Oct. 28, 1958 N. C. SCHUTT ET AL 2,857,697

ETCHING MACHINE

Filed June 16, 1955 3 Sheets-Sheet 1

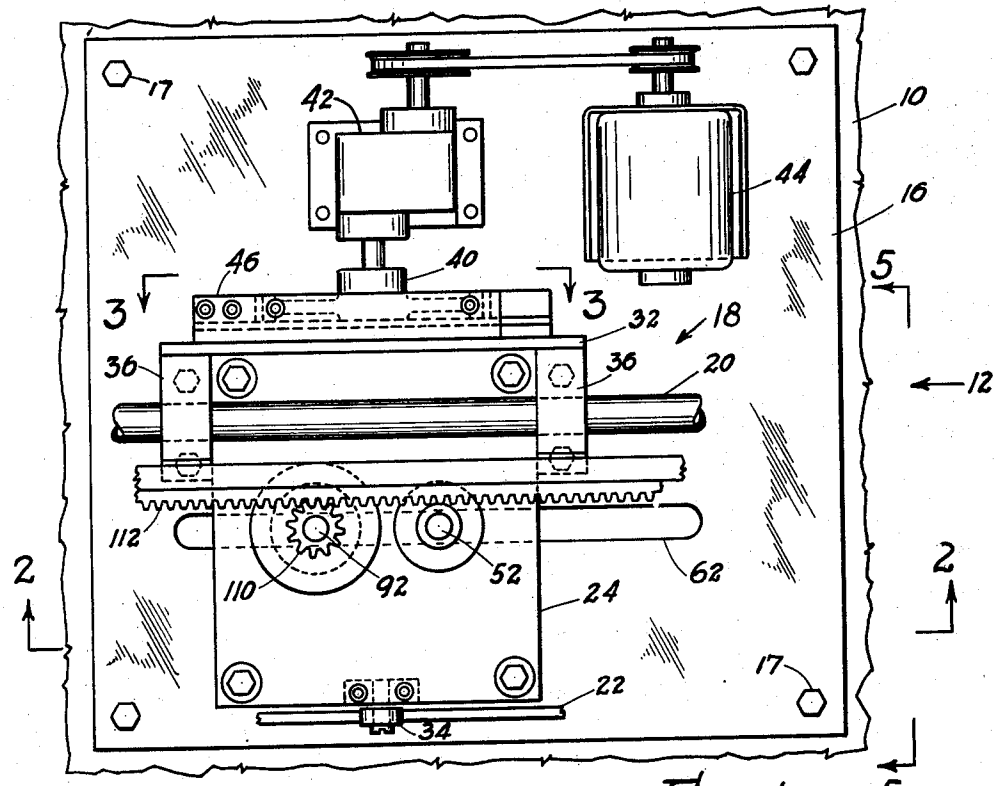


FIG. 1

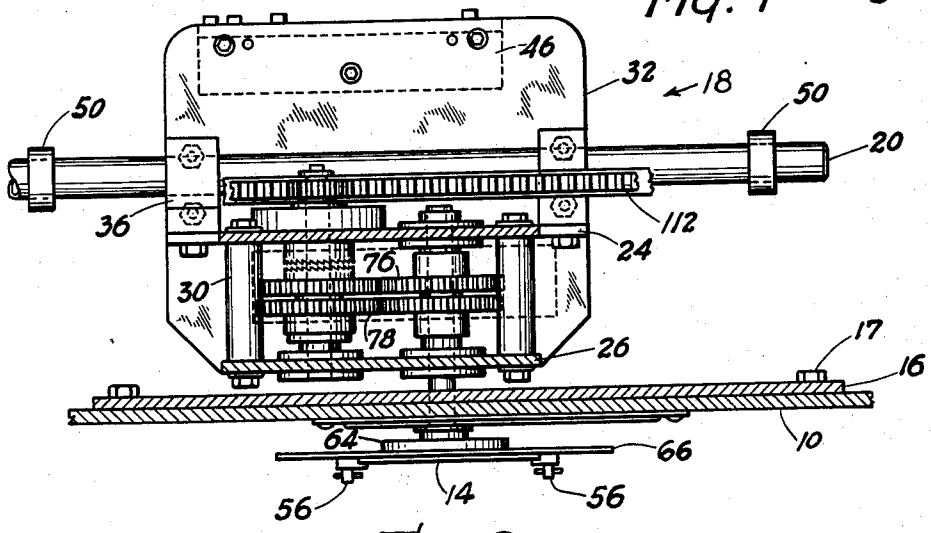


FIG. 2

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ETCHING MACHINE

Filed June 16, 1955 3 Sheets-Sheet 2

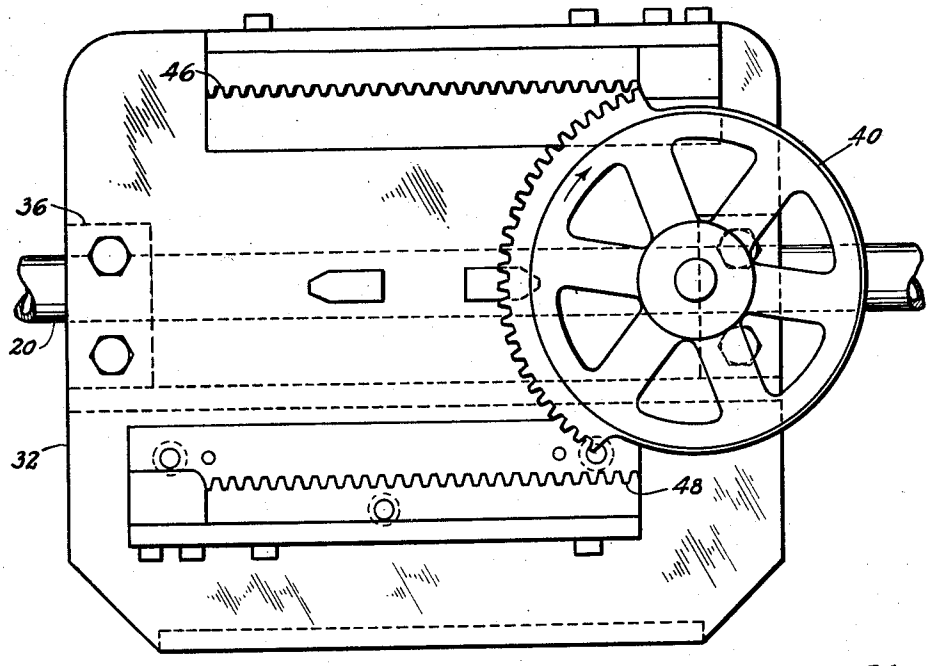


FIG. 3

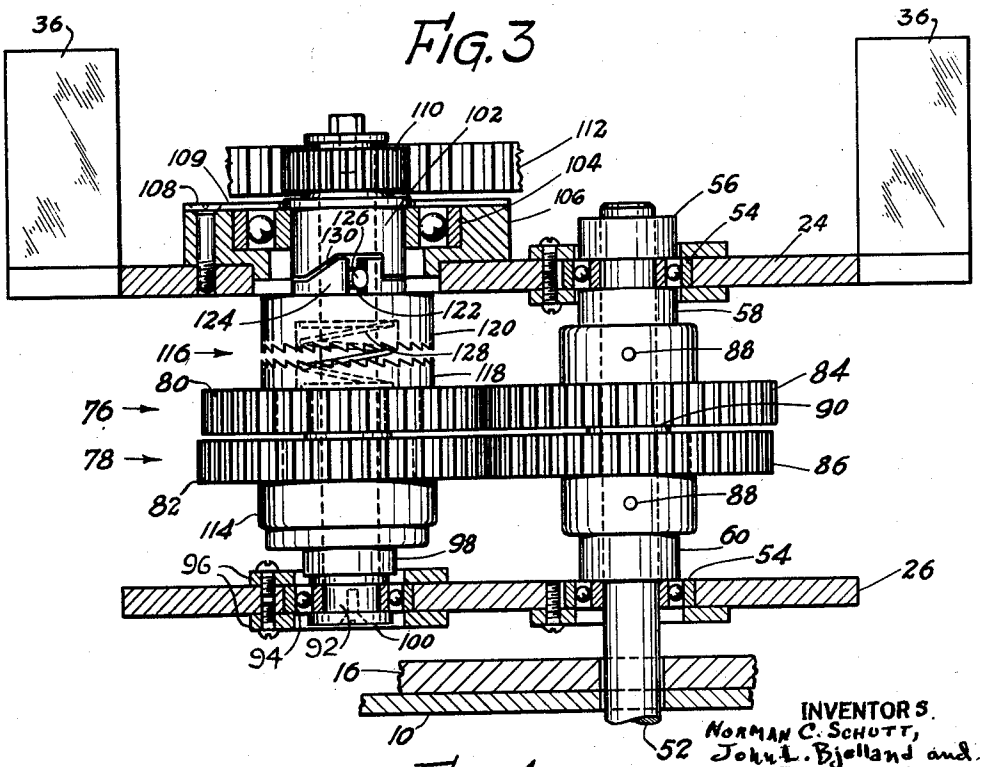


FIG. 4

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ETCHING MACHINE

Filed June 16, 1955 3 Sheets-Sheet 3

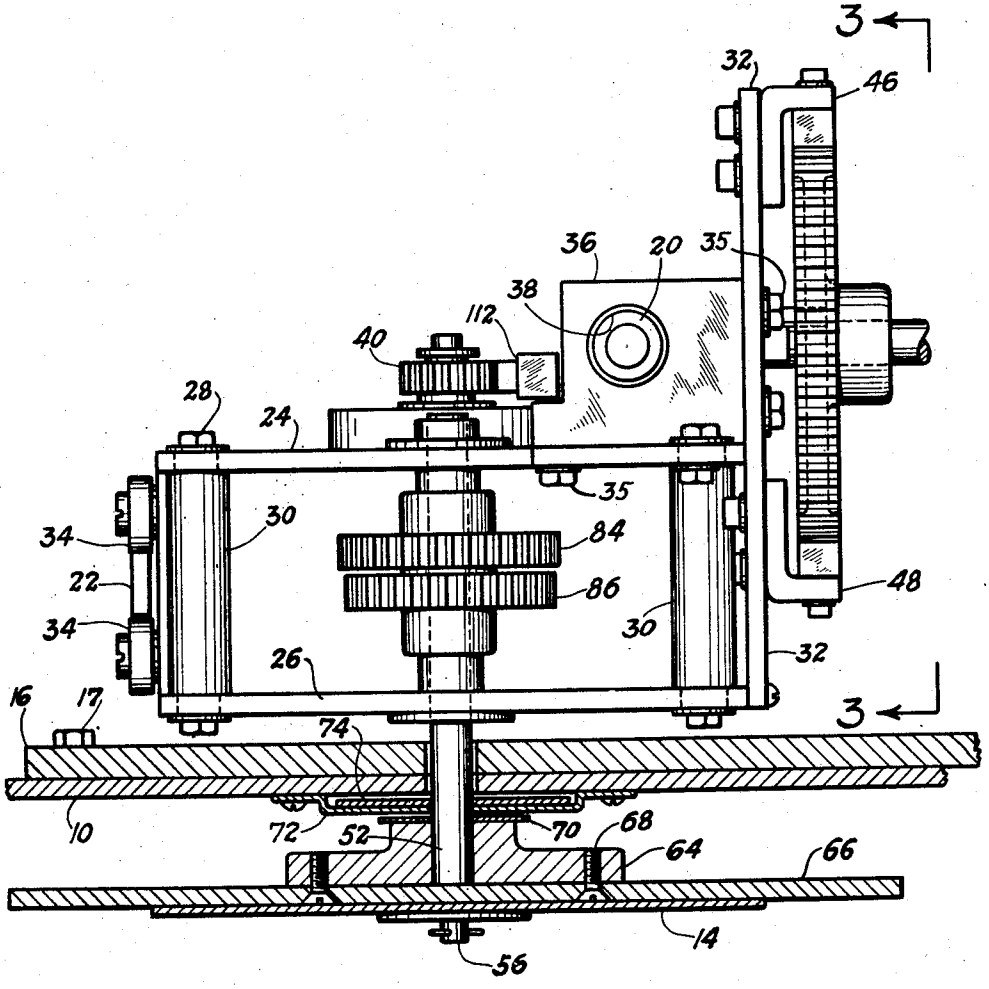


FIG. 5

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2,857,697

ETCHING MACHINE

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Application June 16, 1955, Serial No. 515,956

17 Claims. (Cl. 41—9)

This invention relates to etching machines for etching printing plates and the like and has specific reference to a machine wherein etching acid is continuously sprayed against the plate during the etching process and where an irregular motion is imparted to the plate during this process to insure that the etching will be uniform throughout the entire area of the plate.

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 an irregular motion to the printing plate shown mounted on top of the machine.

Figure 2 is a sectional view of this mechanism for imparting an irregular motion to the printing plate and is taken generally along line 2—2 of Figure 1.

Figure 3 is a rear view of the carriage which forms a part of this mechanism with this view being taken generally from line 3—3 of Figures 1 and 5 and showing in detail the sector gear drive for imparting a reciprocating motion to the carriage.

Figure 4 is a view somewhat similar to Figure 2 but showing to an enlarged scale details of the mechanism for imparting an irregular motion to the printing plate.

Figure 5 is an end view of this mechanism for imparting an irregular motion to the printing plate taken generally from line 5—5 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 and retained in the housing for the time necessary to etch the plate as desired. 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 continuously move the plate through a constantly varied motion pattern during the etching process with the motion that is imparted to the plate 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 which have drive mechanism for the printing plate that produce such a desired motion of the plate during the printing process with the machines disclosed in United States Patent Nos. 2,669,048 and 2,700,838 issued to J. A. Easley et al. and W. Guenst, respectively, being two such machines. However, these

prior art machines, while being capable of performing the desired function, have certain inherent undesirable characteristics in that operational difficulties are experienced because of the particular design and construction of the drive mechanism with stoppages, breakdowns and/or repairs being relatively frequent.

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 an irregular motion pattern. Another object of the invention is to provide such an etching machine wherein the drive for imparting this irregular motion to the plate includes means operative to reciprocate the plate at a uniform linear velocity. Another object of the invention is to provide such an etching machine wherein the drive for the plate includes a pair of gear drives each of which has associated therewith a unidirectional clutch with this mechanism being constructed and arranged to rotate the plate and impart the desired irregularity of motion to the plate. A further object of the invention is the provision of such an etching machine that is extremely rugged and highly reliable in its operation and which results in uniform etching of the plate.

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 an irregular 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 the carriage and acordingly the shaft connected thereto being continuously reciprocated at a uniform linear velocity through a motor driven drive including a sector or mangler gear rotated by a motor through a speed reducer and positioned between a pair of toothed racks provided on the carriage for alternate engagement with these racks. The shaft is rotatably driven in response to reciprocation of the carriage by a drive assembly that includes two pairs of intermeshed gears with one gear of each pair being coaxial with and secured to the shaft and the other gear of each pair being rotatably mounted upon and coaxial with a drive shaft that is journaled to the carriage in parallel spaced relation with the shaft that carries the plate to be etched. Secured to the outer end of this drive shaft is a pinion that is continuously intermeshed with a stationarily mounted toothed rack during reciprocation of the carriage so that the drive shaft is rotated in opposite directions as the carriage is reciprocated in opposite directions. Each of the gears mounted on the drive shaft is interconnected therewith through a unidirectional clutch so arranged that only one of the gears is positively connected to and driven by the drive shaft when the shaft is rotated in one direction with the other gear being positively connected to and driven by the drive shaft when the shaft is rotated in the other direction. One of the unidirectional clutches is a conventional overriding clutch while the other is a special clutch spring biased to the disengaged position and moved to the engaged position through the action of a pair of coacting cam surfaces one of which is formed on a member secured to the drive shaft and the other on the driving portion of the clutch which is connected to the drive shaft through a lost motion connection. These cam surfaces are effective to move the clutch to its engaged position, where the associated gear is positively

connected to and driven by the drive shaft, only after the drive shaft has rotated through a predetermined arc determined by this lost motion connection thereby insuring that the two clutches will not be simultaneously engaged which would lock the drive assembly. Through the two pairs of intermeshed gears the shaft that carries the printing plate is rotated in opposite directions as it is reciprocated in opposite directions with each of the pairs of gears having a different gear ratio so that the angular extent of the rotation of the plate in opposite directions is different thereby continuously varying the rotative position of the plate relative to its linear position and imparting an irregular motion pattern to 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 operation. 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 **17** or other suitable means. Mounted immediately above and in spaced relation to this base plate is the carriage **18** which is mounted upon rod **20** and elongated bar **22** for reciprocal movement therealong with this bar and rod being secured to plate **16** in any suitable manner, not shown. The carriage **18** comprises a pair of parallel plates **24** and **26** secured together in spaced relation by bolts **28** and spacers **30**. Overlying and secured to one edge of these plates is the upright plate **32** with the pair of spaced rollers **34**, between which is positioned bar **22**, being supported generally between and extending from the opposite edge of these plates. Secured to the upper surface of plate **24** and to the rear surface of plate **32**, as by cap screws **35**, are the laterally spaced blocks **36** which are provided with coaxial bores **38** into which are press fitted or otherwise secured suitable bearings, with stationarily mounted rod **20** being snugly but slidably received within these bearings.

Reciprocation of carriage **18** along the parallel disposed rod **20** and bar **22** is effected through the motor driven sector or mangler gear **40** which is stationarily mounted upon base plate **16** and rotated at a uniform speed through speed reducer **42** which is driven by motor **44**. Sector gear **40** is interposed between the spaced toothed racks **46** and **48** which are mounted upon the front face of plate **32** in parallel relation with bar **22** and rod **20** so as to be alternately engaged by the toothed portion of the sector gear to thereby effect reciprocation of the carriage. Through this sector gear drive carriage **18** may be continuously reciprocated with the amplitude of the reciprocation in each direction being equal to the circumferential length of the arc of the toothed portion of this gear and with the linear velocity of the reciprocation being uniform throughout each reciprocal movement. Reciprocal movement of the carriage is limited by stops **50** secured to rod **20** with these stops being so positioned that gear **40** will properly mesh with the teeth of racks **46** and **48** upon becoming disengaged with one and engaged with the other of these racks.

Carried by and journaled to carriage **18** is the shaft **52** which extends through plates **24** and **26** being received within suitable bearings **54** mounted within openings provided in these plates with the upper bearing **54** being interposed between collars **56** and **58** disposed on the upper end of shaft **52** and with the lower of the bearings **54** having spacer ring **60** resting thereon. Base plate **16** and housing **10** are provided with elongated slot **62** parallel with the axis of reciprocation of the carriage and through which extends shaft **52** with flange **64** being secured to the inner end of the shaft. The printing plate **14** is supported within housing **10** during the etching process by support plate **66** which is secured to the inner surface of flange **64** by screws **68** with special clamp means **56** being provided to permit easy attachment and removal of the printing plate to and from the support plate. Leakage of acid spray from the interior of housing **10** along shaft **52** is prevented by baffle plate or ring member **70** which is positioned immediately below housing **72** secured to the underside of the top wall of tank **10** and within which housing is disposed floating ring **74** with this baffle plate, housing and ring forming a labyrinth which effectively prevents the escape of acid spray from within the tank or housing **10**.

Rotation of shaft **52** is effected, in response to reciprocation of the carriage, through the two gear trains **76** and **78** with these gear trains respectively including drive gears **80** and **82** intermeshed with driven gears **84** and **86** and with these driven gears being coaxial with and secured to shaft **52** by set screws **88** or other suitable means and maintained in spaced relation with each other by annular spacer **90** positioned between the gears and over shaft **52**. Extending through and rotatably received in the central openings of driving gears **80** and **82** is the shaft **92** which is parallel with shaft **52** and is carried by and journaled to carriage **18**. The lower end of shaft **92** is mounted within bearing **94** which is retained within a suitable opening in plate **26** by the spaced retaining rings **96** with the shaft being prevented from moving axially with respect to carriage **18** by collar **98** and plate member **100** which are secured to the shaft on opposite sides of the bearing **94**. Secured to the upper end of shaft **92** is sleeve **102** which is embraced within bearing **104** being provided with a radial flange which rests upon the upper surface of this bearing with the bearing **104** being mounted within support member **106** which is secured to the upper surface of plate **24** by screws **108** with these screws also being effective to retain bearing retainer ring **109** in place. Rotation of shaft **92** in response to reciprocation of the carriage **18** is effected through the action of pinion **110** mounted on and secured to the upper end of sleeve **102**, which is of reduced diameter for the reception of this pinion, with the pinion being intermeshed with toothed rack **112** throughout the reciprocal movement of the carriage and with this rack being stationarily mounted upon the machine in parallel relation with the axis of reciprocation of the carriage through any suitable mounting means, not shown.

Through this rack and pinion drive shaft **92** is rotated in opposite directions as carriage **18** is reciprocated in opposite directions and in order for this rotation of shaft **92** to be imparted to shaft **52** through gear trains **76** and **78**, respectively, the driving gears **80** and **82** have unidirectional clutches **114** and **116**, respectively, connected thereto with clutch **114** being a conventional over-riding type of unidirectional clutch arranged to cause shaft **92** to rotate gear **82** when the shaft is rotated in the clockwise direction as viewed in Figure 1 and with clutch **116** being a special type of unidirectional clutch which is effective to disengage gear **80** from shaft **92** when the shaft is rotated in a clockwise direction but is moved to the engaged position thereby effectively connecting this gear to shaft **92** for rotation therewith when the shaft is rotated in the counter-clockwise direction with clutch **114** then permitting relative movement between shaft **92** and gear **82**.

Thus, when shaft 92 is rotated in the clockwise direction shaft 52 is driven through gear train 78 while when shaft 92 is rotated in the counter-clockwise direction shaft 52 is driven through gear train 76 and in order that the angular extent of the rotation that is imparted to plate 14 carried at the inner end of shaft 52 will vary during each reciprocation of the carriage so that the respective linear and rotative positions of the plate will constantly vary, producing an irregular motion pattern for the plate, gear trains 76 and 78 are of different gear ratios with the driving gears 80 and 82 and the driven gears 84 and 86, respectively, having different pitch diameters. In the illustrative organization, gear train 76 has a higher gear ratio than gear train 78 with driving gear 80 having a smaller pitch diameter than driving gear 82 and accordingly driven gear 84 having a greater pitch diameter than driven gear 86.

In order to insure that clutches 114 and 116 will not be simultaneously engaged, which would result in the gear drive mechanism becoming locked, clutch 116 is of a unique construction so that it will not be moved into its engaged position until after shaft 92 has rotated in the counter-clockwise direction through a predetermined arc but will move to the disengaged position upon the initial rotation of the shaft in the clockwise direction. This clutch 116 includes a driven member 118 that extends upward from and forms an integral part of gear 80 and a driving member 120 with these members being urged out of engagement by spring 122 which is disposed about shaft 92 and received within suitable counterbores provided in the members. Driving member 120 is slidably disposed upon shaft 92 and is provided with an upwardly extending cylindrical portion 124 which has its upper surface in engagement with the lower surface of sleeve 102. Driving member 120 is connected to and driven by shaft 92 through a lost motion connection which includes pin 126 that extends radially outward from shaft 92 and is received within slot 128 provided in cylindrical portion 124 with this slot being elongated axially as shown and being of an arcuate dimension substantially greater than that of pin 126 so that shaft 92 moves through a predetermined arc in moving pin 126 through the extent of this arcuate slot from engagement with one of the generally radial faces formed on cylindrical portion 124 by this slot to the other radial face.

The contacting surfaces of cylindrical portion 124 and sleeve 102 are provided with complementary cam surfaces 130, as shown, which have an arcuate dimension equal to the predetermined arc through which shaft 92 moves in taking up the lost motion in the pin and slot connection 126—128. Thus, when shaft 92 is initially rotated in the counterclockwise direction in response to movement of carriage 18 to the right as viewed in Figures 1 and 2, after the carriage has been moved to the left its full distance into engagement with stop 50, the camming surfaces 130 are effective to move driving member 120 down into engagement with driven member 118 as pin 126 is rotated through the arcuate slot 128 with spring 122 being effective to prevent rotation of driving member 120 prior to the pin engaging the counter-clockwise extremity of this slot. Thus, during a substantial portion of this predetermined initial rotation of shaft 92 in the counter-clockwise direction clutch 116 is in the disengaged position thereby insuring that the over-riding clutch 116 will be moved to the disengaged position before clutch 116 is in the engaged position. The complementary surfaces of driving member 120 and driven member 118 are preferably formed with radially extending saw teeth as shown which are intermeshed when driving member 120 is moved down into engagement with driven member 118 thereby providing a positive driving connection between these members.

When shaft 92 is initially rotated in the clockwise direction, in response to carriage 18 moving to the right after having moved its full distance to the left into

engagement with stop 50, it must move through the predetermined arc required to take up the lost motion in pin and slot connection 126—128 before being in driving engagement with driving member 120 and in rotating through this predetermined arc camming surfaces 130 are effective to cause clutch 116 to move to the disengaged position thereby again insuring that both clutches are not simultaneously in their engaged position and in driving engagement with shaft 92.

In operating the present invention carriage 18 and accordingly printing plate 14 carried at the inner end of shaft 52 is continuously reciprocated through a predetermined amplitude through the action of sector gear 40 and the spaced toothed racks 46 and 48 with this sector gear being effective to move the carriage and plate at a constant linear velocity throughout the extent of their movement in each direction with acid being continuously sprayed or splashed against the inner surface of the plate during this reciprocal movement.

In response to reciprocation of the carriage through its opposite directions of movement shaft 52 and accordingly plate 14 are rotated in opposite directions with gear train 78 being effective to rotate plate 14 in the counter-clockwise direction through the action of clutch 114 when the carriage is moved to the left as viewed in Figures 1 and 2 and gear train 76 being effective to rotate plate 14 in the clockwise direction when the carriage is moved to the right, with the angular rotation produced by gear train 78 being less than that produced by gear train 76 for each reciprocal movement of the carriage thereby providing an irregular motion pattern for the plate. By moving the carriage at a constant linear velocity the rotative velocity of plate 14 effected through one of the gear trains in response to movement of the carriage in one direction is constant while that effected through the other gear train in response to movement of the carriage in the other direction is likewise constant but of a different magnitude than that produced by the first mentioned gear train because of the different gear ratios of these trains.

Thus, with the present invention not only is the motion pattern of the plate irregular during the etching process, but the linear and rotative velocities imparted to the plate are uniform and do not vary widely, as was the case heretofore, resulting in more uniform distribution of the acid over the total area of the plate and accordingly more uniform etching.

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 fixed amplitude, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to rotate said shaft in response to reciprocation of said carriage including differential drive mechanism constructed and arranged to rotate the shaft to a greater angular extent in response to reciprocation of the carriage in one direction than in the other.

2. The organization of claim 1 wherein the means for effecting rotation of said shaft comprises a first means operative to rotate said shaft a fixed angular extent in response to reciprocation of the carriage in one direction and a second means operative to rotate said shaft in response to reciprocation of the carriage in the other direction a definite angular extent of different magnitude than that produced by reciprocation of the carriage in said one direction.

3. 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 mounted for reciprocation through a fixed amplitude, a pair of spaced toothed racks provided on said carriage parallel with the direction of reciprocation thereof, a motor driven sector gear interposed between said racks and coacting therewith to reciprocate said carriage in response to rotation of said gear, means operative to limit the reciprocal movement of the carriage to the limit of driving engagement of said sector gear with the respective racks, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to rotate said shaft in response to reciprocation of said carriage including two gear trains of different ratios constructed and arranged to rotate the shaft to a greater angular extent in response to reciprocation of the carriage in one direction than in the other.

4. 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 fixed amplitude, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to rotate said shaft in response to reciprocation of said carriage including a first drive mechanism operative to positively rotate said shaft in response to movement of said carriage in one direction and a second drive mechanism operative to positively rotate said shaft in response to movement of said carriage in the opposite direction, with the angular extent of the rotation effected by each of said drive mechanisms during each reciprocation of the carriage being different.

5. 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 fixed amplitude, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to rotate said shaft in response to reciprocation of said carriage including first and second drive mechanisms, each of said drive mechanisms including clutch means operative to render one of the drive mechanisms effective and the other ineffective to rotate said shaft when the carriage is moved in one direction and said other drive mechanism effective and said one ineffective when the carriage is moved in the opposite direction, said drive mechanisms being constructed and arranged so that the angular extent of the rotation effected by each during each reciprocation of the carriage is different.

6. The organization of claim 5 wherein at least one of said drive mechanisms comprises a differential gear train.

7. The organization of claim 5 wherein one of said clutches is spring biased to the disengaged position and is cam actuated to the engaged position with the cam actuator being effective to move the clutch to the engaged position only after the carriage has moved a fixed distance in the direction in which the clutch is operative to render the drive member with which it is associated effective to rotate the shaft.

8. The organization of claim 5 wherein the means for reciprocating the carriage through a fixed amplitude comprises a pair of spaced toothed racks provided on said carriage in parallel relation with the axis of reciprocation of the carriage and a motor driven sector gear stationarily mounted on said machine for rotation about its axis and interposed between said racks for alternate engagement therewith.

9. 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 fixed amplitude, a shaft rotatably mounted on said carriage and adapted to carry therewith a support for the plate to be etched, means operative to rotate said shaft in response to reciprocation of said carriage including a first gear train effective to drive said shaft in response to movement of said carriage in one direction, a second gear train effective to drive said shaft in response to movement of said carriage in the opposite direction, said two gear trains being of different effective gear ratios.

10. The organization of claim 9 wherein the two gear trains are driven in response to reciprocation of the carriage through a common rack and pinion drive with the rack being stationarily mounted on the machine in parallel relation with the axis of reciprocation of the carriage and the pinion being rotatably mounted on the carriage, clutch means associated with each gear train and constructed and arranged to render a different one thereof ineffective to drive said shaft when the pinion is rotated in its respective opposite directions.

11. In combination with an etching machine, a carriage mounted on said machine for reciprocal movement, said carriage being provided with a pair of spaced toothed racks parallel with the axis of reciprocation of the carriage, a sector gear stationarily mounted on said machine for rotation about its axis and interposed between said racks for alternate engagement therewith, means for driving said gear at a constant speed to thereby reciprocate said carriage a constant linear velocity, a shaft carried by and rotatably journaled to said carriage, said shaft extending into said machine and carrying at its inner end a support for a plate to be etched, first drive means including a gear train operative to effect rotation of said shaft at a definite angular velocity in response to movement of the carriage in one direction, second drive means including a gear train operative to effect rotation of said shaft at an angular velocity different from that produced by the first drive means in response to movement of said carriage in the other direction.

12. In an etching machine, a carriage mounted thereon for reciprocal movement, means operative to continuously reciprocate said carriage through a fixed amplitude, a first shaft carried by and journaled to said carriage, said shaft extending into said machine and carrying on its inner end a support for a plate to be etched, a second shaft carried by and journaled to said carriage, means operative to rotate said second shaft in opposite direction in response to movement of said carriage in opposite directions, means interconnecting said first and second shafts to cause said first shaft to rotate in response to rotation of said second shaft including a pair of gear drives each of which has a clutch associated therewith and constructed and arranged to render one of the drives effective and the other ineffective when said second shaft is rotated in one direction and said other drive effective and said one ineffective when said second shaft is rotated in the opposite direction, said gear drives being respectively of different gear ratios.

13. In an etching machine, a carriage mounted thereon for reciprocal movement, means operative to continuously reciprocate said carriage through a fixed amplitude, a first shaft carried by and journaled to said carriage, said shaft extending into said machine and carrying on its inner end a support for a plate to be etched, a second shaft carried by and journaled to said carriage, a rack and pinion establishing a continuous drive for said second shaft in response to reciprocation of said carriage with said rack being stationarily mounted on said machine parallel with the axis of reciprocation of said carriage and with said pinion being effectively secured to said second shaft thereby effecting rotation thereof in opposite directions as the carriage reciprocates, a first pair of intermeshed gears with one coaxial with and telescoped over each of said shafts, one of said gears being directly secured to its respective shaft with the other of said gears being interconnected with its respective shaft through a unidirectional clutch arranged to cause said gears to drive said first shaft when said second shaft is rotated in one

direction, a second pair of intermeshed gears with one coaxial with and telescoped over each of said shafts and with one of these gears directly connected to its respective shaft and the other interconnected with its respective shaft through a unidirectional clutch arranged to cause this second pair of gears to drive said first shaft when said second shaft is rotated in the other direction, said first and second pairs of gears being of different respective gear ratios.

14. The organization of claim 13 wherein one of said clutches is constructed and arranged to rotate the respective gear only after the second shaft has rotated through an initial definite arc in the driving direction.

15. In an etching machine, a carriage mounted thereon for reciprocal movement, means operative to continuously reciprocate said carriage through a fixed amplitude, a first shaft carried by and journaled to said carriage, said shaft extending into said machine and carrying on its inner end a support for a plate to be etched, a second shaft carried by and journaled to said carriage, a rack and pinion establishing a continuous drive for said second shaft in response to reciprocation of said carriage with said rack being stationarily mounted on said machine parallel with the axis of reciprocation of said carriage and with said pinion being effectively secured to said second shaft thereby effecting rotation thereof in opposite directions as the carriage reciprocates, two distinct drive mechanisms operative to impart the rotation of said second shaft to said first shaft, each mechanism comprising a pair of intermeshed gears with the driving gear disposed over said second shaft in coaxial relation therewith and the driven gear disposed over the first shaft in coaxial relation therewith and secured thereto, a unidirectional clutch means effective to connect the drive gear to said second shaft when the shaft is rotated in one direction but ineffective to connect the drive gear to the second shaft when the shaft is rotated in the opposite direction, with the clutches of the two mechanisms being so effective when said second shaft is respectively rotated in opposite directions, said driving and driven gears of the two mechanism being respectively of different pitch diameters.

16. The organization of claim 15 wherein one of said clutches comprising a driven and a driving member disposed on said second shaft in coaxial relation therewith and having complementary mating surfaces, spring means interposed between said members urging the same apart, said driven member being integral with the gear and said driving member being interconnected with said second shaft through a lost motion connection requiring said shaft to rotate through a predetermined arc before being effective to rotate said driving member, cam means effective to move said members from the disengaged to the engaged position where said complementary surfaces are in contact, said cam means including coacting cam surfaces formed on said driving member and a member secured to said shaft, said cam surfaces being constructed and arranged to require said shaft to rotate through a substantial portion of said predetermined arc before moving said members into engagement.

17. The organization of claim 16 wherein said complementary surfaces are provided with coacting saw teeth that are intermeshed when said members are in engagement.

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