(No Model.) 4 Sheets—Sheet 1.

# T. A. WILLSON & H. BILGRAM.

## MACHINE FOR GRINDING THE EDGES OF SPECTACLE OR EYEGLASS LENSES.

No. 508,196. Patented Nov. 7, 1893.

Fig. 1.

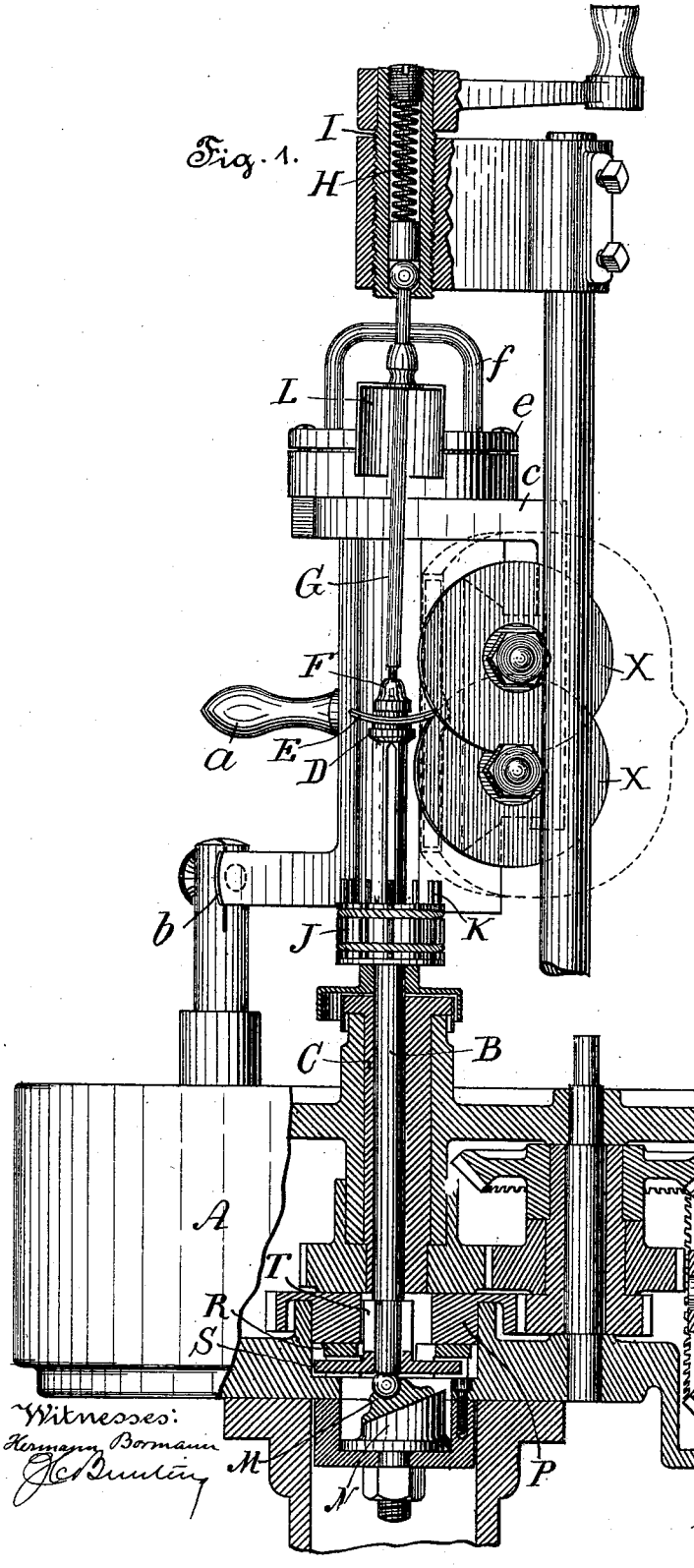
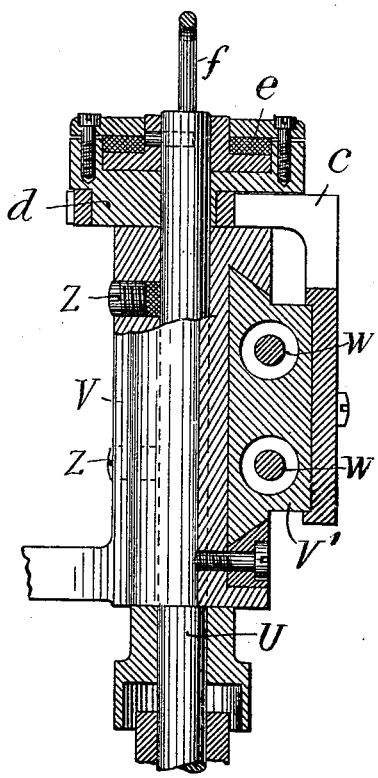



Fig. 5.




Witnesses:
Hermann Bormann
J. C. Dunlap

Inventors:
Thomas A. Willson &
Hugo Bilgram
by Duncan & Clarke
Att'ys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

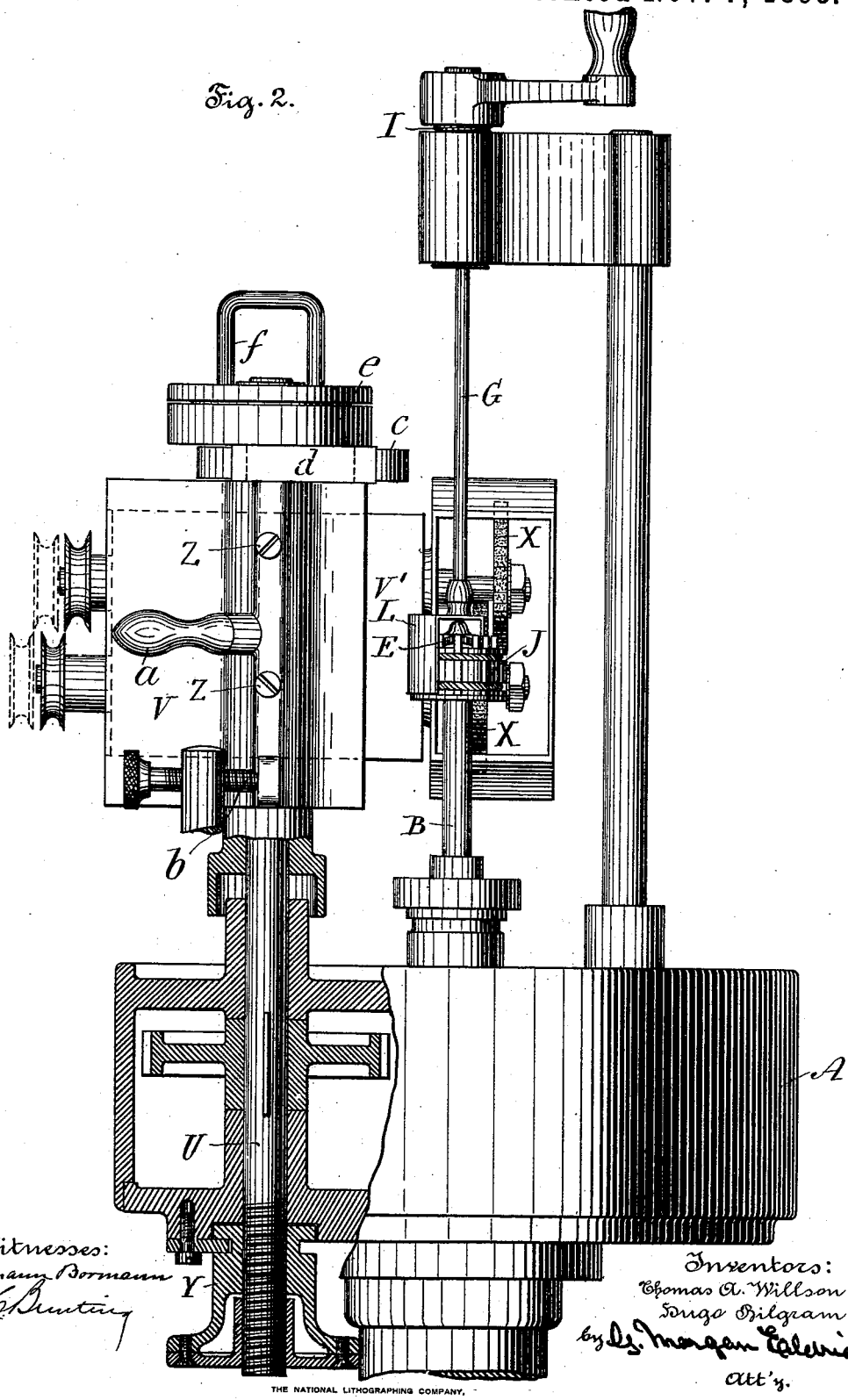
(No Model.) 4 Sheets—Sheet 2.

# T. A. WILLSON & H. BILGRAM.

## MACHINE FOR GRINDING THE EDGES OF SPECTACLE OR EYEGLASS LENSES.

No. 508,196. Patented Nov. 7, 1893.

Fig. 2.




Witnesses:
Hermann Bormann
J. C. Bunting

Inventors:
Thomas A. Willson &
Sonza Bilgram
by D. Morgan Coleridge
Att'y.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

# T. A. WILLSON & H. BILGRAM.

## MACHINE FOR GRINDING THE EDGES OF SPECTACLE OR EYEGLASS LENSES.

No. 508,196. Patented Nov. 7, 1893.

Fig. 3.

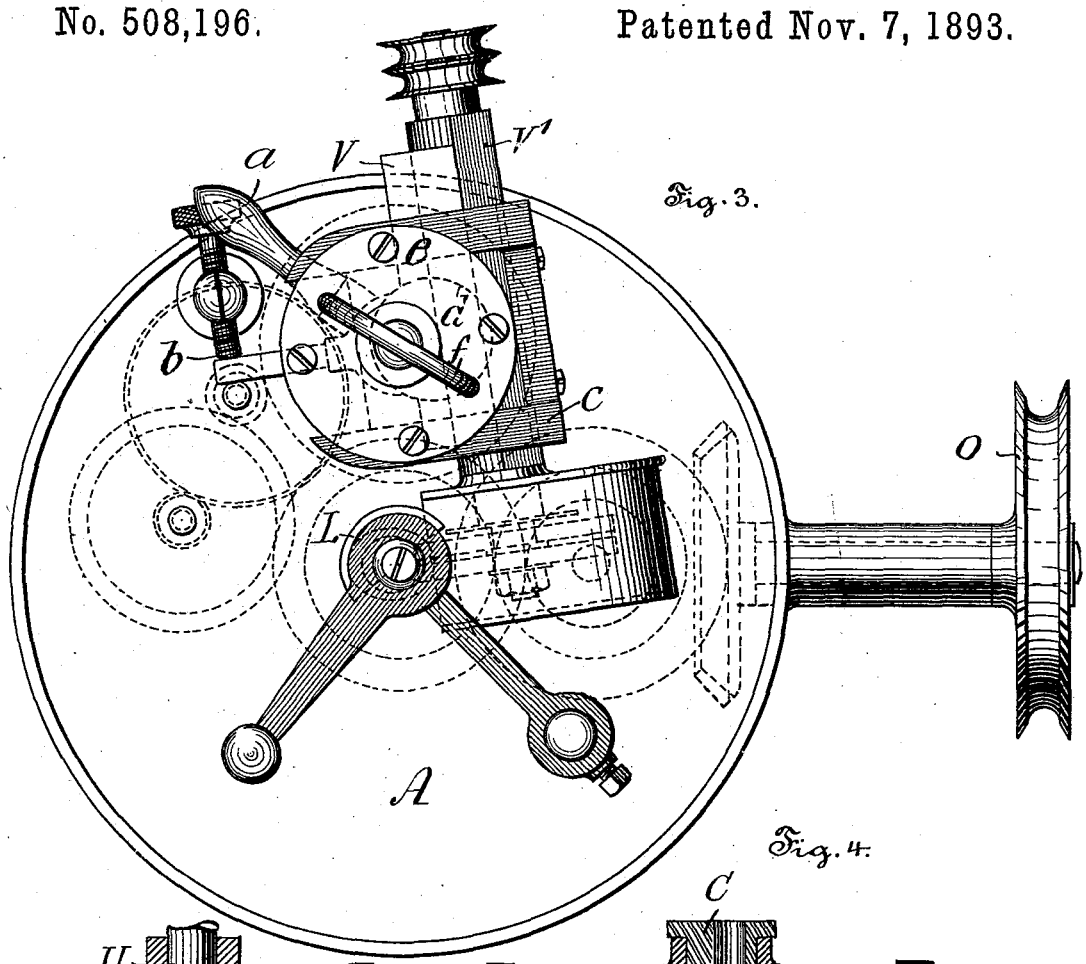
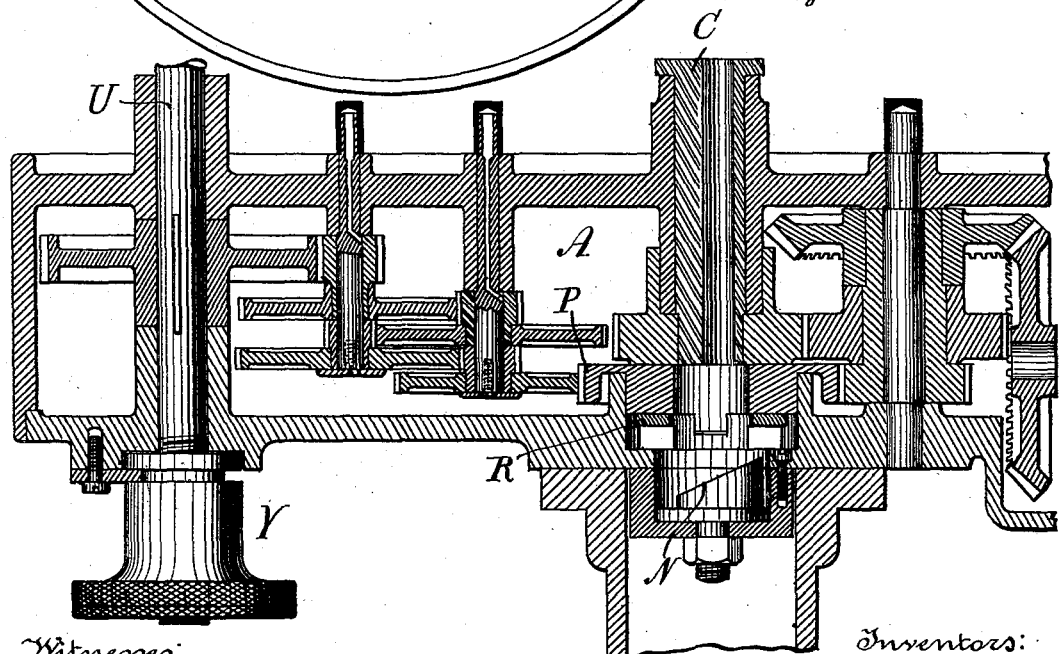



Fig. 4.




Witnesses:
Hermann Bormann
J. C. Bentley

Inventors:
Thomas A. Willson &
Hugo Bilgram
by L. Morgan Coleman
Att'y.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

# T. A. WILLSON & H. BILGRAM.

## MACHINE FOR GRINDING THE EDGES OF SPECTACLE OR EYEGLASS LENSES.

No. 508,196. Patented Nov. 7, 1893.

Fig. 6.

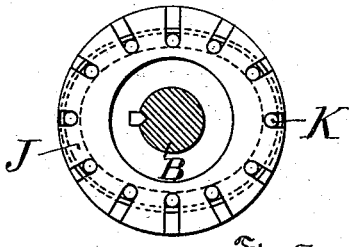



Fig. 8.

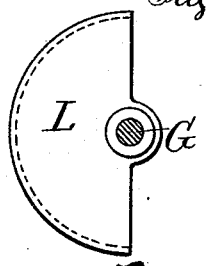



Fig. 7.

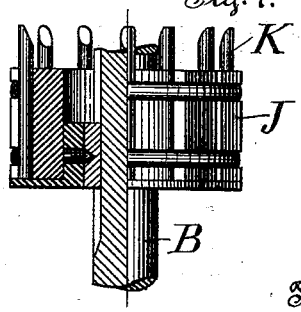



Fig. 9.

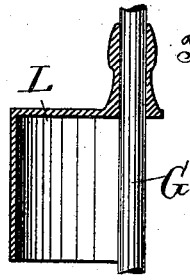



Fig. 10.

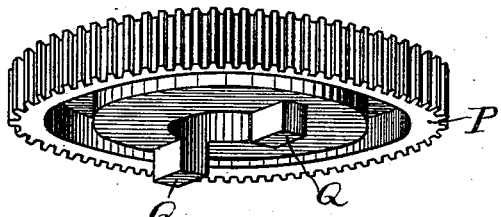



Fig. 11.

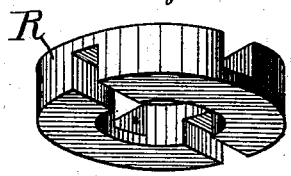
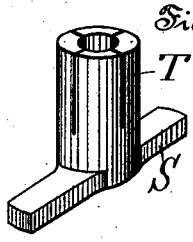



Fig. 12.




Witnesses:
Hermann Bormann
Jos. Bunting

Inventors:
Thomas A. Willson &
Hugo Bilgram.
by G. Morgan Edwards
Att'y.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

THOMAS A. WILLSON, OF READING, AND HUGO BILGRAM, OF PHILADELPHIA, PENNSYLVANIA; SAID BILGRAM ASSIGNOR TO SAID WILLSON.

## MACHINE FOR GRINDING THE EDGES OF SPECTACLE OR EYEGLASS LENSES.

SPECIFICATION forming part of Letters Patent No. 508,196, dated November 7, 1893.

Application filed August 4, 1892. Serial No. 442,127. (No model.)

*To all whom it may concern:*

Be it known that we, THOMAS A. WILLSON, residing in the city of Reading, county of Berks, and State of Pennsylvania, and HUGO BILGRAM, residing in the city and county of Philadelphia and State aforesaid, both citizens of the United States of America, have invented certain new and useful Improvements in Machines for Grinding the Edges of Spectacle and Eyeglass Lenses, of which the following is a specification, reference being had therein to the accompanying drawings.

Our invention relates to the construction of a machine for grinding the edges of spectacle and eye-glass lenses to adapt them to the frames therefor, and it consists in a construction by which the elliptical motion of the glass is made absolute and with the minimum of friction; the lens is centered with certainty on its holders, and in its proper elliptical position and in the case of concavo-convex or "coquille" lenses the beveled edge follows the double curve due to the conversion of the circle into an ellipse; the grinding wheels are given a movement radial to the center of the lens, whereby the projecting corners are first roughly ground off and the grinding is then continued to the proper size of the lens and also a movement tangential to the lens for the purpose of grinding both sides of the beveled edge equally.

Referring to the accompanying drawings, Figure 1 is an elevation of the machine, partly in section. Fig. 2 is an elevation, partly in section, proximately at right angles to the position shown in Fig. 1. Fig. 3 is a plan of the machine. Fig. 4 is a section of the base of the machine on a broken line through the centers of the operative shafts. Fig. 5 is a section of the carriage supported by the arbor and carrying the grinding-wheel slide. Figs. 6 and 7 are, respectively, plan and section, and elevation of the gage-chuck centering the lens-blank on the spindle. Figs. 8 and 9 are, respectively, plan and section of the half bell on the rod carrying the upper lens-holder whereby that holder is centered on the lens. Fig. 10 is a gear-wheel driving the spindle carrying the lens. Figs. 11 and 12 are guide-plates carried in this gear-wheel to allow the elliptical movement of the spindle.

This machine consists essentially of an elliptical lathe, having at its head a cup carrying a leather disk, between which and a spring-pressed holder, free to move with the ellipticity of the lathe, and also carrying a leather disk, a lens-blank is centrally clamped with its longer axis in the line of the longer axis of the elliptical movement of the lathe and elliptically rotated in contact with a pair of grinding wheels, which have a movement radial to the lens, and thus first rough off projecting points on the blank and then reduce the lens to the proper size, and also a movement tangential to the lens, and thus grind the edge of the lens evenly on both sides, and wear themselves evenly.

A. is the frame of the machine.

B. is a vertical spindle placed within an eccentric sleeve C. which revolves at twice the velocity of the spindle, by which the motion of an elliptic lathe is given to the spindle. This spindle is provided at its upper end with a cup D. which carries a disk of leather and supports the lens E. The lens is held in place by another disk of leather carried in the cup-shaped appendage F. at the extremity of the rod G., which has ball-joints at both ends and is held down in bearing by a spring H. compressed by the screw I., as a result of which the lens is held firmly in position and given an elliptical motion. The lens-blank E. must be centered on the spindle B. in such position that its longer axis will coincide with the longer axis of the ellipse produced by the movement of that spindle. For this purpose we place on the spindle B. the gage-chuck J., held from turning on the spindle by a feather but capable of vertical movement upon it. This gage-chuck is shown in detail in Figs. 6 and 7. It has a number of radial grooves, the bases of which are on the line of the ellipse of the lens, in which grooves are pins K. held inward by elastic bands. When the lens-blank is to be placed in position the gage-chuck is raised till the pins are in the plane of the blank, (as shown in Fig. 2,) which is then inserted between them. If the blank

happens to have ragged points, from imperfect cutting, the pins in contact with these points will recede without putting the lens out of center.

Upon the rod G. is a bell-shaped device L. shown in detail in Figs. 8 and 9, half of which is cut away, which is movable vertically upon the rod, and which, when down, partly incloses the gage-chuck J. and centers the cup F. over the lens E. as shown also in Fig. 2. When in this position the screw I. is turned down, bringing pressure upon the rod G.; the gage-chuck is lowered and the cup is raised, as shown in Fig. 1 and the lens is ready to be ground, and when ground will be of the proper elliptical form, being so moved by the lathe. In the case of concavo-convex or coquille lenses, one of which is represented in Fig. 1, it is necessary that the cut edge shall be on a curve, and, to that end, that the spindle carrying the lens shall have a reciprocating vertical movement in relation to the grinding wheels as well as a movement producing an ellipse. To obtain this movement the lower end of the spindle B. is provided with a ball working in a socket-step M. resting on an inclined plane N. shown in Figs. 1 and 4. The center of the spindle B. having a circular movement, from the action of the eccentric sleeve C., the socket-step will rise and fall, once for each revolution of the sleeve, and twice for each revolution of the spindle. These vertically oscillating devices as described are only used in the case of coquille lenses, and not when grinding plain lenses, when the spindle is furnished with a plain step.

The part of the apparatus above described is driven by the pulley O., the shaft of which is geared to the spindle and sleeve. By the gearing shown in Figs. 1 and 4 the motion of the pulley O. is transmitted to the spindle B. and sleeve C. so that the sleeve is driven at twice the velocity of the spindle. This results in a movement of the spindle eccentric to the wheel which drives it. For the purpose of accommodating the parts to this movement the devices are inserted which are shown in detail in Figs. 10, 11, 12, in which P. is the wheel rotating the spindle, having a large central opening and two downwardly-projecting lugs Q. Q., which fit into the upper slots of the ring R., in the lower slots of which is fitted the bar S., Fig. 12, upon which is the socket T., which carries the spindle B. In order to enable the adjustment of the spindle B., and thereby the gage-chuck J. to its proper elliptical position the socket T. is split and thus rendered elastic, producing a friction coupling.

U. is an arbor carrying the carriage V., in which is the slide V'. supporting the journals W. W., driven by belting, and carrying the juxtaposed grinding wheels X. X., which grind the edge of the lens on both sides. Besides their rotary movement these wheels have a triple movement; a vertical movement, and movements both proximately radial and tangential to the lens. The vertical movement is given by means of the nut Y. and is for the purpose of adjusting the grinding wheels so that the edge of the lens shall be equally beveled.

The radial movement is given manually by the rotation of the carriage V. on the arbor U., and automatically by the rotation of the arbor obtained by gearing shown in Figs. 2 and 4, the arbor being connected to the carriage by a friction coupling consisting of set-screws Z. Z. under which are leather washers, shown in Fig. 5. By means of this friction coupling the wheels are moved out of contact with the lens by the handle (*a*) for the purpose of removing the ground lens and inserting a new blank, and are then brought back to their grinding position. If not quite so returned they are still farther moved by the rotation of the arbor U. till the motion of the carriage is arrested at the proper position by the stop (*b*).

The tangential movement of the slide V'. carrying the grinding-wheel-journals is produced by a forked bracket (*c*) upon the slide V', which bracket engages with an eccentric (*d*) connected to the arbor U. by the friction coupling (*e*). By means of this eccentric and forked bracket the grinding wheels are moved tangentially on the edge of the lens, with the result of an even bevel on the lens and an even wear on the grinding wheels. For the purpose of putting the wheels in proper position to begin grinding on the lens-blank they are so moved by the handle (*f*) on the eccentric (*d*), this movement being enabled by the friction coupling (*e*).

We claim as our invention—

1. A machine for grinding the edges of spectacle and eyeglass lenses having rotatable elliptically-moving holders for the glass, devices adapted to center the lens-blank on the lens-holder in the elliptical axis of its movement, and to center the clamp upon the blank, two grinding wheels juxtaposed adapted to grind the two sides of the edge of the lens at the desired bevel, devices adapted to give to the grinding wheels a motion tangential to the lens while it is being ground, devices adapted to effect a vertical adjustment of the grinding wheels, devices adapted to impart to the lens holder a reciprocating motion in the direction of its axis of rotation.

2. A machine for grinding the edges of spectacle and eyeglass lenses having rotatable elliptically moving holders for the glass, and devices adapted to center the lens-blank on the lens holder in the elliptical axis of its movement.

3. A machine for grinding the edges of spectacle and eyeglass lenses having rotatable elliptically moving holders for the glass and devices adapted to impart to the lens-holder a reciprocating motion in the direction of its axis of rotation in relation to the grinding wheels.

4. A machine for grinding the edges of spectacle and eyeglass lenses having rotatable elliptically moving holders for the glass, devices adapted to center the lens-blank on the lens-holder in the elliptical axis of its movement and to center the clamp upon the blank, and devices adapted to impart to the lens-holder a reciprocating movement in the direction of its axis of rotation in relation to the grinding wheels.

5. In a machine for grinding the edges of spectacle and eye-glass lenses the combination of a spindle having the motion of an elliptic lathe, as B., having at its top a holder for a lens, and a gage-chuck, as E., held from turning on the spindle but capable of a vertical movement upon it and having elastically attached pins forming an ellipse whose axis is in the axis of the elliptical movement of the spindle.

6. In a machine for grinding the edges of spectacle and eye-glass lenses the combination of a spindle having the motion of an elliptic lathe, as B., having at its top a holder for a lens, and a spring-pressed rod, as G., having at its upper end a fixed support and at its lower end a clamp adapted to bear upon the lens, and having ball-joints at both ends, whereby the clamp is adapted to follow the elliptical movement of the lens and to remain in bearing upon it.

7. The combination of the sleeve C. mounted in a frame, the spindle B. eccentrically placed therein, and devices adapted to cause the sleeve to revolve at twice the velocity of the spindle.

8. The combination of sleeve C. mounted in a frame, spindle B. eccentrically placed therein, devices adapted to cause the sleeve to revolve at twice the velocity of the spindle, a ball-bearing at the foot of spindle B., and devices adapted to cause said ball-bearing to rise and fall at each revolution of the sleeve.

9. The combination of a sleeve, as C., a spindle, as B., eccentrically placed therein, devices adapted to cause the sleeve to revolve at twice the velocity of the spindle consisting in part of a gear-wheel adapted to rotate the spindle, a universal sliding joint substantially as specified, adapted to accommodate the rotary motion of said gear-wheel to the eccentric motion of said spindle.

10. The combination of a sleeve, as C., a spindle, as B, eccentrically placed therein, devices adapted to cause the sleeve to revolve at twice the velocity of the spindle consisting in part of a gear-wheel adapted to rotate the spindle, a universal sliding joint substantially as specified, adapted to accommodate the rotary motion of said gear-wheel to the eccentric motion of said spindle, said devices comprising a connection between said gear-wheel and said spindle adapted to allow the adjustment of the spindle to a predetermined axis of ellipticity.

11. The combination of an elliptic lathe, devices for holding a lens-blank thereon, an elliptic gage-chuck adapted to center the lens-blank in its proper elliptic position and devices adapted to enable the adjustment of the long axis of said gage-chuck to the long axis of the ellipse produced by the movement of said lathe.

THOMAS A. WILLSON.
HUGO BILGRAM.

Witnesses:
ALF. H. FABER,
H. D. DUNN.