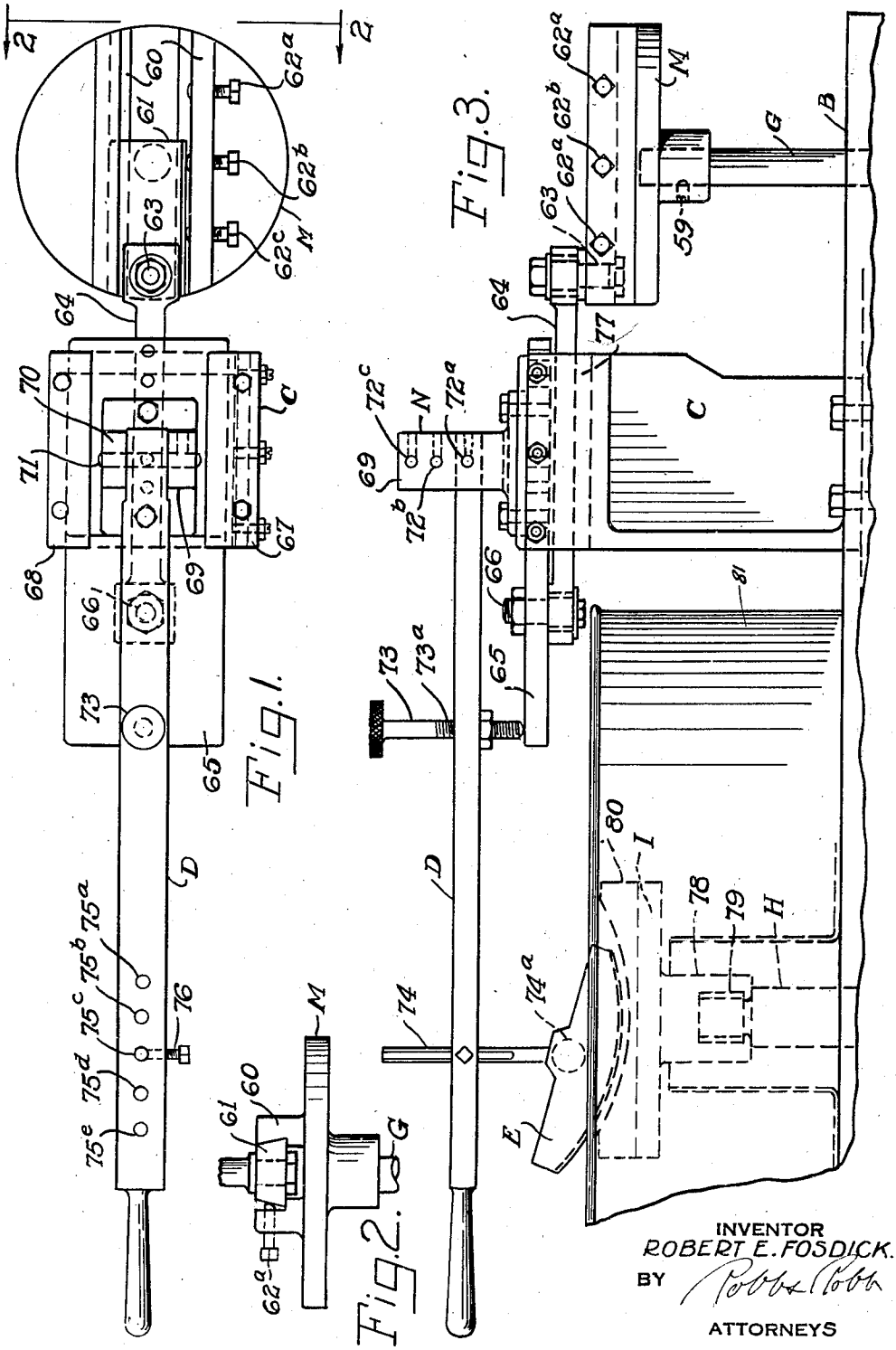
Jan. 27, 1942. R. E. FOSDICK 2,271,334

LENS GRINDING MACHINE

Filed Aug. 23, 1938 3 Sheets-Sheet 1




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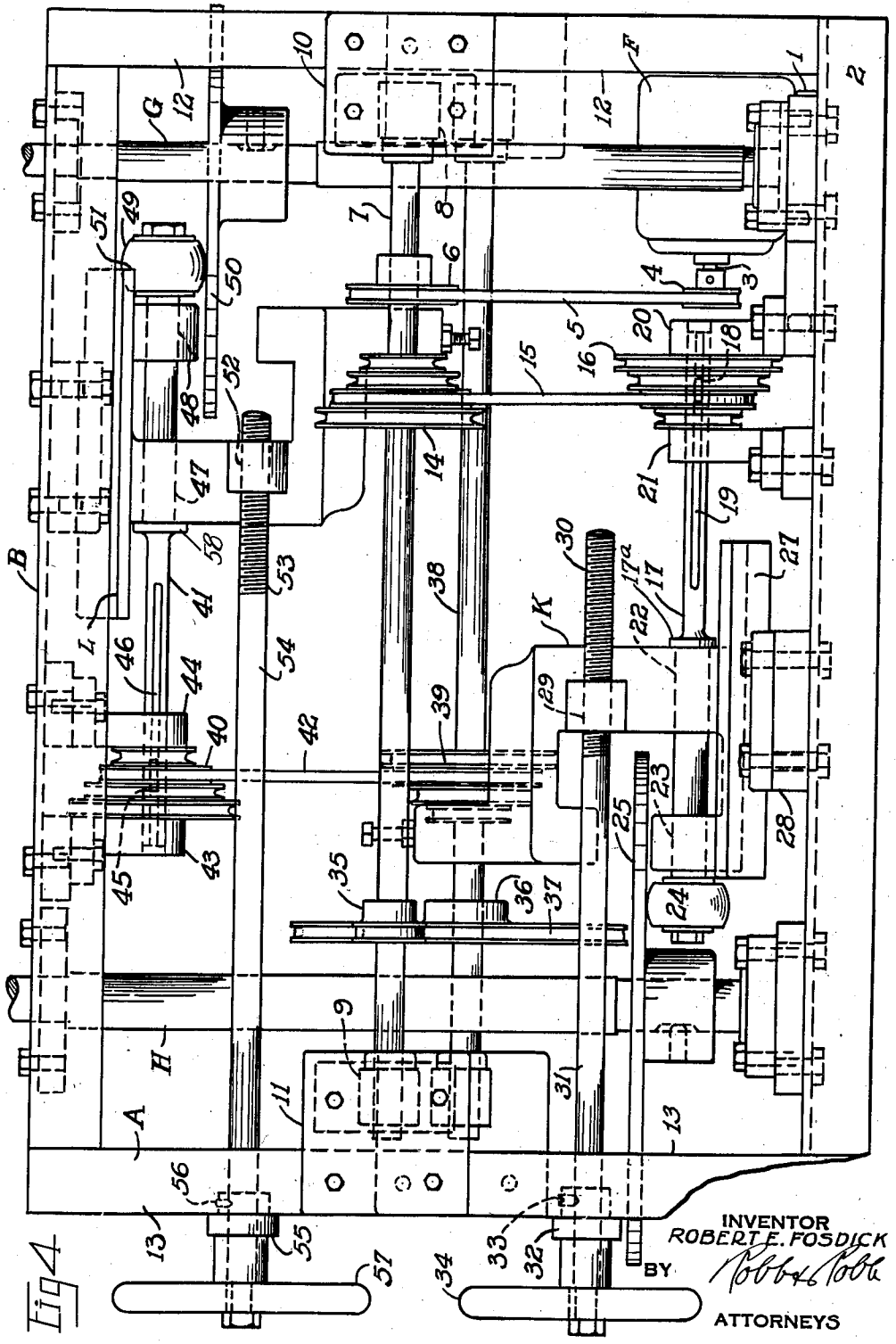


Fig 4

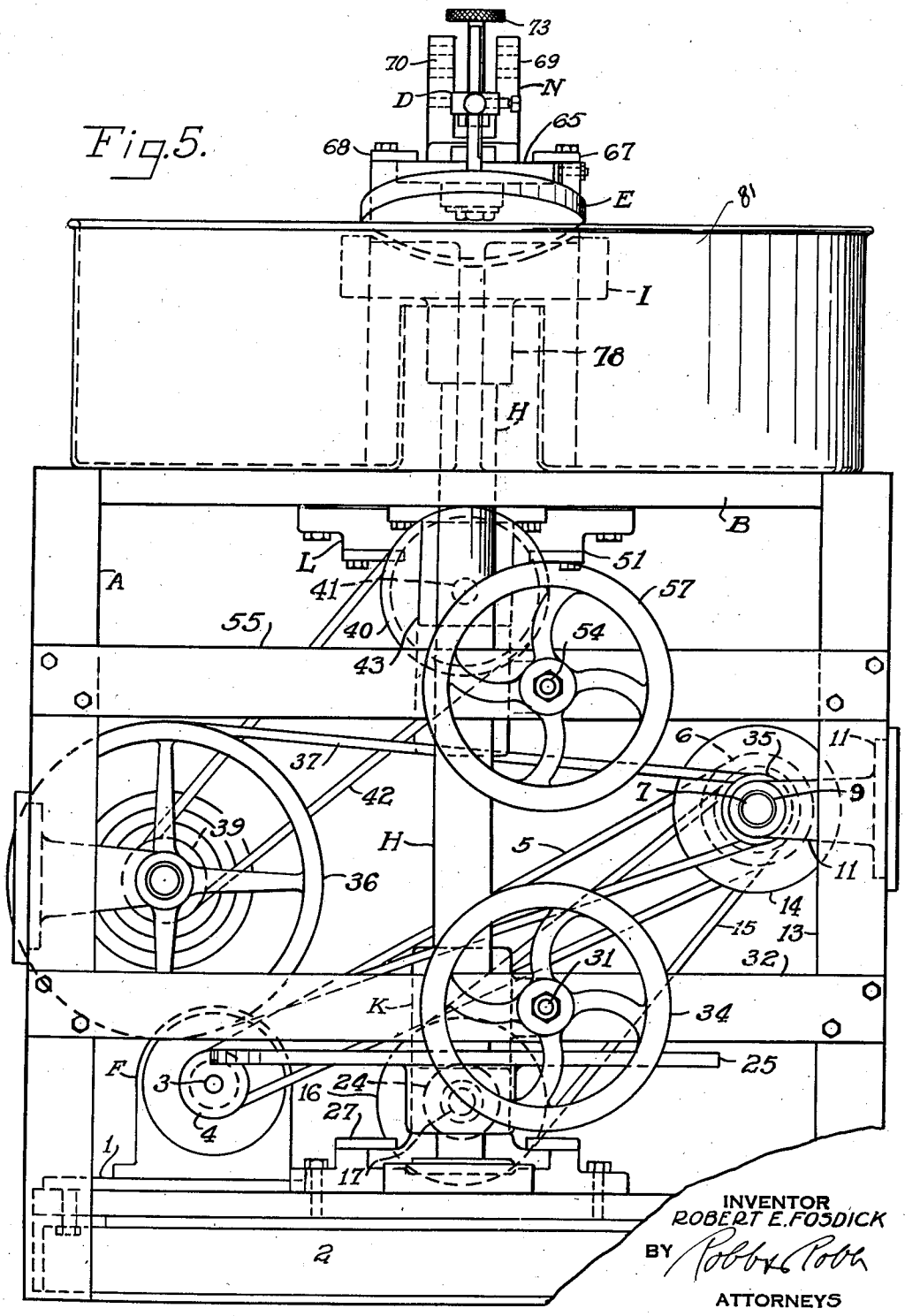
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Fig. 5.




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2,271,334

## LENS GRINDING MACHINE

Robert E. Fosdick, Dayton, Ohio

Application August 23, 1938, Serial No. 226,354

6 Claims. (Cl. 51—67)

This invention appertains to the art of grinding lenses and more particularly to the provision of an automatic machine for this purpose having provision for various types of adjustment whereby any desired sort of lens grinding operation may be accomplished with facility, accuracy and speed.

The grinding of lenses is ordinarily accomplished by causing the lens glass to be rotated while an abrasive block is held thereagainst and moved backward and forward over the surface to be ground. This is an operation requiring great skill of an operator so engaged, involving the factors of speed of rotation of the lens glass, the pressure with which the abrasive is held thereagainst, the speed of reciprocating movement of the abrasive across the surface to be ground, and the uniformity of this reciprocating movement. In the hand operation of lens grinding the results of these factors are dependent entirely upon the skill of the operator, and under most favorable conditions accuracy and uniformity of results is an object most difficult to achieve.

It is, therefore, an object of the present invention to secure these desired results by the provision of a machine in which the human element controlling the factors above mentioned is to a great extent eliminated, and by means of which uniform results are obtained automatically in accordance with certain initial adjustments

It is a further object of the invention to provide a machine of the type set forth having provision for a variety of adjustments whereby to enable the same to perform any desired lens grinding operation.

A still further object of the invention is to provide a machine which will duplicate any hand operation of lens grinding but with greater accuracy and uniformity than heretofore possible.

While it is impossible, of course, to eliminate entirely the human element, or requisite skill of an operator to perform, satisfactorily, special lens grinding operations, such as those for which the present invention has been designed, it is the aim and actual accomplishment of the instant invention to confine the need for such skill to initial adjustments of the operating parts of the machine, which then performs uniformly and accurately in accordance therewith. Once initial adjustments are made, the skill of the operator is mainly relied upon to determine the extent to which the machine is to be operated according to such adjustment before new adjustments are required, and, of course, the ability of an operator to make proper adjustments is essential.

In carrying out the practice of the invention I provide a machine comprising means for revolving a lens glass to be ground, at varied rates of speed, means for holding an abrasive substance at varying degrees of pressure against the lens glass in accordance with a variety of adjustments of adjustable means provided for this purpose, means for reciprocating the abrasive holding device across the surface of the lens glass, means for adjusting the length of stroke of the reciprocating means, and means for reciprocating the same at different rates of speed. The various motions for accomplishing the above objects and purposes are produced from a single source of power.

Other objects, advantages and features of novelty will appear more fully as the description of the invention progresses in conjunction with the drawings and as defined in the appended claims.

In the drawings:

Figure 1 is a top plan view of the reciprocating means and ancillary parts.

Figure 2 is an end elevation looking in the direction of the arrows 2—2 of Figure 1.

Figure 3 is a side view of a portion of a machine embodying the invention, the same particularly showing the relation of parts which hold and act upon the lens glass to be ground, and their relation to their respective operating instrumentalities.

Figure 4 is a view contiguous to Figure 3, being a side view of a portion of the machine illustrated in Figure 3, showing more particularly the operating instrumentalities.

Figure 5 is an end view of the machine illustrated in the foregoing figures, illustrating the relation of the instrumentalities shown in Figure 4.

Referring now to the embodiment of the invention shown in the accompanying drawings, the same generally comprises a frame A, the upper portion of which forms a table B upon which is supported a carrier bracket C to which is adjustably secured a reciprocating arm D carrying an abrasive block E. In the lower part of the frame is mounted a source of power F which, through instrumentalities later to be described, drives the eccentric shaft G, for reciprocating the arm D, and the main spindle H to which latter is splined the lens block or carrier I.

Figures 3 and 4 are contiguous, the former showing the instrumentalities positioned above the table B and the latter showing those instrumentalities positioned below the table B.

### *Structure*

For the present Figures 4 and 5 will be more particularly referred to.

The motor F is carried by a bracket 1 suitably secured to base 2 of the frame A, and to its drive shaft 3 is fixed a pulley 4. A belt 5, trained over pulley 4 and a second pulley 6 fixed to the main drive shaft 7, enables said shaft 7 to be driven by the motor. The shaft 7 is journaled in bearings 8 and 9 carried by brackets 10 and 11 respective-

ly which are secured to upright members 12 and 13 respectively of the frame A.

Fixed to the drive shaft 7 is a step-pulley 14. A belt 15 is trained thereover and also over a step-pulley 16, the latter being fixed to a driven shaft 17 by means of a key 18 engaging the key-way 19 of said shaft 17. Shaft 17 is journaled in bearing cross-members 20 and 21 secured to the base 2 of frame A and also extends through passages 22 and 23 of a slide member K. Shaft 17 also carries at one end a roller 24 which is in driving engagement with the friction disc 25 fixed to the main spindle H.

The slide member K is movable from left to right, referring to Figure 4, in a guide-way 27 carried by a bracket 28 bolted to the base 2 of frame A. Said slide member K has an internally threaded passage 29 which receives the threaded end 30 of screw shaft 31 rotatably journaled in a bearing cross member 32 secured to upright member 13 of frame A. Said screw shaft 31 is prevented from horizontal movement by a collar 33 fixed thereto which is positioned against said bearing 32. Exteriorly of the frame A there is secured to said screw shaft 31 an operating wheel or member 34.

The speed at which the main spindle H is rotated is regulated by operation of the screw shaft 31 rotated by the wheel 34. Rotation of the screw shaft 31 causes leftward or rightward movement, referring to Figure 4, of the slide member K by cooperation of the internally threaded passage 29 thereof with the threaded portion 30 of said screw shaft 31. Movement of slide member K is transmitted to the driven shaft 17 by engagement of said member with abutment member 17*a* fixed to shaft 17 or by engagement with the roller 24, depending upon the direction in which said slide member K is moved, to move said shaft 17 correspondingly. The roller 24 is thus caused to engage the friction disc 25 at a greater or less distance from the center thereof to vary the speed of rotation of said disc, and consequently, of said main spindle H. The rotational speed of said spindle H is also controlled by selecting the portions of the step pulleys 14 and 16 over which the belt 15 is trained, as will be apparent.

Also fixed to drive shaft 7 is a pulley 35. Over this pulley and a larger pulley 36 is trained belt 37, the pulley 36 being fixed to a driven shaft 38. A step-pulley 39 is fixed to this latter shaft and trained thereover and also over a step-pulley 40, fixed to a driven shaft 41 is a belt 42. The shaft 41 is journaled in bearing cross-members 43 and 44 secured to the table or platform B. Pulley 40 is fixed to shaft 41 by a key 45 slidable in a key-way 46. Thus shaft 41 is movable through the bearings 43 and 44 in the same manner that shaft 17 is movable through its respective supporting bearings.

Shaft 41 extends through passages 47 and 48 of a slide member L and has secured to one end the roller 49 in driving engagement with a friction disc 50 secured to the eccentric shaft G. The slide member L is slidable from left to right, referring to Figure 4, in a guide-way 51 secured to the underside of the table B. Said slide member L has an internally threaded passage 52 through which extends the threaded portion 53 of a screw shaft 54 journaled in a bearing 55 secured to upright member 13 of the frame A. Said shaft 54 is maintained against horizontal movement with respect to bearing 55 by a collar 56 fixed to the shaft and which engages said bearing.

Driven shaft 41 is movable leftwardly or rightwardly, referring to Figure 4, upon operation of the hand wheel 57 fixed to screw shaft 54, to cause engagement of roller 49 closer to or farther away from the center of disc 50, by engagement of slide member L with abutment member 58 on shaft 41, or roller 49, in the same manner as that described in reference to the movement of shaft 17. The speed of rotation of eccentric shaft G is thus controlled as a consequence thereof, as well as by adjustment of belt 42 upon the step-pulleys 39 and 40.

Now referring more particularly to Figures 1 to 3 it will be seen that there is supported at the top of eccentric shaft G an eccentric disc or plate M fixed thereto as by the set-screw 59. Formed on the upper side thereof is a guide-way 60 in which is slidably mounted the slide member 61 which is adapted to be fixed at any desired adjustment in the length of the guide-way by one or more of the set screws 62*a*, 62*b*, or 62*c*. A pivot bolt 63 extends through the slidable member 61 and one end of a pitman 64, the other end of the latter being pivotally secured to a slidable plate 65 as by a pivot bolt 66 extending therethrough. The plate 65 is slidable from left to right, referring to Figures 1 and 3, in the grooved ways or channels 67 and 68 of the carrier member or bracket C, the latter being suitably secured to the upper side of the table B as by bolts or otherwise.

Fastened to the slidable plate 65 is a U-shaped bracket N between the upstanding portions 69 and 70 of which one end of the reciprocating arm D is adjustably secured as by a pin 71 extending through a hole in said arm and through one of the pairs of oppositely disposed holes 72*a*, 72*b* or 72*c* in the upstanding portions 69 and 70 of the U-shaped bracket N. An adjusting screw 73 has a threaded portion 73*a* extending vertically through the arm D at a point between the ends thereof and engages the plate 65 to support the said arm at such point.

Also extending vertically through said arm D is a carrier pin 74 formed with a lower rounded or ball end 74*a* which is received in a ball socket of the abrasive block E. The pin 74 may be fixed permanently respecting the arm D or adjustably received in one of the openings 75*a*, 75*b*, 75*c*, 75*d*, or 75*e*, its vertical position respecting said arm being fixed by set screws such as 76 provided for cooperation with each of the said openings.

If desired a pin having a straight or pointed lower end may be substituted for the pin 74, the abrasive block E receiving said end loosely and maintaining connection with said pin during the grinding operation by contact of said block with the lens to be ground.

Arm D is reciprocated through rotation of eccentric plate M to which is pivotally connected the pitman 64 as above described, said pitman being free to move longitudinally and transversely in the under-cut portion 77 of the carrier C beneath the plate 65. The length of stroke of arm D is regulated by adjusting the position of the slidable member 61 radially respecting the eccentric plate M, by the means above described.

The lens block or carrier I has formed therebeneath a hub 78 which receives the upper end 79 of the main spindle H, said end 79 being splined to said hub. To the carrier I is suitably secured a lens 80 to be ground.

*Operation*

The block of glass 80 which is to be ground into a lens having been suitably secured to the carrier I, ordinarily by cementing the same thereto, and an abrasive block E of the desired curvature having been secured to the arm D, the proper tension of the block E upon the glass 80 is adjusted by securing the arm D to the bracket N in the desired vertical position and regulating the adjusting screw 73 with reference to the plate 65. The length of stroke of the arm D is adjusted by releasing the set screws 62*a*, 62*b*, and 62*c* and moving slide member 61 radially inward or outward with respect to the center of the eccentric M.

Next the belts 15 and 42 are trained over the desired steps of the pulleys 14 and 16, and 39 and 40, respectively. The hand wheels 34 and 57 are then operated to position the rollers 24 and 49, respectively, at the proper distance from the center of their friction discs 25 and 50. This manipulation will regulate the speed of rotation of the main spindle H and eccentric shaft G respectively.

Now the motor F is started into operation rotating motor shaft 3 and shaft 7 through belt 5 trained over pulleys 4 and 6. Shaft 17 will be consequently rotated through belt 15 trained over step-pulley 14 and 16. Main spindle H will be rotated by engagement of roller 24, fixed to shaft 17, with friction disc 25. Shaft 38 will be rotated by belt 37 trained over pulleys 35 and 36, and shaft 41 will be rotated through belt 42 trained over step-pulleys 39 and 40. The eccentric shaft G will thus be rotated by engagement of roller 49, fixed to shaft 41, with friction disc 50. Rotation of the eccentric plate M, fixed to shaft G will reciprocate the pitman 64, and consequently plate 65 to which it is pivotally attached, bracket N secured to said plate, and arm D, attached to said bracket. This will cause abrasive block E to move across the surface of the glass 80 to grind the same.

The tension with which the abrasive block E is held against the glass 80 will be adjusted by turning the adjusting screw 73 to move the arm D closer to or farther away from the plate 65. As the grinding operation proceeds the ground glass dust and abrasive dust will be caught in the pan or tub 81 supported on the table B and surrounding the portion of the main spindle H protruding above the top of said table.

During the grinding operation hand wheels 34 and 57 may be actuated to vary the rotational speeds of the main spindle H and the eccentric shaft G, respectively, the latter affecting the speed of reciprocation of the arm D.

From the above it will be seen my invention provides an automatic lens grinding machine suitable for the performance of many sorts of lens grinding operations as a result of the many adjustments of the various instrumentalities provided.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a device of the class described, in combination, a frame, a rotatable member, a reciprocable member, one of said members carrying an abrasive material, the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame, an arm pivotally secured to said carriage and supporting the second member proximate the first member, means for reciprocating said carriage respecting said first member in a straight line path, and means for vertically adjusting said arm to different fixed positions relative to said carriage while maintaining said arm in a horizontal position.

2. In a device of the class described, in combination, a frame, a rotatable member, a reciprocable member, one of said members carrying an abrasive material, the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame, an arm pivotally secured to said carriage and supporting the second member proximate the first member, means associated with said carriage for reciprocating the same in a straight line path, means for vertically adjusting said arm to different fixed positions respecting said carriage, and means for vertically adjusting said second member relative to said arm.

3. In a device of the class described, in combination, a frame, a rotatable member, a reciprocable member, one of said members carrying an abrasive material, the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame, an arm pivotally secured to said carriage and supporting the second member proximate the first member, means associated with said carriage for reciprocating the same in a straight line path, means for vertically adjusting said arm to different fixed positions respecting said carriage, means for vertically adjusting said second member relative to said arm, and means for adjusting the angle of said arm relative to said carriage.

4. In a device of the class described, in combination, a frame, a rotatable member, a reciprocable member, one of said members carrying an abrasive material and the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame and supporting the second member proximate the first, and means for reciprocably sliding said carriage in said frame respecting said first member, driving means common to both the aforesaid means and including instrumentalities interrelating the same for simultaneously varying the relative speeds of one to the other, and separate means associated with each of said first and second means for independently varying the speed of each.

5. In a device of the class described, in combination, a frame, a rotatable member, a spindle associated therewith, a reciprocable member, one of said members carrying an abrasive material and the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame and supporting the second member proximate the first, means for reciprocably sliding said carriage in said frame respecting the first member, driving means common to both the aforesaid means and comprising a pair of rotatable spindles each of which is associated with one of said means, a friction member fixed to each of said spindles, a plurality of shafts slidable in said frame, each shaft having means engageable with one of said friction members, said driving means comprising instrumentalities for varying the rotative speeds of said shafts relative to each other, and means associated with said shafts for axially shifting the same radially respecting said friction members to vary the

rotational speed of either of said spindles independently of the other.

6. In a device of the class described, in combination, a frame, a rotatable member, a reciprocable member, one of said members carrying an abrasive material and the other of said members being adapted to carry a glass blank to be ground, means for rotating the first member, a carriage slidable in said frame and supporting the second member proximate the first, means for reciprocably sliding said carriage in said frame respecting the first member, driving means common to both the aforesaid means and comprising a pair of rotatable spindles each of which is associated with one of said means, eccentric means associated with one of said spindles and said carriage for reciprocating the latter, means associated with each of said spindles for varying the rotative speed thereof independently of the rotative speed of the other, said driving means including instrumentalities interrelating said spindles for simultaneously varying the relative rotative speed of each to the other.

ROBERT E. FOSDICK.