Feb. 2, 1943. R. C. DAVID 2,309,936

LENS GRINDING AND POLISHING MACHINE

Filed Dec. 23, 1940 2 Sheets-Sheet 1

Fig. 1.

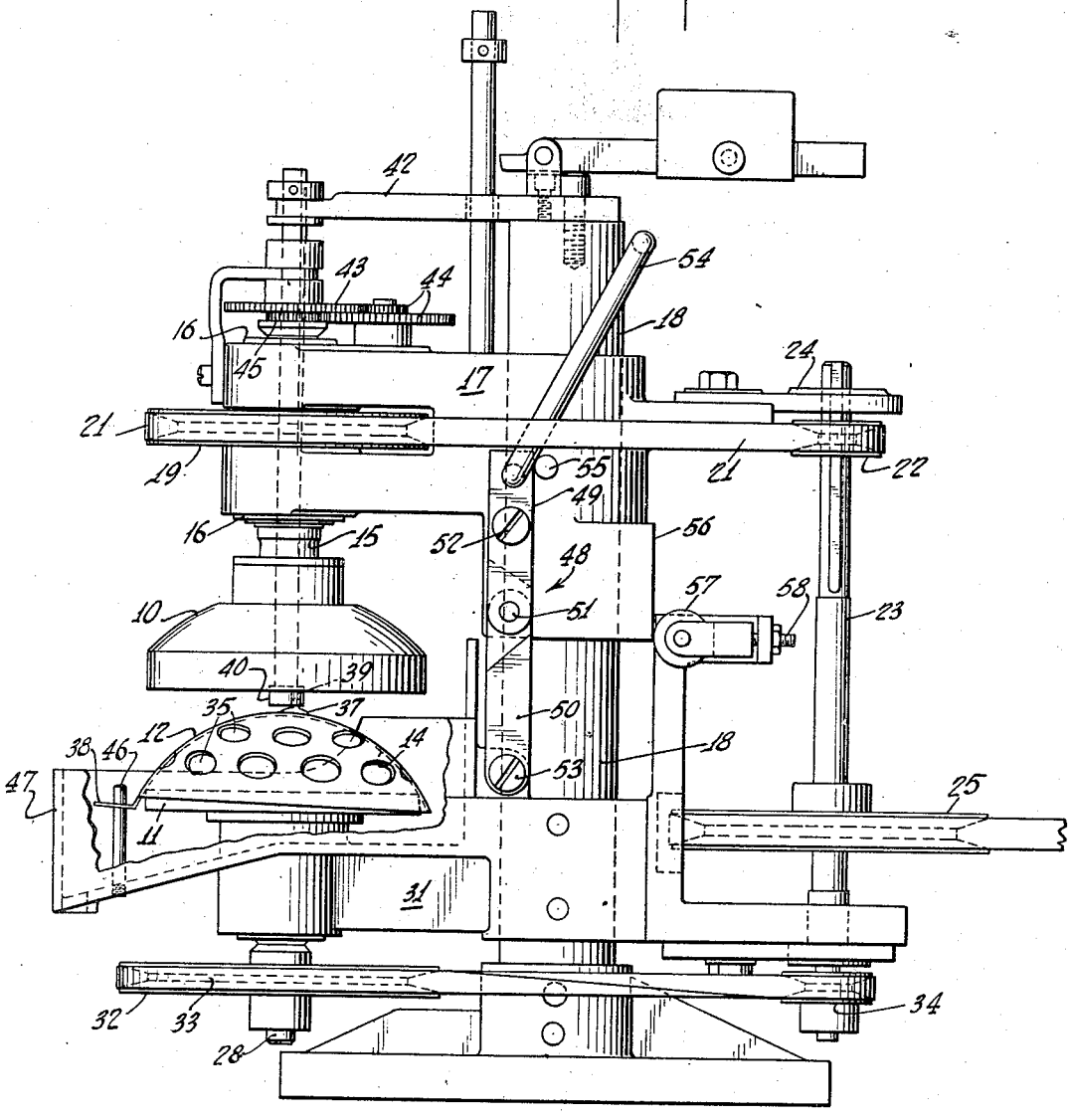

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Fig. 2.

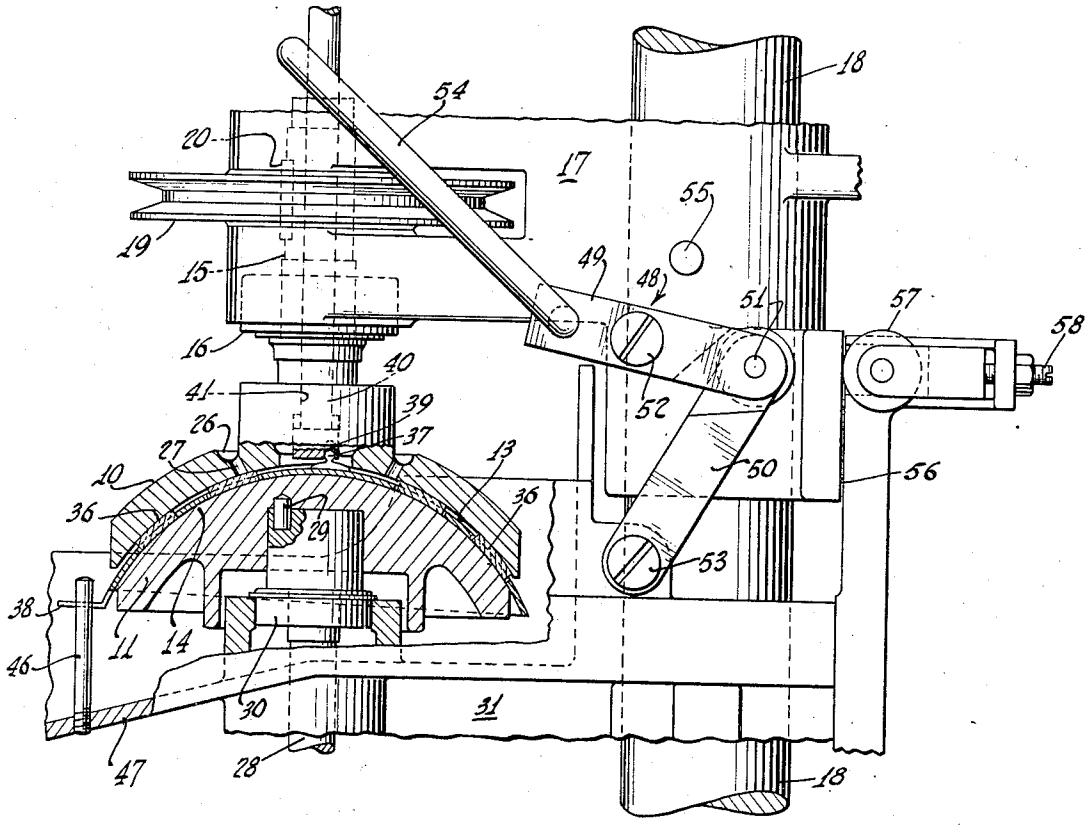
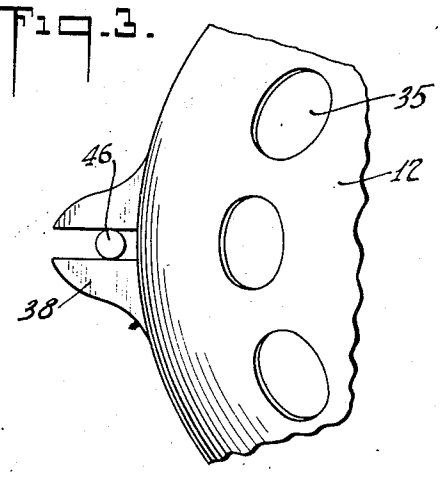


Fig. 3.



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UNITED STATES PATENT OFFICE

2,309,936

LENS GRINDING AND POLISHING MACHINE

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Application December 23, 1940, Serial No. 371,293

7 Claims. (Cl. 51—111)

This invention relates to a machine for grinding and polishing lenses having two curved surfaces, such as are commonly known as coquille lenses.

The primary object of the invention is to provide a machine for grinding or polishing both curved surfaces of a plurality of lenses simultaneously.

Another object is to provide a machine for abrading both curved surfaces of the lenses evenly throughout their entire area.

Another object is to provide a machine for grinding and polishing a plurality of coquille lenses to a given uniform thickness in all parts.

A further object is to provide a machine having two opposed, oppositely rotating curved abrading tools or laps that act simultaneously on both curved surfaces of the lenses to grind or polish the two surfaces smoothly and in parallelism.

A still further object of the invention is to provide the machine with a spider or lens-holder for loosely holding a plurality of lenses between the two opposed rotary laps so that the lenses may turn or move in the holder during rotation of the laps.

Another object is to provide novel means for moving the spider between the laps with a compound movement at a slower rate of motion than that of the rotation of the laps.

I am aware that it has heretofore been proposed to grind and polish lenses having two curved surfaces between opposed laps, one of which is stationary and the other rotary, and to move the lenses with a break-up motion during the abrading operation; however, it has been found that such machines are not efficient for grinding and polishing coquille lenses because the abrasive action of the lap is not uniformly effected over all parts of both curved surfaces of the lenses.

Further objects of the invention will appear to those skilled in the art from the following description thereof, reference being had to the accompanying drawings, in which:

Figure 1 is a view in elevation of the lapping machine, showing the laps separated;

Fig. 2 is a view in elevation, partly in section, showing the laps in abrading position; and

Fig. 3 is a fragmentary top view of the lens-holder or spider.

The machine has two opposed curved rotary tools or laps 10 and 11 between which a correspondingly curved spider or lens-holder 12 is interposed. The upper rotary lap 10 is mounted to move vertically, and it has a concave abrading surface 13. The lower rotary lap 11 is stationarily mounted and has a convex abrading surface 14 of concentric curvature to that of the surface 13 of the upper lap.

The upper lap 10 is carried on and is fixed to the foot of a hollow rotary shaft 15, which shaft turns in suitable bearings 16 in, and is supported by, the frame member 17. The frame member 17 is bodily movable vertically on the frame-stanchion 18. The shaft may be driven by a pulley 19, keyed thereto at 20, through a belt 21 or the like from a pulley 22. The latter pulley is vertically movable on a driving shaft 23 and is connected by a lug 24 to the frame member 17 to move therewith. The shaft 23 may be driven from any suitable power source by a main driving pulley 25, or the like. In operation of the machine, the lap 10 bears by gravity of its own weight on the lenses, but it may be additionally weighted if desired. The lap may be provided with a channel 26 having passages 27 leading to its abrasion surface 13 and through which the usual abrading or polishing substances may be introduced. The lap 10 preferably rotates in a clockwise direction and at a speed of about 110 R. P. M.

The lower lap 11 is mounted on the upper enlarged end of a rotary shaft 28 and is secured thereto by any suitable means, such as the driving or dowel pin 29. The axis of the shaft 28 is in vertical alignment with that of the shaft 15. The shaft 28 is supported in suitable bearings 30 on a stationary frame member 31, and may be driven by a pulley 32 through a belt 33, or the like, preferably a crossed belt, from a pulley 34 which is driven by the shaft 23. The lap 11 preferably rotates in the opposite direction to the lap 10, that is, counter-clockwise, and at slightly slower speed. To this end, it will be noted, that the pulley 32 is somewhat larger in diameter than the pulley 19.

The lens-holder or spider 12 is shaped to conform to the curvature of the abrading surfaces of the laps, and is formed with a plurality of openings 35 for receiving the coquille lenses 36 to be ground and polished. Each of these openings is slightly larger than the size of a lens so that the lenses may move or turn freely therein during the grinding and polishing operations. The spider also has a knob 37 projecting upwardly therefrom at approximately its center, and a fork 38 extending downwardly and outwardly from its rim.

The knob 37 seats in a socket 39 disposed eccentrically in the enlarged foot of a vertical rod 40, by rotation of which rod the spider movement is actuated. The rod passes freely through the axial bore 41 of the rotary shaft 15, and is supported at its upper end in a fixed frame-piece 42 extending sideways from the stanchion 18. It is to be noted, however, that the rod does not move vertically with the upper lap 10 but remains in its fixed position, as will be apparent on comparison of Figs. 1 and 2 of the drawings.

The rod 40 is independently rotated, but in the same direction as the lap 10, by a gear 43, through the reduction gears 44, from a driving 45 fixed to the upper end of the rotary shaft 15. The ratio of the gears is such that the rod will

rotate at a considerably slower speed than the shaft, and consequently than the lap 10. The ratio is preferably such that when the lap rotates at about 110 R. P. M., the rod 40 will rotate at about 35 R. P. M., although these velocities, as well as the relative velocities, may be varied. The gear-train is carried and mounted on the vertically movable frame member 17 to move up and down with said frame member.

The fork 38 of the spider 12 engages a fixed upright pin 46 by which the motion of the spider is controlled. Because of its eccentric drive, as governed by the pin and fork, the spider has a compound motion that is the resultant of its impulses to rotate eccentrically in relation to the axis of the laps, to oscillate relatively to the pin, and to rock back and forth on the curved surface of the lower lap. This compound motion of the spider, coupled with the fact that the lenses themselves turn in the openings in the spider, by reason of the differential velocities of the two laps, produces a smooth, uniform and even abrasive action, simultaneously and in parallelism, on both curved surfaces of each of the lenses throughout their entire area.

The frame-part 47, to which the pin 46 is fixed, is preferably in the form of an apron to prevent spattering of the abrasive substance during the operations of grinding and polishing the lenses.

Any suitable means may be provided for raising or lowering the upper lap 10 as required. A mechanism for this purpose is shown in the drawings consisting of a toggle 48 composed of two links 49 and 50 pivoted together at 51. The upper link 49 is pivoted at 52 to the vertically movable frame member 17, while the lower link 50 is pivoted at 53 to a stationary part of the frame. A handle 54 operates the toggle, and a stop 55, or equivalent means, may be provided for limiting the movement of the toggle and to hold the upper lap 10 in its raised position.

To facilitate the up and down movement of the movable member 17 on the stanchion 18, the member 17 may be provided with a smooth flat face 56 against which a roller 57 may bear, and the roller may be provided with an adjustable screw 58, or the like, for adjusting its pressure.

In operation of the machine, the lap 10 is raised to give access to the spider 12, and the coquille lenses 36 are placed in the openings 35, after which the lap is lowered to its operative position, shown in Fig. 2. The laps are then caused to rotate and the spider is caused to move the lenses about in between the rotating laps, but at a slower rate of motion. After the grinding and polishing operations are finished, or whenever desired, the upper lap may be raised, by manipulation of the toggle 48, to permit of inspection of the lenses or their removal from the spider.

While I have shown and described a preferred embodiment of the invention, it is to be understood that modifications may be made within the scope of the invention as set forth in the claims.

What I claim is:

1. In a machine of the character described, a vertically movable hollow rotary shaft, a curved lap carried by said shaft to rotate and move vertically therewith, a vertically immovable rotary rod passing axially through said shaft, means for rotating said rod at a slower speed than the rotation of the shaft, a vertically immovable rotary shaft in axial alignment with the first mentioned shaft, a curved lap mounted on said second shaft to rotate therewith, a spider for holding a plurality of lenses disposed between the laps, and means for rocking and oscillating the spider relatively to the laps including an eccentric connection of the spider to the rod.

2. In a machine of the character described, a pair of opposed rotary curved laps, a spider for holding a plurality of lenses between said laps, and means for moving the spider with a compound motion which is the resultant of rotary, oscillatory and rocking movements imparted to the spider.

3. In a machine of the character described, a pair of opposed rotary curved laps, a curved spider for holding a plurality of lenses between said laps, means for rotating said spider eccentrically to the axis of the laps, a fork extending downwardly and outwardly from an edge of the spider, and a fixed pin upon which the fork rides to cause the spider to oscillate and to rock relatively to the laps.

4. In a machine of the character described, a pair of rotary laps in axial alignment, said laps having opposed faces of common curvature, one of which is concave and the other convex, means for rotating both laps in opposite directions with a differential speed, a work-holder disposed between the laps and shaped to conform to the opposed faces thereof, said work-holder being adapted to hold a plurality of lenses loosely to permit of turning movement of the lenses in the holder during rotation of the laps, and means for rotating the work-holder eccentrically with respect to the axis of the laps and imparting a compound oscillatory and rocking movement thereto.

5. In a machine of the character described, a pair of rotary laps in axial alignment, said laps having opposed faces of common curvature, one of which is concave and the other convex, means for rotating both laps with a differential speed, a work-holder disposed between the laps and shaped to conform to the opposed faces thereof, said work-holder being adapted to hold a plurality of lenses loosely to permit of turning movement of the lenses in the holder during rotation of the laps, and means for rotating the work-holder eccentrically with respect to the axis of the laps and imparting a compound oscillatory and rocking movement thereto.

6. In a machine of the character described, a pair of rotary laps in axial alignment, said laps having opposed faces of common curvature, one of which is concave and the other convex, means for rotating both laps, a work-holder disposed between the laps and shaped to conform to the opposed faces thereof, said work-holder being adapted to hold a plurality of lenses loosely to permit of turning movement of the lenses in the holder during rotation of the laps, and means for rotating the work-holder eccentrically with respect to the axis of the laps and imparting a compound oscillatory and rocking movement thereto.

7. In a machine of the character described, a pair of opposed rotatable laps, a work-holder for loosely holding a plurality of lenses therebetween, an independently rotatable shaft extending axially through one of said laps, said work-holder being connected eccentrically to said shaft, and means for guiding the movement of the work-holder to impart a compound oscillating and rocking sliding movement thereto between the laps.

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