(No Model.)

D. CHAMBERS & C. C. INSKEEP.

APPARATUS FOR PRODUCING ELLIPSOIDAL LENSES.

No. 583,670. Patented June 1, 1897.

Fig. 2.

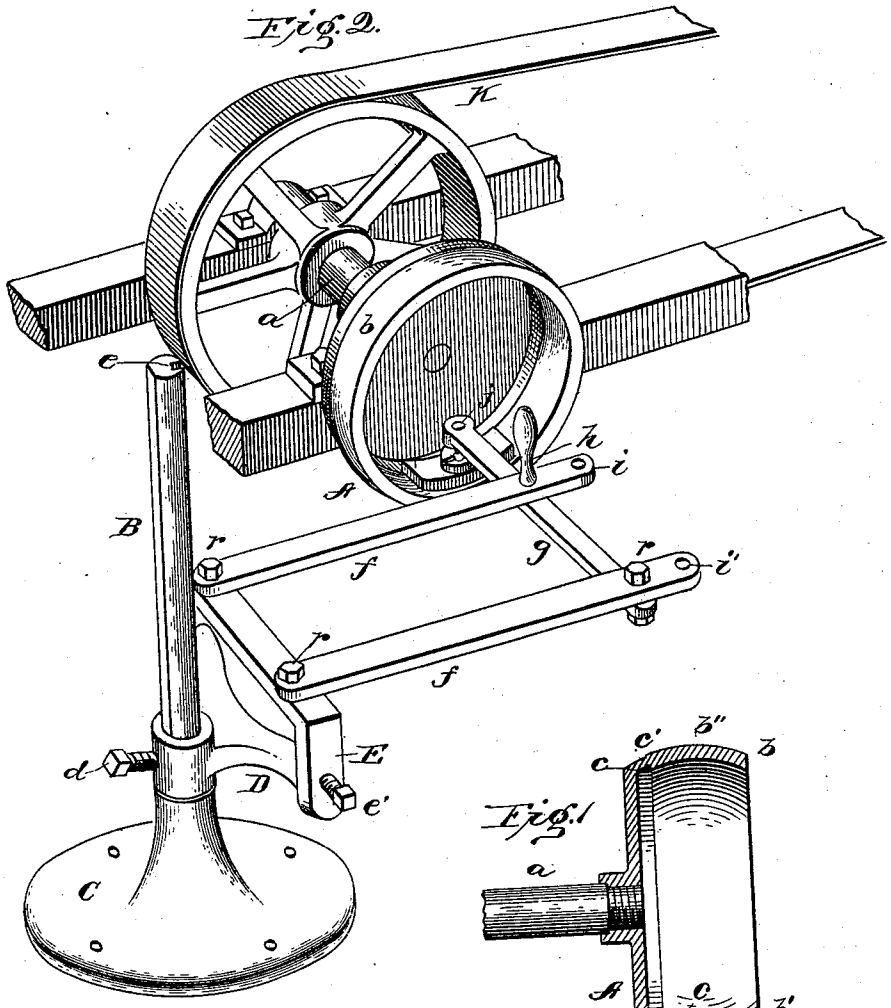


Fig. 1

Fig. 3

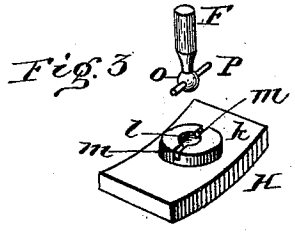
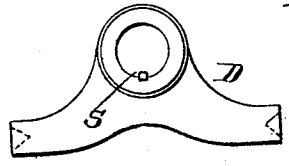


Fig. 4



Witnesses:
J. M. Fowler Jr.
Wm. P. Churchill.

Inventors:
David Chambers &
Charles C. Inskeep.
by Henry H. Bates
their Attorney.

UNITED STATES PATENT OFFICE.

DAVID CHAMBERS AND CHARLES CHAMBERS INSKEEP, OF CHICAGO, ILLINOIS.

APPARATUS FOR PRODUCING ELLIPSOIDAL LENSES.

SPECIFICATION forming part of Letters Patent No. 583,670, dated June 1, 1897.

Application filed January 17, 1896. Serial No. 575,863. (No model.)

To all whom it may concern:

Be it known that we, DAVID CHAMBERS and CHARLES CHAMBERS INSKEEP, citizens of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Producing Ellipsoidal Lenses; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to an improved apparatus for the production of ellipsoidal lenses for optical purposes; and it consists in the mechanism and means hereinafter described. Lenses of the above description are useful for the correction of astigmatism and other imperfections of vision.

The object of our invention, which we have quite perfectly attained, is to produce lenses with ellipsoidal surfaces on one or both sides, either convex or concave, with accuracy and expedition and at a cost which enables them to come into extensive commercial use. Such lenses, as is well known, have different radii of curvature in the same surface, the longer radius being, usually, that of the transverse curve lying in the major axis of the lens and the shorter that of the curve corresponding to the minor axis. These lenses are usually made convex on the outer surface and concave on the inner surface, but they can as easily be made double convex or double concave or plano-convex or plano-concave, if desired, with true ellipsoidal surfaces of double curvature. To this end we have devised the machine or apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a representation of the grinding-tool which we employ. Fig. 2 is a perspective view of the apparatus set up for producing a convex ellipsoidal surface. Fig. 3 illustrates the lens-holder with its rocking joint; and Fig. 4 is a detail view of the piece D, which supports the rocking piece E, Fig. 1, and is itself supported by the upright channeled shaft B, on which it traverses.

In Fig. 1, A represents the rotary grinder, usually of cast metal, circular in outline, consisting of a disk-shaped base and a circular curved wall *b*, the whole mounted on a centrally-applied rotary shaft or axis, so as to be conveniently revolved by appropriate machinery, as shown in Fig. 2. The diameter of the rotary tool is such as to give the requisite curvature of usually larger radius on both the external and internal surfaces of its circular wall, commonly between eight and nine inches, while the curvature of the said wall in its other dimension, transverse to the former, is such on both inner and outer surfaces as to give the requisite curvature of different and usually smaller radius in the other direction to the lenses ground thereon. These two curvatures can be proportioned and adjusted to each other in any required degree, for it is obvious that if the radius of the tool in its plane of revolution were exactly the same as the radius of curvature of the circular wall in its axial plane true spherical surfaces only would be produced, the form of the grinding-surfaces being spherical, while extreme departure from this equality of curvature will give the extreme spheroidal or ellipsoidal form to any practical extent required.

Referring now to the drawings, in which like parts are indicated by like letters of reference, A represents the dish-shaped grinding-tool which we employ. *a* is the rotary shaft or axis, and *b* is the curved circular wall, having a grinding-face on both its inner and outer surfaces, the inner one *b'* being employed for grinding convex lenses or lens-surfaces and the outer one *b''* for grinding the concave surfaces of lenses, when such are demanded. The radii of curvature of each of these respective surfaces are made to correspond to the concavity or convexity required in the lens to be produced. The wall carrying the respective grinding-surfaces is made of sufficient thickness to permit of wearing away and still maintaining a true surface, the extent of the grinding-surface proper being indicated by the shoulders interior and exterior, (shown at *c c'*.) The surfaces of the tool are supplied with emery or other customary abrasive substance in the usual manner until

the true figure of the required lens is obtained, when the said surfaces are cleaned and covered with felt secured by pitch in the manner well known to optical-lens makers, and the polishing is accomplished by the use of the polishing materials usually employed, such as rouge.

Fig. 2 shows the apparatus as set up for grinding, in which B is an upright metallic rod or standard, usually of steel, firmly set in a base-piece C. This standard is channeled on one side, as shown at *e*, to receive the key *s* on sliding hub D and preferably flattened on the other. This standard enables the parallel-motion framework to be raised and lowered and sustained at any required height for grinding on any-sized tool of any specific curvature, both internally and externally, by means of the clamp-screw *d*. The parallel-motion frame is composed of the parts D, (shown in detail in Fig. 4,) rocking piece E, held to the piece D by adjustable pivots, one of which is shown at *e'*, link-pieces *f f*, rod *g*, and handle *h*. The link-pieces are attached to piece E and rod *g* by pivotal bolts, as *r r*, admitting of free angular motion. Adjustment-holes are provided at *i i'*. The lens-holder is attached in a vertical position to the rod *g* at its extremity, as at *j*. This lens-holder H is shown in detail in Fig. 3, being one adapted for convex grinding. For concave grinding it must have a different curvature and be used on the exterior of the rotary tool. It is made with its under side of approximately the curvature of the grinding-surface to which it is to be applied. At its back is the boss *k*, having spherical concave socket *l* and transverse semicylindrical channel *m*. F is an upright stem which fits into the vertical socket at the end of the rod *g*. It carries at its lower end a ball *o* and transverse pin P, which fit, respectively, the socket *l* and the channel *m* on the back of the lens-holder H, and confer upon it the rocking motion required under the manipulation of the workman as he moves the rod *g* back and forth during the operation of grinding or polishing. In use the lens or lenses to be ground are cemented to the under side of the lens-holder in a manner well known to practical manufacturing opticians, the lens-holder being first moderately heated and then thickly coated with pitch. In this the lens or lenses to be ground are embedded at the required angles for giving the requisite axes of curvature. From one to eight lenses may be ground at once in such a tool-holder with this apparatus, the tool-holder shown in the illustration being of dimensions about sufficient for three lenses. At K we have shown an ordinary driving pulley and belt by which rotary motion is communicated to the grinding-tool. The speed of rotation usually employed to secure the best results with glass lenses is about eighty revolutions per minute.

The mode of procedure in grinding the lenses is as follows: The parts being assembled for operation and the tool of the requisite curvature for grinding the contemplated lens having been selected and fitted to the rotary shaft the lens-holder is heated and coated with pitch, into which the lenses to be ground are embedded, as before said. The stem F is then inserted in the extremity of the rod *g*, the parallel-motion frame is set at the proper height for grinding the species of surface desired and fixed by the clamp-screw *d*, the lens-holder is applied to the surface of the grinder, and the stem is placed in its socket at the back of the lens-holder. The workman seats himself in front of the open grinding-tool, taking hold of handle *h* with his right hand, and the machinery having been set in motion and the abrasive powder having been applied he moves the lenses back and forth over the grinding-surface as the tool revolves with a skilled movement designed to prevent the formation of furrows or *striæ* in the glass and to give a true and uniform figure to the surface. After the grinding is accomplished the tool is rigged for polishing in the manner above described and the operation is carried on to completion. The opposite sides of the lenses are treated and finished in the same manner, a suitable lens-holder being selected and mounted for the purpose.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In an apparatus for grinding ellipsoidal lenses, the grinding and polishing tool A, mounted upon a rotary shaft *a*, having the circular wall *b*, formed with concave interior grinding-surface *b'* and convex exterior grinding-surface *b''* substantially as and for the purpose specified.

2. In an apparatus for grinding ellipsoidal lenses, the grinding and polishing tool A, mounted on a rotary shaft *a*, having the circular wall *b* formed with concave interior grinding-surface *b'*, and the convex exterior grinding-surface *b''*, concentric therewith, both surfaces having shorter radii of curvature in the axial plane than the radius of the tool in the plane of revolution, whereby lens-surfaces ground thereon have simultaneously imparted to them a figure of two curvatures, substantially as and for the purpose specified.

3. In a grinding-tool for grinding and polishing ellipsoidal lenses, the curved circular wall *b*, having spheroidal exterior and interior surfaces projecting above the normal line of the wall as at *c c'* to provide for wear in the grinding-surfaces proper substantially as and for the purpose specified.

4. The apparatus for grinding ellipsoidal lenses herein described, comprising upright shaft or standard B, parallel-motion frame D E *f g*, lens-holder H, rotary tool A with concave grinding-surface and convex exterior grinding-surface, shaft *a*, and means for rotating the same, substantially as and for the purpose specified.

5. In an apparatus for producing ellipsoidal lenses, the parallel-motion frame, consisting

of adjustable hub D, rocking piece E, pivoted links *f f*, pivoted rod *g* and clamp-screw *d*, substantially as and for the purpose specified.

6. In an apparatus for producing ellipsoidal lenses, the lens-holder H, having boss *k*, provided with hemispherical socket *l* and transverse semicylindrical channel *m*, in combination with stem F, having ball *o* and transverse pin *p*, substantially as and for the purpose specified.

7. In an apparatus for producing ellipsoidal lenses the combination of a rotary grinding-tool having exterior and interior grinding-surfaces each of double curvature, a lens-holder, a parallel-motion frame for grinding and directing the lens-holder, adjustable at different heights to provide for exterior and interior grinding, and means for imparting rotary motion to the grinding-tool, substantially as and for the purpose specified.

8. In an apparatus for producing ellipsoidal lenses, a rotary grinding-tool having exterior and interior grinding-surfaces of spheroidal contour, the curvature of each surface in one direction being of longer radius than the curvature in the direction at right angles thereto, substantially as and for the purpose specified.

9. In an apparatus for producing ellipsoidal lenses, a rotary grinding-tool having exterior and interior grinding-surfaces of spheroidal contour, the curvature of each surface being of greater radius in the rotational plane than in the axial plane, substantially as and for the purpose specified.

In testimony whereof we affix our signatures in presence of two witnesses.

DAVID CHAMBERS.
CHARLES CHAMBERS INSKEEP.

Witnesses:
E. A. INSKEEP,
RICHARD BERGMAN.