

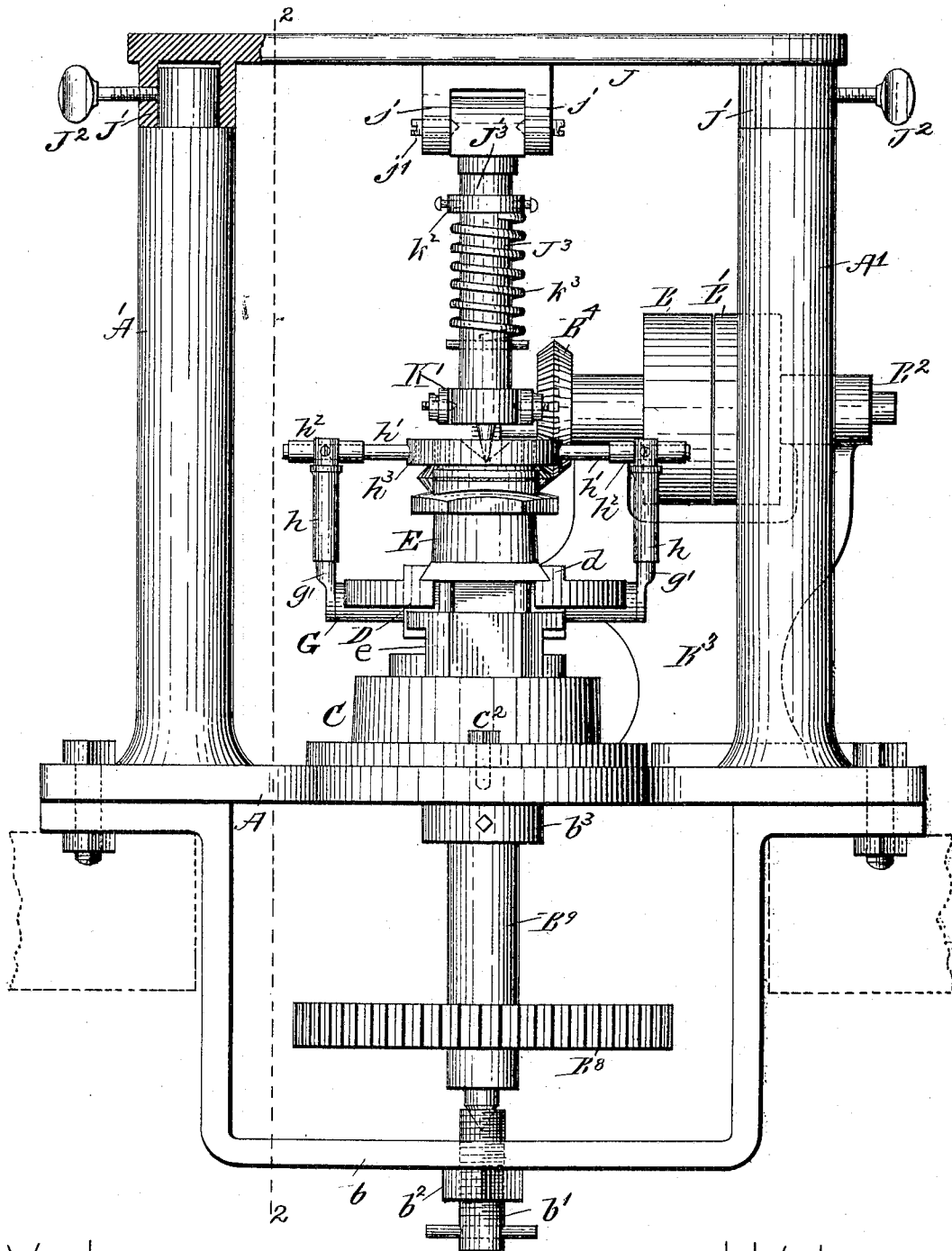
No. 766,482.

PATENTED AUG. 2, 1904.

W. G. WOLFE.
LENS GRINDING MACHINE.
APPLICATION FILED OCT. 12, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



WITNESSES:
No. E. Flaherty
M. V. Foley

Fig. 1.

INVENTOR:
Walter G. Wolfe
J. E. Kay and Son
his attys.

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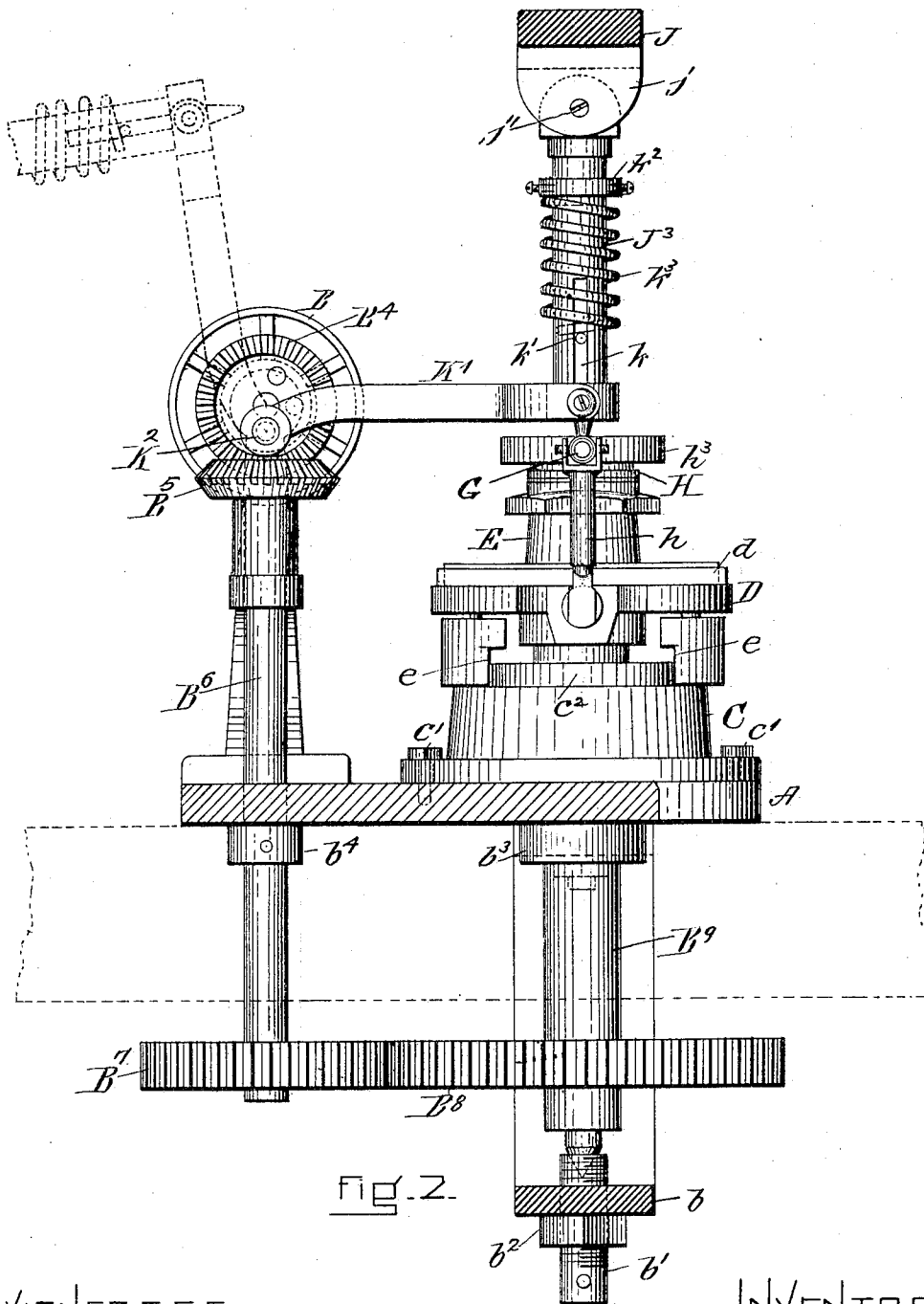


fig. 2.

WITNESSES=
H. S. Flaherty
M. V. Foley

INVENTOR=
Walter G. Wolfe
J. Blount, agent
his attorney

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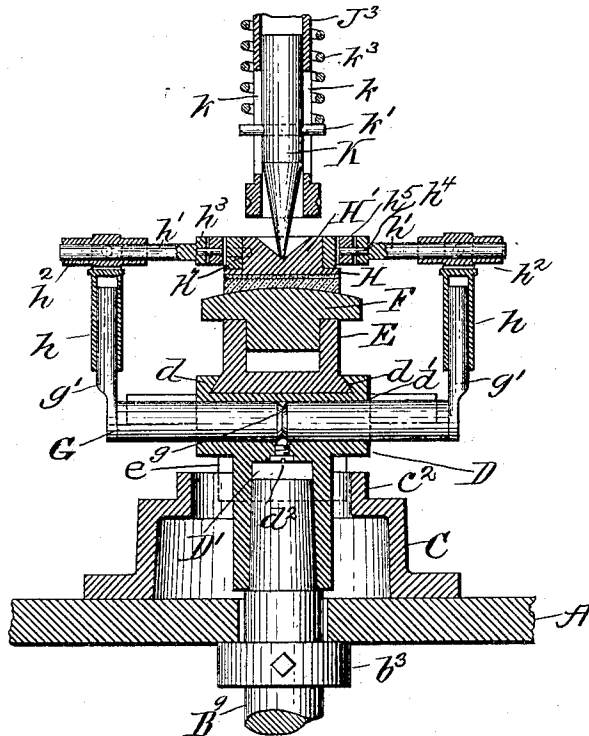


Fig. 3.

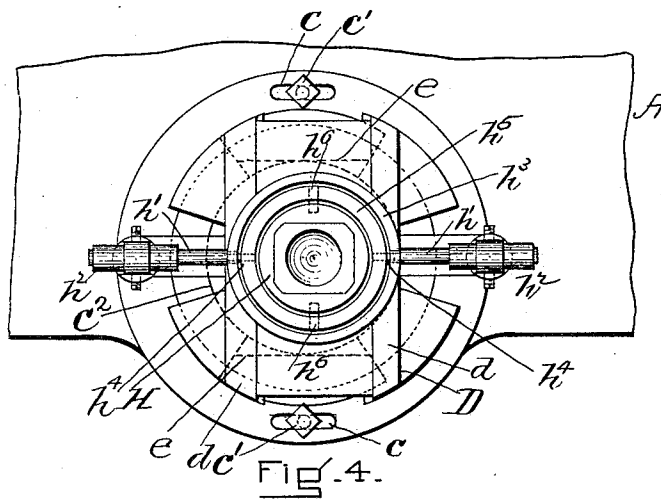


Fig. 4.

WITNESSES:
H. E. Flaherty
M. V. Foley

INVENTOR:
Walter G. Wolfe
J. Charles Kuyundt & Co.
Chicago, Ill.

UNITED STATES PATENT OFFICE.

WALTER G. WOLFE, OF WAKEFIELD, MASSACHUSETTS.

LENS-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 766,482, dated August 2, 1904.

Application filed October 12, 1903. Serial No. 176,594. (No model.)

To all whom it may concern:

Be it known that I, WALTER G. WOLFE, a citizen of the United States, and a resident of Wakefield, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Lens-Grinding Machines, of which the following is a specification.

Prior to my present invention there was no practical machine, so far as I know, by which Toric lenses could be ground automatically, and the work has been done entirely by hand or by somewhat-imperfect machines, which because of their imperfections have required skilled labor to operate them. My purpose has been to make a machine which should so far as possible imitate the operations of the skilled workman in working over the entire surface of the lens, so as to get it smooth and of even and regular curvature. This has been particularly difficult to accomplish in grinding lenses of the spherocylindrical type—as, for instance, a lens of the so-called “Toric” variety, where the axes cross. Hand labor in this art when skilled is expensive, and the grinding by hand has always been a work of considerable time.

My invention is intended to do away with hand labor entirely for this purpose, my machine being one which grinds automatically, and consequently can be attended by unskilled labor; and it consists, primarily, in a grinding-tool and lens-holder which have a series of movements given them of such character that all points of the lens are reached and ground equally to the desired shape according to the shape of the grinding-tool. For this purpose I have shown a machine by which a rotary movement is given to one of these parts and a reciprocating movement to the other, the rotary movement being preferably elliptical in character, though not necessarily a true ellipse. I shall term the curve which my mechanism will give a “compound” curve for convenience of expression, especially in view of the fact that it is ordinarily the result of two mechanical movements, both of which operate simultaneously to accomplish the desired result.

My invention will be understood by reference to the drawings, in which—

Figure 1 is a front elevation of the machine embodying my invention, Fig. 2 being a side view, Fig. 3 a vertical section of the grinding-tool and lens-holder and the parts immediately connected with their operation, Fig. 4 being a plan of the mechanism shown in Fig. 3, the mechanism for moving the lens being omitted.

A is the base of the machine, upon which are supported two posts A'.

B B' are fast and loose pulleys mounted on a shaft B², supported in bearings B³, also mounted on the table A. The shaft B carries at its end a beveled gear B⁴, which is suitably held in mesh with a horizontal beveled gear B⁵, mounted on the upper end of a vertical shaft B⁶. This shaft is supported in a bearing mounted on the table A, and at its lower end is a gear B⁷, meshing with a second gear B⁸ on the lower end of the shaft B⁹.

The shaft B⁹ is pointed at its lower end and is supported in a cavity in an adjusting-screw b', which is carried by the yoke-piece b, b² being a set-nut to hold the screw b' in place. By this means the position of the shaft B⁹ is adjusted. A collar b³, bearing on the under side of the table A, prevents the shaft B⁹ from lifting out of the screw b'. A collar b⁴ serves a similar purpose for the shaft B⁶ and assists in keeping these parts in proper relation to each other.

C is a cylindrical frame having preferably different diameters. This frame is attached to the table A about the opening up through which the shaft B⁹ passes by means of slots c and set-screws c', so that the position of this frame C may be either concentric or eccentric to the vertical axis of the shaft B⁹. In view of its function, to be described, I prefer to call it a “cam-frame,” the surface c² being what may be termed a “cam-surface” to operate the tool-carriage, as below described.

Upon the top of the shaft B⁹ is carried a carriage-support D, having a socket D', which fits on the shaft B⁹, and having ways d on its upper side, in which slides horizontally the tool-carriage E. The tool-carriage E has de-

pending therefrom two cam-bearings e , one at each end of the tool-carriage, each having a straight inner edge parallel with the corresponding edge of the other and adapted to engage with the cam-surface c^2 on the cam-frame C. This cam-surface c^2 , as shown, is cylindrical in character, and its value as a cam-surface in this construction depends upon the degree of eccentricity imparted to the cam-frame C by its location on the table A with relation to the shaft B⁹.

The tool-carriage E moves horizontally in the ways d , and by means of the engagement of the cam-pieces e with the cam-surface c^2 on the cam-frame C during the rotation of the tool-carriage a constant reciprocation is given to the tool-carriage, the direction of this reciprocation constantly changing.

F is the grinding-tool of ordinary construction as to its face and suitably shaped on its upper surface to give the desired shape to the lens. If it is convex, the finished lens will be concave, and vice versa. Its shank is set into a suitable socket in the tool-carriage. It is best to have the tool-shank and its socket suitably shaped, so that the tool will always have the same relation to the line of movement of the carriage.

The carriage-support D has below the ways d and transversely to it a horizontal bearing d' for the shaft G. This shaft is grooved at g , and a screw d^2 passes up through the carriage-support D and into this groove g to prevent the shaft G from moving endwise while allowing it to turn.

The shaft G has at each end an arm g' , on which set the two supporting-sleeves h of the mechanism for supporting the lens-holder H. This mechanism is an ordinary gimbal supported in axes h' h' , each of which is carried in bearings h^2 h^2 , each bearing being mounted on one of the sleeves h . Each axis h' terminates in the ring h^3 , within which is supported by pivots h^4 a ring h^5 , and this ring by means of the pivots h^6 supports the socket h^7 for the lens-holder H at right angles to the pivots h^4 . The lens-holder H has a shank H' , which sets into the socket h^7 , and to the under side of the lens-holder the lens is cement-

ed. By this means the lens-holder is enabled to conform to any desired position, so that as the lens is ground it may engage during its grinding with the entire surface of the grinding-tool F.

In order to hold the lens in engagement with the grinding-tool F and also to give it a positive motion with relation thereto, I have provided a moving spring-clamp which is constructed as follows: This clamp comprises a cross-bar J, provided at each end with sockets J', each of which fits into the upper end of one of the posts A'. Set-screws J² hold the cross-bar J in place upon the top of the posts A' and allow it to be moved at will.

From the under side of the cross-bar J pro-

ject downward two ears j , in which is pivoted at j' the enlarged upper end of a sleeve J³. The sleeve J³ is slotted for a portion of its length on opposite sides at k , and within the sleeve is a sliding rod K, provided with a cross-pin k' , the ends of which project through the slots k . An adjustable collar k^2 is carried on the upper part of the sleeve J³, and between it and the cross-pin k' is a spring k^3 , the stress of which tends to force the rod K out from the sleeve. The lower end of the rod K is pointed and is adapted to rest in a suitable depression in the top of the shank H' of the lens-holder. Its primary purpose is to hold the lens in contact with the grinding-tool, which it does by means of the spring k^3 and the other parts supporting it; but in addition it is utilized to give to the lens a reciprocating movement, which, in connection with the movement of the grinding-tool, causes the efficient grinding of the lens. For this purpose the lower end of the sleeve J³ is pivotally connected with the two arms of a forked crank-rod K', the other end of which is mounted on the crank-pin K² on the bevel-gear B⁴. The rotary motion of the gear B⁴ therefore gives a swinging motion to the lower end of the sleeve J³ about its pivots j' and a corresponding movement to the lens, which, as is stated above, is kept in contact with the grinding-tool by means of the rod K and its spring k^3 , the lens-holder being able to swing properly, being supported on the axis G.

I prefer to provide the connection between the crank-rod and crank-pin adjustable, so that the effective length of the crank-rod can be adjusted to give a greater or less reciprocation to the lens.

By the means described an adjustable reciprocating movement is given to the lens, and an adjustable rotary movement is given to the grinding-tool by means of the cam-frame and tool-carriage. These parts may be interchanged, and the details of the mechanism for giving the reciprocating and rotary movements may be changed so long as the desired movements are secured, though I believe the above to be the best embodiment of my invention.

It will be noted that, as shown, the clamp is pivotally hung on the crank-pin K², so that it may be easily swung out of the way when the operator wishes to examine the lens, (see dotted lines in Fig. 2,) he first having released the clamp by unscrewing the set-screws J⁴.

By means of the spring k^3 the pressure of the lens on the grinding-tool may be regulated. This is necessary because of the different grades of emery which are used in grinding a lens, the coarser emery at first and when the lens is nearly finished the finer emery being used.

I prefer for convenience to make the carriage-support D of the shape shown in Fig. 4—that is, of a generally circular shape—from

which segments have been cut to allow the passage of the shaft G and also to allow opportunity for the cam-pieces *c* on the tool-carriage to project downward, so that the carriage-support in plan resembles a circular center having four segmental arms extending therefrom. This, however, is a mere matter of convenience, although it assists in balancing the carriage-support and also in stiffening it.

It will be noted that the motion given to the various parts of this machine is all transmitted from the one pulley and main shaft B² and that when power is removed all the parts must of necessity stop at the same instant. This is an exceedingly important feature, because it is very desirable, if not necessary, that, for example, the grinding-tool should not move after the motion of the lens has stopped, as the result is often irregular grinding or scratching of the lens. Moreover, this enables the operator to stop the machine in such position as to expose the tool, so that the emery may be easily renewed.

It is evident that the mechanical movements above described may be attained by other means than those hereinbefore described, and I therefore do not mean to limit myself to the precise construction shown in the drawings.

What I claim as my invention is—

1. In a lens-grinding machine, a tool-holder, and a lens-holder, and means whereby the one is given a compound rotary movement and the other a reciprocating movement as described.

2. In a lens-grinding machine, a tool-holder, and a lens-holder, and means whereby one is given an adjustable, compound rotary movement and the other a reciprocating movement as described.

3. In a lens-grinding machine, a tool-holder, and a lens-holder, and means whereby one is given a compound rotary movement and the other an adjustable, reciprocating movement as described.

4. In a lens-grinding machine, a tool-holder, a swinging lens-holder, and means whereby said tool-holder is given a compound rotary movement and the lens-holder a reciprocating, swinging movement as described.

5. In a lens-grinding machine, a lens grinding or supporting tool, a rotatable element upon the face of which said tool is mounted, said tool having a transverse movement across the face of said element during the rotation of the same.

6. In a lens-grinding machine, a rotatable element, a frame mounted to swing on an axis carried by said rotatable element, a lens grinding or supporting tool carried by said frame, reciprocating means geared to swing said frame during its rotation.

7. In a lens-grinding machine, a tool-carriage support mounted upon a shaft, a cam-

frame surrounding said shaft, a tool-carriage mounted to reciprocate in said tool-carriage support at right angles to the axis of rotation of said shaft, said tool-carriage carrying cam-pieces adapted to engage with the cam-surfaces on said cam-frame, whereby said tool-carriage will be reciprocated as described.

8. In a lens-grinding machine, a shaft carrying a tool-carriage support, a circular cam-frame surrounding said shaft and adjustable with relation thereto and having a cam-surface, a tool-carriage adapted to be reciprocated in said tool-carriage support and carrying cam-pieces adapted to engage the cam-surfaces on said cam-frame as described.

9. In a lens-grinding machine, a rotatable element, a frame mounted to swing on an axis carried by said rotatable element, a lens grinding or supporting tool carried by said frame, reciprocating means in operative connection to the frame and having a harmonic motion the general effect of which is perpendicular to the axis of the frame whereby this frame is swung during its rotation.

10. In a lens-grinding machine, a swinging frame for carrying a lens grinding or supporting tool said frame comprising a transverse element forming its axis, uprights from said element, said uprights being adjustable in length, a cross-piece at the upper ends of the uprights and means for pivotally supporting the tool in said cross-piece.

11. In a lens-grinding machine, in combination with a rotatory grinding-tool, having a curved grinding-surface, a lens-holder mounted to present the lens in contact with all points on the surface of the grinding-tool, and means for holding the lens in contact with said grinding-tool comprising a yielding rod and means whereby the pressure exerted by said rod may be adjusted.

12. In a lens-grinding machine, a lens grinding or supporting tool, a rotatable element carrying said tool, said tool having a line of action across the face of its support during rotation, a second lens grinding or supporting tool mounted to rotate on the axis of rotation of the first tool and having motion transverse to such axis of rotation and to the line of the transverse action of the first tool.

13. In a lens-grinding machine, a lens grinding or supporting tool, means for rotating said tool and means for causing said tool to move in a plane transverse to its axis of rotation during such rotation.

14. In a lens-grinding machine, in combination with a rotatory grinding-tool, means for reciprocating a lens thereover and in contact therewith comprising a lens-holder mounted to conform to the surface of the said grinding-tool, yielding means adapted to press said lens against the face of said grinding-tool, and means for reciprocating said lens-holder across the axis of rotation of said grinding-tool as described.

15. In a lens-grinding machine, in combination with a rotatory grinding-tool, a lens-holder, and means for pressing the lens held thereby against said grinding-tool and reciprocating it in contact therewith comprising a yielding rod pivotally supported in contact with said lens-holder and means whereby the free end of said yielding rod is swung as described.
16. In a lens-grinding machine, in combination with a rotatory grinding-tool, a lens-holder, and means for pressing the lens held thereby against said grinding-tool and reciprocating it in contact therewith comprising a yielding rod pivotally supported in contact with said lens-holder and means whereby the free end of said yielding rod is swung comprising a reciprocating arm, and means whereby it is reciprocated.
17. In a lens-grinding machine, in combination with a rotatory grinding-tool, a lens-holder, and means for pressing the lens held thereby against said grinding-tool and reciprocating it in contact therewith comprising a yielding rod pivotally supported in contact with said lens-holder, and means whereby the free end of said yielding rod is swung comprising a crank-arm one end of which is con-

nected with the free end of said yielding rod, and a crank-pin connected with the other end of said crank-arm, and means for operating said crank-pin as described.

18. In a lens-grinding machine, in combination with a grinding-tool, a lens-holder, a yielding rod adapted to hold the lens in contact with said grinding-tool, a clamp supporting said yielding rod, a crank-rod adapted to swing said yielding rod to cause the lens to be reciprocated, a crank-pin and means for operating said crank-pin, and means for supporting said clamp whereby the releasing of said clamp will allow it to be swung back around the axis of said crank-pin as described.

19. In a lens-grinding machine, a power-shaft, a rotary grinding-tool and a reciprocating lens-holder, and positive means connecting said power-shaft with said lens-holder and said grinding-tool whereby the stopping of the rotations of said power-shaft will cause the simultaneous stopping of the movement both of said lens-holder and grinding-tool as described.

WALTER G. WOLFE.

Witnesses:

GEORGE O. G. COALE,
J. M. DOLAN.