D. E. PLAISTED.

GRINDING MACHINE.

APPLICATION FILED DEC. 28, 1908.

965,222. **Patented July 26, 1910.**

4 SHEETS—SHEET 1

Fig. 1.

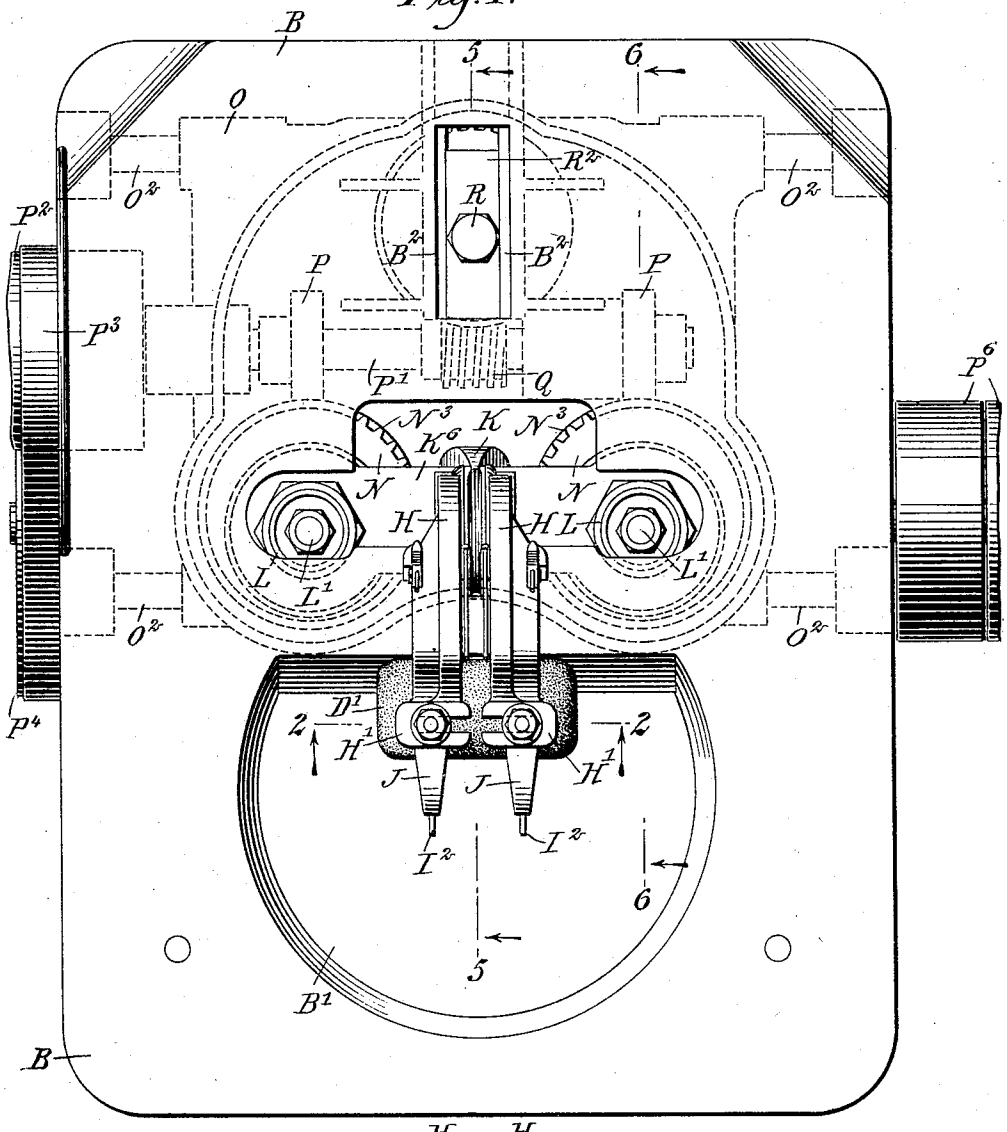
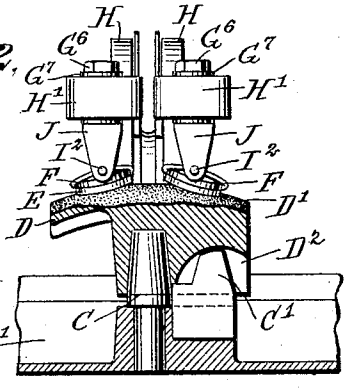


Fig. 2.



WITNESSES

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4 SHEETS—SHEET 2.

Fig. 3,

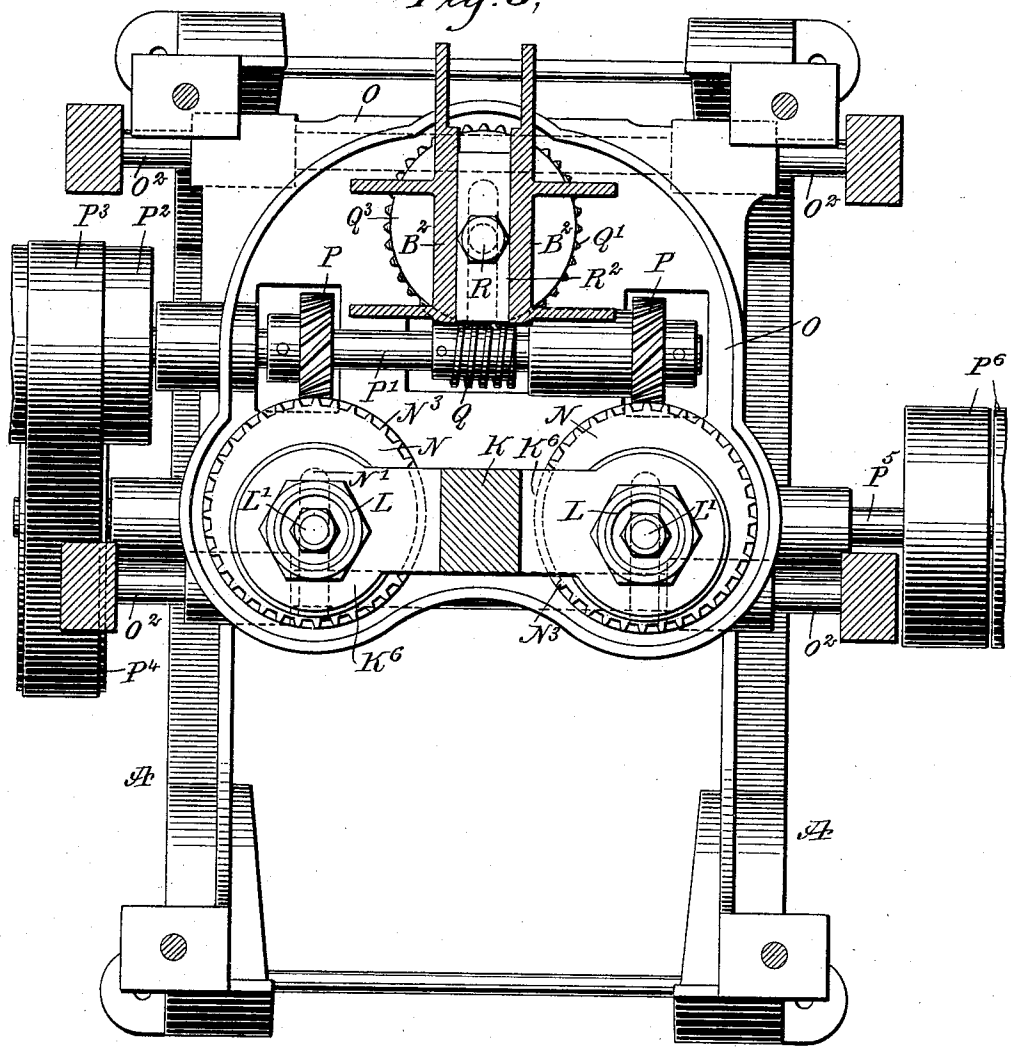
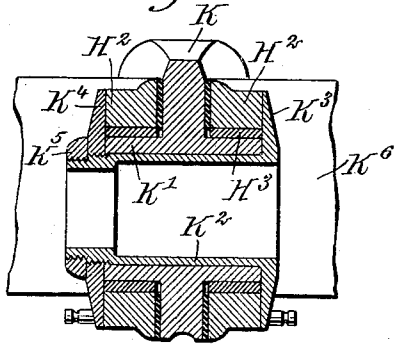


Fig. 4,



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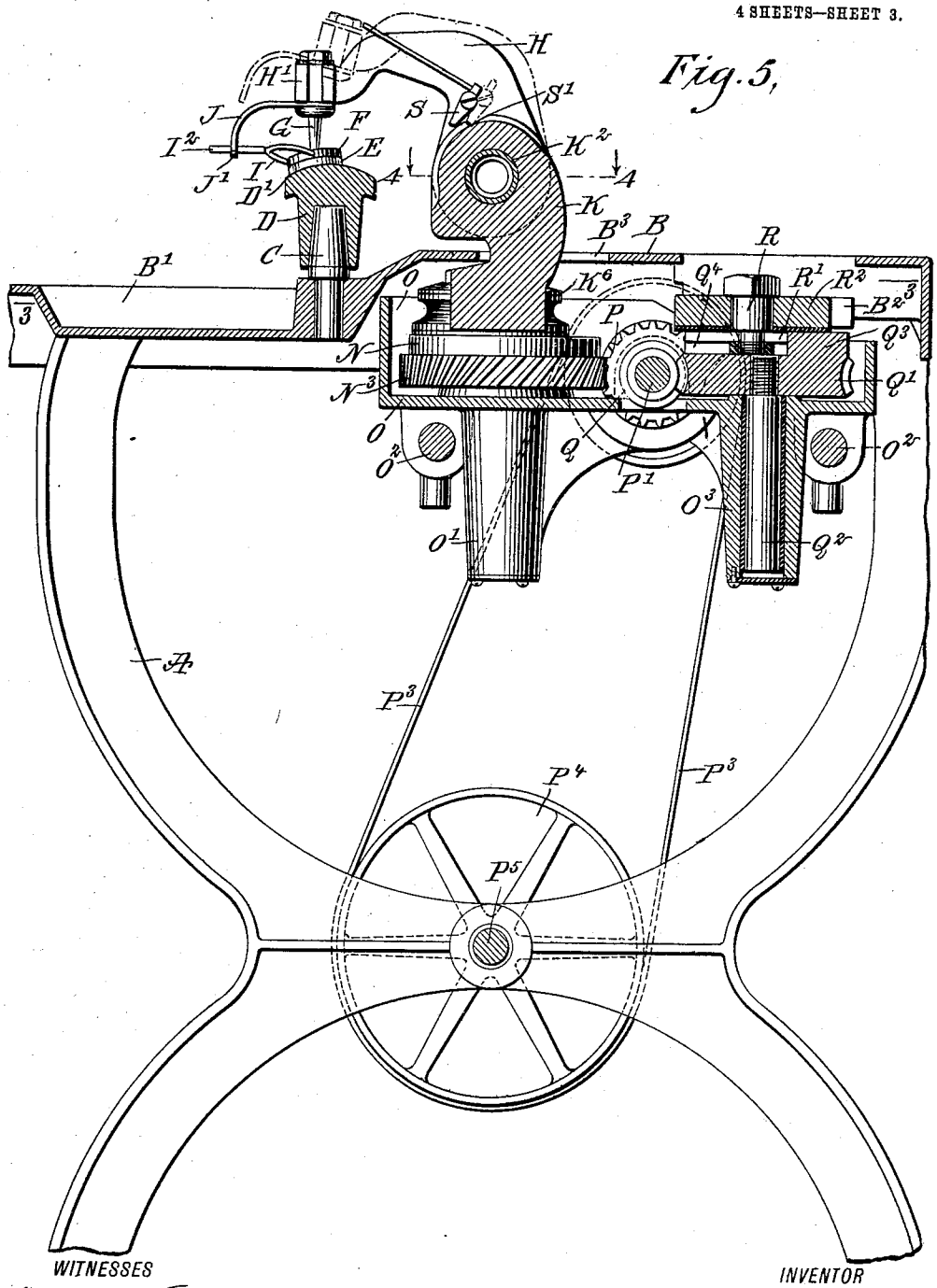
4 SHEETS—SHEET 3.

Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6,

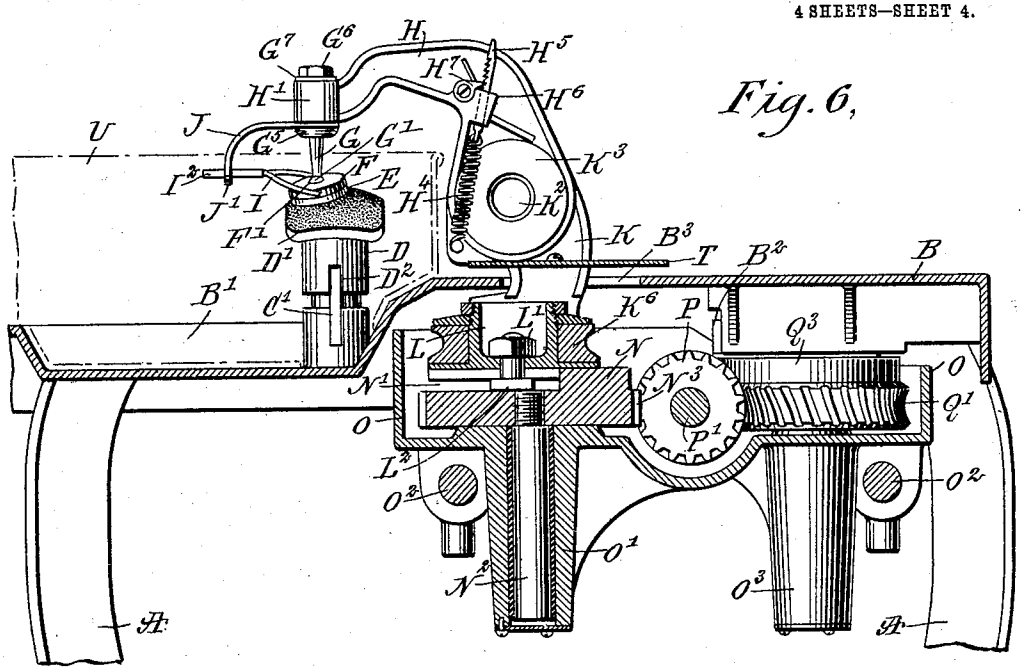

Fig. 7,

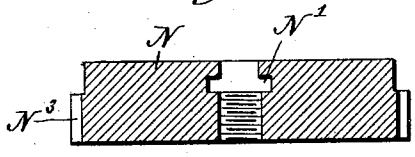

Fig. 9,

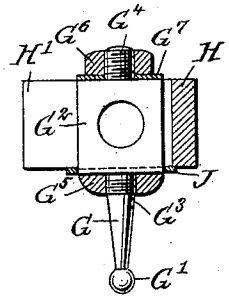

Fig. 10,

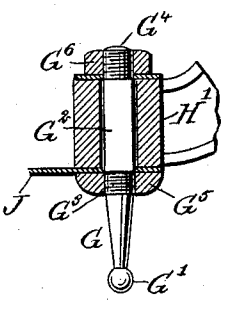

Fig. 8,

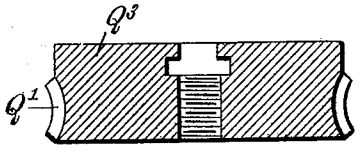

Fig. 11,

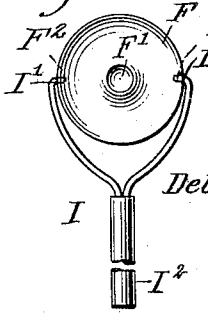

Fig. 12

WITNESSES

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UNITED STATES PATENT OFFICE.

DELBERT ERMAN PLAISTED, OF NEW YORK, N. Y., ASSIGNOR TO D. S. THOMPSON MANUFACTURING COMPANY, OF LIVERMORE FALLS, MAINE, A CORPORATION OF MAINE.

GRINDING-MACHINE.

965,222. Specification of Letters Patent. Patented July 26, 1910.

Application filed December 28, 1908. Serial No. 469,544.

To all whom it may concern:

Be it known that I, DELBERT E. PLAISTED, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Grinding-Machine, of which the following is a full, clear, and exact description.

The invention relates to grinding machines, such as shown and described in the Letters Patent of the United States, No. 77,258, granted to Davilla Sturtevant Thompson, on November 15, 1904.

The object of the present invention is to provide a new and improved high speed grinding machine for grinding cylindrical, toric and other lenses with the greatest accuracy and in a comparatively short time, and without undue wear of the working parts of the machine.

The invention consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of the improved grinding machine; Fig. 2 is a cross section of the same on the line 2—2 of Fig. 1; Fig. 3 is a sectional plan view of the grinding machine, the section being on the line 3—3 of Fig. 5; Fig. 4 is an enlarged sectional plan view of the pivot for the actuating arms, the section being on the line 4—4 of Fig. 5; Fig. 5 is a sectional side elevation of the grinding machine, on the line 5—5 of Fig. 1; Fig. 6 is a similar view of the same on the line 6—6 of Fig. 1; Fig. 7 is a cross section of the high speed spiral gear and crank disk for causing the work carrier to travel bodily in a circle; Fig. 8 is a like view of the low speed spiral gear and crank disk for imparting a reciprocating motion to the carriage; Fig. 9 is an enlarged cross section of the actuating arm and the carrying pin in position thereon; Fig. 10 is a sectional side elevation of the same; Fig. 11 is a plan view of the work holder and the arm for preventing the holder from turning on its axis; and Fig. 12 is a cross section of the work holder.

The standards A of the frame of the machine support a table B, having a pan-like depression B′, and carrying a support C for the grinding or abrading block D, on the upper curved surface D′ of which are ground the lenses E to the predetermined shape given to the surface D′ of the block D. In order to hold the block D against turning on the support C, the latter is provided with a fixed key C′, engaging a slot D^2 formed on the under side of the block D, as plainly shown in Figs. 2 and 6. As shown, the block D is arranged to permit of grinding a pair of lenses at the same time to the same shape, each lens being temporarily fastened to the under side of a lens holder F, shown in the form of a disk, having in its top a socket F′ for engagement by a ball G′ on a pin G held adjustably on the free end H′ of the actuating arm H, having a bodily circular and a bodily transverse motion, as hereinafter more fully described. By having the ball and socket connection between the lens holder F and the pin G, the lens holder is free to rock in any desired direction. The lens holder F is provided at diametrically opposite points of its periphery with recesses F^2 (see Figs. 11 and 12), for engagement by trunnions I′ on the members of a fork I, having its shank I^2 loosely engaging an eye J′ in a bracket J, held on the pin G to move bodily with the latter and with the arm H and at the same time the fork I allows the holder F to rock, but prevents it from turning on its axis, thus maintaining the lens holder F and its lens E in the same relative position for each circular movement over the grinding surface D′.

The pin G is provided with a flat portion G^2 fitting into the slotted end H′ of the corresponding arm H, and the pin is provided with screw threads G^3, G^4 below and above the flattened portion G^2, and on the screw thread G^3 screws a collar G^5 against the bottom of the flat portion G^2 and against the under side of the bracket J, clamping the latter in place against the under side of the end H′ of the arm H. It is understood that the bracket J has an elongated opening through which extends the flat portion G^2 of the pin G, so that when the pin G is adjusted in the slotted end H′ of the arm H, the bracket J is adjusted with it, so that the bracket J and pin G are always in the same relative position one to the other. On the upper screw thread G^4 screws a nut G^6 abut-

ting against a washer G^7 engaging the top of the slotted end H′ of the arm H, so that by loosening the nut G^6 the pin G can be adjusted transversely in the slotted end H′ of the arm H, to bring the pin in the desired relation relative to the curved surface D′ of the grinding block D. By having the flattened portion G^2 fitting the slot in the end H′ the pin is held against turning, and by the arrangement above described a transverse adjustment of the pin is had to suit existing circumstances. As shown in Fig. 9, the flat portion G^2 of the pin G may be provided with an orifice for the purpose of reducing the weight.

The fulcrum ends or hubs of the arms H are provided with bushings H^3 (see Fig. 4) fitting on the ends of a hub K′ integral with a yoke K, and through the hub K′ extends a hollow bolt K^2 having its head K^3 engaging the outer face of the hub H^2 of one of the arms H, while the nut K^4 of the bolt K^2 engages the outer face of the hub H^2 of the other arm H, and the nut K^4 is locked in place on the bolt K^2 by a jam nut K^5.

Springs H^4 are attached at one end to the yoke K, and the other ends of the springs are provided with notched bars H^5 slidingly engaging bearings H^6 on the arms H, and a pawl H^7 fulcrumed on the corresponding arm H engages the notched bar H^5 to hold the spring H^4 under the desired tension. By the operator engaging the pawl H^7 with any one of the teeth of the bar H^5, the corresponding spring H^4 can be placed under more or less tension, and the tension of the spring is utilized to swing the arm H downward, so as to cause the pin G to press the lens holder F downward and with it the lens E, to insure the proper contact of the under face of the lens with the grinding surface D′ of the grinding block D. Thus by the arrangement above described, the lens E can be held with more or less force in contact with the grinding surface D′.

The yoke K is provided with a transversely-extending arm K^6, engaged near each end by a wrist pin L having a bolt L′ provided with a head L^2 engaging a radial slot N′ formed in a crank disk N, having a depending shaft N^2 mounted to turn in a suitable bearing O′ arranged in a carriage O, mounted to reciprocate in a transverse direction on guideways O^2 attached to the under side of the table B. By the use of the bolts L′ each of the wrist pins L can be adjusted relative to the crank disk N, so as to give more or less throw to the yoke K and consequently more or less throw to the lens holders F and the lenses E.

On each crank disk N is secured or formed a spiral gear N^3 in mesh with a spiral P secured on a transversely-extending shaft P′, journaled in suitable bearings arranged on the carriage O, and on the outer end of the shaft P′ is secured a pulley P^2 connected by a belt P^3 with a pulley P^4 secured on the main shaft P^5 journaled in suitable bearings on the standards A and carrying fast and loose pulleys P^6 connected by belt with other machinery, for imparting a continuous rotary motion to the main shaft P^5. The rotary motion of the shaft P^5 is transmitted by the pulleys P^4, P^2 and the belt P^3 to the shaft P′, which by the two spirals P causes the rotation of the spiral gears N^3, to simultaneously rotate the crank disks N, which by the wrist pins L impart a bodily circular motion to the yoke K and consequently a like movement to the arms H mounted on the said yoke K.

In order to impart a transverse reciprocating movement to the carriage O, the following arrangement is made: On the driven shaft P′ is secured a worm Q in mesh with a worm wheel Q′, having its shaft Q^2 journaled in suitable bearings O^3 formed on the carriage O, and integral with the worm wheel Q′ is a crank disk Q^3 having a radial slot Q^4, into which extends the head R′ of a wrist pin R, on which is mounted a block R^2 mounted to slide in longitudinal guideways B^2 formed on the under side of the table B (see Figs. 3 and 5). Now when the machine is running then the shaft P′ by its worm Q rotates the worm wheel Q′ and the crank disk Q^3, so that the wrist pin R is carried around, but as the wrist pin R is held in the block R^2 it is evident that a transverse reciprocating movement is given to the carriage O, as the latter carries the bearing O^2 for the shaft Q^2 of the worm wheel Q′ and the crank disk Q^3. As the carriage O supports the shaft P′ the spirals P, the spiral gears N^3, crank disks N and consequently the yoke K and the arms H, it is evident that the said parts move bodily with the carriage O, and hence the arms H and their pins G receive a bodily circular motion and simultaneously a bodily transverse sliding motion. It will further be noticed that by driving the crank disks N by the spiral gearing N^3, P from the shaft P′ and by driving the crank disk Q^3 from the said shaft P′ by the worm wheel Q′ and the worm Q, it is evident that a different rate of speed is had for the bodily circular motion and the transverse sliding motion, that is, the gearing for imparting a lateral sliding motion is considerably slower than the gearing for producing a bodily circular motion.

It is understood that by the arrangement described each lens holder F instead of returning to the same point at the end of each lateral motion, it requires a number of such lateral motions and a large number of circular motions to bring the lens holder F back to the same point to complete a circle. By this travel of the lens holders F undesirable scratches and the like on the lenses

E are completely prevented, as the path of the lens holders F is constantly varying and the danger of running in the same road and causing scratches is entirely prevented.

I do not limit myself to the proportion of the gearing above mentioned, as the same may be varied without departing from the spirit of my invention. It is, however, desirable that a similar proportion between the gearing for the circular motion and the gearing for the transverse sliding motion be maintained, so as to produce the best results.

In order to hold either of the arms H in an inactive position, it is only necessary to swing the arm upward into the position shown in dotted lines in Fig. 5, and in order to hold the arm in this inactive position, use is made of a spring-pressed pawl S held on each of the arms and adapted to engage a corresponding notch S′ in the peripheral face of the yoke K.

The yoke K extends through an opening B^3 formed in the table B, and in order to prevent dust and grinding material from passing through the said opening B^3 to the working parts mounted in the carriage O use is made of a covering plate T secured to the yoke K and extending directly over the table B at the opening B^3 to cover the same at all times. A pan U (see dotted lines in Fig. 6) is arranged on the table B at the depression B′ for holding the grit or other grinding substance used for grinding the lenses on the surface D′.

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

1. A grinding machine having a fixed curved grinding surface, a holder for the lens to be ground on the said grinding surface, the holder having a socket, an actuating arm having a pin provided with a ball engaging the said socket, the said pin being adjustable transversely in the end of the actuating arm a yoke to which the actuating arm is pivoted, a transversely reciprocating carriage, the said yoke moving bodily with the carriage, to move the actuating arm transversely, and means for moving the yoke and the actuating arm bodily around in a circle.

2. A grinding machine having a fixed curved grinding surface, a holder for the lens to be ground, the holder having a socket, an actuating device comprising an arm, and a pin provided with a ball engaging the socket in the lens holder, the pin being adjustable transversely in the end of the said actuating arm, a reciprocating carriage, a yoke to which the actuating arm is pivoted, the said yoke moving bodily with the carriage, means for moving the yoke and the actuating arm bodily around in a circle, and means for holding the said holder against turning on its axis, the said means being adjustable transversely with the said pin.

3. In a grinding machine, in combination, a reciprocating carriage, a driven shaft journaled on the said carriage, a pair of crank disks journaled on the said carriage, a yoke traveling bodily with the said carriage, adjustable wrist pin connections between the said yoke and the said crank disks to move the yoke bodily in a circle, actuating arms pivoted on the said yoke, an adjustable pin on each of said arms, work holders having ball and socket joint connections with the said pins, a fixed curved grinding surface over which operate the said holders, and means for preventing each of said work holders from turning on its axis.

4. A grinding machine having a fixed curved grinding surface, a holder for the lens to be ground on the said grinding surface, the said holder being provided with recesses at opposite points on its periphery, an actuating arm having a ball and socket joint connection with said holder, means for carrying the said actuating arm bodily around in a circle, means for simultaneously moving the said actuating arm transversely, a bracket carried by the actuating arm and provided with an eye, and a fork having its members provided with trunnions engaging said recess in the holder, the shank of said fork loosely engaging the eye of said bracket.

5. A grinding machine having a fixed curved grinding surface, a holder for the lens to be ground on the said grinding surface, an actuating arm carrying a pin provided with a ball engaging a socket in the said lens holder, means for carrying the said actuating arm bodily around in a circle, means for simultaneously moving the said actuating arm transversely, a bracket connected with the said actuating arm, and a fork having its shank engaging said bracket, the members of the fork being provided with trunnions engaging recesses at opposite sides of the said holder.

6. In a grinding machine, in combination, a reciprocating carriage, a driven shaft journaled on the said carriage, a crank disk journaled on the said carriage, a yoke traveling bodily with the said carriage, an adjustable wrist pin connection between the said yoke and the said crank disk to move the yoke bodily in a circle, an actuating arm pivoted on the said yoke, a pin on the said arm, a work holder having a ball and socket joint connection with the said pin, and a fixed curved grinding surface over which operates the holder.

7. In a grinding machine, in combination, a reciprocating carriage, a driven shaft journaled on the said carriage, a crank disk journaled on the said carriage, a yoke traveling bodily with the said carriage, an adjustable wrist pin connection between the

said yoke and the said crank disk to move the yoke bodily in a circle, an actuating arm pivoted on the said yoke, a pin on the said arm, a work holder having a ball and socket joint connection with the said pin, a fixed curved grinding surface over which operates the said holder, a spring connected at one end with the said yoke, and an adjustable connection between the other end of the spring and the said actuating arm.

8. In a grinding machine, in combination, a reciprocating carriage, a driven shaft journaled on the said carriage, a crank disk journaled on the said carriage, a yoke traveling bodily with the said carriage, an adjustable wrist pin connection between the said yoke and the said crank disk to move the yoke bodily in a circle, an operating arm pivoted on the said yoke, a fixed table having an opening through which extends the said yoke and the said carriage being arranged below the said table, a curved grinding surface supported on the said table and over which operates the free end of the said actuating arm, and a covering plate attached to the said yoke and covering the said opening to prevent grinding material from passing to the carriage and the operating parts mounted thereon.

9. A grinding machine provided with a pair of crank disks driven in unison and having radial T-shaped slots, wrist pins having bolts provided with heads adjustable in the said slots, a yoke having a transversely extending arm in which the said wrist pins are secured, and a carriage mounted to reciprocate and on which said crank disks are journaled.

10. A grinding machine provided with a pair of crank disks driven in unison and having radial slots, wrist pins held adjustably in the said slots, a yoke in which the said wrist pins are secured, a carriage mounted to reciprocate and on which said crank disks are journaled, a driven shaft journaled on the said carriage, a single crank disk having a radial slot and journaled on the said carriage, a wrist pin adjustably held in the said slot, a block mounted on the said wrist pin, and a fixed guideway slidingly engaged by the said block.

11. A grinding machine provided with a transversely reciprocating carriage, a driven shaft mounted on the carriage, a crank disk mounted on the carriage and driven from the said shaft, the said crank disk having a radial T-shaped slot, an actuating swing arm for the work, a yoke on which the said arm is mounted, the yoke moving bodily with the carriage, and a wrist pin having a bolt provided with a head slidably engaging the said slot of the crank disk.

12. A grinding machine provided with a carriage mounted to reciprocate in a transverse direction, a driven shaft journaled on the said carriage, a crank disk journaled on the said carriage and driven from the said shaft, the said crank disk having a radial T-shaped slot, a wrist pin having a head at its lower end extending into the said slot, a fixed guideway above the crank disk, and a block mounted on said wrist pin and slidable in said guideway.

13. A grinding machine provided with a carriage mounted to reciprocate in a transverse direction, means for reciprocating the carriage, comprising a driven shaft journaled on the said carriage, a crank disk journaled on the carriage and driven from the said shaft, the crank disk having a radial slot, a wrist pin adjustably held in the said slot, a block mounted on the wrist pin, and a fixed guideway slidably engaged by the said block, an actuating arm, a yoke moving bodily with the carriage and carrying said arm, means for moving the yoke bodily around in a circle, the said means comprising a pair of crank disks journaled on the carriage and driven in unison from the said shaft, the said crank disks having radial slots, and wrist pins secured in said yoke and adjustably held in the slots in said crank disks, and a work holder having a ball and socket joint connection with said actuating arm.

14. A grinding machine having a grinding surface, a holder for the lens to be ground on the said surface, the holder having a socket, and an actuating device comprising an arm, having a slot at its end, and a pin adjustable transversely in the said slot and provided with a ball engaging the socket in the lens holder.

15. A grinding machine having a fixed curved grinding surface, a holder for the lens to be ground, the holder having a socket, an actuating arm, a pin provided with a ball engaging the socket in the lens holder, the pin being adjustable transversely in the end of said actuating arm, a bracket through which extends the said pin, the bracket being adjustable with the pin, and means carried by the bracket and engaging the lens holder to hold the said lens holder against turning on its axis.

16. A grinding machine, having a fixed curved grinding surface, a holder for the lens to be ground on the said grinding surface, the holder having a socket, an actuating arm having an elongated slot at its end, a pin provided with a ball engaging the said socket in the holder, the said pin having a flat portion fitting in the elongated slot in the arm and adjustable transversely therein, and means for holding the pin in position.

17. A grinding machine, having a fixed curved grinding surface, a holder for the lens to be ground on the said grinding sur-

face, the holder having a socket, an actuating arm having an elongated slot at its end, a pin provided with a ball engaging the said socket in the lens holder, the said pin having a flat portion adjustably engaging the elongated slot in the actuating arm, a bracket having an opening through which extends the said pin, means for fastening the pin and bracket in position, and a fork in which the said lens holder is hung, the shank of said fork engaging the said bracket.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DELBERT ERMAN PLAISTED.

Witnesses:
GEO. M. JACKSON,
J. M. GAMISCH.