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METHOD OF SUPPORTING LENS BLANKS FOR GRINDING AND POLISHING

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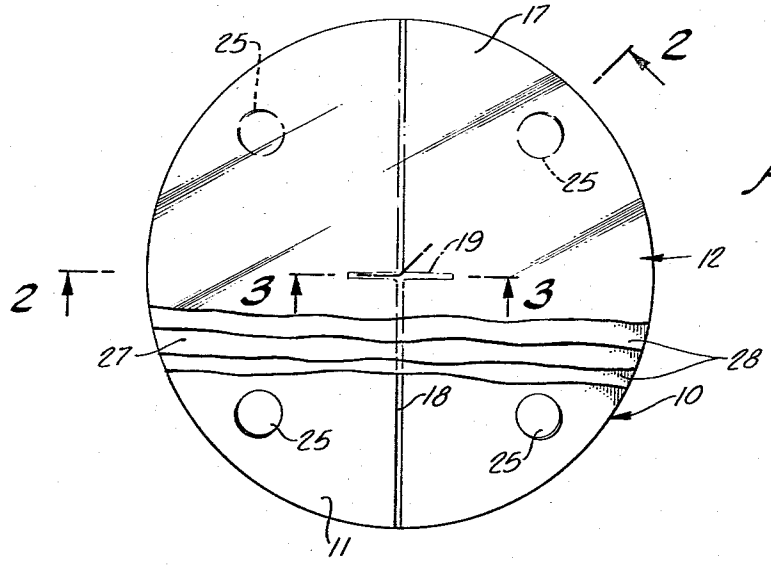

FIG. 1.

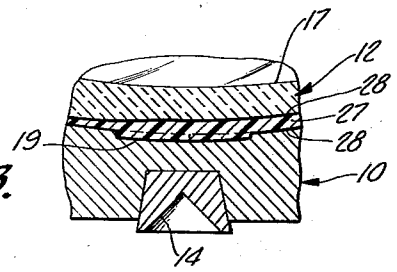

FIG. 3.

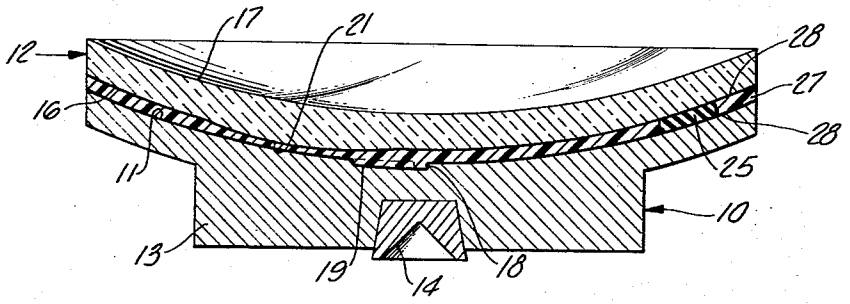

FIG. 2.

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METHOD OF SUPPORTING LENS BLANKS FOR GRINDING AND POLISHING

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ABSTRACT OF THE DISCLOSURE

The invention utilizes a plurality of small spacer elements of uniform thickness appropriately and equitably distributed about the outer portion of each lens blank supporting area and effective to assure precision anchorage of a lens blank to a supporting lens block therefor while being ground and polished. The spacers preferably have a thickness corresponding to that of the bonding layer employed to anchor the blank to the lens block. Also one face of the spacers may and preferably is coated with an adhesive film, such as a pressure sensitive type, to expedite and facilitate use of the spacers without risk of their movement after being placed in a desired position on the face of the lens block. Also featured by the invention is a bonding adhesive having negligible shrinkage and exothermic heat during setting.

This invention relates to the lens finishing and grinding art and more particularly to an improved method and technique for mounting and supporting a plastic lens blank in a lens holder with greater precision while avoiding numerous undesirable factors present in lens anchoring techniques used heretofore.

According to prior technique it has been common practice to anchor a lens blank against the surface of a lens holder while subjecting its outer exposed surface to finish grinding and polishing. Anchorage of the lens blank to the holder has been performed in the main by waxes, paraffin, and various adhesives distributing as a layer between the parts. Many problems attend the use of these various materials. Among these adverse factors is the fact that these various anchoring materials require heating of fusible material or evolve exothermic heat while taking a set. This temperature change heats the blank unequally setting up undesirable strains and stresses within the lens blank and cause distortion. These undesirable consequences are augmented by difficulties attending the unequal distribution and unequal thickness of the bonding layer sandwiched between the lens blank and the lens block. It is most difficult to obtain a bonding layer of uniform thickness as is desirable except by the use of costly complex blocking machines. Commonly used bonding materials are also subject to shrinkage and if the layer is thicker in one area than in another, unavoidable differential shrinkage occurs and this can result in serious consequences for obvious reasons. Another problem arises from the presence of volatile constituents in many bonding agents. These can escape but slowly from the rim of the layer thereby greatly prolonging setting.

By the present invention the foregoing and other serious disadvantages of prior lens supporting techniques are substantially avoided or entirely eliminated. To this end, there is utilized a plurality of thin flexible spacer members having a thickness corresponding to the desired thin layer of bonding material. The diameter or width of these spacers is a small fraction of the diameter of the lens block and preferably, the lower surface is coated with a film of pressure sensitive adhesive to expedite their accuracy and immovable mounting against the surface of the lens block. In consequence, the spacers are not subject to displacement as by contact with the operator's fingers while positioning other spacers or by the bonding agent itself as the latter spreads out over the block surface.

An important feature of the invention is the use of a bonding agent having negligible shrinkage and which takes a set without any material temperature change. Additionally the bonding agent is characterized by the absence of a solvent or other constituent which vaporizes while the constituents take a set.

Additionally the preferred bonding agent used with the present technique is transparent enabling the operator to view the locator guide marks customarily present on the surface of the lens holder and used to orient the lens blank in a predetermined relation to the holder thereby facilitating grinding the upper surface to meet prescription requirements.

Accordingly it is a primary object of the present invention to provide an improved precision method for supporting lens blanks in lens holders during grinding and polishing operations.

Another object of the invention is the provision of an improved mode of supporting a lens blank in a lens holder characterized by the use of a plurality of identical flexible spacer elements corresponding in thickness to the thickness of the bonding layer and enabling the operator to gauge the thickness of this layer quickly and with precision during the assembly of the blank to the holder.

Another object of the invention is the provision of an improved technique for holding a lens blank to a lens holder utilizing gauging spacers between the parts and a bonding agent having negligible shrinkage and taking a set substantially without a change in temperature.

Another object of the invention is the provision of identical precision flexible spacer elements suitable for use by lens grinders in accurately positioning and supparting a lens blank while the blank is being subjected to grinding and polishing.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated:

FIGURE 1 is a top plan view with parts broken away and showing the lens blank supported on a lens block in accordance with the invention;

FIGURE 2 is a cross-sectional view taken along line 2—2 on FIGURE 1; and

FIGURE 3 is a fragmentary sectional view taken along line 3—3 on FIGURE 1.

Referring to the drawing, there is shown one preferred embodiment of facilities for practicing the present invention using a typical conventional lens block **10**. It will be understood that these blocks differ in size and, in particular, as respects the contour of its upwardly facing surface **11** which is contoured to mate generally with the previously finished lower face of the blank to be finish-ground on its upper face. As here shown, surface **11** is generally concave and conforming generally with the downwardly facing surface **16** of the lens blank **12** the upper surface **17** of which is to be finish ground. The main body of block **10** includes a shank **13** provided axially of its undersurface with a hardened center cone **14** to receive the grinding machine drive pins of conventional grinding equipment.

To be noted is the fact that holder **10** preferably has a size somewhat larger than the blank to be finished. In consequence the upwardly facing surface **11** of the block underlies the entire lower surface **16** of blank **12** even though the blank is supported slightly offcenter as often

required by the prescription specifications. It will be understood that lens blank **12** is usually cast from suitable plastic materials with one surface, as **16**, cast exactly to shape and with a surface so smooth as to require no additional processing. Such blanks as cast are sufficiently thick to permit the opposite surface **17** to be finished and ground to a desired shape to satisfy a particular prescription requirement.

It will be understood that surface **11** of the lens block customarily is provided with suitable guide or reference lines by which the lens blank can be mounted in the holder in a predetermined position or orientation, thereby enabling the operator to grind surface **17** in exact correlation to surface **16**. Such guide means, as here illustrated, comprise a shallow long groove **18** extending diametrically of the holder and a second shorter groove **19** passing through the center of the holder at right angles to groove **18**. A typical mode of utilizing these guide grooves will be explained in connection with FIGURE 2 and the mounting therein of a lens blank **12** for use in making bifocal spectacles. For this purpose blank **12** is cast with a bulge or raised area **21**. This area occupies a portion of the lower half of the finished lens with the peripheral surface areas merging smoothly and imperceptibly with the adjacent surface area **16** of the lens proper. It will be understood that, by use of grooves **18** and **19**, the operator assembling the blank in holder **10** can position this raised area **21** in a precise angular location relative to one quadrant of the holder as defined by intersecting guide grooves **18**, **19**. This orientation operation is performed before the bonding agent takes a set and enables the operator to know with certainly the position of special contours on lower surface **16**, such as bifocal portion **21**, while grinding upper surface **17**.

Referring now more particularly to FIGURE 1 it is pointed out that an important feature of the invention comprises use of a plurality of identical precision spacer elements **25**, **25**. These are relatively small in width as compared to the diameter of block **10**, a width of 50 to 150 mils being suitable. The thickness of the spacers corresponds to the thickness desired for bonding layer **27**. This layer is normally very thin in order to minimize the adverse effects of the slightest shrinkage and temperature change. In the case of a blank having bifocal capabilities a somewhat thicker layer of adhesive is appropriate and, in this case, a thicker spacer is employed.

Spacers **25** are formed of thin flexible material capable of being calendered accurately to uniform thickness. Flexible sheet plastic material is excellent for this purpose as for example, polyvinyl chloride and polyethylene. This material conforms readily to a wide range of lens holder and lens blank contours between the surfaces being bonded together. Desirably one surface of spacers **25** is provided with a film of pressure sensitive adhesive for use in holding the spacers in a selected position on surface **11**.

In practicing the present technique the operator selects a holder **10** having an upper surface corresponding generally to that of the lens blank to be finish ground. Making certain that the upper surface of holder **10** is clean, the operator supports this holder firmly in an upright position with surface **11** facing upward and applies a spray coating to form an adhering film **28** to both surface **11** and surface **16** of the blank. Suitable material for this film is commercially available and comprises cellulose acetate butyrate as a principal constituent and a plasticizer to provide a separable bonding film between the epoxy resin layer and the adjacent surfaces of the lens block and the lens blank. Without this film the epoxy tends to adhere to the parts too tenaciously whereas the presence of the described film assures adequate holding power while permitting the parts to be separated after polishing by chilling followed by light tapping or slight flexing.

The operator then proceeds to apply three or four of the spacers **25** to surface **11** at points spaced uniformly from one another and from the outer rim edge of the holder. A suitable position is that shown in FIGURE 1 wherein four of the spacers are shown. As there illustrated, the spacers are located along the bisectors of the respective quadrants formed by guide grooves **18**, **19**. Alternatively and particularly when mounting a bifocal lens blank, spacers **25** are preferably applied to surface **16** with care being exercised to locate the spacers to either side of the raised bifocal segment. The blank may then be rotated and oriented with respect to the guide lines.

Having located the spacers on coated surface **11** or **16**, the operator proceeds to pour an accurately measured quantity of adhesive material having the characteristics identified above into the center of concave surface **11**. A suitable bonding agent providing excellent results is an epoxy resin such as Epon 815 from Shell Chemical Co., or the epoxy resin made by Pace Products Co., Chicago, Ill. Both adhesive products have negligible shrinkage during setting, no solvents which vaporize during setting. Both set with negligible temperature change. This measured quantity of adhesive is preferably slightly in excess of that required to form a layer **27** coextensive with surfaces **11**, **16** and corresponding to the thickness of spacers **25** when the adhesive is distributed uniformly between these surfaces. Initially, the quantity of the adhesive poured into the holder is located well inwardly of spacers **25**. Thereafter the operator orients blank **12** to be ground to its approximate position and lowers it toward the holder with its finished surface **16** lowermost. The final phase of the lowering operation progresses slowly as the blank contacts the pool of adhesive and spreads radially outward past spacers **25**. The adhesive does not pass into contact with the upper surface of the spacers owing in part to the proximity of these surfaces to blank surface **16** and in part to the surface tension of the adhesive. Accordingly there is substantially no opportunity or risk that the tops of the spacers will be contacted by the adhesive.

No air bubbles are entrapped because all air is forced outwardly ahead of the advancing rim of the adhesive pool. Any excess adhesive overflows the rim of the holder and may be caught by an underlying receptacle. Once the blank is in contact with spacers **25**, the operator checks to make certain that the center line through area **21**, or other reference line, coincides exactly with the axis of one of the grooves, as **19**, and then presses the blank firmly and equally against each of the spacers. It is then known that the adhesive is uniformly distributed and of uniform thickness except in the area underlying the bifocal raised portion **21**.

The assembled parts are left in this position for the short period required for the adhesive to take a set at room temperature and without any material change in the temperature of the adhesive itself. The time period for setting varies with the particular adhesive used. Once setting is complete, the operator may proceed immediately with the grinding and polishing operation with full knowledge that the lens blank is not distorted or under strain or stress either by shrinkage of the adhesive or by unequal temperature conditions within the blank. Following completion of the grinding and polishing operation the parts are disassembled in known manner, the adhesive layer is cleaned away from the parts and the lens is ready for mounting and use and the holder reused in finishing innumerable other blanks.

It will also be understood that it is a feature of this invention to employ spacers **25** of differing thicknesses and employed in a desired combination to enable the grinder to grind a lens blank having prismatic characteristics with one edge thicker than the diametrically opposed edge.

It will also be recognized that four of the spacers may be located at the corners of a square, and equally distant from the axis of a lens blank having a cylindrical surface.

While the particular method of supporting lens blanks for grinding and polishing herein shown and disclosed in

detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. That method of supporting semi-finished lens while grinding and polishing the unfinished face thereof which method comprises, placing a plurality of thin flexible spacers at spaced points against the upwardly facing surface of a lens block inwardly of the rim thereof, placing a quantity of fluent adhesive in the center of the lens block adequate to provide a layer of distributed adhesive as thick as said spacers over the upper surface of said lens block, lowering a blank lens onto said adhesive with the finished surface thereof facing downwardly, pressing said lens blank firmly toward said spacer elements to distribute said adhesive throughout the thin space between said lens blank and said lens block, and allowing said adhesive to take a set before proceeding to finish grind the exposed upper surface of the adhesively anchored lens blank.

2. That method of firmly supporting a lens casting while the surface on the opposite face thereof is being finish ground and polished and of the type having high bifocal area thereof projecting outwardly from one curved surface thereof, said method comprising supporting a lens block having a surface conforming generally with the finished surface of the casting to be ground in a generally horizontal position with its lens seating surface facing upwardly, placing thin small-diameter flexible spacers at intervals on said upwardly facing surface and inwardly from the rim thereof, pouring a small quantity of a transparent fluent adhesive material into the center area of said lens seating surface adequate to provide a layer as thick as said spacer disks over the upwardly facing surface thereof, lowering the finished surface of a lens blank onto said adhesive causing the adhesive to flow outwardly along said upwardly facing block surface and around the rims of said spacer disks, firmly seating the lower finished surface of the lens blank against the upper surface of said spacer disks and allowing said adhesive to take a set.

3. That method defined in claim 2 characterized in that said spacers have a film of pressure sensitive adhesive on their lower surfaces and including the step of pressing the coated surface of said spacers firmly against the surface of said lens block when distributing said spacers thereon thereby preventing said spacers from being displaced as the adhesive is forced outwardly during the seating of the lens blank.

4. That method of firmly supporting a lens casting having a high area projecting outwardly from one curved surface thereof while the surface on the opposite face thereof is being finish ground and polished, said method comprising horizontally supporting a lens block of the type having an upwardly facing concave lens-supporting surface provided with lens-positioning guide means thereon, pressing the pressure sensitive coating on the lower surface of small spacers of uniform thickness onto said concave surface near but inwardly of the rim thereof and so located as to be laterally to one side of a raised area on the lower finished surface of a lens blank when the blank is properly supported relative to said lens-positioning guide means for the finish grinding of its upper surface, placing a small quantity of fluent transparent adhesive centrally of said concave surface and adequate to provide a layer covering said concave surface as thick as said spacers, gradually lowering a lens blank to be ground vertically into said adhesive with the finished surface thereof facing said concave surface and with its raised area properly oriented relative to the guide means on said concave surface, said lowering operation being performed slowly and in a manner permitting the fluent adhesive to flow outwardly toward the rim edges of the concave surface and about the rims of said spacers without coming into contact with the upper surfaces of said spacers, and firmly pressing said lens blank against the upper surfaces of the spacers and checking the orientation thereof to make certain said raised area is accurately positioned relative to said guide means as viewed through the lens blank and said layer of transparent adhesive.

5. That method defined in claim 2 characterized in that said adhesive has negligible shrinkage and negligible exothermic heat during setting.

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