

June 30, 1942.

R. A. ERZ

2,288,128

ETCHING MACHINE

Filed July 24, 1941

2 Sheets-Sheet 1

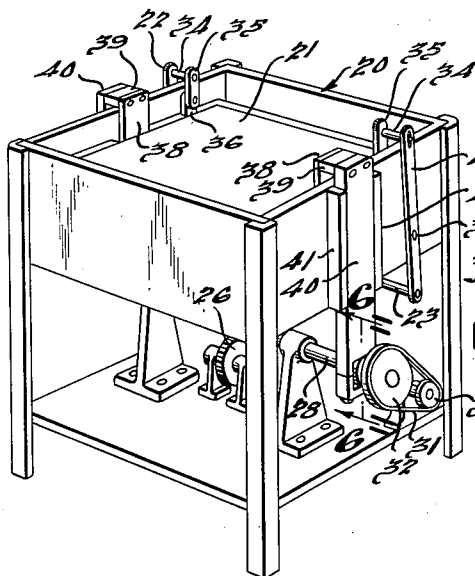


FIG. 1.

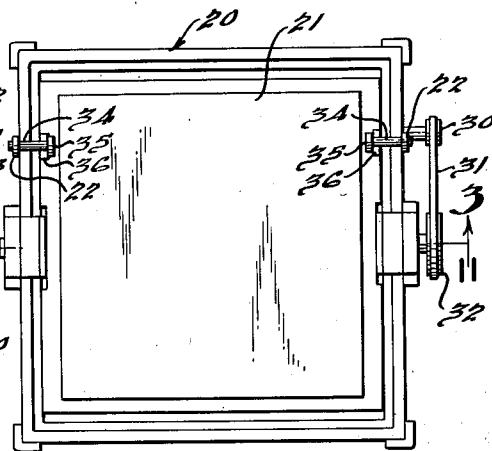


FIG. 2.

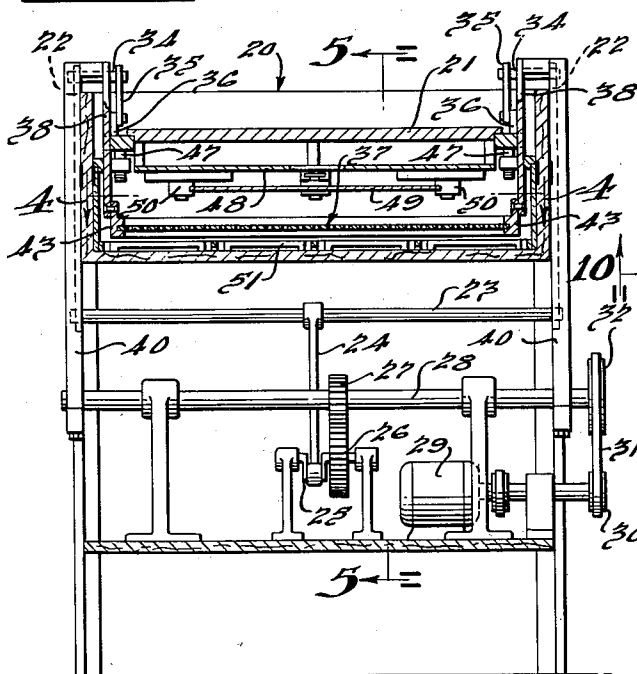


FIG. 3.

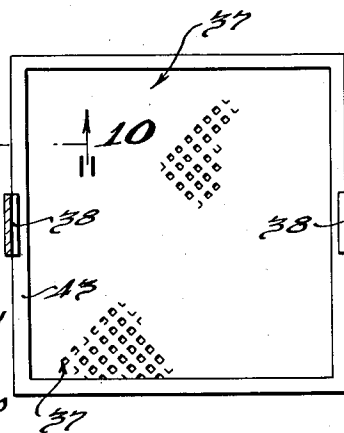


FIG. 4.

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2 Sheets-Sheet 2

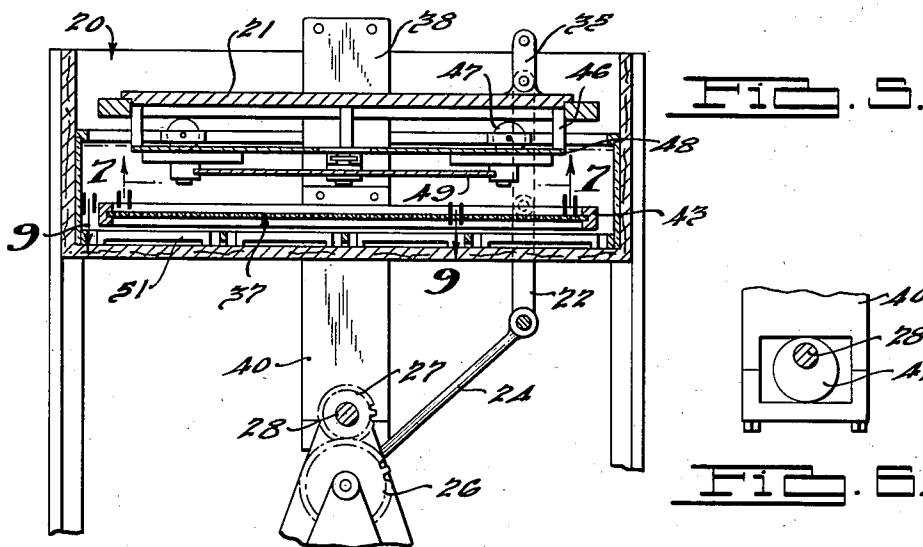


FIG. 5.

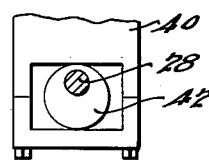


FIG. 6.

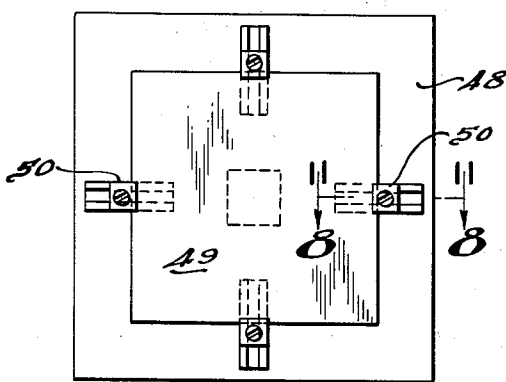


FIG. 7.

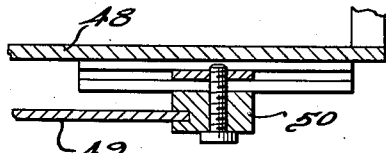


FIG. 8.

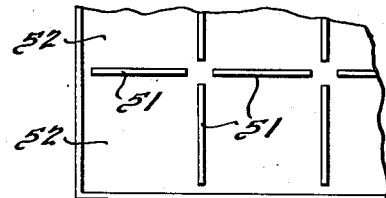


FIG. 9.

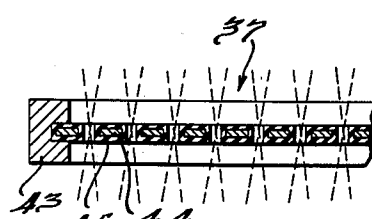


FIG. 10.

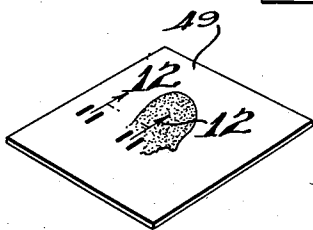


FIG. 11.



FIG. 12.

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ETCHING MACHINE

Raymond Albert Erz, Detroit, Mich.

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10 Claims. (Cl. 41—9)

The present invention relates to improvements in etching machines wherein the acid or etching solution is distributed over the surface of the plate to be etched in such a manner as to provide a uniform covering of the surface to be etched.

An object of the invention is to provide an improved etching machine wherein the acid or etching solution is agitated and distributed over the surface of the plate to be etched, while the plate to be etched is moved relative to said acid or etching solution in such a manner that a uniform distribution of the acid or etching solution over the face of the plate is effected.

Another object of the present invention is to provide an etching machine of an improved and novel construction and in which the etching acid or solution is delivered to the face of the plate to be etched under pressure and is drawn away from the surface of the plate by a suction and thereby removing the exhausted acid or etching solution and taking with it the etched portions of the plate so as to provide a clean etching of the surface and a continual removal of salts formed by the action of the acid or etching solution on the surface of the plate.

Another object of the present invention is to provide an improved etching machine which is of a relatively simple construction but which is efficient and economical in operation and produces improved results in the mechanical etching of a photoengraved plate.

A further object of the present invention is to provide an etching machine in which provision is made for the agitation of the acid or etching solution in a tank in such a manner as to create a continuous flow in such tank in a direction generally vertical to the face of the plate to be etched and at the same time moving the plate horizontally relative to the acid or etching solution in the tank, the plate at all times having its surface to be etched submerged in the acid or etching solution in such vat or tank.

The above and other objects and advantages of the invention will appear from the following description and appended claims when considered in connection with the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

A machine embodying the present invention is shown in the accompanying drawings, in which

Fig. 1 is a view in perspective of an etching machine embodying the present invention.

Fig. 2 is a plan view of the machine shown in Fig. 1.

Fig. 3 is a vertical section taken substantially on the line 3—3 of Fig. 2, looking in the direction of the arrows.

Fig. 4 is a horizontal section taken substantially on the line 4—4 of Fig. 3 looking in the direction of the arrows.

Fig. 5 is a fragmentary sectional view taken substantially on the line 5—5 of Fig. 3 looking in the direction of the arrows.

Fig. 6 is a view taken along the line 6—6 of Fig. 1 looking in the direction of the arrows.

Fig. 7 is a plan view taken substantially on the line 7—7 of Fig. 5 looking in the direction of the arrows.

Fig. 8 is a sectional view taken substantially on the line 8—8 of Fig. 7.

Fig. 9 is a fragmentary plan taken of the line 9—9 looking in the direction of the arrows of Fig. 5.

Fig. 10 is an enlarged fragmentary section of the perforated grill or plunger taken on the line 10—10 looking in the direction of the arrows of Fig. 4.

Fig. 11 is a view in perspective of a plate etched by the etching machine of the present invention.

Fig. 12 is an enlarged fragmentary section taken substantially on the line 12—12 looking in the direction of the arrows of Fig. 11.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Briefly, the preferred embodiment of the present invention may be said to consist in the provision of a receptacle for the etching solution, in which receptacle is provided a movable grill which acts as a plunger and moves vertically within the vat or tank. This grill, moving vertically in the tank, keeps the etching acid or solution in circulation and at the same time creates currents within the material so that the etching acid or solution is at all times delivered to the face of the plate to be etched under pressure as a result of the movement of the plunger downward from the plate and is drawn away from the face of the plate as a result of the

movement of the plunger in the opposite direction. During the time that the plunger is moving vertically within the tank of acid or etching solution, the plate is moved horizontally in the tank. It has been found preferable that the movement of the plate should be at a different rate from the rate of movement of the grill or perforated member in the tank, since in this way different surfaces of the plate to be etched are brought into position relative to the currents of etching acid or solution so that all portions of the face of the plate are subjected uniformly to the action of the etching acid or solution.

Referring now to the drawings, and particularly to Figs. 1, 3 and 5 thereof, the numeral 20 designates a tank or vat for containing the etching acid or fluid. A conventional form of acid used, for example, in the etching of copper plates is perchloride of iron. It is essential, therefore, that the tank or vat 20 as well as all parts of the apparatus which come in contact with the etching acid or fluid should be treated so as to resist the action of the etching acid. I have found that a wooden construction covered with rubber or asphaltum is satisfactory for this purpose. Since the machine is intended to be used with etching acids or fluids, it is important that all portions of the apparatus which come in contact with the acid should be similarly treated.

In order to prevent splashing of the acid and to have the machine enclosed during its operating cycle, a cover 21 which extends over the plateholder carrier 46 is provided. The plateholder 48 is mounted for horizontal movement in the tank and this movement is effected by the pivoted levers 22 which are connected with the cross shaft 23 (Fig. 3) which in turn is connected with the connecting rod 24 attached to the crank 25 which is driven through the meshed gears 26 and 27 from the rotatable shaft 28. The rotatable shaft 28 is driven by the motor 29 through the motor pulley 30, the belt 31 and the shaft pulley 32 mounted on the shaft 28. Movement of the cross shaft 23 causes pivoting of the levers 22 about the pivot points 33 and this motion is transmitted to the cross pin 34 and the link 35 which is connected to the lug 36 on the plateholder 48. It is to be understood that the same mechanism is provided on each side of the plate holder but that other ways of moving the plate holder horizontally in the tank 20 may be used if desired. Where the duplicate parts appear on opposite sides of the apparatus shown in the drawings, similar numbers have been used and are used throughout the present specification.

The etching acid or other fluid inside the tank is agitated by the perforated plunger 37 which is mounted for vertical movement in the tank 20. The perforated plunger 37 preferably consists of a frame 43 and a plurality of cross members 44 which, as shown in the present drawings (Fig. 4), are preferably placed diagonally to the frame 43 and cross one another to form a plurality of substantially diamond shaped or square perforations between the respective strands. One form of such material which is satisfactory for the present purpose is a perforated steel plate which is coated with an acid-proofed material such, for example, as the rubber coating 45 (Fig. 10). The perforated plunger 37 is moved vertically in the tank 20 by the arms 38 which extend vertically above the surface of the frame 43 and are connected through blocks

39 with Scotch yokes 40 which are movable vertically in ways or guides 41 (Fig. 1). It is understood that arms 38, blocks 39, Scotch yokes 40 and ways or guides 41 are provided on each side of the apparatus as here shown. The Scotch yokes 40 are driven from the rotatable shaft 28 by cams 42 as shown in Fig. 6.

I have found that it is desirable in a machine embodying the present invention to move the plateholder 48 in a horizontal direction at a different speed from the speed employed in moving the plunger 37 in the vertical direction. Thus, the pulleys 30 and 32 and the gears 26 and 27 are selected so that the plateholder moves at a different speed from the speed of movement of the plunger 37. In this way the formation of streaks on the surface of the etched plate is avoided since different portions of the surface of the plate 49 are constantly brought into position above the perforations in the plunger 37. I have found that if the two move at the same speed the same portion of the plate will be brought into position above the same portion of the perforated plunger 37 during each cycle of operation and that this tends to cause some portions of the plate to be etched more deeply than others, leading to an inferior etching of the plate since the deeper portions show up as streaks in the finished etched plate.

The carrier 46 for the plateholder 48 is supported on a plurality of rollers or other anti-friction supports 47 which are secured to the tank. The rollers 47 are preferably formed of acid-proof material such as hard rubber or the like or they may be formed of other types of material and treated so as to prevent their disintegration and deterioration in the etching acid. The plate 49 to be etched is held in the plateholder 48 by a plurality of adjustable clamps 50 (Figs. 7 and 8) which may be adjusted in such a way as to accommodate different sizes of plates in the plate carrier.

In order to prevent surging of the etching acid or fluid in the tank, the bottom of the tank is constructed as shown in detail in Fig. 9 with a plurality of spaced and angularly disposed baffle members or ribs 51 so that the tank bottom, as shown, contains a plurality of areas or spaces 52 which are defined by the baffle members 51. In this way, surging of the etching acid or fluid due to the vertical movement of the plunger 37 is eliminated.

When the plate to be etched has been treated in the present apparatus, it is found upon removing the plate therefrom that the etched surface is very cleanly etched and the etched areas are sharply defined. This is indicated in the section (Fig. 12) which is an enlarged, somewhat schematic view of a portion of a plate etched in the present machine. The view is typical of the dot formation on the etched plate in that the top portion of the dots is parallel to the bottom of the etched portions of the plate and each dot appears as a small, substantially cylindrical element which is secured to the plate. The channels between the dots are substantially straight sided and there is a substantially sharp line of juncture between the dots and the plate. In this way plates etched in the present machine exhibit properties not found in plates etched in other types of mechanical etching devices.

The clean sharp etching which results from the use of the machine embodying the present invention is due to two factors. First, as shown in Fig. 5, the plate to be etched 49 is at all times

submerged in the acid. The movement of the plate horizontally through the acid causes all portions of the plate to be brought in contact with the acid at all times. The acid itself is agitated by the action of the perforated plunger 37 and as the plunger 37 moves vertically in the tank relative to the plate 49, a constant flow of acid is provided. During the downstroke of the plunger 37, the acid is brought forcibly in contact with the face of the plate 49 and as the plunger 37 moves in the opposite direction, there is a drawing away or suction effect which causes the acid to be drawn away from the face of the plate 49. Thus, the acid is constantly circulating and fresh acid is continually being brought into contact with the plates 49 and the exhausted acid carrying the salts of the etching reaction is drawn out of and away from the plate 49. In this way, the salts of the reaction do not block out the subsequent action of the etching acid as is the case in many conventional etching machines where a continuous spraying or splashing of the acid onto the surface of the plate is employed.

While I have described particular means of effecting the movements of the plate and the plunger relative to one another, it is to be understood that other types of mechanisms may be employed for the same purpose.

In the course of my experiments I have found that it is preferable that the openings between the strands of material forming the perforated plunger 37 should comprise approximately 40% of the total area of the plunger. Instead of the crossed strands as shown in Fig. 4, the plunger also may be formed of pierced or perforated sheets of metal or other materials or they may be formed of parallel strips of metal, wire, wood or the like which are given suitable acid-proof covering.

I claim:

1. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a plunger mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger.

2. An etching machine comprising a tank, a plate carrier mounted to hold a plate to be etched below the acid level in said tank and to move said plate horizontally therein, a plunger mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger.

3. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger mounted for reciprocating movement in said tank, and means for moving said plate carrier and said plunger.

4. An etching machine comprising a tank, a plate carrier mounted for reciprocating vertical movement therein and adapted to hold a plate

to be etched below the acid level in said tank, a perforated plunger mounted for reciprocating vertical movement in the acid in said tank, and means for moving said plate carrier and said plunger.

5. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger comprising crossed metal members secured to a frame and provided with an acid resisting covering and mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger.

6. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a plunger mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger at different speeds.

7. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger comprising crossed metal members secured to a frame and provided with an acid resisting covering and mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger at different speeds.

8. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger comprising crossed metal members secured to a frame and provided with an acid resisting covering, the openings between said crossed metal members comprising approximately 40% of the total area of said plunger, said plunger being mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger.

9. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger comprising crossed metal members secured to a frame and provided with an acid resisting covering, the openings between said crossed metal members comprising approximately 40% of the total area of said plunger, said plunger being mounted for reciprocating vertical movement in said tank, and means for moving said plate carrier and said plunger at different speeds.

10. An etching machine comprising a tank, a plate carrier mounted for reciprocating horizontal movement therein, a perforated plunger comprising crossed metal members secured to a frame and provided with an acid resisting covering, the openings between said crossed metal members comprising approximately 40% of the total area of said plunger, said plunger being mounted for reciprocating vertical movement in said tank, and common means for moving said plate carrier and said plunger at different speeds.

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