W. S. EATON.

GEOMETRICAL MACHINE.

APPLICATION FILED MAR. 26, 1917.

1,294,639.

Patented Feb. 18, 1919.

4 SHEETS—SHEET 1.

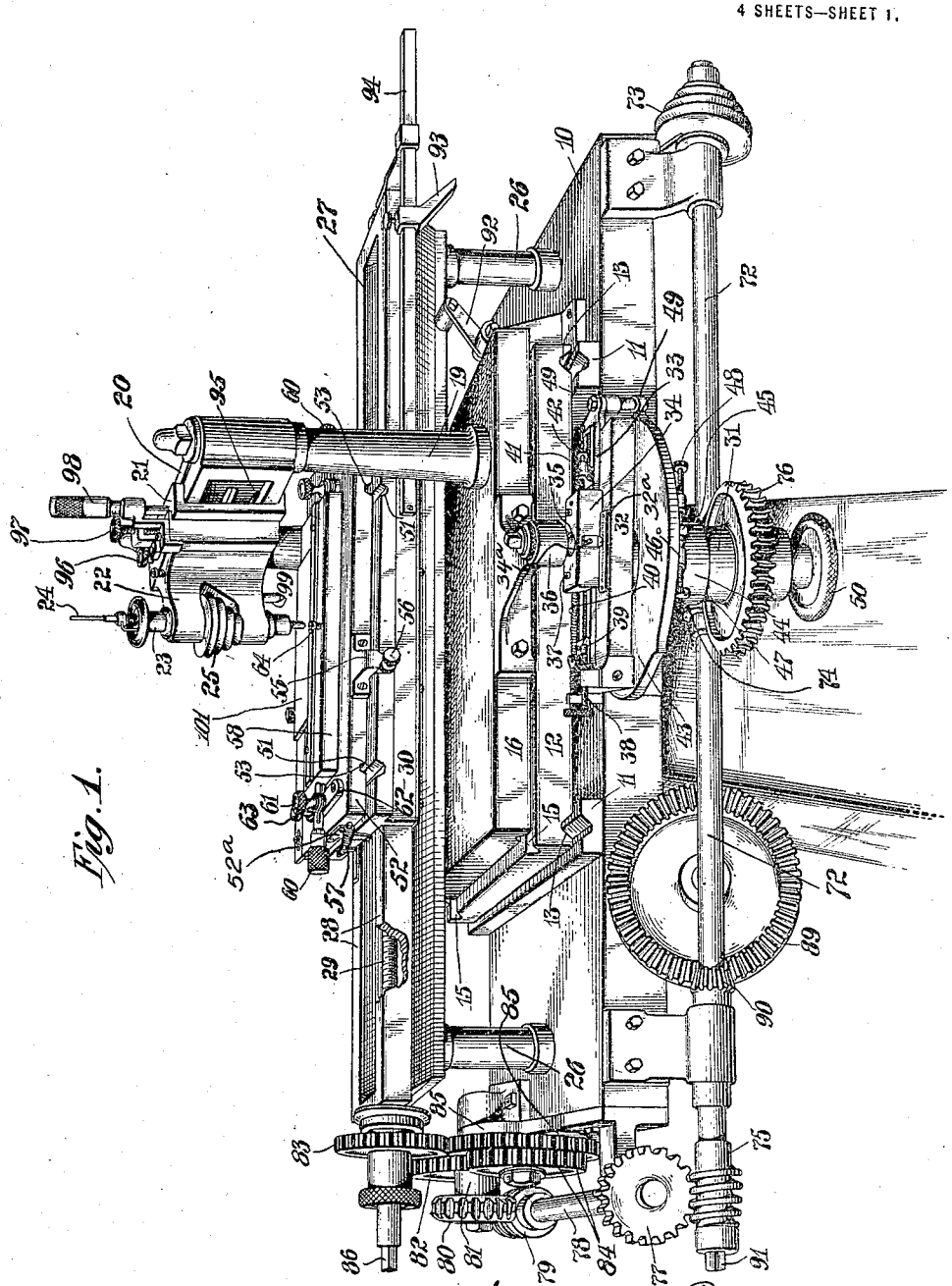


Fig. 1.

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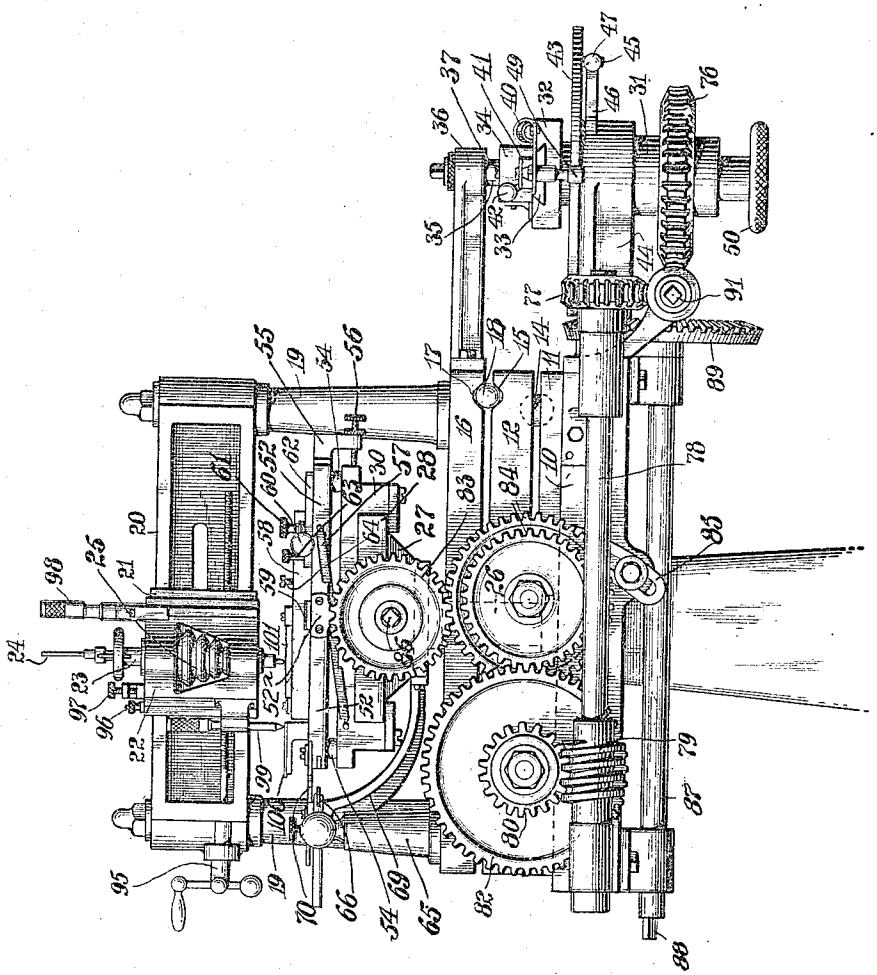
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 7.

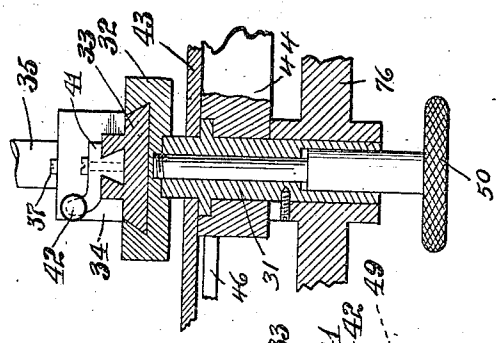


Fig. 3.

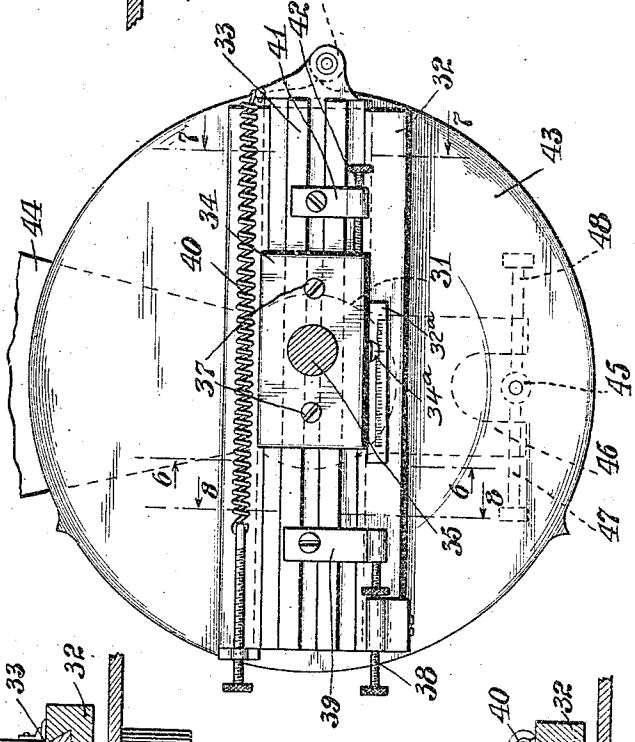


Fig. 6.

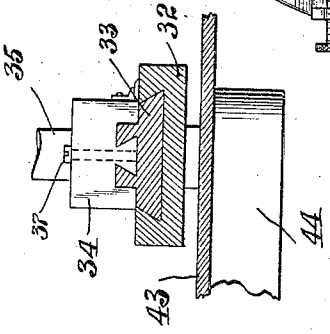
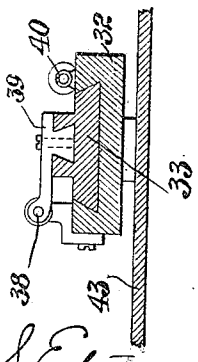


Fig. 8.



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Patented Feb. 18, 1919.

4 SHEETS—SHEET 4.

Fig. 4.

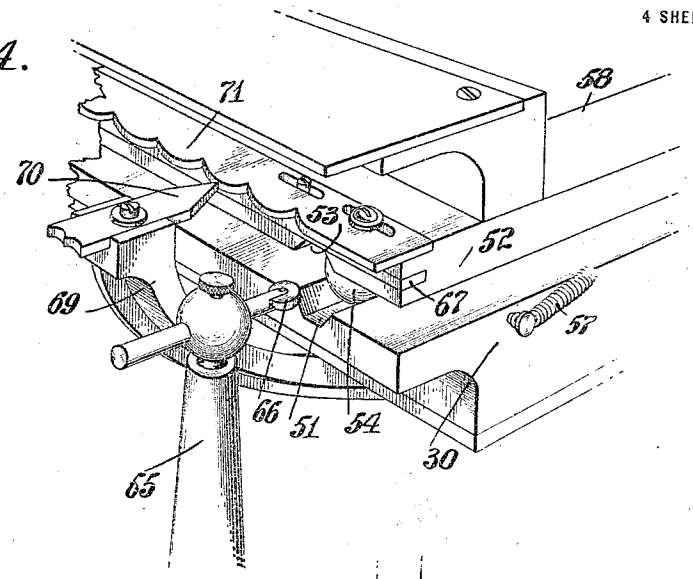
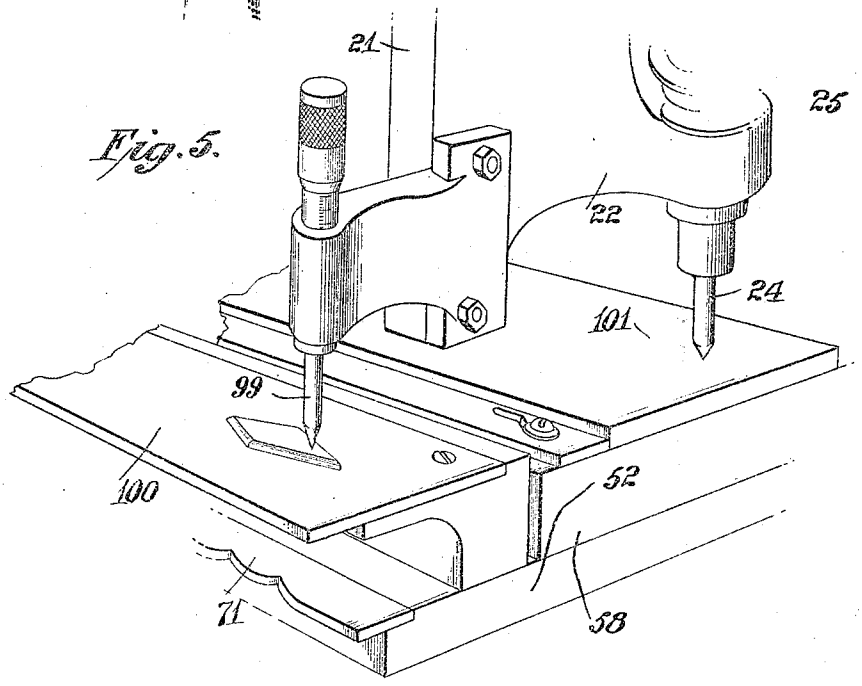


Fig. 5.



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UNITED STATES PATENT OFFICE.

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GEOMETRICAL MACHINE.

1,294,639. Specification of Letters Patent. Patented Feb. 18, 1919.

Application filed March 26, 1917. Serial No. 157,430.

To all whom it may concern:

Be it known that I, WILLIAM S. EATON, a citizen of the United States, residing at Sag Harbor, in the county of Suffolk and State of New York, have invented certain new and useful Improvements in Geometrical Machines, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to geometrical machines and more particularly to a type thereof adapted to create intricate line designs.

Heretofore engine lathes, rose engines and pantographic engraving machines have been used for creating designs, such as are extensively used in incorporating in printing plates what is known as white line safety designs for bank notes and other negotiable instruments. Such machines, however, are limited in their range of work and as a rule are adapted to create only medallion designs. Furthermore, such machines as have heretofore been used, have either been manually operated, or when the machines were automatic, the designs created were the result of a definite fixed cycle of operations of the different parts of the machine, resulting always in the formation of one and the same design. Manually actuated machines have been made by me which are capable of producing an elongated continuous design of this character, but all automatic machines, so far as I am aware, are limited to the creation of a design having a medallion effect.

The machine of my present invention is an entirely automatic machine, capable of producing, what may be called, a running design, which design in its entirety, or as to different portions thereof, may be varied indefinitely by means of regulating and adjusting devices incorporated in the machine. The design is developed by the simultaneous relative movement of the work plate and the work tool under the control of two dissimilarly operating, actuating mechanisms, the operative effect of each of which mechanisms is capable of such variation as to permit an infinite number of different designs to be created by one and the same combination of parts.

The created design is determined by a number of different adjustments in the machine and the general effect of the design is varied by a change in one or more of these adjustments, which change will ordinarily result in a total absence of any resemblance between different designs created. In fact, the character of these designs is such that it is practically impossible to reproduce any design even by means of the machine without knowing exactly how the machine was adjusted, even to the most minute detail.

The general character of the design is determined by a rotating member imparting relative, circular movement to the work support and to the work point carrier, and in a controlling plate modifying the operative effect of this member. At the same time, rectilineal movement is imparted to one of these parts relative to the other so as to secure a general cycloidal effect in the lines of the designs; and at the same time, permit the elongation of a design. In conjunction with these mechanisms, I also provide means whereby the contour of either, or both, edges of the design may be controlled independently of the other mechanisms of the machine, which means is, like the other mechanisms, capable of adjustment in order to permit an infinite variation, both as to the opposite edges of the design, and as to the design in its entirety.

The machine is capable of use in creating designs upon paper, smoked glass or chalk plates, or it may be used to produce a printing plate bearing the design by actually removing metal from the plate by means of a routing tool or graver.

When the machine is used for actually engraving a plate, it is possible, to set the routing tool or graver so as to remove metal to a predetermined maximum depth, and to cause the automatic movement of the tool in a manner to vary the depth of cut in different portions of a design so that if desired one design may be superimposed upon, or incorporated, in another by a varying depth of cut, resulting when printing from the plate in deeper or lighter tones at certain predetermined points in the design. This characteristic of the machine may also be utilized for providing certain key markings by which the genuineness of a bank note or other negotiable instruments may be readily determined.

By reason of the interchangeability of

controlling plates in the machine, it is possible to modify the normal operations of the machine infinitely, although the same controlling plate may be used for a large range of different designs by means of other adjustments in the machine.

Furthermore, the controlling plate itself may be adjusted in relation to its coöperating parts to change the general character of the created design.

The machine is so constructed that it may be actuated from any desired source of power while being capable of hand actuation for the purpose of facilitating the re-setting of the machine, in the event of the necessity for grinding the tool, or re-finishing parts of the created design, or for operating the machine slowly in the event that it is desired to observe the workings of the machine.

The invention consists in the novel features of construction and combination of parts hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

Referring to the drawings,

Figure 1 is a perspective view of a machine embodying my invention;

Fig. 2 is an end view therof, from the left of Fig. 1;

Fig. 3 is a plan view of the controlling or cam plate and the rotating member;

Fig. 4 is a perspective fragmentary view of the machine illustrating the mechanism for varying the contour of the border;

Fig. 5 is a detail view of the mechanism in use for varying the depth of an engraved line;

Fig. 6 is a section on the line 6—6 of Fig. 3;

Fig. 7 is a section on the line 7—7 of Fig. 3; and

Fig. 8 is a section on the line 8—8 of Fig. 3.

Like numerals refer to like parts throughout the several views.

In the drawings, I have shown an embodiment of my invention wherein the work table or other support for the work plate or sheet is adapted to receive rectilineal movement while the carrier for the work tool or point is adapted to receive circular movement, although it is apparent that this condition might be reversed without in any way modifying the operative effect secured by the use of the machine. Above I speak of a rectilineal movement and a circular movement, but these terms are merely general, as both movements are adapted to be so modified that the lines described will be erratic or irregular thus imparting intricacy to the designs created and varying the tonal values in different portions thereof. The terms rectilineal and circular are used merely because such are the general direction of the lines described.

In describing the machine, I will first consider the general combination and relation of parts, then the rotating actuation mechanism with the various means for adjustment by means of which the operative effect of this mechanism may be varied. I will then describe the particular features of the machine by which the edges or contour of the design is controlled and the various adjustments of this mechanism, and finally, I will describe the means by which the depth of cut is varied to incorporate a concealed design in the general design, or what might be termed a superimposed, independent design.

In the description, I will refer particularly to the form of invention shown in the drawings.

In the embodiment of my invention shown in the drawings, the table of the machine is shown at 10, said table having thereon laterally extending tracks or ways 11 upon which is mounted a carriage 12 having therein ways parallel with the tracks or ways 13, steel balls 14, or other traction devices, being contained in said ways 11 and 13 so as to permit the carriage 12 to move freely laterally of the machine. Said carriage 12 has upon the upper surface thereof tracks or ways 15 extending longitudinally of the machine, or perpendicularly to the ways 13. Superimposed upon the carriage 12 is a carriage 16 having ways 17 on the under side thereof registering with the ways 15, steel balls 18 being seated in said ways 15 and 17 so as to permit the said carriage 16 to move freely longitudinally of the machine.

Carried by the said carriage 16 are pedestals 19 connected by a cross head 20 having slidably mounted thereon, a keeper 21 for a vertically movable support 22 for a work point or tool. In the form of the invention shown, this support has parallel arms in which is rotatably mounted a hollow spindle 23 carrying a chuck at the lower end thereof, adapted to receive a routing tool or graver. By making the spindle hollow, I am also enabled to use in connection therewith a dry point, or marking stylus 24 which is removable therefrom so as to permit the substitution of a routing tool or graver therefor if desired. The spindle 23 is provided with a stepped pulley 25, as shown, by means of which the spindle may be rotated if desired.

Supported from the table 10, by means of the columns 26, is a frame 27 having tracks or ways 28 thereon, which extend longitudinally of the machine. Mounted in the frame 27 is a feed screw 29 by means of which rectilineal movement is imparted to a traveler carriage 30 mounted upon the tracks or ways 28.

The frame 27, is positioned between the pedestals 19 and below the cross head 20, sufficient clearance being provided between

the said pedestals and said frame to permit the desired range of movement of the work point or tool in creating the design.

The traveler carriage 30 is adapted to support a work plate or sheet, said carriage being preferably so constructed as to permit the control of the contour of the created design by a movement perpendicular to the rectilineal movement imparted thereto by the feed screw 29. This mechanism will be described in detail hereinafter.

The construction and arrangement of the carriages 12 and 16 and the support for the work point or tool, above referred to, permit a universal movement of said support upon a single plane, under the control of an actuating mechanism adapted normally to impart a circular movement to said work point or tool; means, however, being provided whereby this normal operative effect will be modified in a manner to impart predetermined irregularities in this movement and in the lines described by the work point or tool.

To simplify the description of the machine and to avoid confusion in the terms employed, I shall have occasion to refer to "adjusting devices" and to "regulating devices". By the first term, I mean those devices by means of which different portions of the mechanism may be set for a given cycle of operation, and by the other term, I mean devices by which the normal cycle for which the machine is set, will be modified.

The means above referred to, for imparting circular movement to the work point or tool, comprises a shaft 31 carrying a head 32 rotatable therewith. This head has mounted thereon a slide 33 carrying a block 34, which block is provided with a crank pin 35 journaled in or bearing on an extension 36 carried by the carriage 16.

To make the machine operative, it is essential that the pin 35 be set eccentrically of the shaft 31, the degree of this eccentricity controlling the width of the design and other characteristics thereof.

The block 34 is adjustably mounted upon the slide 33 by means of coöperating dovetailed tongues and ways upon said members respectively, said block being provided with set screws 37 by means of which it may be fixed in any adjusted position.

The head 32 is provided with an adjustable screw stop 38 acting upon an abutment 39 carried by the slide 33, a spring 40 normally acting upon said slide to hold said abutment in engagement with said stop. Said stop 38 provides for an adjustment in the machine by which the entire character of the design may be changed, the nature of which adjustment will be more fully referred to hereinafter.

The abutment 39 is adjustably mounted by means of a dovetailed tongue seated in the undercut ways upon the slide 33 for the purpose of increasing the range of adjustment secured by means of his mechanism.

Accurate adjustment of the block 34, is secured by means of an arm 41 carried by the slide 33, and having mounted therein an adjusting screw 42 acting upon the block 34. This arm 41 is also adjustable with relation to the slide in the same manner as the abutment 39 and for the same general purpose. The block 34 is provided with an indicator finger 34^a coöperating with a gage plate 32^a, carried by the head 32, to facilitate accuracy in the adjustment of the said block.

Acting upon the crank pin 35, through the medium of the slide 33, is one of the regulating devices heretofore referred to, which consists of a controlling or cam plate 43 carried by the bracket 44 in which the shaft 31 is journaled. In the operation of the machine, the plate 43 remains stationary, although it is capable of circumferential adjustment for varying the character of the design produced. The means for securing this adjustment comprises a stud 45 upon the underside of said plate which enters the forked end 46, of the bracket 44, as shown in dotted lines in Fig. 3, and is acted upon by the screws 47 and 48 carried by the opposite arms of said forked end.

Coöperating with the controlling or cam plate 43 is a contact member 49 carried by the slide 33, said contact member preferably consisting of an anti-friction roller mounted upon a stud projecting downwardly of the slide 33. The spring 40 has a normal tendency to force the roller 49 into engagement with the operative face of the plate 43 either as to the whole surface, or as to different portions thereof, as determined by the screw stop 38. This controlling or cam plate 43 is an essential characteristic of my invention, since were it not for this plate, the operation of the machine would result merely in the development of a cycloidal line upon the work plate or sheet. The head 32 is mounted upon the shaft 31 by means of the screw 50, so that said head may be removed for the purpose of permitting the removal of a controlling or cam plate 43 having one contour, and the substitution of another such plate having a different contour. The capability of substituting one controlling or cam plate for another, is a highly desirable characteristic in the machine, although the specific manner of securing this effect is immaterial to the invention, it being merely essential that there shall be a controlling or cam plate, the rises of which shall be operative upon the slide 33 in a manner to impart movement to said slide and to its appurtenances radially of the axis of the shaft imparting relative circular movement to the support for the work plate or sheet, and the support for the work point or tool.

The traveler carriage 30 has upon the upper face thereof, tracks or ways 51 extending laterally of the machine; and mounted upon said tracks or ways is a carriage 52 having tracks or ways 53 upon the under side thereof and oppositely disposed as to the tracks or ways 51. Steel balls 54 or other traction devices are interposed between said traveler carriage 30 and said laterally movable carriage 52, in said tracks or ways.

The carriage 52 is provided with end plates 52[a] which overlap the edges of the traveler carriage 30, to prevent movement of said laterally movable carriage relative to said traveler carriage, longitudinally of the machine. The carriage 52 also carries a bracket 55 having mounted therein a set screw 56 acting upon one side of the traveler carriage 30 to limit the lateral movement of said carriage 52, in one direction only, however. Extending from the carriage 52 to the carriage 30, at each end thereof, is a spring 57 having a normal tendency to force the screw 56 into engagement with the carriage 30, or under certain conditions of adjustment of the machine, to impart movement to said carriage laterally of the machine within the limits defined by said screw.

Mounted upon the carriage 52 is a support 58 for a work plate or sheet, which support is provided with the usual clamp plates, dogs or other devices for holding the work plate or sheet thereon. This work plate or sheet, may be either a metal plate, smoked glass, a chalk plate, paper, or other device adapted to have the design described thereon by the work point.

The support 58 is mounted upon the carriage 52 by means of the tongue and groove 59 so as to be adjustable upon said carriage longitudinally of the machine. Acting upon opposite ends of the support 58 are micrometer screws 60 mounted upon the carriage 52, each of said screws being provided with a split collar acted upon by a clamp screw 61, adapted to set said micrometer screws in any adjusted position and prevent the slightest displacement of the support 58 while the machine is in action. One of the screws 60 is carried by a removable block 62, so as to permit the removal of the support 58 from the machine if desired, the said block being normally held in position by means of the pin 63. In this manner the support 58 may be removed from and restored to its position on the machine without disturbing any adjustments in the machine.

The support 58 is also provided with a set screw or screws 64 to permit said support to be locked in any adjusted position upon the carriage 52.

With a construction of machine as heretofore described, the edges of the design created will be symmetrical to the extent, that there will be absolute uniformity of both edges throughout the entire length of the design. By providing means, however, whereby movement may be imparted to the carriage 52 with the work point or tool, during a portion of the movement thereof, and with the same rate of travel; or by imparting movement to said carriage in a direction opposite to the direction of said work point or tool, during a portion of the stroke thereof; or by imparting movement to said carriage independently of the movement of said tool in either direction, the entire character of the contour of the design and of different portions of the design adjacent said contour, may be modified with relation to the normal edge design resulting from the coöperation of other mechanism in the machine. At the same time, each design created, in its entirety by means of this mechanism, may be condensed or extended so as to modify the general character of the design and as to the tonal values in the body thereof.

The movements of the carriage 52 in modifying the created design are rectilineally and laterally of the machine, the movements being simultaneous with the longitudinal traverse of the traveler carriage 30.

The means for imparting movement to the carriage 52 with the work tool or point in either direction during a portion of the lateral traverse of the tool or point, consists of a post 65 having adjustably mounted thereon a contact 66 adapted to engage a controlling surface 67 carried by the carriage 52, the contact 66 preferably including an anti-friction device engaging said surface 67 to permit the free movement of said contact relative to said surface, longitudally of the machine. The surface 67, as shown in the accompanying drawings, is upon a bar having a straight edge, mounted in a slot extending longitudally of the machine. It may take any desired irregular form, however, so as to vary the moment of initial engagement of said contact with this surface, at predetermined points of the entire design.

The means for imparting movement to the carriage 52 independently of the movements of the work tool or point, comprises a bracket 69 carried upon the frame 27 and having adjustably mounted thereon, a contact member 70 adapted to coöperate with an elongated controlling or cam plate 71 adjustably mounted upon the carriage 52 by means of slots in said plate, and set screws carried by said carriage. The character, number and arrangement of the rises upon said controlling or cam plate may be varied indefinitely, and the character of the outline or body of the design may be modified by shifting this plate longitudally of the machine, or by adjusting the contact 70 to or from said controlling or cam plate.

The screw 29 and the shaft 31 are simultaneously rotated from the same source of

power by an actuating mechanism, which will now be described; although, if desired, said actuating mechanism may be operated by hand to reduce the speed of the machine. The actuating mechanism for said screw 29 and shaft 31 comprises a worm shaft 72 having a stepped pulley 73 thereon and two worm sections 74 and 75, the former of which coöperates with the worm gear 76 on the shaft 31 and the latter of which coöperates with a worm gear 77 upon a worm shaft 78 having thereon a worm 79 coöperating with a worm gear 80 mounted upon a shaft 81. This last named shaft also has mounted thereon the first gear 82 of a gear train including a gear 83 mounted upon the shaft of the feed screw 29 and intermediate gears 84. The gears 84 are mounted upon a swinging frame 85 pivoted upon the shaft 81 to facilitate their disengagement from the gear 83 for the purpose of resetting the machine. The screw shaft 29 is provided with a squared end 86 for the purpose of permitting a hand crank to be used for turning said shaft. I also provide the machine with a shaft 87 having a squared end 88, for receiving a hand crank and carrying a beveled gear 89 meshing with a beveled pinion 90 upon the shaft 72 so as to permit the machine to be operated at a moderately high speed, by hand. To operate the machine at a still lower speed, I provide one end of the shaft 72 with a squared portion 91 adapted to receive a hand crank. At 92, I have shown a belt shifting device adapted to stop the machine at a predetermined point in the operation thereof, as determined by the cam 93 adjustably mounted upon the rod 94 carried by the traveler carriage 30.

The lever 92 is operatively connected in any desired manner with a belt shifting mechanism carried by the pulley from which power is derived to drive the shaft 72 through the pulley 73. As the cam, with the continued movement of the carriage 30, engages the lever 92, it will depress this lever, and thus actuate the belt shifter. The belt shifting mechanism is not shown in the drawings, as the connection of the lever 92 therewith, involves merely mechanical skill, and the belt shifting mechanism *per se*, is old and well known in the art.

The keeper 21 is adapted to be adjusted laterally of the machine upon the cross head 20, by means of the feed screw 95, a set screw 96 being provided to lock the keeper 21 in any adjusted position. The support 22 is adapted to be raised and lowered by means of a feed screw 97 carried thereby and acting upon the keeper 21, a micrometer stop 98 being provided to determine the maximum downward movement of the support 22 while doing work.

Adverting now to the attachment by means of which the operative effect of a work tool or point, may be controlled so as to superimpose a distinctive design upon the design created by the functionings of the other portion of the machine, I secure this result by automatically raising and lowering the support 22 during the progress of the work in a manner to increase the depth and breadth of the line being described, at certain points thereof, or by preventing the line being described at those points, although as a rule the disengagement of the tool from the work plate or sheet is not desirable as making the superimposed design too conspicuous. It is possible, however, to make this design in this way.

This mechanism comprises a micrometer stop 99 carried by the support 22, and adapted to engage a plate 100 removably mounted upon the carriage 52, this plate having impressed thereon, either in relief or in intaglio, the design which it is desired to superimpose upon the main design. As the traveler carriage 30 moves longitudinally of the machine, the length of the design upon the plate 100 will ultimately be brought within the operative range of the stop 99, while the movement of the stop 99 under the control of the other mechanism of the machine over the design upon said plate 100 will insure the accurate reproduction of the entire design upon the plate 100, upon the work plate or sheet, which is illustrated in the drawings at 101.

The operation of the herein described machine is substantially as follows, reference being had to the particular embodiment of the invention shown in the drawings.

The main operations of the machine are apparent from the foregoing description and the accompanying drawings, the desirable characteristics of the created design being dependent upon the various adjusting and regulating devices incorporated in the machine.

The operation of the various worm shafts, worm gears and gear trains either under power or by hand will result in the simultaneous rotation of the feed screw 29 and the shaft 31 with its head 32 and the eccentric pin 35. Were it not for the adjusting and regulating devices, the design created would consist only of a cycloidal line continuing during the entire length of the design created. Such a design may be readily reproduced by a number of machines, and has little or no value for use in connection with safety designs for negotiable instruments. This general design, however, may be modified to produce an infinite number of designs entirely dissimilar to each other, by imparting radial movement to the pin 35 at one or a number of different points during each revolution thereof, and by imparting lateral movement to the carriage 30 at different points of its rectilineal trav-

erse, either under control of the shaft 31, or independently thereof, with a resultant complete change in the character of the whole design created. Each of the regulating devices is capable of use independently of the others, as well as with either or both of them, and a modification of the design may be secured by a change of adjustment in one or any of these regulating devices.

The rate of feed of the carriage 30 may also be varied by substituting gears 83 and 84 of one diameter for other gears having different diameters.

With this general survey of the functionings of the machine, I will now describe in detail the functionings of the several mechanisms, it being understood that these mechanisms act conjointly in creating the design.

The degree of eccentricity of the pin 35 determines the quantity of lateral movement of the work point or tool, thus fixing the normal width of the design, the length of which is determined by the rectilineal traverse of the carriage 30. The block 34 may be adjusted upon the slide 33 by means of the adjusting screw 42, the set screws 37 being released to permit this adjustment and re-set after the adjustment, to permit power to be transmitted through the crank pin 35. The said crank pin 35 may be set upon either side of the axis of the shaft 31 as desired, the nature of the design determining upon which side of this axis, said pin is set. As the shaft 31, and its head 32, rotate, the contact 49 carried by the slide 33 will, as it engages each of the rises upon the controlling or cam plate 43, impart radial movement to the pin 35 so as to vary the operative effect of this pin upon the work tool or point. The character of the design will depend largely upon the number, formation and position of the rises upon this plate 43 and may be entirely changed by adjusting this plate circumferentially by means of the screws 47 and 48. By reason of the short radius at which the pin 35 acts and the relatively great radial movement imparted to the slide 33, the created design resulting from a single rotation of the shaft 31 will bear little or no resemblance in form to the contour of the plate 43. If the pin 35 be positioned between the axis of the shaft 31 and the contact member 49, the design will have projections coinciding in position with the rises upon the plate 43, and if on the contrary said pin be upon the side of the axis of the pin 35 away from the member 49, there will be no such projections; but there will be depressions. The form of these projections or depressions and their heights or depths will vary according to the length of the radius at which the pin 35 is set.

Normally the spring 40 will act upon the slide 33 in a manner to cause the contact 49 to engage every portion of the edge of the controlling or cam plate 43. The stop 38, however, may be actuated so that the said contact 49 will engage said plate 43 only at the rises thereon, and the extent of this engagement may also be controlled so that the created design may also be modified by means of this stop 38.

By using different plates 43 and by changing the adjustments upon the block 34 and upon the slide 33, a wide range of designs may be created, but each design will possess substantial similarity throughout its entire length.

As the crank pin 35 is actuated, it will impart a similar movement to the carriage 16 and to the work tool or point carried thereby, the manner of mounting said carriage, permitting universal movement of said work tool or point upon a single plane. As a result of this movement, there will be described upon the work plate or sheet 101, a design coinciding with the line of movement of said pin 35, providing no lineal traverse is imparted to the carriage 58 for said work plate or sheet. With such traverse, however, succeeding reproductions will be spaced apart to an extent determined by the rate of travel of said support, thus producing a running design formed of a continuous line. The various points of intersection of this continuous line, which points will vary according to the different adjustments of the plate 43, slide 33 and block 34, will introduce into the design, portions, the tonal values of which will be deeper than other portions of the design. In some places there will be a practically solid tone, while in other places there will be mezzo tones due to the criss-crossing of lines and a closer relation thereof than in portions of the designs having a still lighter tone.

If it be desired to merely create the design upon paper, or smoked glass, an ordinary tracing point or stylus is used and the support 22 is lowered until this point or stylus engages the paper or glass. The same conditions would exist if it were desired merely to remove the resist so as to produce a plate for making an acid etching. If, however, it be desired to actually remove the metal from a plate, it is necessary to first lower the support 22 by means of the feed screw 97 until the dry point, graver or routing tool just contacts with the surface of the metal plate. When this condition exists the micrometer screw 98 is lowered until it engages the top of the slide 21, thus causing said screw to be in a position to sustain the load of the support 22. The screw 98 is then raised to an extent to determine the maximum depth of the cut to be made, and when it is so set the screw 97 is actuated to permit the support 22 to advance by gravity to the full extent per-

mitted by the screw 98. The lateral adjustment of the slide 21 is solely for the purpose of setting the machine so as to position the design upon the work plate or sheet.

While the regulating mechanisms and the adjusting mechanisms heretofore described will permit indefinite variation of the designs created, the regulating and adjusting devices for controlling the contour of the created design may be used in a manner to modify the operative effects of the crank pin 35 and the parts operative thereon, in a manner to completely destroy any similarity in any portion of the design to a figure created by the normal functionings of said crank pin.

If it be desired to control the contour of the edge of the design toward the pin 35, the contact 66 carried by the post 65 is advanced toward the coöperating surface 67 upon the carriage 52. When adjusting this contact 66, it is desirable that the pin 35 be to the extreme right, (Fig. 2,) thus permitting the said contact 66 to be brought against the surface 67 in a manner to impart movement to said carriage 52, against the tension of the springs 57 to an extent to permit subsequent movement of said carriage 52 by said springs, during a portion of the movement of the work tool or point, and at the same rate of speed. With this adjustment, as the work tool or point moves away from the shaft 31, the contact member 66, being movable with said work tool or point, will recede from the coöperating surface 67 and permit the carriage 52 to move under the control of the springs, in a manner to prevent, during the interval of engagement of said contact and said surface, any relative movement of the work plate or sheet upon the support 58 and the work tool or point laterally of the machine. As a consequence, if the surface 67 be a straight edge, a straight longitudinally extending line of a length determined by the longitudinal component of motion of the work tool or point, will be described upon the work plate or sheet, and a laterally extending line will be described only when the contact 66 passes out of engagement with the surface 67, as the set screw 56 engages the carriage 30. Hence, by adjusting this set screw 56, the design adjacent its edge toward the pin 35 may be varied independently of the adjustment of the contact 66.

After the contact 66 passes from its engagement with the surface 67, the line described thereby will conform to the normal design resulting from the functionings of the pin 35, but toward the end of the return stroke of the said contact 66, after it engages the surface 67, movement will be imparted to the carriage 52 against the tensions of the spring 57 which movement being with, and at the same speed as, the work tool or point will cause a straight line to be described as before, but the movement of the work point or tool will be toward the straight line previously described. This operation will be repeated with each rotation of the shaft 31.

With this adjustment of the machine, not only the contour of the created design will be changed, but the entire general effect of the design as well, by reason of the elimination of a portion of the edge of the normal design toward the pin 35.

By having the surface 67 an undulating surface, or a surface formed of a sequence of rises and depressions, the succeeding intervals of disengagement and engagement of the contact 66 of the surface 67 may be varied at different portions of the design, thus imparting irregularities to the edge of a design instead of forming a straight edge as heretofore described.

The use of this regulating means will not change the body of the design or effect the tonal values thereof excepting along and adjacent one edge thereof, in the manner above referred to.

The regulating device consisting of the contact member 70 and the controlling or cam plate 71 may be used alone to modify both edges of the created design, or it may be used in conjunction with the contact member 66 and its coöperating surface 67 to modify one edge of the design, while said contact member 66 and its coöperating surface 67 modifies the other edge of the design. When so used in conjunction with said contact member 66 it may have the effect of varying the operative effect of said last named contact, or it may be so set as not to have this effect.

In addition to modifying the outline of the edge of the design most remote from the pin 35, the contact member 70 and the coöperating controlling or cam plate 71 will also have the effect of changing the tonal values in different portions of the body of the design, by reason of the systematic lateral displacement of the carriage 52 with a resultant variance in the points of intersection of the line forming a design.

The degree, quantity, and timing of this displacement may be controlled in any of several ways. Different controlling or cam plates 71 may be used in the machine. These controlling or cam plates may be shifted longitudinally of the machine, so that the contact member 70 will operate thereon at different points of the rotation of the pin 35. The contact member 70 may be adjusted toward and from the plate 71, so that it may either operate upon the entire surface of said plate, or only upon a portion of each rise thereon. The set screw 56 may also be used to change the relation of said

controlling or cam plate 71 and the contact member 70 with the same effect as would follow from the adjustment of said contact member 70.

Lateral displacement of the carriage 52 results from the rectilineal traverse of the traveler carriage 30, a camming action resulting from the movement of the plate 71 with relation to the relatively fixed contact 70, the springs 57 permitting the movement of the carriage 52 and maintaining the engagement of the plate 71 and the contact 70.

This constant or intermittent variation in the lateral position of the carriage 52, according to the form of the controlling or cam plate 71 used, would normally have the effect of varying both edges of the design. If the movement of the carriage 52 be simultaneous with, and in the same direction as, but to a lesser degree than the movement of the work tool or point, the effect would be the condensing of the design at that point of one edge. If, however, the movement of the carriage 52 be opposite in direction to that of the work tool or point, with conditions the same as above referred to, the design would be extended at that point.

The rate of travel of the traveler carriage 30 is very slow, so that the formation of the edge effect upon the design is one of gradual development requiring a number of revolutions of the pin 35 to effect same.

The operative effect of the operating mechanism 70 and 71 will vary according to the position of the rises upon the plate 71 with relation to the pin 35. If the contact 70 be in engagement with the high point of a rise upon said plate when the pin 35 is to the extreme right, (Fig. 2) one effect is secured, but this effect will be different with practically every different position of the pin 35, because the coöperation of these parts in creating the design will have different operative intervals with such changes, so as to vary the point of intersection of the lines at different points of the design. The contact 70 and its coöperating plate 71 in their functionings will modify the operative effect of the controlling or cam plate 43 throughout the entire design created.

When the contact 70 and its coöperating parts are so adjusted as to be operative simultaneously with the contact member 66 and its coöperating surface 67, the latter regulating device will, adjacent one edge of the created design, prevent the contact 70 and its plate 71 having an operative effect on the design by moving the carriage 52 and said plate 71 out of the operative range of the contact 70. The quantity or movement of the carriage under the control of the contact 66, may, however, be so limited as to move said carriage out of the operative range of the contact 70 as to portions of the controlling or cam plate 71 only, thus still further modifying the created design. When two or more of the regulating devices heretofore referred to are simultaneously operative in creating the design, each will modify the operative effects of the other in creating the design.

If desired, the various parts of the machine which are capable of adjustment, may be provided with scales for the purpose of keeping a record of the adjustments to permit the duplicating of any design. Some such expedient is necessary since it is impossible to tell by inspection of the machine what the design created will be; and any particular design must result from a number of different regulating and adjusting devices which must be set with accuracy.

If it be desired to superimpose upon the design, what may be called a concealed design, a plate 100 bearing the design to be incorporated in the created design, is mounted upon the carriage 52 below the stop 99. If it be desired to form this design by broader or deeper lines, the design upon this plate will be in intaglio, but if it be desired to make the lines narrower and shallower this design will be in relief. If the design upon the plate 100 is in intaglio, the micrometer stop 99 is so set as to engage the flat top of the plate 100 when the work tool or point has penetrated the work plate or sheet 100 to the maximum depth. The stop 98 need not be used when the stop 99 and its coöperating plate 100 are used. As the support 22 has movement imparted thereto, the point of the stop 99 will be passed over the depressions of the plate 100, so that at these points the support 22 will be permitted to descend by gravity and thus increase the depth and width of the line at that point, the support 22 being raised as the point passes from such depression. Consequently the main geometrical design at that point will have an increased depth of tone in a manner to form a design within said geometrical design. If the design upon the plate 100 be in relief, the operation will be as heretofore described with the exception that the support 22 will be raised in a manner to either entirely remove the work tool or point from contact with the work plate or sheet, or raise it to an extent to make the line formed thereby shallower and narrower, than other portions of the line, with the result that there is created a design of lighter tone within the body of the geometrical design. The portions of the lines forming the superimposed design may be made of graduated depth, if desired, so as to secure different tonal values in this design, this variance of depth being secured by the use of a design of graduated heights or depths upon the plate 100.

As heretofore stated, if desired, it is merely necessary to belt the shaft 72 by means of the pulley 73 with any desired

source of power, to have the machine act entirely automatically in creating the designs. When so operated and the machine is used in connection with a steel or other like plate, a completed design can be made in the course of a few hours, which would require days or weeks to make by the ordinary methods.

A machine made in accordance with my invention is capable of the most intricate functionings as the result of a very simple mechanical design. It is capable of great accuracy in its operation, there being little or no lost motion in any of the operative parts of the machine, and the rate of movement of the various parts is sufficiently slow to avoid any substantial wear which would result in a loss of this accuracy.

It is not my invention to limit the invention to the precise detail of construction shown in the accompanying drawings, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention what I claim as new and desire to have protected by Letters Patent is:—

1. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, and means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member.

2. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member, a movable crank pin carried thereby, connections between said crank pin and said first named means, regulating means whereby said crank pin is intermittently moved radially of said rotary member, and means simultaneously actuating said rotary member, and said means for imparting rectilineal traverse to one of said supports.

3. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member, a movable crank pin carried thereby, connections between said crank pin and said first named means, regulating means whereby said crank pin is intermittently moved radially of said rotary member, adjusting means whereby the normal operative radius of said crank pin may be varied, and means simultaneously actuating said rotary member, and said means for imparting rectilineal traverse to one of said supports.

4. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member, a movable crank pin carried thereby, connections between said crank pin and said first named means, regulating means whereby said crank pin is intermittently moved radially of said rotary member, means whereby the operative effect of said regulating means may be modified, and means simultaneously actuating said rotary member, and said means for imparting rectilineal traverse to one of said supports.

5. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member, a movable crank pin carried thereby, connections between said crank pin and said first named means, regulating means whereby said crank pin is intermittently moved radially of said rotary member, adjusting means whereby the normal operative radius of said crank pin may be varied, means whereby the operative effect of said regulating means may be modified, and means simultaneously actuating said rotary member, and said means for imparting rectilineal traverse to one of said supports.

6. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member, a movable crank pin carried thereby, connections between said crank pin and said first named means, regulating means whereby said crank pin is intermittently moved radially of said rotary member, means whereby said regulating means may be adjusted to vary its operative interval upon said crank pin, and means simultaneously actuating said rotary member, and said means for imparting rectilineal traverse to one of said supports.

7. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said

member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof.

8. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified.

9. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified.

10. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means whereby said support for the work tool or point will be automatically raised and lowered to superimpose a distinctive design upon the design created by the other mechanisms of the machine.

11. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

12. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said slide may be adjusted upon said head to vary the operative relation of said contact and said controlling or cam plate, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

13. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a block adjustably mounted on said slide, a crank pin carried by said block, means wherbey said block may be adjusted upon said slide diametrically of said

rotary member, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

14. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a block adjustably mounted on said slide, a crank pin carried by said block, means whereby said block may be adjusted upon said slide diametrically of said rotary member, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said slide may be adjusted upon said head to vary the operative relation of said contact and said controlling or cam plate, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

15. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said controlling or cam plate may be adjusted circumferentially of said rotary member to vary the operative intervals of the rises thereon with relation to the points of engagement of said contact therewith, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

16. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support may receive rectilineal movement longitudinally of the machine, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a forked arm, a controlling or cam plate mounted upon said arm and having a pendant stud thereon, oppositely disposed adjustment screws carried by said forked arm and acting upon said stud whereby said controlling or cam plate may be moved circumferentially of said rotary member, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, connections between said crank pin and said first named means, and means simultaneously actuating said rotary member and said means imparting rectilineal traverse to one of said supports.

17. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports, adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support.

18. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact

member carried by and movable with said support actuated by said rotary member, a coöperating contact surface upon said rectilineally movable support, and means whereby said contact is rendered adjustable toward and from said last named support.

19. A geometrical machine embodying therein a support for a work sheet or plate comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively whereby said last named carriage may have movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member, operative connections between said member and said support for a work tool or point adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse to said longitudinally movable carriage simultaneously with the actuation of said rotary member, and means whereby movement laterally of the machine will be imparted to said laterally movable carriage by and in accordance with the functionings of said rotary member during a portion of each rotation thereof, to modify the created designs adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support.

20. A geometrical machine embodying therein a support for a work sheet or plate comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively whereby said last named carriage may have movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member, operative connections between said member and said support for a work tool or point adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse to said longitudinally movable carriage simultaneously with the actuation of said rotary member, and means whereby movement laterally of the machine will be imparted to said laterally movable carriage by and in accordance with the functionings of said rotary member during a portion of each rotation thereof, to modify the created designs adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, a coöperating contact surface upon said laterally movable support, and means whereby said stop is rendered adjustable to vary the operative relation of said laterally movable carriage and the contact coöperating therewith.

21. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said longitudinally movable support.

22. A geometrical machine embodying therein a support for a work sheet or plate, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact, an elongated controlling or cam plate carried by and movable with said longitudinally movable support, and means whereby said plate is rendered adjustable longitudinally of said support to vary the operative interval of the engagement of said contact thereon.

23. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to

normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact, an elongated controlling or cam plate carried by and movable with said longitudally movable support, and means whereby said contact is rendered adjustable toward and from said plate.

24. A geometrical machine embodying therein a support for a work sheet or plate comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively whereby said last named carriage may have movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member, operative connections between said member and said support for a work tool or point adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse to said longitudinally movable carriage simultaneously with the actuation of said rotary member, and means operative independently of said rotary member adapted to impart lateral movement to said laterally movable carriage whereby the design adjacent both edges thereof will be modified, comprising a stationary contact, an elongated controlling or cam plate, carried by and movable with said laterally movable carriage, and means whereby said contact is rendered adjustable toward and from said plate.

25. A geometrical machine embodying therein a support for a work plate or sheet, a support for a work tool or point, a rotary member, operative connections between said member and one of said supports adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said longitudinally movable support.

26. A geometrical machine embodying therein a support for a work sheet or plate comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively whereby said last named carriage may have movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member, operative connections between said member and said support for a work tool or point adapted to normally impart a circular movement to said support, means whereby movement radially of said normal circle will be intermittently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse to said longitudinally movable carriage simultaneously with the actuation of said rotary member, means whereby movement laterally of the machine will be imparted to said laterally movable carriage by and in accordance with the functionings of said rotary member during a portion of each rotation thereof, to modify the created designs adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support, and means operative independently of said rotary member adapted to impart movement to said laterally movable carriage whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said longitudinally movable support.

27. A geometrical machine embodying therein a support for a work plate or sheet, a vertically movable support for a work tool or point, means whereby one of said supports is universally movable upon a single plane, means whereby the other support

may receive rectilineal movement longitudinally of the machine, a rotary member, operative connections between said member and said universally movable support adapted to normally impart a circular movement to said support, means whereby movement radially of said support will be independently imparted to said support during each revolution of said rotary member, means imparting rectilineal traverse longitudinally of the machine to said other support simultaneously with the actuation of said rotary member, a plate having a portion of its surface flat and a design not in the plane of said flat surface, carried by one of said supports, and a contact carried by the other of said supports and in constant engagement with said plate, whereby said support will be automatically raised and lowered to superimpose a distinctive design upon the design created by the other mechanisms of the machine.

28. A geometrical machine embodying therein a support for a work plate or sheet, comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, cooperating traction members carried by said carriages respectively, whereby said last named carriage may receive movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, connections between said crank pin and said universally movable support, means simultaneously actuating said rotary member, and said means imparting rectilineal traverse to said longitudinally movable carriage, means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said longitudinally movable support.

29. A geometrical machine embodying therein a support for a work plate or sheet, comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, cooperating traction members carried by said carriages respectively, whereby said last named carriage may receive movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member having a head, a slide mounted upon said head, a crank pin carried by said slide, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said slide may be adjusted upon said head to vary the operative relation of said contact and said controlling or cam plate, connections between said crank pin and said universally movable support, means simultaneously actuating said rotary member, and said means imparting rectilineal traverse to said longitudinally movable carriage, means whereby movement laterally of the machine will be imparted to said last named support by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said rectilineally movable support, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said longitudinally movable support.

30. A geometrical machine embodying therein a support for a work plate or sheet, comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively, whereby said last named carriage may receive movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member having a head, a slide mounted upon said head, a block adjustably mounted

on said slide, a crank pin carried by said block, means whereby said block may be adjusted upon said slide diametrically of said rotary member, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said slide may be adjusted upon said head to vary the operative relation of said contact and said controlling or cam plate, connections between said crank pin and said universally movable support, means simultaneously actuating said rotary member, and said means imparting rectilineal traverse to said longitudinally movable carriage, means whereby movement laterally of the machine will be imparted to said laterally movable carriage by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said laterally movable carriage, and means operative independently of said rotary member adapted to impart lateral movement to said last named support whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said laterally movable carriage.

31. A geometrical machine embodying therein a support for a work plate or sheet, comprising a carriage adapted to have movement longitudinally of the machine, a second carriage mounted thereon, coöperating traction members carried by said carriages respectively, whereby said last named carriage may receive movement laterally of the machine, springs connecting said carriages, a stop limiting the action of said springs, a support for a work tool or point whereby said work tool or point is universally movable upon a single plane, a rotary member having a head, a slide mounted upon said head, a block adjustably mounted on said slide, a crank pin carried by said block, means whereby said block may be adjusted upon said slide diametrically of said rotary member, a controlling or cam plate stationarily supported adjacent said head, a contact member carried by said slide adapted to operatively engage said controlling or cam plate, a spring connection between said head and said slide, means whereby said slide may be adjusted upon said head to vary the operative relation of said contact and said controlling or cam plate, means whereby said controlling or cam plate may be adjusted circumferencially of said rotary member to vary the operative intervals of the rises thereon with relation to the points of engagement of said contact therewith, connections between said crank pin and said universally movable support, means simultaneously actuating said rotary member, and said means imparting rectilineal traverse to said longitudinally movable carriage, means whereby movement laterally of the machine will be imparted to said laterally movable carriage by and in accordance with the functionings of said rotary member during a portion of each rotation thereof to modify the created design adjacent one edge thereof, comprising a contact member carried by and movable with said support actuated by said rotary member, and a coöperating contact surface upon said laterally movable carriage, and means operative independently of said rotary member adapted to impart movement to said laterally movable carriage whereby the design adjacent both edges thereof will be modified, comprising a stationary contact and an elongated controlling or cam plate carried by and movable with said laterally movable carriage.

In witness whereof, I have hereunto affixed my signature in the presence of two subscribing witnesses, this 21st day of March, 1917.

WILLIAM S. EATON.

Witnesses:
E. P. EATON,
THOS. F. BISGOOD.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."