

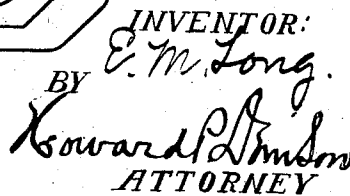
MACHINE FOR GRINDING THE SURFACES OF LENSES.

APPLICATION FILED MAY 21, 1906.

Patented Nov. 23, 1909.

3 SHEETS—SHEET 1.

940,978.



WITNESSES:

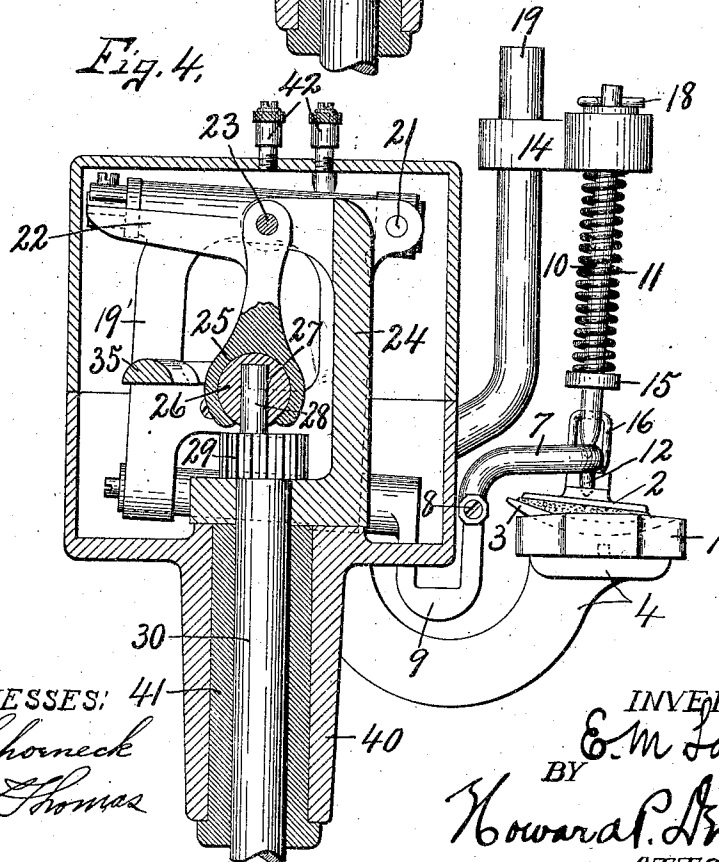
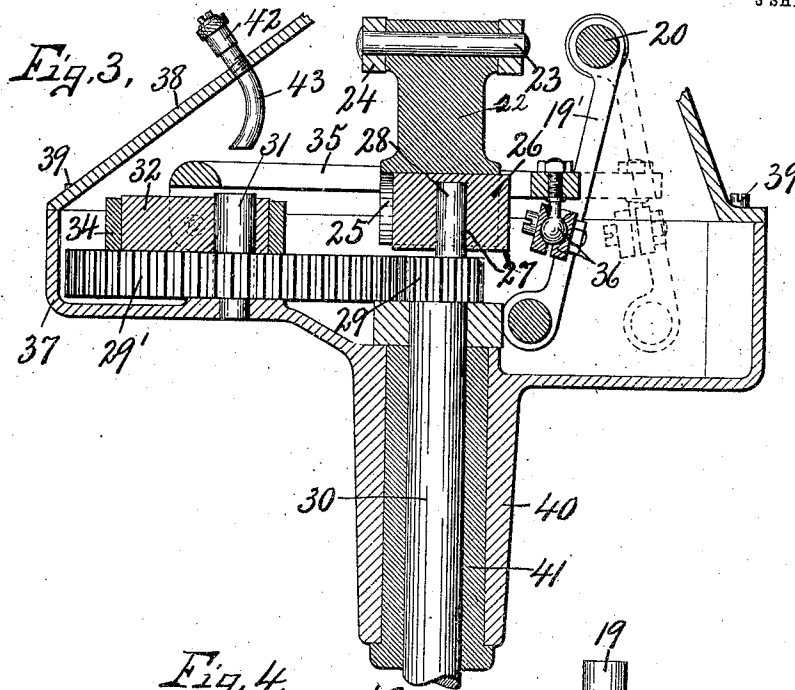
C. C. Schorneck
 & Thomas

E. M. LONG.
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WITNESSES:

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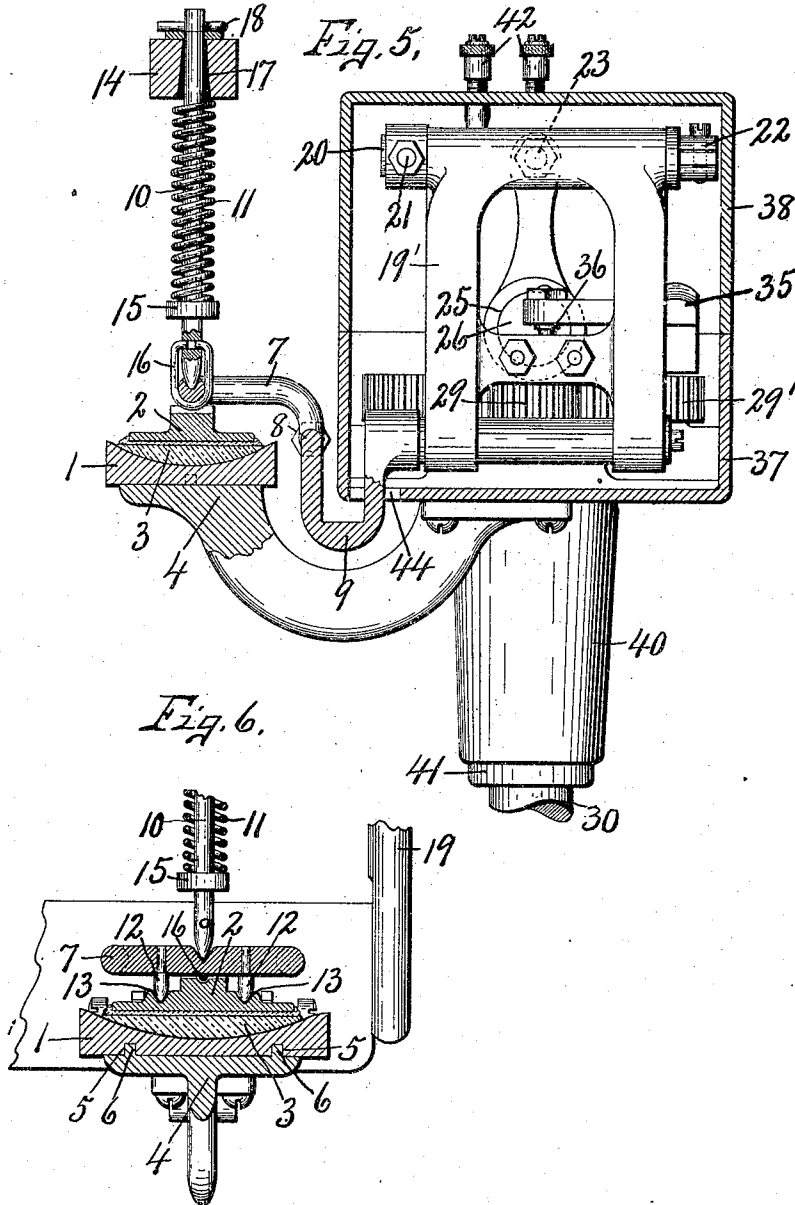
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WITNESSES

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UNITED STATES PATENT OFFICE.

ELI M. LONG, OF GENEVA, NEW YORK, ASSIGNOR TO THE STANDARD OPTICAL COMPANY, OF GENEVA, NEW YORK, A CORPORATION OF NEW YORK.

MACHINE FOR GRINDING THE SURFACES OF LENSES.

940,978.

Specification of Letters Patent.

Patented Nov. 23, 1909.

Application filed May 21, 1906. Serial No. 317,992.

To all whom it may concern:

Be it known that I, ELI M. LONG, of Geneva, in the county of Seneca, in the State of New York, have invented new and useful

5. Improvements in Machines for Grinding the Surfaces of Lenses, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

10 This invention relates to certain improvements in machines for grinding the surfaces of lenses, and contemplates an attachment adapted to be applied to any available rotary shaft or spindle of similar or different
15 machines for automatically grinding the surface of the lens to a predetermined contour. In other words, the invention involves the use of a grinding bed or lap and a suitable holder for the lens, one of which
20 parts is caused to traverse the surface of the other to bring the surface of the lens into exact coincidence with the grinding surface of the lap.

25 The abrasive or grinding material usually consists of emery-dust or powder placed upon the surface of the lap to contact with and reduce the surface of the lens to the desired contour, and it, therefore, becomes necessary to protect the greater portion of the
30 power transmitting mechanism from accumulation of emery-dust or powder thereon, which would soon cause excessive abrasion or wear of the working parts, thereby impairing the working efficiency of the whole
35 device.

One of the essential objects of this invention is to inclose the working parts of the power transmitting mechanism in a dust-proof case calculated to exclude the emery-
40 dust or powder which is used for grinding.

Another object is to associate the grinding bed or lap and lens holder in such manner that one of the parts may be caused to traverse back and forth across the other in serpentine curvilinear paths, but not in coincident lines so that the moving part changes its line of travel at each sweep. This latter
45 object, more specifically stated, is to mount the lens holder upon an oscillatory frame having a comparatively long sweep through one median line, and a shorter sweep through a second median line and in a plane at substantially right angles to the plane of movement through the longer sweep so that while

the lens is caused to travel back and forth 55 from one extreme point to another, it is continuously diverted from a direct line between said points, thereby traveling in a serpentine path across and to opposite sides of such line.

Another object is to cause the lens to 60 travel across the grinding surface of the lap in different serpentine paths so as to distribute the abrasion or grinding evenly over the entire surface of the lens without liability of cutting objectionable channels or 65 grooves therein. In other words, I have sought to impart a double oscillatory movement to the lens holder or grinding bed, as the case may be, through the medium of 70 suitable eccentrics driven from a single rotary spindle or shaft whereby the lens is caused to swing through different arcs at substantially right angles to each other.

Other objects and uses will be brought out 75 in the following description.

In the drawings—Figure 1' is a side elevation of a lens surface grinding device embodying the features of my invention. Fig. 2 is a top plan of the same with the upper 80 half of the case section-removed showing the interior construction. Figs. 3, 4, 5, and 6 are sectional views taken respectively on lines 3—3, 4—4, 5—5, and 6—6, Fig. 2, except that the eccentric for the long sweep 85 and parts actuated thereby are shown in one of the extreme positions in Fig. 3, while the eccentric for the short sweep and parts actuated thereby, are shown in one of the extreme positions in Fig. 4. 90

This machine is especially adapted for automatically grinding the surfaces of toric, cylindrical and other compound lenses or curved surfaces of different radii, and comprises essentially the grinding mechanism 95 proper and actuating mechanism for the movable element of the grinding mechanism, and a dust-proof case or housing inclosing one of said mechanisms to exclude the emery-dust from the working parts of the 100 actuating mechanism.

The grinding device proper consists of a bed or lap —1— of cast metal or other suitable material and a lens holder, as a metal disk —2—, one of which parts, in this in- 105 stance, the lens holder, is adapted to traverse the grinding face of the lap.—1— and to impart similar movement to the lens, as

—3—, which is held between the lens holder and lap and is rigidly secured by cement or other fastening means, to the lens holder.

The grinding bed or lap —1— is removably seated upon a rigid supporting bracket —4—, its upper face being formed to the desired contour forming a counterpart of that to which the surface of the lens is to be ground and in this instance, is concave and receives a suitable quantity of powder emery to form a corresponding convex surface on the lens. The lower side of this bed is formed with recesses or sockets —5— to receive pins —6— which project upwardly from the supporting bracket —4— and permit the bed to be readily removed and replaced by a lap of different contour when desired to grind the surface of a different lens, the bracket —4— forming a part of the main supporting frame.

The lens holder —2— and its lens —3— are moved across the grinding face of the lap —1— by means of a vertically swinging yoke —7— which forms a part of the actuating mechanism, said yoke being pivoted at —8— to an oscillating member —9— and has its free end spring pressed downwardly by a plunger —10— and spring —11— so as to hold the surface of the lens in yielding contact with the grinding surface of the lap —1—.

The yoke —7— is loosely connected to the lens holder —2— by what may be termed a "universal joint", comprising a pair of pins —12— which bear in suitable sockets —13— in the upper face of the lens holder —2— to permit said lens holder to oscillate with reference to the yoke —7—, thereby enabling the lens to readily conform to the contour of the grinding surface as the lens holder is reciprocated back and forth across said surface. The lens holder —7— is also engaged with the plunger —10— by, what may be termed a "universal joint", which consists in tapering the lower end of the plunger and seating said tapering end into a tapering socket in the upper face of the yoke —7— substantially midway between the pins —12— so as to exert a downward pressure directly over the center of the lens and its holder —2—.

The upper end of the plunger —10— is loosely seated in one end of a vertically adjustable arm —14— to allow said arm to oscillate to conform to the movement of the lens holder, the spring —11— being interposed between the lower face of said arm —14— and a shoulder 15— on the plunger to force said plunger and yoke —7— downwardly, thereby holding the lens against the grinding surface during its traversing movement across said surface.

The lower end of the plunger —10— is loosely connected to the intermediate portion of the yoke —7— by means of a link

or loop —16— which serves to tie the plunger and yoke together to permit them to be raised simultaneously out of engagement with the lens holder, thereby permitting said holder and lens thereon to be removed from the grinding bed or lap —1—. The upper end of the plunger passes through an aperture —17— in the arm —14— and is held from downward movement by a cotter-key or equivalent holding means —18—, said aperture being elongated laterally to permit the free oscillation of the plunger, which latter may be moved upwardly against the action of the spring —11— to disengage it from the lens holder.

The arm —14— is vertically adjustable upon a fixed rod —19— for the purpose of varying the tension of the spring —11—, thereby varying the degree of pressure of the lens upon the grinding surface, said arm —14— being locked in its adjusted position by the action of the spring —11—, which tends to cramp and to frictionally hold the arm in engagement with the standard —19—.

The extension —9— to which the yoke —7— is pivoted forms a part of an oscillatory frame —19'— which is adapted to swing on different axes at right angles to each other and preferably disposed in coincident planes.

As shown in the drawings, the oscillatory frame —19'— is pivotally suspended from a shaft —20—, which in turn, is pivoted near one end upon a suitable bearing —21—, the axes of the bearings —20— and —21— being disposed at right angles to each other and in coincident planes to permit the oscillation of the frame —19'— in two vertical planes at right angles to each other, and to impart similar motion to the yoke —7— and lens holder through the medium of the extension —9— which connects the lower end of the frame —19'— to the yoke —7—.

The end of the bearing —20— opposite the pivotal bearing —21— is loosely connected to one arm, as —22—, of a bell crank-lever, which in turn, is pivoted at —23— to a fixed support —24— and has its other arm provided with a journal bearing —25— in which is seated a rock-shaft or spindle —26— having a socket —27—. Journaled in this socket is a spindle —28— which is eccentrically secured to a pinion —29— on the upper end of a driving shaft —30— so that, as the pinion —29— is rotated, oscillatory motion is imparted to the bell crank lever through the medium of the eccentric pin —28— and rock-shaft 26—, thereby imparting lateral rocking movement to the frame —19'—.

The pinion —29— meshes with a somewhat larger gear —29'— which is journaled in the dust-proof case presently described, and is provided with an upwardly project-

ing spindle —31— upon which is mounted an eccentric —32—. This eccentric is removable from the spindle —31— to permit the eccentrics of different throw to be replaced thereon and is rigidly locked to rotate with the gear —29— by a set screw or equivalent fastening means —33—.

The eccentric —32— is journaled in a non-rotatable annulus —34— separate from the gear —29— and is connected by a yoke link —35— to the lower portion of the oscillatory frame —19— through the medium of a ball and socket joint —36, best seen in Fig. 3. This link —35— serves to impart a rocking motion from the eccentric —32— to the frame 19', the throw of the eccentric being sufficient to move the lower end of the frame —19— through a considerable arc, thereby imparting similar motion to the lens holder to reciprocate the lens back and forth from one extreme end to the other of the long axis of the bed plate or lap —1—, and during such movement the frame —19— is oscillated laterally in opposite directions upon the pivot —21— through the medium of the eccentric pin —28— and bell crank connected thereto, thereby imparting a similar, but comparatively short lateral movement to the lens across the grinding surface of the lap. This compound oscillatory movement of the frame —19— causes the lens to traverse the grinding surface in serpentine paths, and in order that the same point of the lens may not travel in the same path, the number of teeth in the larger gear —29— are not divisible by the number in the pinion —29—, or in other words, the number of teeth in the gear is not a multiple of the number of teeth in the pinion, thereby avoiding the recurrent intermeshing of the same teeth of both gears except at long intervals, which causes the lens to travel back and forth across the grinding surface in different curvilinear or serpentine paths, and thereby avoids any liability of channeling or unduly grooving the lens, as would be the case if the lens were allowed to travel in the same path. The essential feature of this actuating mechanism is that of oscillating the frame —19— from two different axes in the same horizontal plane and at right angles to each other to impart a long sweep and a comparatively short lateral sweep to the lens across the grinding surface, the short lateral sweep recurring several times during each long sweep from one extreme to the other, the number of recurrences of the short sweep depending upon the relative size of the pinion —29— with reference to the gear —29—. In this instance, the pinion is comparatively small and causes its eccentric pin —28— to oscillate the bell crank lever and frame —19— connected thereto rapidly back and forth a predetermined number of times during each cycle of movement of the

eccentric —32— which imparts lengthwise sweep to the frame —19— and lens —3—.

Another important feature of the invention is the fact that both of these oscillatory movements are effected through the medium of a single rotary shaft or spindle, as —30—, to which the pinion —29— is secured, and in attaching my improved grinding device to any similar or other machine, it is simply necessary to connect with the spindle —30—, or mount the pinion —29— upon the spindle with which the other machine may be provided.

I have now described the grinding mechanism proper, and also the mechanism for actuating one of the movable parts, as the lens holder, and inasmuch as the accuracy and efficiency of the machine depend upon the close fit and harmonious working of the various parts of the actuating mechanism, it is desirable to protect such working parts from the accumulation of emery dust which may be liberated from the grinding mechanism, and I therefore, inclose practically the entire actuating mechanism within a dust-proof case composed of lower and upper sections —37— and —38— which are closely fitted together and clamped by suitable fastening means, as screws, —39—, said case sections being divided horizontally so that the upper section may be removed readily without disturbing any of the parts of the actuating mechanism.

The lower case section is provided with a depending hub —40— which receives a bushing —41— in which the shaft —30— is journaled, and this hub enables the whole device to be clamped in place upon a similar machine.

The upper case section —38— is provided with suitable oil cups —42— having leads —43— for directing the oil to various bearings of the actuating mechanism within the case without removing the upper section.

By inclosing the actuating mechanism in the manner just described, the grinding mechanism is outside of the case and is only connected to the actuating mechanism by the extension —9— which enters the bottom of the lower case section —37— through an aperture —44— of sufficient dimensions to permit the lengthwise and lateral oscillation of said extension therein.

What I claim:

1. In a machine for grinding the surfaces of lenses, an oscillatory frame and a rocking support therefor, the swinging axes of the frame and support intersecting each other at right angles, in combination with a driving shaft, means actuated by the shaft for rocking said support, additional means actuated by the same shaft for oscillating said frame upon its support, a lap and a lens holder coacting therewith to grind the lens, and means for transmitting motion from the os-

illatory frame to the lens holder whereby the latter is moved in serpentine paths relatively to the lap.

2. In a machine for grinding the surfaces of lenses, a lap, a lens holder movable in two directions at substantially right angles to each other, and mechanism for actuating said lens holder comprising a driving shaft, and separate intermeshing gears driven by said shaft and having eccentrics of different throw whereby the lens holder is caused to move back and forth in serpentine paths.

3. In a machine for grinding the surfaces of lenses, a grinding element and a lens holding element, one of said elements being movable back and forth in serpentine paths across the other element, and mechanism for actuating the movable element including an oscillatory frame and a rocking support therefor, the swinging axes of said frame and support being disposed in the same horizontal planes at substantially right angles to each other.

4. In a machine for grinding the surfaces of lenses, a grinding element and a lens holding element, one of said elements being movable back and forth in serpentine paths across the other element, and mechanism for actuating the movable element including intermeshing gears and eccentric members thereon for changing its path of movement at the end of each stroke whereby said movable element is prevented from traveling twice in the same path.

5. In a machine for grinding the surfaces of lenses, a grinding element and a lens holding element, one of said elements being movable back and forth in different serpentine paths across the other element, and mechanism for actuating said movable element including an oscillatory frame and rocking support therefor having its swinging axis in a plane at substantially right angles to the swinging axis of the frame and two intermeshing gears, one of which is eccentrically connected to the rocking support and the other gear eccentrically connected to the swinging frame, the number of teeth of one gear being indivisible by that of the other gear whereby the movable element is caused to change its path of movement during each cycle of operation.

6. In a machine for grinding the surfaces of lenses, a grinding element, and a lens holding element, one of said elements being movable back and forth in serpentine paths across the other element an oscillatory frame moving in two directions at right angles to each other and connected to the movable element, a rocking support for said frame for imparting one movement thereto, a driving shaft provided with a pinion having an eccentric bearing, connections between said eccentric bearing and rocking support for imparting rocking movement to

the latter, a gear meshing with the pinion and also provided with an eccentric bearing, and connections between the last eccentric bearing and oscillatory frame for rocking the latter upon the rocking support.

7. In a machine for grinding the surfaces of lenses, a grinding element and a lens holding element, one of said elements being movable back and forth in serpentine paths across the other element, yielding means for pressing one of the elements toward the other, and mechanism for actuating the movable element including eccentrics and operating gears therefor, one of said gears having a number of teeth indivisible by the number of teeth of the other gear for changing its path of movement of the movable element at all points in its line of travel after the first operation.

8. In a machine for grinding the surfaces of lenses, a lap, a lens holder movable back and forth in serpentine paths across the lap, an oscillatory frame and rocking support therefor, the swinging axes of the frame and support intersecting each other at substantially right angles, a yoke pivoted to the frame and bearing upon the lens holder, an oscillatory plunger spring-pressed against the yoke to force the lens holder toward the lap, and mechanism for imparting oscillatory movement to the frame and its support.

9. In a machine for grinding the surfaces of lenses, a grinding element and a lens holding element, one of said elements being movable relatively to the other element, and mechanism for actuating the movable element including a swinging frame and rocking support therefor, the axes of said frame and support being disposed in the same horizontal planes, and a rock arm fulcrumed on a different axis from those of the frame and support, a driving shaft, means for transmitting motion from the driving shaft to the rock arm, and separate means for transmitting motion from the shaft to the frame.

10. In a machine for grinding the surfaces of lenses, a stationary lap, a lens holder movable relatively to said lap, an oscillatory plunger supported at one end and having its opposite end spring pressed toward the lap and yieldingly pressing the lens holder toward said lap, and mechanism including separate eccentrics of different throw for moving the lens holder and adjacent end of the plunger in different curvilinear paths at each cycle of operation.

11. In a machine for grinding the surfaces of lenses, a driving shaft, an eccentric driven by said shaft, a rock arm having a bearing journaled therein and engaged with said eccentric, an oscillatory frame actuated by said rock arm in one direction, means actuated by the shaft for rocking said frame in a direction substantially at right angles

to the first named direction, a lens holder, and means for transmitting motion from the oscillatory frame to the lens holder.

5 12. In a machine for grinding the surfaces of lenses, a dust-proof housing having a hub, a driving shaft journaled in the hub, a bracket secured to the housing, a lap mounted on the bracket exterior to the housing, a lens holder spring pressed toward the
10 lap, an oscillatory frame movable in different directions at substantially right angles

to each other, means for transmitting motion from the oscillatory frame to the lens holder, and mechanism within the housing and driven by said shaft for oscillating said frame. 15

In witness whereof I have hereunto set my hand this 14th day of May 1906.

ELI M. LONG.

Witnesses:

SMITH A. HARRIMAN,
EDWARD S. BOYDEN.