Sept. 11, 1956

A. K. ANANDER

2,762,151

ETCHING MACHINE

Filed March 30, 1955

2 Sheets-Sheet 1

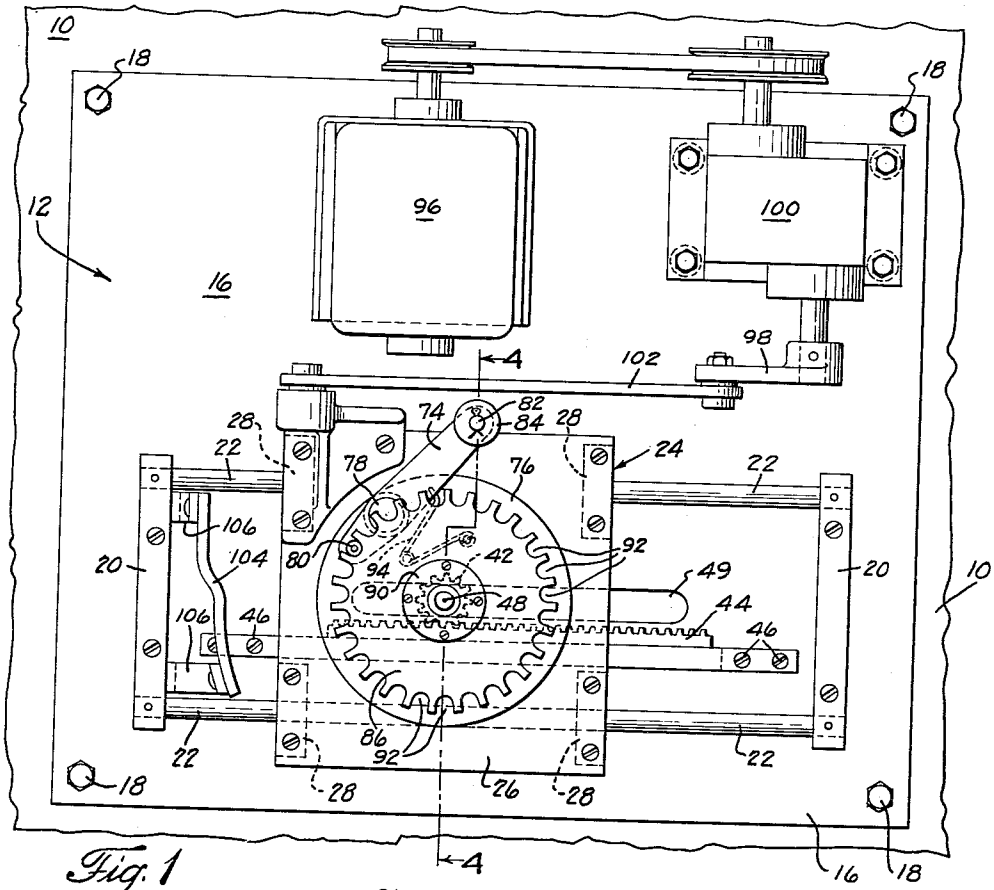


Fig. 1

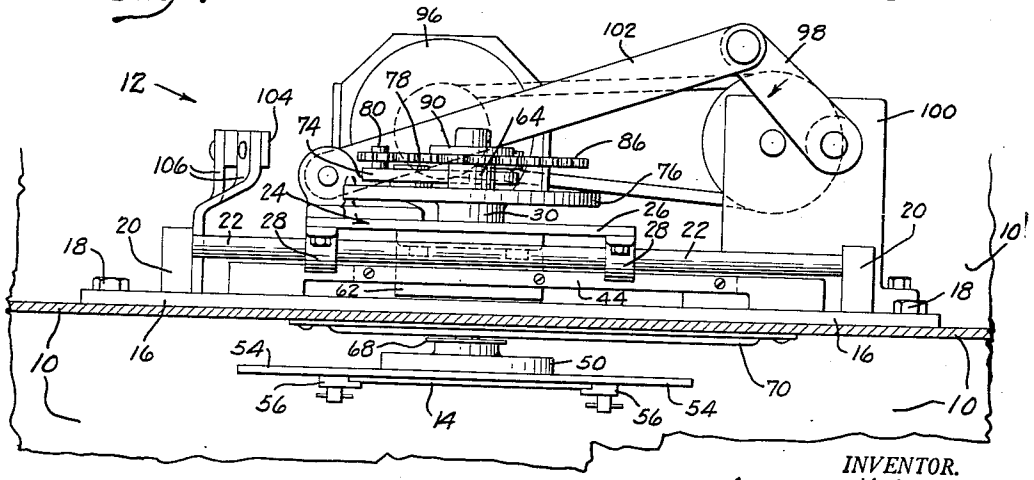


Fig. 2

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2 Sheets-Sheet 2

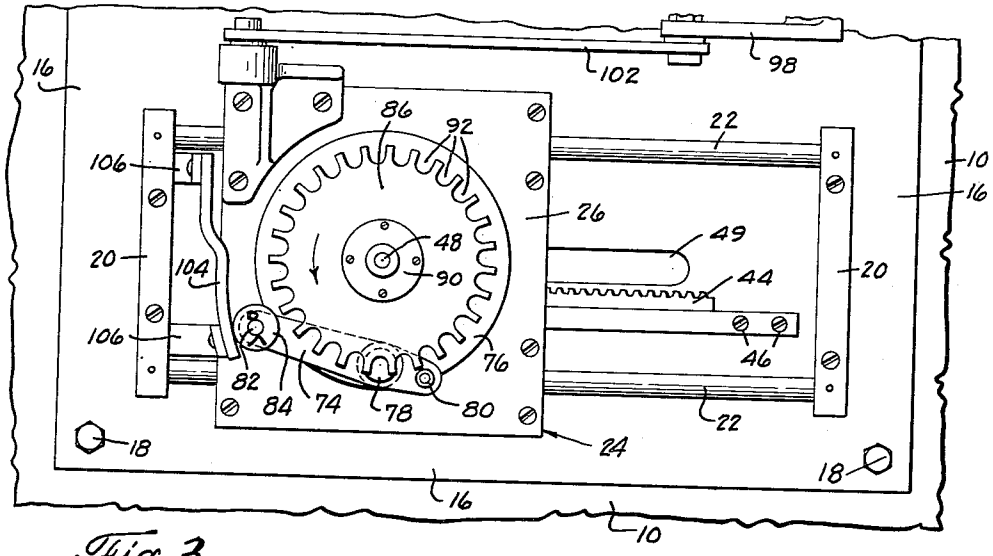


Fig. 3

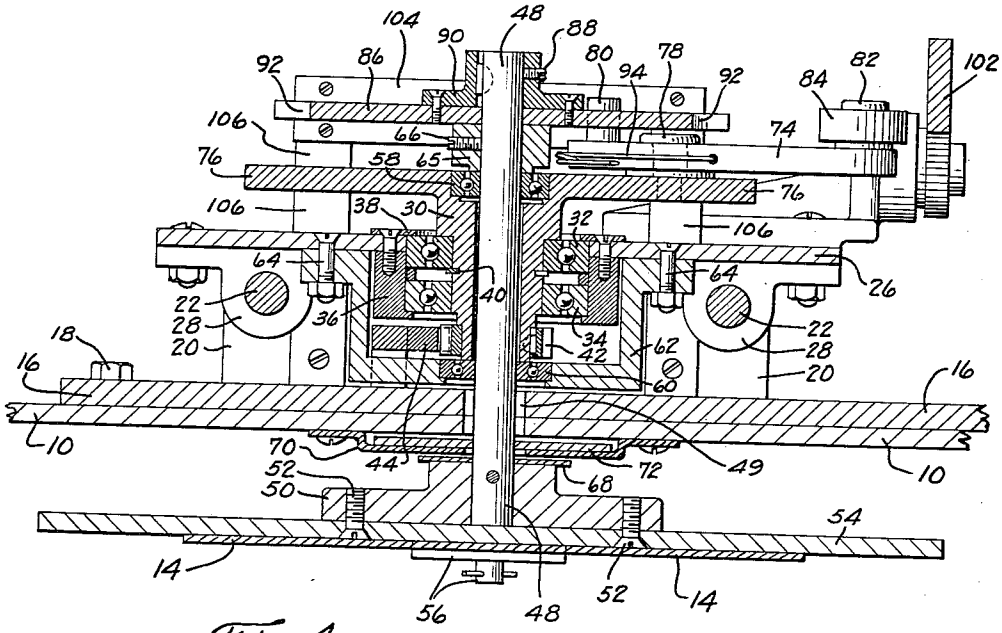


Fig. 4

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2,762,151

ETCHING MACHINE

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This invention relates to etching machines for etching printing plates and has specific reference to a machine wherein etching acid is continuously sprayed against the plate during the etching process and where a random motion is imparted to the plate to insure that the etching will be uniform.

Objects and advantages of the invention will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

In the drawings:

Figure 1 is a plan view of the etching machine of the present invention with portions of the machine being broken away and with the mechanism for imparting a random motion to the printing plate shown mounted on the machine;

Figure 2 is a side view of this mechanism for imparting a random motion to the printing plate shown in the same relative position as in Figure 1;

Figure 3 is a view somewhat similar to that of Figure 1 but showing the mechanism for imparting a random motion to the printing plate in another of its operative positions; and

Figure 4 is a sectional view taken generally along line 4—4 of Figure 1.

In etching machines of the type to which the present invention pertains, etching acid is contained in a housing or tank and is continuously sprayed by suitable mechanism against a printing plate introduced into the housing. In order to have uniform acid distribution and accordingly uniform etching of the printing plate it has been recognized that it is highly desirable to impart a random or chance motion to the plate during the etching process with this motion preferably being both reciprocatory and rotary and restricted to a plane generally normal to the direction of spray projection. There are several known etching machines for accomplishing this result of providing a random motion to the printing plate during the etching process such as those disclosed in United States Patent Nos. 2,669,048 and 2,700,838 issued to J. A. Easley et al. and W. Guenst, respectively. However, these prior art machines, while capable of performing the desired function, have certain inherent undesirable characteristics in that the construction thereof is such that they are susceptible to frequent breakdown or are otherwise not reliable in operation.

The present invention has for its object the provision of an improved etching machine of the type wherein during the etching process acid is continuously sprayed against the plate while the latter is moved in a random

or irregular fashion. Another object of the invention is to provide such an etching machine wherein the drive for imparting the random or irregular motion to the plate includes a clutch movable to and from its engaged position and actuated so as to produce the desired irregularity of motion. A further object of the invention is the provision of such an etching machine that is extremely rugged and highly reliable in operation yet is relatively simple in construction and economical to manufacture.

In accordance with the present invention the etching machine comprises a housing or tank upon the top or side of which is mounted mechanism effective to impart a random motion to a printing plate supported within the housing and having acid sprayed against the face to be etched by any suitable means. The plate is removably secured to a support member disposed on the end of a shaft that extends outwardly through a slot provided in the top or wall of the housing and which is carried at its outer end by a carriage in a manner permitting rotation of the shaft about its axis. This carriage is mounted on the etching machine in a manner so that it may be reciprocated longitudinally of this slot with continuous reciprocation of the carriage and accordingly of the shaft connected thereto being had through a motor driven drive including a crank and a connecting rod interconnecting the crank and the carriage. The shaft is rotatably driven in response to reciprocation of the carriage by a drive assembly which includes a drive sleeve telescoped over the outer end of the shaft in coaxial relation with the shaft and mounted on the carriage for rotation about its axis and relative to the shaft. Secured to the inner end of this sleeve is a pinion that is continuously intermeshed with a stationarily mounted toothed rack during reciprocation of the carriage so that the sleeve is rotated in response to reciprocation of the carriage. Mounted on the outer end of this drive sleeve is a positive acting clutch in the form of an elongated pawl pivoted intermediate its ends and pivotally movable between an engaged position where one end of the pawl engages an indexing plate secured to the outer end of the shaft to establish a positive connection between the shaft and the drive sleeve and a disengaged position where said pawl is free of said indexing plate allowing the shaft and printing plate to freely rotate relative to the drive sleeve. The pawl is biased to its engaged position and disposed in this position during a major portion of each reciprocation of the carriage but is moved to and retained in the disengaged position as the carriage approaches one end of its stroke with this pivotal movement being effected through the medium of a cam arranged to engage the end of the pawl and pivot it to its disengaged position thereby allowing the plate to freely rotate by its own inertia during a minor portion of each reciprocation of the carriage and establishing an irregularity or chance variation in motion pattern of the plate.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now to the drawings, wherein like reference numerals are used throughout to designate like elements, the illustrative and preferred embodiment of the invention shown therein comprises housing or tank **10**, only a fragmentary portion of which is shown, and which is adapted to contain a suitable etching fluid as well as suitable means for continuously spraying the fluid against the face of a printing plate that is to be etched, all as is well known in the art.

Mounted upon housing **10** is the mechanism **12** which supports printing plate **14** within the housing and imparts a random motion to the plate during the etching opera-

tion. While this mechanism is shown as mounted on the top or cover of the housing it may equally well be mounted upon a vertical or slanted wall of the housing so long as the acid spray impinges against the face of plate 14. The mechanism 12 comprises a base plate 16 overlying and secured to the top of housing 10 by cap screws 18 with spaced guide supports 20 being secured to this base plate and securely receiving the ends of guide rods 22 so as to support the same in spaced relation with base plate 16 and in spaced relation with each other. Mounted upon these guide rods for reciprocation along the rods is the carriage 24 which includes plate member 26 provided with slide blocks 28 secured to its under side and bored to slidably receive the guide rods 22 in the manner shown.

Journaled to plate member 26 and rotated in response to reciprocation of the carriage is the drive sleeve 30 which is mounted within the spaced bearing members 32 and 34 through the medium of retaining rings 36, 38 and 40 in a manner so that the sleeve may freely rotate about its axis but is restrained from movement in an axial direction. Rotation of drive sleeve 30 in response to reciprocation of carriage 24 along guide bars 22 is effected through the action of pinion 42 secured to the lower end of the sleeve and intermeshed with toothed rack 44 which is secured to base plate 16 by screws 46 or the like in parallel relation with the axis of reciprocation of the carriage.

Extending through and in coaxial spaced relation with drive sleeve 30 is the shaft 48 which passes through slot 49 in housing 10 and base plate 16 and has flange member 50 secured to its inner end. The printing plate 14 is supported within housing 10 during the etching process by support plate 54 which is secured to the inner face of flange member 50 by screws 52 with special clamp means 56 being provided to permit easy attachment and removal of the printing plate to and from the support plate. Shaft 48 is mounted for rotation about its axis through the medium of spaced bearings 58 and 60 with bearing 60 being mounted in an upwardly facing counterbore provided in bearing housing 62, which is secured to plate member 26 by means of bolts 64, while bearing member 58 is mounted within a counterbore provided in the upper end of drive sleeve 30. Downward movement of shaft 48 is prevented by thrust collar 65 which is secured to shaft 48 by set screw 66 and bears against the upper surface of bearing member 58 while upward movement of the shaft as well as leakage of acid spray from the interior of housing 10 along the shaft is prevented by baffle plate or ring member 68 which is positioned immediately below housing 70 secured to the underside of the top wall of tank 10 and within which housing is disposed floating ring 72 with this baffle plate, housing and ring forming a labyrinth which effectively prevents the escape of spray from within the tank or housing 10.

The shaft 48 and drive sleeve 30 are interconnected by a positively acting clutch mechanism that includes lever or pawl 74 which, through connecting member 78, is pivotally secured to flange 76 formed on the upper end of drive sleeve 30, with this pawl being provided with stud 80 on one end and stud 82 on the other and with this latter stud having roller 84 rotatably mounted thereon. Secured to the upper end of shaft 48, as by set screw 88 in flange member 90, is the indexing plate 86 which is provided with recesses 92 in its periphery for receipt of stud 80 in a manner to form a positive connection between drive sleeve 30 and shaft 48. The pawl 74 is pivotally movable to and from a position where stud 80 is in engagement with or received within one of the recesses 92 and a position where this stud is free of these recesses with spring 94 being effective to urge the pawl into its engaged position and with these two operative positioned of the pawl being indicated by the representations of Figures 1 and 3, respectively.

During the etching process, at which time acid is continuously sprayed against the surface of plate 14, carriage 24 is reciprocated through a predetermined amplitude by motor 96 which drives crank 98 through speed reducer 100 with crank 98 being interconnected wtih carriage 24 by connecting rod 102. In response to this reciprocating of the carriage drive sleeve 30 is rotated through the action of rack 44 and pinion 42 with this rotational movement being imparted to shaft 48 when the clutch is in its engaged position, i. e., when stud 80 of pawl 74 is received within one of the recesses 92 in indexing plate 86.

As carriage 24 approaches one end of its stroke or one end of its reciprocal movement roller 84 contacts the cam or striker plate 104 which is secured to the guide support 20 by brackets 106 with this cam or striker plate being arranged to thereby pivot pawl 74 to its disengaged position against the biasing force of spring 94 resulting in disconnecting drive sleeve 30 from shaft 48 and permitting the shaft to rotate relative to the drive sleeve. Cam 104 is preferably arranged so that pawl 74 is moved to its disengaged position a short distance prior to carriage 24 reaching the end of its stroke and retains the pawl in its disengaged position until the carriage has reached this same distance on its return movement. Thus as the pawl is moved to its disengaged position shaft 48 is being driven by drive sleeve 30 and upon being disconnected from the drive sleeve through this movement of pawl 74 to its disengaged position the shaft together with printing plate 14 will continue to rotate by means of their own inertia and will thus rotate relative to drive sleeve 30 which will be completely stopped upon carriage 24 reaching the end of its stroke and rotated in the opposite direction in response to the return movement of the carriage prior to re-engagement of pawl 74. Thus during the period that cam 104 is effective to move and retain pawl 74 in its disengaged position substantial relative movement between shaft 48 and drive sleeve 30 will occur resulting in a chance or random motion pattern being established for plate 14.

Since carriage 24 is driven through a crank and connecting rod drive mechanism the linear velocity of the carriage which determines the rotational velocity of drive sleeve 30 will be greatest at its centermost position intermediate the ends of its stroke with this velocity decreasing as the distance from this centermost position increases and becoming zero at the end of the stroke. Thus, by moving pawl 74 to its disengaged position through the medium of cam 104 just prior to carriage 24 reaching the end of its stroke the rotational velocity of drive sleeve 30 and accordingly shaft 48 is relatively low so that the reactionary forces set up incident to re-engagement of the pawl are not excessive and do not detrimentally effect the operating mechanism.

It will thus be seen that with the present invention there is provided an etching machine wherein a random motion is imparted to the printing plate during the etching process with the drive mechanism for effecting this random motion being of simple construction and highly reliable in its operation.

The invention in its broader aspects is not limited to the specific mechanism shown and described but departures may be made therefrom, within the scope of the accompanying claims, without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. In an etching machine of the type wherein the etching acid is continuously sprayed against the plate to be etched, the combination of a carriage, means operative to reciprocate said carriage through a predetermined amplitude, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to effect positive rotation of said shaft in response to reciprocation of said carriage, said means including a positive acting clutch normally disposed in its engaged position but moved to and re-

tained in its disengaged position during a portion of the reciprocal movement of said carriage.

2. The organization of claim 1 wherein the clutch is spring biased to the engaged position and moved to and retained in the disengaged position through the action of a cam and cam follower.

3. The organization of claim 1 wherein the clutch comprises a pivotally mounted pawl spring biased to the engaged position and wherein there is provided stationary means adapted to engage a portion of said pawl and pivot the same to and retain it in its disengaged position during said portion of the reciprocal movement of the carriage.

4. In an etching machine where etching acid is continuously sprayed against the plate to be etched during the etching process and a random motion is imparted to said plate during said process, the combination of a mounting member upon which is reciprocably mounted a carriage, means operative to reciprocate said carriage through a predetermined amplitude, shaft means carried by said carriage and journaled thereto for rotation about its axis, said shaft means carrying a mounting for said plate at one end thereof, means operative to rotate said shaft in response to reciprocation of said carriage, said means including a clutch having an engaged and a disengaged position and effective when in the disengaged position to prevent said last named means from rotating said shaft and permit said shaft to freely rotate relative thereto by its own inertia, and means effective to operate said clutch to retain it in its engaged position during a major portion of each reciprocation of said carriage and move it to and retain it in the disengaged position during the remainder of each reciprocation.

5. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, means connected to said carriage to continuously reciprocate the same, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and having connected thereto a support for a plate to be etched, a member rotatably journaled to said carriage and rotated in response to reciprocation of said carriage, positive acting clutch means effective when in the engaged position to positively connect said shaft to said member for rotation therewith and when in the disengaged position to render said shaft free of said member so that said shaft may freely rotate by its own inertia, said clutch being biased to and retain the same in the disengaged position during the remainder of each reciprocation.

6. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, means connected to said carriage to continuously reciprocate the same, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and having connected thereto a support for a plate to be etched, a member rotatably journaled to said carriage and rotated in response to reciprocation of said carriage, positive acting clutch means effective when in the engaged position to positively connect said shaft to said member for rotation therewith and when in the disengaged position to render said shaft free of said member so that said shaft may freely rotate by its own inertia, said clutch including means pivotally mounted on said member for rotation therewith and movable between a first position wherein said clutch occupies its engaged position and a second position wherein said clutch occupies its disengaged position, said pivotally mounted means being biased to said first position and means effective to move said pivotally mounted means to said second position during a minor portion of each reciprocal movement of said carriage.

7. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, means connected to said carriage to continuously reciprocate the same, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and having connected thereto a support for a plate to be etched, a member rotatably journaled to said carriage and rotated in response to reciprocation of said carriage, positive acting clutch means effective when in the engaged position to positively connect said shaft to said member for rotation therewith and when in the disengaged position to render said shaft free of said member so that said shaft may freely rotate by its own inertia, said clutch including means pivotally mounted on said member for rotation therewith and movable between a first position wherein said clutch occupies its engaged position and a second position wherein said clutch occupies its disengaged position, said pivotally mounted means being biased to said first position a cam mounted on said machine in a manner to be engaged by a portion of said pivotally mounted means and effective to move said pivotally mounted means to said second position during a minor portion of each reciprocal movement of said carriage.

8. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, means connected to said carriage to continuously reciprocate the same, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and having connected thereto a support for a plate to be etched, a member rotatably journaled to said carriage, a rack and pinion establishing a continuous drive for said member in response to reciprocation of said carriage with said rack being mounted on said machine parallel with the axis of reciprocation of the carriage and the pinion being secured to said member, a clutch constructed and arranged to interconnect said member and said shaft to cause said shaft to rotate in response to rotation of said member when the clutch is in the engaged position while permitting unrestricted relative rotational movement between the two when in the disengaged position and means for operating said clutch effective to retain it in the engaged position for a major portion of each reciprocation of said carriage and to move it to and retain it in the disengaged position for the remainder of each reciprocation.

9. The combination defined in claim 8 wherein said clutch is positive acting and comprises an indexing plate secured to said shaft and having recesses provided therein, a pawl pivotally mounted on said member with means engageable in said recesses, said pawl being pivotally movable to and from a position where said means is in its engaged position and a position where said means is free of said recess and resilient means biasing said pawl to the engaged position.

10. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, means connected to said carriage to continuously reciprocate the same, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and having connected thereto a support for a plate to be etched, a member rotatably journaled to said carriage, a rack and pinion establishing a continuous drive for said member in response to reciprocation of said carriage with said rack being mounted on said machine parallel with the axis of reciprocation of said carriage and the pinion being secured to said member, a clutch constructed and arranged to interconnect said member and said shaft to cause said shaft to rotate in response to rotation of said member when the clutch is in the engaged position while permitting unrestricted relative rotational movement between the two when in the disengaged position, said clutch including means pivotally mounted on said member for rotation therewith and movable between a first position wherein said clutch occupies its engaged position and a second position wherein said clutch occupies its disengaged position, said pivotally mounted means being biased to said first position, cam means mounted on said machine generally at the location of one end of the reciprocal

movement of said carriage and constructed and arranged to engage said pivotally mounted means as the carriage approaches said end of its reciprocal movement and move the same to and retain it in said second position prior to and during the reversal of movement of said carriage at said end of its reciprocal movement.

11. The etching machine of claim 10 wherein the means for reciprocating the carriage comprises a motor driven crank connected to said carriage through a connecting rod.

12. In an etching machine wherein etching acid is continuously sprayed against the plate to be etched, a mounting for the plate operative to impart a random motion to said plate during the etching process and comprising carriage means reciprocated through a predetermined amplitude, a drive sleeve mounted on said carriage for rotation about its axis and rotatively driven in response to the reciprocal movement of said carriage, a shaft disposed coaxial with and extending through said sleeve, said shaft being mounted on said carriage for rotation about its axis and relative to said sleeve, a positive acting clutch interposed between said shaft and said drive sleeve and effective when in the engaged position to positively interconnect said shaft to said drive sleeve for rotation therewith and effective when in the disengaged position to free said shaft from said drive sleeve and permit the same to freely rotate relative thereto by its own inertia, said clutch being biased to its engaged position and means operative to move said clutch to and retain it in the disengaged position during a minor portion of each reciprocation of the carriage.

13. An etching machine of the type wherein etching acid is continuously sprayed against a plate and including a mounting for the plate operative to impart a random motion to said plate during the etching process, said mounting comprising carriage means reciprocated through a predetermined amplitude, a drive sleeve carried by and journaled to said carriage for rotation about its axis, a rack and pinion establishing a positive drive for said sleeve for rotation of the same in response to reciprocation of said carriage with said rack being parallel with the axis of said reciprocation and secured to said machine and with said pinion being integral with said sleeve, a shaft disposed coaxial with and extending through said sleeve with shaft extending into said machine and carrying a support for the plate to be etched, said shaft being mounted on said carriage for rotation about its axis and relative to said sleeve, positive acting clutch means interposed between said shaft and said drive sleeve and effective when in the engaged position to positively interconnect said shaft to said drive sleeve for rotation therewith and effective when in the disengaged position to free said shaft from said drive sleeve and permit the same to freely rotate relative thereto by its own inertia, said clutch means including a pawl pivotally mounted on said sleeve and pivotally movable between first and second positions wherein said clutch is respectively engaged and disengaged, resilient means biasing said pawl to said first position, and cam means secured to said machine and effective to move and retain said pawl in said second position during a minor portion of each reciprocal movement of said carriage.

14. An etching machine as defined in claim 13 wherein the cam is positioned adjacent one end of the stroke of said carriage and is effective to engage the pawl and move it to said second position prior to said carriage reaching this end of its stroke and release said pawl permitting it to move to said one position after said carriage has reached this end of its stroke and is moving away therefrom.

15. An etching machine as defined in claim 14 wherein said carriage means is reciprocated through a motor drive crank interconnected with said carriage by means of a connecting rod.

16. An etching machine of the type wherein acid is continuously sprayed against the plate to be etched during the etching process and a random motion is continuously imparted to said plate during said process, said machine comprising a carriage mounted for reciprocation, means operative to reciprocate said carriage through a predetermined amplitude, a drive sleeve carried by and journaled to said carriage for rotation about its axis, said sleeve having a flange at one end and a pinion at the other end, a toothed rack secured to said machine and intermeshed with said pinion throughout the reciprocal movement of said carriage whereby said sleeve is rotated in response to reciprocation of said carriage, a shaft disposed coaxial with and extending through said sleeve with said shaft extending into said machine and carrying a support for the plate to be etched, said shaft being mounted on said carriage for rotation about its axis and relative to said sleeve, positive acting clutch means interposed between said shaft and said drive sleeve and effective when in the engaged position to positively interconnect said shaft to said drive sleeve for rotation therewith and effective when in the disengaged position to free said shaft from said drive sleeve and permit the same to freely rotate relative thereto by its own inertia, said clutch means including an elongated pawl pivotally mounted on the flange of said sleeve intermediate its ends, a circular indexing plate secured to and coaxial with said shaft in spaced overlying relation with said flange and having circumferentially spaced recesses provided in its periphery, said pawl being provided with means adjacent one of its ends for engagement with said recesses providing a positive connection between said drive sleeve and said shaft, said pawl being pivotally movable between a position where said means is in engagement with said recesses and a position where said means is free of said recesses, resilient means biasing said pawl to the engaged position and cam means constructed and arranged to engage the other end of said pawl and pivot the same to and retain it in the disengaged position during a minor portion of each reciprocation of said carriage.

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