Jan. 8, 1957 W. GUENST 2,776,512

ETCHING MACHINE

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Fig. 1.

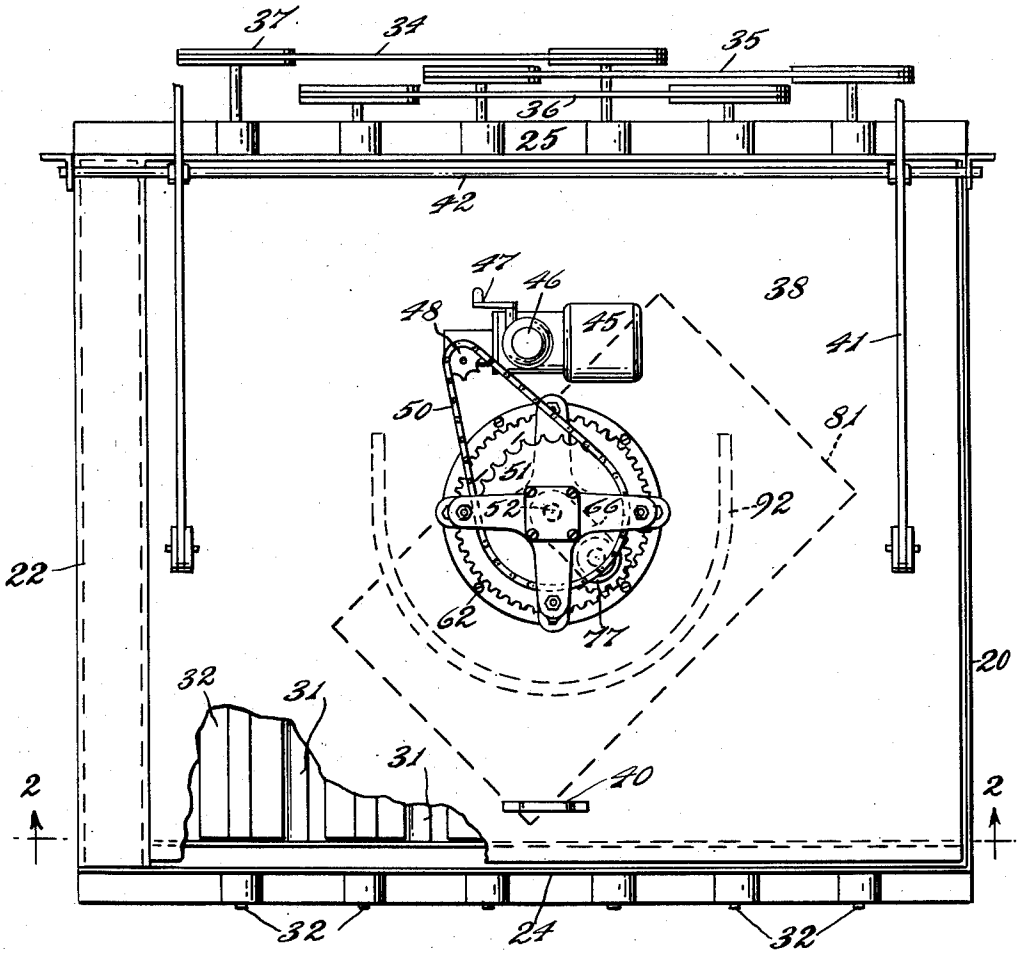
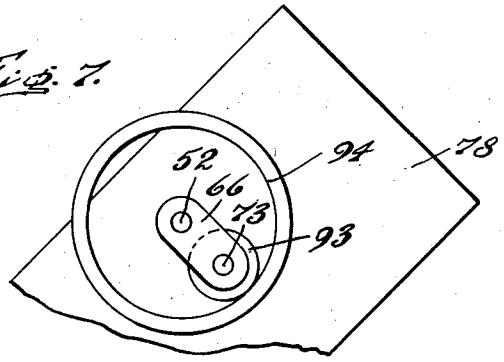


Fig. 7.



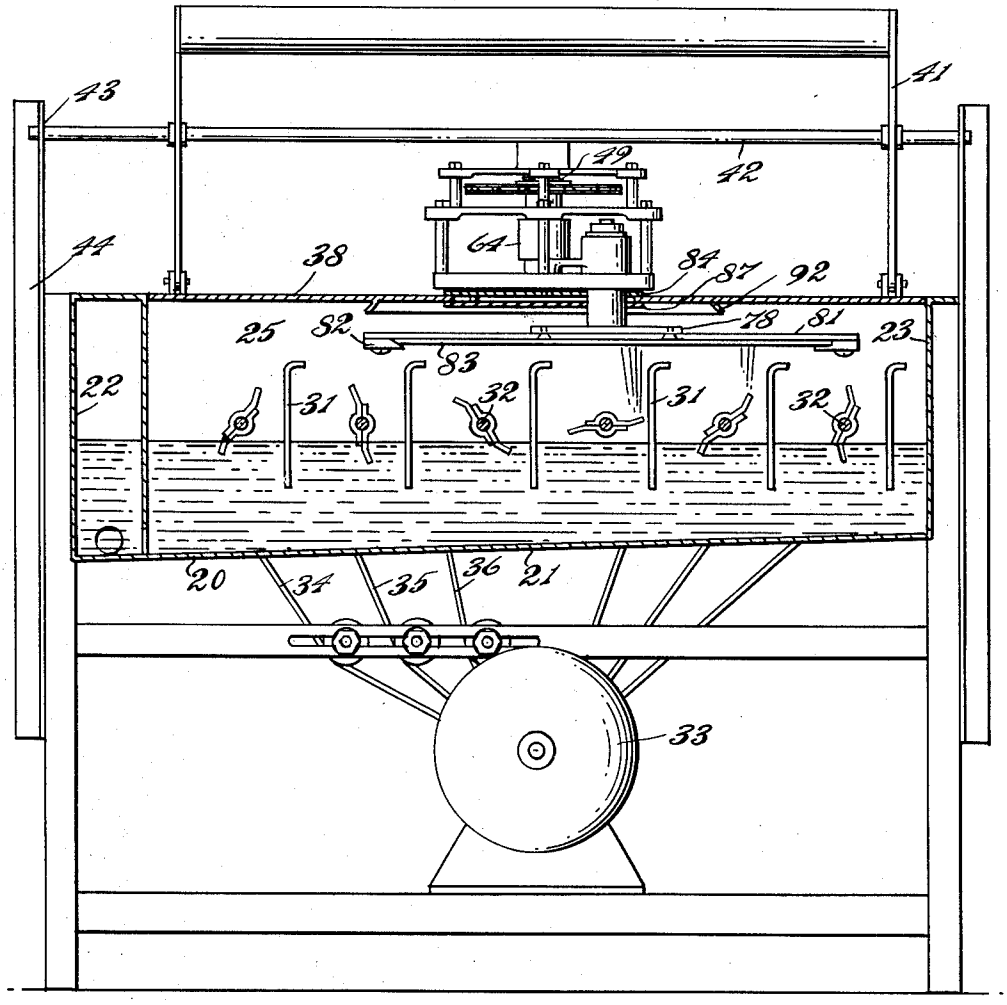
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ETCHING MACHINE

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Fig. 2.



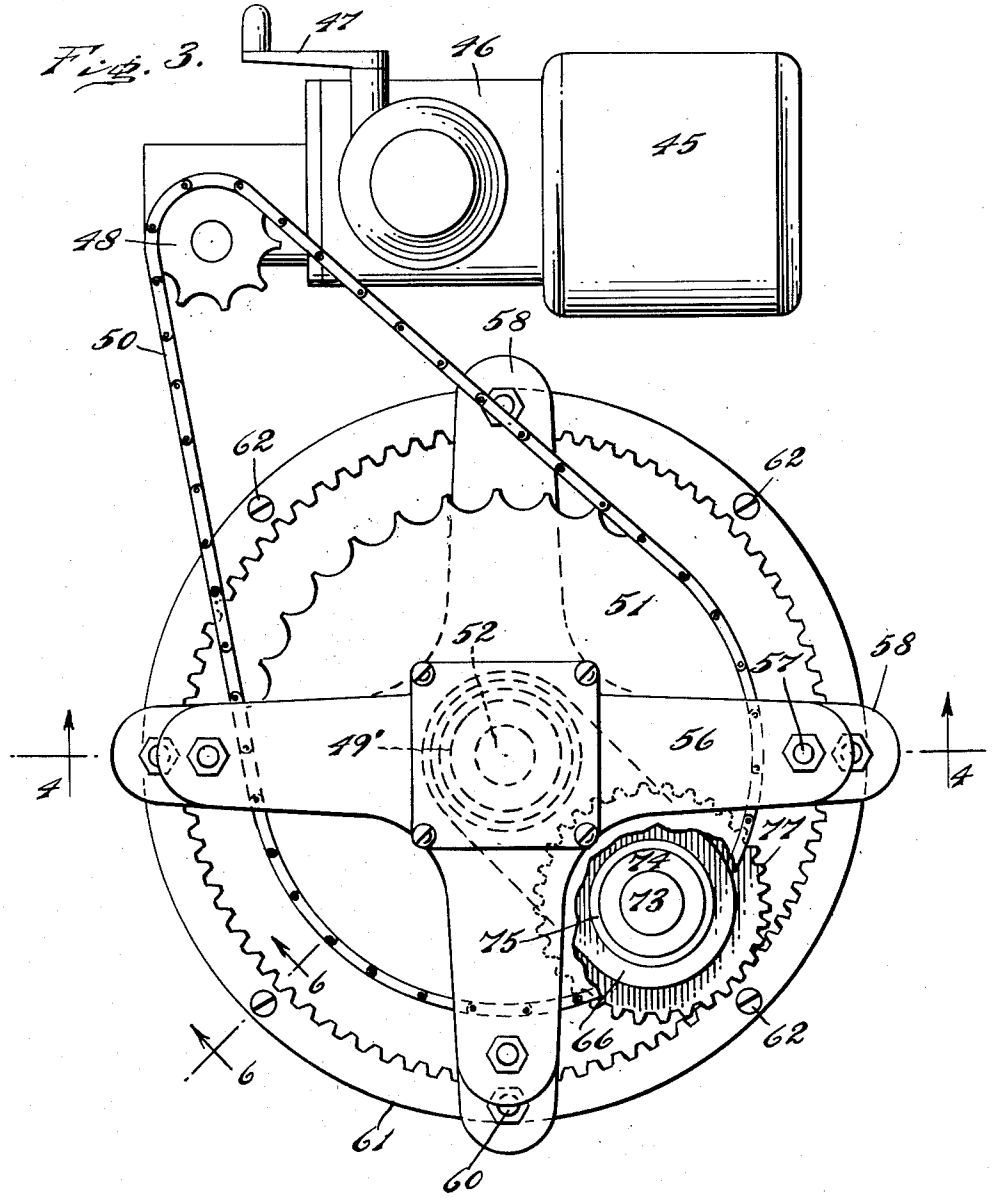
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Fig. 3.



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ETCHING MACHINE

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Fig. 4.

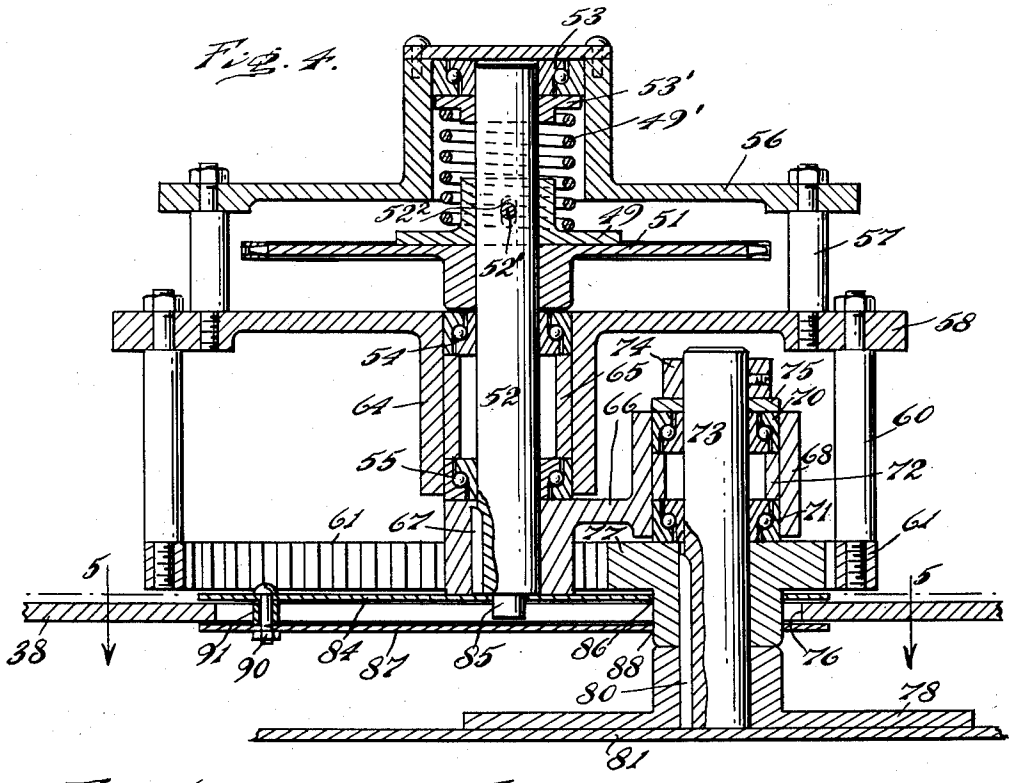


Fig. 6.

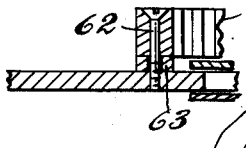
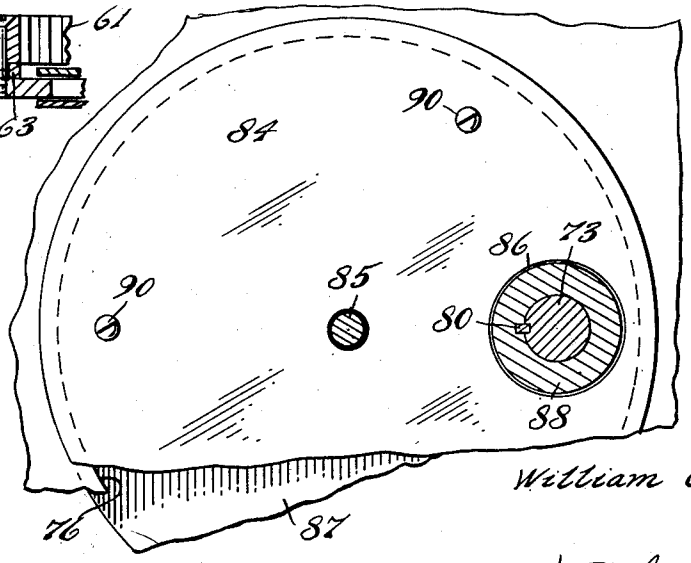


Fig. 5.



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2,776,512

ETCHING MACHINE

William Guenst, Elkins Park, Pa.

Application December 12, 1955, Serial No. 552,471

3 Claims. (Cl. 41—9)

The present invention relates to etching machines of the type which are useful in etching printing plates.

A purpose of the invention is to obtain more uniform and constant etching of a printing plate.

A further purpose is to provide a simpler and less expensive mechanism for manipulating a plate to be etched.

A further purpose is to turn a revolving work support by a planet and ring gear combination, the ring gear having a number of teeth not evenly divisible by the number of teeth in the planet gear so that the position of a given point on the work on successive cycles will be different throughout a number of cycles.

A further purpose is to provide a more effective closure adjoining the driving mechanism of the work support.

A further purpose is to permit the operator to shift the work carrier bodily with respect to the drive without releasing the work from the work carrier, so that the work carrier can be brought to a comfortable position for loading and unloading regardless of the position at which it comes to rest.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the numerous embodiments, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a top plan view of an etching machine according to the invention, partially broken away.

Figure 2 is a partially diagrammatic vertical section on the line 2—2 of Figure 1.

Figure 3 is an enlargement of the driving mechanism of the work support illustrated in plan, partly broken away to show the planet gear.

Figure 4 is a fragmentary section on the line 4—4 of Figure 3.

Figure 5 is a fragmentary section on the line 5—5 of Figure 4.

Figure 6 is a fragmentary section on the line 6—6 of Figure 3.

Figure 7 is a diagrammatic top plan view of a variation.

Describing in illustration but not in limitation and referring to the drawings:

In certain types of etching machines the work, suitably a printing plate, is manipulated by a drive mechanism and exposed to a stream of etchant, which may suitably be an acid. See my U. S. Patent No. 2,700,838, granted February 1, 1955, for Etching Machines.

Difficulty has been encountered in driving the work support by means which will avoid placing the same point of the plate at the same position on successive cycles. Accordingly nonuniformity in etching is likely to occur because the motion does not prevent nonuniform motion over a path of fluid distribution.

The present invention is designed to provide a simpler and more reliable mechanism which will move the work support in a nonrepetitive work path for at least several revolutions.

The invention also provides a simplified closure for the cover and prevents the possibility of leakage.

While it is not vital from the standpoint of the present invention as to whether the axis of the work support is vertical or horizontal, it is most convenient to illustrate the drive with the axis vertical.

Considering now the drawings in detail, I illustrate an etchant tank 20 having a bottom 21, ends 22 and 23, and sides 24 and 25.

The tank is divided by suitable vertical baffles 31 extending across the same and the space between the baffles is occupied by impeller shafts 32 which are journalled at the sides of the tank and driven from a motor 33, suitably beneath the tank, having multiple pulleys, by a series of belts 34, 35 and 36, each connecting to one of the motor pulleys and a pair of pulleys 37 on the impellers.

The top of the machine in the working space is closed by a cover 38 manipulated by a handle 40 and counterweighted by counterweight levers 41 pivoted on a shaft 42 which is journalled at 43 in the frame 44.

Mounted on the cover is a work support driving motor 45 which has a built-in speed reducer 46 adjusted by handle 47 and which produces its output by driving a sprocket 48 which meshes with chain 50 to drive a larger sprocket 51 which is loose on a shaft 52 journaled in antifriction bearings 53, 54 and 55. The shaft 52 is preferably located directly above a baffle 31. Bearing 53 is a thrust bearing mounted in a spider 56 which is secured by studs 57 on a spider 58 in turn secured by stud 60 to a ring gear 61 which is mounted by poles 62 through spacers 63 in the cover 38. Bearings 54 and 55 are secured in a tubular projection 64 on the spider 58 and are spaced by a sleeve 65.

A friction sleeve 49 surrounds shaft 52 above the sprocket 51 and engages the side of the sprocket under the pressure of helical compression spring 49' acting against retaining washer 53' seated against thrust bearing 53. A pin 52' through shaft 52 engages axial slot 52^2 in flange 49 to prevent the flange from turning with respect to the shaft.

The shaft 52 at the end adjoining the tank has a rotation arm 66 secured thereon by a key 67. The length of the arm 66 is preferably equal to the distance from the center baffle to the axis of the next paddle. The arm at its outer end carries a bearing housing 68 which mounts antifriction bearings 70 and 71 spaced by a sleeve 72. The antifriction bearings journal a planet stub shaft 73 and thrust bearing action is assured by a collar 74 at one end of the shaft and a washer 75.

The planet shaft 73 revolves in a suitably circular opening 76 in the cover plate and extends beneath the cover.

The planet shaft 73 has keyed thereon a planet gear 77 and also a flange 78, a common key 80 suitably being used. The flange 78 has secured thereto a work support 81 which is provided with clamping lugs 82 which hold a plate 73 to be etched, the active face of the plate being directed toward the interior of the tank.

The opening 76 in the cover is closed by a closure plate 84 on the top of the cover which extends out beyond the opening and has a central hole which engages an end extension 85 on the shaft 52. Closure plate 84 has a hole 86 through which the flange of the planet gear extends. A second closure plate 87 is positioned on the inner side of the cover and extends out beyond the opening 76 and likewise has a hole 88 through which the flange of the planet gear extends.

The two closure plates are held central by the engagement of one of them in the shaft extension 85 and they turn with the arm due to the fact that the flange of the hub of the gear passes through openings in the closure plates. The two closure plates are held together by bolts 90 at intervals which pass through spacers 91 between the closure plates.

The planet gear **77** continually meshes with the interior of the ring gear but on each successive revolution the planet gear does not hold the work support in the same position. To assure this the number of teeth on the ring gear is preferably not evenly divisible by the number of teeth on the planet gear. For example, in an individual case with 100 teeth on the ring gear the planet gear might have 42 teeth or a ratio of 50 to 21, so that on each successive revolution the angular position of the work holder will be different.

In operation, with the work suitably positioned on the work holder, the tank full of etchant and the etchant spraying against the work, the work holder is driven by the sprockets and chain, to rotate shaft **52**. This causes arm **66** to rotate revolving the planet gear, and turning planet shaft **73** due to the engagement between the planet gear and the stationary ring gear.

On each successive revolution, due to the uneven number of teeth, the work support is differently placed angularly at a given circumferential position so that the effect of the spray pattern of the impellers is evened out and uniform etching is obtained. The closure plates turning with the work holder prevent leakage through the opening in the cover, and any leakage which occurs through the inner closure plate still does not permit leakage through the outer closure plate, the etchant returning under the effect of gravity. It also will be evident that when the lid is raised, etchant which may adhere to the work support is not likely to run out on the top of the lid.

It will be evident that readjustment of the position of the work carrier to a convenient position for loading or unloading can be accomplished by the operator, who can simply turn the work carrier manually, overcoming the frictional drag exerted by the flange **49** against the sprocket **51**, and thus causing readjustment of the work carrier position without turning the motor and speed reducer.

A deflector plate is provided at **92** extending in a horseshoe formation around the interior of the lid to prevent the tendency of etchant from running out through the opening when the lid is raised.

Figure 7 illustrates a modification in which the shaft **52** mounts on its arm **66** a shaft **73** secured to the work holder **78**. The shaft **73** has keyed thereon a friction wheel **93**, suitably of rubber or nylon or metal which rides on and frictionally engages the internal surface of

a friction ring **94** suitably also of rubber or nylon or metal.

In operation, in the form of Figure 7, the wheel **93** performs the function of the planetary pinion and the ring **94** performs the function of the ring gear. It will be evident that there is an advantage in having the circumference of the friction wheel unevenly divisible into the internal circumference of the friction rim.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure and apparatus shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In an etching machine, a tank, a generally horizontal work carrier exposed on the interior of the tank, a first vertical shaft rotatably mounted and supporting the work carrier, an arm extending at right angles to the first shaft and revolvably supporting the first shaft, a second vertical shaft generally parallel to the first shaft, rotatably mounted and supporting the arm to rotate the arm, means for turning the second shaft, a planet gear on the first shaft, and a ring gear engaging the planet gear, whereby on rotation of the second shaft the arm turns, revolving the first shaft and revolving the work carrier, and as the first shaft revolves, the planet gear engages the ring gear and rotates the first shaft and the work carrier.

2. An etching machine of claim 1, in which the number of teeth on the ring gear is unevenly divisible by the number of teeth on the planet gear.

3. An etching machine of claim 1, in combination with a friction clutch interposed between the means for turning the second shaft and the second shaft and permitting shift of the work carrier position with respect to the driving means.

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