Aug. 25, 1964 S. H. VEGORS ETAL 3,145,506

CONTACT LENS CONTOURING AND POLISHING MACHINE

Filed March 21, 1962 2 Sheets-Sheet 1

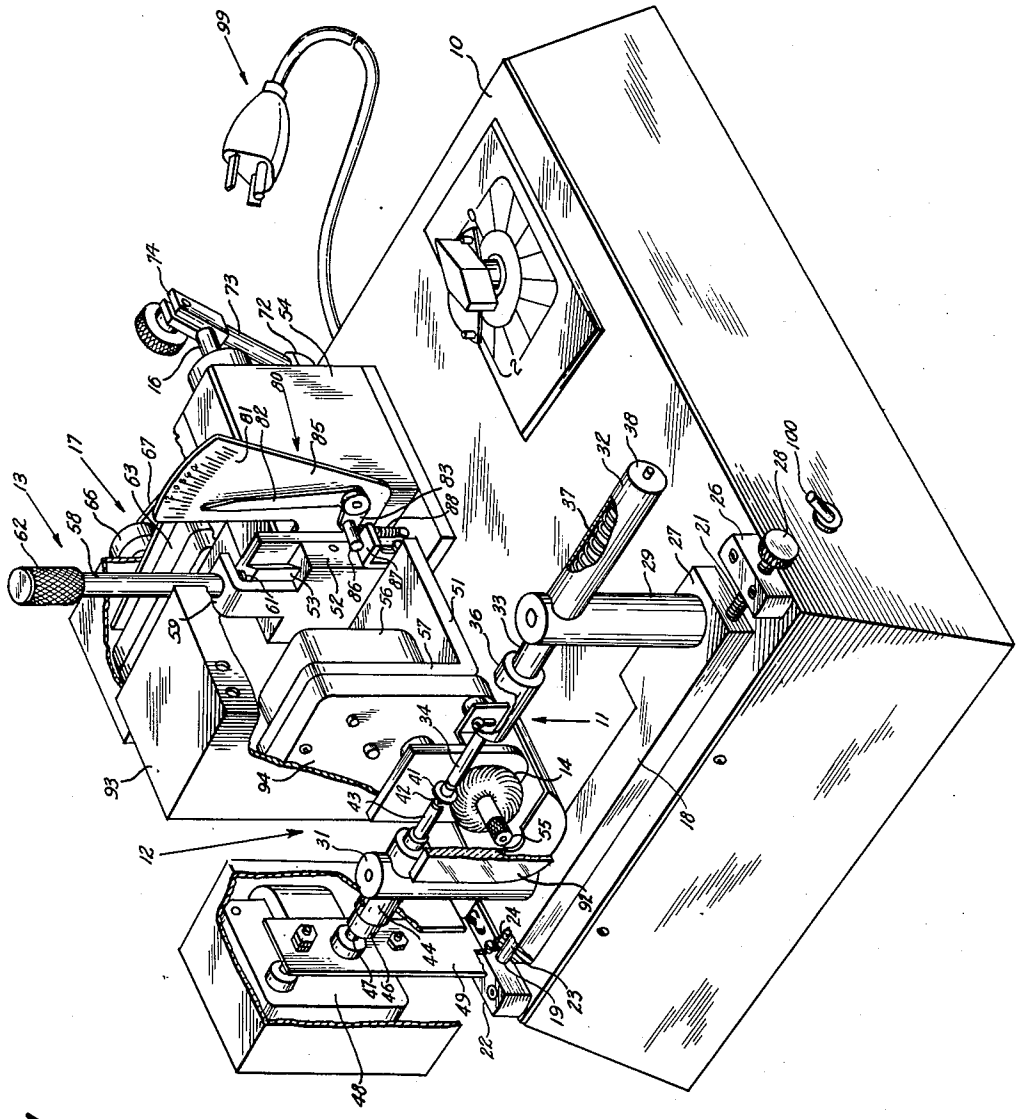

Fig. 1

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FIG. 2

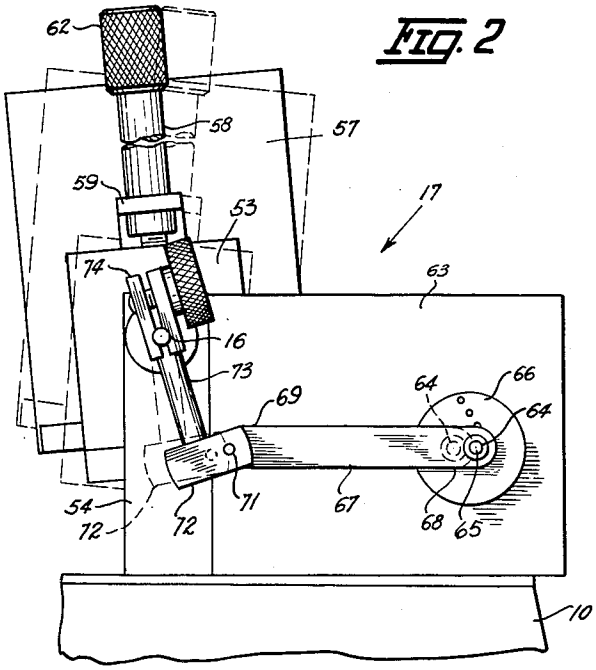


FIG. 5

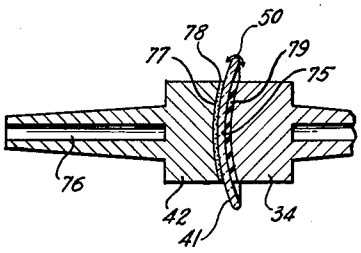


FIG. 3

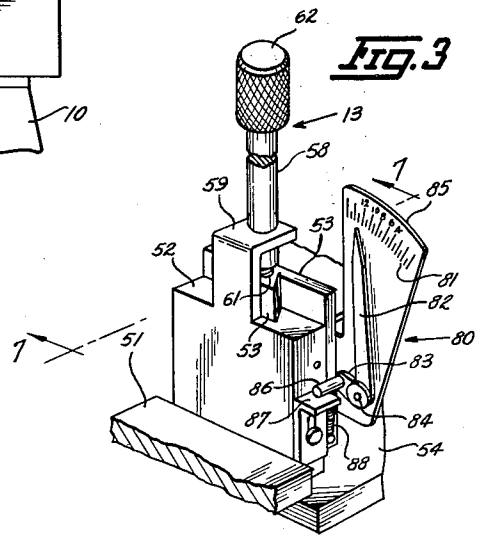


FIG. 4

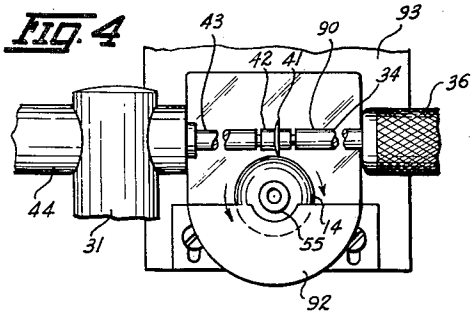
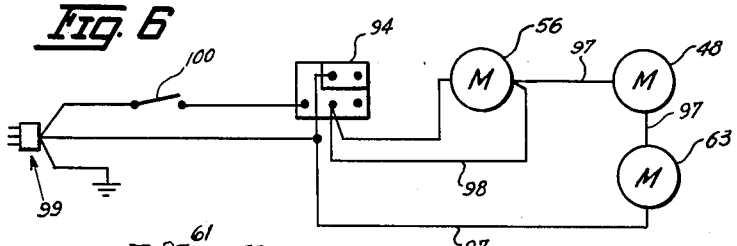


FIG. 6



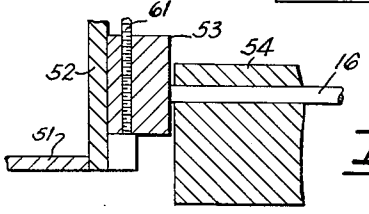


FIG. 7

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3,145,506 CONTACT LENS CONTOURING AND POLISHING MACHINE

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Filed Mar. 21, 1962, Ser. No. 181,401
6 Claims. (Cl. 51—33)

This invention relates generally to material polishing machines and more particularly to an apparatus for contouring and polishing the peripheral edge and adjacent side portions of a contact lens.

Prior to applicants' invention the method in most common use for polishing and contouring the peripheral edge and adjacent side portions of a contact lens was a hand method, the success of which was dependent entirely upon the skill and dexterity of the practitioner.

Thus a lens manufacturer supplied the practitioner with a lens having acceptable tolerances for power, center thickness, over-all diameter and radius of curvature. The practitioner, in the best way he could, would then hone, grind, file or otherwise attempt to hand contour the peripheral edges of the lens along with polishing the same. By virtue of these hand operations the lens would vary in the configuration of its peripheral edges and in the degree of polish given to the over-all configuration, all to the ultimate discomfort of the lens user.

Importantly by the above method duplicate lenses were most difficult if not impossible to reproduce since the practitioner could only attempt to match the previously finished lens rather than to duplicate the same according to a set or predetermined pattern or method used in its finishing.

It is an object of this invention therefore to provide a novel apparatus to contour and polish the peripheral edge and adjacent side portions of a contact lens.

A further object of this invention is to provide apparatus for contouring and polishing the peripheral edges of a contact lens so as to positively control both the removal of material and the contour whereby the contour of the finished lens is uniform about its entire periphery.

A further object of this invention is to provide an apparatus wherein the peripheral contour of the lens can be adjusted and after adjustment uniformly maintained about the complete periphery of the lens.

Still another object of this invention is to provide an apparatus for polishing and contouring the peripheral edge and adjacent edge portions of a contact lens wherein the lens is supported for rotation about an axis coincident with the optical center of the lens while being worked upon by a rotatable material removing and polishing member.

Still another object of this invention is to provide an apparatus for contouring and polishing the peripheral and adjacent peripheral edges of a contact lens which is economical, time saving and efficient in operation to produce lenses and reproduce duplicate lenses with controlled accuracy.

Further objects, features and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawing wherein:

FIG. 1 is a perspective view of the lens finishing apparatus of this invention with certain parts removed to more clearly show its construction;

FIG. 2 is an elevational detail view showing a part of the mechanism for controlling the shaping of the contour of the periphery of a lens;

FIG. 3 is a detailed perspective view showing the mechanism for controlling the amount of material to be removed from a lens in the contouring of its peripheral edge and adjacent side portions;

FIG. 4 is a detail elevational view showing the relative arrangement of a contact lens with a material removing and polishing member;

FIG. 5 is an enlarged detail view of a chuck and lens assembly wherein the optical center of the lens is coincident with its axis of rotation;

FIG. 6 is a diagrammatic showing of the electrical circuit for the operating motors used in the apparatus of this invention; and

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 3.

With reference to the drawing the apparatus of this invention is illustrated in FIG. 1 as including a base **10** of a rectangular shape having mounted on its top side a spindle unit indicated at **11** and a buffing unit indicated at **12**, that is vertically adjustable relative to the spindle unit by an adjusting device indicated at **13**. Concurrently with the rotation of a buffer wheel **14**, which forms part of the buffing unit **12**, the complete unit is oscillated or rocked with a shaft **16** that forms part of a contour adjusting control device indicated generally at **17**.

The spindle unit **11** includes an elongated base plate **18** having pivots **19** and **21** at its opposite ends to provide for its hinged movement toward and away from a supported position on the base **10**. The pivot **19** consists of a pin fixed at one end in a block member **22** secured to the base **10** and having its opposite end portion **23** slidably movable within an associated bore **24** formed in the base plate **18**.

The pivot **21** comprises a screw threadable through a block member **26** also secured to the base **10**. The inner end of the screw **21** is secured in a usual manner for rotation within the end **27** of the base plate **18**. A control knob **28** at the outer end of the pivot screw **21** provides for rotation of the screw and resultant adjustable movement of the base plate **18** axially of the pivots **19** and **21** for a purpose to appear later.

Projected upwardly from adjacent the opposite ends of the base plate **18** are a pair of standards or supports **29** and **31**. The standard **29** carries a fixed transversely extended tubular sleeve **32** which receives in telescopic engagement a rod **33** having a spindle **34** rotatably carried in a bearing **36** positioned at the inner end of the rod **33**. The rod **33** is biased outwardly from the sleeve **32** by a coil spring **37** mounted within the sleeve **32** and maintained under compression between the rod **33** and the sleeve end **38**. The rotatable spindle **34** is urged by the spring **37** into engagement with a lens **41**, to be worked upon, which is mounted in a chuck **42** carried in a spindle **43** that is rotatably journaled in a bearing **44** supported on the standard **31**. It is seen therefore that the spindles **34** and **43** are in axial alignment with each other and with the lens chuck **42**.

To remove the chuck and lens assembly **41** and **42** from between the rotatable spindles **34** and **43** the base plate **18** is pivoted to move the spindles away from the buffer wheel **14**, after which the rod **33** is gripped at the bearing **36** and moved against the action of the spring **37** toward the standard **29**. The chuck and lens assembly **41** and **42** is then removed from the spindle **43**.

It is to be understood that the same procedure is followed in the mounting of a chuck and lens assembly between the spindles **34** and **43**, with the spring pressure applied through the spindle **34** against the lens **41** acting to hold the lens in a predetermined position relative to the chuck **42**, and to provide for a rotation of the spindle **34** in response to a rotation of the spindle **43**. The shaft for the spindle **43** is connected at **46** with the shaft **47** of an electrical motor **48** which is mounted on a bracket **49** secured to the base plate **18**.

The buffing unit 12 includes a mounting bracket 51 (FIG. 1) of a generally U-shape having a rear leg 52 constituting a dovetail guide block operatively associated with a dovetail guideway 53 which is fixed to an upright support member or bearing block 54 mounted on the base 10. The buffer member 14 is mounted on a shaft 55 that is suitably connected in a driven relation with a reversible electric motor 56 secured to the front leg 57 of the mounting bracket 51. As best appears in FIG. 1 the buffer shaft 55 is arranged below and normal to the spindles 34 and 43, with the buffer wheel 14 being rotatable in a plane normal to the shaft 55, and with the lens 41 being rotatable in a plane normal to the axes of the spindles 34 and 43 whereby the lens 41 and buffer wheel 14 lie in planes at right angles to each other.

Linear vertical movement of the buffer wheel 14, relative to the lens 41, is accomplished by means of a hand actuated control rod 58 (FIGS. 1 and 3) rotatably supported in a mounting 59 secured to the guide block 52 and threadable at 61 within the guideway 53. Thus on rotation of the control rod 58, by means of a finger knob 62, the mounting bracket 51 and in turn the shaft 55 of the buffer wheel 14 are vertically movable as a unit relative to the guideway 53 and in turn to the spindle means 34 and 43. In other words, on manipulation of the control rod 58 the buffing unit 12 is movable to a vertically adjusted position relative to the lens 41.

Concurrently with the rotation of the buffer wheel 14, by the drive motor 56, the buffing unit 12 is oscillated or rocked with the shaft 16 which is rotatably supported in the bearing block 54 and secured at its inner end to the guideway 53 as shown in FIG. 7. The shaft 16 is spaced vertically upwardly from the buffer wheel shaft 55 with the axis thereof lying in a plane common to the axis of rotation of the shaft 55.

The shaft 16 is driven by an electric motor 63 (FIGS. 1 and 2) having a shaft 64 which, as best shown in FIG. 2, is provided with an eccentric mounting 66. A connecting link 67 has one end 68 rotatably connected with the eccentric mounting 66 by means of a crank pin 65 and its other end 69 pivotally connected by bolt 71 to a clamp member 72 adjustably mounted on a rock arm 73 which is adjustably clamped, as indicated at 74, on the shaft 16. By adjusting the clamp 72 longitudinally of the rock arm 73 the amplitude of oscillation of the shaft 16 may be varied. Further, by angularly adjusting the clamp 74, relative to the shaft 16, the extent of oscillation of the buffing unit 12, to either side of a vertical plane extended through the axes of the shafts 16 and 55, may be varied.

As a result of this oscillatory movement of the buffing unit 12 relative to the axis of the shaft 16, the axis of the buffer wheel shaft 55 is moved in an arc or arcuate path, indicated at 50 in FIG. 5, extended transversely of the plane of the contact lens 41 in what might be termed a concentric or following relation with the periphery and adjacent side edges of the lens 41.

Prior to the use of the apparatus of this invention to contour and polish a lens 41 the lens, as received from a supplier or manufacturer, is initially placed in the chuck 42 (FIGS. 4 and 5) with its optical center, indicated at 75, positioned coincident with the axis 76 of the chuck 42. This centering is accomplished by means, including a lensometer; the lens 41 being held in its optically centered position within the concavity 77 of the chuck 42 by a double-faced adhesive 78, one face of which adheres to the surface of the concavity 77 and the opposite face of which adheres to the convex surface of the lens 41.

In the manner previously described the lens and chuck assembly 41 and 42 is mounted between the spindles 34 and 43, the spindle 34 being provided with a rubber or like nose piece 79 (FIG. 5) of a generally convex form adapted to fit in a nested relation with the concave surface of the lens 41. By manipulation of the control knob 62 the buffing unit 12 is vertically adjusted relative to the peripheral edge of the lens 41. To facilitate this

adjustment the apparatus is provided with a lens size indicator, designated generally at 80 in FIG. 1, which includes a calibrated scale 81 and an indicating needle 82 movable relative to the scale 81. The needle 82 is integral with a crank arm 83 and is supported on a pivot 84 mounted on a plate 85 which carries the calibrations 81. The plate 85 in turn is mounted on the rear side of the guideway 53.

The crank arm 83 is in contact engagement with a lateral projection 86 adjustably secured, as illustrated at 87, to the guide block 52. Thus on movement of the guide block 52 relative to the guideway 53, the needle 82 is pivotally actuated, with a spring 88, connected at one end to the crank arm 83 and at its opposite end to the guideway 53, acting to continuously maintain the crank arm 83 engaged with the lateral projection 86. As shown in FIG. 1 the scale 81 is calibrated directly in millimeters to indicate the diameter size of the lens 41.

This initial setting of the buffer wheel 14 relative to the peripheral edge of the lens 42, at a position dependent on the diameter of the lens being finished, provides for a uniform removal of stock from the peripheral edge of the lens.

The oscillation of the buffer wheel 14 relative to the peripheral edge of the lens 41, concurrently with the rotation of both the lens 41 and the wheel 14, moves that peripheral portion of the buffer wheel that engages the adjacent peripheral portion of the lens 41 in a small arcuate path, indicated at 50 in FIG. 5, about the peripheral edge and adjacent side portions of the lens 41. What might be termed the gross setting of the peripheral configuration of the lens is accomplished by the adjustment of the connecting clamps 72 and 74 relative to the rock arm 73 and shaft 16, respectively. This gross setting is complemented by what might be termed a fine or vernier shaping, which is obtained by actuation of the control knob 28 which adjustably moves the spindle unit 11 axially of the spindle members 34 and 43, and in turn the lens 41 transversely of the axis of rotation for the buffer wheel 14.

Extended about the lower portion of the buffer wheel 14 is a trough 92 which is secured to the housing 93 for the reversible motor 56. The trough is filled with a liquid polishing compound which includes a tin oxide, to a level providing for the travel therethrough of the lower peripheral portion of the buffer wheel 14.

On completion of the above adjustments to provide for the desired relation between the buffer wheel 14 and lens 41, the motors 48, 56 and 63 are concurrently set into operation by the actuation of a switch and timer device 94 (FIG. 6). The usual time for working on the lens 41 is about five minutes, but, of course, such time can be varied. For about one-half of such total time the buffer wheel 14 is operated in a clockwise direction, as viewed in FIG. 4. The motor 56 is then reversed, through the action of the device 94, to provide for the rotation of the buffer wheel 14 in a counterclockwise direction, as also viewed in FIG. 4, for the remaining time of the contouring and polishing operation on the lens 41.

The working peripheral surface of the buffer wheel 14 is composed of a soft plastic or styrofoam material. Upon rotation in one direction, therefore, there is a tendency for such material, and the polishing compound from the trough 92, to accumulate or pile up on what might be termed the trailing end of that portion of the peripheral surface of the buffer wheel 14 which is in contact engagement with the lens 41. As a result of this accumulating action there is a tendency of one peripheral edge portion of the lens 41 being more aggressively worked upon relative to an opposite peripheral edge portion. By providing for a reversed rotation of the buffer wheel 14, during the polishing and contouring cycle, this tendency is completely eliminated so as to provide for a uniform working of the buffer wheel 14 on all portions of the lens 41 being contoured and polished.

On expiration of the total time period of operation, the motors 48, 56 and 63 are concurrently stopped by the device 94. The chuck and lens assembly 41 and 42 is then removed from the apparatus, and the configuration and surface finish of the peripheral edges of the lens 41 checked for accuracy through a commercially available magnifying device. If any correction is required, the lens and chuck assembly 41 and 42 is replaced in the apparatus of this invention, any necessary adjustments of the shape controls 28, 72 and 74 are made, and the lens 41 again worked upon to make the correction.

In one embodiment of the invention the buffer wheel is rotated at a speed of about 60 r.p.m.; the lens at a speed of about 3000 r.p.m.; and the buffer unit 12 is oscillated at a rate of about 25 oscillations per minute.

As shown in FIG. 6 the motors 48, 56 and 63 are connected in series with each other and with the timer 94 by the connecting wire 97. Reversal of the motor 56 by the timer 94 is accomplished through the connection 98. A usual plug-in 99 to a source of a 110 voltage supply is connected with the timer device 94, the switch therefor being indicated at 100.

Although the invention has been described with respect to a preferred embodiment thereof, it is to be understood that it is not to be so limited since changes can be made therein which are within the full intended scope of this invention as defined by the appended claims.

We claim:

1. An apparatus for contouring and polishing the peripheral edge and adjacent side portions of a contact lens comprising:

(*a*) a rotatable buffer member,

(*b*) rotatable spindle means for holding a contact lens having a peripheral edge and adjacent side portions for rotation in a vertical plane normal to the plane of rotation of said buffer member,

(*c*) means for adjustably vertically moving said buffer member toward and away from the peripheral edge of the contact lens,

(*d*) means for horizontally adjustably moving said spindle means to move the lens relative to said buffer member, and

(*e*) means for oscillating said buffer member about an axis parallel to the axis of rotation thereof such that said buffer member, concurrently with rotation thereof, is oscillated in an arc about the peripheral edge and adjacent side portions of the lens.

2. An apparatus for contouring and polishing the peripheral edge and adjacent side portions of a contact lens comprising:

(*a*) a rotatable polishing and contouring unit including a buffer member,

(*b*) a rotatable spindle means for holding a contact lens having a peripheral edge and adjacent side portions, the axes of rotation of said buffer member and spindle means being normal to each other and with the plane of a lens substantially in a plane common to the axis of rotation of said buffer member,

(*c*) means for adjustably moving the buffer member toward and away from the peripheral edge of said lens,

(*d*) means for adjustably moving said spindle means in a direction axially thereof, and

(*e*) means for oscillating said buffer member, concurrently with rotation thereof, in an arc about the peripheral edge and adjacent side portions of the lens.

3. An apparatus for contouring and polishing the peripheral edge and adjacent side portions of a lens comprising:

(*a*) a rotatable buffing unit having a buffer member,

(*b*) a rotatable spindle unit for holding a lens having a peripheral edge and adjacent side portions, the axes of said two units being arranged normal to each other, with the plane of the lens being substantially in a plane extended through the axis of said buffer unit and normal to the axis of said spindle unit,

(*c*) means for adjustably moving said buffer member toward and away from the lens in a path parallel to the plane of the lens,

(*d*) means for adjustably moving the spindle means in a direction longitudinally thereof, and

(*e*) means for oscillating the buffer member in an arc about the peripheral edge and adjacent side portions of the lens.

4. An apparatus for contouring and polishing the peripheral edge and adjacent side portions of a lens comprising:

(*a*) a rotatable buffing uit including a buffer member,

(*b*) a rotatable spindle means for holding a lens having a peripheral edge and adjacent side portions for rotation therewith, the planes of rotation of said buffer member and lens being arranged normal to each other and with the rotational plane of said lens extendible through the axis of rotation of said buffer member,

(*c*) means for linearly moving said buffer member toward and away from said spindle means to an adjusted position relative to the peripheral edge of the lens,

(*d*) means for adjustably moving said lens axially of the axis rotation thereof, and

(*e*) means for oscillating said buffer unit about an axis parallel to the axis of rotation of said buffer member to provide for the movement of the lens engageable portion of the buffer member in an arcuate path extended transversely of the rotational plane of the lens and about the peripheral edge and adjacent side portions of the lens.

5. The apparatus according to claim 4 wherein the buffer member is rotatable in reversed directions.

6. The apparatus according to claim 4 wherein the oscillating means is adjustable to vary the extent of arcuate movement of the buffer member to opposite sides of the plane of the lens.

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