June 10, 1969 J. D. SPRAGG 3,449,198

LENS BLANK

Filed Sept. 29, 1966

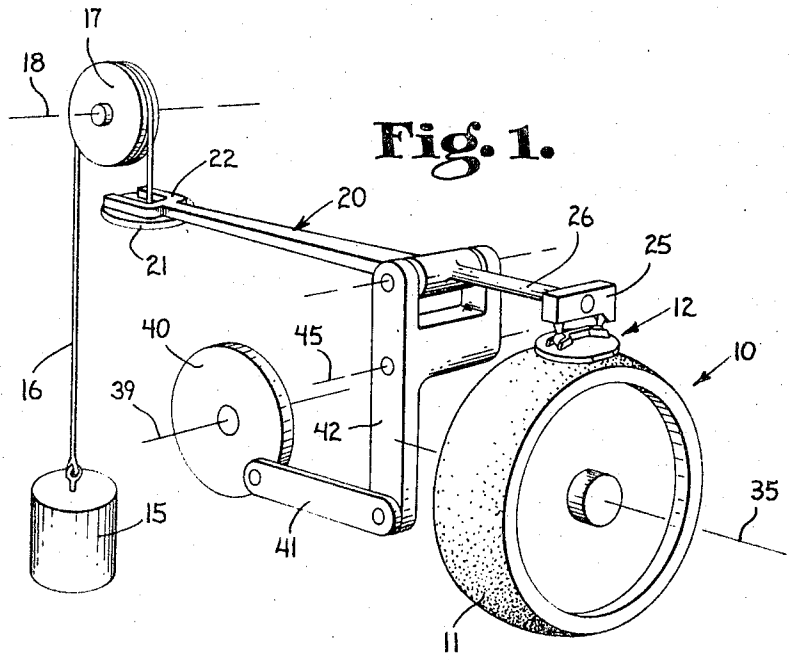


Fig. 1.

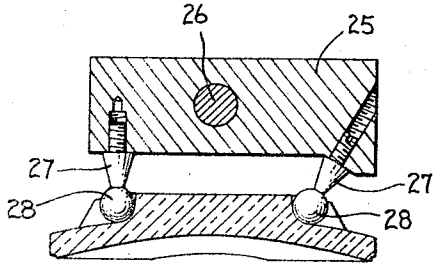


Fig. 2.

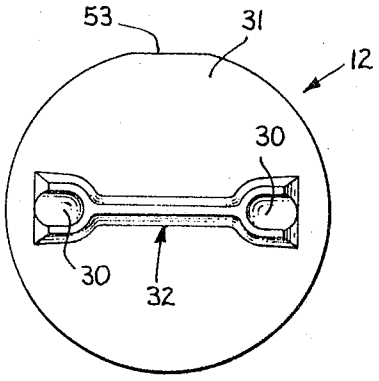


Fig. 3.

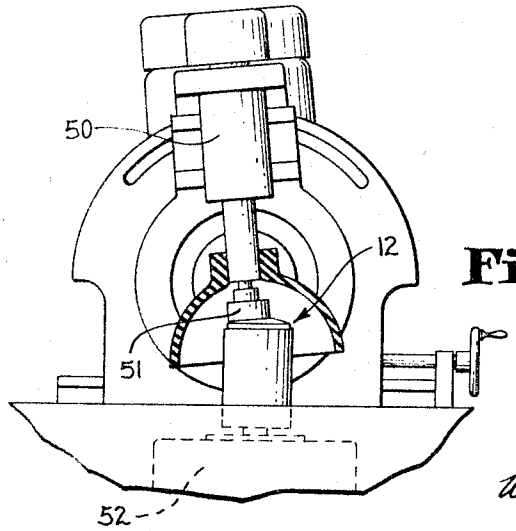


Fig. 4.

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LENS BLANK

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ABSTRACT OF THE DISCLOSURE

A slab of material with an integrally formed nubbin adapter for engagement by oscillating pins of a workpiece mounting device on a grinding machine for forming a lens from the slab. After the side of the slab opposite the integral nubbin adapter is ground to size, the slab is reversed and the adapter is removed by grinding.

The present invention relates to a lens blank used in lens forming.

Various means are available in the prior art for holding a glass molded blank during grinding and polishing or, in other words, during the generating of a desired surface configuration on the blank. For example, adhesive may be used to attach a plastic or metal adapter to the molded blank, or the blank may be mechanically gripped into an adapter, or vacuum may be used for holding the blank into or against an adapter. As further alternatives, the blank may be placed loosely into an adapter or a low melting point alloy adapter may be molded directly to the blank. Each of these methods has one or more of the following disadvantages. Accurate alignment of the lens blank cannot be obtained and maintained in progressing from the grinding to the polishing operation. The adapter must be attached to and removed from the lens blank which requires time and labor and in some cases requires expensive apparatus. Handling of the lens blank and adapter is complicated and thus requires labor skill and time.

One object of the present invention is to provide an improved lens blank.

Another object of the present invention is to provide a lens blank which make possible the obtaining of accurate alignment is progressing through and from the grinding operation to and through the polishing operation ing operation of the lens blank.

Still another object of the present invention is to provide a lens blank which makes possible the elimination of the operations of attaching and removing adapters.

Still another object of the present invention is to provide a lens blank which makes possible simplification in handling of the lens blank during grinding and polishing.

One embodiment of the lens blank of the present invention might involve a slab of glass formed for grinding and polishing into a finished lens, a glass nubbin adapter formed integrally on said slab, said nubbin adapter being shaped to fit a mounting device.

One embodiment of the apparatus operating upon the present invention might involve a generating wheel having an abrasive surface adapted for engagement with one surface of a lens blank, a nubbin adapter of the same material as the lens blank and formed integrally on the lens blank, and means for holding the lens blank against the abrasive surface, said means for holding including a pair of pins having ball shaped distal ends, said nubbin adapter having a pair of sockets which receive said ball shaped distal end.

One embodiment of the process of forming lenses by using this invention might involve the steps of molding a lens blank to have a pair of faces and an integral nubbin adapter on one of said faces, abrading the other

of said faces with an abrading means to generate a desired surface configuration, retaining said lens blank against said abrading means with a retainer formed to engage said nubbin adapter, and abrading said one face to remove said nubbin adapter and to generate a desired surface configuration.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is a perspective view, with certain portions removed for clarity, of apparatus for grinding a lens blank according to the present invention.

FIG. 2 is an enlarged vertical section taken through a portion of the structure of FIG. 1 and showing the lens blank nubbin adapter and associated structure.

FIG. 3 is a top plan view of the lens blank of the present invention.

FIG. 4 is a side elevation of apparatus used in one of the steps of the process of the present invention.

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawing and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now more particularly to the drawings, there is illustrated a grinding wheel **10** which has an external peripheral surface **11** formed in the proper toric configuration desired for the concave surface of the lens. The lens **12** is held against the wheel **10** with a pressure supplied by a weight **15** suspended by a cable **16** which extends over a pulley **17** rotatably mounted about a fixed axis **18**. The cable **16** acts on an arm **20** through a member **21** secured to the end of the cable **16** and bearing against the lower surface of the end **22** of the arm **20**.

A block **25** is rotatably mounted on the arm **20** for swinging about the axis of the cylindrically shaped elongated portion **26** of the arm. The block **25** has secured thereto two pins **27**, each of which has a ball shaped distal end **28**. In the preferred embodiment of this invention these distal ends are spherical in shape although conceivably other rounded configurations could be used. The ball shaped distal ends **28** seat in suitable sockets or recesses **30** which open or face away from one another and away from the convex face **31** of the lens blank **12**. The recesses **30** are formed within a nubbin adapter **32** molded integrally on the convex face **31** of the lens blank **12**. The nubbin adapter **32** extends across substantially the complete surface of the lens blank and has a configuration as shown in FIGS. 2 and 3 which might be termed a "dog bone" shape.

Referring again to FIG. 1, the external shape or configuration of the surface **11** of the wheel **10** may be spherical or may be toric. The wheel **10** is driven so as to rotate about the fixed axis **35** during the grinding operation. The major diameter of the wheel **10** controls the concave curve to be ground on the lens blank in the major or sphere meridian. The curve across the surface **11** of the wheel **10** and lying in the plane of the wheel axis **35** controls the cross-curve to be ground on the lens blank **12**.

As the wheel **10** rotates about the axis **35**, the lens blank **12** is made to oscillate across the surface **11** of the wheel by an eccentric wheel **40**. The wheel **40** is rotatably driven about the fixed axis **39** and is pivotably secured by the link **41** to an oscillating arm **42** which is pivotably mounted for oscillation about a fixed axis **45**. As illus-

trated, the arm **20** is pivoted to the arm **42** at its upper end so that oscillation of the arm **42** also oscillates the arm **20**, the block **25** and the lens blank **12**.

After the grinding operation has been completed on the concave face of the lens blank, the wheel **10** may be replaced by a polishing wheel of the same or similar spherical or toric configuration and similar apparatus to that illustrated in FIG. 1 used to complete the polishing of the concave face of the lens blank **12**. Of course, in conventional manner, slurry is pumped onto the wheel **10** and onto the similarly shaped polishing wheel during both the grinding and the polishing operation.

One of the most important features of the present invention is the fact that the nubbin adapter **32** is molded integrally with the lens blank **12** at the same time that the remainder of the lens blank is molded. Such molding is accomplished by conventional glass molding apparatus such as, for example, a Corning opthalmic pressing line manufactured by Opthalmic Division of Corning Glass Company of Herodsburg, Ky. By molding the adapter **32** simultaneously with the molding of the entire lens blank **12**, the step of attaching a separate adapter to the lens blank for holding it during the grinding and polishing operation is eliminated.

After the grinding and polishing of the concave surface of the lens blank has been completed, the glass nubbin adapter **32** is removed from the convex surface **31** of the lens blank by the grinding of the convex surface with a conventional ring-tooled diamond generator as shown in FIG. 4. The lens blank **12** may be secured to an adapter in the same manner as is illustrated, for example, in the patent application Ser. No. 384,873 of Tracy H. Calkins and Frank E. Duckwall, said patent application also being assigned to Textron, Inc., the assignee of the present patent application.

The grinding of the convex surface **31** may then be accomplished by the apparatus of FIG. 4 which includes a motor **50** operatively connected to a grinding tool **51** which is applied to the lens' convex surface **31** at a preset angle so as to grind the lens to a desired spherical curvature and thickness. The adapter which has been secured to the concave face of the lens blank **12** is rotated by an electrical motor **52**. Of course, grinding is accomplished by the simultaneous rotation of the tool **51** by the motor **50** and rotation of the lens blank **12** by the motor **52**. This grinding procedure not only removes the nubbin adapter from the lens blank but also rough grinds the proper spherical shape on the convex side of the lens. Because the nubbin adapter extends substantially completely across the surface **31**, uneven wear is not caused on the grinding tool **51**.

The lens blank **12** is provided at its outer periphery with at least one flat edge **53** which may be used to reference the lens in any later grinding and polishing operations. Thus, the straight edge **53** indicates the direction of the axis of any cylinder shape on the concave surface of the lens blank since the nubbin adapter **32** has now been removed.

The next step in the method of forming the final lens configuration is fine grinding, for example, on the apparatus as illustrated. in FIG. 10 of the above mentioned copending patent application. Since this is a conventional procedure and can be accomplished in various ways, it will not be further described herein. Also, the convex surface of the lens blank is polished and can be polished as illustrated and described in connection with FIG. 11 of the above mentioned copending patent application. The manner of removing the adapter of the copending application is fully described in that application and will not be again described herein inasmuch as various procedures can be used for grinding and polishing the convex side of the lens.

It will be evident from the above description that the present invention provides an improved lens blank. It will be evident that the present invention makes possible accurate alignment during the complete grinding and polishing operations of the concave surface of the lens blank. This is true because of the fact that the nubbin adapter **32** maintains its exact and precise location on the convex surface **31** of the lens blank **12** during the complete grinding and polishing operations of the concave surface.

It will also be evident that the present invention eliminates the operation of attaching and removing an adapter to the convex side of the lens blank. The attaching is, of course, eliminated because the nubbin adapted **32** is molded simultaneously with the molding of the remainder of the lens blank. The removal of the adapter by a separate step is made unnecessary because the grinding of the convex surface of the lens blank is also used to remove the nubbin adapter. Because a separate adapter need not be connected to the convex surface of the lens blank and removed therefrom, handling of the lens blank is simplified.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired desired to be protected.

The invention claimed is:

1. A lens blank comprising a slab of material formed for grinding and polishing into a finished lens, a nubbin adapter formed integrally on said slab of the same material as said slab, said nubbin adapter being shaped to fit a mounting device.

2. The lens blank of clam **1** wherein said slab is glass and has a curved shape with a convex side and a concave side, said nubbin adapter being located on said convex side whereby said slab can be retained by the mouning device for grinding of said concave side.

3. The lens blank of claim **1** wherein said nubbin adapter includes a pair of oppositely facing sockets formed to receive ball shapes on the end of pins.

4. The lens blank of claim **1** wherein said slab is glass and has a curved shape with a convex side and a concave side, said nubbin adapter being formed on one of said sides and extending across substantially the entire face whereby said nubbin can be ground off with little damage to a grinding tool, said nubbin adapter including two enlarged portions connected by a reduced sized portion, each of said enlarged portions having a recess formed therein, said recesses facing away from said blank and also facing away from one another.

References Cited

UNITED STATES PATENTS

1,448,699	3/1923	Parsons.	
1,495,018	5/1924	Girard.	
2,633,675	4/1953	Ellis	51—33
3,128,580	4/1964	Davis	51—284 X
3,144,737	8/1964	Faas	51—284 X
3,262,233	7/1966	Schrier	51—284 X
3,355,342	11/1967	Lanman	51—284 X

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