No. 774,745. PATENTED NOV. 15, 1904.

E. L. EGOLF.

MACHINE FOR GRINDING LENSES.

APPLICATION FILED FEB. 26, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

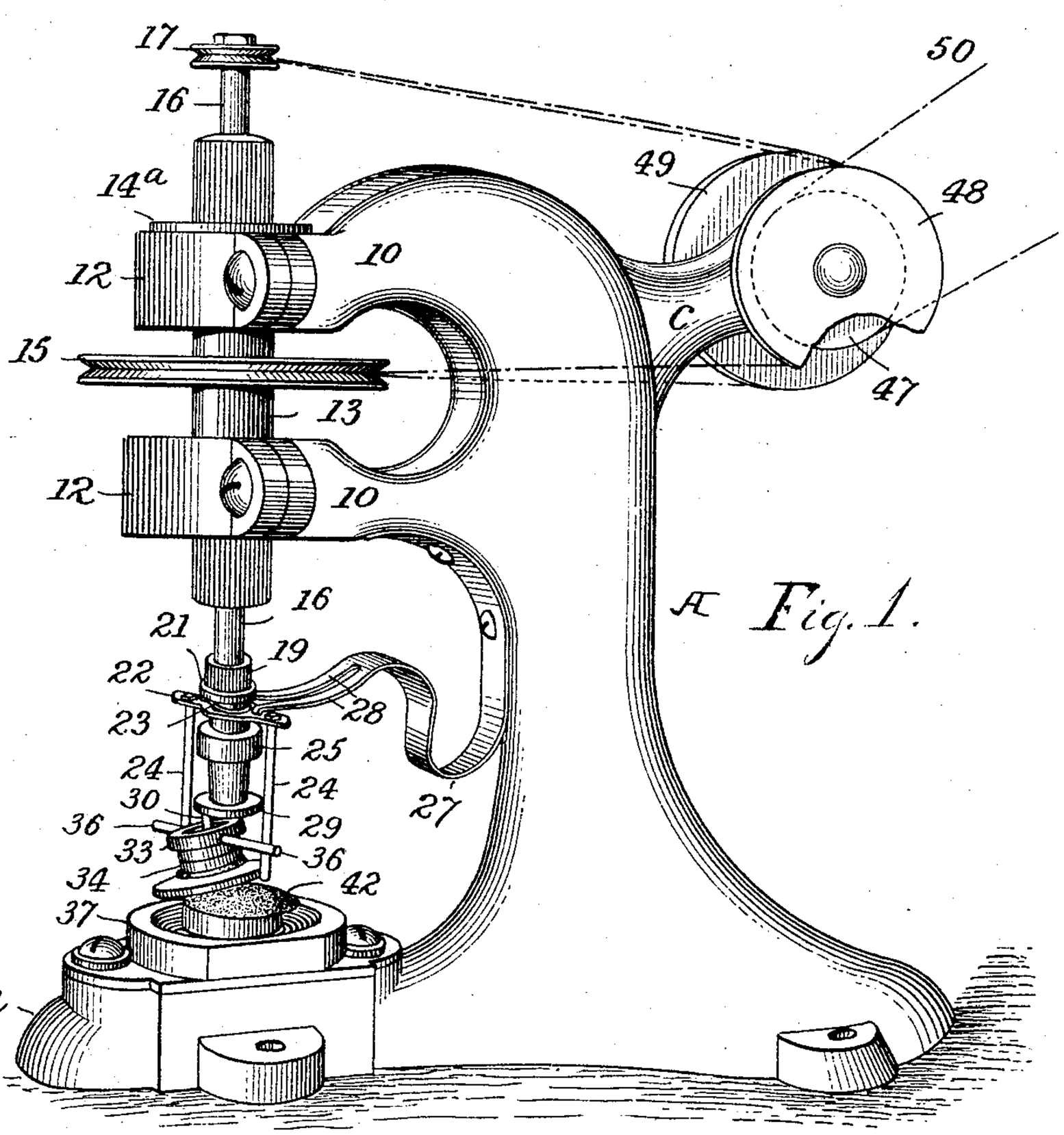

Fig. 1.

Witnesses
J. J. Stinkel
G. N. Freeman.

Inventor
by Edgar L. Egolf
Foster Freeman & Watson
Attorneys.

No. 774,745. PATENTED NOV. 15, 1904.

E. L. EGOLF.

MACHINE FOR GRINDING LENSES.

APPLICATION FILED FEB. 26, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

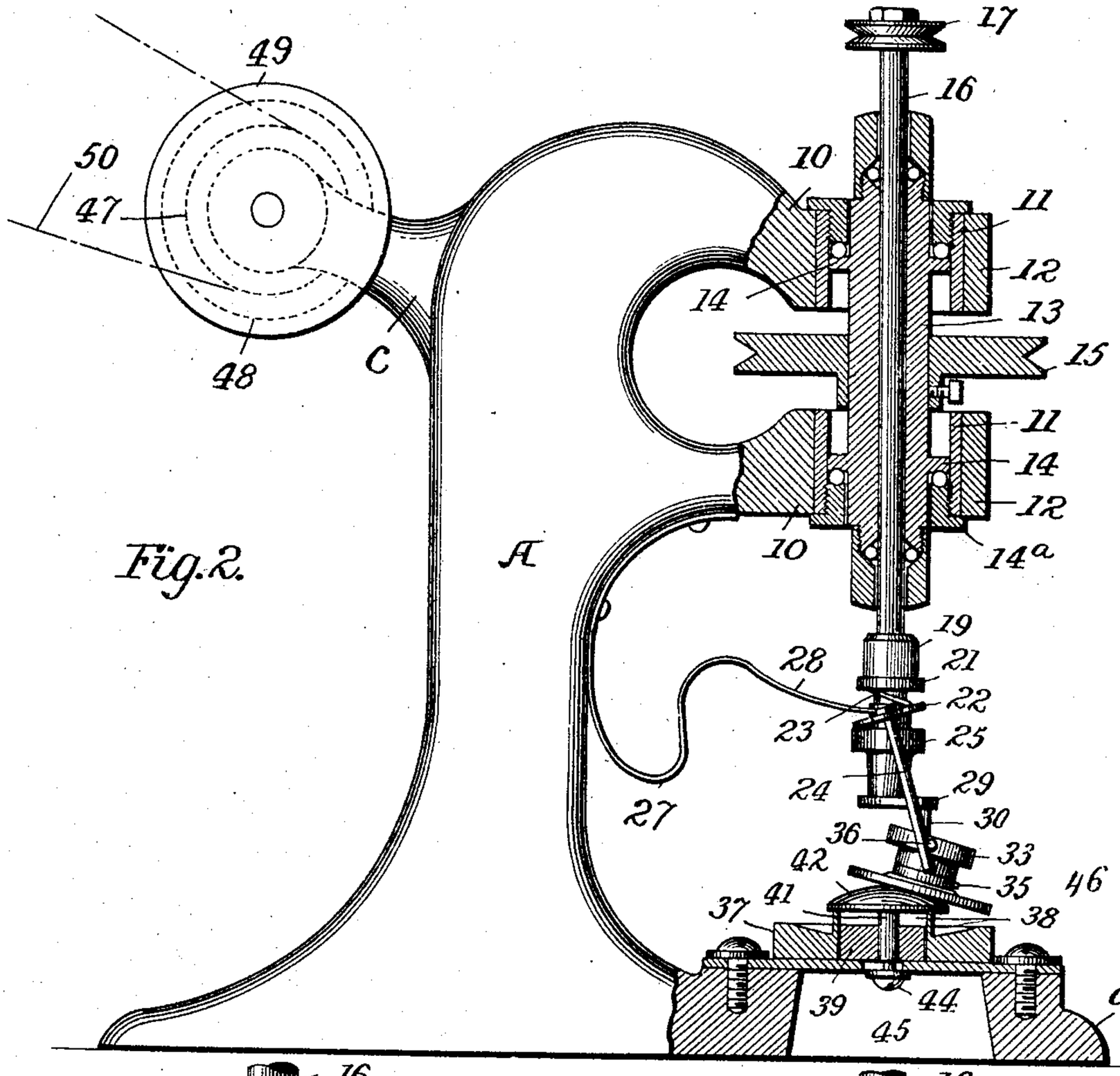

Fig. 2.

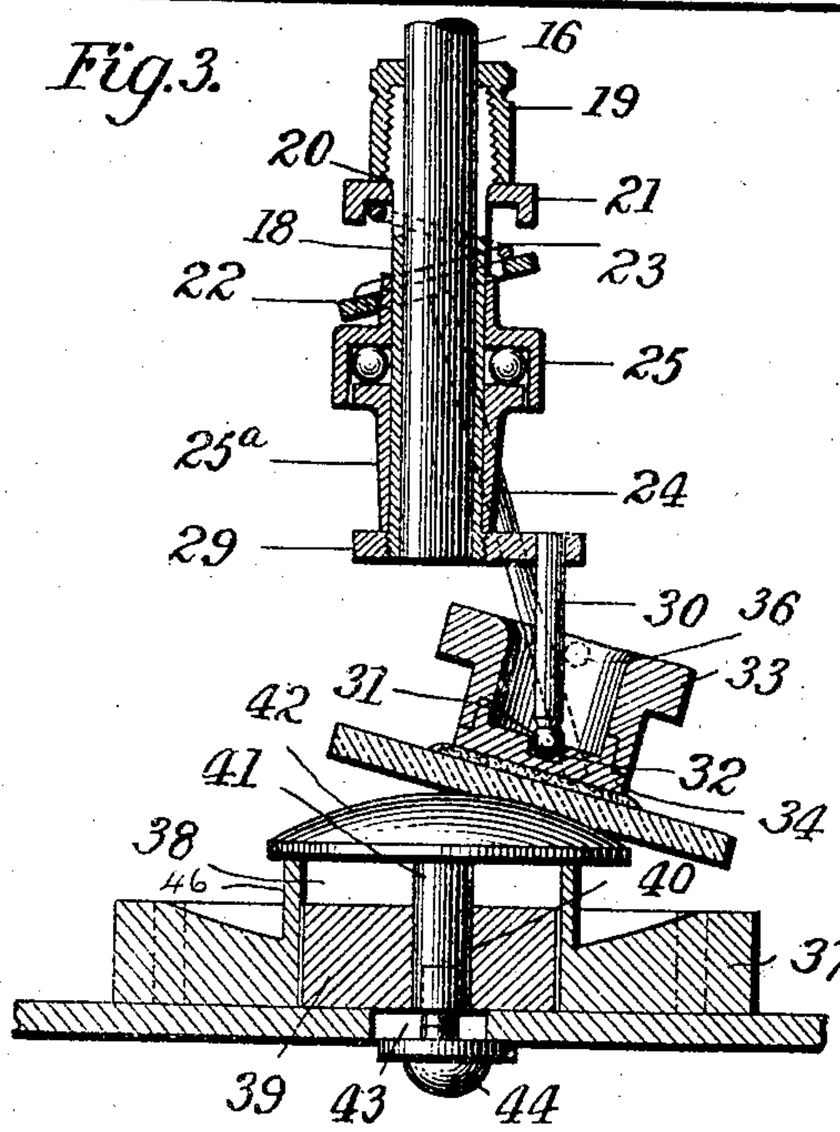

Fig. 3.

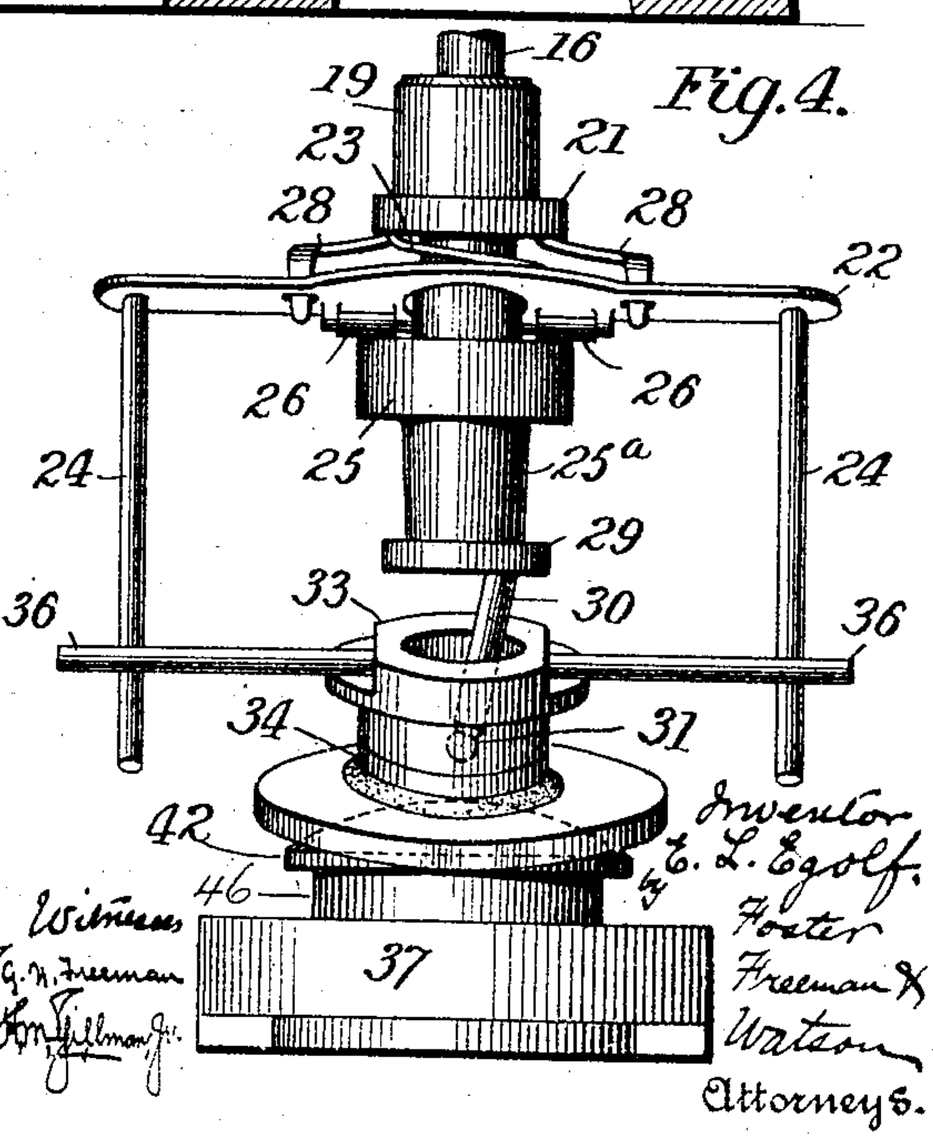

Fig. 4.

Witnesses
G. H. Freeman
Wm. Fellman Jr.

Inventor
E. L. Egolf.
by Foster Freeman & Watson
Attorneys.

No. 774,745. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

EDGAR L. EGOLF, OF HARRISBURG, PENNSYLVANIA.

MACHINE FOR GRINDING LENSES.

SPECIFICATION forming part of Letters Patent No. 774,745, dated November 15, 1904.

Application filed February 26, 1904. Serial No. 195,421. (No model.)

To all whom it may concern:

Be it known that I, EDGAR L. EGOLF, a citizen of the United States, residing at Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Machines for Grinding Lenses, of which the following is a specification.

This invention relates to machines for grinding lenses; and the object of the invention is to provide a simple and efficient machine for accurately grinding and polishing lenses, and more particularly for grinding and polishing a toric lens—that is, a lens the surface of which is composed of two curves of different radii. In machines of this general character either the grinding-tool or the lens is moved about an axis over the surface of the other, and it is necessary to constantly change the position of this axis in order that the moving part will not continuously travel in the same path over the other; and one of the special features of my invention is the means employed for automatically effecting this change of axis, and so far as this feature is concerned it is equally valuable for grinding either a toric, spherical, plano, or cross-cylinder lens.

The invention will be fully described hereinafter, reference being had to the accompanying drawings, in which I have illustrated a preferred form of mechanism for grinding a toric lens; but it is to be understood that the invention is not to be restricted to the precise details of construction illustrated and described, and also that some parts of the invention, substantially as illustrated and described, may be used without other parts thereof.

In said drawings, Figure 1 is a perspective view of a machine embodying my invention. Fig. 2 is a vertical section through the grinding-tool holder, the lens-carrier, and the mechanism for moving and grinding the latter. Fig. 3 is a sectional view, on enlarged scale, of the lower portion of Fig. 2. Fig. 4 is a similar view taken at right angles to Fig. 3.

A is a standard secured to or integral with a base *a* and having two arms 10 10, projecting laterally from its upper portion. These arms form half-bearings for two thimbles 11 11, which are held in place by the caps 12 12, detachably secured to the arms 10. A sleeve 13 extends through these thimbles and is provided with collars 14, between which and the inner ends of jam-nuts 14ª a series of balls are supported to form ball-bearings for the sleeve. The parts are so arranged that the sleeve can rotate freely, but has substantially no vertical movement. A pulley 15 is secured to the sleeve between the two arms 10 10, by which the sleeve will be rotated, as hereinafter described.

The sleeve 13 is bored eccentrically and a shaft 16 is journaled in the bore of the sleeve and provided with a pulley 17 at its upper end, and this shaft is free to have vertical movement in the sleeve. Ball-bearings are interposed between the shaft and sleeve.

A thimble 18 fits over the lower end of the shaft 16 and has its upper end split and tapered, and the tapered portion is screw-threaded exteriorly to receive a nut 19, by means of which the thimble can be clamped on the shaft. The thimble is provided with a shoulder 20, and a collar 21 fits loosely on the thimble and abuts against the shoulder. A bar 22 is provided with an opening substantially midway its length through which the thimble 18 passes loosely, and between the collar 21 and the bar 22 a spring 23 is coiled around the thimble, with one end engaging the collar and the other the bar on the same side of the thimble. This spring has the effect of tilting the bar 22, as clearly shown in Fig. 2, and normally throws the lower ends of the depending rods 24 forward. These rods are connected at their upper ends to the cross-bar 22.

Below the bar 22 a collar 25 fits loosely on the thimble and serves as a support for the bar, and in order to permit the bar to tilt or rock freely the latter is provided with rounded bearing-surfaces 26, which engage the collar. The collar 25 is supported by a sleeve 25ª, secured on the thimble, and balls are interposed between the collar and sleeve. A spring 27 is connected at one end to the standard A, and its other end is forked, and the two prongs 28 are loosely connected to the bar 22 on opposite sides of the shaft 16. This spring normally depresses the bar 22 and the shaft 16, but will yield to permit them to be

lifted upwardly. This spring, by reason of its forked end connected to the bar 22, will also prevent the latter from rotating on the thimble 18, but permits it to rock or tilt freely in either direction.

The thimble 18 carries at its lower end a disk 29, from which a crank-pin 30 extends downwardly, and the lower end of this pin is rounded, as indicated at 31, and works in a concave recess 32 in the lens-carrier. Preferably the carrier is in two parts, one part, 33, being tubular to receive the other part, 34, and the latter has the recess 32 formed in its inner end. The lens will be secured to the outer end of the part 34 by cement or wax in the usual manner, and the two parts may be detachably connected together by a set-screw 35 or other suitable locking device. To the part 33 are secured the two oppositely-extending arms 36, which when the carrier is position on the machine will be engaged by the depending rods 24, and the carrier will be prevented from rotating about its axis.

Secured to the base *a* is a holder 37 for the grinding or polishing tool, it being understood that so far as this invention is concerned one is the equivalent of the other. For the purposes of this specification, however, I shall refer only to a "grinding-tool," with the understanding, however, that the term also includes a polishing-tool. The holder is provided with a circular recess 38, into which a disk 39 fits to turn therein. The disk is provided with an opening 40, eccentrically arranged and extending through it to receive the stem 41 of the grinding-tool 42. An opening 43 extends through the bottom of the holder to permit the passage of the clamping-screw 44, which screws into the stem 41 and the head of which engages the under surface of the holder 37, and an opening 45 is formed in the base *a* to afford access to the head of the screw 44. The object of the foregoing devices is to enable me to center the grinding-tool on the lens, as it frequently happens that the lens is not fastened to its carrier so as to center it on the grinding-tool in its normal position. By turning the disk 39 in the recess the grinding-tool can be accurately adjusted with respect to the lens. An upwardly-extending flange 46 surrounds the recess 38 and the grinding-tool rests upon its upper edge. From the standard A another arm, *c*, projects rearwardly and supports a short shaft on which two pulleys 47 and 48 are journaled. These pulleys may be connected by a clutch or otherwise to turn together, and one, 47, is adapted to be driven from any suitable source of power, a belt 50 being shown. On the other side of the arm *c* another pulley, 49, is journaled to run idle. An endless belt runs over the pulleys 49, 17, 15, and 48, as indicated in the drawings, and the result is that the shaft 16 and sleeve 13 are rotated in opposite directions and the latter at less speed than the former. It is not essential that the shaft 16 and sleeve 13 shall rotate in opposite directions, as the same result would be accomplished if they rotated in the same direction.

Such being the preferred construction the operation is as follows: The lens having been secured to its carrier and the grinding-tool properly adjusted the lens is placed on the tool and the crank-pin 30 engaged in the recess 32 in the carrier. The pulleys are then rotated and the shaft 16 will be rotated at considerable speed, and thereby cause the lens to move over the grinding-surface of the tool in a circular path; but on account of the arms 36 engaging the depending rods 24 the carrier and lens will be prevented from having any rotary movement about their own axes, and the spring 23 will act upon the bar 22 to cause it to hold the rods 24 engaged with the arms 36. Of course it is understood that the surface of the grinding-tool is curved to correspond to the curvature of the lens desired, whether toric, spherical, or cylindrical, and in the machine, as illustrated, the tool would have two curves of different radii to grind a toric lens. During the movement of the carrier and lens in said circular path they will also have a rolling movement on the surface of the tool from the center of the lens outwardly—that is, every portion of the edge will in its turn occupy the lowest position, and the lowest portion is continuously changing around the entire circle of movement.

It will be observed that the axis of the crank-pin 30 is not parallel with the axis of the shaft 16, but is inclined thereto. The object of inclining the pin in this manner is to prevent the lens and its carrier from being thrown out of the machine in case the lens should tend to stick at any point on the grinding-tool. Experience has shown that when the pin is parallel with the shaft and the lens tends to stick at any point the lens and holder will tip up sufficiently to disengage the pin from the recess in which its end works, and as the shaft 16 is revolved at considerable speed the lens and carrier are thrown out of the machine with considerable force and frequently causes much damage. With the pin inclined from the vertical, as shown, I have found that there is little or no tendency of the holder and lens to tip when the latter tends to stick to the tool. It will also be observed that while the shaft 16 is rotating the sleeve 13 is also being rotated continuously, and this results in constantly varying the position of the axis of the shaft 16 with respect to the axis of the tool, and consequently the path of travel of the lens and carrier on the tool is constantly changing and grooves will not be formed in the lens or tool.

While the machine so far described is designed especially for grinding toric lenses, it may also be used just as it is for grinding a spherical or a cylindrical lens by substituting

a tool of the proper surface curvature. For a spherical lens, however, it is not necessary to prevent the rotation of the lens about its own axis. In fact, the grinding operation will be materially expedited by permitting such movement. I therefore propose to remove the bar 22 and its adjuncts, as well as the arms 36, when the machine is to be used for grinding a spherical lens, and the lens and its carrier will then, in addition to having the circular and rolling movement over the surface of the tool, also rotate about their own axis, and the means for varying the position of the axis of the shaft 16 are just as valuable when the machine is thus used as when it is used for grinding a toric lens.

Having described the invention, I claim—

1. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable shaft, means for transmitting the rotary movement of the shaft to the carrier to move the latter over the tool, and means for varying the position of the axis of the shaft relative to the axis of the tool, substantially as set forth.

2. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable sleeve, a shaft eccentrically journaled in the sleeve, means for rotating the shaft and sleeve simultaneously but independently of each other, and means for transmitting the movement of the shaft to the carrier to move the latter over the tool, substantially as set forth.

3. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable sleeve, a shaft eccentrically journaled in the sleeve, means for rotating the shaft and sleeve simultaneously and at different speeds, and means for transmitting the movement of the shaft to the carrier to move the latter over the tool, substantially as set forth.

4. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, a rotatable shaft having a crank-pin to loosely engage in said recess, and means for varying the position of the axis of the shaft relative to that of the tool, substantially as set forth.

5. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, a rotatable shaft having a crank-pin to loosely engage in said recess to move the lens-carrier over the tool, means for varying the position of the axis of the shaft relatively to that of the tool, and means for preventing the lens-carrier from rotating about its own axis when moving over the tool, substantially as set forth.

6. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, a rotatable shaft having a crank-pin to loosely engage in said recess to move the carrier over the tool, a bar loosely fitted over the shaft and supported to rock thereon, depending rods carried by said bar, arms projecting from the lens-carrier and extending across the said rods, and a spring engaging the bar to rock the latter in one direction and hold the rods engaged with the arms, substantially as set forth.

7. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, a rotatable shaft having a crank-pin to loosely engage in said recess to move the carrier over the tool, a bar loosely fitted over the shaft and supported to rock thereon, means for preventing the bar from turning about the shaft, depending rods carried by said bar, arms projecting from the lens-carrier and extending across the said rods, and a spring engaging the bar to rock the latter in one direction and hold the rods engaged with the arms, substantially as set forth.

8. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable shaft, means for transmitting the rotary movement of the shaft to the carrier to move the latter in a circular path over the tool, arms projecting from the carrier, a bar loosely supported upon the shaft to rock thereon, rods depending from the bar, a spring engaging the bar to rock it in one direction to hold said rods in engagement with the arms, and a spring secured to a fixed support and having a forked end, the prongs of which are loosely connected to the said bar on opposite sides of the shaft to prevent the bar from turning about the rod and permitting the rocking of the bar on the shaft, substantially as set forth.

9. In a machine for grinding lenses, a grinding-tool holder having a circular recess, a disk having an opening eccentrically arranged, a tool having a stem to fit in said eccentric opening, and a flange surrounding said recess for supporting the tool, substantially as set forth.

10. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable shaft having its axis parallel to that of the tool, means for transmitting the rotary movement of the shaft to the carrier to move the latter over the tool, and means for varying the positions of the axes of the shaft and tool relatively to each other, substantially as set forth.

11. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable shaft having its axis parallel to that of the tool, means for transmitting the rotary movement of the shaft to the carrier to cause it and the lens to move in a circular path and also to have a rolling movement over the surface of the tool, and means for varying the position of the axis of the shaft relatively to that of the tool, substantially as set forth.

12. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier, a rotatable shaft, means for transmitting the

rotary movement of the shaft to the carrier to cause the latter to move in a circular path and also to have a rolling movement over the surface of the tool, and means for varying the position of the axis of the shaft relative to that of the tool, substantially as set forth.

13. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, and a rotatable shaft having a crank-pin to loosely engage in said recess, and the axis of the pin being inclined to that of the shaft, substantially as set forth.

14. In a machine for grinding lenses, the combination of a grinding-tool, a lens-carrier having a central recess, a rotatable shaft having a crank-pin to loosely engage in said recess, and the axis of the pin being inclined to that of the shaft, and means for varying the position of the axis of the shaft relative to that of the tool, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDGAR L. EGOLF.

Witnesses:
EDWIN CRUSE,
THOMAS DURANT.