July 16, 1940. L. L. HOUCHIN 2,208,527

APPARATUS FOR PRODUCING ONE-PIECE MULTIFOCAL OPHTHALMIC LENSES

Filed June 14, 1939 2 Sheets-Sheet 1

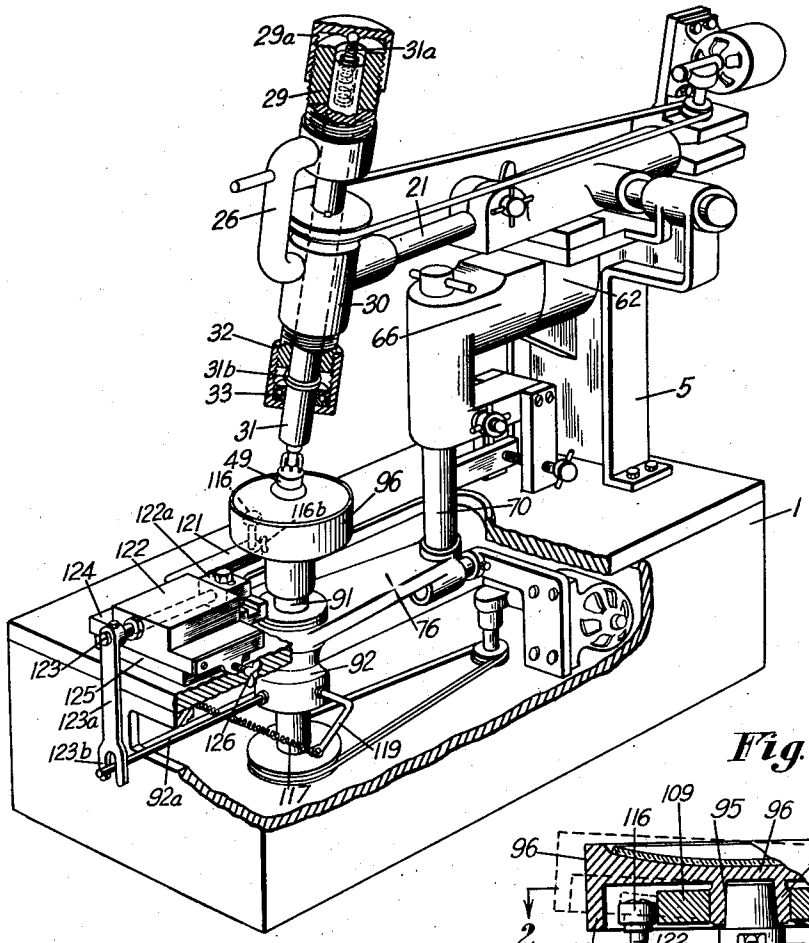

Fig. 1

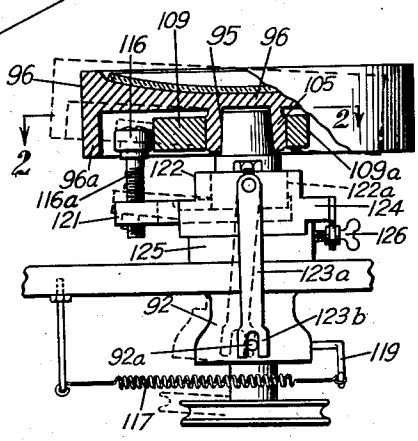

Fig. 3

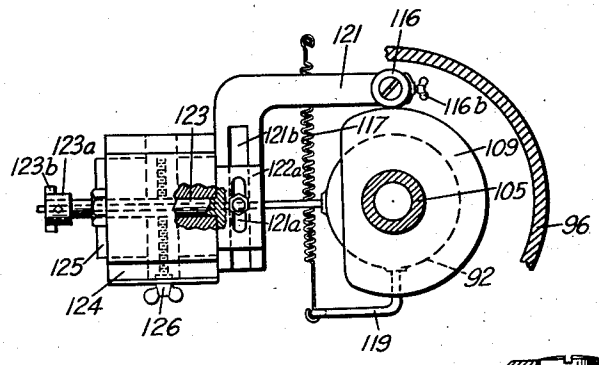

Fig. 2

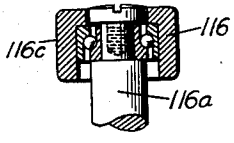

Fig. 4

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APPARATUS FOR PRODUCING ONE-PIECE MULTIFOCAL OPHTHALMIC LENSES

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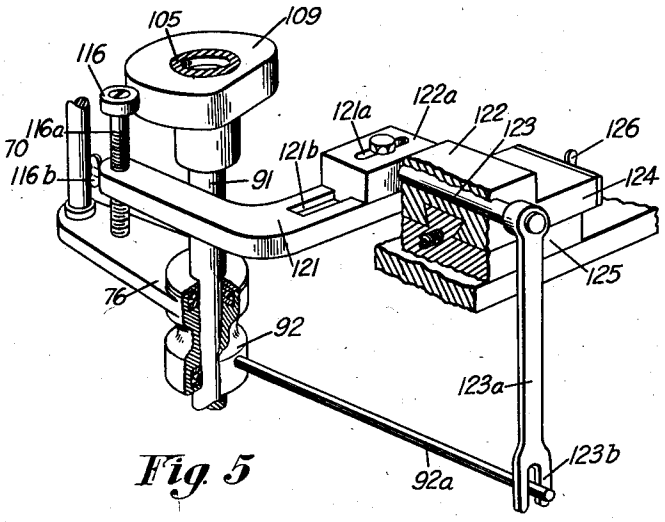

Fig. 5

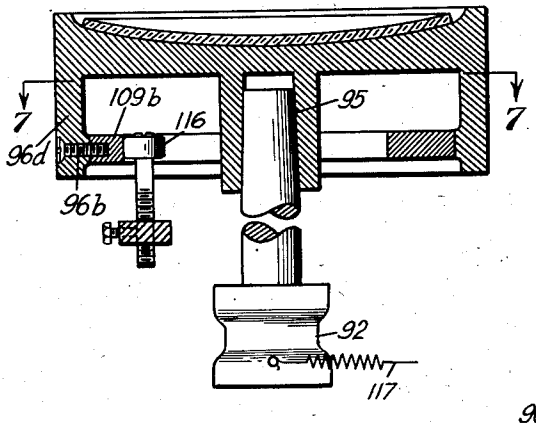

Fig. 6

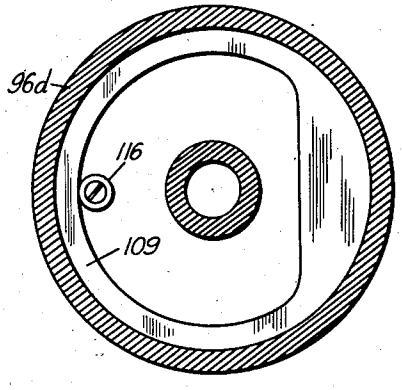

Fig. 7

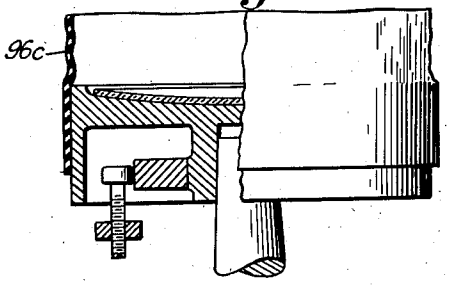

Fig. 8

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Patented July 16, 1940

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UNITED STATES PATENT OFFICE

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APPARATUS FOR PRODUCING ONE-PIECE MULTIFOCAL OPHTHALMIC LENSES

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Application June 14, 1939, Serial No. 279,155

8 Claims. (Cl. 51—127)

My invention relates to apparatus for producing one-piece multifocal ophthalmic lenses. It relates, more particularly, to a novel apparatus for producing one-piece bifocal lenses, although it is also applicable to the production of one-piece lenses having more than two fields of vision.

This invention is particularly applicable to that type of machine disclosed in my prior Patent No. 2,087,687 which issued July 20, 1937.

The machine disclosed in my said prior patent consists mainly of an abrading tool adapted to contact with the surface of the lens blank mounted on a lens blank carrier, which is rotatably mounted on the machine. This abrading tool rotates about its own axis and is located at one side of the center of the lens blank carrier. The lens blank carrier is also mounted for oscillating or swinging movement about a horizontal axis relative to the abrading tool. Means is provided for effectively and positively controlling this movement. This means takes the form of a cam of proper outline which it attached directly to the lens blank carrier. This cam is held in resilient contact with a flanged roller. When the carrier rotates, the cam contacting with the flanged roller will produce movement of the lens blank carrier relative to the abrading tool. By moving the lens blank carrier in this manner relative to the abrading tool, the abrading tool is caused to trace a closed non-circular path on the lens blank, producing a non-circular outline on the inner area of the lens blank. The outline produced will depend upon the shape of the cam which is used and it is possible to use practically any desirable shape. Because of the fact that the cam is mounted directly on the lens blank carrier, it is possible to remove the carrier and the lens blank, from time to time, for the purpose of inspecting the lens blank, and to replace the carrier and lens blank without altering the relative position of the lens blank and the cam, thereby eliminating any chance of error due to misalignment. The flanged roller with which the cam contacts is automatically vertically adjustable to compensate for movement of the cam in an arc caused by the swinging movement of said lens blank carrier about the horizontal axis.

The machine disclosed in my said prior patent has been used successfully in making lenses according to the method disclosed in said patent. This machine has a large number of advantages. However, I have found it desirable to change the location of the cam which controls relative movement of the tool and the lens blank carrier. According to the present invention, the cam is located beneath the lens blank carrier in such a position that it will be completely covered and protected from the abrasive used in the grinding and polishing operations.

I have also found it desirable to provide means on this machine for positively moving the roller, which contacts with the cam, vertically in order that it will flatly contact with the edge of the cam at all times during the swinging movement of the cam. In the machine disclosed in my prior patent, the roller is moved vertically merely by contact between the flanged roller and the cam. I have found that with this structure the flanged roller and the cam bind and also that the cam is worn by the flanged roller producing inaccuracies in the lens blank. According to the present invention, I use a flat roller and provide a connection between the support for the lens blank carrier and the support for the roller which causes positive vertical movement of the roller in accordance with the swinging movement of the support for the carrier. This insures that the roller will firmly and flatly contact with the edge of the cam at all times during the swinging movement of the cam. Thus, extreme accuracy of the outline of the inner segment of the lens blank will result.

The preferred embodiment of my invention is illustrated in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view, partly broken away, illustrating a machine in which my invention has been incorporated.

Figure 2 is a plan view of the means for controlling the vertical position of the roller which contacts with the cam.

Figure 3 is a view partly in section and partly in side elevation illustrating the location of the cam and also showing the means for controlling vertical movement of the roller.

Figure 4 is a detail partly in section and partly in side elevation showing the roller.

Figure 5 is a perspective view, partly broken away, of the structure shown in Figure 2.

Figure 6 is a vertical sectional view showing a modified cam arrangement.

Figure 7 is a horizontal sectional view taken along line 7—7 of Figure 6.

Figure 8 is a view partly in section and partly in side elevation showing how an abrasive retaining sleeve may be disposed in the carrier without interference with the cam.

With reference to the drawings, in Figure 1

I have illustrated a machine for grinding and polishing lens blanks which in its general structure is practically identical with that disclosed in my prior Patent No. 2,087,687. Therefore, it will not be necessary to describe this machine in detail.

This machine is adapted to be used in performing the method described in my patent. It will perform the grinding and polishing operations on the lens blank having the central depressed circular area and will result in the changing of the circular inner area to an area of any desired non-circular outline and will simultaneously finish the outer area to the desired curvature.

The machine consists generally of a base 1 which carries a vertical standard 5 at its rear end. On the upper end of the standard 5, a tool supporting structure 21 is hinged so that it may be swung in a vertical plane. This structure 21 carries a depending spindle 31 on its forward end which, in turn, supports an abrading tool 49 on its lower end. The abrading tool 49 is preferably of the "free" type disclosed in my patent although it may be rigidly mounted on the lower end of the spindle.

The spindle 31 is rotatably carried in bearing members 29 and 30 carried by yoke 26. The spindle 31 may also move vertically in these bearings 29 and 30. It is normally forced downwardly by a compression spring 31*a* extending into a socket in the upper end thereof and bearing against a cap 29*a* through a ball thrust bearing, the cap 29*a* being threaded on bearing 29. By adjusting cap 29*a*, the effective force of the spring may be varied. The bearing 30 has a sleeve 32 threaded on its lower end. This sleeve 32 carries at its lower end a ball bearing 33. A stop 31*b* is provided on the spindle 31 and when the spindle 31 reaches its lowermost position, the stop 31*b* will contact with the upper surface of bearing 33. By rotating sleeve 32 the lowermost limit of the spindle 31 may be varied. Thus, with this structure, the spindle 31 may be set to grind the lens blank to a predetermined depth and then the grinding operation will be automatically interrupted.

The standard 5 carries a bearing 62 adjacent to its upper end. As disclosed in my said patent, a pivot pin is disclosed in the portion 62 and extends into a member 66 which receives the upper end of a rod 70. The rod 70 extends downwardly through an opening in the base plate to a point below the base plate. The lower end of this rod carries a horizontal arm 76. The forward end of the arm 76 carries a ballbearing 92 in which a shaft 91 is rotatably mounted. The upper end of the shaft 91 is tapered as indicated at 95 in Figure 3 for the reception of a tapered chuck 105 formed on a lens blank carrier 96. It will be apparent that the lens blank carrier 96 is so supported that it may be swung about a horizontal axis, namely, the axis of the pivot pin connecting portion 62 and 66 together. The lens blank carrier and the abrading tool will be rotated by the mechanism shown and described in my patent.

The cam means which I provide according to this invention for controlling the movement of the lens blank carrier relative to the abrading tool and the lens blank carrier associated therewith will now be described in detail.

As previously indicated, the lens blank carrier 96 is provided with a centrally disposed chuck 105. This chuck has a tapered socket within which the upper tapered end 95 of the shaft 91 is adapted to fit. The lens blank carrier 96 is provided with a depending peripheral flange 96*a*. A cam 109 is provided which has an opening of such size that it will fit over the chuck 105. It is preferably shrunk on the chuck so that it will always be the same position relative to the carrier 96. Thus, the cam 109 will always occupy a certain position relative to the lens blank mounted on the carrier 96. The cam 109 may be of any required outline. It will be noted that it is disposed beneath the carrier 96 and between the flange 96*a* and the chuck 105 thereof. Thus the cam 109 will be completely protected from the abrasive used in the grinding and polishing operations.

It is highly desirable to have the cam 109 attached directly to the lens blank carrier 96 since, with such a structure, it will be possible to remove the lens blank carrier 96, from time to time, during the abrading operation for inspection of the lens blank mounted thereon. The carrier 96 may be placed on one machine for grinding and another for polishing without danger of misalignment of the cam 109 and lens blank. When the lens blank carrier 96 is removed, the cam 109 is also removed and its position on the lens blank carrier 96 will not be changed. Thus, the cam 109 will always occupy a certain position relative to the lens blank on the carrier 96. Therefore, the blank may be inspected merely by removing the lens blank carrier 96 from its spindle 91 and, when the carrier 96 is replaced after inspection, there will be no danger of error, due to misalignment of the cam 109 and lens blank. Obviously, slight misalignment would be fatal to the operation.

The cam 109 is always held in contact with a roller 116 by means of a spring 117 which has one end attached to the base of the machine and the other end attached to a member 119 carried by the bearing 92 which supports shaft 91. Instead of spring 117 a weight may be employed. The roller 116 is mounted in such a manner that its axis will be in the plane of oscillation of the axis of the shaft 91 which carries the lens blank carrier 96. The roller 116 is so mounted that its axis will always be substantially the same distance from the axis of the shaft 91 and will always be substantially parallel thereto. The roller 116 is disposed in contact with the edge of the cam 109 and is located in the space between the edge of the cam 109 and the peripheral flange 96*a* of the carrier 96. Thus both the roller 116 and the edge of the cam 109 will be protected from abrasive which would cause wear and produce inaccuracy.

The roller 116 preferably is of the ballbearing type, as indicated in Figure 4. This roller 116 is a flat roller and is carried on the upper end of a pin 116*a* which is threaded for vertical adjustment through an opening in the outer end of the arm 121 (Figure 5). The pin 116*a* is held in adjusted position by means of a set screw 116*b*. The member 121 is substantially L-shaped. The inner end of this arm 121 is connected by a cap screw and slot connection 121*a* to a block 122*a* which has a depending guide portion fitting in guide slot 121*b* formed in member 121. This block 122*a* is keyed to a pivot pin 123 which extends through an opening in a block 122. The block 122 is carried by a slide 124 which is mounted on a slideway 125 in the usual manner. Knob operated screw mechanism 126 is provided for adjusting slide 124 along member 125. This adjustment is used to vary the position of the roller 116 rela-

tive to the horizontal axis about which the cam 109 swings. It can be used to position the edge of the tool 49 at the edge of the previously formed circular depressed inner area of the lens blank as described in my prior patent, regardless of the size of such area. The pivot pin 123 preferably has its axis in the same vertical plane as the axis of the shaft 91, and in the same horizontal plane as that occupied by cam 109. The distance from the pivot pin 123 to the roller carrying pin 116a may be varied by adjustment of member 121 relative to member 122a through the medium of the cap screw and slot connection 121a. This adjustment will vary the radius of the swinging movement of the roller 116 about the axis of the pin 123 which movement is brought about in the manner now to be described.

As previously indicated, it is desirable to have the flat face 116c of the roller 116 always in firm and flat contact with the flat edge 109a of the cam 109. To accomplish this it is necessary to maintain the axis of the roller 116 substantially parallel with the axis of the shaft 91 at all times during the swinging movement of the cam 109 which is carried by the lens blank carrier 96. This is accomplished by means of a depending arm 123a which has its upper end keyed to the outer end of the pin 123. The lower end of the arm 123a has a yoke 123b formed thereon which straddles the outer end of a rigid rod 92a. This rod is carried by the bearing member 92.

It will be apparent that when the cam 109 is rotated, due to rotation of the carrier 96, since it contacts with the roller 116, the lens blank carrier 96 will be moved laterally and will swing around the axis of the pin connecting members 62 and 66. Movement of the lens blank carrier and its associated parts will cause lateral movement of rod 92a. This will cause the lower end of the arm 123a to swing, rotating the pin 123 in the member 122. This, in turn, will cause upward or downward swinging movement of the roller carrying arm 121 about the axis of the pin 123. Thus, vertical and arcuate movement of the roller 116 will be produced. This will maintain the axis of the roller 116 and the axis of the shaft 91 substantially parallel. Consequently, this will insure that the cam 109 and the roller 116 will contact flatly and firmly with each other at all times even during the swinging movement of the cam 109.

In Figures 6 and 7, I show a different arrangement of the cam. In this instance the cam 109b is secured to the inner surface of the flange 96d by screws 96b. The cam is substantially ring shaped and the roller 116 will bear against the inner edge of the cam 109b rather than the outer edge. However, the structure will function substantially as before.

The cam is attached to the lens blank carrier in both forms which I show. In each instance, however, the cam is a separate part and can be machined and hardened separately. In both instances the cam is located where it will be protected. Also in both instances the cam is so located that it will not interfere with the positioning of a rubber sleeve 96c around the carrier which is preferably used for retaining the rouge solution on the lens blank during the polishing operation.

It will be apparent from the above description that this invention will result in a number of advantages. Due to the fact that the cam is located beneath the lens blank carrier and is completely covered thereby, there will be no danger of the abrasive used in the grinding and polishing operation passing between the edge of the cam and the roller with which it contacts. Also, due to the connection which I provide between the carrier support and the roller support, the roller will be moved positively in a vertical direction through an arc such that it will always firmly and flatly contact with the edge of the cam. Due to these improvements which form the basis of this invention, extreme accuracy is insured in producing lenses according to the method disclosed in my prior patent.

Having thus described my invention, what I claim is:

1. Apparatus for producing lens blanks comprising a lens blank carrier, an abrading tool member normally disposed in position to work upon the upper surface of a lens blank mounted upon said carrier, said lens blank carrier being provided with a depending peripheral flange and a depending centrally disposed sleeve-type chuck, means for producing relative movement between said lens blank carrier and said tool member, said means comprising a cam disposed in surrounding relationship to said chuck member and within said flange, and a follower member disposed between the edge of the cam and said flange.

2. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier and being rotatable therewith, a roller with which the cam always contacts, said roller being carried by an arm, said arm being carried by a pivot pin which is rotatably mounted so that the arm may be moved about the axis thereof in a vertical plane, the axis of the roller being in alignment with the axis of the cam, said pivot pin having an arm secured thereto for producing rotation thereof, and a member carried by said lens blank carrier support and connected to said last-named arm for swinging it in accordance with the movement of said support to move said pivot pin about its axis so as to move said roller supporting arm in order to maintain the axis of the cam and the axis of the roller substantially parallel with each other at all times.

3. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier and being rotatable therewith, a roller with which the cam always contacts, said roller being carried by a substantially L-shaped arm adjacent one end thereof, said arm having its opposite end secured to a pivot pin which is rotatably mounted so that the arm may be moved about the axis thereof in a vertical plane, the axis of the roller being in alignment with the axis of the cam, said pivot pin being in alignment with the axis of the cam at a point located substantially ninety degrees

from said roller, said pivot pin having an arm secured thereto for producing rotation thereof, and a member carried by said lens blank carrier support and connected to said last-named arm for swinging it in accordance with the movement of said support to move said pivot pin about its axis so as to move said roller supporting arm in order to maintain the axis of the cam and the axis of the roller substantially parallel with each other at all times.

4. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the surface of a lens blank mounted upon said member, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier and being rotatable therewith, a roller with which the cam always contacts, said roller being carried by a substantially L-shaped arm adjacent one end thereof, said arm having its opposite end secured to a pivot pin which is rotatably mounted so that the arm may be moved about the axis thereof in a vertical plane, the axis of the roller being in alignment with the axis of the cam, said pivot pin being in alignment with the axis of the cam at a point located substantially ninety degrees from said roller, said pivot pin having an arm secured thereto for producing rotation thereof, and a member carried by said lens blank carrier support and connected to said last-named arm for swinging it in accordance with the movement of said support to move said pivot pin about its axis so as to move said roller supporting arm in order to maintain the axis of the cam and the axis of the roller substantially parallel with each other at all times, said pivot pin being carried by a support which is adjustable in a direction at right angles thereto.

5. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier and being rotatable therewith, a follower with which the cam always contacts, said follower being carried by an arm, said arm being carried by a pivot pin which is rotatably mounted so that the arm may be moved about the axis thereof in a vertical plane, said pivot pin having an arm secured thereto for producing rotation thereof, and a member carried by said lens blank carrier support and connected to said last-named arm for swinging it in accordance with the movement of said support to move said pivot pin about its axis so as to move said follower supporting arm in order to maintain the cam and the follower in proper contact at all times.

6. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier support and being rotatable, a follower with which the cam always contacts, said follower being carried by an arm, said arm being supported independently of the support for the lens blank carrier in such a manner that it may be swung in a vertical plane, means for swinging said arm in accordance with the movement of said lens blank carrier support in order to maintain the cam and the follower in proper contact at all times, said means comprising a lever connected to said arm, and a member carried by said lens blank carrier support and connected to said lever for swinging it in accordance with the movement of said lens blank carrier support.

7. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, a tool member normally disposed in position to work upon the surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier support and being rotatable, a follower with which the cam always contacts, said follower being carried by a support independent of the support for the lens blank carrier which may be moved in a vertical plane, means for moving said follower support in accordance with the movement of said lens blank carrier support in order to maintain the cam and the follower in proper contact at all times, said means comprising a pivoted lever connected to said follower support so as to produce vertical movement thereof, and a member carried by said lens blank carrier support and connected to said lever for swinging it in accordance with the movement of said lens blank carrier support.

8. Apparatus for producing lens blanks comprising a lens blank carrier, said carrier being rotatable, an abrading tool member normally disposed in position to work upon the upper surface of a lens blank mounted upon said carrier, a support for said lens blank carrier mounted for swinging movement about a horizontal axis in a vertical plane relative to said tool member, means for causing said support to swing about said axis, said means comprising a cam carried by the lens blank carrier and being rotatable therewith, said lens blank carrier being provided with a depending flange and said cam being disposed within said flange, a roller with which the cam always contacts, said roller being carried by a pivoted support, means for moving said roller support about its pivot in accordance with the movement of said lens blank carrier support in order to maintain the cam and the roller in proper contact at all times, said means comprising a mechanical connection independent of the cam and the roller for connecting the roller support and the lens blank carrier support together.

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