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MEANS OF CHUCKING THIN EDGE LENSES

Filed April 16, 1952

Fig. 1

Fig. 2

Fig. 3

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2,688,220
MEANS OF CHUCKING THIN EDGE LENSES
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Application April 16, 1953, Serial No. 282,566

7 Claims. (Cl. 51—235)

The present invention relates to a lens abrading apparatus, and more particularly to a means for chucking thin edge lenses for the abrading operation. The specific problem is to chuck condenser lenses that have one molded surface. In many cases the molded surface is warped and thus affords a poor seating surface.

In the grinding and polishing processes, it is necessary to move the lens from one chuck to another, therefore, it is desirable to have some simple method of holding the lens in the chuck. It has been prior practice to hold the lens in the chuck by means of vacuum, but it is found that if the lens does not fit the seat properly, coolant is sucked into the vacuum lines. Such coolants contain rouge and other valuable ingredients. Obviously, therefore, it is desirable to prevent the loss thereof into the vacuum lines. In an attempt to reduce this loss of coolant, a small pad was placed under the lens to protect the lower molded surface thereof. While this arrangement was somewhat of an improvement, it was still found to be unsatisfactory as it did not properly seat the lens as the lower surface thereof was aspherical and often warped and contained high spots. Also, the lens was not seated at the edge and was not held firmly, with the result that the lens would spin relative to the chuck during the abrading operation. In addition, it was found that such a pad was not sufficient to withstand polishing pressures, and the lens would shift and/or rotate, causing chipping of the lens edges.

In order to overcome these disadvantages, the present invention provides an annular seating ring on which the lens rests at its edge. Also, a suction cup occupies the space between the bottom of the lens and the chuck recess, as shown in Fig. 2, and later to be more fully described. The particular composition of the cup depends upon the material employed in the coolant, as will be readily appreciated by those in the art. This suction cup forms a seat against the chuck thus preventing the coolant from passing and to prevent relative rotation or movement of the lens. The lens and cup may be held down by the force of grinding or polishing. However, it is preferred to employ vacuum to hold the lens in tight engagement with the cup; and, in turn, to hold the latter tight against the chuck recess to provide a fluid-tight seal which will effectively prevent loss of coolant to the vacuum system, and will firmly yet yieldably retain the lens against movement relative to the chuck.

The present invention has as its principal object, the provision of a sealing arrangement which prevents loss of coolant to the vacuum system.

Still another object of the invention is the provision of a sealing means which holds the lens tightly in place and prevents rotation of the lens relative to the chuck to prevent chipping and/or damage to the lens.

Yet another object of the invention is the provision of a sealing means of the class described which is simple in structure, comprises few parts of rugged construction, easy to assemble and highly effective in use.

To these and other ends, the inventive idea resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is an exploded perspective view of a lens chuck and the sealing means of the present invention.

Fig. 2 is a longitudinal or axial sectional view through a lens chuck and its drive spindle, showing the relation thereto of the sealing means of the present invention.

Fig. 3 shows an axial sectional view through the chucking arrangement used prior to the present invention.

Similar reference numerals throughout the various views indicate the same parts.

Fig. 3 shows a lens chucking arrangement used prior to the present invention. A chuck body 11 is formed with an inclined recess 12, the upper portion of which is formed with a vertical annular flange 13 adapted to receive the edge 14 of the lens 15. The chuck is formed with a depending pilot stem 16, which is adapted to be inserted in a hollow drive spindle 17 and connected to the latter in any suitable and well known manner, such, for example, by means of a dowel pin 18 carried by spindle 17 and engaging in a registering opening 18 in the chuck. In order that the chuck can be rotated to abrade the upper surface 28 of the lens, the spindle 17 is rotated in any suitable and well known manner. The lower molded surface 20 of the lens 15 extends into the recess 12, as shown in Fig. 3. The lens 15 was held in the chuck 11 by vacuum. To secure this result, the bottom 21 of the spindle was formed with an opening 22 which was connected to a suitable source of vacuum, such, for example, as a vacuum pump 23. In order that the vacuum could be effective in holding the lens in place in the chuck, the stem 16 thereof was formed with an axial hole 24 which connected the open-
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In order to protect the lower molded surface 20 of the lens against damage, a small flat pad 27 was placed under the lens 15 between the annular slot 22 and the bottom 26 of the recess, as shown in Fig. 3.

In order to protect the lower molded surface 20 of the lens against damage, a small flat pad 27 was placed under the lens 15 between the annular slot 22 and the bottom 26 of the recess, as clearly indicated in Fig. 3. It was found that due to the warped or aspherical nature of the lower surface 20, the lens was not properly seated, particularly at the edges, and that the pad 27 did not provide the desired seal. Also, this arrangement did not hold the lens firmly, but permitted the lens to rock and/or spin relative to the chuck during the abrading operation. Also, the pad 27 did not withstand the polishing pressures employed, with the result that the edges of the lens often became chipped or broken.

In order to overcome these disadvantages, the lens sealing and supporting means, illustrated in Figs. 1 and 2, were developed. This sealing means comprises a dish-shaped suction cup 30 placed in the recess 12 with its edges resting on the bottom 26 of the recess, and the upper surface 32 of the cup engaging the molded surface 20 of the lens near the outer periphery 33 of the cup, as clearly illustrated in Fig. 2. The upper edge of the recess 12 is formed with an annular slot 34 in which an annular sealing ring 35 is positioned. This ring 35 serves as a seat and support for the lens 15 adjacent the edge 14 thereof. When such ring is new, it will afford somewhat of a seal around the edges of the lens. However, it is found that such ring may become damaged and/or deformed in use, but even in its deformed condition it will still be effective to seal the lens accurately although it may not afford the desired seal. Also, the use of the sealing ring 35 will effectively prevent the lens from spinning relative to the chuck during the abrading operation.

The cup 30 has depending therefrom, a stem 36 which extends into a central opening 37 in a pilot stem 38 of the chuck 14a. Stem 36 fits loosely in the opening 37 and serves to position the cup 30 on the recess bottom 26. If desired, the stem 36 may be made of the same material as the cup, but is preferably formed of brass and secured to the cup by a threaded or other similar member 39. As the stem 36 fits loosely in opening 37, any vacuum applied to the hole 22 by means of the vacuum pump 23 will evacuate the space between the stem 36 and the wall of the opening 37. Also, the space 40 between the bottom 31 of the cup 30 and the bottom 26 of the recess 12 will be evacuated so as to draw the cup 30 downward into tight sealing relation with the recess bottom 26 to provide a seal between the cup and the recess, as is deemed apparent from an inspection of Fig. 2.

An improvement in this simple arrangement is to provide a hole or aperture 41 through the cup 30. The result is that when the vacuum is applied, the space 42 between the lower surface 20 of lens 15 and the upper surface 32 of the cup 30 is also evacuated to draw the lens downward into tight engagement with the surface 32 of the cup 30, and also against the sealing ring 34 thus providing a fluid seal which effectively prevents drawing of the coolant into the vacuum line. Also, evacuation of the space 42 will increase the holding force on lens 15 and insure that the latter will not rotate or spin relative to the chuck, the advantages of which are deemed apparent. In addition, due to the flexible nature of the cup 30, the latter will accommodate itself to irregularities in the surface 20 to provide the desired sealing between the lens and the cup.

Instead of relying on the loose fit between the stems 36 and 39 to evacuate the above-mentioned space, the brass stem 36 may have a longitudinally flat section on its outer surface, or the inner surface of the opening 37 may be formed with an axially extending keyway or slot 43 which connects hole 32 and the spaces 40 and 42 in fluid communication. In order to position cup 30 in the opening 37 and prevent rotation of the cup relative thereto, the stem 36 is provided with a radially extending pin 44 which projects into keyway 45. This pin-and-slot arrangement will permit free axial movement of the stem 36 and cup 30 to draw the latter downward into tight sealing relation with the recess bottom 26, but will effectively prevent rotation of the cup 30 relative to the chuck. Accordingly, the pin-and-slot arrangement 40 and 44 provides, in effect, a spline connection between the stems 36 and 38, as is deemed apparent.

By means of the above arrangement, the lens 15 is held tightly yet yieldably in place, so that it will not rotate or spin relative to the chuck, thus increasing the effectiveness of the lapping, and preventing damage to the lens. Also, the use of the suction cup affords the desired seal which eliminates the sucking or drawing of the expensive coolant into the suction line. In all cases, the cup 30 should be formed of a material which will not be acted upon by the particular materials being used. In the case of the lens polishing a combination of water and rouge is used. In such cases the cup 30 may be formed of rubber. However, in the grinding operation, oil is used so that the cup must be formed of a material which is oil resistant. Rubber does not provide this essential qualification. However, any suitable oil resistant material may be used. For example, a synthetic polymerized material such as cellulose nitrate or polymerized 2-chloroalcohol, a 2-chloroalcohol, a 1.3, which is sold under the trade name of "Neoprene" has been found suitable for use with oil. The designation of this material is, however, merely illustrative of a suitable substance and is not deemed as a limitation as any other oil resistant material which provides flexibility may be employed. Also, while it is preferred to use a separate sealing ring 35, the periphery 33 of the cup 30 may be extended upward so as to form a sealing ring which would then be integral with the cup 30.

The above-described arrangement of the present invention thus provides an effective seal which prevents loss of valuable coolants into the vacuum system. Also, the arrangement securely retains the lens in place to prevent rocking or spinning of the lens relative to the chuck, so as to reduce or eliminate lens damage during grinding and/or polishing.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. Therefore, this application is not to be limited to the precise details described, but is intended to cover all variations and modifications which fall within the scope of the appended claims.
I claim:

1. In an apparatus for chucking thin-edge lenses the combination with a chuck body formed with a recess and an annular lens seat arranged at the top of said recess and adapted to receive the edge of a lens and to position the lens with the surface to be abraded extending above said body, of a flexible member positioned below said lens and resting on the bottom of said recess, said member having an aperture extending there-through to place the space between said member and bottom in fluid communication with the space between said lens and member, and means for evacuating said spaces to draw said lens into fluid-tight contact with said member and also to draw the latter into fluid-tight contact with said bottom to provide a seal between said lens and said body.

2. In an apparatus for chucking thin-edge lenses the combination with a chuck body formed with a recess and an annular lens seat arranged at the top of said recess and adapted to receive the edge of a lens and to position the lens with the surface to be abraded extending above said body, of a flexible member positioned below said lens and resting on the bottom of said recess, means to position said member in said recess and relative to said bottom, said member having an aperture extending therethrough to place the space between said member and bottom in fluid communication with the space between said lens and member, and means for evacuating said spaces to draw said lens into fluid-tight contact with said member and also to draw the latter into fluid-tight contact with said bottom to provide a seal between said lens and said body.

3. In an apparatus for chucking thin-edge lenses the combination with a chuck body formed with a recess and an annular lens seat arranged at the top of said recess and adapted to receive the edge of a lens and to position the lens with the surface to be abraded extending above said body, of a flexible member positioned below said body, a hollow pilot depending from said body, a depending stem on said member extending into and fitting loosely in said pilot to position said member in proper relation in said recess and in said bottom, a spline connection between said stem and said pilot, and means for applying a vacuum to said connection to reduce the pressure below said member to draw the latter into tight relation with said bottom to form a fluid-tight seal therewith.

4. In an apparatus for chucking thin-edge lenses the combination with a chuck body formed with a recess and an annular lens seat arranged at the top of said recess and adapted to receive the edge of a lens and to position the lens with the surface to be abraded extending above said body, of a flexible member positioned below said lens and resting on the bottom of said recess, said member having an aperture extending there-through to place the space between said member and bottom in fluid communication with the space between said lens and member, a hollow pilot depending from said body, a depending stem on said member extending in and fitting loosely in said pilot to position said member on said bottom, and means to evacuate said spaces to draw said lens into fluid-tight contact with said member and also to draw the latter in fluid-tight contact with said bottom to provide a seal between said lens and bottom.

5. In an apparatus for chucking thin-edge lenses, the combination with a chuck body formed with a downwardly extending recess and an annular lens seat arranged at the top of said recess, a sealing ring in said recess on which a lens may rest adjacent the edge thereof, of a flexible suction cup positioned in the recess below said lens and resting loosely on the bottom of said recess, a hollow pilot depending from said body, a depending stem on said member fitting loosely in said pilot to position said member in said recess and on said bottom, said cup having an aperture there-through to place the space between said lens and said cup in fluid communication with the space between said cup and bottom, said pilot having an axially extending keyway formed in the inner surface thereof and communicating with the space between said member and bottom, a laterally extending pin carried by said stem extending into said keyway to prevent rotation of said cup relation to said body, and means for evacuating said spaces to draw said lens into tight engagement with said cup and to draw the latter into tight engagement with said bottom to provide a fluid-tight seal between said lens and said body below said lens.

6. In a lens chuck adapted for use with a rotatable vacuum spindle, the combination with chuck body having a recess in the upper side thereof adapted to receive and position a lens with the upper surface of the latter extending above the chuck, of a suction cup positioned in said recess and engaged by said lens to hold the latter against rotation relative to said chuck, said cup resting on the bottom of said recess and also providing a seal between said lens and said cup and between the latter and said bottom to provide a fluid-tight seal between said lens and chuck, and means for applying a suction to said cup to draw the latter into tight sealing relation with said bottom.

7. In a lens chuck adapted for use with a rotatable vacuum spindle, the combination with chuck body having a recess in the upper side thereof adapted to receive and position a lens with the upper surface of the latter extending above the chuck, of a disk-shaped suction cup of flexible material lying on the bottom of said recess and drawn tightly therewith by the vacuum of said spindle, said lens being drawn tightly against said cup to hold the lens against rocking or spinning relative to said chuck, said cup completely filling the space between said bottom and said lens to provide a fluid-tight seal between said lens and chuck.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,294,103</td>
<td>Hitchcock</td>
<td>Feb. 11, 1919</td>
</tr>
<tr>
<td>2,395,700</td>
<td>Walker</td>
<td>Feb. 26, 1946</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>33,334</td>
<td>Great Britain</td>
<td>Dec. 1, 1914</td>
</tr>
<tr>
<td>120,697</td>
<td>Great Britain</td>
<td>Nov. 11, 1918</td>
</tr>
<tr>
<td>659,371</td>
<td>Great Britain</td>
<td>Oct. 24, 1951</td>
</tr>
</tbody>
</table>