June 26, 1962 F. R. LEAR, SR 3,040,754

ETCHING MACHINE

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Fig. 2.

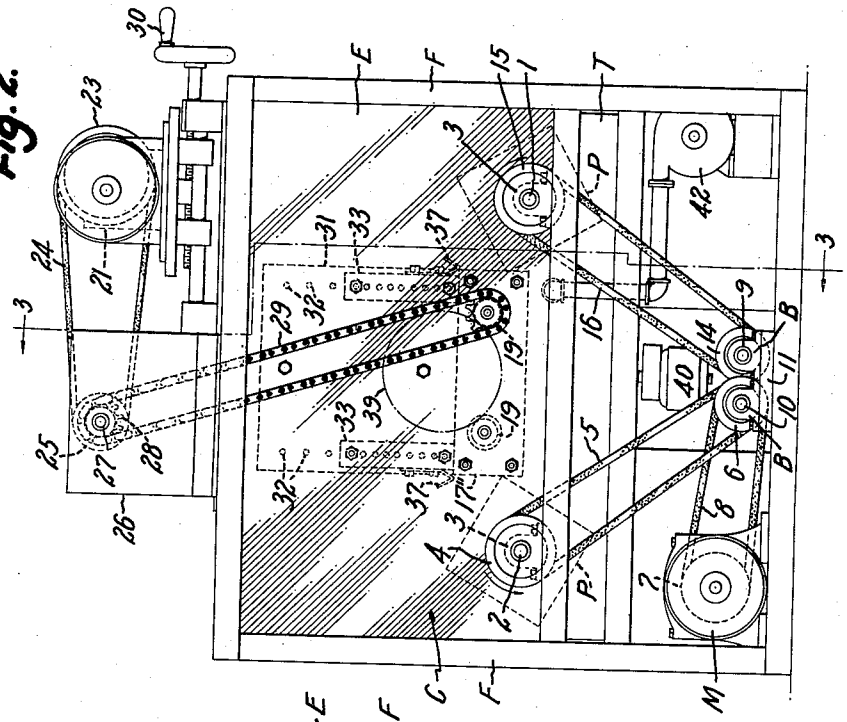

Fig. 1.

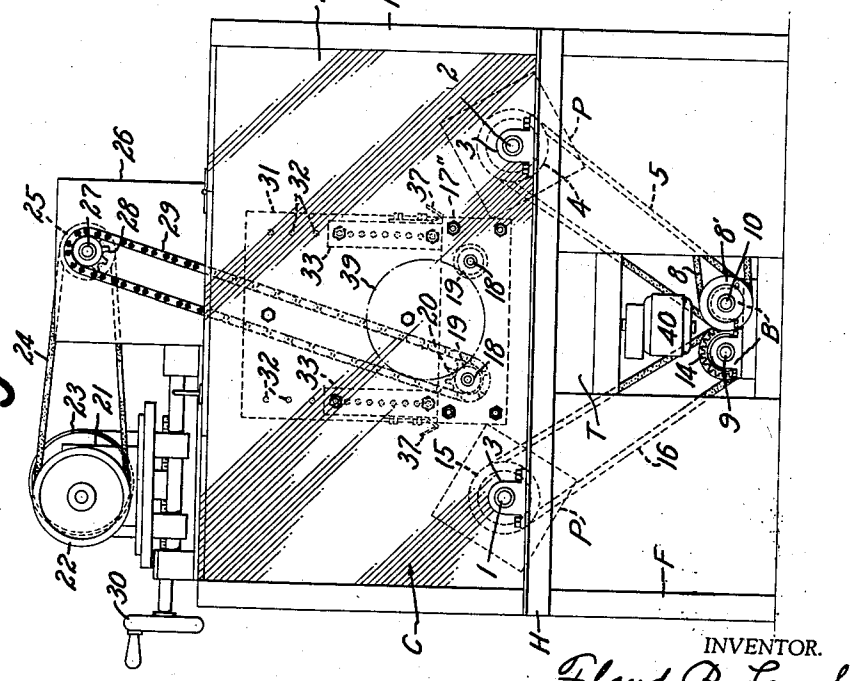

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Fig. 8.

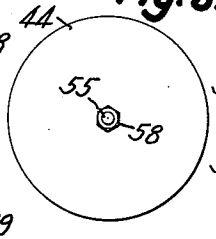


Fig. 7.

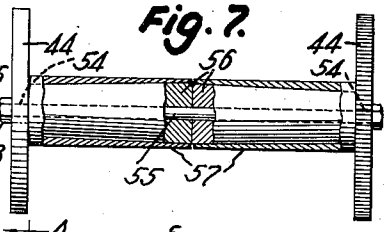


Fig. 3.

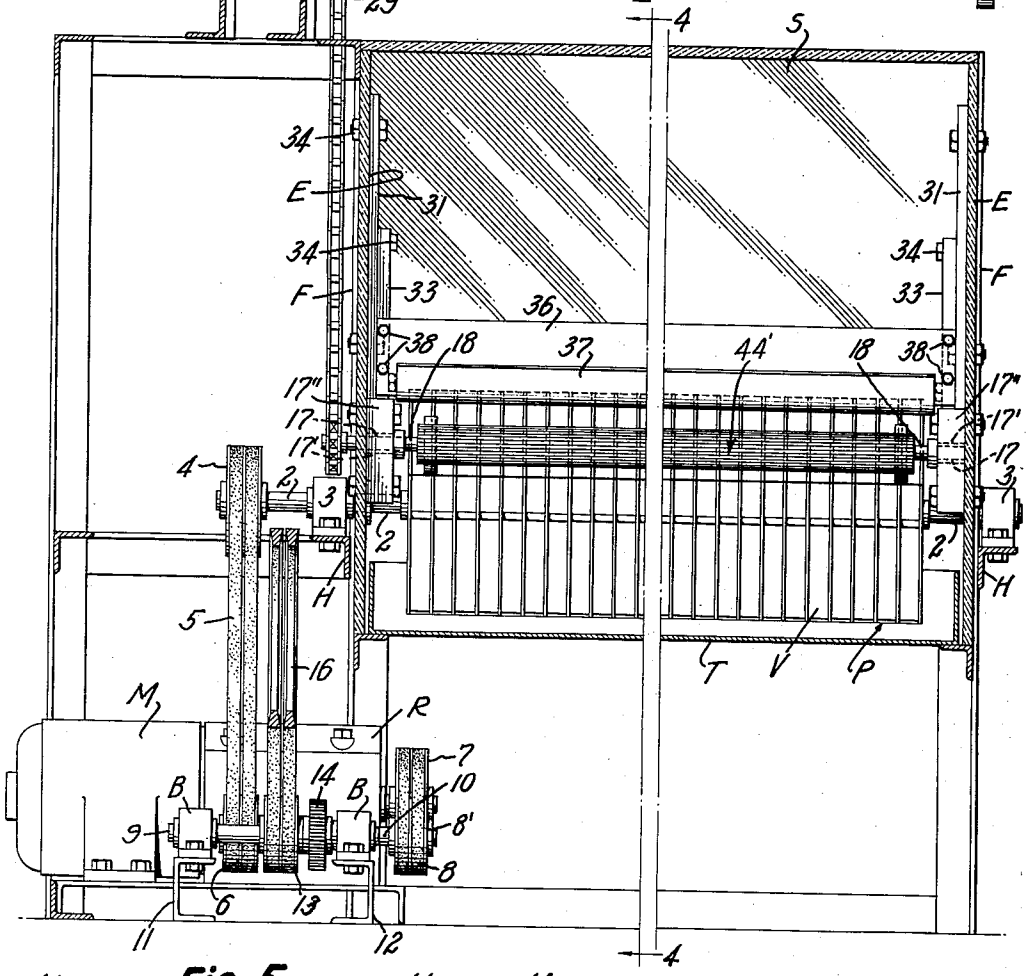
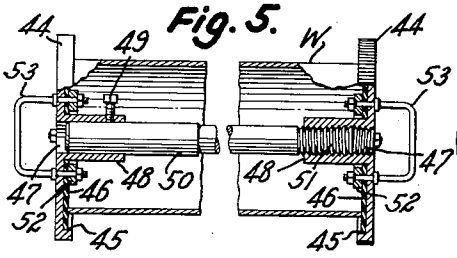


Fig. 5.



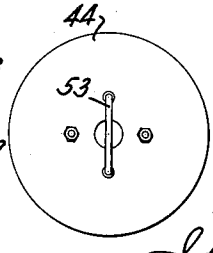


Fig. 6.

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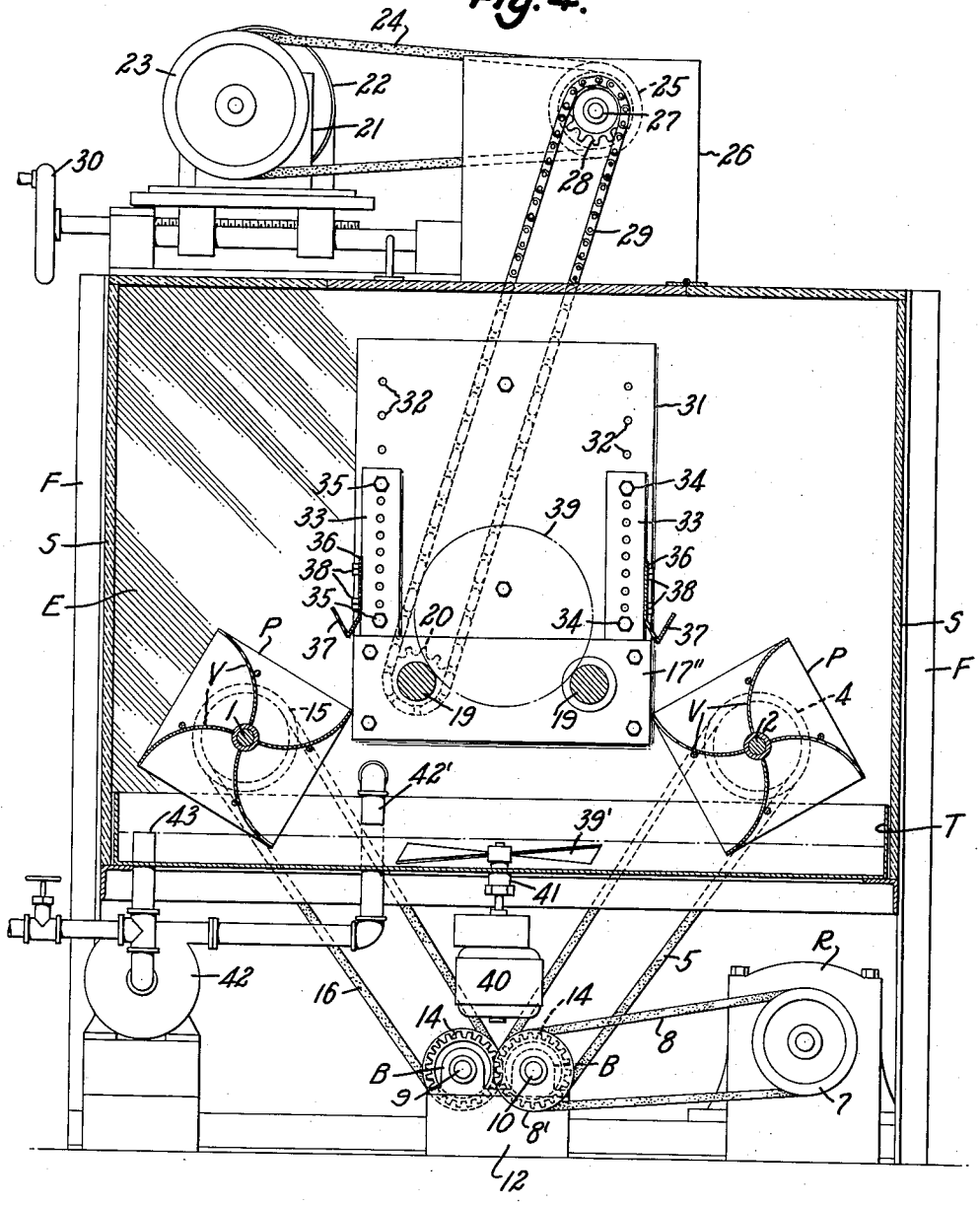
Fig. 4.



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United States Patent Office 3,040,754 Patented June 26, 1962

3,040,754

ETCHING MACHINE

Floyd R. Lear, Sr., Easton, Pa., assignor to Industrial Gravure Company, Easton, Pa., a corporation of Pennsylvania

Substituted for abandoned application Ser. No. 803,185, Mar. 31, 1959. This application Aug. 15, 1961, Ser. No. 131,685

6 Claims. (Cl. 134—147)

This invention relates to the art of etching rotogravure or letterpress printing cylinders or curved sections, and more particularly to an apparatus for etching wherein the cylinder or curved section to be etched is revolved about a horizontal axis in a receptacle or chamber, and wherein provision is made to control the flow of mordant to the cylindrical surface.

This application is a substitute for the parent application of Floyd R. Lear, Sr., filed March 31, 1959, Serial No. 803,185, and later abandoned.

It is common practice in photoengraving to prepare rotogravure or letterpress printing cylinders for etching by providing a cylinder having a polished metal surface mounted on a horizontally disposed shaft with the journals or trunnions mounted relatively axially at each end of the cylinder. By subsequently positioning such a cylinder on a suitable stand, as the support, with the journals held in bearings, and with, at least, one end of the shaft extending sufficiently far enough from the end thereof it may be associated with a means to revolve the cylinder during the etching operation.

At the present time, one of the more common methods of etching is to mount the cylinder previously referred to, in horizontal position over a sink adapted to collect the mordant as it drips from the cylinder. The cylinder may be revolved by any convenient means such as a hand-wheel attached to one end of the shaft extending therefrom or by means of a motor and a suitable reduction gear arrangement so that the cylinder may be rotated slowly in its bearing support. The etching composition is either poured over the cylinder or is applied by swabbing it on by hand and rubbing the cylinder as it revolves so as to apply the etching material to the surface of the cylinder as uniformly as possible.

As is well-known to those skilled in the art phototypesetting has immediate application in label work, large posters, cards, catalogues, children's books, books without excessive author's corrections, directories, newspaper ads, and work requiring much white space. The present inventor believes that in combination with fast etch magnesium, zinc, or copper of which he avails himself, phototypesetting will exert its influence upon letterpress as well as offset and gravure. Applicant has found that magnesium offers a superior lightweight letterpress plate that is very economical due to its rapid etching speed and the elimination of the need for powdering. He has also recognized that this development can provide the industry with a precision printing plate adaptable to direct printing or duplicate platemaking. In addition, applicant is of the firm belief that the use of curved magnesium plates or cylinders for direct printing might well usher in a new era of lightweight presses as a substitute for the cumbersome presses of today, and, therefore, this invention is a definite step forward in the graphic art industry.

As distinguished from etching cylinders, flat plates are also etched, but by a more common method. This is accomplished by utilizing an acid-proof receptacle to contain the mordant, with means being provided in the receptacle for supporting the plate or plates as well as a rotating liquid propelling means which is arranged in such a manner as to pick up the mordant during rotation and then throw it onto the plate or plates to be etched. A

variety of apparatus is disclosed in the patented art for accomplishing this type of etching operation. In one type of a device, that is well-known, the plates are arranged in a horizontal plane above the rotating liquid propelling means and in still another, a support, such as a ledge, is provided in a receptacle for holding the lower edge of the plate above the bath of mordant while the upper edge of the plate leans against one of the vertically disposed walls of the receptacle. A revolving liquid propelling means picks up the mordant from the tank and impels it against the inclined plates.

Although some of the machines of the type referred to have been accepted in the trade still others have been gradually improved over the years and it is thought that the present improvement in the arrangement of elements provides the ultimate in etching apparatus, particularly insofar as curved plates or segments and cylindrical elements are concerned.

The principal object of the present invention is to provide an improved means for positively driving horizontally spaced annular elements that are arranged to support the work element or elements to be etched.

Another object of the invention is to provide parallel deflecting means which are disposed adjacent to, but spaced from the axis of the elements to be etched so that the spray pattern of mordant applied to said elements may be controlled within certain limitations.

A further object of this invention is to provide an improved means for relative positioning of the elements to be etched with respect to their means of support which are revolubly mounted within the receptacle.

The details of the invention, as well as additional objects and advantages, will be clearly understood with reference to the embodiment illustrated in the accompanying drawings employing similar reference numerals to identify the same elements in each of the several views, and in which:

FIG. 1 is an elevational view of one end of the machine disclosing parts of the drive means in full and phantom lines;

FIG. 2 is an elevational view of the opposite end of the machine;

FIG. 3 is a cross-sectional view of the machine taken on line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view of the machine taken on line 4—4 of FIG. 3;

FIG. 5 is a sectional view of one type of work carrier;

FIG. 6 is an end view of the work carrier shown in FIG. 5;

FIG. 7 is a sectional view of a modified embodiment of another type of work carrier; and

FIG. 8 is a horizontal end view of the modified embodiment of the work carrier of FIG. 7.

With reference particularly to FIG. 1, it will be seen that the receptacle or chamber C within which the etching operation is conducted is supported above the floor at a predetermined distance by a framework comprising angle iron uprights, designated as F, and having horizontal members H, also including angle iron members secured thereto in any suitable manner, such as by welding, thereby forming a unitary structure. The chamber C is mounted within the aforementioned framework and includes side and end panels S and E, respectively, of a suitable material such as stainless steel capable of withstanding the action of the etching material. Conventional paddle means P—P of a well-known type and which include radiating vanes, such as indicated at V—V, are arranged to lift the mordant from the trough T and propel it toward the longitudinal center of the machine. (See FIGS. 1, 2 and 4.) The paddle means are provided with an elongated axially arranged shaft support indicated at 1 and 2, which projects through the end panels E of the

chamber, and, thence, into bearings 3—3 the bases of which are bolted into position on the horizontal members H at opposite ends of the framework. This is clearly shown in FIGS. 1, 2 and 3. As shown in the view of the machine illustrated in FIG. 3, the extreme left end of the shaft 2 is provided with a pair of pulleys 4 over which belts 5 are arranged to travel. The lower portion of the belts 5 are connected to pulleys 6 which are mounted and driven in a manner now to be described.

With reference at this time to FIG. 2, there is illustrated the end view of an electric motor M which is connected to a gear reduction unit R shown in FIG. 3. The shaft axes of both the motor and reduction unit are in substantially the same plane with the end of the shaft extending from the gear reduction unit being provided with a pair of pulleys 7. The pulleys 7 carry belts 8 which, as shown in the drawings in FIGS. 1, 2 and 4 extend toward the longitudinal center of the machine. Parallel shafts 9 and 10 are mounted in fixed bearings B—B which are supported in parallel transversely extending members 11 and 12. Interposed between the pulleys 8' and 13 and mounted on the shafts 9 and 10, respectively, are counter-rotating gears 14—14 which, when driven through the gear reduction unit, are arranged to rotate in opposite directions and consequently drive the paddles P—P through their pulleys 4 and 15, by means of belts, 5 and 16. As will be apparent to those skilled in the art, this organization of elements is one manner representative of accomplishing the end result of counter-rotation paddles to impel the etching material upon the work surface. Various other concepts probably will be manifest to those who work in this field of endeavor, and, therefore, this organization is not intended to be restrictive, but rather merely suggestive of one system.

As illustrated clearly in FIGS. 1, 2, 3 and 4 each of the end panels of the receptacle C has bearings 17—17 arranged within apertures 17'—17' of bearing plates 17''—17'' carried by the end panels E, the bearings being adapted to receive the offstanding ends of shafts 18—18 carried by the cylindrical work supporting elements 19—19. It is to be noted upon an examination of FIGS. 2 and 3 that the shaft of at least one of the cylindrical work supporting elements 19 is elongated sufficiently so that it may have attached thereto a sprocket 20, for a purpose now to be described.

With reference to FIGS. 1 and 4 it will be observed that a gear reduction unit, indicated generally at 21, and partially hidden by the pulleys 22 which are carried by the electric motor 23, is arranged to drive belts 24. The belts 24 in turn drive a pair of pulleys 25 which are hidden by the parallel vertically arranged plates 26—26 that provide bearing supports for the shaft 27. See FIG. 3. The shaft 27 has one elongated end which extends toward the receptacle which is provided with a sprocket 28. An endless chain 29 extends between the sprocket 20, which is carried on the shaft of the revoluble element 19 and sprocket 28 thereby driving the cylindrical element 19 at a predetermined suitable speed to accomplish a proper and uniform etching treatment. Indicated generally at 30 (FIG. 4), is a manually operable means which cooperates with suitable illustrated elements, for tensioning the belts which travel between the reduction unit and the shaft that drives the aforementioned chain and sprocket mechanism.

Referring again to FIG. 4, it will be observed that the end panel E has secured thereto a perforated plate member 31. Since each end panel of the chamber has a similar plate it will suffice to describe only one. The plate 31 is provided with a plurality of apertures 32—32 arranged in a vertical series adjacent to each edge thereof and is adapted to receive a pair of elongated perforated upstanding elements 33—33 that are juxtaposed relative to said plate 31. The upstanding elements 33—33 may be adjustably supported relative to the several series of apertures of said plate 31 by means of headed pins 34—34 and 35—35, respectively. The pins immediately referred to may be threaded if desired. Secured to said upstanding elongated elements 33—33 and extending longitudinally of the chamber are parallel baffles 36—36, the baffles being provided with trough shaped bottoms 37—37. Plural screw-threaded means 38—38 fasten the baffles to the upstanding elements 33—33, and it is immediately apparent that adjustability of these baffles may be achieved by raising or lowering elements 33—33, relative to said plates 31—31, by removing and re-positioning of the headed pins 34. Further, with reference to FIG. 4, it will be noted that the work carrier 39 is illustrated in phantom outlnie and shown supported on the cylindrical revoluble elements 19. During the normal operation of the machine, an additional advantage of the arrangement of parts is that, the cylindrical revoluble elements 19 act as a baffling means to control the amount of mordant permitted to reach the surface to be etched. Together with the aforesaid revoluble elements the baffles 36—36 control this flow to a reasonably fine degree. By careful planning and designing of the present machine it has been found that the etching operation takes place only at the area which revolves past and is exposed to the flow which passes between the surface of the revoluble elements 19—19 and the lower extremity of the trough 37. It will be manifest that the aforesaid troughs 37—37 will also serve to carry the mordant to the opposite ends of the chamber where it will be returned to the supply. An emulsifying propeller means 39' that is arranged in the trough T is set into operation by a suitable motor 40, the shaft of which extends upwardly through a conventional stuffing box 41. A mordant supply pump 42 is provided with an inlet pipe 42' and an overflow or eduction pipe 43 all of which are clearly shown in FIG. 4. It will be apparent that this construction will thereby provide a constant predetermined liquid level in the trough T.

In FIG. 5, there is shown one form of a work carrier which includes disc members 44—44 the surface of one of which is suitably milled, and, therefore, is complemental to the milling 44' provided on at least one of the surfaces of the revoluble cylindrical elements 19—19, which is illustrated in FIG. 3. The discs 44—44 are provided with annular confronting flanges 45—45 and disposed within each of said flanges are suitable resilient means 46—46 that provide a seal at each end of the work piece, indicated generally as W, upon the discs being assembled relative to said workpiece. As also shown in FIG. 5, the discs are axially apertured as at 47—47 and include collars 48—48. A set screw 49 is positioned transversely of one of the collars 48 (left end) and serves to fasten the shaft 50 relative to the disc 44. The opposite end of the shaft 50 is threaded at 51 and is complemental to the threaded collar 48. Suitable means such as an annulus 52—52 is provided adjacent to each of the aforesaid collars and secured thereto by bolting through the disc or otherwise. Handles such as those indicated at 53—53 and provided at the exterior surface of each of the discs are used to adjust the discs and thereby tighten them relatively to each other and to the workpiece interposed therebetween.

FIG. 6 is a horizontal end view of the work-carrier referred to in FIG. 5.

In FIG. 7, there is shown a modified embodiment of the work holding element shown in FIG. 5, which includes generally similar parallel discs. However, in the modification, each of the discs 44—44 is centrally apertured at 54—54 and adapted to receive an elongated bolt 55. The shank of the bolt is provided with a pair of tapered spools 56—56 the larger ends of which are juxtaposed. Before the spools are positioned on the shank of the bolt 55 the sleeves 57—57 are arranged thereon. It will be clearly shown from an examination of this figure that the sleeves also have tapered inside surfaces that are complemental to the spools. After one of the

discs and the bolt shank are associated the sleeves and spools are also slipped thereon and the second disc is secured to the threaded portion of the bolt by nut 58.

FIG. 8 is a horizontal end view of the modified embodiment of the work carrier of FIG. 7.

Although but one embodiment of the invention has been depicted and described, it will be apparent that this embodiment is illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an etching machine, means providing a chamber for entirely enclosing and confining a work-piece during the etching operation, rotatable work-piece supporting means in said chamber for revolubly supporting said work-piece and disposed in spaced relation with respect to the axis of rotation of said work-piece, means for imparting rotation to said work-piece through said rotatable means, means disposed below said rotatable means for containing a bath of etchant fluid, spaced paddle means disposed in revoluble proximity to said bath and adapted to propel the etchant fluid therefrom onto said work-piece, and means for supporting said work-piece out of direct contact with said rotatable means and horizontally between said spaced paddle means and above said bath of etchant fluid.

2. In an etching machine, means providing a chamber for entirely enclosing and confining the work-piece during the etching operation, rotatable work-piece supporting means in said chamber for revolubly supporting a work-piece and disposed in spaced parallelism with respect to the axis of rotation of said work-piece, means for imparting rotation to said rotatable means, means disposed below said rotatable means for containing a bath of etchant fluid, paddle means disposed in revoluble proximity to said bath and adapted to propel the etchant fluid therefrom onto said work-piece, and means for supporting said work-piece out of direct contact with said rotatable means and horizontally between said paddle means and above said bath of etchant fluid.

3. In an etching machine, as claimed in claim 2, wherein said means for supporting said rotatable work-piece out of direct contact with said rotatable means comprise separable annular elements.

4. In an etching machine as claimed in claim 3, wherein said rotatable work-piece supporting means disposed in spaced parallelism with respect to the axis of rotation of said work-piece comprise a pair of cylindrical elements at least one of which is driven and is arranged to support said work-piece by means of said separable annular elements above and out of contact with said cylindrical elements.

5. In an etching machine as claimed in claim 3, wherein at least one of said cylindrical elements is provided with means for imparting a positive drive to at least one of said separable annular elements supporting said work-piece.

6. In an etching machine, means providing a chamber for entirely enclosing and confining a work-piece during the etching operation, rotatable work-piece supporting means in said chamber for revolubly supporting said work-piece and disposed in spaced relation with respect to the axis of rotation of said work-piece, means for imparting rotation to said work-piece through said rotatable means, means disposed below said rotatable means for containing a bath of etchant fluid, paddle means disposed in revoluble proximity to said bath and adapted to propel the etchant fluid therefrom onto said work-piece, and means for supporting said work-piece out of direct contact with said rotatable means and horizontally spaced from said paddle means and above said bath of etchant fluid.

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