June 5, 1934. W. McKAY 1,961,773

ETCHING MACHINE

Filed March 30, 1933 2 Sheets-Sheet 1

Fig. 1.

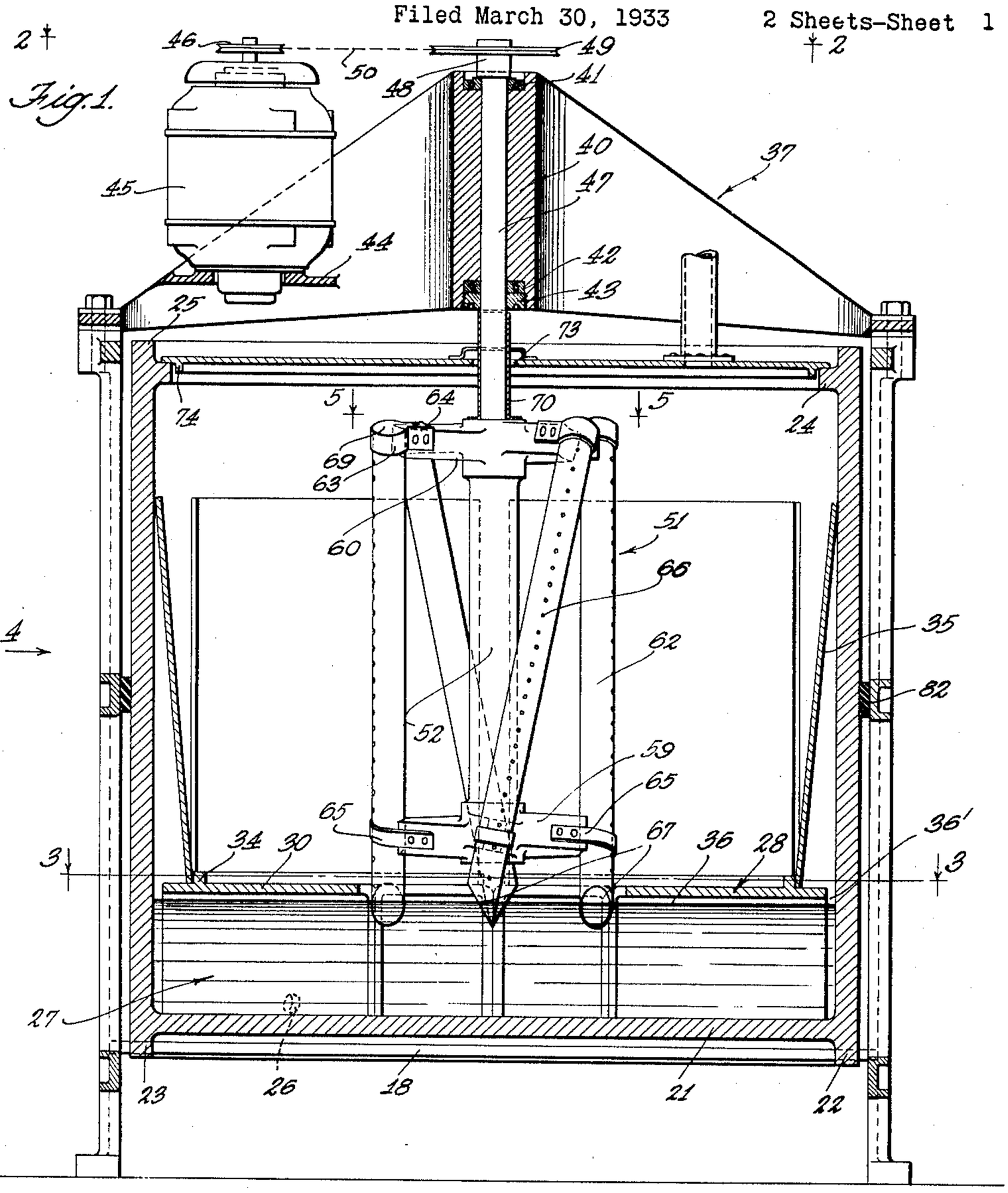

Fig. 5.

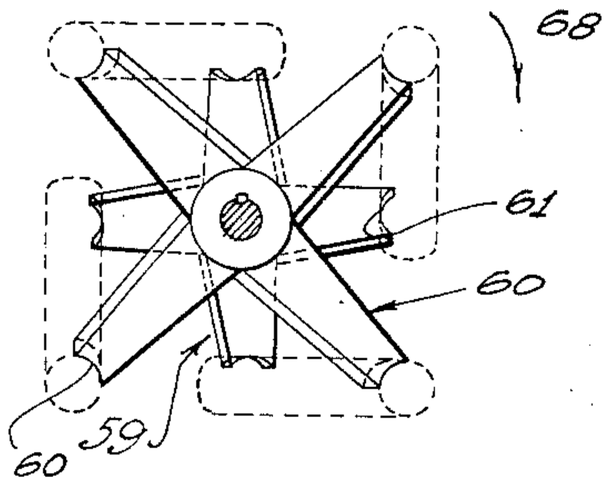

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Fig. 2.

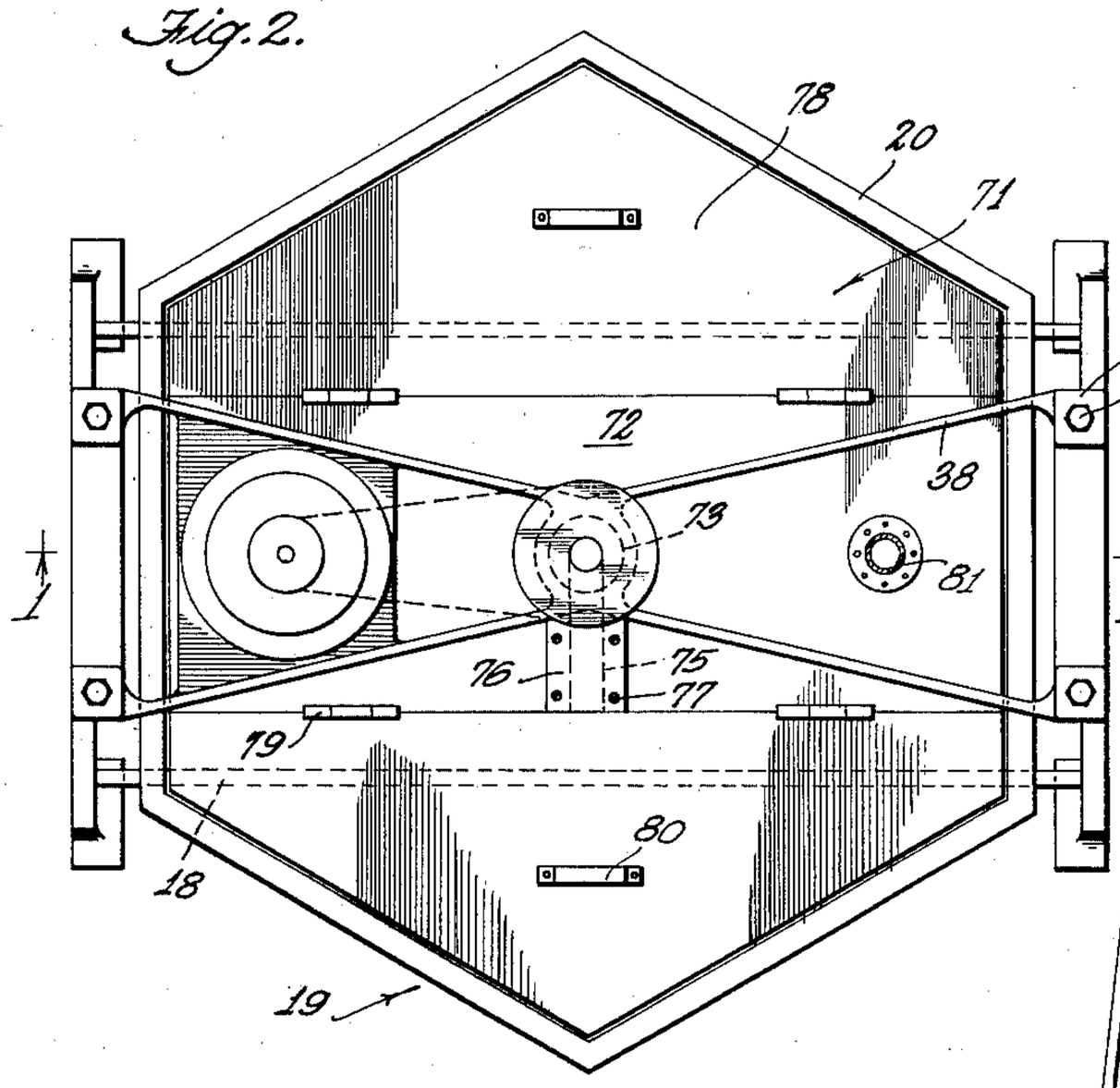


Fig. 4.

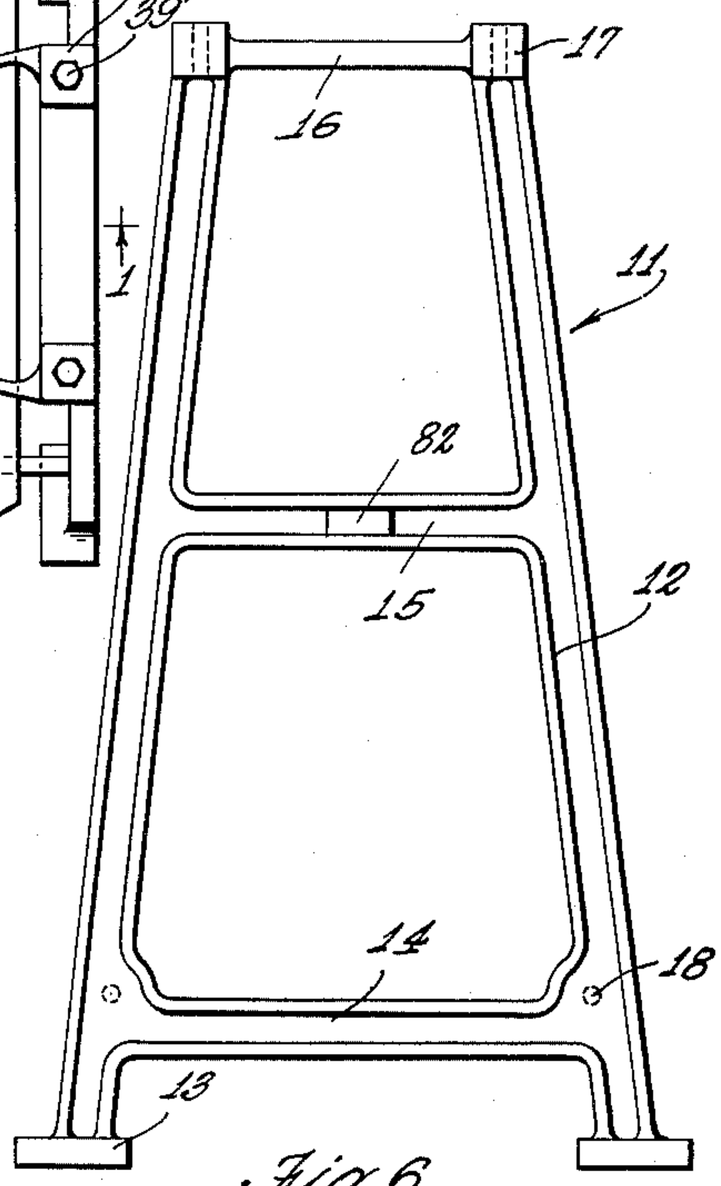


Fig. 3.

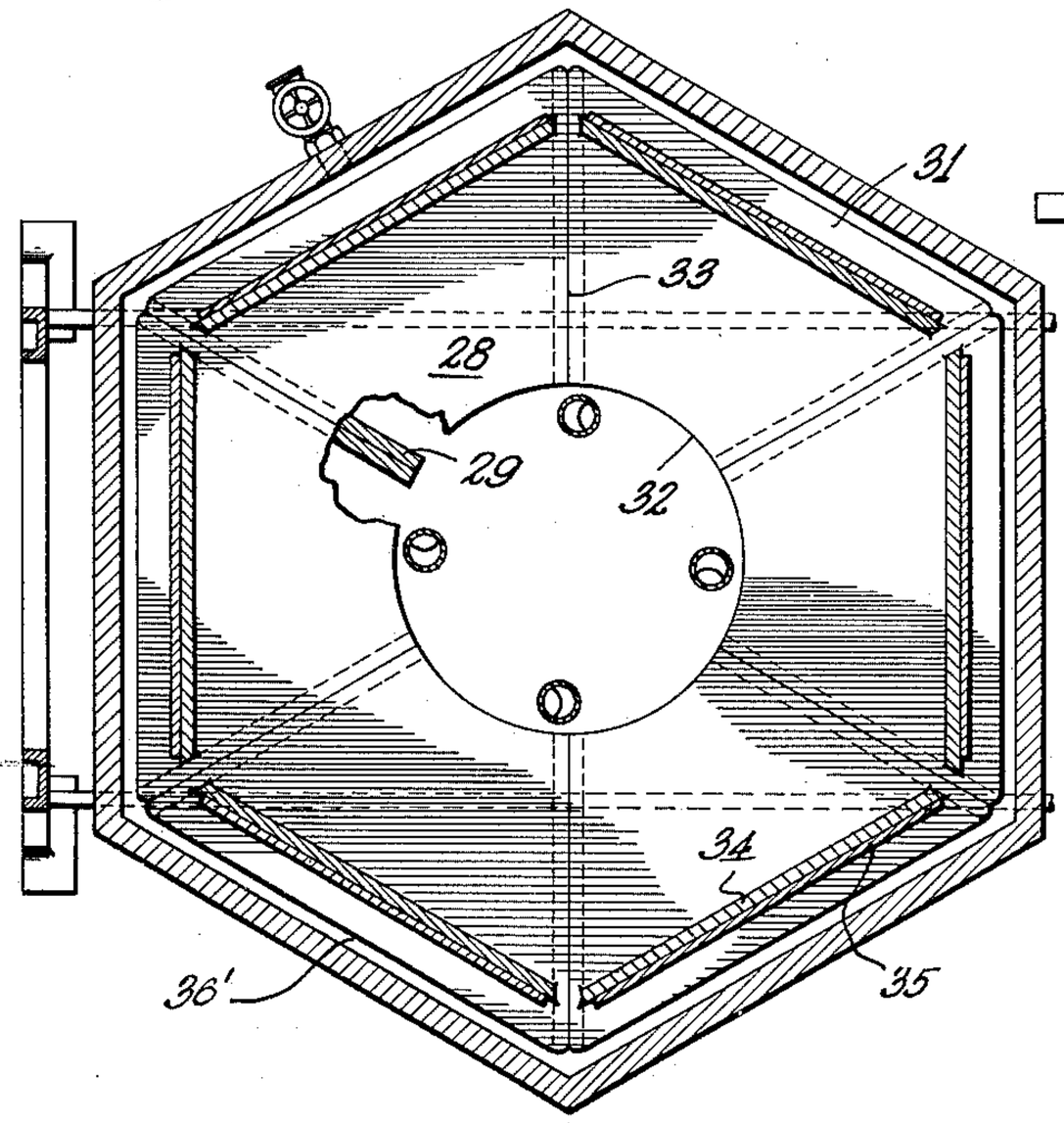
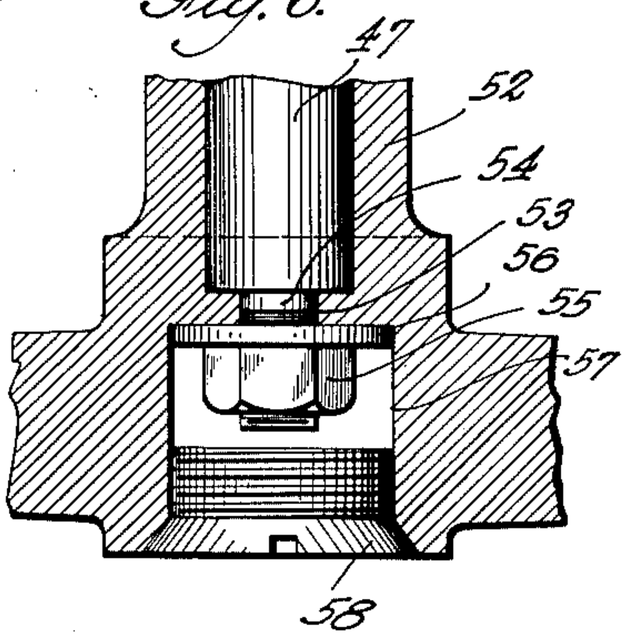


Fig. 6.



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Patented June 5, 1934 1,961,773

UNITED STATES PATENT OFFICE

1,961,773

ETCHING MACHINE

William McKay, Los Angeles, Calif.

Application March 30, 1933, Serial No. 663,526

14 Claims. (Cl. 41—9)

An object of my invention is to effect the etching of plates by acid in which the acid is thrown in a horizontal spray with considerable impact force on the plates to be etched, and also that the plates are thoroughly covered with the acid from top and bottom.

Another object and feature of my invention is effecting the spraying of the plates by means of rotary sprayers which, by centrifugal force, throw the acid out in horizontal streams from perforations in pipes extending upwardly, the perforations or jets in the different pipes being staggered one in relation to the other to obtain sprays giving a complete coverage of the plates.

Another object and feature of my invention is the forcing of the etching acid upwardly through slightly inclined spray tubes having the perforations, the lower ends of these tubes dipping into the acid and causing its elevation on rotation of the spray head having the various tubes.

Another object and feature of my invention is that in the rotation of the spray head with the tubes dipping into the acid, a swirling or whirlpool action of the acid is prevented, but the acid is confined so it may surge within the walls of a confining compartment. This always maintains the level of acid when the machine is in operation at substantially a constant level so that when the spray head is rotated at a constant velocity, the throwing of the etching jets on the plates to be etched is constant.

Another feature of my invention relates to the mechanical construction in that the bearing for the rotary spray head, which is suspended from a rotary shaft, is high above the acid tub and thus is not subject to the acid spray or acid fumes. Another feature as relates to the handling of the etching is that the operator may open the cover of the acid tub while the machine is running full speed without danger to his eyes other than the fumes, as none of the fluid is thrown upwardly, but all in a horizontal direction.

Another feature, due to the shape of the rotor, is that no ventilating fan is necessary, but a simple bent pipe.

In the mechanical construction of my invention, some detail features relate to the construction of the spray head, the mounting of the spray pipes, and also the acid confining chambers which prevent whirlpooling and thus depression of the surface of the acid.

My invention is illustrated in connection with the accompanying drawings, in which:

Fig. 1 is a vertical section taken substantially on the line 1—1 of Fig. 2 in the direction of the arrows.

Fig. 2 is a plan taken in the direction of the arrows 2 of Fig. 1.

Fig. 3 is a horizontal section on the line 3—3 of Fig. 1 in the direction of the arrows.

Fig. 4 is an elevation of one of the legs of the acid tube support taken in the direction of the arrow 4 of Fig. 1.

Fig. 5 is a horizontal section on the line 5—5 of Fig. 1 in the direction of the arrows, illustrating part of the spray head.

Fig. 6 is a detail section showing the manner of clamping the rotary drive shaft and the lower end of the spray head.

In my construction, I employ legs or supports 11, which are illustrated as having posts 12 with feet 13, the two posts of a leg being connected by a lower cross bar 14, a center cross bar 15, and an upper cross bar 16. At the upper ends of the posts there are blocks 17. The two legs on opposite sides of the machine are connected by a pair of supporting tie rods 18.

The acid tub 19 is illustrated as hexagonal in shape, having six sides 20, each side being vertical; an imperforate floor 21 connects the sides; the sides have a downward extension 22; an opposite pair of sides having notches 23 to rest on the tie rods 18. An inturned ledge 24 is located adjacent the top of the sides, which sides terminate in an upwardly extending rim 25. A drain opening 26 is provided through one of the sides for cleaning out the acid tub.

The acid confining structure, designated by the assembly numeral 27, comprises six segmental structures 28, each having two radial side walls 29 resting on the floor 21 of the acid tub. These each have a cover section 30, the outer edge 31 of which is parallel to one of the sides 20, and the inner edge 32 is arcuate, and being formed on a curve with the center of the acid tub as a center curvature. Thus, when the segmental sections 27 are assembled, the vertical side walls 29 meet on the vertical joints 33, these joints being radial. On the upper surface structure 30 of each segment there is a raised bead 34, against which the plates 35 to be etched may rest at their lower edge, the lower edge being supported on the cover section 30 and the upper edge of the plates leaning against a wall 20 of the acid tub. Thus, six large plates may be supported at one time in the etching tub. It will be seen by this construction that the acid confining structure has a cover section spaced slightly above

the normal surface of the acid, which is indicated at 36. This cover section has a circular opening, and also, there are spaces 36' between the outer end of each section and the adjacent side wall of the tub.

A bridge member 37 is constructed with two pairs of triangular webs 38. Each web has a foot 39 at the outside fitting on a block 17 at the upper end of one of the posts of a leg structure, and these are secured together by screws 39'. Thus, the bridge structure is attached at four places to the two legs at opposite sides of the tub. A central vertical hub 40 is formed tubular and connects the webs at the center and upper portion. In this hub there is an upper anti-friction bearing 41 and a lower anti-friction bearing 42, the latter being supported on a plug 43. A motor supporting plate 44 extends horizontally between two of the webs 38, and on this there is mounted an electric motor 45 which carries a drive pulley 46.

The spraying construction employs a drive shaft 47, which extends through the tubular hub 40 and has a driving head 48 resting on the anti-friction bearing 41 at the top. This has a driven pulley 49 driven by the belt 50 from the pulley 46 of the motor. The lower end of the shaft has a bearing on the lower anti-friction bearing 42.

This drive shaft extends downwardly into the tub and supports a spray head designated by the assembly numeral 51. This spray head has a central tubular hub 52. At the bottom this hub has an inwardly contracted neck 53, through which a reduced section 54 on the drive shaft 47 extends. The reduced end is threaded and receives a nut 55 bearing against a washer 56. The nut and washer are housed in a socket 57 at the lower part of the tube, the bottom of this socket being closed by a removable plug 58 threaded therein. This plug is made resistant to acid and prevents acid from contacting the threaded lower end of the drive shaft.

The tubular hub carries, at the bottom, lower spider arms 59, there being four arms shown, rotating outwardly in a horizontal plane. At the top there are also a set of four spider arms 60 also rotating outwardly horizontally. The lower arms are shorter than the outer arms and these arms are spaced to be intermediate each other. The arms of each set extend across diameters and intersect at right angles. Thus, the arms of each set are ninety degrees apart. Each of the arms has a circular outer face 61 which is inclined downwardly and at a slight angle to hold a spray tube 62. Each spray tube is secured at the top by a clamp 63 encircling the tube and being secured by screws 64. At the bottom there is also a clamp 65, each clamp being secured to a radial arm by screws, each in a similar manner. Each of the spray tubes is provided with a series of perforations 66 on its outer edge, this being the edge nearest the wall of the acid tube, and at the bottom each spray tube is open and has an edge cut on a bevel 67 so that when the spray head rotates in the direction of the arrow 68 in Fig. 5 the open end of the tube will be forced into the acid. The open end dips below the surface of the acid with a small surface of this end being above the surface of the acid. Each tube is closed at the top, as indicated at 69. A protective sleeve 70 extends upwardly from the tubular hub 52 of the spray head, surrounding the drive shaft 67 below the lower bearing 42.

A cover designated by the assembly 71 is formed with a center cover plate 72 having a central opening 73 for the drive shaft and the sleeve 70. The cover rests on the ledge 24 at its outer edge and has a downwardly extending slight flange or bead 74. A slot 75 is formed in the cover plate 72 extending from one side to the central opening 73. This is to allow removal of the cover from around the shaft without disturbing the shaft, and in order to form a complete closure, a closure strip 76 covers the slot and is secured in place by screws 77. Hinged flaps 78 are hinged at 79 to the center cover plate 72. These have lifting handles 80. The flaps rests on the ledge 24. A vent pipe 81 is secured to the cover plate 72 and extends upwardly between two of the webs 38 of the bridging member 37.

The manner of operation of my invention is as follows:

On account of the lower arms 59 of the spray head being of lesser length than the upper arms 60, the spray tubes 62 extend from an inclination outwardly from the lower end and also, on account of the lower and upper arms being relatively offset, these tubes slope rearwardly considered in their direction of rotation. Thus, when the drive shaft is rotated, the acid is forced into the open beveled lower ends of each tube and flows upwardly, and by centrifugal action is forced to the outer side of the tube, where the acid is discharged through the spray jets. On account of the jets of the succeeding tubes being staggered or slightly offset relative to those in the next adjacent tube, the jets thoroughly cover the plate to be etched. In the rotation of the spray head, the tendency would be to develop a rotational whirling or whirlpool action of the acid, which would cause the center of the body of acid to be depressed below the sides, but this circular rotational movement is prevented by the segmental structures 28, which have the vertical radial side walls 29 and a comparatively narrow opening at the circular or arcuate section 32, through which circle the lower ends of the spray tubes extend. It is preferable to have the spray tubes with their open end immersed only partly below the level of the acid so that a certain amount of air is carried up with the spray acid in the tubes and discharged with the jets, thus causing a breaking up of the spray into extremely fine jets of acid.

If desired, I may use spacing blocks or wedges 82 wedged between the sides of the tub and the legs for the purpose of restricting the vibration of the tub.

My invention also comprehends a method of etching the plates in which the etching acid is forced upwardly during the rotation of the spraying tubes through the open lower end of each tube and discharged radially by centrifugal force in a series of jets on to the plates to be etched.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims:

I claim:

1. An etching machine comprising, in combination, an etching tub having means to support plates to be etched, a rotary spray head having a plurality of spaced spray tubes extending above the top and below the bottom of the plates to be etched, said tubes being arranged about a common vertical axis and diverging radially outward, each tube having spraying perforations, means for flowing etching acid through the tubes, said acid being discharged outwardly by centrifugal action on the plates to be etched.

said acid being discharged outwardly by centrifugal action on the plates to be etched.

2. An etching machine as claimed in claim 2, the etching tub having a space for etching acid, said tubes dipping into acid and having openings to scoop the acid upwardly during rotation of the spray head.

3. An etching machine comprising, in combination, an etching tub having means to support plates to be etched, a rotary spray head having a plurality of spraying tubes with perforations for spraying jets, said tubes being spaced about a vertical axis and at an angle thereto and extending below the bottom of the plates and above the top of the plates, the bottom of the tubes being adapted to scoop up etching acid, and each tube having an open end for immersion in the acid.

4. An etching machine as claimed in claim 3, each tube being inclined upwardly and outwardly considered radially from the bottom to the top.

5. An etching machine as claimed in claim 3, each tube being inclined rearwardly at its upper end compared with its lower end and considered in the direction of rotation.

6. An etching machine as claimed in claim 3, each tube being inclined outwardly considered radially at the upper end to a greater extent than the lower end, and the upper end also being inclined rearwardly relative to the lower end considered in the direction of the rotation, said perforations being on the portion of the tube closest to the plates to be etched.

7. An etching machine comprising, in combination, an etching tub having a floor and side walls, means to support plates to be etched with the upper ends of the plates meeting against the side wall, a rotary spray head extending downwardly into the tub and having spray pipes with perforations extending longitudinally thereof, each tube having its lower end below the bottom of the plates to be etched and adapted to dip into the etching acid, the lower end of each tube having an open end facing in the direction of rotation.

8. An etching machine as claimed in claim 7, the means to support the plates being etched having a means to confine the acid to restrict the whirling action of the acid due to the action of the rotating spray tubes.

9. An etching machine comprising, in combination, an etching tub having a floor and side walls, a bridging member extending across the top of the tub and having a vertical rotatable drive shaft depending therefrom, a spray head attached to the shaft and having a plurality of upwardly inclined spray tubes, each tube having an open lower end positioned to scoop acid in the lower part of the tub upwardly on rotation of the shaft, each spray tube having perforations through which the acid may be discharged by centrifugal force, and means to support plates to be etched to lean against the wall of the tub.

10. An etching machine as claimed in claim 9, the means to support the plates to be etched comprising an acid confining structure having a cover section on which the lower edge of the plates may rest, and having a central opening through which the lower ends of the tubes extend, and means in the confining structure to restrict the whirling action of the acid.

11. An etching machine comprising, in combination, a supporting structure having an acid tub therein, said tub having a floor and side walls formed of a plurality of sections, each in a vertical plane, an acid confining structure having radial side walls resting on the floor of the tub and having a cover section with a central opening therein, a bridging member having a central bearing, a vertical drive shaft extending downwardly therefrom and into the tub, a spray head mounted on the shaft in the tub and having a plurality of spray tubes, each with perforations, the lower ends of the tubes extending through said central opening, and each tube having an open lower end positioned to scoop acid from the acid within the confining structure, the acid being adapted to flow upwardly through each tube and to be discharged radially by centrifugal action.

12. An etching machine as claimed in claim 11, the spray head having a tubular hub, radial arms at the lower and upper ends of said hub, the upper and lower arms being located out of vertical alignment, the upper arms being longer than the lower arms, a tube being secured to an upper and a lower arm.

13. In an etching machine, a rotatable spray head having a vertical hub with a lower and an upper set of radial arms, the lower arms being offset from the upper arms and shorter in length, and means to attach a tube to an upper and a lower arm whereby such tube attached to a pair of arms is inclined outwardly at the top considered radially and rearwardly at the top considered in the direction of rotation, each tube having the lower open end formed on a slant adapted to be immersed in etching acid.

14. In an etching machine, an etching tub having a floor, a side wall formed of a plurality of sections, each section being flat and forming a vertical plane, the adjacent sections meeting at an angle, means in the tub to support plates to be etched with the lower edge of a plate resting on said supporting means and the upper edge resting against one of the flat side sections the means to support the plates comprising an acid confining means having a cover section formed of segments with a central opening, each segment having radial side walls, the cover section of each segment having an edge spaced from and parallel to the vertical plane section of the side wall of the tub.

WM. McKAY.