May 26, 1964 J D RICHMOND 3,134,208

LENS HOLDING DEVICE

Filed Jan. 8, 1962

Fig. 1

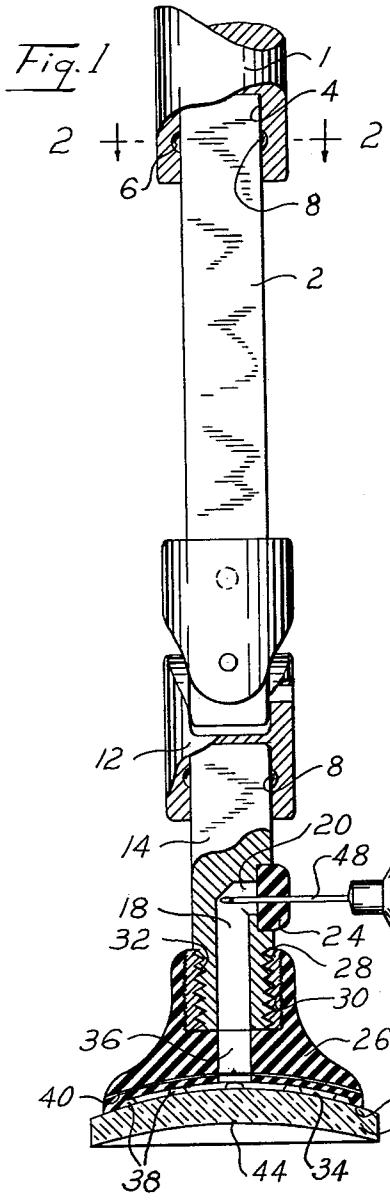


Fig. 2

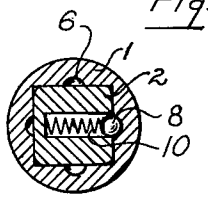
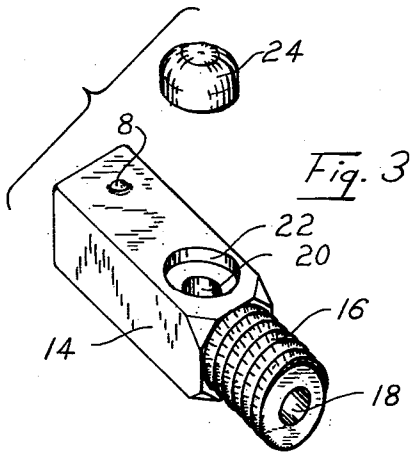


Fig. 3



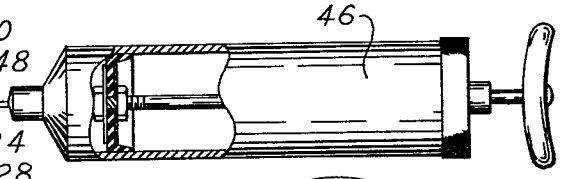


Fig. 4

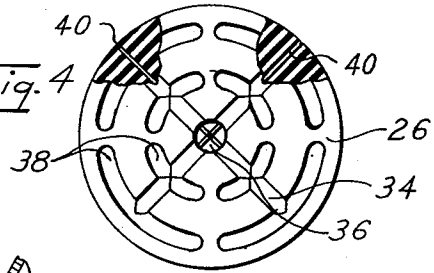
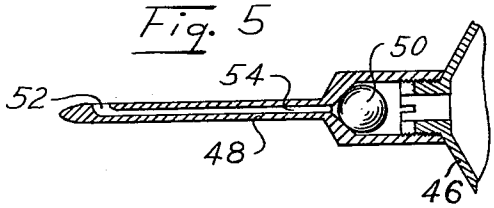


Fig. 5



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LENS HOLDING DEVICE

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This invention relates to improvements in an optical blank holding device for making lens, and more particularly to an optical blank holding device which may be readily attached to an optical blank or to a lens and detached therefrom without marring or distorting the optical blank or the lens made therefrom.

Various devices for holding optical blanks or lenses have been proposed heretofore, however these, for the most part, required extensive preparation to fit the optical blank or lens in place on the holding device, which usually utilized pitch to cement the optical blank or lens to the mandrel which was used to turn the optical blank or the lens with respect to the abrading element, and since optical blanks which are used in the manufacture of lens usually have one side finished, it is therefore necessary only to grind and polish the unfinished side of the optical blank to make a lens of the desired optical power of magnification.

Optical blanks usually have the convex side thereof polished and finished ready for use, with the opposite or concave side thereof being unfinished. These optical blanks also usually have a centering dot on the unfinished side thereof to enable the lens to be attached to a mandrel with the dot positioned substantially axially of the mandrel.

Heretofore, after an optical blank had been finished into a lens, it has been necessary to remove the pitch from the lens, which required chilling the lens to a subfreezing temperature and then scraping the pitch from the lens, which sometimes would result in the lens becoming scratched to such an extent that it would have to be re-ground or even discarded.

The present lens holding device is so designed that an optical blank may be readily secured thereto and to be held firmly thereby during all phases of the operations thereon, that is, the grinding of the lens, both the roughening grind and the finished grind, and also the polishing thereof. Furthermore, without removing the lens from the lens holding device, the lens may be cut to the exact shape and the edges thereof finished ready for use.

Having an optical blank or lens holding device of the character described herein mounted on a spindle which is readily detachable, as by a spring pressed ball seating in an indentation, enables the mandrel to be readily removed from one chucking arrangement and reinserted into another, thereby obviating the necessity of having to remove and remount the optical blank or lens for the various operations thereon.

An object of this invention is to provide a device for holding an optical blank to enable the abrading and polishing operations to be performed thereon to enable the optical blank to be finished into a lens to the desired curvature or combination of curvatures to obtain the desired power of magnification and/or correction.

Another object of this invention is to provide a suction cup arrangement to enable an optical blank to be quickly attached to a mandrel for the grinding and polishing operations on the optical blank, without the necessity of removing the optical blank from the mandrel.

A further object of the invention is to provide an optical blank holding device which may be readily attached to and detached from a mandrel holding element, yet maintaining the lens in a fixed relation with respect to the axis thereof.

Still another object of the invention is to provide a removable, elastomer suction cup of a curvature which approximates the curve of the optical blank to be ground and/or polished, which cup is in communication with an air evacuating device so as to enable the optical blank to be affixed to the elastomer cup by suction.

Yet a further object of the invention is to provide a device for holding an elastomer suction cup, the face of which is grooved to evenly distribute the suction over the face of the optical blank to prevent distortion thereof while it is being held for grinding and/or polishing.

A still further object of the invention is to provide a combination hollow mandrel and elastomer suction cup whereby the passage in the hollow mandrel registers with a passage in the suction cup so air may be evacuated from the suction cup through the mandrel.

Another object of the invention is to provide a device which is simple in construction, low in the cost of manufacture, easy to use, and which will give long continued service with a minimum of repair.

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is an elevational view of the optical blank holding device, showing a hollow spindle attached thereto, with a hollow needle and an air evacuating syringe positioned in the hollow mandrel, and also showing a universal joint and a mandrel extension connected in chuck relation to a rotating spindle, with parts broken away and with parts shown in section to bring out the details of construction;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1, looking in the direction indicated by the arrows;

FIG. 3 is a perspective view of the hollow spindle with the lens holding device and the universal joint removed therefrom, and showing the self-sealing elastomer plug in exploded relation thereto;

FIG. 4 is a bottom plan view of the elastomer suction cup for holding optical blanks, with parts being broken away and with other parts being shown in section to bring out the details of construction; and

FIG. 5 is an enlarged fragmentary view of a hollow needle used in the air evacuating syringe for removing air from the hollow spindle, showing the passages intermediate the face of the suction cup and an optical blank.

With more detailed reference to the drawing, the numeral 1 designates a power driven, rotatable spindle of the character to chuck a mandrel 2 for rotation therewith. The spindle 1, in the present instance, is shown to have a squared recess 4 therein to receive the squared mandrel 2. Each inner face of the squared recess 4 of the spindle has semi-cylindrical recesses 6 therein, so that a spring pressed ball 8, of conventional character, will register with the indentation or recess 6 to hold the mandrel 2 against longitudinal movement, yet the ball 8 is spring-pressed by the spring 10, as will best be seen in FIG. 2, which is well known in the art of socket wrenches and the like.

The other end of the mandrel 2 preferably has a similar spring pressed ball to engage with a similar socket in a universal joint 12. The universal joint 12 is of conventional block and cross-pin type, as will best be seen in FIG. 1. The universal joint 12 has a socket in each end thereof to receive the respective mandrels 2 and 14. The mandrel 14 also has a spring pressed ball 8 which is adapted to register with an indentation or recess in the squared socket of the universal joint 12 so as to retain the mandrel 14, which has a portion thereof drilled and cross-

drilled so as to form a passage therethrough, as will be more fully brought out hereinafter.

The mandrel 14 is threaded as indicated at 16 at one end and has an axial opening 18 extending thereinto, with a passage 20 drilled through a side thereof so as to interconnect with axial opening 18, as will best be seen in FIG. 1. A counterbore 22 is made in the side of hollow mandrel 14, which counterbore 22 is adapted to receive an elastomer, self-sealing plug 24 therein, as will best be seen in FIG. 1, the purpose of which will be more fully brought out hereinafter.

An elastomer cup 26 has an internally threaded insert 28 therein axially thereof, which metal insert is preferably knurled or roughened on the outside, as indicated at 30. The elastomer cup 26 is vulcanized to the threaded insert 28 so that the knurled portion 30 will serve as a holding surface between the insert and the elastomer cup 26. The threads of the insert 28 complementally engage the threaded portion 16 of mandrel 14. This enables the ready removal of the elastomer suction cup 26 and the insertion of an elastomer cup of a different curvature to fit a particular optical lens as desired; however, the elastomer material in the cup 26 is sufficiently pliable that it will fit a variety of curvatures of optical blanks without distortion.

The elastomer cup 26 has concave face and radial grooves 34 in the lower face thereof, which grooves connect with an axial passage 36 in the elastomer cup 26. Further parti-annular or lateral grooves 38 are formed in the lower face of elastomer cup 26, which grooves 38 interconnect with radial grooves 34 and axial passage 36 in the elastomer cup 26.

The lower end of the threaded mandrel 14 is open, so when the mandrel is screw threaded into screw threaded insert 28, the lower end of the mandrel will form a fluid tight seal with the face of elastomer cup 26. In this manner the passages 18 and 36 form a continuous, leak-proof passage.

The elastomer cup 26 has a pair of cross wires 40 embedded therein, which wires 40 are so arranged as to cross centrally of the axial passage 36 so these may be viewed through optical blank 42, and by the use of optical blanks with the centering dot or marker 44, the optical blank may be readily aligned with the axis of the mandrel 14.

An evacuating syringe or pump 46 is provided which has a hollow needle 48 to enable the withdrawal of air from passages 18, 20, 36, 34 and 38 to cause the optical blank 42 to adhere to the elastomer suction cup 26, which cup seals with the lens around the edge 27 thereof.

A check valve 50 is provided into the pump 46 so that the air which is drawn through passages 52 and 54 of the pump is prevented from returning, once it has been evacuated. The syringe or pump 46 is of a conventional piston type, and when the air has been evacuated to the desired degree from passages within the mandrel and the elastomer cup 26, the needle is removed longitudinally from the elastomer self-sealing plug 24, whereupon, the hole in the plug will seal, which will enable the optical blank 42 to be held in secure aligned relation so as to perform an abrading or grinding action and the finishing and polishing of the lens without having to remove the lens from the suction cup, once it has been adjusted and secured thereto.

The mandrel 14 may be removed from the universal joint 12 and fitted within the squared recess 4 in spindle 1, in event it is not desired to use the universal joint 12 or the extension mandrel 2. Furthermore, the lens may be held on the suction cup 26, while it is being cut or the edges finished, thereby precluding dropping the lens while these actions are being performed. When it is desired to remove the lens, which has been ground, from the optical blank 42, from the elastomer suction cup 26, the hollow needle, such as shown in FIG. 5, may be used to pierce the elastomer sealing plug 24, which will permit air to enter through passages 54 and 52 into axial opening 18, which will equalize the pressure on each side of the lens, thereby permitting the lens to be readily removed.

The above procedure is practiced when the elastomer cup 26 is utilized for holding a lens when the lens is being ground for a spherical concave surface, however certain optical corrections require other special grinding technique, such as a cylinder grind or a combination of cylinder and spherical grinding, in which case, the mandrel 14 is removed from universal joint 12 and is fitted into a stationary fixture (not shown). An optical blank is then mounted in the mandrel 14 in the manner set out above, whereupon, the optical blank will be held in secure relation so an abrading element rotating on a horizontal axis is brought into engagement with the concave face of the optical blank, and the optical blank will be shaped in accordance with the contact surface of the abrading face. However, in certain instances, the mandrel 14 will be mounted in a fixture which will rock about the horizontal axis as the abrading element is brought into abrading relation with the concave face of the optical blank 42. It is to be pointed out, however, that the removal of sufficient air from passages 18, 20, 34 and 36 will cause the optical blank to be held in secure relation on the elastomer cup by the atmospheric pressure exerted thereon. It is preferable that the mandrel 14 be relatively short and that the elastomer plug 24 be so fitted in counter-bore 22 that it may be readily removed and replaced when it begins to leak, as its usefulness as a valve has been lost.

This form of valve is inexpensive to produce and a vacuum or air exhaust pump can be readily made from the so-called "foot-ball pump" by reversing the cup of the plunger therein, thereby converting the customary foot-ball pump with the hollow needle into a vacuum pump. However, it is to be understood that a conventional valve and valve fitting may be used instead of the elastomer plug and hollow needle. The present arrangement, however, greatly expedites the operation of the device.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A device for holding an optical blank for processing, which device comprises:

(*a*) a rotatable, glandless mandrel,

(*b*) elastomer cup means detachably secured to said mandrel,

(*c*) said mandrel having an axial opening extending thereinto for a portion of the length thereof,

(*d*) said mandrel having a lateral passage formed therein, which lateral passage intersects said axial opening therein,

(*e*) self-contained valve means in said rotatable, glandless mandrel to close said lateral passage therein in air tight relation,

(*f*) detachable pump means to selectively pass air through said valve means on said rotatable, glandless mandrel only when said mandrel is not rotating, which valve means selectively closes said lateral opening in said mandrel to form a self-contained air tight chamber,

(*g*) said elastomer cup having an axial passage formed therethrough, which passage in said elastomer cup is adapted to register with said axial opening in said mandrel, and

(*h*) a face of said elastomer cup being so conformed to seat near the edge of an optical blank.

2. A device for holding an optical blank for processing, which device comprises:

(*a*) a rotatable, glandless mandrel,

(*b*) elastomer cup means detachably secured to said mandrel,

(*c*) said mandrel having an axial opening extending thereinto for a portion of the length thereof,

(*d*) said mandrel having a lateral passage formed therein, which lateral passage intersects said axial opening,

(e) said rotatable, glandless mandrel having a counterbore formed therein, which counterbore is coaxial with and in communication with said lateral passage in said mandrel,

(f) a self-sealing elastomer plug fitted in said counterbore in said mandrel, which plug closes said lateral passage in said mandrel,

(g) detachable pump means for selectively passing air through said elastomer sealing plug only when said mandrel is not rotating,

(h) said elastomer cup adapted to complementally fit said optical blank and having an axial passage formed therethrough, which axial passage in said elastomer cup is adapted to register with said axial opening in said mandrel,

(i) a face of said elastomer cup being conformed so the edges thereof will seat on said optical blank, and

(j) said pump which interconnects with said elastomer cup being adapted to evacuate at least a portion of the air from the grooved passages therein.

3. A device for holding an optical blank for processing, which devices comprises:

(a) a rotatable, glandless mandrel,

(b) an elastomer cup detachably secured to said mandrel,

(c) said mandrel having an axial opening extending thereinto for a portion of the length thereof,

(d) said mandrel having a lateral passage formed therein, which lateral passage intersects said axial opening,

(e) self-contained valve means in said rotatable, glandless mandrel to close said lateral passage,

(f) a pump for selectively passing air through said valve means on said rotatable, glandless mandrel only while said mandrel is not rotating,

(g) said elastomer cup having an axial passage formed therethrough, which axial passage in said elastomer cup is in register with said axial opening in said mandrel,

(h) cross members embedded in said elastomer cup and being arranged a spaced distance below the surface thereof so as to form visible centering means through the axial passage in said elastomer cup, and

(i) a face of said elastomer cup being conformed so the edges thereof will seat on an optical blank.

4. A device for holding an optical blank for processing, which device comprises:

(a) a rotatable, glandless mandrel,

(b) an elastomer cup secured to said mandrel,

(c) said mandrel having an axial opening extending thereinto for a portion of the length thereof,

(d) said mandrel having a lateral passage formed therein, which lateral passage intersects said axial opening,

(e) self-contained valve means in said rotatable, glandless mandrel to close said lateral passage to form a self-contained air tight chamber,

(f) a pump to selectively pass air through said valve means on said rotatable glandless mandrel only while said mandrel is not rotating,

(g) said elastomer cup having an axial passage formed therethrough, which axial passage in said elastomer cup is in register with said axial opening in said mandrel,

(h) a face of said elastomer cup being conformed so the edges thereof will seat on an optical blank,

(i) said elastomer cup having a plurality of radial grooves formed in the face thereof, which radial grooves are in communication with said axial opening in said mandrel, and which radial grooves extend outward from said axial passage less than half the diameter of said elastomer cup, and

(j) said pump which interconnects with said elastomer cup being adapted to evacuate at least a portion of the air from the grooves in said elastomer cup through said axial passage therein, when said optical blank is fitted thereagainst.

5. In a device for holding an optical blank for processing:

(a) a mandrel having a squared end,

(b) means on an end of said mandrel to detachably connect said mandrel to a socket,

(1) the other end of said mandrel being threaded,

(c) said mandrel having an axial opening formed therein for only a portion of the length thereof,

(d) said mandrel having a lateral passage formed therein, which lateral passage is in fluid communication with said axial opening,

(e) said mandrel having a counterbore formed therein, the axis of which counterbore is coaxial with the axis of said lateral passage,

(f) an elastomer, self-sealing plug fitted in said counterbore in said mandrel in leak proof relation,

(g) an elastomer cup threadably fitted on said threaded end of said mandrel,

(1) which elastomer cup has a concave face,

(2) which concave face of said elastomer cup has a peripheral edge,

(h) said elastomer cup having an axial passage formed therein which is in fluid communication with the axial opening in said mandrel,

(i) the concave face of said elastomer cup being adapted to complementally engage the convex side of an optical blank,

(j) a hollow needle, and

(k) a pump connected to said hollow needle to evacuate at least a portion of the air from said lateral opening in said mandrel, from said axial opening in said mandrel, from said axial passage in said elastomer cup, and from said grooved passages in said elastomer cup when the optical blank is in engagement with the concave face of said elastomer cup to bindingly engage the optical blank with the concave face of said elastomer cup by atmospheric pressure.

6. In a device for holding an optical blank for processing:

(a) a mandrel having a squared end,

(b) means on an end of said mandrel to detachably connect said mandrel to a socket,

(1) the other end of said mandrel being threaded,

(c) said mandrel having an axial opening formed therein for only a portion of the length thereof,

(d) said mandrel having a lateral passage formed therein, which lateral passage is in fluid communication with said axial opening,

(e) said mandrel having a counterbore formed therein, the axis of which counterbore is coaxial with the axis of said lateral passage,

(f) an elastomer, self-sealing plug fitted in said counterbore in said mandrel in leak proof relation,

(g) an elastomer cup threadably fitted on said threaded end of said mandrel,

(1) which elastomer cup has a concave face,

(2) which concave face of said elastomer cup has a peripheral edge,

(h) said elastomer cup having an axial passage formed therein which is in fluid communication with the axial opening in said mandrel,

(i) the concave face of said elastomer cup being adapted to complementally engage the convex side of an optical blank,

(j) a hollow needle, and

(k) a pump connected to said hollow needle to evacuate at least a portion of the air from said lateral opening in said mandrel, from said axial opening in said mandrel, from said axial passage in said elastomer cup, and from said grooved passages in said elastomer cup when the optical blank is in engagement with the concave face of said elastomer cup to bindingly

engage the optical blank with the concave face of said elastomer cup by atmospheric pressure,

(*l*) thin cross members embedded within said elastomer cup a spaced distance from the concave face therein, so said members will cross at substantially ninety degrees centrally of said axial passage in said cup to form a centering gauge for an optical blank which has a central marker thereon.

7. A device for holding an optical blank for processing, as defined in claim 4, wherein:

(*a*) the face of said elastomer cup has laterally grooves formed therein,

(*b*) which lateral grooves are in communication with said radial grooves therein, and

(*c*) which lateral grooves are so arranged as to dispense

suction over the greater portion of the area of the face of said cup when said optical blank is secured in place thereon.

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