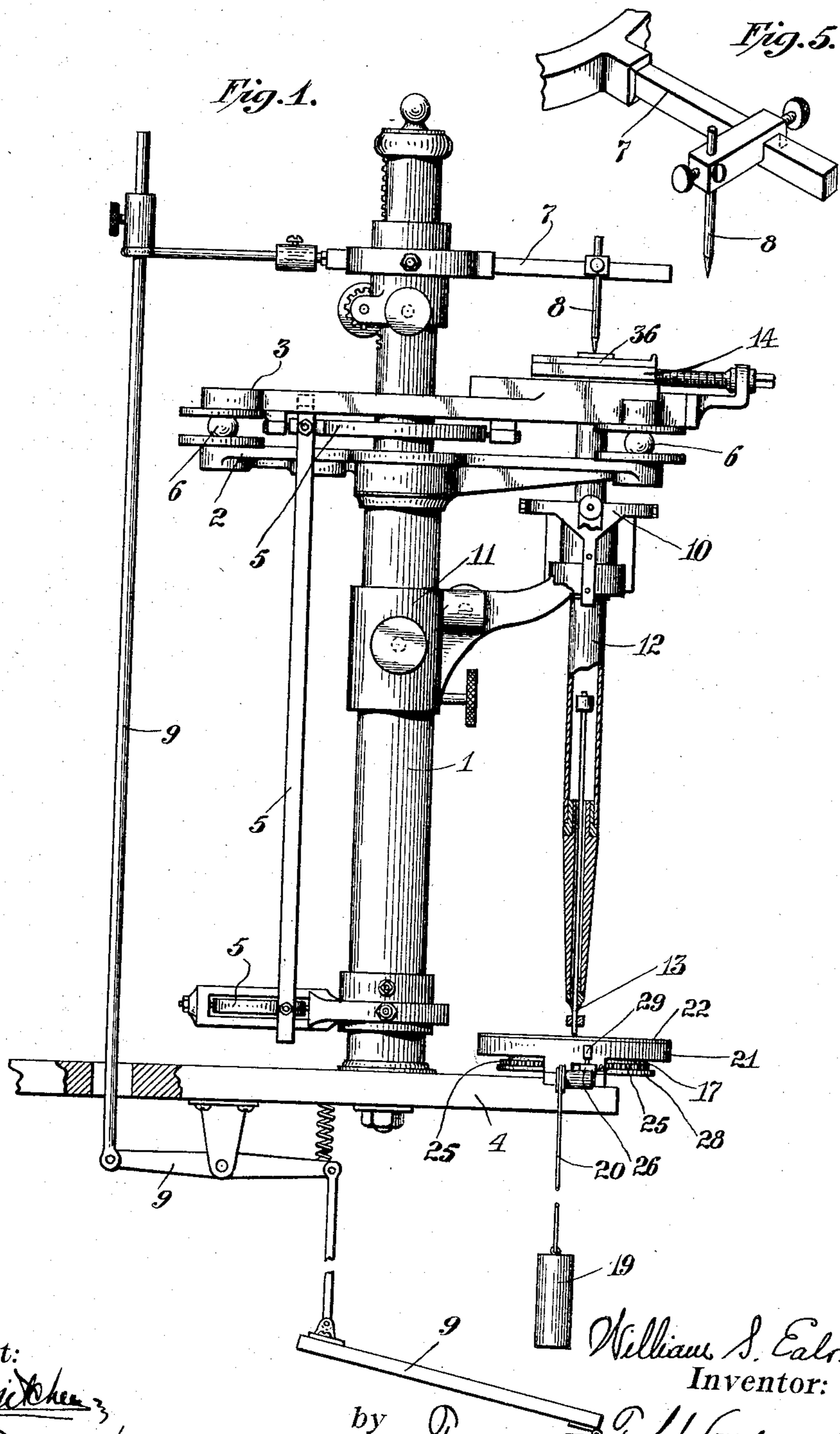


1,166,513.

W. S. EATON.  
GEOMETRICAL MACHINE.  
APPLICATION FILED FEB. 20, 1913.

Patented Jan. 4, 1916.  
3 SHEETS—SHEET 1.



Attest:  
*E. M. McKee*  
Eugene McKee

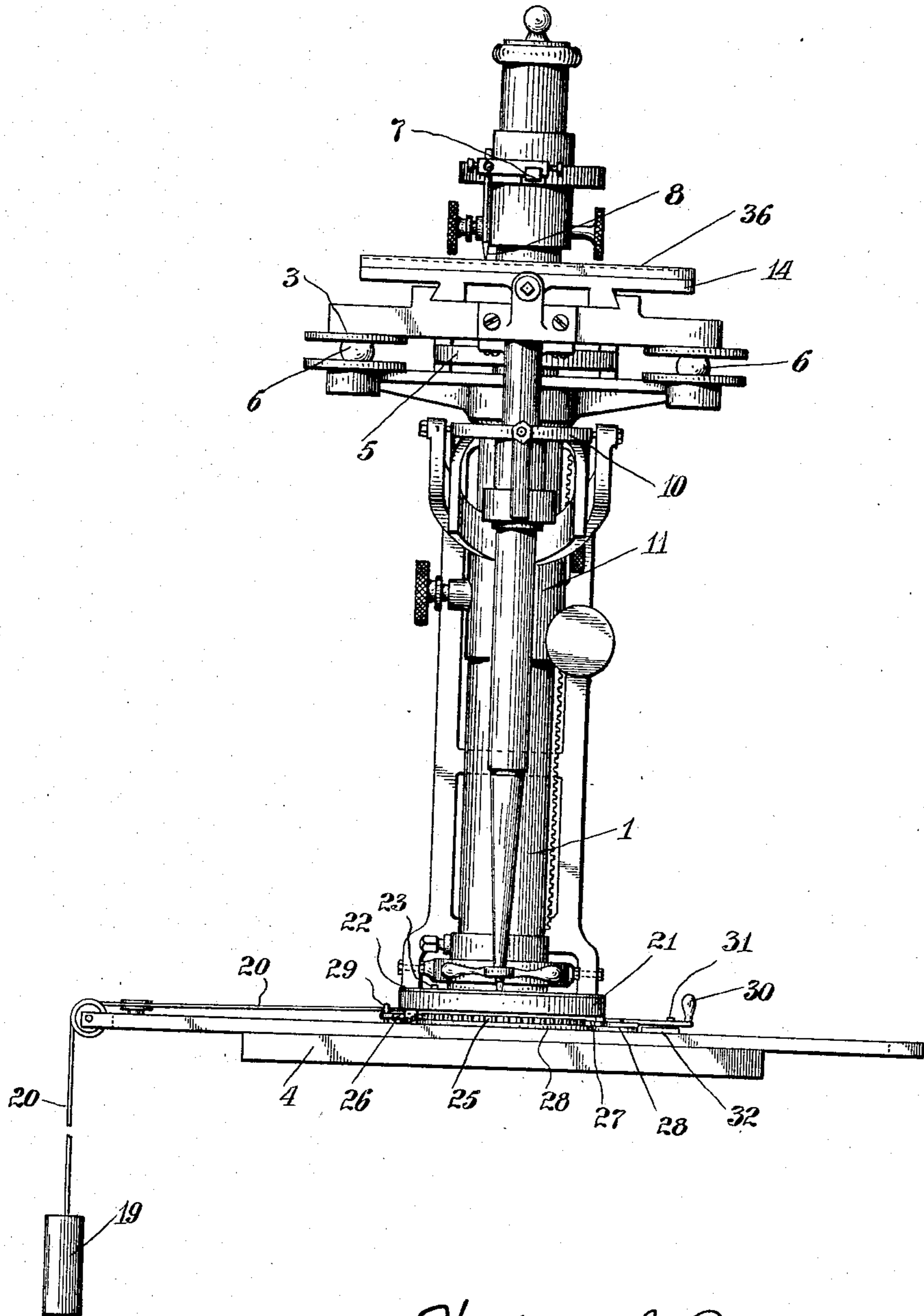
by *Frank J. Wentworth*  
William S. Eaton  
Inventor:  
his Atty

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3 SHEETS—SHEET 2.

Fig. 2.



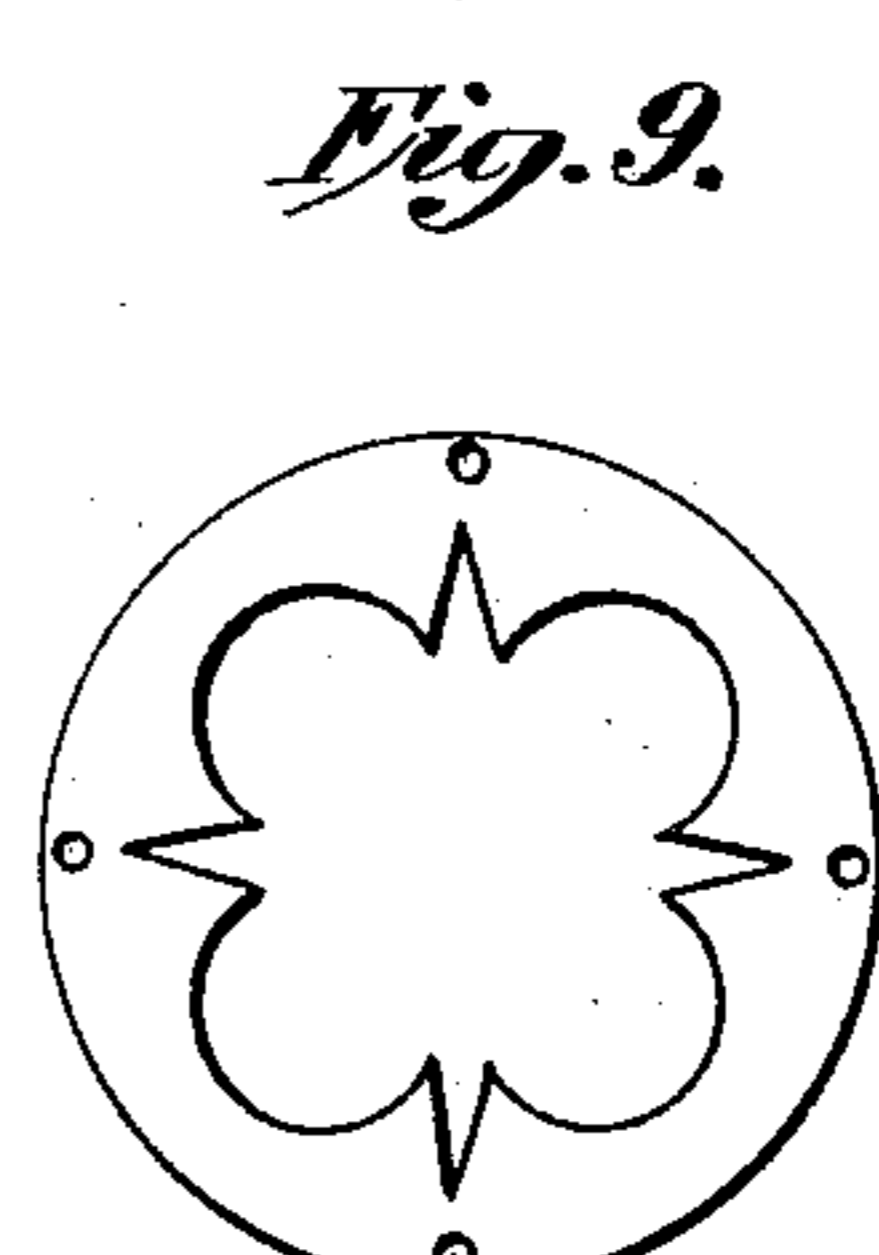
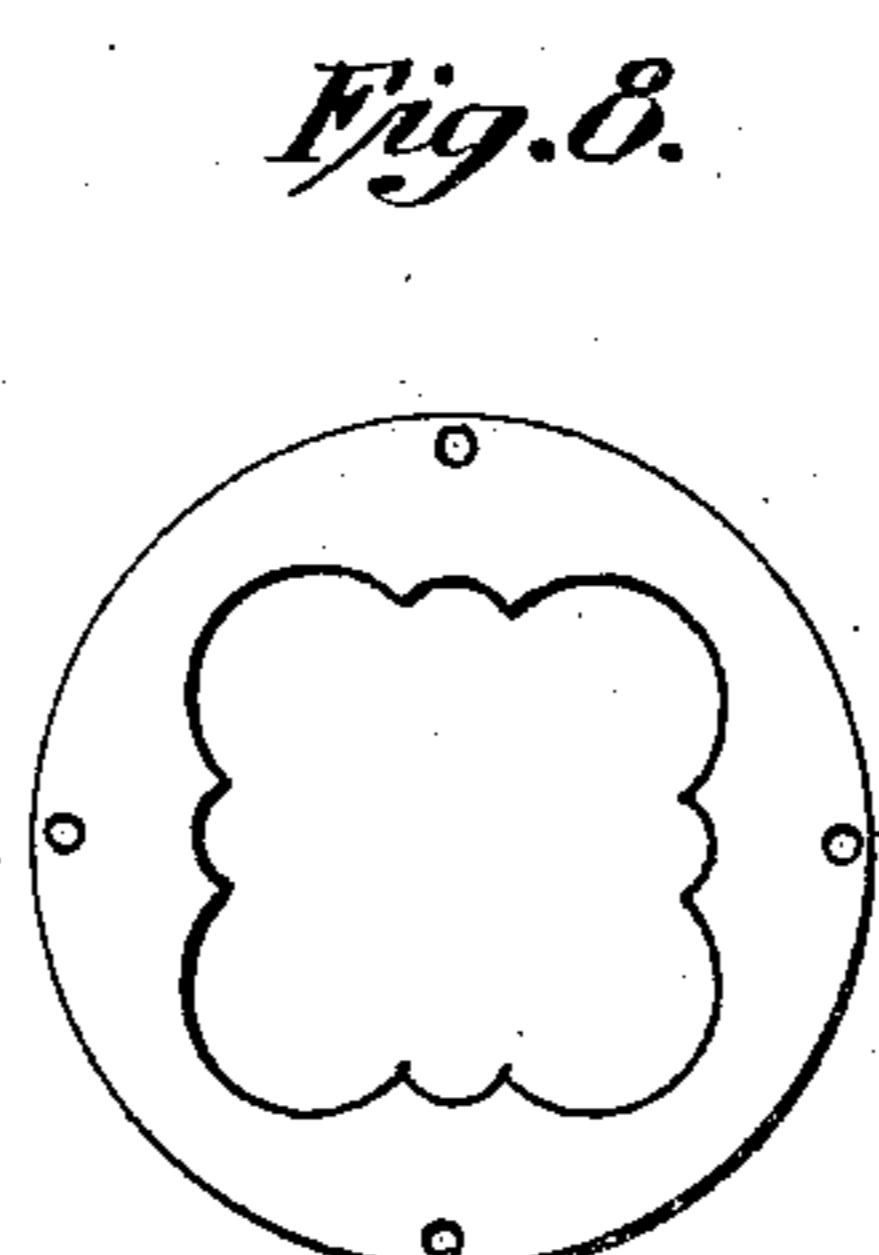
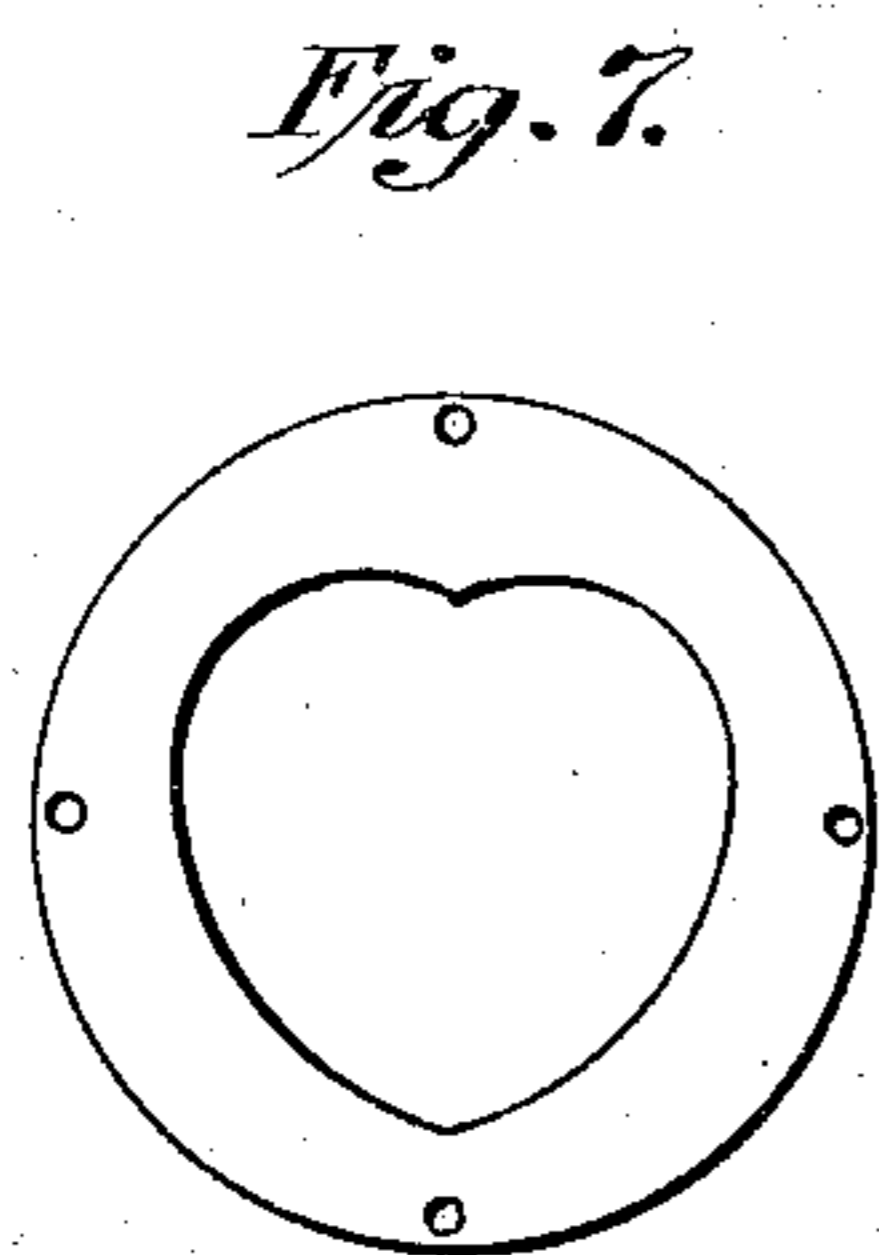
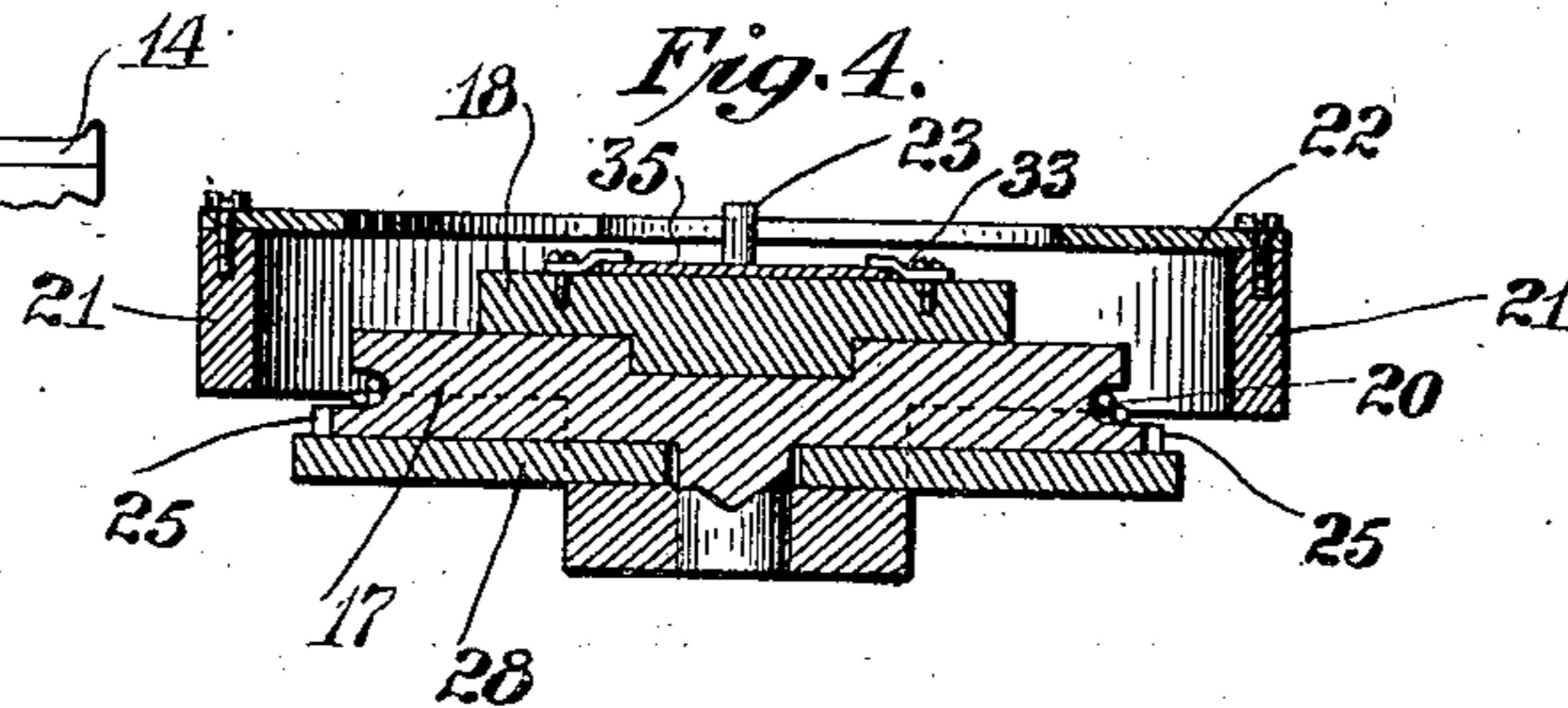
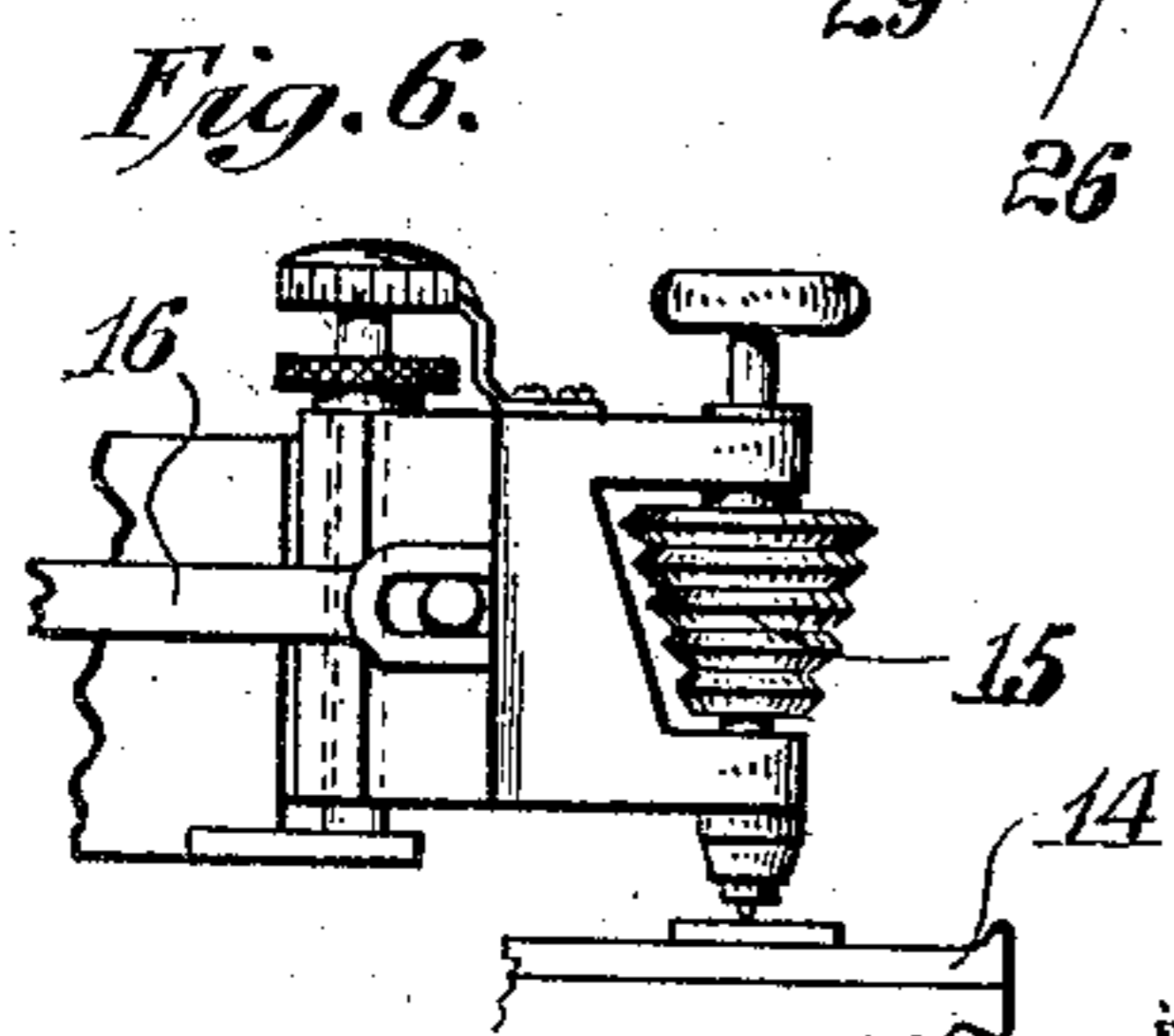
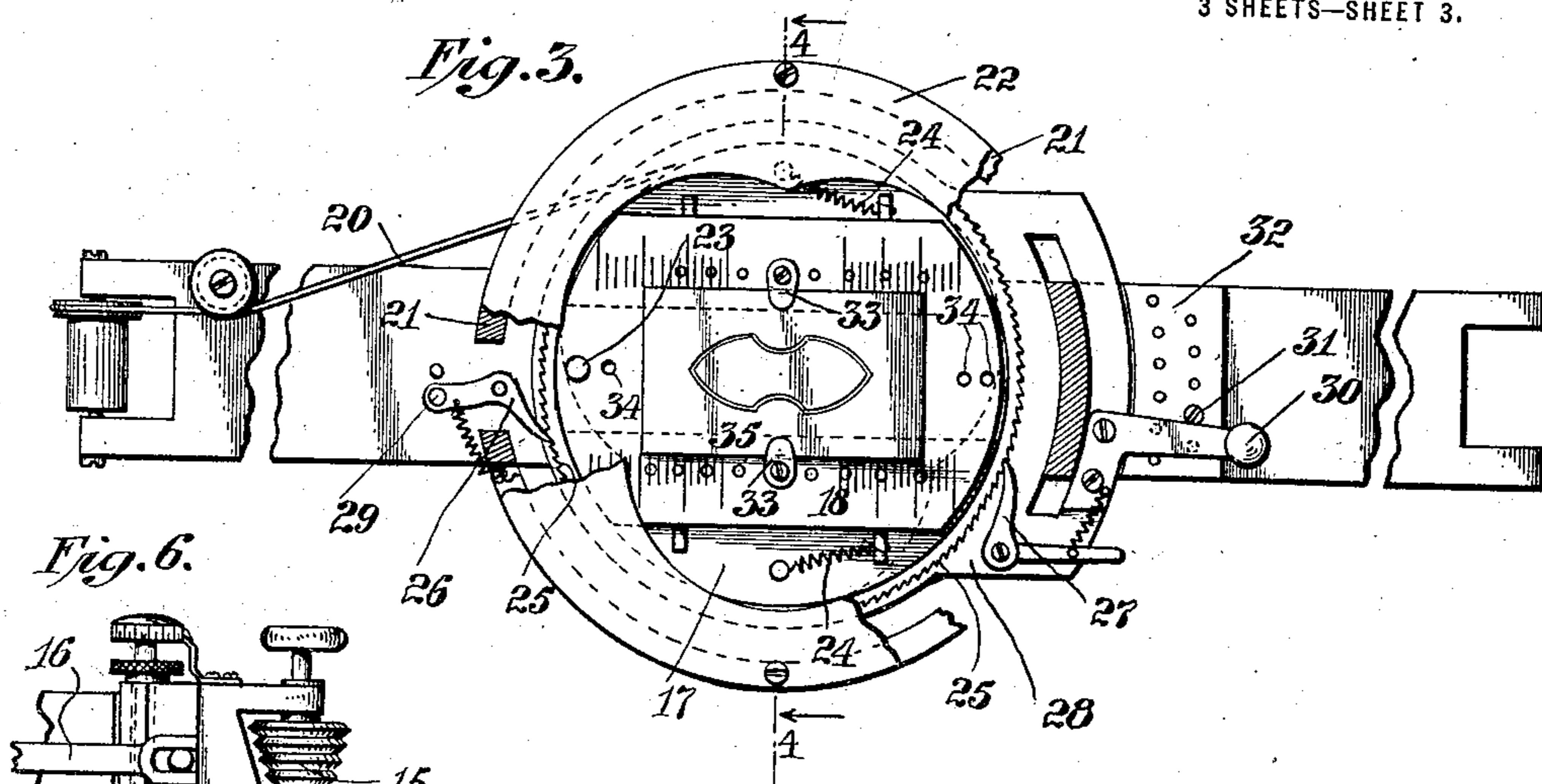
Attest:  
*E. Mitchell*  
*Eugene Werning*

*William S. Eaton* Inventor:  
by *Frank J. Wentworth*  
his Atty.

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W. S. EATON.  
GEOMETRICAL MACHINE.  
APPLICATION FILED FEB. 20, 1913.

Patented Jan. 4, 1916.  
3 SHEETS—SHEET 3.



Attest:  
*E. Mitchell*  
*Eugene Werning*

*William S. Eaton* Inventor:  
by *Frank J. Wentworth*  
his Atty.

# UNITED STATES PATENT OFFICE.

WILLIAM S. EATON, OF SAG HARBOR, NEW YORK, ASSIGNOR TO AMERICAN BANK NOTE COMPANY, A CORPORATION OF NEW YORK.

## GEOMETRICAL MACHINE.

1,166,513.

Specification of Letters Patent.

Patented Jan. 4, 1916.

Application filed February 20, 1913. Serial No. 749,616.

*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 machine adapted to create intricate designs, by means of a master bearing a simple outline, character or base, having as a whole no resemblance to the design to be created or produced.

The main object of the invention is to produce mechanically, from an elementary outline, character or base, in itself simple, an intricate design or geometrical figure having as a whole, no similitude to the elementary outline, character or base.

A further object is to provide a machine for creating geometrical designs from a simple elementary outline, character or base, which is capable of such adjustment as to permit a large number of entirely dissimilar geometrical designs to be produced from a single elementary outline, character or base.

A still further object is to provide a machine for creating geometrical designs from a simple elementary outline, character or base, which machine during a single sequence of operations, will create and superimpose one upon the other, two dissimilar line designs.

A still further object is to provide a machine for creating intricate geometrical designs or figures from a simple elementary outline, character or base, which machine will be so constructed and arranged as to operate with great accuracy and with a certainty which will not require expert knowledge of machinery, nor any skill in drafting or engraving.

A still further object is to provide a machine which may be operated continuously by a sequence of similar operations to create or produce any geometrical design.

A still further object is to provide a machine capable of use to produce metallic plates for engraving purposes, prepare

metallic plates for acid etching, or make matrices adapted for use in making cameo or intaglio line safety designs for negotiable instruments.

A still further object is to provide a machine adapted to create intricate rosette designs in which the operation of the machine instead of being purely mechanical is variable as determined by a master or element having indicated thereon an elementary outline, character or base, the configuration of which and the adjustable relation of the master or element to other cooperating elements of the machine will determine the character of the rosette, thus eliminating the purely mechanical nature of the design and minimizing likelihood of duplication thereof.

A still further object is to provide a machine of this character wherein the operation of the machine, irrespective of the nature of the design to be created, will always be the same, the compelling or controlling means acting entirely independent, and without the control, of the operator of the machine.

A still further object is to provide a machine of this character wherein a plurality of different compelling or controlling means may be interchangeably used upon the machine and adjustments may be made in a manner to vary the character of the created design at the will of the operator, thus preventing additional elements of safety and preventing duplication or reproduction of the design, even with a similar machine, unless the exact setting of the compelling or controlling element and other adjustments are known to the operator.

A still further object is to provide a machine wherein the spacing of the lines may be varied, thus not only varying the design, but adapting the machine to different classes of work. And a still further object is to provide a machine which will be simple in its design and mode of operation, and capable of quick and accurate adjustment to secure the creation of any desired design.

The invention consists primarily in a geometrical machine embodying therein an elementary outline, character or base, means adapted to follow said elementary outline, character or base and successively describe a plurality of similar outlines upon a work

plate or sheet, and means adapted to vary the relative position of said outline, character or base, and said work plate or sheet following each actuation of said first named means; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

10 Referring to the drawings—Figure 1 is a side elevation of a machine embodying my invention; Fig. 2 is a front elevation thereof; Fig. 3 is a plan view in detail of the controlling or compelling mechanism  
15 by means of which the movements of the support for the means carrying the elementary outline, character or base are defined, parts thereof being broken away; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5  
20 is a detail view of one form of the supporting means for the work point, used in making matrices, proofs or plates for etching; Fig. 6 is a detail view of a different form of support for the work point adapted  
25 to actually remove the metal for making cameo or intaglio plates; Figs. 7, 8 and 9 are detail views illustrating some different forms of controlling plates; and Figs. 10,  
30 11 and 12 are detail views illustrating some different elementary outlines, characters or bases which may be used.

Like numerals refer to like parts throughout the several views.

35 In the accompanying drawings, I have shown an embodiment of my invention which includes therein the essential characteristics of a well known type of pantographic engraving machine, which in actual use I have found to give highly satisfactory results. This machine, however, is  
40 merely typical of a large number of machines in which my improvement may be incorporated, and if desired, still other and special designs of machines adapted for  
45 special uses may be constructed so as to embody the essential characteristics of my invention.

In the following description, I have referred more particularly to the particular  
50 type of machine shown in the drawings, it being expressly understood, however, that it is not my intention to in any way limit myself to any particular mechanisms for transmitting movement as defined by the  
55 elementary outline, character or base, to the mechanism by which the design is produced.

60 My invention is especially adapted for use in creating designs for, or upon printing plates, and plates, or matrices, for use in developing printing plates, which designs are in the form of rosettes or other intricate geometrical designs, to be used in connection with the production of safety papers  
65 such as are used in bank notes, negotiable

papers or instruments. Heretofore, these safety designs have been either made by hand or upon a rose engine or engine lathe, the design resulting from certain predetermined mechanical movements in the machine itself. By this means, a limited number of designs only could be produced, and the safety factor was limited by the known capacity of the machine. Growing out of this condition, it has heretofore been the custom to develop a part of the design by machine and the balance by hand. A rose engine is capable only of producing scroll work, and if it be desired to include in the white line safety elements of a note, paper or instrument, an element other than a scroll, such as is usually found in bank notes, this is always done by hand. The old method of producing safety designs referred to required a period of from two to ten weeks, or more of expensive, high class skilled labor, and as I have heretofore stated, the designs created in most instances were all modifications of one general design.

By my improved mechanism, I am enabled to secure intricate geometrical designs, susceptible of practically infinite variations, each of which designs will be complete in itself and, when a plate is made upon a machine, will require no hand finishing. I am also enabled to mechanically superimpose one design upon another, or insert a number or word design in the body of a scroll work design. I am also enabled to make a proof design and a completed design in a materially shorter time than is possible with the old rose engine and hand work method.

In the form of the invention shown in the accompanying drawings, 1 indicates a central column carrying a bed plate 2 for a movable table 3 adapted to carry the sheet or plate upon which the design is to be formed. Said column is mounted upon the main table 4 of the machine which may be supported in any desired manner. The table 3 is mounted to have universal movement upon a single plane so as to place no limitation upon the movement thereof, and thus permit the formation of straight or curved lines in any direction. At 5 I have shown a steadying mechanism to insure absolute accuracy in the movement of the work supporting table 3. At 6 are ball bearing mounts for the table 3 which insure absolute freedom of movement. Mounted upon the column 1 above the work table 3 is a supporting means, as the oscillatory arm 7, for a work point 8 which in the form of the invention shown is an ordinary graver. The oscillating work point carrying arm is controlled by the link, treadle and lever mechanism 9, this point being adapted to be brought into contact with the work surface through gravity only.

Mounted by means of a universal joint 10 and a vertically adjustable collar 11 upon the column 1, is a transmitter 12, one end of which is adapted to have mounted therein a tracing point or stylus 13, and the other end of which is connected by means of a universal joint, not shown, with the work table 3.

The adjustability of the collar 11 is for the purpose of varying the range of movement of the table as compared with that of the tracing point or stylus. Carried by the work table 3 is a work support 14 having means whereby a plate or sheet may be attached thereto, which means are adapted to be released to permit the adjustment of the plate or sheet on said table to secure the proper placing of the design on said plate or sheet.

In Fig. 6 I have shown a rotary spindle 15, and old and well known means for setting it for a predetermined depth of cut, and a lever mechanism 16, by means of which the work point or routing tool is brought into engagement with the work. By this means a cameo or an intaglio plate may be accurately produced which plate may be used as a master plate from which transfer rolls may be made, or the plate itself may after hardening, be used for under-surface printing.

The mechanism above described has been heretofore patented to me and it is not my intention to claim such mechanism broadly at this time. The elements above referred to constitute one type of pantographic engraving machine embodying one character of reproducing means, the mode of operation of which contemplates the exact reproduction of a design or pattern upon any desired scale. By my present invention, however, I do not reproduce a fixed design, but vary the operation of the above described mechanism in a manner whereby a design is created which as a whole bears absolutely no resemblance to the original design or master. This mechanism comprises a support for the master or element having thereon an elementary outline, character or base, which support is capable of movement as defined by an actuating mechanism, and a controlling plate which determines the general character of the outline of the rosette or other design, although by adjustments provided, this outline itself may be varied.

The actuating mechanism comprises a rotary base 17, mounted upon the main bed 4 of the machine and having mounted thereon a slide 18, capable of movement radially of the center of rotation thereof. This base is acted upon by the weight 19, through the cord 20 which weight has the function of aiding in that rotary movement of the base which will be hereinafter referred to.

Surrounding the base 17 is a rim 21, adapted to receive a controlling or cam plate 22, having an opening therein defining the extent and direction of movement of the slide 18. The configuration of the opening through the plate 22 may be varied infinitely, (examples of such variations being shown in Figs. 7 to 9), thus making it possible to vary infinitely the general character of the outline of the geometrical design to be created.

The slide 18 carries a contact pin 23 adapted to be forced into engagement with the edge of the opening in the plate 22 by the springs 24 acting upon said slide, thus imparting to said slide with the rotation of the base 17, an eccentric movement due to the simultaneous rotary movement of said slide and its lineal traverse under the control of said springs and said controlling plate. To secure the desired movement of the slide 18 means are provided for imparting a rotary movement to said base, which means operate simultaneously with the means imparting lineal movement to said slide, that is the springs 24 and the controlling plate 22. This actuating mechanism comprises a ratchet wheel 25 formed on or carried by the base 17, which ratchet is acted upon by the spring pressed detent dog 26 and the actuating dog 27 carried by the oscillatory plate 28 rotatably mounted upon a pivot in the base 17.

The function of the dog 26 is to prevent a return movement of the base upon the return oscillation of the plate 28. The dog 26 is provided with a lock pin 29 by means of which this dog may be disengaged from the ratchet to facilitate the restoration of the base 17 to normal. The movement of the said plate 28 is guided by a slot therein through which a portion of the rim 21 projects, this plate having movement beneath other portions of said wall.

Adjacent to the operating handle 30 of the plate 28, I provide an adjustable stop comprising a pin 31 adapted to be mounted in any one of a series of graduated openings carried by the stop plate 32.

The controlling plate 22 is detachably mounted upon the rim 21 so that said plate may be removed at any time and another plate having a different design of opening substituted therefor to vary the character of the design to be created, or the position of the plate upon the rim 21 may be changed.

The slide 18 is provided with dogs, gripper jaws or other securing means 33, by means of which the plate or other device carrying the elementary outline, character or base may be firmly mounted upon said slide. This means for securing the element carrying the outline, character or base permits a variance in the positioning thereof relative to the center of rotation of the base

17, which adjustment, however slight, will have the effect of varying the character of the design created either as to its general outline, or its center design. The bearing  
5 pin 23 is also capable of adjustment upon the slide 18, the holes 34 at opposite ends thereof being provided so as to vary the radial position of this pin relative to the center of rotation of the base 17.

10 By the mechanism heretofore described, I am enabled to vary not only the relative position of the support for the elementary outline, character or base, and the work bed,  
15 but also the relative position of the work bed and the work point, thus causing said point to operate upon a different portion of the plate, sheet or body carried by said work bed, this variance causing an outline  
20 similar to said elementary outline, character or base to be successively described upon different portions of the work plate or sheet. Hence, variance in the design created from any elementary outline, character or base,  
25 may be accomplished either by the substitution of one controlling plate for another having an opening of dissimilar configuration, by a change of position of said outline, character or base upon the slide, or by a  
30 change of the position of the slide relative to the center of rotation of the base 17 and to the controlling plate through the adjustment or change in position of the contact  
35 pin 23. A still further variance in the appearance of the design, without, however, changing its general character, may be accomplished by means of the stop pin 31,  
40 the position of which will control the number of lines entering into the created design and their spacing. The design may be still  
45 further modified by accomplishing any of these adjustments during the operation of developing the design.

In Figs. 10 to 12, I have shown three  
45 illustrative outlines, characters or bases, other than that shown in Fig. 3, and as these themselves may be varied infinitely, it can be readily understood that the number of designs which may be created is infinite, and  
50 yet, whatever the nature of the design created the movements of the operator and of the operative parts of the machine are always the same, varying merely in degree, in some instances.

55 The eccentricities of the machine are so pronounced that even with a definite outline, character or base; and a definite controlling plate, it is impossible to determine what the character of the created design will be, or what the formation of the center of the design will be, and this uncertainty is also  
60 present with every adjustment of the machine, irrespective of a change of the elementary outline, character or base, or of the controlling plate itself. In fact, to duplicate a given design, it is necessary to record

not only the elementary outline, character or base, and the controlling plate, but also every adjustment upon the machine, and without such a record, a reproduction of the design even with a similar machine could  
70 be secured only by chance.

In the drawings, I have shown the master or element carrying the elementary outline, character or base as consisting of a metallic  
75 plate 35 having a single line geometrical figure cut thereinto so as to form a guide for the tracing point or stylus 13, and the work plate 36 upon which the design is to be created as a prepared plate adapted to have  
80 portions thereof removed by the graver, although in no sense am I limited to the use of such.

Throughout this specification when referring to an elementary outline, character or base, I contemplate a geometrical figure or  
85 an incomplete geometrical figure as distinguished from mere straight or curved lines, the outline of which figure taken as a base and repeatedly reproduced in the manner determined by the controlling or com-  
90 pelling mechanism will create, form or constitute the completed intricate geometrical design.

By the term work plate or sheet as used in the specification, I contemplate a metallic  
95 plate from which portions of the metal are to be actually removed; a copper plate coated with resist to be removed preparatory to an acid etching process; proof glass or paper upon which a design may be made to de-  
100 termine the suitability thereof before making a plate; matrices from which a cast is to be made, or any other substance or material adapted to receive in any manner whatsoever, a design. By the term "work point"  
105 is to be included any instrument or implement for marking, cutting or scratching upon any material.

The operation of the herein described machine is substantially as follows:—Before  
110 beginning work with the machine, the controlling or compelling cam plate 22 is first secured upon the rim 21 in the desired position. By providing the rim 21 with regularly spaced screw holes, said cam plate  
115 may be shifted around in any desired position upon said rim. The master or element 35 is then mounted upon the slide 18 in the desired relation to the center of rotation of the support 17, said slide 18 being provided  
120 with scale marks to facilitate the accurate setting or positioning of this master or element. The stop pin 31 is then set in the desired position on the plate 32 to limit the movement of the lever 28 with each actua-  
125 tion thereof, and the bearing pin 23 is set in the desired hole. These various adjustments having been accomplished, the machine is ready to be placed in operation. The work plate is then mounted upon the  
130

work bed 14, being so placed thereon that the design to be created will appear in the proper position upon this plate. The positioning of this plate does not in any way affect the character of the design produced or created. The tracing point or stylus 13 is then brought into position relative to any point of the elementary outline, character or base, and the treadle mechanism 9 actuated to bring the work point into engagement with the work plate or sheet 36. When the parts are in this position, the tracing point or stylus 13 is moved completely around the elementary outline, character or base, and brought to rest at its starting point. Thereafter either with or without actuating the treadle mechanism 29, the lever 28 is actuated, rotating the support 17 and slide 18, and changing the position of the slide 18 to an extent defined by the controlling or compelling plate 22. The actuation of the lever 28, therefore, has the twofold function of varying the relative position of the elementary outline, character or base and the work plate or sheet, and of spacing the successive line reproductions of said elementary outline, character or base in the created design. If the work point be raised from the work plate or sheet, the outline of the figure will be interrupted, or formed of a series of sections the character of each of which will be defined by the configuration of an end of the elementary outline, character or base. If, however, the work point be held in engagement with the work plate or sheet, the outline of the created design will be defined by a continuous line connecting the series of sections above referred to, or a part thereof only, according to the setting of the machine. The alternate tracing of the elementary outline, character or base, and actuation of the lever 28 is repeated until the rotary support 17 and its slide 18 reach the starting point in operating the machine, or until the desired depth of cut in the lines of the design is secured, when the material of the work plate or sheet itself is to be removed. The controlling plate 22 has the effect of imparting to the slide 18 movement toward or from the center of rotation of the support 17 to an extent controlled by the contour or configuration of the cut out portion of said plate, but while this plate 22 will absolutely determine and control the movements of the slide 18, the outline of the created design and its dimensions will not necessarily be the same as the outlines of the cut out portion of this plate, nor are the dimensions always the same, as the adjustment of the elementary master or element 35 upon the slide 18 will vary both the character of the outline, body and center design of the created design, and its dimensions. For instance, if the elementary master or element

35 be set upon the slide 18 close to the bearing pin 23, and entirely upon one side of the center of rotation of the support 17, the outline of the created design will be substantially the same as the outline of the opening in the plate 22, and the dimensions of said design will be large. Also when the said master or element is so set, the lines upon the design may or may not intersect the center of the created design, (according to the dimensions of the elementary outline, character or base), thus producing one character of center. If, however, the said master plate or element be set closer to or with the major portion thereof only upon one side of the center of rotation of the support 17, the outline will remain the same as before but the lines will intersect each other and the center of the design at different points, and by extending upon the opposite sides of this central point, modify this design about the center, thus creating an entirely different design, although one having the same general outline.

When the quantity of movement of the slide 18 under the control of the plate 22 is small, that end of the elementary outline, character or base most removed from the center of rotation of the plate 17 and adjacent, or toward, the pin 23, will always describe the outline of the created design. If, however, the quantity of movement imparted by the plate 22 be great, at some point of the design, one end of the elementary outline, character or base may be made by the setting of the plate 35, to describe an outline dissimilar to any portion of the controlling plate and at another point the other end thereof will describe the outline. This eccentricity will create a design where in not only the center will be extremely complicated, but the outline itself, unless the master or element bearing the elementary outline, character or base be set close to the pin 23, will have absolutely no similarity to the configuration of the cut out portion of the controlling plate. If, however, the master plate or element be set so as to bring the elementary outline, character or base, either wholly or in major part upon that side of the center of rotation opposite that of the bearing pin 23, the effect will be an outline in the created design which will possess no similarity to the design of the cut out portion of the controlling plate 22, although the center of the figure may bear some resemblance to the cut out portion of said plate. The explanation of this is that the outline of the created design will ordinarily be defined by that portion or end of the elementary outline, character or base which is closest to the cut out portion of the plate 22. Hence when the master or element 35 is mounted wholly or in major part upon that side of the center of rotation of

the support 17 toward the bearing pin 23, the changes of position of the parts of the elementary outline, character or base nearer to the said plate 22, will accord with the movements of the slide under the control of the plate 22. In other words, if the slide 18 move outwardly, the master plate or element will also move outwardly or away from the center of rotation of the support 17, and to an extent defined by said plate 22. If, however, the said master or element be upon the other side of the center of rotation of the support 17, as the pin 23 and slide 18 move outwardly or away from the center of rotation of said support 17, under the control of the plate 22, the portion of the elementary outline, character or base forming the outline of the created design instead of moving outwardly from the center of rotation of the support 17 will move toward said center of rotation, or vice versa, and thus not coincide with the configuration of the cut out portion of the plate 22. This difference is further accentuated by the changes in the point of intersection of the numerous lines. Under some conditions a portion of the elementary outline, character or base will form a portion of the center of the design, and at points of the design it will project beyond the normal outline of the created design and thus form a part of the outline of the design which is particularly noticeable in controlling plates wherein the cut out portion is of a configuration to impart sufficient movement to the slide 18 to cause the major portion of the elementary outline, character or base to be first on one side of the center of rotation of the support 17, and then on the other side thereof. This will be readily understood from the fact that that portion of the design which at any time is closest to the controlling plate 22 will constitute the outline of the created design and with a constant shifting of the slide 18, one end of the elementary outline, character or base may at one time be close to said plate while at other times another portion of said elementary outline, character or base may be close thereto.

From the foregoing, it becomes apparent that the created design in outline will coincide or differ with or from the configuration of the cut out portion or cam surface of the plate 22, according to the quantity of movement of the slide under the control of said plate and the location of the master plate or element carrying the elementary outline, character or base, upon this slide.

Ordinarily if the master or element carrying the elementary outline, character or base is set so that its center coincides with the center of rotation of the support 17, and the controlling plate 22 has a symmetrical opening therein, the resulting figure in outline will coincide with the configuration of

said opening, but the setting of the said master or element upon either side of the center will vary its outline to an extent which may be determined only by the actual operation of the machine.

Heretofore I have referred merely to the effect of the controlling plate 22 upon the outline of the created figure, but it must be understood that with every adjustment of the machine heretofore referred to, even though the outline of the created figure may be the same as the configuration of the opening in the plate 22, the innumerable intersecting lines in the body of the created figure will form a large number of minute figures, which figures constitute the body of the created design. Each of the minute figures and the tone of the center of the design will change with every variance in the adjustment of the machine irrespective of any change in the general outline. This is due to the fact that there will be a change of the angle and point of intersection of the numerous lines with each adjustment of the machine. By these adjustments the tone of the center of the design also may be changed, an increase in the dimensions of the created design generally resulting in a dark center in the design created, and a reduction in these dimensions resulting in a light center. When the pin 23 is shifted in position to vary the dimensions of the created design, or the plate 35 is so adjusted for the same purpose, the character of the center will always change, while the character of the outline may or may not change, according to the extent of the adjustment.

The scale of the created design may be varied by using a plate 22 having a smaller similar opening, and a proportionately smaller elementary outline, character or base, or when my improvements are used upon a pantographic machine, the scale may be varied by the ordinary pantographic adjustments. By either of these methods, any created design may be reproduced in the manner heretofore described, but on a different scale; the outline, body design and center being unchanged excepting as to dimensions.

By setting the master or element carrying the elementary outline, character or base entirely upon one side of the center or rotation of the support 17, a "simple" design will result from the actuation of the machine. If, however, portions of the elementary outline, character or base are upon opposite sides of the center of rotation of said support, a "complex" design is the result, one design being superimposed upon the other. These designs will be dissimilar inasmuch as the movement of the portion of the design upon one side of the center of rotation will be away therefrom, at the same time that the portion upon the other side

will be toward said center. The superimposed design may range from two designs substantially of the same dimensions as each other, to a large design, with a dissimilar and smaller design extending about the center of the created figure. When it is desired to superimpose a still different design upon a created design, it is merely necessary to remove one master or element, substitute another therefore and repeat the operations of the machine, or if desired, when a different figure, as a numeral or a word is to be thus superimposed, a master of this numeral or word may be substituted for the elementary outline, character or base, and the machine used as an ordinary pantograph.

If it be desired to vary the spacing of the lines in a design, it is merely necessary to change the location of the pin 31.

The pin 29 may be used to disengage the pawl 26 from the ratchet 25 to permit the rewinding of the pull cord 20 upon the support 17.

If desired, the pin 23 may be shifted from adjacent one end of the slide 18 to adjacent the other end of said slide, and the springs 24 reversed, thus entirely changing the outline and character of the design without the necessity for shifting the master or element 35.

By the foregoing description, it is apparent that an infinite number of different designs may be created by reason of the different manner in which the machine may be adjusted and the interchangeability of controlling or cam plates, and masters or elements, of different configuration; and that whatever the configuration of the controlling plate, or the master or element, the operation of the machine consists solely in causing the stylus 13 to follow the elementary outline, character or base, and the partial rotation of the support 17 to an extent determined by the mechanism of the machine. By these two operations practised alternately, the most intricate and complex designs may be created by labor totally unskilled in engraving or drafting, and in a fraction of a day, work may be completed which under the old methods would require weeks.

In the accompanying drawings, I have shown merely one embodiment of my invention, and it is apparent that the structure therein shown may be varied indefinitely without departing from the spirit and scope of the invention.

An essential of the machine is the employment of an elementary outline, character or base, a plate, sheet or body upon which the design is to be created, a reproducing mechanism acting as defined by said elementary outline, character or base, and describing a similar outline upon said plate, sheet or body, and means varying the relative posi-

tion of the reproducing means and the work plate or sheet so as to make the operative portion of the former act upon successive portions of the latter. Various mechanisms may be employed for accomplishing this result, and in the accompanying drawings I have shown but one such mechanism. The elementary outline, character or base may be a separate part of the machine, or may appear directly upon the support therefor.

I believe it to be broadly new to provide a machine wherein an intricate geometrical design may be created mechanically from a mere simple elementary outline, and I intend to claim such broadly.

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

1. A geometrical machine embodying therein an elementary outline, character or base, means adapted to follow said elementary outline, character or base and successively describe a plurality of similar outlines upon a work plate or sheet, and means adapted to vary the relative position of said elementary outline, character or base and said work plate or sheet following each actuation of said first named means.

2. A geometrical machine embodying therein an elementary outline, character or base, a support for the work plate or sheet, supporting means for a work point in operative relation to said support, means adapted to follow said elementary outline, character or base and successively cause a similar relative movement of said support and said supporting means, and means for varying the operative relation of said supporting means and said work plate or sheet to create an intricate geometrical design.

3. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, means adapted to impart relative movement of said work bed and the supporting means for said work point, and means whereby the relative position of said support and said work bed may be varied independently of said last named means.

4. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, means adapted to impart relative movement of said work bed and the supporting means for said work point, and means acting independently of said last named means adapted to simultaneously vary the relative position of said support and said work bed in two directions.

5. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation with the

work surface upon said bed, a support for an elementary outline, character or base, means carried thereby wherein the elementary outline, character or base may be set to define a "simple" design, a design composed of superimposed designs, or designs of varying outlines, bodies or centers, means adapted to impart relative movement of said work bed and the supporting means for said work point, and means whereby the relative position of said support and said work bed may be varied independently of said last named means.

6. A geometrical machine embodying therein an elementary outline, character or base, a support for the work plate or sheet, supporting means for a work point in operative relation to said support, means adapted to follow said elementary outline, character or base and successively cause a similar relative movement of said support and said supporting means, and means for varying the operative relation of said supporting means and said work plate or sheet to create an intricate geometrical design, including therein a rotary member, a second member having a dissimilar movement mounted thereon, and means defining the operative movement of said last named member.

7. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, means limiting the movement of said slidable member, and means whereby said support may be actuated.

8. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein defining the movement of said sliding member, and means whereby said support may be actuated.

9. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the

supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, a bearing pin carried by said sliding member and adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, and means whereby said support may be actuated.

10. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member, a sliding member having movement substantially radially thereof, and means upon said sliding member whereby a plate carrying an elementary outline, character or base may be adjusted relative to the axis of said rotary member, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein defining the movement of said sliding member, and means whereby said support may be actuated.

11. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member having on the face thereof ways extending across its axis, and a sliding member mounted in said ways, means adapted to impart relative movement to said work bed and the supporting means for said work point, means limiting the movement of said slidable member, and means whereby said support may be actuated.

12. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, a bearing pin carried by said sliding member adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, said bearing pin being adjustable upon said sliding member radially of said rotary member, and means whereby said support may be actuated.

13. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an ele-

mentary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, said plate being removably mounted whereby it is interchangeable with other plates having dissimilar openings, a bearing pin carried by said sliding member and adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, and means whereby said support may be actuated.

14. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, a bearing pin carried by said sliding member and adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, means forcing said bearing pin into engagement with the edge of said opening, and an oscillatory member whereby intermittent rotary movement may be imparted to said rotary member.

15. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, said plate being removably mounted whereby it is interchangeable with other plates having dissimilar openings, a bearing pin carried by said sliding member and adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, said bearing pin being adjustable upon said sliding member radially of said rotary member, and means whereby said support may be actuated.

16. A geometrical machine embodying therein an elementary outline, character or base, means adapted to follow said elementary outline, character or base and successively describe a plurality of similar outlines upon a work plate or sheet, means adapted

to vary the relative position of said elementary outline, character or base and said work plate or sheet following each actuation of said first named means, and means whereby the scale of the outlines described by said first named means relative to said elementary outline, character or base may be varied.

17. A geometrical machine embodying therein an elementary outline, character or base, means adapted to follow said elementary outline, character or base and successively describe a plurality of similar outlines upon a work plate or sheet, means adapted to vary the relative position of said elementary outline, character or base and said work plate or sheet following each actuation of said first named means, and means whereby said last named means may be adjusted to vary the spacing of such successively described outlines.

18. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a controlling or compelling plate having an opening therein about and above said sliding member, a bearing pin carried by said sliding member and adapted to engage the edge of said opening whereby the movement of said sliding member is defined by said plate, means forcing said bearing pin into engagement with the edge of said opening, an oscillatory member whereby intermittent rotary movement may be imparted to said rotary member, and adjustable means whereby the operative movement of said oscillatory member may be controlled.

19. A geometrical machine embodying therein an elementary outline, character or base, means adapted to follow said elementary outline, character or base and successively describe a plurality of similar outlines upon a work plate or sheet, means adapted to vary the relative position of said elementary outline, character or base and said work plate or sheet following each actuation of said first named means, and means whereby said first named means may be made operative or inoperative during the operative movement of said last named means.

20. A geometrical machine embodying therein an elementary outline, character or base, a support for the work plate or sheet, supporting means for a work point in operative relation to said support, means adapted to follow said elementary outline, character or base and successively cause a simi-

lar relative movement of said support and said supporting means, means for varying the operative relation of said supporting means and said work plate or sheet to create an intricate geometrical design, and means whereby said work point may be held in or out of contact with said work plate or sheet during the operative movement of said last named means.

10 21. A geometrical machine embodying therein a work bed, supporting means for a work point in operative relation to the work surface upon said bed, a support for an elementary outline, character or base, comprising a rotary member and a sliding member 15 having movement substantially radially thereof, means adapted to impart relative movement to said work bed and the supporting means for said work point, a rim surrounding said sliding member, a controlling or compelling plate having an opening therein mounted upon said rim, means 20 whereby said plate may be adjusted upon said rim, a bearing pin carried by said slid-

ing member and adapted to engage the edge 25 of said opening whereby the movement of said sliding member is defined by said plate, and means whereby said support may be actuated.

22. A geometrical machine embodying 30 therein an elementary outline, character or base, means whereby said outline, character or base may be reproduced upon a plate or sheet, and controlling or compelling means whereby successive reproductions will be 35 erratically positioned so as to create an intricate geometrical design having as a whole no similitude to the elementary outline, character or base.

In witness whereof, I have hereunto 40 affixed my signature, in the presence of two subscribing witnesses, this 14th day of February, 1913.

WILLIAM S. EATON.

Witnesses:

OTTO MUNK,

F. T. WENTWORTH.

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