Feb. 10, 1970 TOMIYA YOSHIMATSU 3,494,815

APPARATUS FOR ETCHING A PRINTING PLATE

Filed July 22, 1966

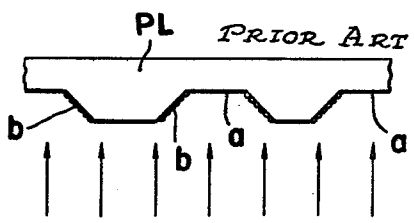


FIG. 1

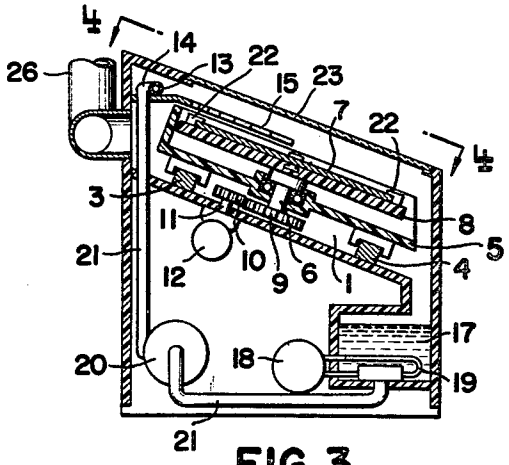


FIG. 3

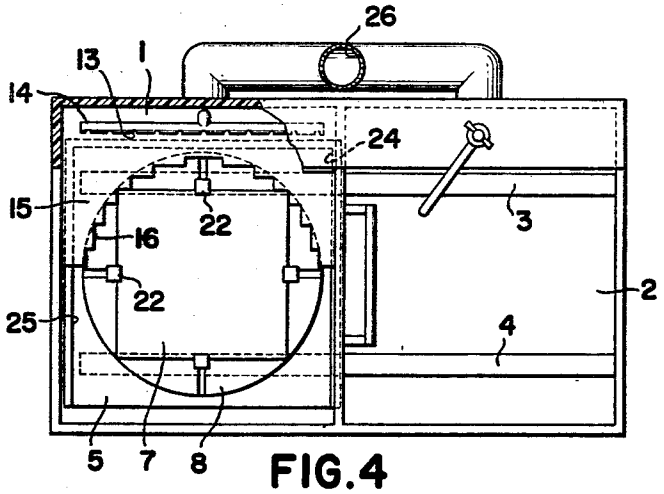


FIG. 4

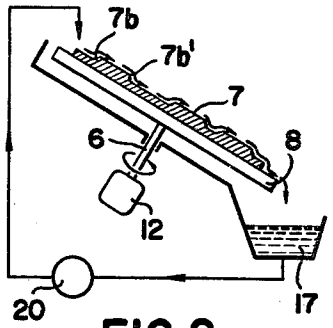


FIG. 2

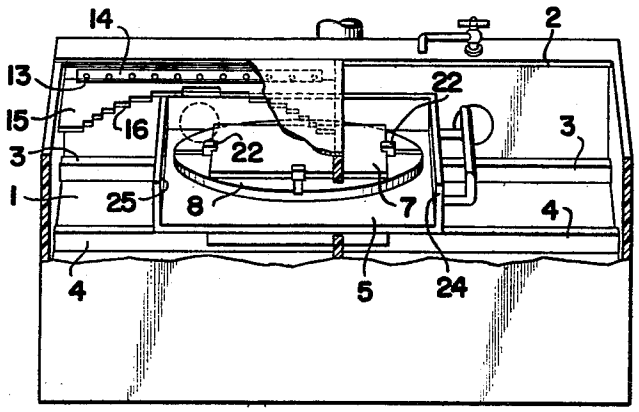


FIG. 5

United States Patent Office 3,494,815
Patented Feb. 10, 1970

3,494,815

APPARATUS FOR ETCHING A PRINTING PLATE

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Filed July 22, 1966, Ser. No. 567,249
Claims priority, application Japan, Dec. 27, 1965, 40/80,106
Int. Cl. C23f *1/02;* B41c *1/00*
U.S. Cl. 156—345 5 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for etching a metallic printing plate comprises a frame which is mounted on guide rails for travel between an etching tank and a washing tank, the frame carrying a disc which is supported on a tilted rotatable shaft such that the disc forms an angle with the horizontal. A printing plate is placed on the disc and is carried beneath a distributing plate in the etching tank such that etching solution which is discharged from an outlet, coextensive in length with the diameter of the disc and located above the plate, passes on the distributing plate and is uniformly distributed onto the printing plate and flows to the bottom of the etching tank where it is collected and recirculated to the outlet.

The present invention relates to an apparatus for making a metallic printing plate, more particularly to an apparatus for making a metallic printing plate wherein the plate is subject to etching operation in a horizontal position with its face directed upwardly.

In a conventional etching apparatus, such as the one used in a powderless etching process, a solution including nitric acid, a surface active agent and an oil is sprayed on a plate which is subject to an etching operation in a horizontal position having its face directed downwardly in the tank, the etching solution being applied upwardly to the plate by means of a paddle means or nozzle means which are located under the plate and which involves expensive equipment and is noisy in operation. Accordingly, it was not possible to monitor the operation in the tank, and a bulky, expensive paddle means, together with its actuating mechanism, has to be provided, and the etching tank must be sufficiently rigid to support the weight of the paddle means and must be sufficiently tight to prevent the etching solution from leading, thus making the construction complicated and costly.

This invention is adopted to overcome those disadvantages of the conventional device by applying etching solution to the plate, which is directed upwardly, without using any paddle means of rotating type.

The invention provides an apparatus for etching a printing plate, wherein the printing plate is supported on a rotating disc, which is rotatably mounted on a movable frame, with its surface inclined to the horizontal, and etching solution is applied downwardly on this printing plate by means of a circulating pump while rotating the printing plate at a constant speed.

According to the invention, the construction is simplified and the power consumption for operation thereof is substantially reduced by eliminating the paddle means

for spraying the etching solution against the printing plate, thereby reducing the construction and operation cost to a minimum.

In further accordance with the invention, the apparatus is adapted to be monitored during its operation through a transparent panel mounted on a top partion of the etching tank.

The apparatus according to the invention for etching a printing plate comprises an etching tank, a printing plate supporting disc rotatably mounted on a frame located within said etching tank and having a rotating shaft disposed at an angle with reference to the vertical, whch shaft is connected to a driving motor, an outlet means of etching solution including outlet openings having a length substantially equal to diameter of said supporting disc and located in a level substantially higher than highest portions thereof, a guide plate for spreading etching solution discharged from said outlet means uniformly over the printing plate secured on said disc, and a circulating pump for supplying etching solution to said outlet means.

Now, the preferred embodiment of this invention will be described in detail by way of examples with reference to accompanying drawings, in which:

FIG. 1 is a transverse sectional view on enlarged scale showing a printing plate subjected to a spraying operation according to the conventional process;

FIG. 2 is a schematic view showing the principle of the etching apparatus according to this invention;

FIG. 3 is a vertical sectional view showing one embodiment of this invention;

FIG. 4 is a top plan view taken along a line 4—4 of FIG. 3 and partly broken away and shown in section; and

FIG. 5 is a longitudinal elevation view of the embodiment partly broken away and in section.

Referring now to drawings, particularly FIG. 1, a printing plate PL is held in an etching tank with its surface to be etched directed downwardly and etching solution is applied onto this surface upwardly from the lower part of this etching tank in a conventional etching process. In the area *a* in FIG. 1, oil is separated from the etching solution the action of impingement on the plate and collects and remain in the sloped area *b* to insulate this area from etching operation.

Contrary to this conventional process, according to this invention, the metallic printing plate **7** is always held at an angle to the horizontal with its face directed upwardly and etching solution is applied on the printing plate downwardly while rotating said printing plate, as shown in FIG. 2.

Now, referring to FIGS. 3, 4 and 5, there is shown an embodiment of the apparatus according to the invention comprising an etching tank **1** provided with a washing tank **2**, which is disposed side by side with the former. Reference numerals **3** and **4** show horizontal guide rails bridging over both tanks. Numeral **5** designates a support frame adapted to run along rails **2**, **3**, and this frame **5** is mounted at an angle of 30 degrees relative to the horizontal as shown in FIG. 3. A tilted shaft **6** is rotatably mounted on this sloped support frame **5**. A support disc **8** is fixedly mounted on this shaft **6** at the top end thereof and is intended for supporting a metal-

lic printing plate 7 to be etched. A spur gear 9 is secured to shaft 6 at the lower end thereof. A pinion 10 is adapted to mesh with the spur gear 9 and is fixedly mounted on another shaft 11, which is connected to a driving motor 12 through a suitable reduction gear. An outlet means 13 having a length substantially equal to the diameter of the support disc 8 is disposed at an elevation higher than the highest portion of said disc 8. The outlet means 13 consists of a plurality of holes of considerable size perforated in a horizontal pipe 14 but it may be constituted as a single slit instead. Or a tray of suitable size may be provided at this location in such a manner as to permit etching solution contained therein to overflow toward the disc. A sloped guide or distributing plate 15 is located below the outlet means 13 and is extended to overlie the circular circumference of the disc 8 in the upper half thereof. The lower edge of this guide plate 15 delineates substantially an arc having a diameter slightly less than that of the disc 8, and is formed in saw-tooth configuration along said arc as seen in FIG. 4. A reservoir 17 for the etching solution is located in the lower part of this etching tank 1. A refrigerating system 18 having a cooling coil 19 is provided for maintaining the etching solution at a suitable temperature. A circulating pump 20 and a suction pipe 21 are also disposed in the bottom part of this tank 1.

The operation of the etching apparatus according to this invention will be described hereinbelow. A printing plate 7 is first secured on the support disc 8 by means of clamps 22 and then rotated together with the disc 8 about the axis of shaft 6 at a slow speed, e.g. 5 to 10 revolutions per minute, by means of driving motor 12.

Etching solution is conveyed by circulating pump 20 from the reservoir 17 and then delivered to the outlet means 13 to flow uniformly over the guide plate 15. Overflowing etching solution will be uniformly distributed onto the printing plate 7, which is rotating at a slow speed, from the lower edge 16 of said guide plate 15, and will flow along the printing surface of the plate 7 and drop into the reservoir 17. This process will be repeated until the operation is stopped.

In this manner, the solution flowing over the printing plate 7 will etch it in portions thereof not covered by acid-resisting films and flow away downwardly. When the solution, which consists of nitric acid, a surface active agent and an oil and which eliminates old-fashioned "dragon's blood," is used in the etching apparatus according to this invention, the etching solution will stay stagnantly at shoulder portions 7*b* in the upper side of stroke lines which have been produced as the etching operation proceeds and it will also stay stagnantly at shoulder portions 7*b'* in the lower side of stroke lines due to turbulent eddy flows (see FIG. 2). And this stagnant flow will produce a protective film consisting of oil ingredient over the stroke lines of the plate.

The etching solution is merely lifted up and caused to flow simply over the printing plate in the apparatus according to this invention, in contrast to conventional etching devices wherein the solution is splashed upwardly by means of rotating blades thereby utilizing only the vertical component of this velocity, or the solution is pressurized and sprayed upwardly through a small nozzle against gravity. For this reason, according to this invention, a small amount of pressure head will suffice and the necessary power will be much less than that used in the conventional devices. Since the printing plate is exposed to comparatively large amounts of flowing solution, it will be brought into contact with the solution much longer and the time required for effecting the etching operation will be much reduced, for instance, 20–30%, in comparison with that of the conventional devices.

Since the plate is rotating, it will be subjected to etching uniformly, instead of tending to be etched concentratedly in one particular direction.

Since the solution is not splashed but merely caused to flow in the apparatus according to this invention, the operation is carried out quietly and a transparent glass plate mounted on a top portion of this tank will not be stained with solution, thus enabling the etching operation to be observed satisfactorily. Further, there will be little or no solution suspended in the atmosphere, thus preventing the atmosphere in the plant from becoming polluted and no airtight sealing means need be provided on the etching device.

Since the tilted shaft 6 connected to the actuating motor 17 is journaled on support frame 5 and the support disc 8 is secured on this shaft 6 perpendicularly thereto, the angle of inclination of the disc 8 is maintained constant regardless of the rotation thereof, thereby assuring etching operation uniformly on the printing plate 7. Moreover, since the outlet opening 13 has a length substantially equal to the diameter of the disc 8 and is disposed in a level higher than the highest portion of the disc 8 to convey solution to the sloped guide plate 15 as described hereinabove, all of the etching solution flowing out of the outlet opening 13 will be directed properly onto the printing plate.

Further, since the support disc 8 is directed upwardly to support the weight of the printing plate, handling, such as securing, removing and changing, of the printing plate and construction of securing means is simplified.

Since the support disc 8 is adapted to rotate at a slow speed and a pump of small capacity, together with a driving motor of small horse power, will suffice, the whole apparatus becomes very compact.

When the frame 5 supporting the disc 8 is adapted to run laterally along guide rails 3, 4 as shown in FIGS. 3 and 4, the frame 5 will be moved into a washing tank 2 adjacent to the etching tank 1. Washing, securing, removing and replacing of the printing plate 7 will be carried out in this washing tank 2. Hence, there will be no need of opening and closing any cover, nor any danger of inhaling fumes produced in reservoir 17 of the etching solution.

Spur gears 9, 11 will be engaged or disengaged as the frame 5 is brought into the etching position or transferred into the washing tank 2. The weight of the frame 5 has been reduced by disposing the driving motor 12 out of the etching space.

In FIGS. 2, 3 and 4, 23 designates a transparent glass plate mounted on a top portion of the apparatus, 24 and 25 designates vertical walls respectively provided in both sides of the support frame 5, and 26 designates a vent.

What is claimed is:

1. Apparatus for etching a metallic printing plate comprising an etching tank and a washing tank disposed adjacent one another, guide rails between said tanks, a frame displaceably supported on said guide rails for travel between the etching tank and washing tank, a rotatable shaft supported on said frame and extending at an angle with respect to the vertical, a disc secured to said shaft for rotation therewith and adapted for supporting a printing plate thereon, means supported at a level above the disc for the discharge of etching solution, said means having an outlet extending a length substantially equal to the diameter of said disc and coextensive therewith, a distributing plate disposed beneath said outlet at a level between the disc and the outlet for uniformly distributing etching solution onto a printing plate on said disc, and means in said etching tank for collecting etching solution after it passes on said plate and for recirculating the solution to said outlet.

2. Apparatus as claimed in claim 1 comprising a transparent cover plate on said etching tank extending parallel to said disc.

3. Apparatus as claim in claim 1, wherein said distributing plate extends parallel to said disc.

4. Apparatus as claimed in claim 3, wherein said distributing plate has a saw-tooth edge configuration extend-

ing along an arc which is approximately coincident with the upper semicircular edge of the disc.

5. Apparatus as claimed in claim 4, wherein said means for the discharge of etching solution comprises a horizontal pipe, said outlet therein being constituted by a plurality of apertures.

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U.S. Cl. X.R.

134—33, 85, 89, 153; 156—14