

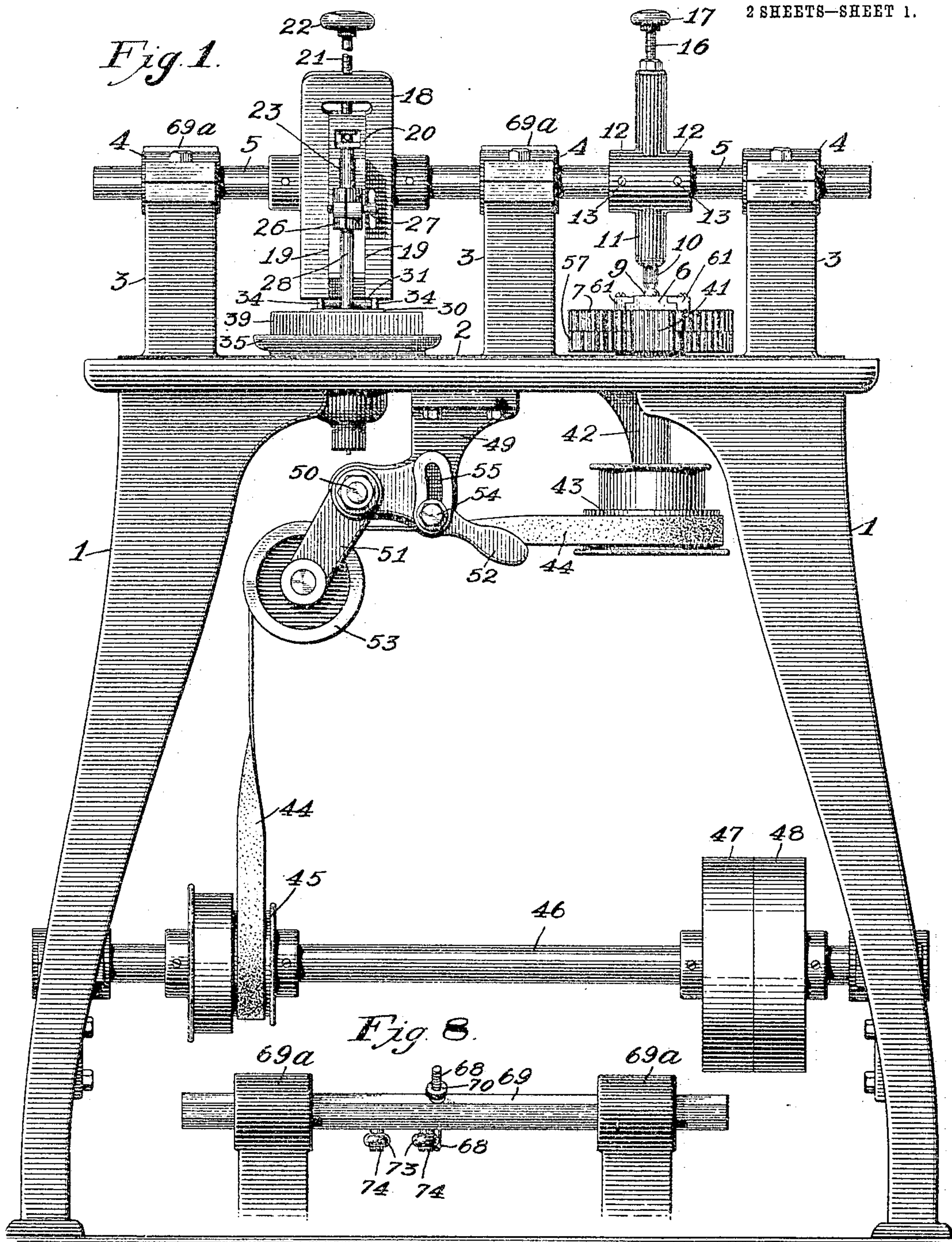
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L. W. BUGBEE.  
MACHINE FOR GRINDING LENSES.

APPLICATION FILED JUNE 19, 1902.

2 SHEETS—SHEET 1.



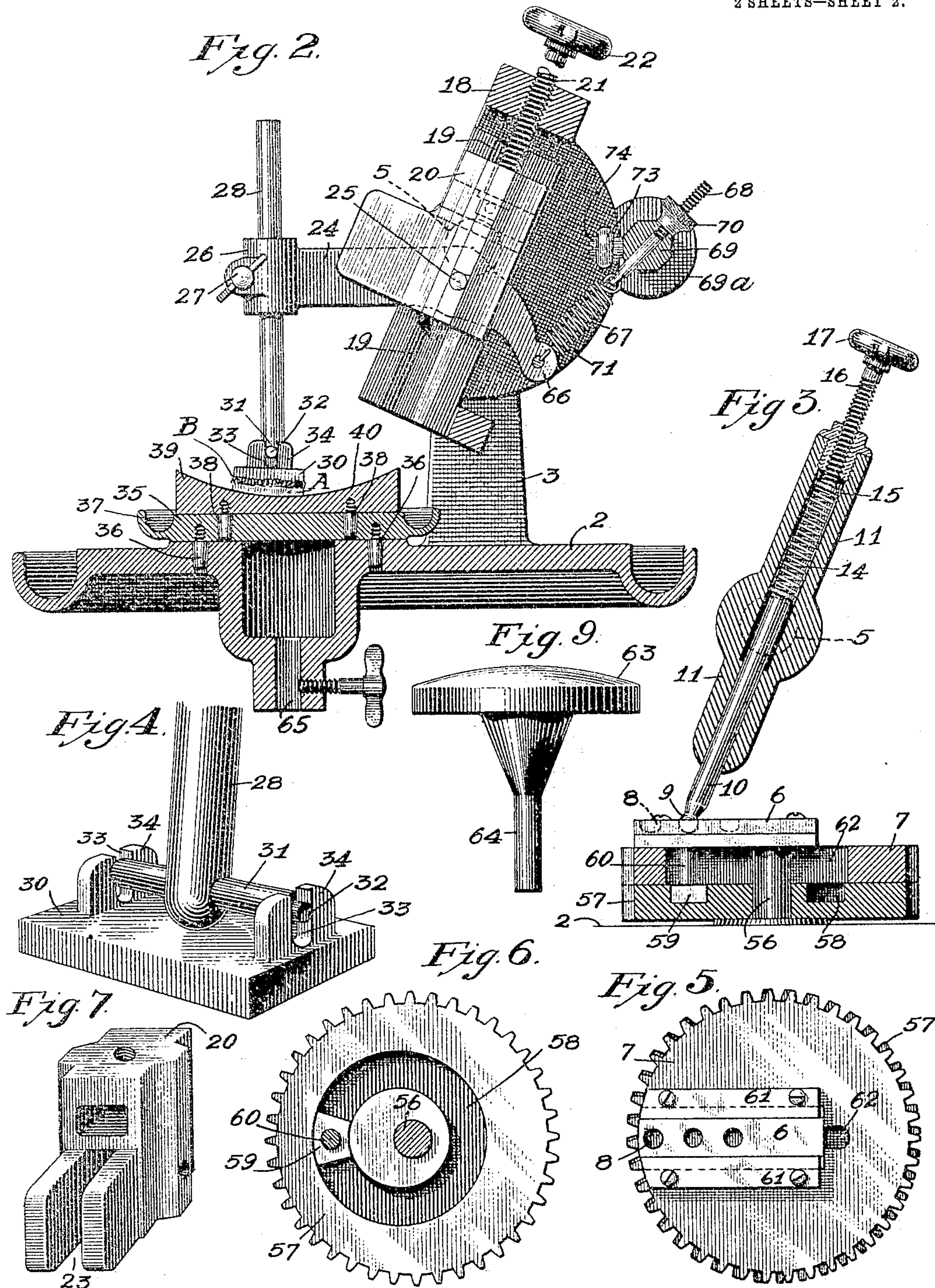
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2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

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## MACHINE FOR GRINDING LENSES.

SPECIFICATION forming part of Letters Patent No. 781,712, dated February 7, 1905.

Application filed June 19, 1902. Serial No. 112,301.

*To all whom it may concern:*

Be it known that I, LUCIAN W. BUGBEE, a citizen of the United States, residing at Tilton, in the county of Belknap and State of New Hampshire, have invented a new and useful Improvement in Machines for Grinding Lenses, of which the following is a specification accompanied by drawings forming a part of the same, in which—

Figure 1 represents a front view of a machine for grinding lenses embodying my invention. Fig. 2 is a central vertical sectional view of the oscillating yoke for imparting a reciprocating motion to the lens-holder. Fig. 3 is a central vertical sectional view through a portion of the actuating mechanism for moving the lens-holder. Fig. 4 is a perspective view of the lens-holder. Fig. 5 is a top view of the gear and crank-plate for imparting a compound movement to the lens-holder. Fig. 6 is a top view of the gear containing an eccentric groove for varying the "throw" of a crank-plate carried by the gear shown in Fig. 5. Fig. 7 is a perspective view of the adjustable block 20. Fig. 8 is a detached view of a portion of tension device for imparting a downward pressure to the lens-holder, and Fig. 9 represents a modified form of grinding-surface.

Similar reference letters and figures refer to similar parts in the different views.

My present invention relates to a machine for grinding lenses; and it has for its object to provide a simple and efficient mechanism for imparting the desired movements to the lens-holder and also to provide means for the requisite adjustments by which the movements of the lens-holder may be varied; and it consists in the construction and arrangement of parts, as hereinafter described.

Referring to the accompanying drawings, 1 denotes a stand or framework comprising a table 2, upon which are mounted the vertical stands 3, provided at their upper ends with bearings 4 for a shaft 5, capable of a rocking and also of a longitudinally-sliding movement within its bearings. The rocking and longitudinally-sliding movement of the shaft is ac-

complished by means of a crank-plate 6, carried upon the upper side of a rotating gear 7 and provided with a series of semispherical sockets 8 to receive the spherical end 9 of a sliding spindle 10, held in a sleeve 11, carried upon the shaft 5 and at right angles thereto, said sleeve 11 being attached to the shaft 5 by means of the hollow hubs 12 12, which receive ends of the shaft 5 and are fastened thereto by means of the pins 13. The spindle 10 is capable of a sliding movement in the sleeve 11 and is pressed downward into engagement with the crank-plate 6 by means of a spiral spring 14, which bears against the upper end of the spindle and also against a washer 15 on the end of an adjusting-screw 16, provided with a hand-wheel 17, by which the tension of the spring is adjusted. The axis of the spindle 10 intersects the axis of the shaft 5, the position of the shaft 5 relatively to the spindle 10 being shown by the broken lines 5, Fig. 3. As the crank-plate 6 is rotated by the rotation of the gear 7 the lower or spherical end 9 of the spindle 10 is carried in a circular path around the axis of the gear 7, thereby imparting both a rocking motion and a longitudinally-sliding motion to the shaft 5.

The shaft 5 carries a yoke 18, provided with ways 19 for a sliding block 20, which is vertically adjusted in the ways 19 by means of an adjusting-screw 21 and hand-wheel 22. The sliding block 20 is provided at its lower end with a mortise or slot 23, in which is pivoted an arm 24 on a stud 25. The forward end of the arm 24 carries a split bearing 26, which is clamped upon a vertical stem 28 by a clamping-bolt 27. The lower end 29 of the stem 28 is round and bears upon the upper surface of a lens-holder 30, and the stem 28 also carries a cross-bar 31, provided at its opposite ends with gudgeons 32, inclosed in the slots 33 of the lugs 34 on the opposite holder. This prevents rotation of the lens-holder 30 around the stem 28. As the slots 33 of the lugs 34 are open at the top, the stem 28 may be raised in the sleeve 26 by loosening the set-screw 27 and the lens-holder 30 released,



so that another lens-holder may be easily substituted, if desired.

Supported upon the table 2 is a supplemental table 35, held in place by dowel-pins 36 5 and provided with a drip-channel 37 around its edge. Supported upon the supplemental table 35 and held in place by dowel-pins 38 is a grinding-shell or "lap" 39, having an upper curved surface 40, whose shape and curvature is determined by the character of the 10 lens to be ground. As the shaft 5 is rocked a rocking motion is given to the yoke 18 about the axis of the shaft 5, and if the block 20 be so adjusted that the axis of the pivot 15 25 is brought coincident with the axis of the shaft 5 no movement will be given to the lens-holder except that caused by the longitudinal movement of the shaft 5, which will cause the lens-holder to slide back and forth 20 on the lap 39 in a line parallel with the axis of the shaft 5. If, however, the block 20 be moved in the ways 19, carrying the axis of the pivot 25 below the axis of the shaft 5, then the rocking motion of the shaft 5 and 25 yoke 18 will impart a traversing movement to the lens-holder 30 back and forth across the lap 39; but as the rocking movement and the longitudinally-sliding movement of the shaft 5 are synchronous the compound movement 30 of the shaft 5 will result in a circular movement of the lens-holder over the surface of the lap.

The gear-wheel 7 is rotated by a pinion 41, carried upon the upper end of a shaft journaled in a bracket 42, said shaft carrying 35 upon its lower end a belt-pulley 43, which is driven by a belt connection 44 from a pulley 45 to a counter-shaft 46, journaled in bearings on the frame of the machine and below 40 the table 2, said counter-shaft 46 carrying tight and loose pulleys 47 48, by which the machine is driven from a main line of shafting.

Attached to the under side of the table 2 is 45 a bracket 49, carrying a stud 50, on which is pivoted a bell-crank 51, having a handle 52 on one of its arms and carrying on its opposite arm a tightening-pulley 53. The bell-crank is rocked to carry the tightening-pulley 50 53 against the belt and is held in position by a clamping-bolt 54 passing through a curved slot 55 in the bell-crank and tightening the bell-crank against the bracket 49.

The gear-wheel 7 turns loosely about a stud 55 56 held in the table 2, and beneath the gear 7 and driven by the pinion 41 is a gear 57 of the same diameter as the gear 7, but having a different number of teeth, the number of teeth being usually increased or decreased by 60 one. The gear 57 is provided upon its upper surface with an eccentric slot 58, in which slides a block 59, carrying a stud 60, the upper end of which enters the crank-plate 6. As the two gears 7 and 57 are rotated by the 65 pinion 41 their relative position is gradually

being changed, owing to the difference in the number of teeth, the gear 57 having a rotary movement relatively to the gear 7, which causes the crank-plate 6 to slide between ways 61 61 on the upper surface of the gear 7 a 70 distance equal to the eccentricity of the groove 58, the gear 7 being provided with a slot 62 to provide for the sliding movement of the stud 60. The lower end of the spindle 10 when placed in any one of the semispherical 75 sockets 8 of the crank-plate 6 will be carried by the crank-plate in a circular path; but the diameter of the circular path will be constantly varying, owing to the sliding movement of the crank-plate 6 in its ways 61 61, as 80 already described, thereby constantly varying both the oscillating movement and the longitudinally-sliding movement of the shaft 5, and consequently causing the lens-holder 29 to be moved over the surface of the lap 39 in a 85 constantly-changing path. The amplitude of the oscillating and longitudinally-sliding movement of the shaft 5 can also be varied by shifting the spindle 10 from one of the semispherical sockets 8 to another, thereby 90 changing the radius of the circular path described by the spindle. The back-and-forth traversing movement of the lens-holder can also be varied, as already mentioned, by sliding the block 20 in the ways 19 by means of 95 the adjusting-screw 21, which increases or decreases the throw of the yoke.

The lens A is attached to the lens-holder in the usual manner by means of adhesive material B, and the lap 39 may be readily ex- 100 changed for others of different curvatures, and the supplemental table 35 may be entirely removed from the table 2 and other grinding-surfaces—such, for example, as that shown at 63, provided with a stem 64 to be held in the 105 socket 65—may be employed in lieu of the lap 39.

The arm 24 is provided with a tailpiece 66, extending on the opposite side of the pivot 25, which is connected by a spiral spring 67 110 with an adjusting-screw 68, which is held in the polygonal sliding bar 69, sliding in bearings 69<sup>a</sup>, supported upon the upright stands 3. The screw 68 passes loosely through the 115 sliding bar 69 and is raised and lowered by a thumb-nut 70 for the purpose of varying the tension of the spring 67. The bar 69 is given a longitudinal sliding motion corresponding to the sliding movement of the shaft 5 by means of a segment 71, attached to the yoke 120 18 and having its outer edge 72 concentric with the axis of the shaft 5 and inclosed between the friction-rolls 73 73, held on studs 74, projecting from the side of the sliding bar 69. As the shaft 5 is given a longitudi- 125 nally-sliding movement carrying the yoke 18, a corresponding longitudinally-sliding movement will be imparted to the square sliding bar 69, so as to maintain the adjusting-screw 68 in the same vertical plane as the tailpiece 130



6, which projects from the rear side of the arm 24. The tension of the spring 67, which can be varied by adjusting the screw 68, serves to impart a downward pressure upon the lens-holder 29.

Having described the movement of the lens-holder as resulting from the compound motions imparted to the yoke 18, the capability of the machine in grinding lenses of different curvatures by the employment of laps of varying faces will be readily understood by those conversant with this class of machines. As the motion of the surface of the lens attached to the lens-holder is relative to the grinding-surface of the lap, it will be readily seen that the attachment of the lens to the moving holder 30 instead of to the stationary lap 39 is determined by convenience in construction and operation. In some instances it may be desirable to hold the lens by the fixed instead of the moving surface. Various changes in the machine as shown and described may also be made without departing from the spirit of my present invention, which has for its object to reduce the number of operating parts, decrease the number of adjustments required to produce any desired variation in the relative movement of the lens and the grinding-surface, and to simplify the construction in machines of this class without narrowing the scope of its operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine for grinding lenses, the combination with a grinding-surface and a lens-holder, of mechanism for producing a relative movement between the lens-holder and said grinding-surface, and comprising a shaft capable of both a longitudinally-sliding and an oscillating motion, an actuating-crank having its axis at right angles to the axis of said shaft, a sleeve carried by said shaft and a sliding spindle in said sleeve operatively connected with said crank, whereby the rotation of said crank will simultaneously slide and oscillate said shaft, substantially as described.

2. The combination with fixed and movable members adapted to grind a lens between them, of a shaft capable of an oscillating and a sliding motion, a crank having its axis at right angles to the axis of said shaft, and operatively connected therewith to simultaneously oscillate and slide said shaft, a yoke carried by said shaft, means for pivotally connecting said yoke and said movable member, substantially as described.

3. The combination with fixed and movable members adapted to grind a lens between them, of a yoke pivotally connected with said movable member, means for varying the axis of said pivotal connection in said yoke, a shaft carrying said yoke, an actuating-crank having its axis at right angles to the axis of said shaft and operatively connected therewith to simultaneously impart a sliding and an oscillating motion to said shaft, substantially as described.

4. The combination with the fixed and movable members in a lens-grinding machine adapted to grind a lens held between them, of a simultaneously-oscillating and a longitudinally-sliding shaft, means for moving said shaft, a yoke carried by said shaft and having ways radial to its axis, a block capable of sliding in ways, an arm pivotally connected with said block and carrying said movable member and means for adjustably holding said block in said yoke, substantially as described.

5. The combination with fixed and movable members adapted to grind a lens held between them, of mechanism for imparting a resultant circular movement to said movable member and comprising a single shaft operatively connected with said movable member and means for imparting an oscillating and a longitudinally-sliding motion simultaneously to said shaft, substantially as described.

6. The combination with fixed and movable members adapted to grind a lens between them, of a shaft operatively connected with said movable member, a crank having its axis at right angles with the axis of said shaft, means for operatively connecting said crank and said shaft, whereby a sliding and an oscillating motion is imparted to said shaft, and means for imparting a pressure between said fixed and said movable members, substantially as described.

7. The combination with fixed and movable members adapted to grind a lens held between them, of mechanism for imparting a circular movement to said movable member, means for applying pressure to said fixed and movable surfaces, and means for adjusting said pressure, substantially as described.

8. The combination with fixed and movable members adapted to grind a lens held between them, of a shaft operatively connected with said movable member, means for imparting a simultaneous, oscillating and longitudinally-sliding motion to said shaft and means for automatically varying said motions, whereby the path of said movable member is constantly varied, substantially as described.

9. The combination with fixed and movable members adapted to grind a lens between them, of a shaft operatively connected with said movable member, a crank having its axis at right angles with said shaft and operatively connected therewith, whereby a sliding and an oscillating motion is imparted to said shaft, and means for varying the throw of said crank, substantially as described.

10. The combination with fixed and movable members adapted to grind a lens held between them, of mechanism for imparting a compound movement to said movable member, whereby said member is moved in a curved path, means for automatically imparting a constant variation to the movement of said

11. The combination with fixed and movable members adapted to grind a lens held between them, of mechanism for imparting a compound movement to said movable member, whereby said member is moved in a curved path, means for automatically imparting a constant variation to the movement of said



movable member, whereby it is made to continually vary its path, substantially as described.

11. The combination with fixed and movable members adapted to grind a lens held between them, of a simultaneously-oscillating and longitudinally-reciprocating shaft operatively connected with said movable member, means for imparting said motions to the shaft and comprising a rotating gear carrying a crank-plate capable of sliding radially on said gear, a second gear provided with an eccentric groove, a block running in said groove and operatively connected with said sliding crank-plate and a pinion engaging said gears in common, said gears having a different number of teeth, whereby said gears are driven at slightly-varying speeds, substantially as described.

12. The combination with fixed and movable members adapted to grind a lens held between them, of a shaft having a simultaneously-oscillating and a longitudinally-sliding motion, means for actuating said shaft, a yoke carried by said shaft and provided with radial ways, a block held in said ways, an adjusting-screw by which said block is adjustably held in said ways, an arm pivotally held in said block and operatively connected with said movable member, substantially as described.

13. The combination with a fixed "lap" having a grinding-surface, of a lens-holder arranged to move over said "lap," a vertical stem pivotally connected to said lens-holder, an arm adjustably attached to said stem and an oscillating and simultaneously-reciprocating yoke pivotally connected to said arm, substantially as described.

14. The combination with the fixed and movable grinding members, of a lens-grinding machine, of an oscillating and simultaneously-reciprocating yoke, an arm pivotally held in said yoke and operatively connected with said movable member, a rod held in fixed bearings

and capable of sliding therein, means for imparting a sliding movement to said rod corresponding with the reciprocating motion of said yoke and a spiral spring connecting said rod and said arm, whereby the tension of the spring is made to impart a pressure to the grinding members, substantially as described.

15. The combination with a fixed "lap" provided with a grinding-surface, of a movable lens-holder consisting of a plate having slotted lugs, said slotted lugs being open at the top, a vertical stem with its end arranged to bear on said plate, a cross-bar held in said stem having gudgeons at its ends sliding vertically in said slotted lugs, whereby said plate is capable of a slight rocking motion, substantially as described.

16. In a lens-grinder comprising a shaft having a simultaneously-oscillating and longitudinally-sliding motion, whereby a resultant curved movement is imparted to the movable grinding member, the combination with said shaft, of an actuating mechanism consisting of a sleeve carried by said shaft and at right angles thereto, a sliding spindle carried by said sleeve, a rotating crank-plate engaging the end of said spindle and a pressure-spring bearing against the end of said spindle to hold it against said crank-plate, substantially as described.

17. The combination with the oscillating and reciprocating shaft, of a sleeve carried by said shaft, a spindle held in said sleeve, a rotating crank-plate provided with a series of sockets to receive the end of said spindle and a yielding spring bearing against said spindle to hold it in engagement with said crank-plate, substantially as described.

Dated this 10th day of June, 1902.

LUCIAN W. BUGBEE.

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