of the gum arabic solution will cause the bare metal to repel the ink, whereas the image is free to pick it up. At the beginning of the ink application, it will usually be found that the ink will slide off the image and will then slowly deposit a certain amount until at last there is a suitable coating of ink on the image, leaving the bare metal completely or substantially completely free of the ink. Any ink which may have accumulated on the bare metal surface can easily be removed by reapplying some of the gum arabic solution, although this solution will not remove the ink from the image. Preferably, the image material is developed in an alcohol in which there is a certain amount of colored dye, preferably purple and the ink used is preferably a darker color such as black so that when the ink is being applied to the resist image, its presence is easily detected by a change of color in the image from purple to black.

When the entire plate has been provided with the superimposed ink top, it is rinsed with water and dried.

The plate may now be used directly for the purpose of wet offset printing, in which case the last mentioned rinsing operation of the plate is followed by an application of gum arabic solution and then the plate is dried and it can now be placed directly on the press to be washed off and cleaned by the regular wet offset process.

If the plate is to be used for dry offset printing, the ink top is gently dusted with either white topping powder or Dragon's Blood or etching powder and the bare metal surfaces are cleaned up with a brush to remove from such surfaces any deposit of the powder. After the dusting and cleaning operations, the plate is placed in a burning-in oven at 140° F. for 45 minutes to allow the ink to dry.

The purpose of applying the ink top is to provide a more acid resistant image than would be accomplished by the utilization of the cold-top enamel image alone. Furthermore, the superimposed ink top serves the purpose of slightly enlarging and spreading the image, whether it be type, half-tone dotted formations or otherwise and the final application of the etching powder and subsequent drying of the ink serves to hold the slightly enlarged area as provided by the superimposed ink top. By this means, a deeper etching may be permitted without destroying the original image definition. That is to say, a slight amount of undercutting is permissible because of the enlargement as provided for by the superimposed ink top and thus the initial etching step may be carried to greater depths than is ordinarily permitted by conventional methods. In the dry offset magnesium plates, the next step is to proceed with the actual etching of the plates and in this respect any conventional procedure may be utilized, although as will hereinafter appear, certain prescribed steps are preferred. As stated before, particularly where the ink top is utilized, the first bite may be made much deeper than normally would be expected without loss of definition or distortion of the image. In some cases, particularly in fine line work, as for example with half tones, the etching need not be carried beyond that which is attained in the first bite. However, where a deeper etching is desired, two or more bites may be taken with intermediate powdering steps, as is conventional.

The above described process exemplifies in a broad sense the principles of the method which is hereinafter described in its preferred and more specific form and in conjunction with apparatus utilized in practicing the preferred form of the method.

Referring now more particularly to FIGS. 1–5 inclusive, wherein a special apparatus for performing the preferred form of the method is shown, the reference character **200** generally designates a special supporting frame which is utilized to hold the magnesium plate after the same has been properly cleaned and prepared. This frame is removable from the basin assembly shown most clearly in FIGS. 1 and 2, in a manner hereinafter described, and consists essentially of a main body portion in the form of a plate **201** which is provided with uniformly spaced perforations or holes **202** throughout and which are preferably closely spaced so as to render the plate as light weight as possible. In this respect also, the plate **201** is preferably made of some light weight material, such as aluminum or the like. The magnesium plate **203** is fastened to the support plate by a number of suitable screw fasteners **204** which are projected through the holes **202** and serve to hold the magnesium plate firmly in place on the support plate.

The support plate is provided on its undersurface with a hub **205** and radiating outwardly from this hub to the four corners of the support plate are the rigidifying ribs **206**, **207**, **208** and **209**. As shown most clearly in FIG. 3, these ribs may be of conventional angle type,

although, of course, any suitable shape may be chosen. The main plate portion **201**, hub **205** and ribs **206—209** are all rigidly connected together and preferably are formed of light-weight material.

The hub **205** is provided with a bore **210** of non-circular cross section which, in the particular example shown, is square and receives a square stub shaft **211** which forms part of a universal joint assembly indicated generally by the reference character **212**. The hub is also provided with a notch **213**, see FIGS. 3 and 4, the side walls **214** and **215** of which flare outwardly from the bore **210**. The notch, as can be seen most clearly in FIG. 4, is not as deep as the bore **210** so that when the support plate assembly is engaged upon the universal joint stub shaft **211**, the upper end of such shaft will be firmly seated within that square socket portion defined by the bore **211** above the notch **213** and the two parts, by virtue of the weight of support assemblies **200** and the magnesium plate **203** will, in effect, be locked upon the universal stub shaft.

The purpose of the notch **213** is to permit the support plate assembly to be easily engaged with the universal joint stub shaft since the divergent walls **214** and **215** of the notch will serve as a guide for the upper end of shaft **211** as the support plate assembly is moved horizontally into engagement therewith until the parts are aligned so that the support assembly will drop down as the blind socket portion in the hub aligns with and receives the upper end of the stub shaft **211**.

The universal joint itself may take any desired form such as that shown specifically in FIG. 4, wherein the shaft **211** has a ball **216** formed integrally at its lower end which is received in a socket **217** fixed to the upper end of a support post **218**. By means of this construction, the base portion of the assembly, together with the support plate assembly, forms a universally tiltable table which is advantageously used for applying the cold-top enamel to the magnesium plate.

The basin **219** includes a conical bottom wall **220** and a cylindrical side wall **221** supported by suitable legs **222** with the center of the bottom being provided with a drain opening defined by the depending nipple **223** with which drain pipe **224** is connected. A dome-like base **225** is secured over the drain opening and is provided with a suitable number of drain openings **226**, as shown in FIG. 3 and the previously mentioned support post **218** is rigid with the base **225** and rises vertically therefrom in the center of the basin as is shown.

Secured on the inner side of and along the upper edge of side wall **221** is a pipe ring **227** having a series of openings **228** formed therein which are directed downwardly as shown and this ring is connected, through a valve **229**, to a water supply pipe **230** so that when the valve **229** is opened, the openings **228** will direct convergent streams of water toward drain **224** forming a sheet-like flood of water along the bottom wall **220** to effect a continuous rinsing action.

The water supply pipe **230** preferably extends upwardly above the level of the universal joint **212** and, through valve **231**, connects with a flexible hose **232** having a nozzle **233** attached to its end. Preferably, nozzle **233** is of the valved type having a control lever **234** controlling the same.

FIG. 6 illustrates the construction of a special drying oven utilized in practicing the novel method for preparing magnesium plates. In this figure, the drying oven will be seen to include a generally flat bottom wall **235** supported by a suitable number of legs **236** and having one or more drain openings **237** therein having drain pipes **238** issuing therefrom for a purpose which will be presently apparent. Projecting upwardly through the center of the bottom wall **235** is a drive shaft **239** driven by a suitable gear box and motor assembly indicated generally by the reference character **240** located beneath the bottom wall **235**. The upper end of the drive shaft **239** is of non-circular configuration, preferably square, and is engageable with a notched boss similar to that described in connection with FIG. 4 for the support plate assembly, and rigid with the support assembly indicated by the reference character **241**. The support assembly **241** is similar to the support plate assembly **200** previously described, at least the general principle is the same, although the support assembly **241** embodies a rigid bordering frame **242** with its main body portion being formed of suitable mesh-like material **243** which preferably is constructed of stainless steel and is of the type which is conventionally referred to as "expanded metal."

The construction of this expanded metal and the rigid bordering frame is shown more clearly in FIG. 9 wherein an enlarged cross section through a corner portion of the support assembly **241** is illustrated. In this figure, it will be seen that the bordering frame **241** is preferably of angle configuration with the lower horizontal leg **244** thereof serving to edge support the expanded metal **243**. This leg portion **244** is provided with a series of openings to receive fasteners **245** which serve to clamp the edge portions of the expanded metal **243** between the previously mentioned leg **244** and the overlying strip **246** as shown. The expanded metal has the advantage of providing relatively widely spaced supporting points **247** which are relatively widely spaced and contact very little surface area of the supported magnesium plate. By this construction, there is less likelihood of distortion or buckling of the magnesium plate when the same is subjected to heat within the drying oven since the plate will be uniformly heated rather than being subjected to a non-uniform heating effect as would be occasioned where large surface area portions of the plate contact with the metal of the support assembly **241**, causing a great deal of heat to be transferred from the plate to the support assembly in those portions in which the two are in contact. This excessive heat transfer is largely obviated by the use of the expanded metal construction since a very small percentage of the surface of the magnesium plate is actually in contact with the expanded metal body.

Referring back to FIG. 6, the burning-in oven is provided with a fixed back wall **248** which is upstanding from the bottom wall **235** and rigidly affixed thereto. Preferably, the back wall **248** extends throughout less than half the total circumference of the bottom wall **235** to permit free and ready access to the interior of the burning-in oven and to permit the support assembly **241** and its boss to be easily engaged with the drive shaft **239**.

The front portion of the side wall of the oven is constructed so as to form a plurality of hinged door members which will enable the entire front portion of the oven to be opened to allow the support assembly **241** and the associated plate **249** to be placed in the interior of the oven. Preferably, each door is of the same length and is divided into two portions hingedly connected together as is indicated by the reference characters **250** and **251** in FIG. 6, the point of pivotal connection between these sections being indicated by the hinges **252**. The rear edge of the section **250** is hinged to the leading edge of the back wall portion **248** by means of hinges **253** and the free edge of the front section **251** is provided with a suitable latch assembly **254** which cooperates with the latch assembly **255** on the section **256** of the other door assembly so that the two may be joined and held in closed position.

The oven also includes a rigid top member **257** which is fixed to the upper edge **258** of the back wall **248**, although in FIG. 6 a portion of the top has been shown broken away from the remainder and lifted up to illustrate details of the heating element construction. It is to be understood that in actual practice the top will be at all times rigid with the back wall **248** and in that

position shown in the right hand portion of FIG. 6. The reason for this is that the drying oven is particularly useful in drying the resist image and by providing a fixed top and inserting the support assembly **241** in the associated plate **249** horizontally through the front of the assembly, the presence of dust is largely eliminated and there is little chance for foreign material and dust to accumulate on the still soft cold-top enamel. In conventional constructions of this type, the lid or top is hinged so as to swing up to permit the plate to be placed inside the oven and then the lid is swung down to close the oven. This type of conventional construction is prone to admit a great deal of foreign material into the interior of the oven and actually the act of closing the cover tends to forcibly project foreign material onto the cold-top enamel surface.

The top **257** is preferably provided with a rigidifying, circumferential, depending rib **259**, the lower edge of which is fixed to the previously mentioned upper edge **258** of the back wall **248** and fixed to the undersurface of the top **257** are a series of heating units such as that indicated by the reference character **260**. For the purpose of heating the burning-in oven, it is preferred that the arrangement of heating units **260** be substantially as is shown in FIG. 6 wherein the elements **261** designate heating bulbs or lamps.

The particular arrangement of the heating units **260** and the number of heating elements **261** embodied therein is, of course, determined by the amount of heat required to properly dry the cold top on the plates, while at the same time maintain the temperature at such a point as not to bake the enamel or dry it beyond the point which will permit it to readily take on the ink top when the latter is applied. Operating in conjunction with the particular number and arrangement of heating units, are certain control elements designated by the reference characters **262**, **263** and **264** which are preferably, as shown, mounted on the top of the oven assembly so as to be readily accessible. These control elements include a starting or off and on switch **262**, a temperature control **263** and a r.p.m. control **264**. The temperature control element **263** is connected with the heating units and controls the amount of energy applied thereto, whereas the r.p.m. control **264** is similarly connected to the motor and gear box assembly **240** for controlling the same. Also operating in connection with the heating units is a thermostatic control mechanism including a bulb **265** mounted in a suitable manner on the undersurface of the top **257** and a control switch **266** preferably mounted on the upper face of the top **257**. The purpose of the thermostatic control is to shut off the heating units should a prescribed temperature be reached.

All of these control elements operate cumulatively to produce the desired results. That is, the r.p.m. in conjunction with the heat control operates to produce an even and uniform drying action on the plate **249** and the cold-top solution applied thereto. For this purpose, it is preferred that the r.p.m. control be set to rotate the plate initially at about 90 to 95 r.p.m. for 30 seconds with the heat control set at approximately 95° F. The r.p.m. control is then adjusted to approximately 70 r.p.m. for 1 minute, then reduced to about 30 r.p.m. for 2 minutes and finally to about 6 to 8 r.p.m. for not less than 15 minutes. This specific method is preferred inasmuch as it produces a uniformly and properly dried top.

Referring now more particularly to FIG. 7, a modified form of top assembly is shown which is to be utilized in conjunction with burning-in operations, that is, for fusing the etching powder when necessary. In this case, the top, which is indicated generally by the reference character **267** and which is constructed identically with that described in connection with FIG. 6, is provided with a far greater number of heating units **268** than the assembly shown and described in connection with FIG. 6. The reason, of course, is that for the burning-in operations, a much greater amount of heat is required to produce the proper results, although the principle of operation remains the same. Each of the heating units **268** as well as those previously mentioned and indicated by the reference character **260** are formed in a manner shown most clearly in FIG. 8 wherein the top **267** will be seen to be provided with slots **269** through which socket members **270** project for receiving the bulbs **271**. Each of the heating units **268** includes a base portion **272** affixed to the undersurface of the top and a removable cover portion formed of the two side walls **273** and **274** and the associated bottom wall member **275** which is provided with circular openings **276** through which the lower portions of the individual bulbs **271** project. The sockets **270** are carried by the base portion **272** and the sockets themselves are provided with a covering member **277** which is preferred to be of the removable type for ease of servicing.

The etching machine is shown most clearly in FIG. 10 and is constructed of generally rectangular form and is provided with a vertical rear wall **278** and a front wall **279** spaced therefrom with side walls **280** interconnecting the front and rear walls as well as a bottom wall **281** so as to form an enclosure within which the plate **282** is disposed during the etching process. On the inside of the tank and along the bottom thereof is provided an open top trough **283** and a similar trough **284** is disposed in spaced parallelism thereto as is shown most clearly in FIG. 10. Each of these troughs extends completely in between the side walls of the machine and associated with each of these troughs is a paddle assembly, the ends of which are shown in FIG. 10 and designated by the reference characters **285** and **286**.

Each paddle assembly incorporates a plurality of splashing blades which dip into a supply of etching solution received in the respective tanks **283** and **284** and when rotated, splash or spray the etching solution forwardly to distribute it more or less evenly against the face of the plate **282** disposed within the machine. The tanks **283** and **284** are connected directly to the rear wall **278** of the machine and the paddle assemblies **285** and **286** are journalled in the side walls **280**, as will be more fully described hereinafter. With the particular arrangement shown, there are actually three supplies of etching fluid within the interior of the machine. The first supply, which is actually a reservoir, is contained in the bottom portion of the machine forwardly of the lower trough assembly **283** and the level of such supply will, at no time, exceed the height of the trough **283** so that there is no communication therebetween. The other two supplies are contained within the troughs **283** and **284** and a pumping system is employed to distribute the etching fluid from the first mentioned reservoir supply to the two troughs **283** and **284** and this forms an important part of the etching machine assembly inasmuch as it effects a continuous agitation and mixing of the etching fluid so that the tendency for concentrations of spent or weak etching fluid are not apt to occur.

The pumping system embodies one or more pumps such as those indicated by the reference characters **287** and **288**, each having a driving means such as the electric motors **289** and **290**. The inlet of each pump is so connected as to pick up the etching fluid from the bottom of the main reservoir or supply chamber within the etching machine, as for example, by means of the inlet pipe **291** shown connected to the pump **288** and being dipped into the etching machine through the opening **292** in the bottom wall **281**. The other pump **287** is provided with a similar inlet pipe **293**. The outlet of each pump is connected through a valve mechanism suitably accessible to the operator and discharges into one or the other or both of the troughs **283** and **284**. For example, the pump **288** is provided with the outlet line **294** which preferably extends up along the side wall **280** to a valve **295**

and thence connects with a horizontally disposed distribution line 296 having connections 297 and 298 discharging through the back wall 278 and into the uppermost trough 284, whereas the other pump 287 is provided with a similar discharge or outlet line 299 leading to the valve 300 and thence to the distribution line 301 having the outlet connections 302 and 303 discharging into the lower trough 283.

In etching machines of the general character herein described, it is conventional practice to raise and lower the paddle assemblies 285 and 286 so as to provide a greater or lesser distribution or spray of etching fluid upon the associated plate, the level of etching fluid remaining substantially constant within the reservoir supply beneath or associated with the paddle assembly. However, the present invention contemplates the use of paddle assemblies which, during the normal operation of the machine, are fixed and wherein the pumping system associated therewith in the specific embodiment shown in FIG. 10 and as described above is so controlled as to permit the raising or lowering of the etchant fluid within the troughs 283 and 284 so that the amount of etchant sprayed or distributed by the paddle assemblies is thereby controlled without necessitating any movement of the paddle assemblies themselves.

Furthermore, in the specific embodiment shown, the individual paddles and their troughs with their individual pumping systems permit the individual control of the spray issuing from each paddle assembly. That is, by utilizing a separate pumping system for each paddle assembly, the paddle assemblies may be individually controlled. This is accomplished by means of the valves 295 and 300 which can be manipulated by the operator to preset the flow characteristics in the distribution lines 296 and 301 so as to maintain any desired level of etchant within the troughs 283 and 284, thus individually controlling the spray characteristics delivered by the individual paddle assemblies 285 and 286.

The paddle assemblies themselves are constructed preferably in the manner which is shown most clearly in FIGS. 14 and 15 wherein each will be seen to include a plurality of individual and separate sections 304, 305, 306, etc. Preferably, each of these sections incorporates a centrally disposed hub portion 307 which is hollow so as to receive therethrough a driving axle, 308 or 309 as shown in FIG. 10, and with a plurality of blade members 310, 311, 312 and 313 projecting radially therefrom and in equidistantly spaced circumferential relationship as shown most clearly in FIG. 10. The contour of each of the blades is preferably similar to that shown in FIG. 14 wherein there is only a slight concave curvature of the blades as presented to the etchant during normal rotation of the paddle assembly, the rotation being clockwise in FIG. 14. It is important to note, in connection with the contour of the blades, that there is no sharp angularity of the same as would tend to pocket and trap the etchant as the paddle is rotated, and the curvature is substantially uniform and to such a small degree as to permit the etchant to be thrown from the paddle assemblies in its entirety without any amount of the etchant being retained. This assures a uniform distribution of the etchant as accomplished by the paddle assemblies.

Each of the sections 304, 305, etc. also includes a circular side plate 314 and when all of the sections are mounted upon the associated driving shaft, as is shown in FIG. 15, these side plates, 314, 315, 316, etc. abut adjacent blade assemblies, as shown, so as to form a unitary paddle assembly and it is preferred, in this respect, that the individual blades be disposed in alignment with each other along a length of the paddle assembly as is shown in FIG. 15.

The previously mentioned drive shafts 308 and 309 of the paddle assemblies are journalled at opposite ends in the side walls 280 and at the other end thereof project outwardly from the associated side wall and are provided with means such as the pulleys 317 and 318. For the purpose of driving each of the paddle assemblies, there may be mounted on suitable stands or brackets 319 and 320 driving means such as the electric motors 321 and 322 operating through belts 323 and 324 to impart the necessary rotation to the paddle assemblies 285 and 286.

Referring at this time more particularly to FIG. 16, the manner of mounting the opposite ends of the paddle drive shafts will be seen. On the outer side of the associated side wall 280, there is provided a generally L-shaped bracket member 325 presenting a horizontally disposed outwardly projecting upper shelf portion 326 having a pair of dipped holes receiving therethrough the elevating bolts 327 and 328. The bolts 327 and 328 are connected to a pillow block assembly 329 and are rigidly affixed thereto, such pillow block journalling the associated end of one of the paddle drive shafts, such as the drive shaft 308 as shown. Lock nuts 330 and 331 are associated with the bolts beneath the shelf 326 and when it is desired to make an adjustment of the associated paddle assembly, these lock nuts are backed off as well as the lock nuts 332 and 333 associated with the pillow block assembly and the bolts 327 and 328 are turned to raise or lower the pillow block assembly and, consequently, the associated end of the shaft 308. When the proper adjustment is attained, the lock nuts are, of course, re-tightened to hold the assembly rigid. The purpose of the pillow block adjusting means is to permit the paddle assemblies to be disposed in a direct horizontal position so that they will be uniformly disposed in partial submersions with relation to the etchant solution throughout the lengths of the same so as to cause a uniformity in the spray action imparted thereby across the entire width of the machine. This is necessary, of course, inasmuch as it is easier to adjust the positioning of the paddle assemblies than it is to level the entire etching machine with relation to the paddle assemblies which would otherwise be necessary in order to achieve the proper relationship between the etchant level and the paddle assemblies.

Cooperating with each of the paddle assemblies to provide the desired spray characteristics is a baffle plate, indicated in FIG. 10 by the reference characters 334 and 335, one of such baffle plates being shown in partial detail more clearly in FIG. 17. In the latter figure, the baffle plate 334 will be seen to be provided at its ends with axially projecting journals 336 which project through an arcuated slot 337 in the associated side wall 280 and in turn journalled within a rectangular plate member 338 lying against the outer side of the associated side wall 280. A pair of wing nuts 339 and 340 project through the plate 338 and cooperate therewith and with the arcuate slot 337 to permit the journal end 336 to be located at will at any position within the confines of the slot 337. Since the plate 338 journals the member 336, the baffle plate 334 may be rotated about the longitudinal axis thereof and suitable means, such as a set screw, not shown, or the like, may be utilized to fix the baffle plate 334 in any desired rotated position with relation to the plate 338. By this construction, the angularity of the baffle plates as well as the fore and aft positioning thereof may be adjusted at will to impart the desired characteristics to the spray issuing from the associated paddle assembly.

FIG. 13 illustrates the construction of the upper portion of the etching machine and illustrates the cover structure therefor as well as a portion of the exhaust ducting therefor. In this figure, it will be seen that the machine is provided with a partially enclosing top wall 341 which projects forwardly from the back wall 278 and terminates substantially midway between the front and back walls as shown. Preferably, the inner end of the fixed top wall portion 341 is provided with a rigidifying bead 342 of suitable configuration to impart sufficient rigidity to this portion of the top to support the overlying slidable cover member 343. The cover member 343 when closed,

extends from the inner face of the front wall **279** to a point beyond the inner edge of the fixed top wall portion **341** as shown and is provided thereat preferably with a vertically projecting edge portion **344** serving as a convenient means to grasp the slidable cover and move it backwardly or to the right in FIG. 13 so as to expose the top front portion of the machine to permit the insertion of the magnesium plate and associated support assembly, hereinafter described, into the machine.

For the purpose of exhausting fumes from the interior of the etching machine, the same is provided with one or more exhaust fan structures indicated generally by the reference character **345** in FIG. 13, which are disposed in vertical alignment below outlet portions **346** of an exhaust ducting system. Associated with the fans **345** may be a shroud plate **347** to direct the exhausted fumes toward the central portion of the fan, the fan being preferably of the centrifugal type.

FIG. 10 illustrates the manner in which the fans may be driven and, in this respect, the rear wall **278** of the machine is provided with a pair of brackets **348** and **349** which support electric motors **350** and **351** having drive shaft projecting into the machine and mounting the exhaust fan structure. In this figure also, the exhaust ducting system **352** is more clearly shown.

FIGS. 11 and 12 illustrate the construction of the plate supporting assembly in the manner in which the plate may be manipulated within the machine. In FIG. 11, reference character **353** illustrates a support plate similar in construction with that previously described in connection with FIG. 1 and mounting thereon the printing plate structure **282** in vertically disposed relationship, as shown. The support plate **353** is provided with a notched hub or boss **354** constructed in the manner described in connection with the hub **205** of FIG. 4 having a square socket portion receiving the square end **355** of the support shaft **356** which is journalled in a suitable bearing block **357** fixed to the inner surface of the front wall **279** and having fixed to its outer end a handle mechanism indicated generally by the reference character **358**. Preferably, this handle assembly, as shown in FIG. 12, is provided with four radially projecting spokes **359**, **360**, **361** and **362**, the purpose of which will be presently apparent. Fixed to the shaft **356** on the outer side of the front wall **279** is a stop collar member **363** serving to position the shaft **356** in its innermost position. The purpose of the handle assembly, constructed as shown, is to provide an indexing means for the operator in performing the etching operation. That is to say, each etching operation is done on four sides of the printing plate **282** and the spokes provide a convenient index for the operator to produce a quarter of a turn on the support plate assembly **353** and, consequently, the magnesium printing plate **282** attached thereto so as to alternately etch all four sides of the plate **282**.

As previously described, the operator may control the spray volume by controlling the valves **295** and **300** and, consequently, the amount of etchant supplied to the troughs **283** and **284**, raising or lowering the level therein to increase or diminish the spray volume, as desired. The operator also has access to a series of control switches along the upper side of the machine and as are designated by the reference characters **364**, **365**, **366**, **367** and **368**. These controls are, respectively, for operating the fan, for rotating the lower paddle assembly, for rotating the upper paddle assembly, for operating both paddle assemblies simultaneously, and for energizing the two pumps. In addition to these controls, there is a timer mechanism **369** mounted adjacent the controls and preferably including a sweep second hand. By utilizing the controls and operating them in accordance with a prescribed elapsed time, it is possible to eliminate, to a large extent, the skill required in the etching operation. For example, it has been found that for fine screen images, say from 110 to 175 line screen, each side should be etched for approximately 2½ seconds and then the paddles are turned off, the plate rotated to the next side and a 2½ second etch repeated until all four sides have been done. This produces an etching depth of approximately 0.010 to 0.015 with nitric acid diluted to approximately 9° Baumé. This general procedure is adhered to throughout the etching process, as will hereinafter be more particularly described.

After the first etching bite is made, the plate is removed from the etching machine and placed on a table similar to that shown in FIG. 18. This table is provided with a slate top **370** resting on and co-extensive in area with a plateform or pedestal member **371** disposed in the center of the table assembly and being spaced on all sides from the adjacent side wall portions **372**, **373**, **374** and **375**, thus providing a continuous trough around the slate top, as is clearly shown in FIG. 18. Along the top edge of each of the side walls **372–375** are closure members or flaps **376**, **377**, **378** and **379** which, as shown, are of a width corresponding to the trough width so that the flaps may be selectively swung to open or closed positions to either expose or cover the etching powder **380** which is disposed within the troughs and thus the flaps normally serve to prevent contamination of the etching powder and yet, at once, permit the operator to easily gain access to the etching powder.

When the plate is removed from the etching machine and rinsed with water and dried, it is placed on the slate top **370** and the powdering operation is initiated. For this purpose, it is preferred that the conventional type of powdering brush be used to spread the etching powder over the surface of the plate and then another brush, preferably a 5" fine camel's hair brush, is used to sweep off the powder from the plate into the powder channel or trough. This latter brush should be held tilted at approximately a 15° angle and a slight pressure only used in executing a continuous brushing stroke from one side to the other of the plate and in one direction only to dust the one side of the image. After this operation has been completed on one side of the plate, the plate is lifted from the powdering table shown in FIG. 18 and disposed in the burning-in oven previously described in connection with FIGS. 6 and 7. Preferably, the heating elements of the burning-in oven are energized for 45 seconds while the temperature inside of the oven is controlled by a thermostat at approximately 140° F. while the plate is driven at a speed of approximately 1 r.p.m. If these conditions are observed, the plate will be very evenly burned in and the etching powder fused properly and to the correct degree against the powdered side of the plate.

This powdering operation is repeated for all four sides of the plate, that is, until all sides of the upraised image have been powdered and protected against undercutting. The table assembly as shown in FIG. 18 is, of course, provided with suitable legs to place the top at a conveniently elevated position.

After the first powdering operation, the plate is placed back in the etching machine and it is etched on all four sides in the manner previously set forth. However, it is preferred that the second etch be set for approximately 30 seconds duration on each side. This will usually produce an etching depth of approximately .003 to .003½. If there is still some powder left on the shoulders, it is necessary to etch the plate again until all such remaining powder has been removed. In the event that some areas of the plate have more shoulder than others, the plate should be placed in the machine and only one acid splash paddle assembly is used so as to direct the etchant only against those areas of the plate which require additional penetration or etching depth.

Normally speaking, only two powdering operations are required, the plate being etched for approximately 1 minute in the last etch so as to obtain an etched depth of some 0.010 to 0.012. Normally speaking, for dry

offset printing, no further etching will be required unless there are large voids or open areas in which case the etching depth may be increased. The reason that the etching need not be carried to great depths is the fact that in the dry offset process, the blanket and roller are only very lightly engaged against the printing plate and the depth of penetration of the plate into these members is very slight, in the order of .003 or .005 and, consequently, the etching depth need not be of large magnitude.

The assembly shown in FIG. 19 is used for the purpose of re-etching and scumming and incorporates an open topped type of box assembly having a wedge-like bottom support member **381** resting upon the bottom wall **382** so as to support the printing plate **383** such that it is inclined downwardly from the rear towards the front of the assembly. This provides a natural drain for the assembly and for this purpose the bottom wall **382** is provided with a suitable drain opening adjacent the forward side wall **384** leading to a drain pipe assembly **385** and a suitable sump. This drain pipe is provided with a manually controlled valve **386**, the purpose of which will be presently apparent.

A reservoir **387** is provided containing a supply of acid or etchant and the bottom wall **382** is provided with another drain opening connected to the drain pipe **388** leading into the reservoir tank **387** and this latter drain pipe is provided with a control valve **389**, the purpose of which will also be presently apparent.

The bottom of the reservoir **387** is connected through an inlet pipe **390** to a pump **391** driven by a suitable power source, such as the electric motor **392**, and the discharge of the pump is connected through line **393** to a length of flexible hose **394** terminating in a manually controlled spray nozzle **395**. The discharge line **393** is provided a manually controllable valve **396** so that the operator may control the volume of etchant issuing from the nozzle **395**.

There is also provided a water supply through the pipe line **397** connected to the flexible hose **398** which, in turn, terminates in the manually controllable spray nozzle **399**.

For the purpose of re-etching and scumming, acid may be applied by means of the pump **391**, having suitable control means associated therewith and the flexible line **394** with the nozzle **395** is utilized to direct the acid or etchant where needed. When the acid is being used, the drain valve **389** is opened, whereas the drain valve **386** is closed, operating to produce a closed circuit insofar as the acid is concerned directing the surplus back into the reservoir **387**. When the etchant is no longer needed, the plate may be rinsed with water in which case the drain valve **389** is closed and the sump drain valve **386** opened and the water line **397** utilized to wash the plate.

A specific embodiment in practicing the method of this invention involves the use of the various constructions shown and described in connection with the drawings. In this specific embodiment, the magnesium plate, as it is obtained from the mill, is first cleaned as described hereinabove and the back of the plate is coated with back-coating enamel. This enamel is preferably baked at approximately 350° F. for at least 15 minutes and to prevent warping, such baking is done in the oven described in connection with FIG. 7 and with the plate supported on an expanded metal support, such as that shown in FIG. 6 and illustrated therein generally by the reference character **241**. Prior to the application of the back-coating enamel, the plate is scrubbed with a caustic soda solution which will clean the surface of the same and prevent oxidation thereof and the plate is then subsequently scoured as, for example, with a pumice paste to make sure that no caustic soda remains on the surface of the plate and then the paste is rinsed away with water, the plate dried and the back-coating enamel applied.

The smoother surface of the plate is cleaned in the manner previously described, that is, by a suitable solvent to remove the oil normally used by the manufacturer to protect the metal surface and the smooth surface is then scrubbed with the pumice paste and thereafter thoroughly rinsed. At this point, the smooth face of the plate may be lightly etched as, for example, by placing it in the etching machine of FIG. 10 or such etching may be, if desired, accomplished by use of the assembly shown in FIG. 19. After the surface is etched, it is rinsed well with plain water. At this point, if the plate is to be stored, it is treated with the alkali or caustic soda solution, rinsed and then dried and the smooth face may then be covered with a sheet of paper to prevent damage.

If, on the other hand, the plate is to be used immediately, it may be merely rinsed after the etching and dried and the smooth surface may then once again be scrubbed with the pumice paste and once again rinsed immediately before the cold-top enamel is applied. The plate is then swabbed with the ammonium bichromate water previously described and the plate then placed in a whirler and, while whirling, sprayed with water for a suitable length of time to thoroughly rinse the smooth surface off and the whirling action continued to whirl off the rinse water and dry the plate.

The plate is then placed on the support assembly previously described in connection with FIGS. 1–5 and designated generally by the reference character **200** and then the support is mounted on the universal joint **212** of the coating basin or table assembly. At this point, it is preferred that the cold-top enamel be prepared by adding to the commercial brand thereof approximately 15 drops of ammonium hydroxide, 26° USP for each gallon of the cold-top enamel. This mixture is then filtered into a suitable container and in this respect it is to be noted that the filtering operation is necessary to insure an even flow of the enamel particularly in the later steps of whirling the plate after the enamel has been applied. With the plate on the assembly shown in FIG. 2, the support is tilted and the cold-top enamel poured across the upper edge thereof and allowed to run and drain over the surface area of the plate while at the same time the support, being tiltable, is manipulated and tilted so as to achieve as uniform a distribution of the enamel over the surface of the plate as is possible. The plate may then be tilted the opposite way and more solution poured along the uppermost edge then presented and the tilting or rocking action repeated. This pouring of the cold-top enamel and rocking of the plate is repeated in all directions until the entire surface area of the plate has been wetted by the cold-top enamel. The support assembly with the plate attached is then removed from the structure shown in FIG. 2 and then placed in the drying oven shown in FIG. 6, at which time the oven is set so as to produce a temperature in the neighborhood of 95° F. and the plate is whirled or rotated at approximately 90 to 95 r.p.m. for 30 seconds and then at 70 r.p.m. for 1 minute and then reduced to 30 r.p.m. for 2 minutes and finally 6 to 8 r.p.m. for not less than 15 minutes. At this point, the cold-top enamel is properly dried but it is not baked and will remain slightly soft so as to permit subsequent steps to be readily performed.

After the cold-top enamel has been applied, any conventional method of printing is utilized as, for example, with a conventional step and repeat machine After printing, the plate is developed in a substantially pure commercial alcohol in which a quantity of die has been dissolved. The use of substantially pure commercial alcohol insures that the cold-top image will remain relatively soft and, of course, the unexposed portions of the enamel will be dissolved by the alcohol leaving only those portions of the plate covered by cold-top enamel which represents the image. The plate is then washed and scummed very lightly as previously described and the gum arabic solution, together with the gum arabic solution having the fountain solution and nitric acid admixed therewith, is

applied as previously described, whereafter the ink top is applied to the image.

The ink top itself is acid resistant as is the cold-top image and the two together form a very acid resistant image for the plate. The further steps in performing the method and in general the same as is set forth previously except that in all cases the specific apparatus described in conjunction with the drawings is utilized in performing the method. The purpose of utilizing the specific apparatus disclosed is to enable even an unskilled operator to produce proper and uniform results in the making of magnesium plates.

It is to be understood that the method may be practiced by other and different apparatus or by hand but it is preferred that the particular apparatus disclosed herein be utilized since it obviates, to a large degree, any special skills required in producing the plates and thus materially lowers the cost of the same.

I claim:

1. A method of making printing plates which comprises applying a coating of light sensitive shellac base cold-top enamel to one surface of a magnesium plate, drying said enamel while maintaining the same in relatively soft condition, exposing said dried enamel coating to a predetermined light pattern, developing the exposed enamel coating so as to leave only predetermined surfaces of said plate covered by said enamel, applying an acidified aqueous gum arabic solution to the exposed enamel coating, applying an etching ink top to the imaged, coated surfaces of said plate, applying etching powder to the ink top, then heating the plate to dry the ink, and then etching said plate to remove a portion of the metal of the plate to produce said imaged surfaces in relief thereon.

2. A method of making printing plates which comprises evenly distributing a uniform coating of light sensitive shellac base cold-top enamel over one surface of a magnesium plate, subsequently drying said coating of cold-top enamel at a temperature not materially in excess of 100° F. so as dry said enamel without imparting undue hardness thereto, exposing said coating of cold-top enamel with a predetermined light pattern to fix an imaged portion thereof and render it alcohol insoluble, developing the exposed cold-top enamel in an alcohol bath so as to remove said enamel except for those alcohol insoluble, imaged portions thereof, applying an acidified aqueous gum arabic solution to the exposed enamel coating, applying a coating of etching ink to said imaged portions of the enamel, applying powder to the ink, then heating the plate to dry the ink, and then etching said plate to remove a portion of the metal of the plate to produce said image in relief thereon.

3. A method of making printing plates which comprises, evenly applying a coating of light-sensitive shellac base cold-top enamel to the surface of a magnesium plate, drying said enamel so as to leave the same relatively soft, exposing the dried enamel surface to a predetermined light pattern, developing the image produced by such exposure to retain the enamel only upon the imaged surfaces of said plate, applying an acidified aqueous gum arabic solution to the exposed enamel coating, then applying an acid resistant etching ink top to said image, applying etching powder to the ink top, then heating the plate to dry the ink, and subsequently etching said plate to remove a portion of the metal of the plate to produce said image in relief in the surface of said plate.

4. The method of applying a resist on a magnesium base metal plate, said method comprising the steps of uniformly distributing a coating of light sensitive shellac base cold-top enamel over one face of the magnesium plate, drying said enamel at a temperature of not appreciably more than 100° F., photographically forming an image on said enamel top, developing the image by immersing the plate in substantially pure alcohol, scumming the plate with a mixture of conventional fountain solution and nitric acid, washing the plate with water, applying an acidified aqueous gum arabic solution to the surface of the plate, and then applying a coating of etching ink to the image.

5. The method of making a printing plate of the type comprising a magnesium base metal plate in which the imaged printing surfaces are in relief with respect to the nonprinting surfaces, said method comprising the steps of uniformly distributing a coating of light sensitive shellac base cold-top enamel over one face of the magnesium plate, drying said enamel at a temperature of not more than about 100° F., photographically forming an image on said enamel top, developing the image by immersing the plate in substantially pure alcohol, scumming the plate with a mixture of conventional fountain solution and nitric acid, washing the plate with water, applying an acidified aqueous gum arabic solution to the surface of the plate, applying a coating of etching ink to the image, powdering the super-imposed ink image with etching powder, drying the superimposed ink image having the etching powder adhering thereto, and then etching said plate to remove a portion of the metal of the plate.

6. The method of applying a resist on a magnesium base metal plate comprising the steps of evenly applying a coating of light sensitive shellac base cold-top enamel to the surface of said plate, drying said enamel so as to leave the same relatively soft, photographically forming an image on said enamel top, developing the image produced by such exposure to retain the enamel only upon the imaged surfaces of said plate, applying an acidified aqueous gum arabic solution to the exposed enamel coating, and applying a coating of acid resistant etching ink to the image.

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