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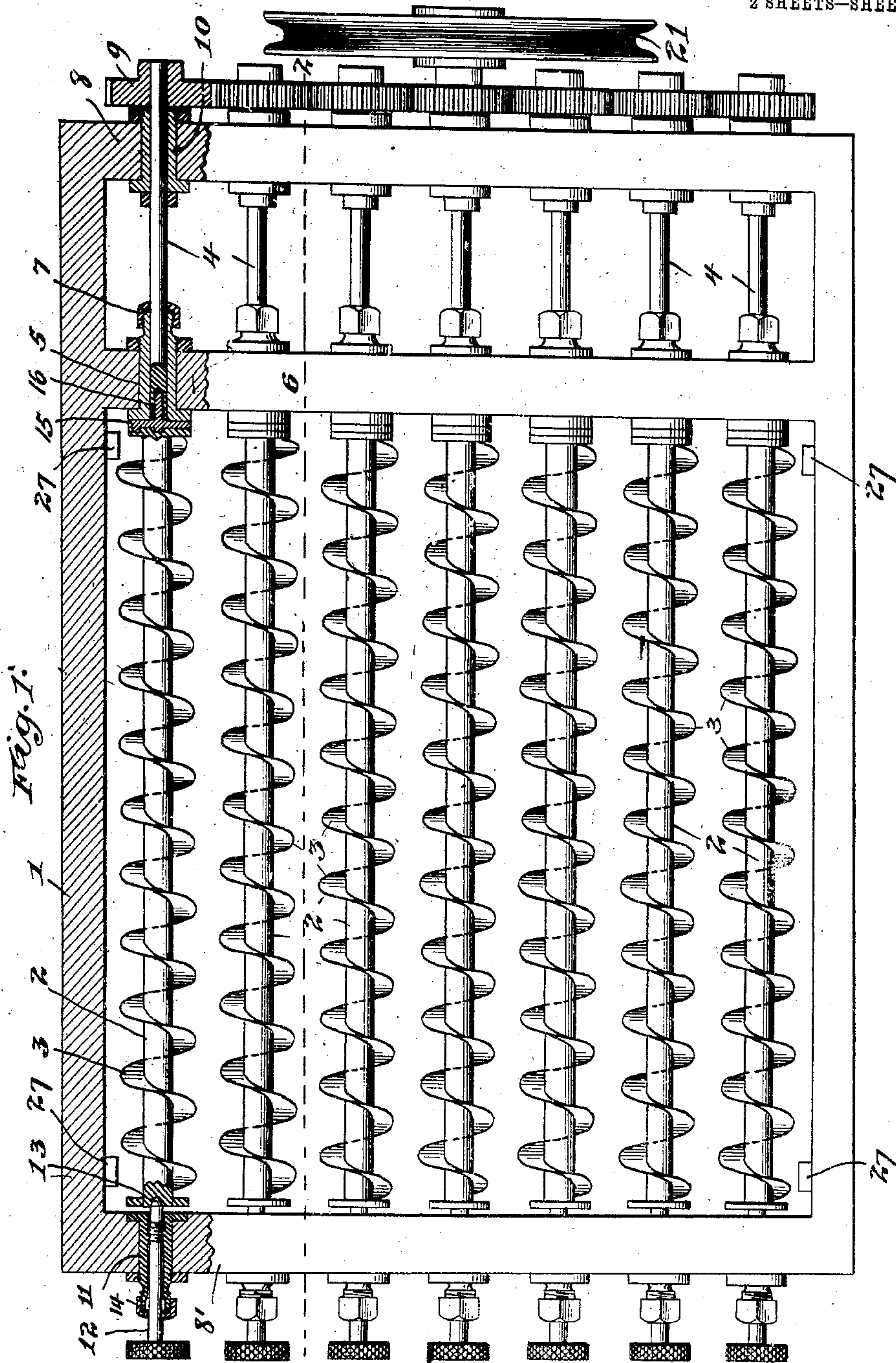
T. C. VAN HOUSEN & W. A. MEYERS.

PROCESS OF ETCHING.

APPLICATION FILED JULY 24, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



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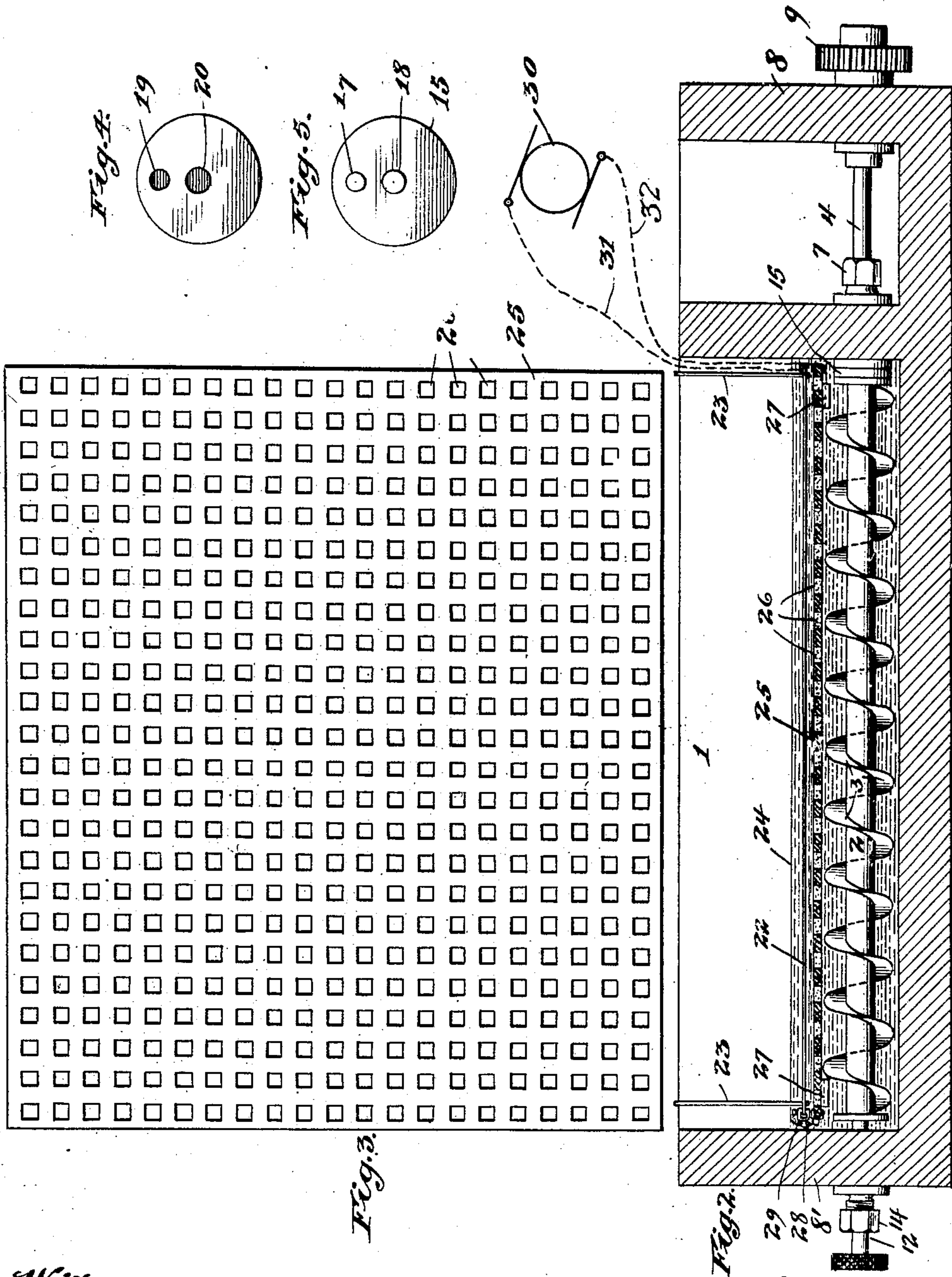
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UNITED STATES PATENT OFFICE.

THOMAS C. VAN HOUSEN AND WILLIAM AUGUSTUS MEYERS, OF
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PROCESS OF ETCHING.

SPECIFICATION forming part of Letters Patent No. 771,340, dated October 4, 1904.

Application filed July 24, 1903. Serial No. 166,854. (No specimens.)

To all whom it may concern:

Be it known that we, THOMAS C. VAN HOUSEN and WILLIAM AUGUSTUS MEYERS, both residents of Chicago, Cook county, Illinois, have invented a certain new and useful Process of Etching, of which the following is a specification.

This invention relates to a process of etching, and refers more specifically to a process adapted for etching such metal plates as are used in photomechanical engraving, the invention pertaining to that class of processes wherein the metal plates are etched by an acid liquid forming a bath within which the face of the plate is submerged.

Among the salient objects of the invention are to provide a process or method of subjecting the plate to the action of the liquid in such manner as to produce a more nearly uniform action upon the surface exposed; to provide a process in which the eroding liquid is impelled against the surface being acted upon and is so controlled in its circulation that it impinges against the surface in lines approximately perpendicular to said surface, thereby rapidly deepening the indentations and minimizing the erosion of the relief portions in lateral directions; to provide a process in which a carbon plate is arranged in proximity to the surface being etched and coöperates both by guiding the eroding liquid and by clarifying the same; to provide a process in which the plate being etched is made to form one element of a galvanic couple and a carbon grid the other element thereof and in such manner that electrolysis contributes to or accelerates the etching action; to provide a process which may be carried out in a simple and rapid manner and in such a way that inspection of the work may be had from time to time with greatest convenience, and in general to provide an improved process of the character referred to.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims, and the invention will be readily understood from the following description, reference being had to the accompanying drawings, illustrating a suitable apparatus for carrying out the process, and in which—

Figure 1 is a plan view with certain parts in horizontal section of the apparatus. Fig. 2 is a longitudinal sectional view of the same, taken on line 2 2 of Fig. 1. Fig. 3 is a plan view of the carbon grid forming one feature of the apparatus. Figs. 4 and 5 are end views of two members of one of the agitators, showing particularly the form of the driving connection between the two.

In carrying out my invention I provide a suitable receptacle for the etching-bath, within which the face of the surface to be etched may be submerged. I also provide means for supporting a skeleton plate or grid near to but out of contact with the surface of the plate to be etched and arranged in parallel or approximately parallel relation to the latter. I also provide means for creating an agitation or circulation of the etching fluid, which means are arranged to impel the liquid through the grid or skeleton plate and against the plate to be etched. Arranged in proximity to the surface to be etched the grid serves as a means of guiding the liquid and causing it to impinge directly against the surface of the plate and in lines approximately perpendicular thereto. By means of suitable agitating apparatus the flow of the liquid through the grid and against the plate is made as uniform as possible over the entire surface to be etched, the liquid being so agitated as to avoid to the greatest practicable extent the creation of any distinct sweeping currents which would tend to traverse the face of the plate being acted upon. The agitation of the etching fluid thus serves a manifold purpose—namely, by combining the mechanical impact of the fluid with its eroding action it hastens the etching process, by impinging against the plate in lines perpendicular thereto it deepens the etching without correspondingly eroding away the relief portions, and by maintaining a constant agitation the bath is maintained of uniform strength throughout all portions and the chemically-satisfied molecules are

promptly replaced by fresh solution. It will be understood, of course, that the plate being etched is first prepared in any of the well-known ways by the application thereto in any
 5 pattern of a composition, such as "dragon's-blood," which protects from the action of the bath the pattern to be left in relief.

As a further adjunct of the process the skeleton grid referred to is made of carbon,
 10 which enables us to use the same as one element of a galvanic couple, and at the same time the porous character of the carbon, or perhaps some other peculiarity not fully understood, causes it to act as a clarifying agent
 15 in the bath. In order that the carbon grid and plate being etched may act as a galvanic couple, these members are connected by one or more conductors, and we have found by practical demonstration that the current gen-
 20 erated by the chemical action of the bath upon the plate augments the chemical reaction and renders the etching more rapid. We have further demonstrated that by employing an auxiliary and independent source of
 25 electricity the etching process is still further expedited, the electrical connections being so made that they cooperate with the current generated by the galvanic couple formed by the plate being etched and the carbon grid.

30 Describing now the apparatus illustrated in the drawings, 1 designates as a whole a relatively shallow receptacle or tank made of suitable material to withstand the action of the bath and preferably open at its top. With-
 35 in the lower part of said tank are journaled a plurality of agitator-shafts 2, arranged in the same horizontal plane, parallel with each other and at uniform distances apart. Upon each shaft is mounted a spirally-disposed agi-
 40 tator-blade 3, these blades being desirably mounted upon the shafts after the fashion of an ordinary conveyer-shaft. The several shafts are revolubly mounted in the tank and operatively connected, so as to rotate together.

45 To this end each shaft is provided with an extension 4, which extends through a bushing 5, seated in a transverse partition member 6, the several bushings being provided with packing-glands 7, which surround the
 50 shaft extensions and prevent the escape of liquid from the tank. The shaft extensions 4 extend through the end wall 8 of the tank and are provided upon their projecting ends with spur-gears 9, suitable journal-sleeves 10
 55 being seated in said end wall, within which the shaft extensions are journaled. At their opposite ends the shafts 2 are mounted upon cone-bearings, and to this end a series of sleeves 11 are arranged to extend through the
 60 end wall 8' of the tank, within which sleeves are seated step-bearing screws 12, which terminate in a cone-point 13, which engages a corresponding bearing-recess formed in the end of the corresponding shaft. The step-
 65 bearing screws have threaded engagement

with the interiors of the sleeves 11 and are also provided with packing-glands 14 to prevent the escape of liquid.

In order that the agitator-shafts may be re-
 moved bodily from the tank, they are connect- 70
 ed with their respective shaft extensions 4 by means of detachable couplings. These couplings each comprise a plate 15, provided at one side with a screw-threaded spur 16, which is engaged with a correspondingly-threaded 75
 socket in the end of the shaft extension and at its opposite side with a pair of studs 17 and 18, which engage corresponding sockets 19 and 20, formed in the end of the agitator-
 shaft, as shown clearly in Figs. 1, 4, and 5. 80
 By retracting the step-bearing screws the shafts are released, so that they may be disconnected from the coupling-studs 17 and 18 and lifted out of the tank.

The several spur-gears 9 of the agitator- 85
 shafts are arranged to intermesh with each other, as shown clearly in Fig. 1, and with one of these, spur-gears is connected a belt-wheel 21, by means of which the shafts may be driven from any suitable source of power. 90
 22 designates the plate which is to be etched, which is supported horizontally within the tank a short distance above and parallel with the series of agitator-shafts conveniently by means of wire loops or suspending-hooks 23, 95
 one end of each of which is hooked over the upper edge of the tank, while the lower end extends beneath and supports the plate. In practice the tank is filled with etching solution to a point high enough to completely 100
 submerge the plate, as indicated by the water-line designated 24.

Immediately beneath the plate 22 and between the latter and the series of agitating-shafts is supported a carbon grid 25, consist- 105
 ing in the present instance of a plate provided at regular intervals apart with openings 26. In the present apparatus said plate is shown as conveniently supported by means of a plu-
 rality of short supporting lugs or ledges 27, 110
 extending inwardly from the side walls of the tank.

In order that the grid 25 and plate 22, which is being etched, may act as a galvanic couple, these members are connected by one or more 115
 conductors 28, which are conveniently removable and attached to the plates by means of clamps 29. These conductors will be of sufficient carrying capacity to reduce their resist-
 120
 ance to current to a very low degree.

In addition to the conductors 28 we have shown the two elements of the galvanic couple connected in circuit with an exterior source of current, such source being indicated dia-
 grammatically as a dynamo in the present in- 125
 stance and the connections therewith indicated in dotted lines. When this auxiliary source of current is to be employed, the conductors 28 will be removed, so that the only
 130
 metallic connection between the elements will

be through the conductors 31 and 32, which serve also as leads connecting with the auxiliary source. It will be seen that these conductors 31 and 32 then serve not only to convey the current generated by the outside source, but also to convey such current as is generated by the electrochemical action of the galvanic couple and electrolyte. In this connection it may be noted that the auxiliary current may be used advantageously where it is desired to accelerate the etching action, the limit of the amount of current which can thus be used being reached when it is such that the oxidation of the zinc occurs as rapidly as the acid can dissolve the oxid. In this same connection it is to be noted that the circulation of the liquid is important when employed in conjunction with the auxiliary electric current, since it will effect a more rapid action of the acid by replacing the chemically-satisfied molecules with fresh acid.

The method as carried out by the use of the apparatus herein described will be entirely obvious and need not therefore be repeated. It is to be noted, however, that during the rotation of the agitator-shafts the liquid will be agitated very uniformly over the entire area of the tank, and by reason of the fact that the agitator-shafts alternately rotate in opposite directions a localized churning effect will be produced, which will result in impelling the liquid away from the agitators, and since this churning effect extends all over the area of the tank the liquid will be impelled away substantially at right angles to the plane of the agitators or in lines substantially normal to the face of the plate being acted upon. The open grid will serve also to guide the liquid to a certain extent, and more particularly to neutralize or prevent the formation of currents tending to sweep across the face of the plate in any direction. The result of the churning thus produced will therefore be to etch the plate uniformly and to deepen it rapidly, while the tendency to eat laterally into the relief portions will be minimized.

It is also to be particularly noted that the plate may be inspected from time to time with the greatest facility by simply lifting it out, reversing it, and examining the surface, the tank being open at its top and the supports so disposed that the plate may be lifted out without disturbing the supports.

The bath ordinarily employed for etching zinc is diluted nitric acid, and this acid acting on the zinc when electrically coupled with a carbon plate produces a galvanic couple having considerable electrical efficiency. The current thus generated, as hereinbefore explained, contributes materially to the etching action. The amount of current thus generated is, however, very much less than the maximum amount which can be advantageously used, and accordingly we in some in-

stances connect the galvanic couple with an auxiliary source of current supply, thus further accelerating the etching action.

The carbon grid, as hereinbefore mentioned, acts in some manner to clarify the etching solution during the carrying out of the process, thus enabling the acid to be used effectively for a longer period of time. Whether this clarifying action is due to the chemical precipitation or electrical deposit or is simply due to the filtering action of the more or less porous carbon grid has not as yet been determined; but this action is pronounced.

It will be understood that the method herein described is not by any means limited to the use of any particular etching solution nor to the etching of any particular model, it being obvious, on the contrary, that the process is applicable to etching generally. The apparatus herein shown is in itself novel and forms the subject of a separate invention the subject-matter of which is reserved for another application for patent.

We claim as our invention—

1. The improvement in the art of etching, which consists in supporting the article to be etched with the face to be acted upon submerged in an etching-bath and agitating the bath and at the same time impelling the liquid against the surface to be etched in directions substantially normal thereto, the agitation and impelling of the liquid being effected at numerous localized points distributed uniformly over the area or opposite the surface to be acted upon, whereby sweeping currents are prevented.

2. The improvement in the art of etching, which consists in supporting the article to be etched with the face thereof to be acted upon submerged in the etching-bath and churning the bath in proximity to, and opposite the said face, substantially uniformly over the entire area of the latter, whereby the liquid is impelled against said face.

3. The improvement in the art of etching, which consists in supporting the article to be etched with the face thereof to be acted upon submerged in the etching-bath, supporting a perforated grid opposite and in proximity to said face, and churning the liquid in proximity to the grid, whereby the liquid is impelled through the perforation of the latter and caused to impinge the face being etched, and sweeping currents across said face prevented.

4. The improvement in the art of etching, which consists in supporting the article to be etched with the face thereof to be acted upon submerged in the etching-bath, supporting a perforated carbon grid opposite and in proximity to said face, and churning the liquid in proximity to the grid, whereby the liquid is impelled through the perforation of the latter and caused to impinge the face being etched and sweeping currents across said face prevented.

5. The improvement in the art of etching which consists in electrically connecting the article to be etched with another element of different electrical potential to form a galvanic couple, applying to the article to be etched a composition protecting the covered parts from the action of the bath, supporting the couple in a bath which is both an etching fluid and an electrolyte and at the same time churning the bath in proximity to and opposite the face of the article being etched substantially uniformly over the entire area of the latter, whereby the liquid is impelled against said face.

6. The improvement in the art of etching which consists in electrically connecting the article to be etched with another element of different electrical potential to form a galvanic couple, applying to the article to be etched a composition protecting the covered parts from the action of the bath, supporting the couple in a bath which is both an etching fluid and an electrolyte and also passing electric current from an external source through said galvanic couple and electrolyte, and simultaneously impelling the liquid against the surface being etched in directions substan-

tially normal thereto, the agitation and impelling of the liquid being effected at numerous localized points distributed uniformly over the area or opposite the surface being etched, whereby sweeping currents are prevented.

7. The process of etching metal articles which consists in applying to the article to be etched a composition protecting the covered parts from the action of the etching fluid, subjecting the article to the continuing action of an etching fluid which is both an etching fluid and an electrolyte, connecting the article being etched in an electric circuit which includes the electrolyte, whereby the electrochemical action induced by the electric current is auxiliary to the etching action, and simultaneously churning the bath at numerous points distributed uniformly over the area thereof, whereby sweeping currents are prevented.

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