Nov. 4, 1924. 1,513,883

C. L. BAUSCH

MACHINE FOR FORMING LENS GRINDING TOOLS

Filed May 14 1921 4 Sheets-Sheet 1

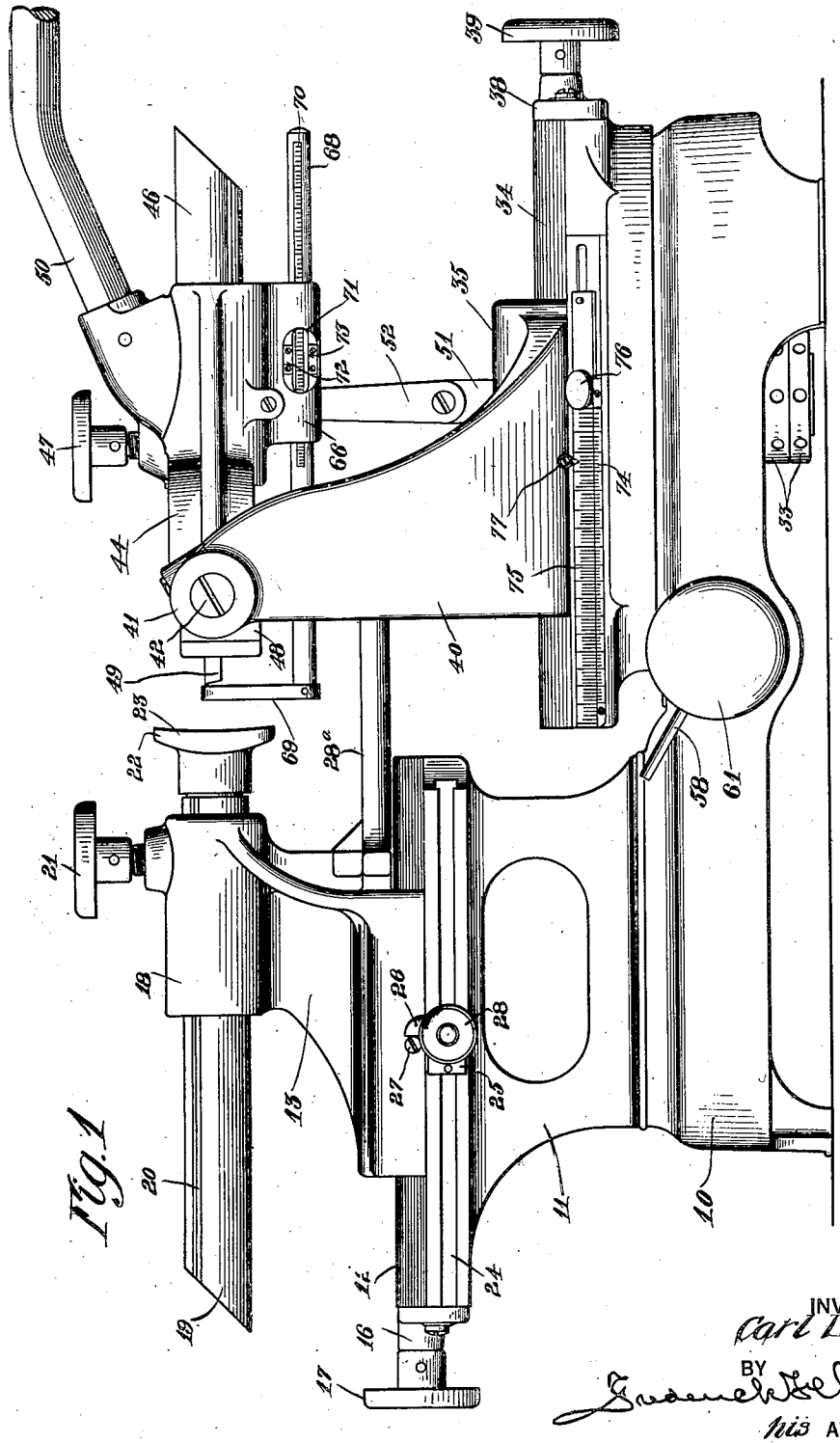


Fig. 1

INVENTOR
Carl L. Bausch.
BY
Gudenek & Schmeckebier
his ATTORNEY.

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C. L. BAUSCH

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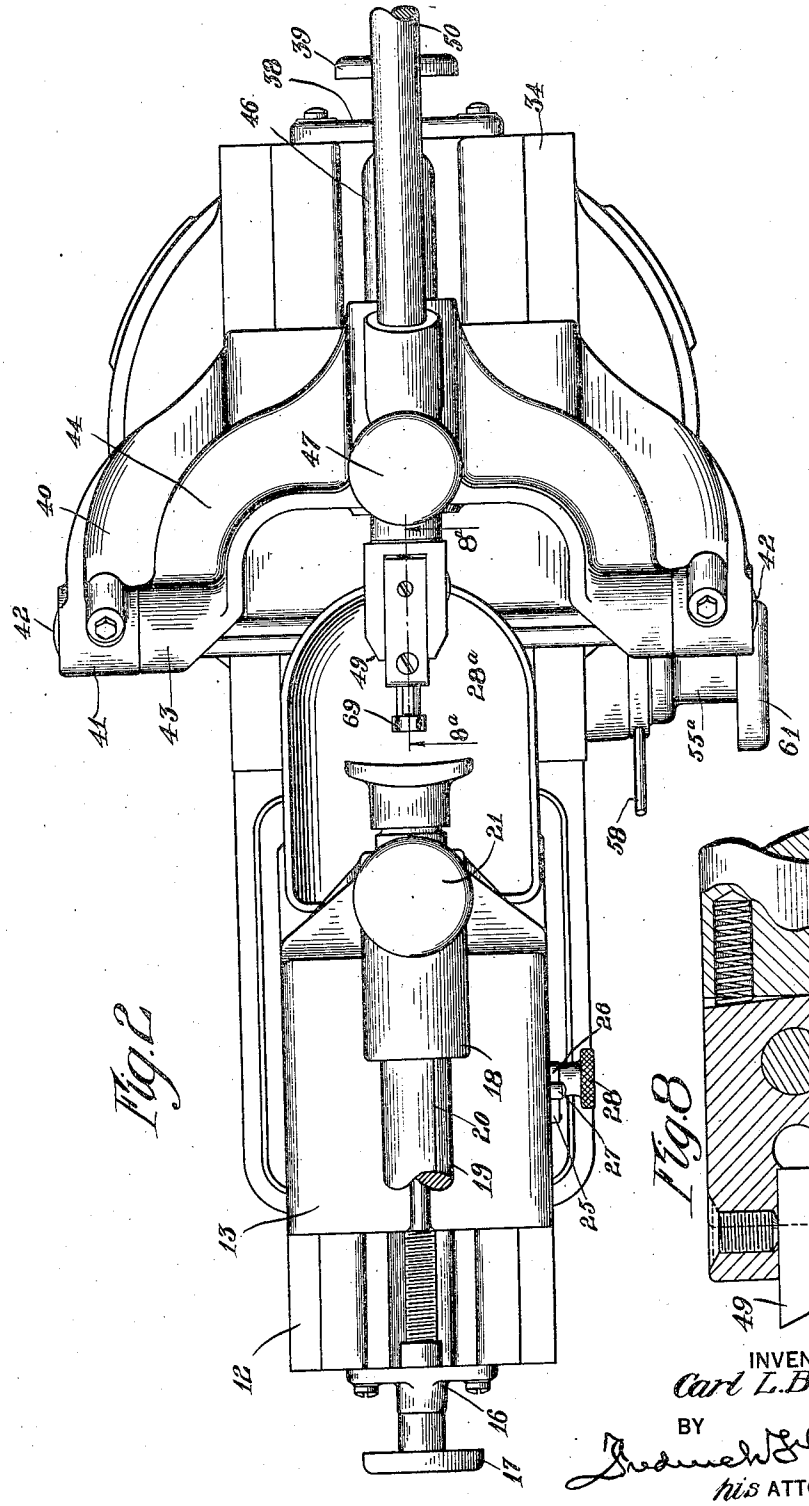


Fig. 2

Fig. 8

INVENTOR
Carl L. Bausch.
BY
Frederick Gilmeh
his ATTORNEY.

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C. L. BAUSCH

MACHINE FOR FORMING LENS GRINDING TOOLS

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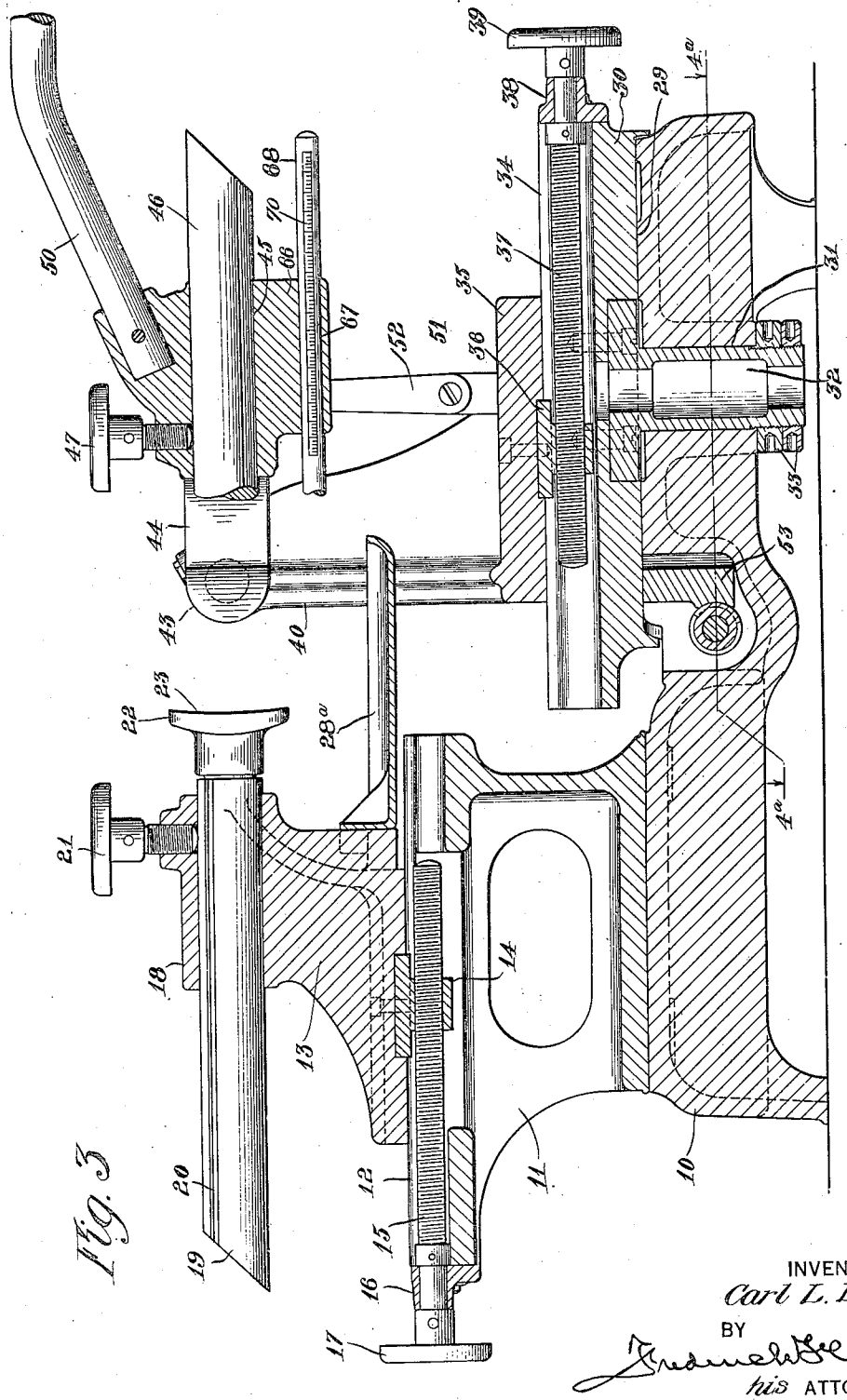


Fig. 3

INVENTOR
Carl L. Bausch.
BY
his ATTORNEY.

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C. L. BAUSCH

MACHINE FOR FORMING LENS GRINDING TOOLS

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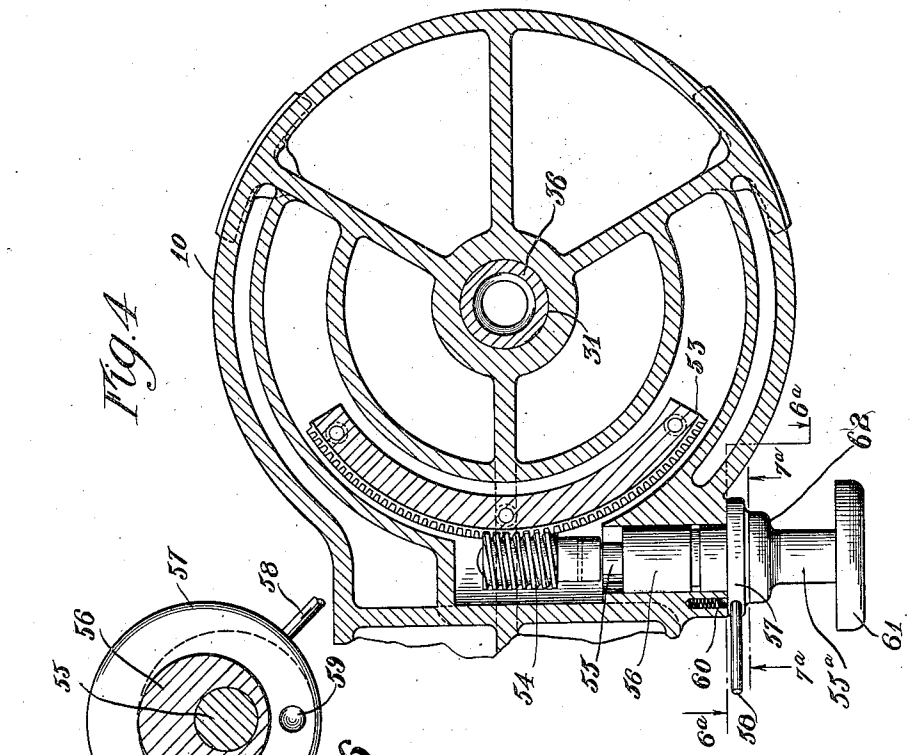


Fig. 4

Fig. 6

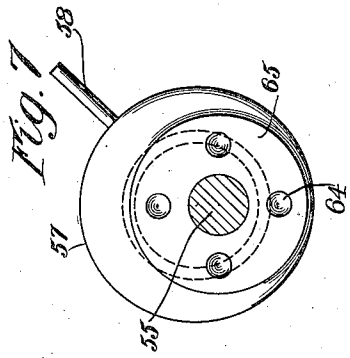


Fig. 7

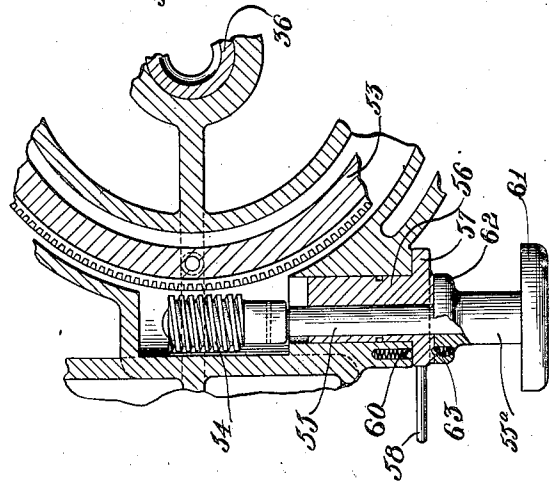


Fig. 5

INVENTOR
Carl L. Bausch.
BY
his ATTORNEY.

Patented Nov. 4, 1924. 1,513,883

UNITED STATES PATENT OFFICE.

CARL L. BAUSCH, OF ROCHESTER, NEW YORK, ASSIGNOR TO BAUSCH & LOMB OPTICAL COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

MACHINE FOR FORMING LENS-GRINDING TOOLS.

Application filed May 14, 1921. Serial No. 469,658.

To all whom it may concern:

Be it known that I, CARL L. BAUSCH, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Machines for Forming Lens-Grinding Tools; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference numerals marked thereon.

This invention has to do with machines for forming lens grinding tools, the chief object of the invention being to provide a practical and convenient machine of this character capable of being readily and accurately adjusted for accomplishing the desired work in an effective manner and which is inexpensive to manufacture. To these and other ends the invention consists in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Figure 1 is a side elevation of a machine embodying the present invention.

Figure 2 is a top plan view of the same.

Figure 3 is an elevation of the same in central longitudinal section.

Figure 4 is a sectional plan view substantially on the lines 4^a—4^a of Figure 3.

Figure 5 is a view similar to Figure 4 partly broken away and showing the parts in different position.

Figures 6 and 7 are detail sectional views on the lines 6^a—6^a and 7^a—7^a of Figure 4.

Fig. 8 is a section through the tool support.

Similar reference characters throughout the several views indicate the same parts.

The preferred embodiment of the invention disclosed herein by way of illustration comprises a machine of the character indicated above adapted for forming or reforming the toric surfaces of lens grinding tools, which are referred to herein, for convenience as the work. The machine comprises, generally speaking, a pair of holding members, or arbors adjacent ends of which, one holding the work and the other the forming tool, have a relative swinging or oscillating movement about two axes for producing the curvature in two directions of the toric surface of the work. In the present instance the forming tool has an oscillating cutting movement in vertical planes about one axis for generating curvature in one direction and an alternate oscillation in a horizontal plane about another axis for generating curvature in the other direction. The arbors are interchangeably supported by the machine for forming both convex and concave surfaces and various convenient adjustments are provided for accurately positioning the arbors relative to their axes and to each other, all as will more fully appear in the following detailed description.

Referring to Figures 1 to 3, there is indicated at 10 a main frame or base for the machine having at one end a tail stock comprising a bed or table 11 on the upper surface of which are provided spaced parallel guiding surfaces 12 over which is movable a slide 13 carrying one of the arbors. Slide 13 has fixed on its under side between the guide surfaces 12 a nut 14 with which engages a threaded spindle 15 rotatably supported in a bearing 16 on bed 11, a knob or hand wheel 17 on the spindle affording convenient means for moving slide 13 longitudinally of its guides. Slide 13 is provided with a bearing 18 in which is longitudinally slidable the work arbor 19, the latter being preferably splined to the bearing as indicated at 20 to prevent rotation. The clamping screw 21 serves to clamp the arbor after adjustment against longitudinal movement in its bearing. The arbor has a tapered inner end on which is tightly fitted the lens grinding tool or work 22 the surface 23 of which is to be formed in the manner described.

For limiting the movement of slide 13, for purposes presently explained, the side of bed 11 adjacent one of the guide surfaces 12 is formed with a T-slot 24, Figure 1, in which slides a block 25 carrying a lug or stop 26 for limiting engagement with a stop pin 27 on the slide, a knob 28 being provided for adjustably moving block 25 and clamping it in adjusted position.

On the opposite end of frame 10 is an opposed supporting means or head stock for the reception of which the upper side of the frame is formed with circular bearing surfaces indicated at 29. On this bearing surface is supported an oscillating turret 30, the frame having a vertical bearing opening

31 therein in which oscillates a trunnion 32 bolted to the under side of the turret, with nuts 33 on the trunnion for holding the same in its bearing. The top of the turret is formed with spaced parallel guiding surfaces 34 on which is movable a turret slide 35 having fixed to its under side between the guiding surfaces a nut 36 with which engages a threaded spindle 37 rotating in a bearing 38 on the turret and having a knob or hand wheel 39 by the rotation of which the slide may be adjusted longitudinally of its guide.

The turret slide 35 has projecting upwardly therefrom spaced arms 40 provided at their upper ends with aligned bearings 41 in which are rotatably carried trunnions 42 on the arms 43 of a supporting member or yoke 44 which is thus supported for operation about a horizontal axis. Yoke 44 is provided with a bearing 45 for a second arbor 46 carrying the tool means, which is also splined in its bearing for longitudinal adjustment, with a clamping screw 47 to clamp it when adjusted.

The tool means is indicated at 48, Figure 8, comprising preferably a clapper box of the usual or any suitable construction, and therefore not requiring detailed description, in which is carried the forming tool 49. A bar or handle 50 fixed in a socket in yoke 44 serves as a convenient means for manually oscillating the yoke to effect cutting movement of the arbor carried thereby. Turret slide 35 is provided with a lug 51 on which is pivotally supported an arm 52 having an upper end adapted when the arm is raised, as shown in Figure 3, to abut yoke 44 and support the latter in horizontal position, as convenient during the adjusment of its arbor, arm 52 being of course swung downwardly to an out of the way position during operation of the machine.

As the oscillating movement of yoke 44 serves to swing the end of the arbor carried thereby in a vertical plane to produce curvature of the work in one direction, so the turret 30 is swung about its vertical axis alternately with the cutting oscillation of the yoke for producing curvature of the work surface in the opposite direction, and the means for oscillating the turret on its axis comprises preferably a worm sector 53, Figures 3 and 4, bolted to the under side of the turret in a depression in the frame providing clearance for the same. Meshing with this gear sector is a worm 54 fixed on the inner end of a spindle 55 rotating in an eccentric opening in a bearing sleeve 56 adapted to be adjustably oscillated between two positions in a bearing in the main frame. Exteriorly of the latter sleeve 56 has a flange 57 carrying handle 58 by means of which the sleeve is turned in its bearing to move worm 54 to and from meshing relation with its gear. In order to yieldably hold the sleeve in one of its positions the latter has formed therein on the side thereof adjacent the main frame spaced recesses 59, Figure 6, with which is adapted to engage a spring pressed ball 60 carried in a bore in the main frame. When the worm is in mesh with the gear rotation of the worm spindle 55 in the bearing sleeve 56 by means of a knob 61 serves to swing the turret about its axis. This latter movement is effected between the vertical oscillations of yoke 44, serving as a feeding movement, and it is therefore desirable to provide means for limiting the swinging movement of the turret and the rotation of spindle 55 to a step by step movement of definite extent. To this end spindle 55 carries a flange 62 in which is formed a bore housing a spring pressed ball 63 bearing against the outer side of flange 57 of the eccentric sleeve. In the latter are formed, equidistant from spindle 55, a series of recesses 64 adapted to receive ball 63 and thereby accentuate or limit the step by step movements of the spindle.

It is apparent from the construction already described that the radial distance of tool 49 from the axis of yoke 44, determines the degree of curvature of the work surface in one direction, and a gauge means is therefore provided for adjusting the tool arbor longitudinally, or transversely of the yoke axis, comprising a housing 66 depending from the under side of the yoke and formed with a bearing 67 parallel with that of the arbor. Sliding in this bearing is gauge bar 68 provided at one end with an angularly extending finger or stop 69, and also with a longitudinally extending indicating scale 70. Housing 66 has a reading opening 71 cut laterally therein and provided on opposite sides with index marks 72 and 73 cooperating with scale 70. Scale 70 is preferably marked off in the units for measuring the refractive power of lenses, commonly known as diopters, and in the arrangement of the arbors shown in the drawings, for forming a concave surface, the gauge bar, as indicated in Figure 1, is adjusted longitudinally until the upper index 72 registers with the desired point on scale 70 corresponding to the curvature in a vertical plane desired for the work surface. The tool arbor is then moved longitudinally to bring the part of the tool lightly against the gauge bar stop 69, thereby setting the tool at the proper radial distance from its axis of oscillation in a vertical plane, after which the arbor is clamped in place. When it is desired to form a convex work surface, the work and tool arbors are interchanged from the arrangement shown in the drawings, and in this case, with the tool bar carried in the tail stock, the gauge bar is set with reference to the lower index point 73 and tail

stock slide 13 is moved longitudinally until the tool touches the opposite side of the gauge bar stop 69, in which position of adjustment of the tail stock slide the stop 26 is set against stop pin 27 of the slide, thus determining the proper radial distance of the point of the tool from the axis of vertical oscillation of the work.

The curvature of the work surface in the other or horizontal direction is of course determined by the distance of the tool from the vertical axis of the turret, and gauge means are therefore provided for properly determining this distance comprising a scale 74 marked off in diopters and fixed on the turret parallel with and adjacent one of the guide surfaces 34 for the turret slide, for indicating distances from the turret axis. It is apparent, however, that the adjustment of the tool relative to the horizontal axis of yoke 44 must be taken into account in adjusting the turret slide relative to the turret axis on the scale 74. In other words, the settings, relative to the two axes must be correlated, and to this end there is slidably carried on the turret between scale 74 and the turret slide an additional gauge or scale 75 which may be clamped in longitudinally adjusted position by means of a screw 76. This scale of course is also marked off in diopters and cooperating therewith is an index 77 fixed on the slide. A convenient manner of making this adjustment is to slide scale 75 to bring into register with the point on scale 74 corresponding to the desired degree of curvature of the work surface in a horizontal direction, the desired point on scale 75 corresponding to the adjustment of the tool relative to the yoke axis, or in other words, to the degree of curvature of the work surface in the other direction. Slide 35 is then adjusted by means of knob 39 to bring its index 77 into registry with the right hand end or zero mark of scale 75. This operation sets the turret to zero position with respect to the vertical axis and it will be noted does not change the position of the cutting edge of the tool with respect to the horizontal axis. The tool is thus conveniently adjusted to the proper radial distance from the vertical axis of the turret for producing the desired curvature of the work surface in a horizontal plane, this method of adjustment being the same regardless of whether the tool arbor or the work arbor is carried by the head stock yoke.

In operation, assuming that the tool arbor is carried by the head stock as shown in the drawings, and adjusted in the manner described and clamped to the yoke, with the latter supported in horizontal position as shown in Figures 1 and 3, the tail stock slide 13 is advanced by means of knob 17 until the surface of the work contacts with the tool. With the parts in this position the tail stock stop 26 is set in advance of stop pin 27 on the slide a small distance corresponding to the amount of feed, after which the slide is retracted, and the head stock swung to one side. The tail stock is then advanced against stop 26 and the head stock turret then swung to position to commence the cutting operation at one side of the work surface by vertical oscillation of the tool. After each such oscillation of the tool the turret is oscillated one step in the manner described by means of handle 61 ready for the next cutting oscillation of the tool. The machine is adapted in this manner to cut on the work a smooth and accurate toric surface having the component curvatures desired.

For forming a convex surface the tool and work arbors are interchanged from the arrangement shown in the drawing and the tool is adjusted on the tail stock, as described, by means of the gauge bar 68, after which the tail stock stop 26 is set against the stop pin, and the tail stock slide is then retracted a slight distance corresponding to the desired amount of feed, when the work is adjusted forwardly in yoke 44 until its surface contacts with the tool after which it is clamped in place. The turret is then swung to one side and the tail stock advanced against stop 26 following which the turret is swung to bring the work to position to start the vertical cutting oscillation as previously described.

As apparent from the above description and drawing the machine is simple and practical in construction and inexpensive to manufacture and the parts are so designed and arranged as to facilitate the quick and convenient setting of the machine for the work in hand. The machine is capable of producing wide variations in curvature whether convex or concave and owing to the convenience in adjustment and operation accomplishes the work in a rapid manner.

I claim as my invention:

1. In a machine of the class described, the combination of a frame, an arbor mounted in said frame for adjustment longitudinally thereof, a support on said frame, a second arbor in said support with an end adjacent an end of said first mentioned arbor and mounted for oscillating movement about a plurality of axes, means for adjusting said arbor relatively to each of said axes, and a tool on one of said adjacent arbor ends for cooperation with work carried by the other.

2. In a machine of the class described, the combination of a frame, an arbor mounted in said frame for adjustment longitudinally thereof, a support on said frame, a second

arbor in said support with an end adjacent an end of said first mentioned arbor and mounted for oscillatory movement about a plurality of axes arranged at substantially right angles to each other, means for adjusting said arbor relatively to each of said axes means for oscillating said second arbor about each of said axes, and a tool on one of said adjacent arbor ends for cooperation with work carried by the other.

3. In a machine of the class described, the combination of a frame, a movable slide supported on said frame, a bearing on said slide, an arbor slidable in said bearing, means for moving said slide to effect longitudinal adjustment of said arbor, a support on said frame, a bearing in said support, a second arbor mounted in said bearing for oscillation about each of a plurality of axes, means for sliding said arbor longitudinally in said bearing for adjustment relative to one of said axes, means for oscillating said arbor about each of said axes, and a tool in one of said adjacent arbor ends for cooperation with work carried by the other.

4. In a machine of the class described, the combination of a frame, a movable slide supported on said frame, a bearing on said slide, an arbor slidable in said bearing, means for moving said slide to effect longitudinal adjustment of said arbor, a turret mounted on said frame for oscillation about an axis, a member mounted on said turret for oscillation about a second axis, and for adjustment relatively to the first axis, a bearing in said member, a second arbor mounted in said bearing for longitudinal adjustment relative to said second axis and having one end disposed adjacent an end of said first arbor, and a tool on one of said arbor ends for cooperation with work carried by the other.

5. In a machine of the class described, the combination of a movably supported holding member, manually operable means for moving said member, an adjustable stop for limiting the movement of said member, a second holding member supported for oscillating movement of a part thereof adjacent a part of said first member and about each of a pair of axes, manually operable means for effecting step by step oscillation of said second member about one of said axes, and tool means held by one of said adjacent member parts for cooperation with work held by the other.

6. In a machine of the class described, the combination of a holding member and supporting means for the same, a second holding member supported for longitudinal movement and also for oscillating movement of a part thereof adjacent an end of said first member and about each of a pair of axes, manually operable means for effecting step by step oscillation of said second member about one of said axes comprising a worm gear connected therewith, a rotary spindle having a worm meshing with said gear, a movable support for said spindle for meshing and unmeshing said worm and gear and detent means limiting rotation of said spindle to step by step movement, and tool means held by one of said adjacent member parts for cooperation with work held by the other.

7. In a machine of the class described, the combination of a holding member and supporting means for the same, a second holding member supported for oscillating movement about each of a pair of axes, means comprising a gauge for effecting adjustment of said second member transversely of one of said axes, means comprising a second gauge for effecting adjustment of said second member transversely of the other of said axes, a third gauge for indicating in cooperation with said second gauge the adjustment of said second member relative to said first gauge, and tool means held by one of said members for cooperation with work held by the other.

8. In a machine of the class described, the combination of a holding member and supporting means for the same, a second holding member, means supporting said second member for oscillating movement about each of a pair of axes and for adjustment transversely of said axes, a gauge adapted to be positioned on said supporting means for indicating the adjustment of said second member relative to one of said axes, a second gauge for indicating the adjustment of said second member relative to the other of said axes, an index movable with said second member relative to said second gauge, a movable indicator cooperating with said index and second gauge for indicating the adjustment of said second member relative to said first gauge and tool means held by one of said members for cooperation with work held by the other.

9. In a machine of the class described, the combination of a frame, supporting means thereon, a holding member carried by said means, an oscillating turret on said frame, a supporting member mounted for oscillation on said turret, a second holding member carried by said supporting member in fixed relation with the latter for movement thereby to effect the cutting operation, and tool means held by one of said holding members for cutting work held by the other.

10. In a machine of the class described, the combination of a frame, supporting means thereon, an arbor carried by said means, an oscillating turret on said frame, a supporting member mounted for oscillation on said turret, a second arbor adjustably clamped to said supporting mem-

ber for adjustment radially of the axis of oscillation thereof and for movement thereby to effect the cutting operation, means for adjusting said supporting member radially of the axis of oscillation of said turret, and tool means carried by one of said arbors for cutting work carried by the other.

11. In a machine of the class described, the combination of a frame, supporting means thereon, a holding member carried by said means, an oscillating turret on said frame, a supporting member mounted for oscillation on said turret and for adjustment radially of the axis of oscillation thereof, gauge means for adjusting said supporting member, a second holding member mounted on said supporting member for adjustment radially of the axis of oscillation thereof, a second gauge means for said second holding member, intermediate gauge means for correlating the adjustments made by said first and second gauge means, and tool means held by one of said holding members for cooperation with work held by the other.

12. In a machine of the class described, the combination of a frame, opposed supports thereon, one of said supports having an oscillating movement about one axis and carrying a supporting member for oscillation about another axis, holding members interchangeably carried by one of said supports and by said supporting member, respectively, and tool means held by one of said holding members for cooperation with work held by the other.

13. In a machine of the class described, the combination of a frame, a first supporting means thereon, a second supporting means on said frame having an oscillating movement about an axis and being also adjustable radially thereof, a first gauge means for the radial adjustment of said second supporting means, a supporting member mounted on said second supporting means for oscillation about a second axis, holding members interchangeably carried by said first supporting means and supporting member, respectively, means for adjusting the holding member carried by said supporting member radially of said second axis, a second gauge means for the radial adjustment of said supporting member, intermediate gauge means for correlating the adjustments made by said first and second gauge means, and tool means held by one of said holding members for cutting work held by the other.

14. In a machine of the class described, the combination of a frame, a first supporting means thereon, a second supporting means on said frame having an oscillating movement about an axis and being also adjustable radially thereof, a first gauge means for the radial adjustment of said second supporting means, a supporting member mounted on said second supporting means for oscillation about a second axis, holding members interchangeably carried by said first supporting means and supporting member, respectively, means for adjusting each of said holding members radially toward and from said second axis, a second gauge means comprising index means on said supporting member for said radial adjustment of the holding members, intermediate gauge means for correlating the adjustments made by said first and second gauge means, and tool means held by one of said holding members for cutting work held by the other.

15. In a machine of the class described, the combination of a frame, supporting means thereon comprising a movable slide, a holding member carried by said slide, an oscillating head stock on the frame comprising a slide movable radially toward and from the axis of said head stock, a yoke mounted for oscillation on said head stock slide, a second holding member carried by said yoke for adjustment toward and from the axis of the latter, said holding members being interchangeably carried by said slide and yoke, gauge means for adjusting said head stock slide toward and from the head stock axis, a second gauge means for adjusting said holding members toward and from said yoke axis, intermediate gauge means for correlating the adjustments made by said first and second gauge means, and tool means held by one of said gauge means for cutting work held by the other.

CARL L. BAUSCH.