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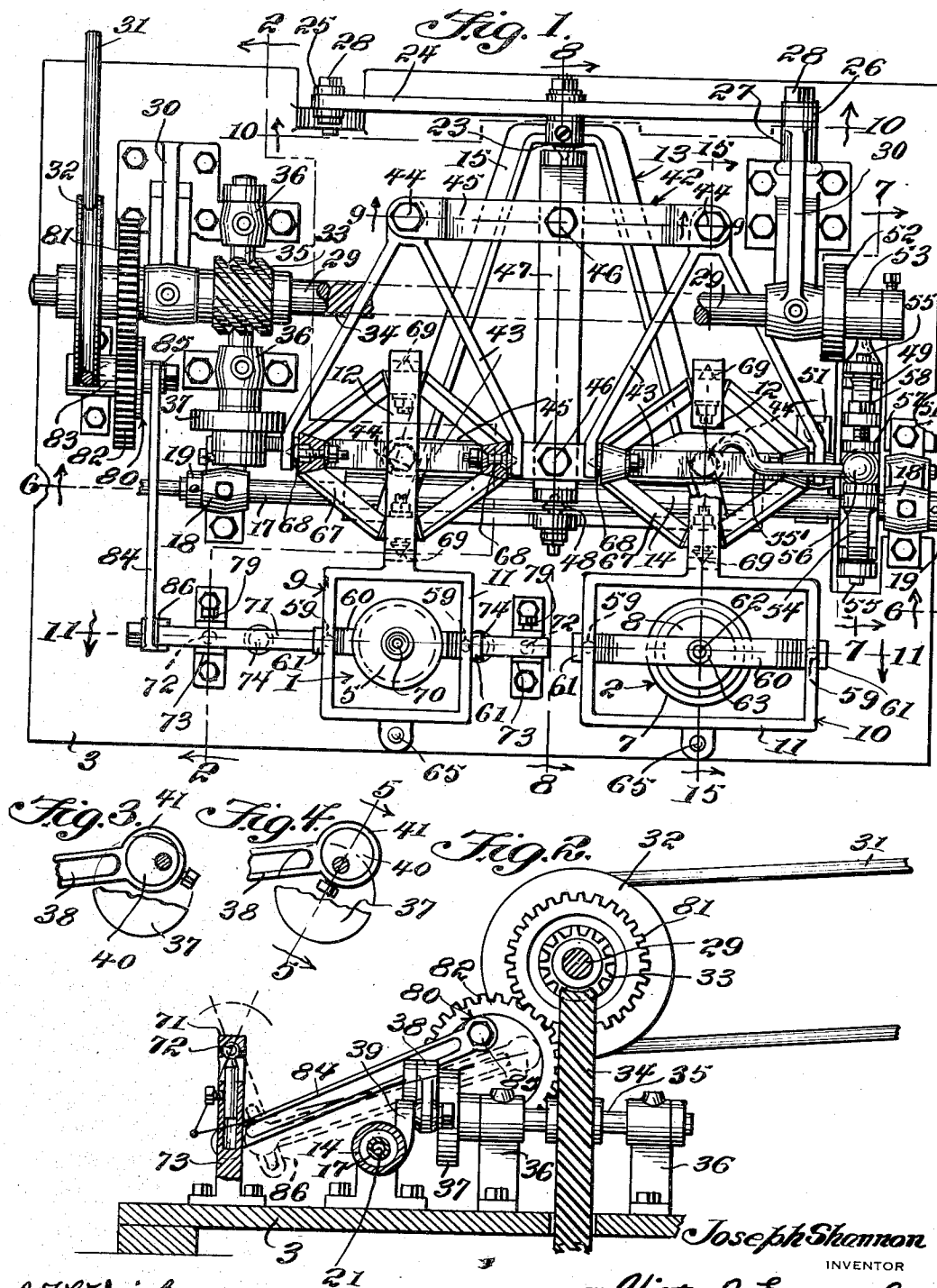
J. SHANNON

2,176,154

LENS GRINDING MACHINE

Filed Dec. 1, 1936

4 Sheets-Sheet 1



J. J. L. Wright  
WITNESS:

Joseph Shannon  
INVENTOR  
BY Victor J. Enns & Co.  
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Oct. 17, 1939.

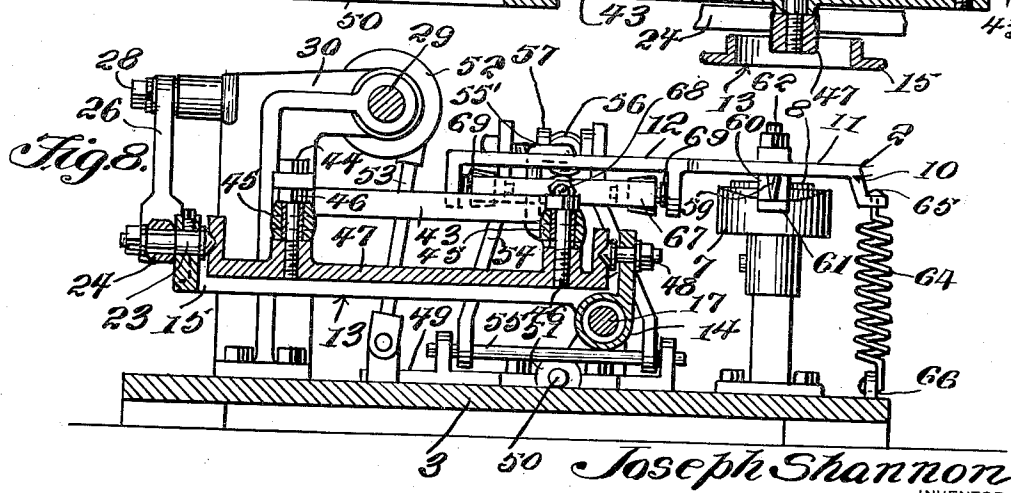
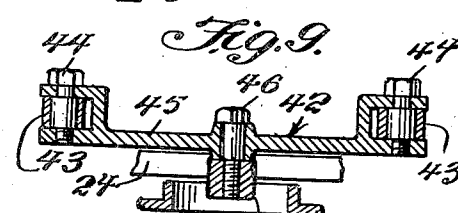
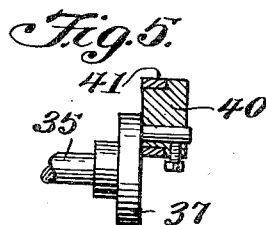
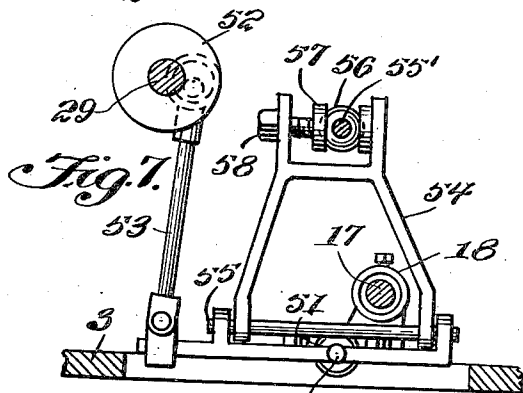
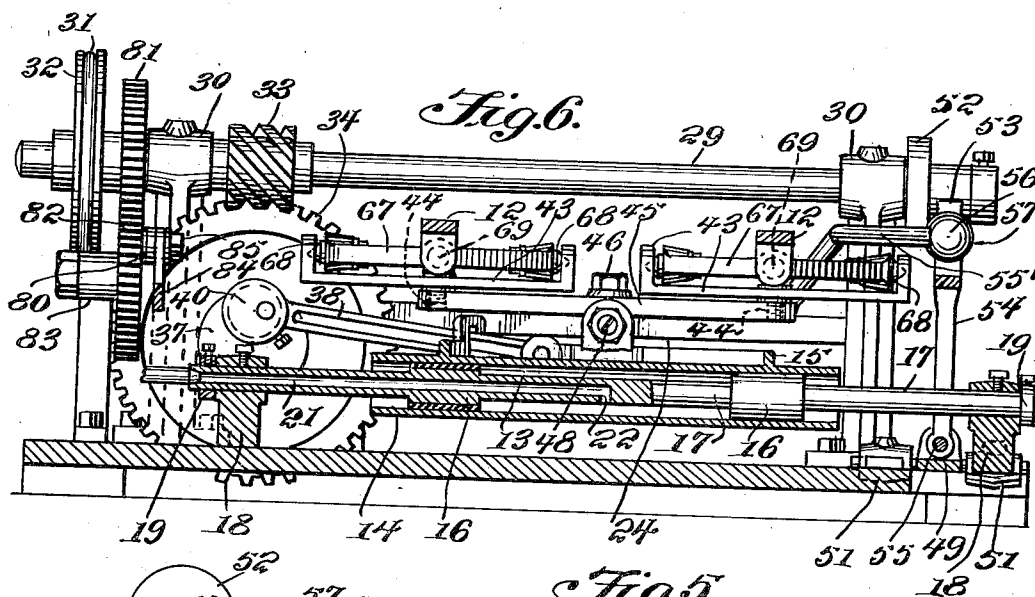
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LENS GRINDING MACHINE

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4 Sheets-Sheet 2



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LENS GRINDING MACHINE

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Fig. 26.

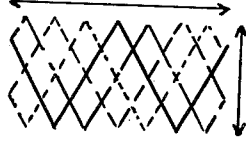


Fig. 10.

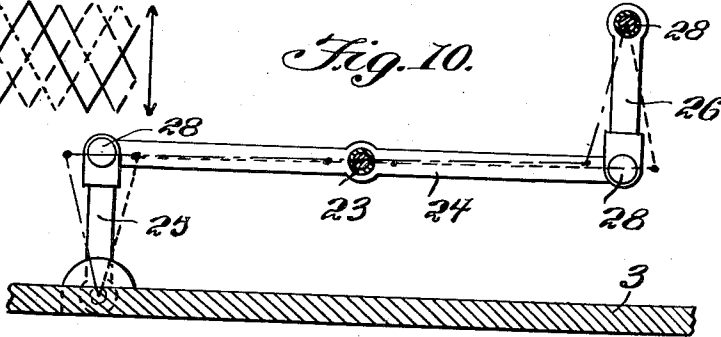


Fig. 15.

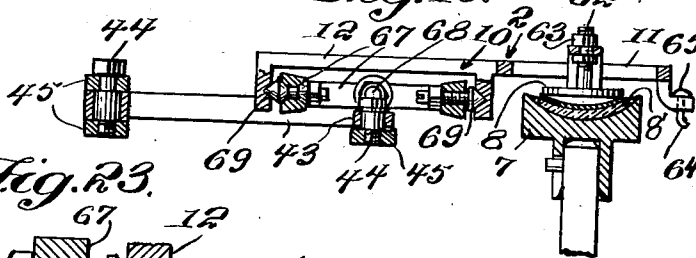


Fig. 25.

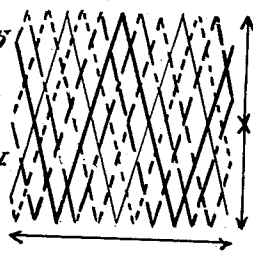


Fig. 23.

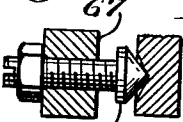


Fig. 16.

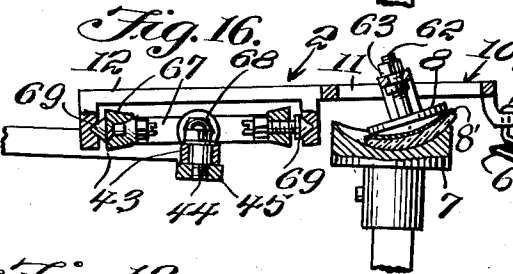


Fig. 17.

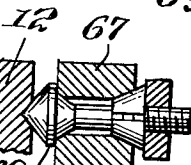
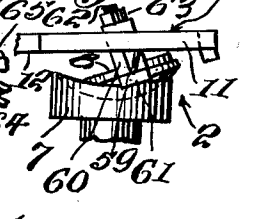


Fig. 18.

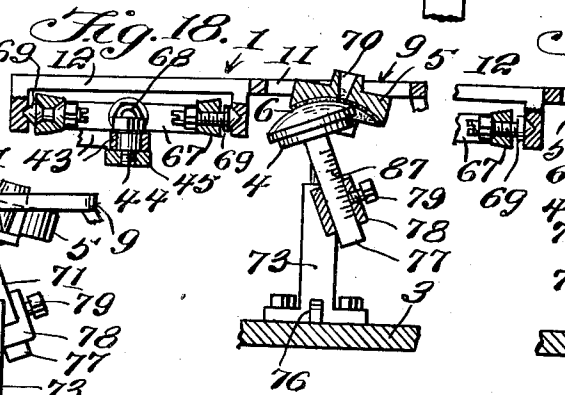


Fig. 19.

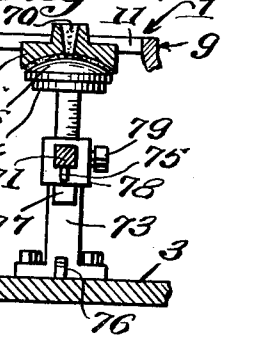
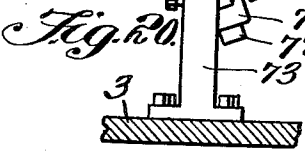
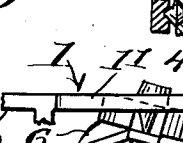


Fig. 24.



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4 Sheets-Sheet 4

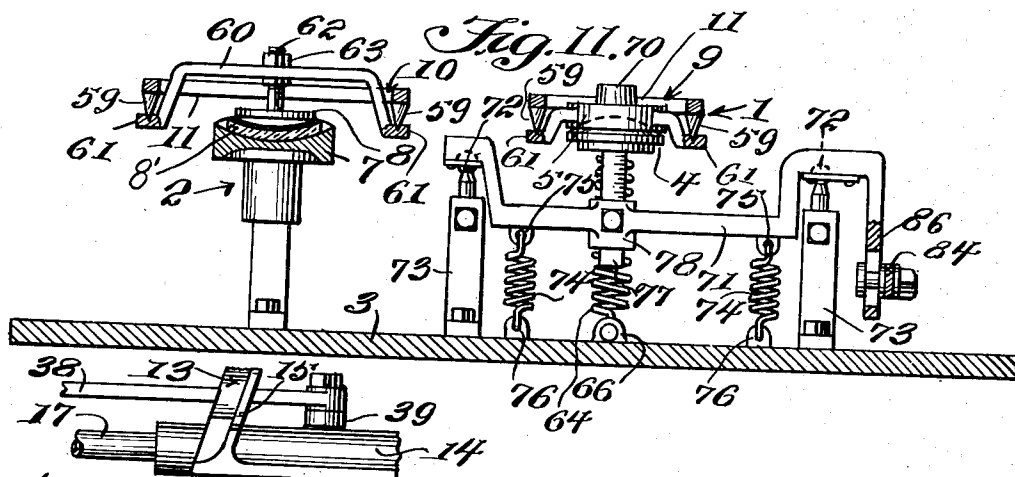
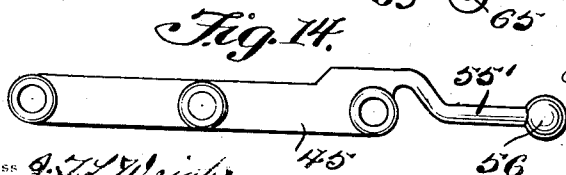
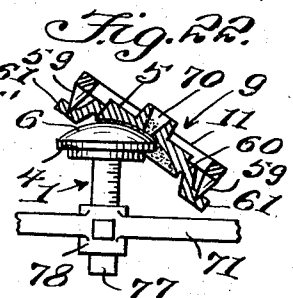
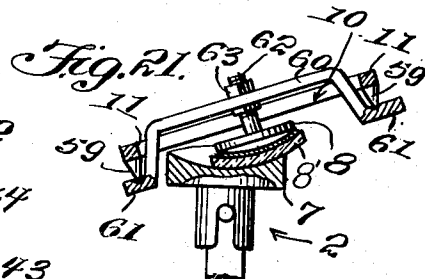
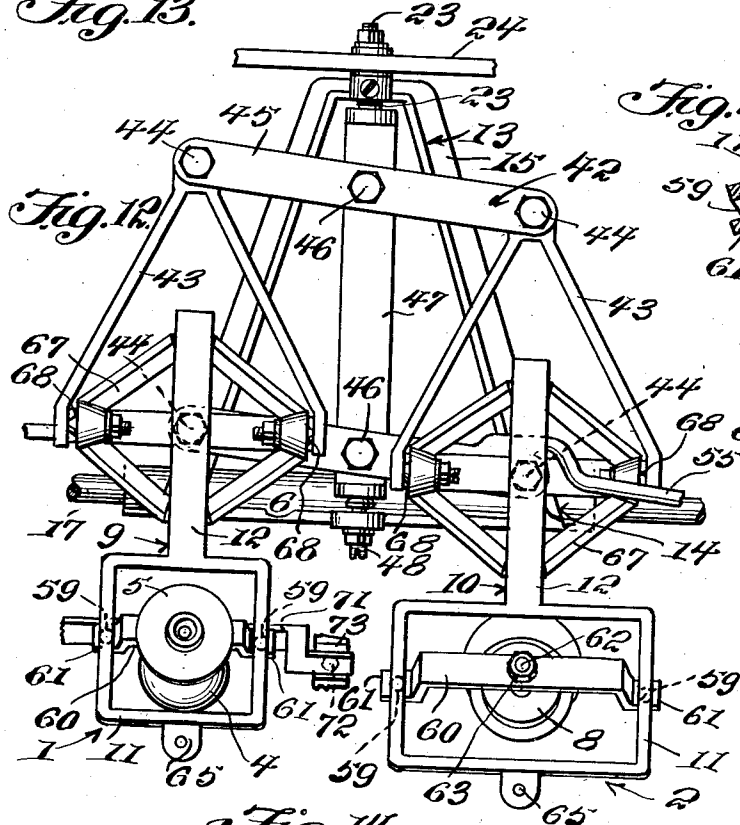


Fig. 13.



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## UNITED STATES PATENT OFFICE

2,176,154

## LENS GRINDING MACHINE

Joseph Shannon, Beaumont, Tex.

Application December 1, 1936, Serial No. 113,684

3 Claims. (Cl. 51—58)

My invention relates to improvements in grinding and polishing machines for producing cylinder lenses.

In machines of this class, as usually constructed, a work support or lens holder and a grinding tool commonly called a lap member, are moved either relatively, or, one with respect to the other, to effect the grinding and polishing operation. The character and direction of movements varies in different makes of machines with more or less satisfactory results but within a limited range or field of operation as regards the cylinder dioptrics which such machines are capable of grinding and polishing accurately on a lens. Moreover, in machines of this class known to me, vibration is excessive, particularly under high speed operation, and frequently results in inaccurately or imperfectly ground lenses.

Having the foregoing in mind, the primary object of my invention is to provide a high speed lens grinding and polishing machine having a wider range of operation than machines heretofore devised for this purpose and in which vibration has been reduced to a negligible degree to render the machine accurate in the high speed operation thereof.

Another object is to provide a machine of the class and for the purpose above set forth adapted for simultaneously grinding and polishing a pair of lenses concave and convex, respectively.

Still another object is to provide a high speed machine for simultaneously driving a lens holder and a lap member over a lap member and a lens holder, respectively, each in different zig-zag paths and with related holders and lap members always in proper axial relation for accurate cylinder grinding.

Still another object is to provide for so-called cap grinding and polishing lenses by movement of a lap member thereover, in a zig-zag path in co-axial relation to the lens and for oscillating the lens with a variable throw to produce surfaces of different cylinder dioptrics on said lenses.

Other and subordinate objects are also comprehended by my invention, all of which, together with the exact nature of my improvements, will be understood as the following description proceeds and upon reference to the drawings accompanying and forming part of the specification.

In said drawings:

Figure 1 is a view in top plan of a machine embodying my improvements.

Figure 2 is a view in transverse section taken

on the line 2—2 of Figure 1 looking in the direction indicated by the arrows.

Figure 3 is a fragmentary view of part of a pitman drive for the machine.

Figure 4 is a similar view of another similar drive with which the machine is equipped.

Figure 5 is a view in transverse section taken on the line 5—5 of Figure 4 looking in the direction indicated by the arrows.

Figure 6 is a view in longitudinal section taken on the line 6—6 of Figure 1 looking in the direction indicated by the arrows.

Figure 7 is a view in transverse section taken on the line 7—7 of Figure 1 looking in the direction indicated by the arrows.

Figure 8 is a similar view taken on the line 8—8 of Figure 1.

Figure 9 is a view in horizontal section taken on the line 9—9 of Figure 1 looking in the direction of the arrows.

Figure 10 is a similar view taken on the line 10—10 of Figure 1.

Figure 11 is another similar view taken on the line 11—11 of Figure 1.

Figure 12 is a detail view in top plan of a reciprocatory carriage and an oscillating carriage thereon forming part of the drive mechanism of the machine.

Figure 13 is a fragmentary view in top plan of a sleeve member and a shaft forming part of the reciprocatory carriage.

Figure 14 is a view in top plan of a rocker arm forming part of the oscillating carriage.

Figure 15 is a view in transverse section taken on the line 15—15 of Figure 1 of a convex lens driving unit.

Figure 16 is a similar view illustrating the operation of said unit.

Figure 17 is a fragmentary view in side elevation of a portion of said unit.

Figure 18 is a view in transverse section of a cap grinding and polishing unit.

Figure 19 is a similar fragmentary view illustrating the parts of said unit in their normal position.

Figure 20 is a view in side elevation of the part shown in Figure 19.

Figure 21 is a detail view in section further illustrating the operation of the convex grinding unit.

Figure 22 is a similar view illustrating the corresponding position in the operation of the machine of the cap polishing and grinding unit.

Figure 23 and 24 are detail views of bearings for said units.

Figure 25 is a diagrammatic view illustrating the operation of the unit, and

Figure 26 is a similar view further illustrating the operation of the cap grinding unit.

Referring to the drawings by numerals, the illustrated embodiment of my invention comprises concave and convex grinding units 1 and 2 respectively, the former, a so-called cap grinding and polishing unit. The two units are arranged side by side on a base 3. The grinding unit 1 comprises a lens support 4, of the usual type, mounted on said base 3, in a manner presently described in detail, and a lap member 5 surmounting the support 4. The support 4 is shown with a lens 6 cemented therein according to the usual way of mounting the lens in the support member. The grinding unit 2 comprises a lap member 7 mounted on the base 3, in a manner presently described, and a lens support or carrier 8 surmounting the lap member 7. The lens 8' is cemented to the support or carrier 8 as shown in Figure 21.

The lap member 5 of the unit 1 and the lens carrier 8 of the unit 2 are mounted in separate frames 9 and 10, respectively, disposed side by side in parallel relation and each comprising a rectangular head part 11 and a rearwardly extending shank part 12. The manner in which the lap member 5 and the lens carrier 8 are mounted in their respective frames, 9 and 10, will presently be referred to in detail. The frames 9 and 10 are mounted on a horizontally reciprocating carriage 13 for reciprocation in unison. The carriage 13 comprises a sleeve 14 having a rearwardly disposed V-shaped extension 15. The sleeve 14 is slidably mounted, on bearing bosses 16, on a horizontally disposed shaft 17 fixed at its opposite ends in brackets 18 arising from the base 3. Set collars 19 on said shaft 17 and set screws 20 in the brackets 18 secure said shaft in position in said brackets. The shaft 17 is bored axially and transversely, as at 21 and 22 respectively, for the introduction of oil through said shaft into the sleeve 14. The extension 15 of the carriage 13 is pivotally mounted by means of a cone bearing stud 23, on a link 24 opposed to the sleeve 14 and pivotally mounted at its opposite ends on a pair of oppositely disposed rocker arms 25 and 26 pivoted on the base 3 and a bearing bracket 27, respectively, as by pivot bolts 28. The arrangement of the link 24 and the rocker arms 25 and 26 is such that the link 24 moves substantially parallel with the sleeve 14.

The carriage 13 is driven from a main drive shaft 29 journaled adjacent its opposite ends, parallel with the shaft 17, in bearing brackets 30 secured to the base 3 in any suitable manner. The main shaft 29 is driven through the medium of a belt and pulley drive, indicated at 31 and 32, by a suitable motor (not shown). A worm 33 fast on the main drive shaft 29 meshes with a worm wheel 34 fast on a short shaft 35 journaled in bearings 36 on the base 3. The short shaft 35 is operatively connected to the carriage 13 by means of a pitman drive comprising a disc 37 fast on said shaft and a pitman rod 38 connected to a lug 39 on the sleeve 14. The connection between the pitman rod 38 and disc 37, as shown in Figures 3 and 5, comprises an eccentric 40 adjustable in a strap 41 for varying the throw of the rod 37, as will be understood.

The frames 9 and 10 are mounted on the carriage 13 for oscillation thereon transversely of their paths of reciprocation by said carriage, in curved paths, respectively, and in opposite di-

rections relative to each other. For this purpose the shank parts 12 of said frames are mounted, by means presently described, on a horizontally disposed oscillating carriage 42. The oscillating carriage 42 comprises a pair of V-shaped yokes 43 pivoted, as at 44, upon the opposite ends of a pair of subjacent parallel links 45 which in turn are pivoted intermediate their ends, as at 46, on a rocker 47. The rocker 47 is pivotally mounted on the carriage 13 between a cone bearing stud 48 on the sleeve 14 and the beforementioned cone bearing stud 23, the arrangement of the rocker 47 being such that the oscillating carriage 42 has a compensating rocking movement vertically about an axis at a right angle to its axes of oscillation.

The carriage 42 is oscillated by means of a yoke member 49 pivotally mounted, as at 50, on the base 3 for vertical rocking movement in bearings 51, on the base 3, and to which the main drive shaft 29 is operatively connected by means of a pitman drive including a disc 52 fast on said shaft and a connecting rod 53 extending between said disc and the yoke. A second yoke member 54 is pivotally mounted, as at 55, on the yoke 49 for vertical rocking movement with the yoke 49 and for independent rocking movement laterally about an axis at a right angle to the common axis of movement of said yoke. The yoke 54 is operatively connected to one of the links 45 of the carriage 42 by means of a rod 55 extending from said link and a ball and socket connection 56 between said rod and the yoke 54. The socket part of the connection 56 comprises a section 57 adjustable in the yoke 54 by means of a set screw 58 to take up wear in the connection and for coupling said connection together. As will be seen, the carriage 42 oscillates arcuately during its reciprocation by the carriage 13. The yoke 54 operates in its independent movement to compensate for such reciprocation during oscillation of said carriage 42. In this connection it is to be noted that the axis of movement of the rocker 47 provides for compensating movement of the carriage 42 under the throw of the yoke 54 during such independent movement thereof.

The lap member 5 and the lens carrier 8 are mounted in the heads 11 of their respective frames, 9 and 10, for swinging movement in the general direction of oscillation of said frames and as follows. The head 11 of each frame, 9 and 10, is provided on its under side with a pair of opposed needle bearings 59. Co-operating with the bearings 59 of each head 11 is a yoke bar 60 having angular ends 61 adapted to seat against said bearings and rock thereon. The lens carrier 8, or the lap member 5, as the case may be, is secured to the under side of said yoke bar intermediate its ends. In the case of the lens carrier 8 a stud 62 on said carrier extends upwardly through the related yoke bar 60 and is adjustably secured therein by nuts 63. The lap member 5 is formed integrally with its related yoke bar 60. A tensioned spring 64 connected with the front of each head 11, as at 65, and to the base 3, as at 66, yieldingly retains the lenses 6 and 8' and the lap members 5 and 7 in engagement, shown in Figures 15 and 20, so that under oscillation of the frames 9 and 10 the lap member 5 and the lens 8' are caused to move in their respective frames 9 and 10 concentrically of the lens 6 and the lap 7, respectively.

The frames 9 and 10 are mounted in their respective yokes 43 for movement of each about right-angularly related axes and as follows. The shanks 12 are supported in their respective

yokes 43 by means of bearing brackets 67. The bearing brackets 67 are each pivotally mounted by cone bearings 68 in their respective yoke 43 for vertical rocking movement about a horizontal axis transverse to the direction of oscillation of said yoke. The shanks 12 of the frames 9 and 10 are pivotally mounted by similar bearings 69 in their respective brackets 67 for lateral movement of the frames 9 and 10 about horizontal axes extending substantially in the direction of the oscillation of said frames. The cone bearings 68 and 69 are each adjustable to take up wear and removable for replacement of parts. By virtue of the described means of mounting the frames 9 and 10 in the yokes 43, the lenses 6 and 8' and the lap members 5 and 7, under the action of the springs 64, are maintained in axial relation during reciprocation of the frames 12 by the carriage 13.

The lap member 5 is provided with an aperture 70 therein for introducing the usual abrasive and grinding material into said lap member without lifting the lap member from off the lens 6.

In the case of the cap grinding and polishing unit 1, the lens support or carrier 4 is mounted for oscillation in the general direction of oscillation of the lap member 5 and with a variable throw. For this purpose the support 4, as shown in Figure 11, is mounted for vertical adjustment on a horizontally disposed rocking yoke 71 mounted to rock vertically at its opposite ends upon spherical bearings 72 on bearing brackets 73 upstanding from the base 3. A pair of tension springs 74 connected at their opposite ends to the yoke 71 and to the base 3, as at 75 and 76, respectively, tension said yoke 71 against movement from a central position. The mounting for the support or carrier 4 on said yoke 71 comprises a shank 77 depending from said support 4 and slidably mounted in a sleeve 78 on said yoke 71 for vertical adjustment of said support to different set positions. A set screw 79 provides for locking the shank 77 and support 4 in different set positions. The yoke 71 is rocked in opposite directions respectively by a pitman drive 80 comprising a pair of reduction gears 81 and 82, the former fast on the drive shaft 29 and the latter mounted in a bearing bracket 83 on the base 3. A pitman rod 84 connected at its opposite ends to a crank pin 85 on the gear 82 and a crank arm 86 on the yoke 71 operatively connects said gearing to said yoke. The oscillating support 4 provides for moving the lens 6 thereon into the lap member 5 so that uniform polishing may be obtained in all meridians of a cylinder. By adjusting the support 4 to different set positions, the throw of the lens thereon may be varied in accordance with the cylinder diopters to be polished. The shank 77 is provided with the graduations 87, Figure 18, which may be appropriately designated to indicate proper settings for the polishing of different cylinder diopters.

From the foregoing it will be manifest that my invention provides a mechanism for moving a lens carrier and a lap, relative to a lap and a lens carrier, with both a reciprocating stroke and an oscillating stroke transverse to the line of movement of the reciprocating stroke, the re-

ciprocating stroke being longer than the oscillating stroke. Preferably the relative timing of the oscillating and reciprocating carriage drives is approximately four to one, so that four oscillating strokes are effected to one reciprocating stroke. The result of this is that the lens carrier and the lap are moved across their related lens carrier and lap in different zig-zag paths, as illustrated in Figures 25 and 26. The short strokes, being in opposed curves, neutralize the vibration so that the machine is easy running at high speed. By adjusting the oscillating support 4, the stroke on this side of the machine may be lengthened or shortened, in accordance with different operating requirements. In this connection it is to be noted that the frames 9 and 10 are always maintained parallel lengthwise, regardless of the size of the oscillating strokes on different sides of the machine, and the lens and the lap carried by said frames prevented from turning axially, which features provides for a high degree of lap accuracy under all conditions.

The foregoing is a detailed description of a preferred embodiment of my invention and it is believed that its operation and advantages will be clear therefrom without further explanation.

It is to be understood, however, that the present disclosure is illustrative rather than restrictive and that right is herein reserved to modifications of details described, and relations of parts, falling within the scope of the claims appended hereto.

What I claim is:

1. A lens grinding and polishing machine comprising a base, a lens support, a lap member, a frame surmounting said support, a second frame surmounting said member, means for reciprocating said frames, a pair of V-shaped yokes connected one to each frame, means connecting said yokes together whereby to effect simultaneous oscillation thereof, and means connected to at least one of said yokes to effect oscillation of said yokes.

2. A lens grinding and polishing machine comprising a base, a lens support, a lap member, a frame surmounting said support, a second frame surmounting said member, means for reciprocating said frames, a pair of V-shaped yokes connected one to each frame, means connecting said yokes together whereby to effect simultaneous oscillation thereof, and operating means connected to said yokes in such a manner that the degree of oscillations may be varied relative to the reciprocation of said frames.

3. A lens grinding and polishing machine comprising a base, a lens support, a lap member, a frame surmounting said support, a second frame surmounting said member, means for reciprocating said frames, a pair of V-shaped yokes connected one to each frame, means connected to one of said yokes for oscillation thereof, and means connected to the convergent ends of said yokes whereby to effect oscillation of the other of said yokes coactive with the oscillation of said one yoke, the oscillation of said other yoke being reverse from the oscillation of said one yoke.

JOSEPH SHANNON.