W. H. JOHNSON.

MACHINE FOR GRINDING LENSES.

APPLICATION FILED JAN. 28, 1911.

1,001,410.

Patented Aug. 22, 1911

3 SHEETS—SHEET 1.

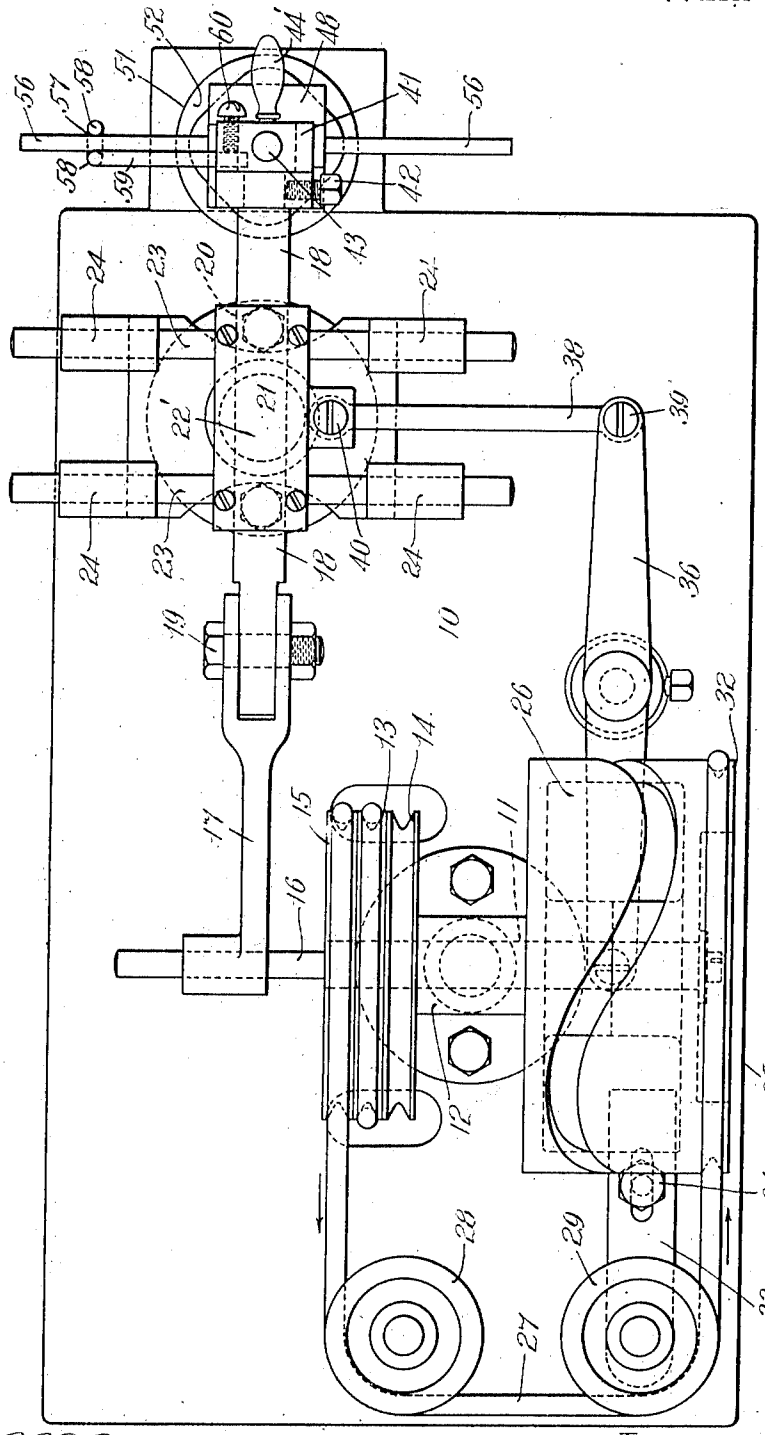

FIG. 1.

Witnesses.
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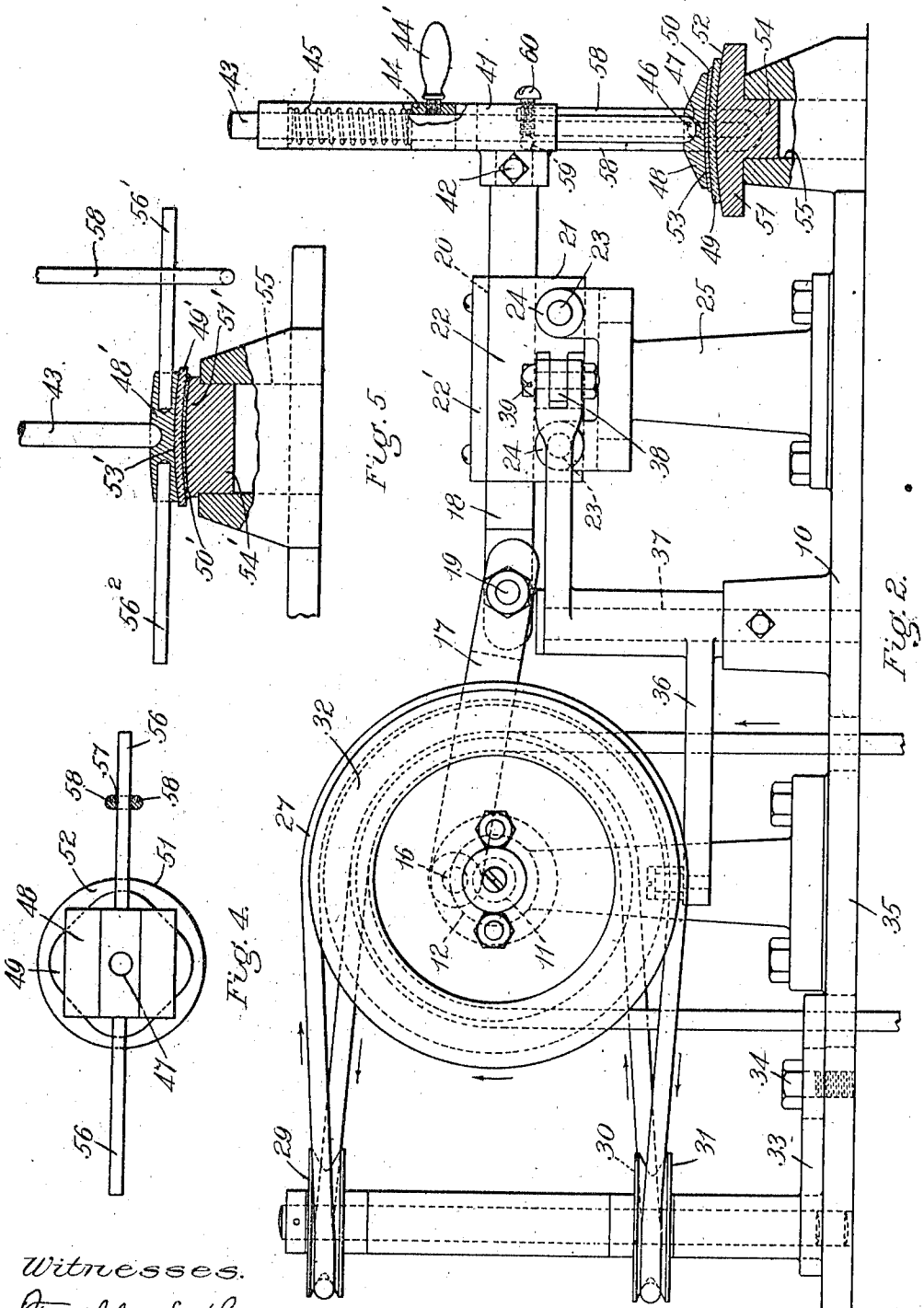

Fig. 2.

Fig. 4.

Fig. 5.

Witnesses.

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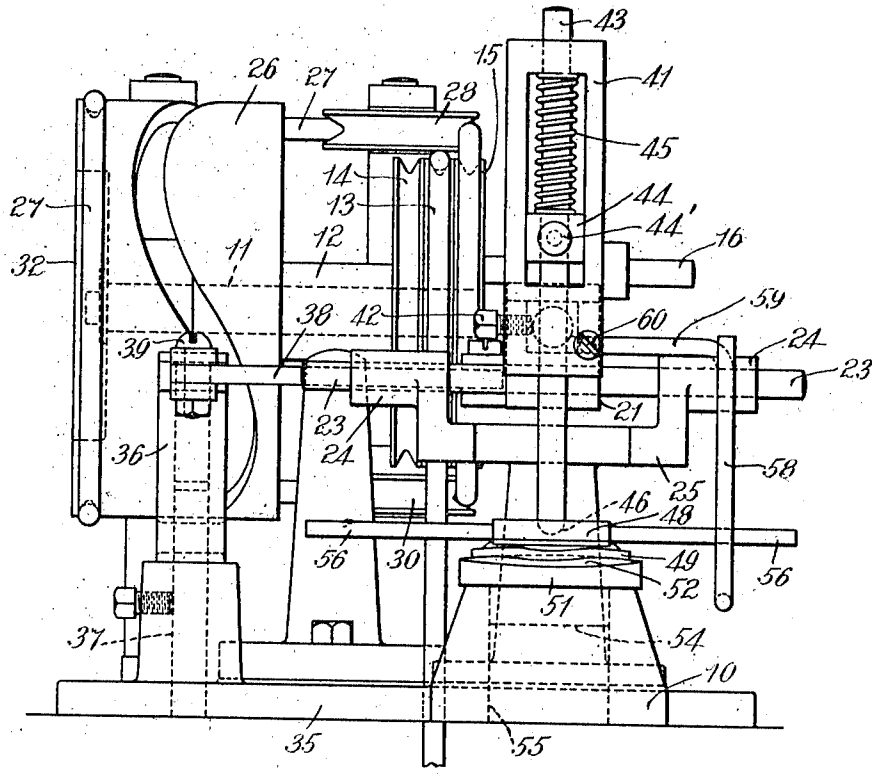

Fig. 3.

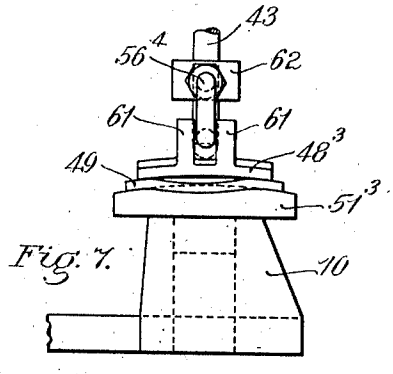

Fig. 7.

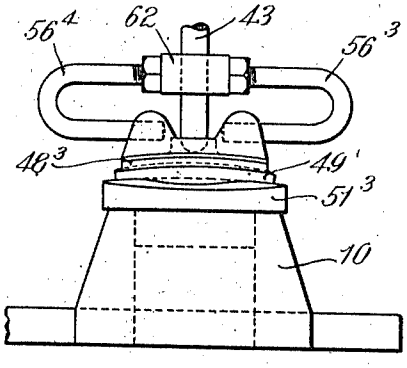

Fig. 6.

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UNITED STATES PATENT OFFICE.

WALTER H. JOHNSON, OF WEST ROXBURY, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO CHARLES T. SAUL, OF WALTHAM, MASSACHUSETTS.

MACHINE FOR GRINDING LENSES.

1,001,410. Specification of Letters Patent. Patented Aug. 22, 1911.

Application filed January 28, 1911. Serial No. 605,157.

To all whom it may concern:

Be it known that I, WALTER H. JOHNSON, a citizen of the United States, residing at West Roxbury, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Machines for Grinding Lenses, of which the following is a specification.

This invention relates to machines for grinding lenses.

The object of the invention is to provide a machine which will grind any kind of cylinder lens, toric or plain, and which will grind the convex or concave faces of lenses with very slight change in the parts.

The object of the machine is further to provide a machine which can be operated quickly and easily by comparatively inexperienced and cheap operators.

In machines of the character set forth it is very desirable that the grinding element should pass over the surface of the lens to be ground in a variety of paths, none of which are duplicates of each other. To accomplish this result, the machine of this invention is so constructed and operated that the grinding element which moves over the surface of the lens, or the lens itself when it is moved over the surface of the work holder, has an indeterminate movement imparted thereto—that is, said element is moved in one direction by one mechanism and in another direction at an angle to the first by another mechanism, and these two mechanisms vary in their action relatively to each other, for the reason that one of them is driven by a slipping frictional means, so that the two mechanisms are constantly changing in their relative times of movement and consequently the grinding element which is driven by these mechanisms moves in a resultant path which constantly varies and which cannot be predetermined, or, in other words, is indeterminate, because of the fact that one of these mechanisms is driven by a slipping frictional means, and said means will slip according to the amount of resistance encountered at certain times by the moving grinding element.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the claims thereof.

Referring to the drawings: Figure 1 is a plan view of my improved lens grinding machine. Fig. 2 is a side elevation viewed in the direction of the arrow *a*, Fig. 1, and shown partly in section. Fig. 3 is a front elevation viewed from the right of Figs. 1 and 2, illustrating the grinding members and work holder arranged to grind the concave side of a lens. Fig. 4 is a plan view of the grinding members and work holder, with the guide for preventing the grinding member from rotating about its medium axial line in section. Fig. 5 is a front elevation viewed in the same direction as Fig. 3, illustrating the machine with the grinding member adapted to grind the convex side of a lens, the same being shown partly in section. Fig. 6 is a front elevation of a modified form of means for preventing the movable grinding member from rotating about its median axial line. Fig. 7 is a side elevation of the parts illustrated in Fig. 6 as viewed from the left of said Fig. 6.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 10 is the frame of the machine and 11 the main driving shaft journaled to rotate in a suitable bearing 12. A driving pulley 13 is fastened to the shaft 12 and journaled upon said shaft is a loose pulley 14. Another pulley 15 is fastened to the shaft 11 and has projecting from its face and fast thereto a crank-pin 16. The crank-pin 16 is connected by a crank-rod 17 to a slide 18 by means of a pivotal connecting bolt 19, said crank rod 17 is movable laterally thereof on the crank pin 16. The slide 18 is guided in ways 20 formed in a slide 21 which consists of a block 22 fastened to rods 23, 23, the rods 23 being adapted to slide in bearings 24, 24 formed on the standard 25 which is a part of the frame of the machine.

A reciprocatory motion is imparted to the slide 21 by a cam 26 loosely mounted to rotate upon the shaft 11, and driven by a belt 27. This belt 27 is an endless belt and extends from the pulley 15 around idler guide pulleys 28, 29, 30 and 31 and around the pulley 32 which is fast to the sam 26. To regulate the tension on the belt 27 the idler guide pulleys, viz., the pulleys 31 and 29 are mounted upon a bracket 33 which is adjustably fastened by means of a bolt 34 to the base 35 of the frame 10. The reciprocatory motion is imparted to the slide 21 from the cam 26 by a cam lever 36 which is pivoted

upon a stud 37 fast to the frame of the machine and said cam lever is connected by a link 38 to the slide 21, said link being pivotally connected at one end thereof to the cam lever 36 by a pivotal stud 39, and at the other end thereof being connected by a pivotal stud 40 to the block 22 which forms a portion of the slide 21, the whole of said slide consisting of the block 22, the cap plate 22′ fast thereto and the guide rods 23, 23.

The slide 18 has fastened to its front end a head 41 by means of a set-screw 42 and this head has slidably mounted therein a rod 43 which has a collar 44 fast thereto, said collar having a handle 44′ fast thereto by means of which it may be raised. Interposed between said collar and the head 41 is a spring 45 which encircles the rod 43 and tends to hold said rod downwardly. The lower end of the rod 43 is rounded at 46 and fits into a recess 47 in the grinding element 48 (Fig. 2).

By reference to Figs. 2 and 3 it will be seen that there are two elements 48 and 51 having opposed faces 53 and 52, respectively one of said elements 48 constituting a grinding element and the other element 51 a work holder. The element 51 is convex upon its grinding surface 52 and has a lug 54 projecting downwardly therefrom into a recess 55 in the frame 10. When it is desired to grind the concave side of the lens 49, said lens is interposed between the elements 48 and 51 and is fastened to the element 48 by means of a suitable cement.

In order to prevent the element 48 from rotating about the median axial line of the rod 43, or about a median axial line extending substantially at right angles to the grinding surface of the element 51, a rod 56 is fastened to the grinding element 48 and projects therefrom toward the right (Fig. 3) into a slot 57 formed between the two sides 58, 58 of a bracket 59 which is bent at right angles at its upper end (Fig. 3) and is preferably formed of wire, the bracket 59 being fastened to the head 41 by a set-screw 60. The rod 56 is extended to the left of the grinding element 48, as illustrated in Fig. 3, in order to enable the operator to conveniently and quickly lift the grinding element 48 away from the element 51 when it is desired to remove the lens from between the opposing faces of the elements 48 and 51 or to insert a new lens therebetween. This extension of the rod 56 to the left, Fig. 3, is also for the purpose of enabling the operator to remove the grinding element 48, with the lens attached thereto, and turn said grinding element around 180°, thus reversing the positions of the right and left hand ends of the rod 56 and that portion which previously extended to the left of the grinding element 48 will then extend to the right of said grinding element and into the slot 57 in the bracket 59.

In Figs. 2 and 3 the lens is illustrated as fastened to the upper grinding element 48 and the convex grinding face 52 of the element 51 remains stationary, while the lens is moved around by the mechanism hereinbefore described in the manner hereinafter more fully set forth. In Fig. 5, however, the grinding element 48 is replaced by a grinding element 48′ having a concave grinding face 53′ and the lens 49 is fastened by cement 50′ to the element 51′, which is removably fastened to the frame of the machine by means of a lug 54′ which projects into the recess 55. The rod 43 is the same as in the form of my invention illustrated in Figs. 1 and 2; also the guiding bracket 59, and the element 48′ are provided with rods 56′ and 56^2 which perform the same functions as the rod 56 in the form of my invention illustrated in Fig. 3.

In Figs. 6 and 7 I have illustrated a modified means for preventing the lens from rotating around an axis substantially at right angles to its surface during the grinding operation, and referring to said Figs. 6 and 7 it will be seen that the element 51^3 is supported on the frame of the machine as in the forms of my invention illustrated in Figs. 2 and 5, while the grinding element 48^3, which, in this particular form has the lens 49′ fast thereto, is pivotally mounted to rock upon the rounded end of the rod 43, as hereinbefore described, the element 48^3 having ears 61, 61 thereon which straddle U-shaped rods 56^3, 56^4 which are fastened to a collar 62 which, in turn, is fastened to the rod 43.

The general operation of the machine hereinbefore specifically described is as follows. Considering, first, the grinding of a lens on the concave face thereof and referring to Figs. 1, 2 and 3, the operator attaches the lens 49 to the grinding element 48 by means of suitable cement as illustrated in Figs. 2 and 3, and utilizes for the other element the part 51. He places the part 51 in the position illustrated in Figs. 2 and 3 and covers the same with a suitable grinding material, then raises the rod 43, by means of the handle 44′, overcoming the action of the spring 45. He then places the lens 49 attached to the grinding member 48 by the cement 50, beneath the rod 43 and lowers said rod until the rounded lower end 46 thereof enters the recess 47 in the grinding element 48. He lowers the rod 43 and the element 48 with the lens attached thereto, manipulating the rod to this end by means of the handle 44′ and the grinding element 48 and lens by means of the handle or rod 56. He then starts the machine by slipping the belt from the loose pulley 14 onto the tight pulley 13. The shaft 11 is then ro-

tated and this imparts a reciprocatory motion to the slide 18 from the front to the back of the machine, while the cam 26 will be rotated loosely upon the shaft 16 by the belt 27, and this will rock the cam lever 36 and, through the link 38, the slide 21 will be given a reciprocatory motion at an angle (in this case at right angles) to the direction of motion of the slide 18. The resultant motion imparted to the grinding element 48, due to the combined movements of the two slides 18 and 21, will move said grinding element in different directions around over the element 51, thus grinding the concave surface of the lens 49 which is in contact with the grinding material upon the convex surface 52 of said element 51.

It is evident that the grinding element 48 and the lens attached thereto can tip in different directions as it is moved around in a curvilinear path by the mechanism hereinbefore described. The distance, however, to which said lens can be rocked about the median axial line of the rod 43 is limited by the rod 56 which projects into the slot 57 between the two sides 58, 58 of the bracket 59. This rod can tip upwardly and downwardly, but limits the angle to which the element 48 can be rotated, together with the lens, about said median axial line.

It will be understood that the belt 27 is loose enough so that if a certain amount of resistance to the movement of the grinding element 48 and the lens attached thereto is encountered said belt will slip upon the pulleys and, therefore, the relative location of the cam 26 to the belt 15 and to the crank pin 16 fast thereto will be changed and as soon as this occurs the path which the element 48 would otherwise have described will be changed. This change occurs according to the amount of resistance and the number of different times that a certain excess of resistance, so to speak, occurs during the grinding operation and, therefore, the resultant path imparted to the grinding element 48' and the lens attached thereto is indeterminate, and also it will be understood that because of this slipping connection between the pulleys 15 and 32, the movement imparted to the grinding element is indeterminate movement, and, further that one of said elements, viz., in this embodiment of my invention, the element 48, will be moved in a plurality of directions at an angle to each other relatively to the element 51.

It will be noted that the handle 44' has screw-threaded engagement with the collar 44 and, therefore, acts as a set-screw to fasten the collar 44 to the rod 43. If it is, desired, therefore, to increase or diminish the tension upon the spring 45, it can be done by loosening the set-screw handle 44' and moving the collar 44 upwardly or downwardly, respectively, according as it is desired to increase or diminish the tension upon the spring 45. This, of course, results in increasing or diminishing the pressure of the lens against the grinding surface.

When it is desired to grind a convex surface on a lens, the parts illustrated in Fig. 5 are utilized. In this case the under side of the element 48' is made concave and the lens 49 is fastened to the element 51', which may have a convex upper surface or not, as desired. The mechanism is the same as that illustrated in Figs. 1, 2 and 3 and in the operation of the machine in this embodiment of my invention the lens remains stationary, while the element 48' slides around upon its convex surface, there being introduced between the grinding element 48' and the upper convex surface of the lens, suitable grinding material.

In Figs. 6 and 7 the grinding element 48^3 is provided with ears which engage the U-shaped rods 56^3 and 56^4, and thus said rods 56^3 and 56^4 allow the grinding element 48^3 to rock, together with the lens, as it is moved around upon the convex surface of the part 51^3, but do not allow said grinding element 48^3 to rotate about the axis of the rod 43. In this embodiment of my invention, the other parts of the machine are the same as illustrated in Figs. 1, 2 and 3 hereinbefore described.

Having thus described my invention, what I claim and desire by Letters Patent to secure, is:

1. A machine for grinding lenses having, in combination, two elements having opposed surfaces one of said elements constituting a work holder and the other a grinding element, two slides, one mounted on the other, said slides adapted to slide respectively at an angle to each other, one of said elements pivotally connected to one of said slides, a crank-pin, a crank-rod connecting said crank-pin to one of said slides and movable laterally thereof on said crank-pin, a cam, and mechanism operatively connecting said cam to the other of said slides, and means forming a slipping frictional connection between said crank-pin and cam.

2. A machine for grinding lenses having, in combination, two elements having opposed surfaces one of said elements constituting a work holder and the other a grinding element, two slides, one mounted on the other, said slides adapted to slide respectively at an angle to each other, one of said elements pivotally connected to one of said slides, a pulley, a crank-pin fast thereto, a crank-rod connecting said crank-pin to one of said slides and movable laterally thereof on said crank-pin, a cam and mechanism operatively connecting said cam to the other of said slides, a pulley fast to said cam, and an endless belt connecting said pulleys and adapted to slip thereon.

3. A machine for grinding lenses having, in combination, two elements having opposed surfaces one of said elements constituting a work holder and the other a grinding element, two slides, one mounted on the other, said slides adapted to slide respectively at an angle to each other, one of said elements pivotally connected to one of said slides, a pulley, a crank-pin fast thereto, a crank-rod connecting said crank-pin to one of said slides and movable laterally thereof on said crank-pin, a cam, mechanism operatively connecting said cam to the other of said slides, a pulley fast to said cam, an endless belt connecting said pulleys and adapted to slip thereon, and means to adjust the tension on said belt.

4. A machine for grinding lenses having, in combination, two elements having opposed surfaces one of said elements constituting a work holder and the other a grinding element, two slides, one mounted on the other, said slides adapted to slide respectively at an angle to each other, one of said elements pivotally connected to one of said slides, a pulley, a crank-pin fast thereto, a crank-rod connecting said crank-pin to one of said slides and movable laterally thereof on said crank-pin, a cam, mechanism operatively connecting said cam to the other of said slides, a pulley fast to said cam, an endless belt connecting said pulleys and adapted to slip thereon, and idler pulleys interposed between said pulleys and adapted to guide said belt, one of said idler pulleys being adjustable, whereby the tension on said belt may be varied and said belt allowed to slip.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WALTER H. JOHNSON.

Witnesses:
CHARLES S. GOODING,
LOUIS A. JONES.