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(71) Applicants
Hoya Lens Corporation, 25 Kowada Itsukaichimachi Nishitama-gun, Tokyo, Japan.
(72) Inventors
Hayao Akaba, Toyoji Wada, Takeshi Yamada, Masayoshi Lee.
(74) Agents
Abel and Imray, Northumberland House, 303-306 High Holborn, London WC1V 7LH.

(54) **Apparatus for cutting peripheral groove on spectacle lens**

(57) An apparatus for automatically cutting a peripheral groove on a lens 17 of spectacles comprises a rotary diamond cutter 41 and a lens holding and rotating section, gripping the lens at its centre by two opposed abutments 16, 18. To accommodate axial and radial movements of the periphery, side guides 27 on arms 28, 29 and a rocking plate 26 adjust the holding section. The rocking plate, by detecting angular changes, causes the lens rotating D.C. motor to vary speed for constant peripheral speed. Also included are a cutting pressure adjusting section and an unusual-operation responsive shutting-down section. The apparatus can cut a peripheral groove of uniform depth and width at a predetermined location of any one of various lenses without regard to the shape or contour of the lenses. One of the abutments 18 is axially adjustable on a graduated rod 19 to determine the position for mean curvature.

FIG. 1

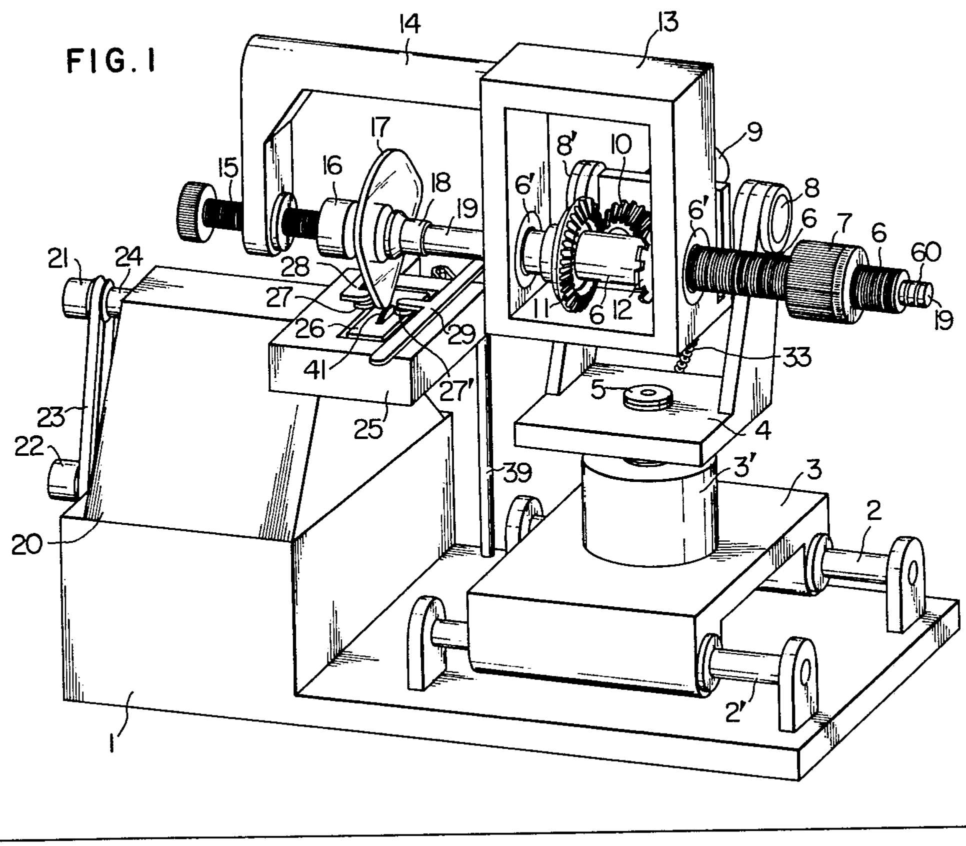

FIG. 1

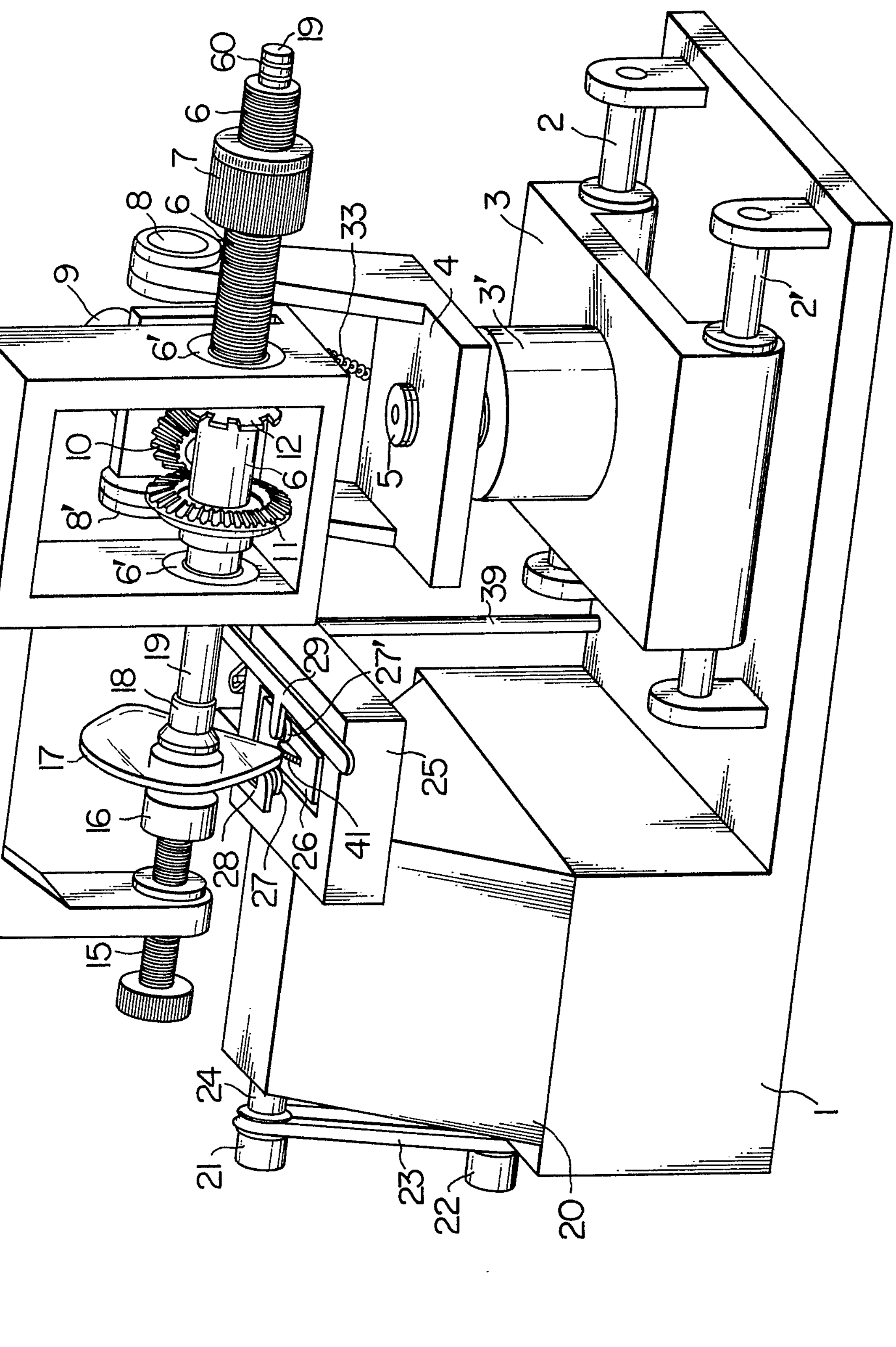

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FIG. 2

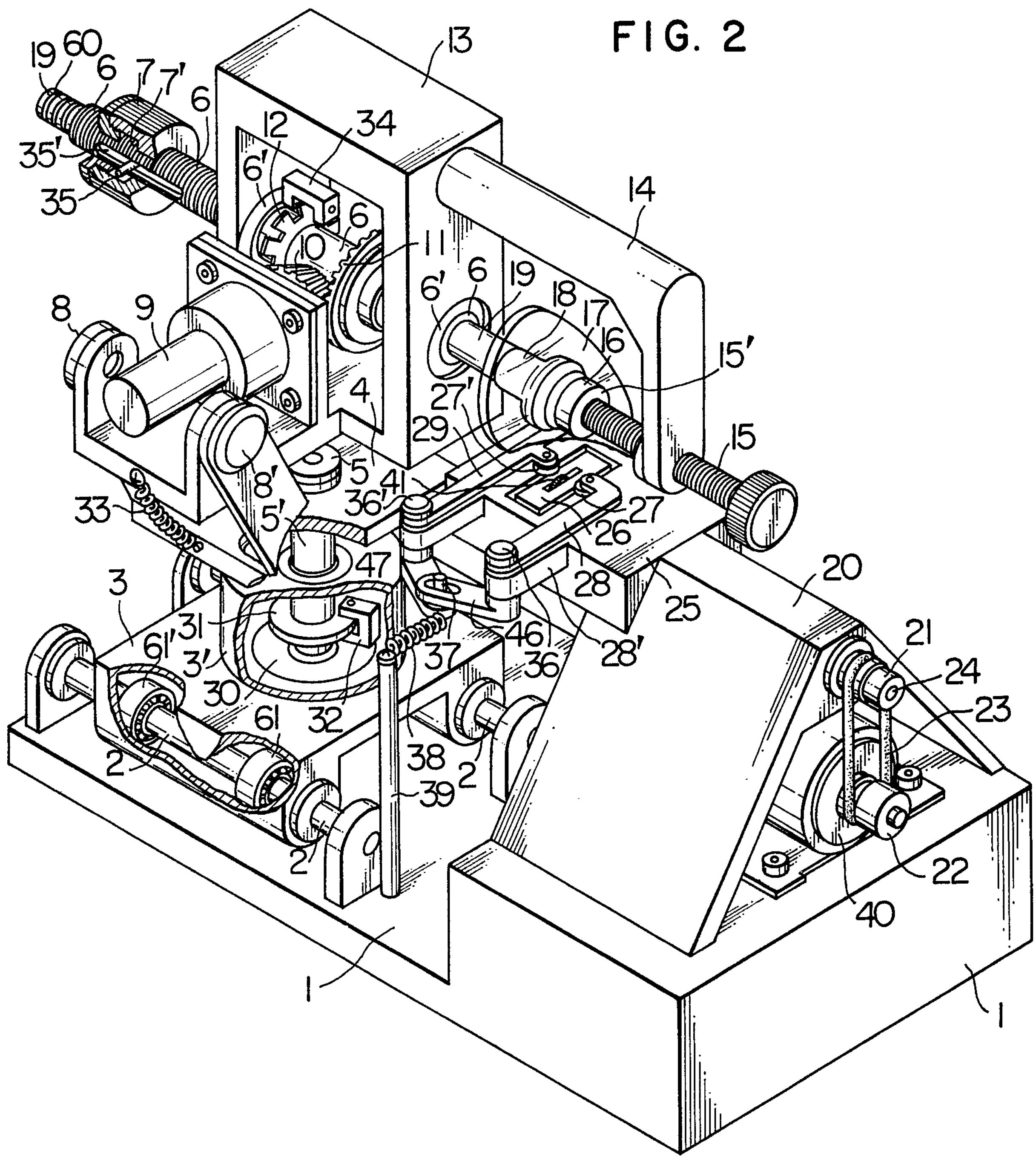
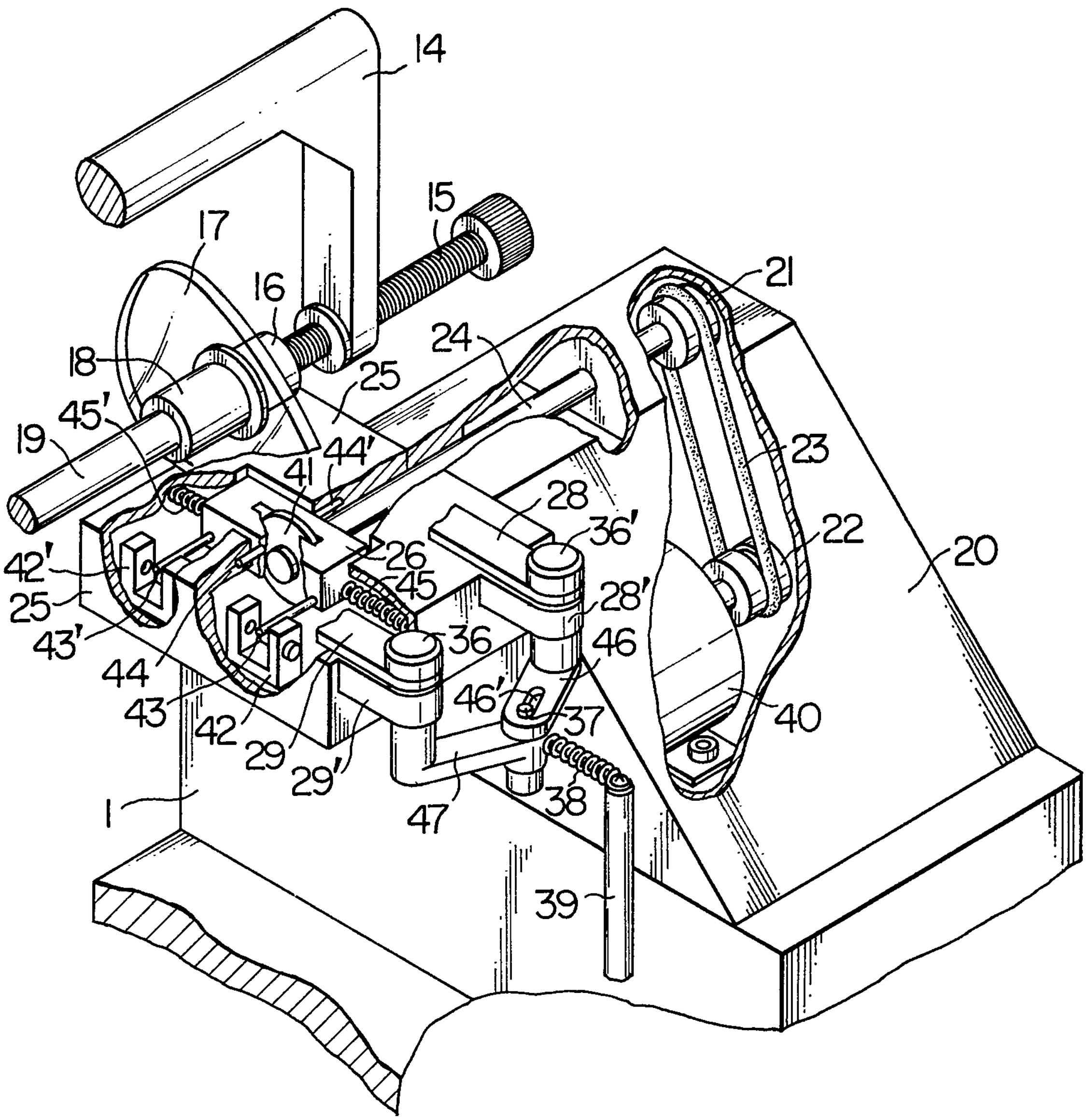


FIG. 3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29'
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FIG. 4

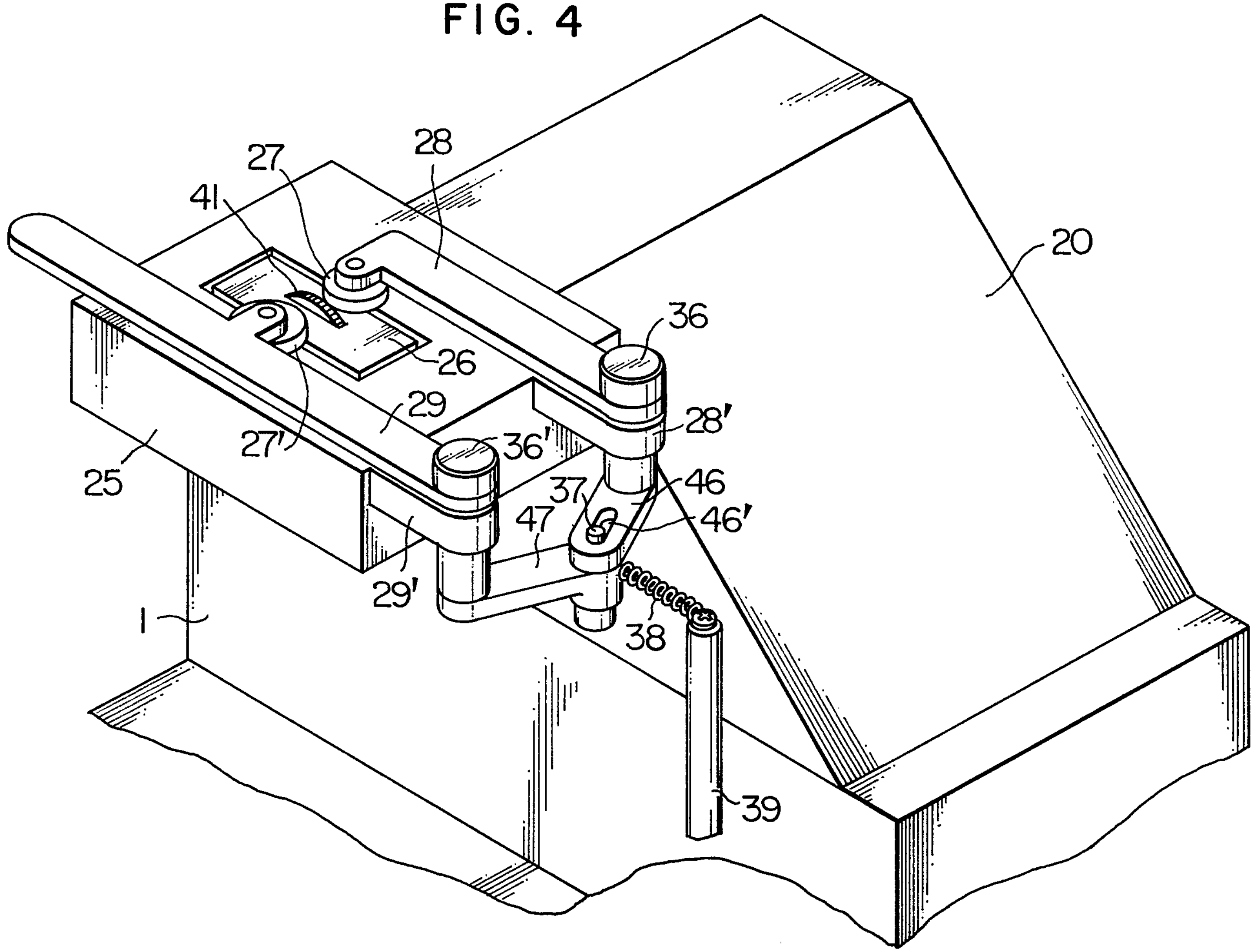


FIG. 5a

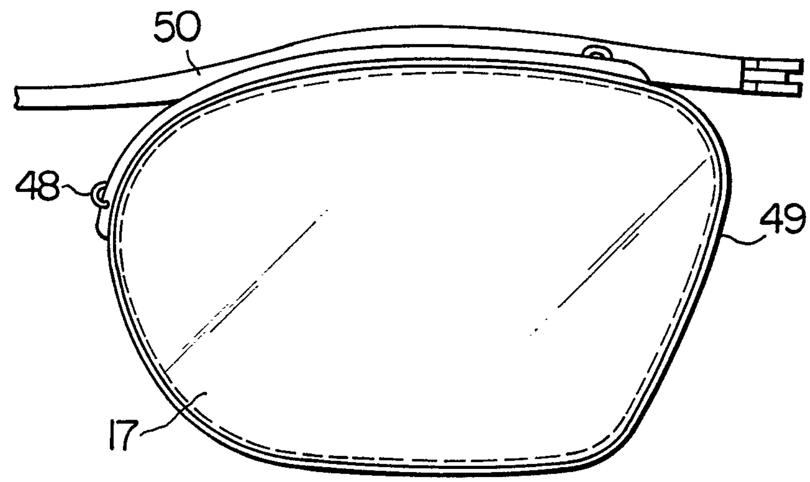


FIG. 5b

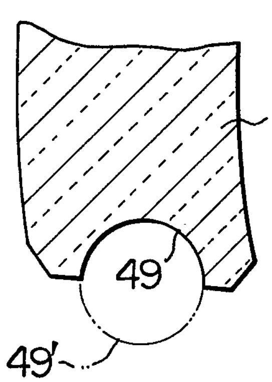


FIG. 5c

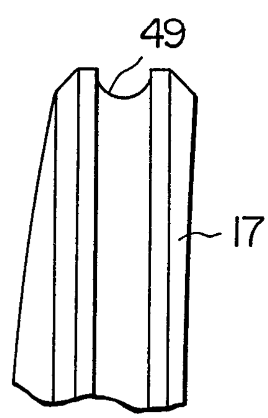


FIG. 6

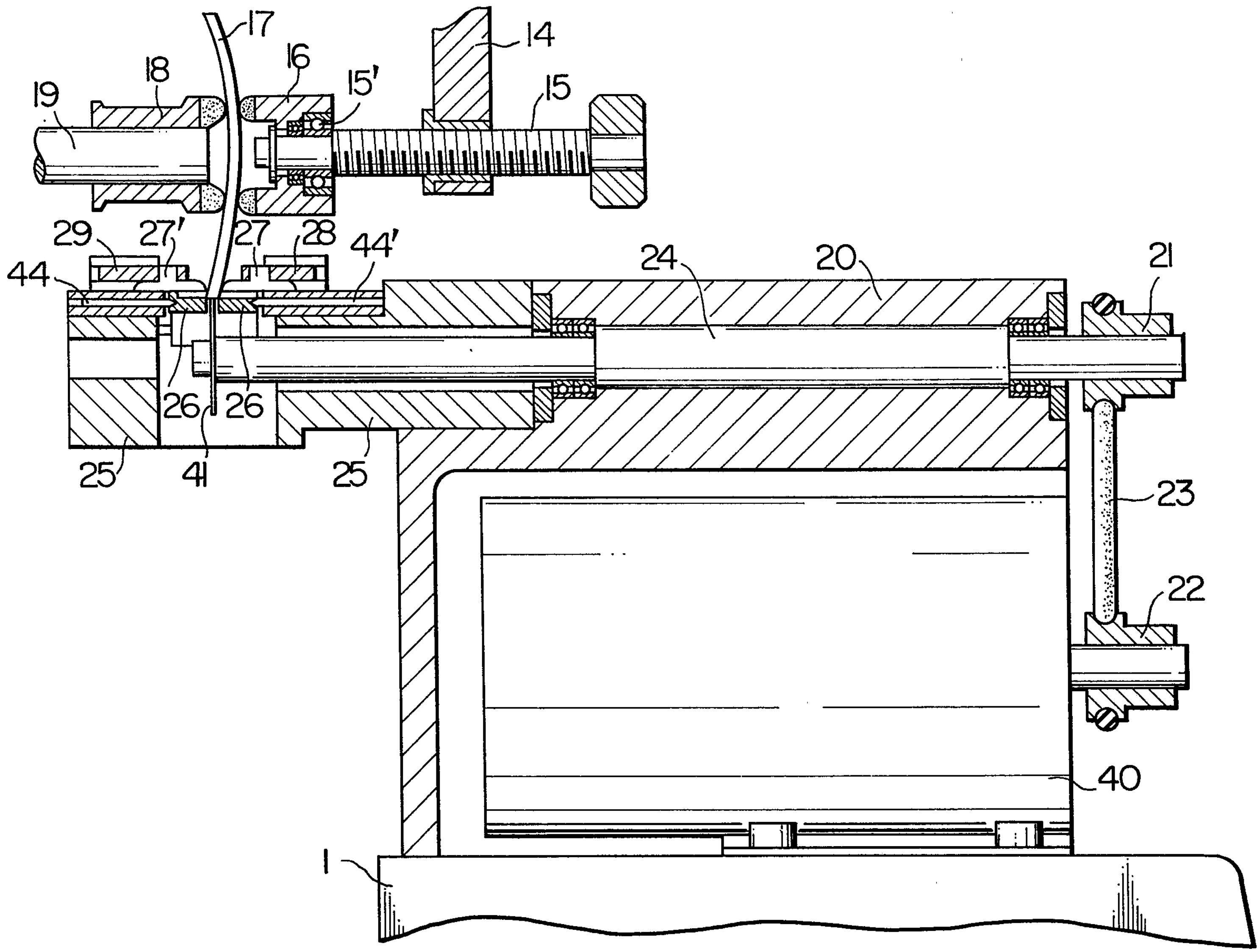


FIG. 7a

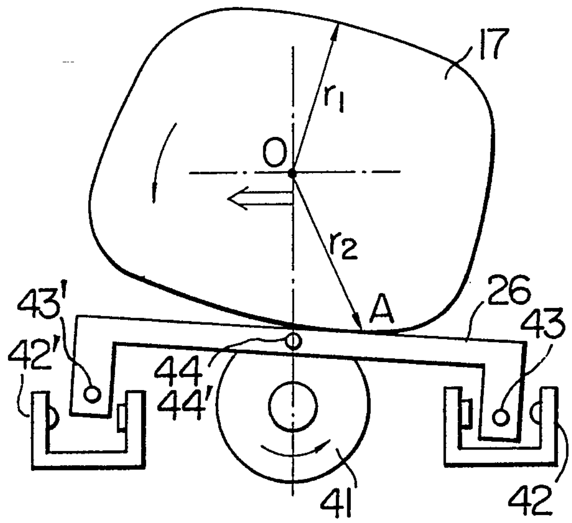


FIG. 7b

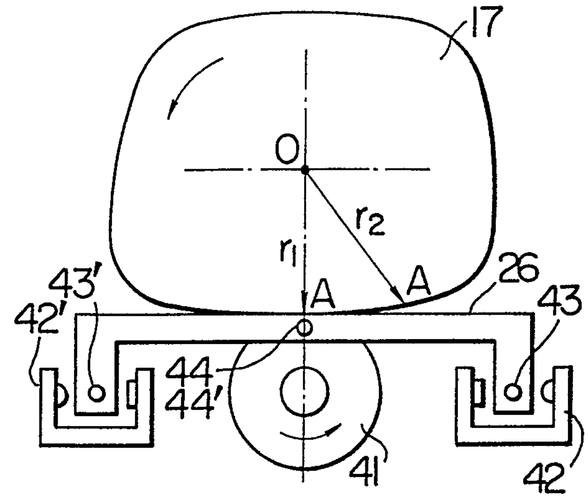


FIG. 7c

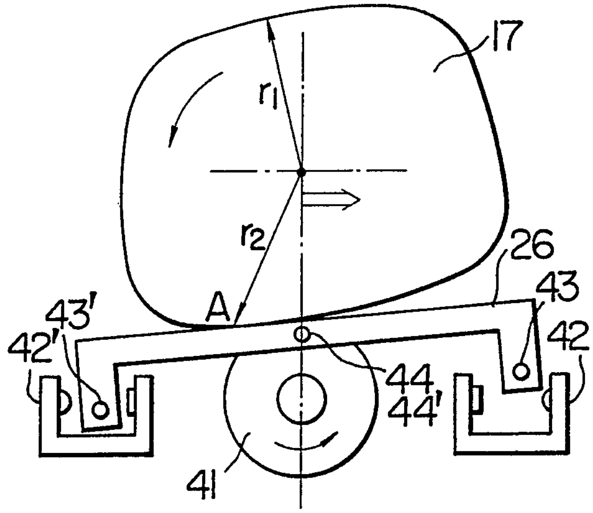


FIG. 8

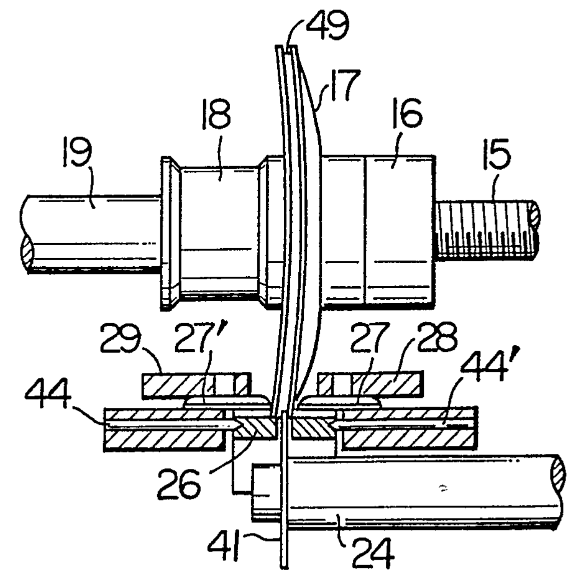


FIG. 9

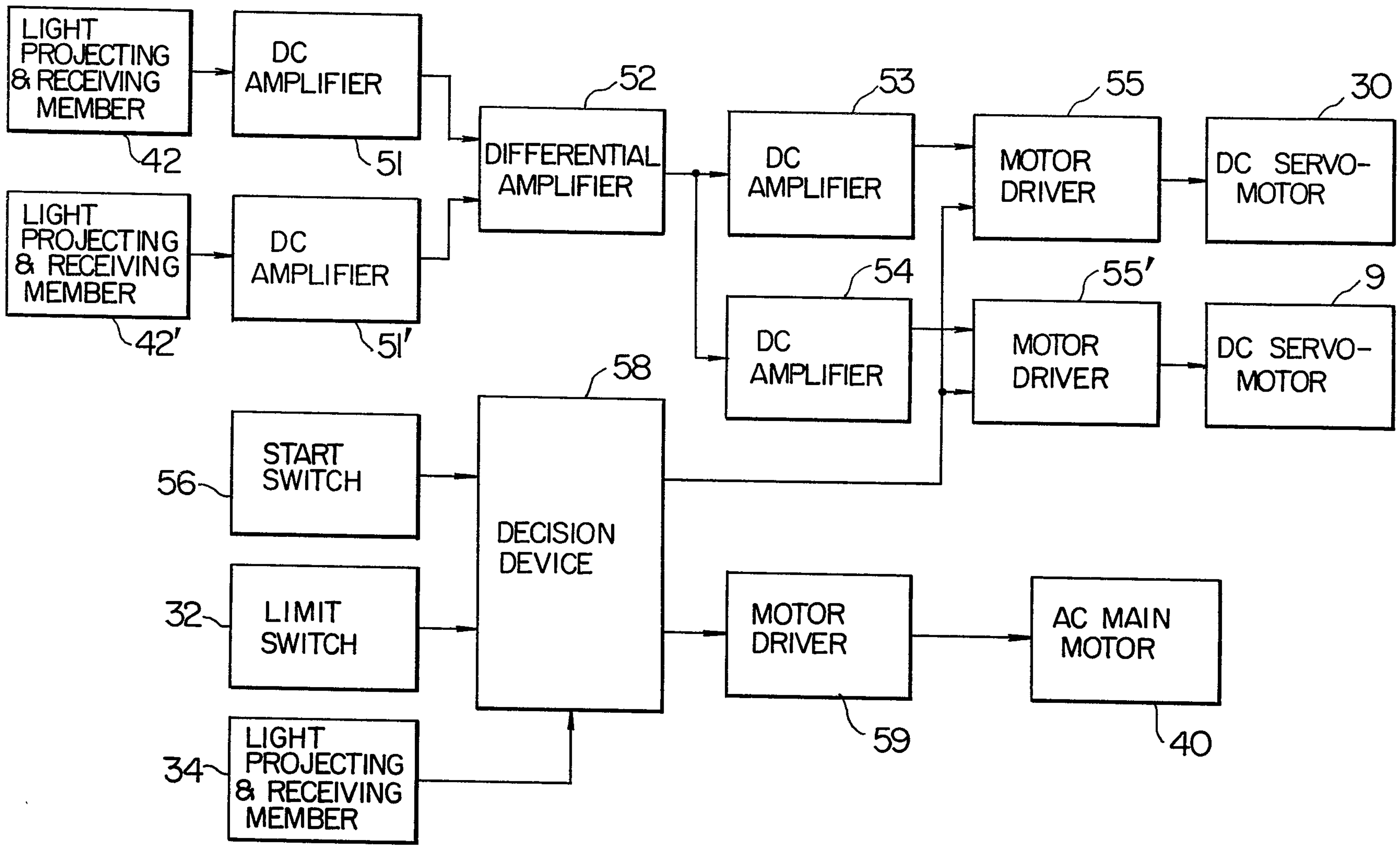

LIGHT PROJECTING & RECEIVING MEMBER
42
DC AMPLIFIER
51
LIGHT PROJECTING & RECEIVING MEMBER
42'
DC AMPLIFIER
51'
DIFFERENTIAL AMPLIFIER
52
DC AMPLIFIER
53
DC AMPLIFIER
54
MOTOR DRIVER
55
MOTOR DRIVER
55'
DC SERVO-MOTOR
30
DC SERVO-MOTOR
9
START SWITCH
56
LIMIT SWITCH
32
LIGHT PROJECTING & RECEIVING MEMBER
34
DECISION DEVICE
58
MOTOR DRIVER
59
AC MAIN MOTOR
40

FIG. 10

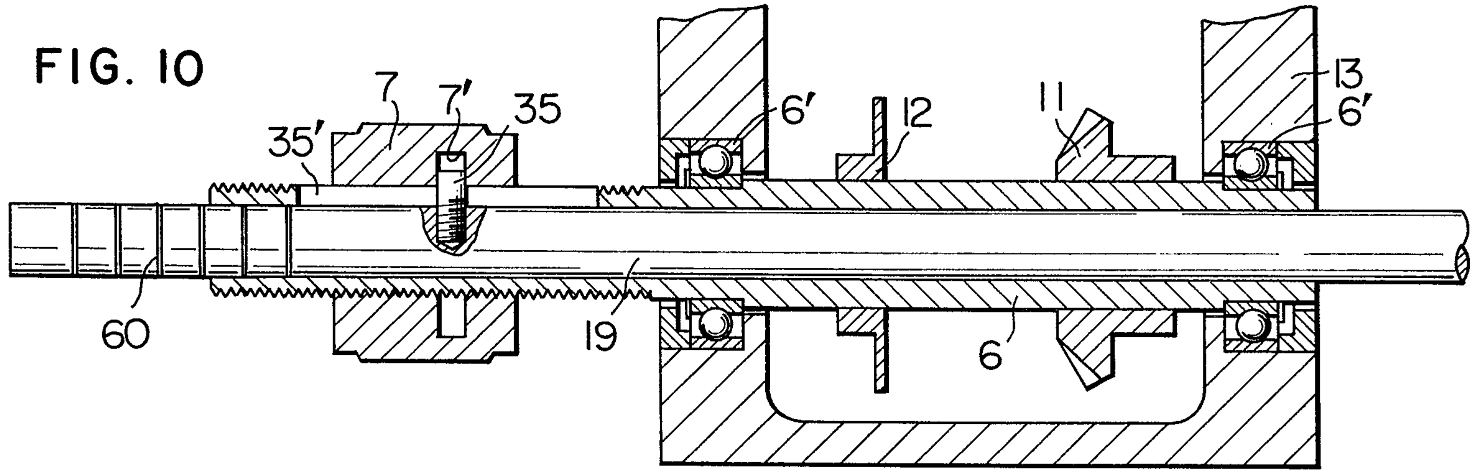


FIG. 11a

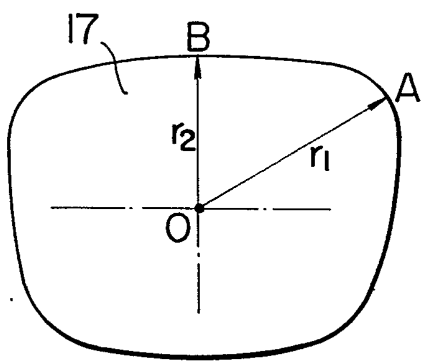


FIG. 11b

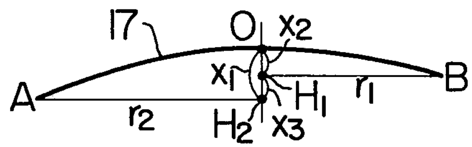


FIG. 11c

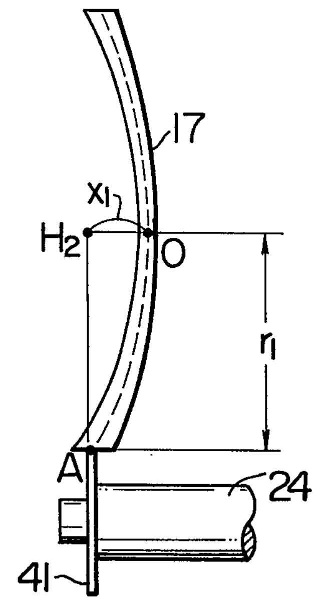
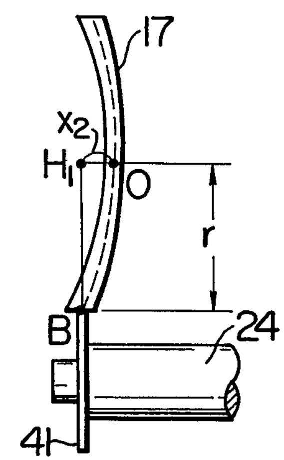


FIG. 11d



SPECIFICATION

Apparatus for cutting peripheral groove on spectacle lens

This invention relates to apparatus for cutting a peripheral groove on a lens of spectacles, and more particularly to an apparatus for automatically cutting a nylon thread-receiving groove on the periphery of a lens of spectacles mounted on a rimless frame.

In a pair of spectacles mounted on a rimless frame, a thread of nylon received in a peripheral groove of the lens of each spectacle (which will be referred to hereinafter merely as a lens) is inserted at its opposite end into an auxiliary frame portion of the rimless frame to be suspended from the auxiliary frame portion, so that the lens can be fixed in position without the use of the rim. Heretofore, the peripheral groove of such a lens has been manually cut by the operator who operates the cutting machine. However, due to the fact that such lenses are prepared to have a variety of radii of curvature to meet various powers of the eyes of spectacle users and are then machined to conform to a variety of shapes of rimless frames on which the lenses are to be mounted, the peripheral contour of one of the lenses differ generally from that of another. Because of the above fact, the skill and experience of the operator has been relied upon for the cutting of the peripheral groove on the selected lens, and this manner of manual groove cutting resorting to the skill and experience of the operator has been defective in that the depth, width and location of the groove tend to be non-uniform throughout the entire periphery of the lens.

It is therefore a primary object of the present invention to provide a novel apparatus which obviates the aforementioned prior art defect and can automatically cut a groove of uniform depth and width at a predetermined location on the entire periphery of any one of various lenses without requiring the skill and experience of the operator and without regard to the shape of the lenses.

According to one aspect of the present invention which attains the above object, there is provided an apparatus for cutting a peripheral groove on a lens of spectacles comprising a lens holding and rotating section, a lens cutter driving section, a lens position adjusting section, a lens rotation speed control section, a lens cutting pressure adjusting section and an unusual-operation responsive shutting-down section, the lens holding and rotating section including lens abutments for holding the lens therebetween at a central area of the lens and a DC servomotor for rotating the lens at a predetermined peripheral speed at a position directly above a diamond cutter; the lens cutter driving section including an AC main motor for driving the diamond cutter coupled to its shaft while maintaining the point of engagement between the lens and the diamond cutter at the position directly above the diamond cutter throughout a groove cutting cycle and a light projecting and receiving member sensing rotation of the lens, a counter disc and a decision device including an integrated logical decision circuit for automatically stopping the operation of the apparatus upon completion of the groove cutting cycle; the lens position adjusting section including a lens-engageable rocking member, light projecting and receiving members sensing an inclination of the rocking member, light shielding lugs, DC amplifiers, a differential amplifier, DC servomotor drivers, DC servomotors, a holder, a cylindrical casing, slide rods and a slider for adjusting the position of the lens in both the axial direction and the radial direction so as to maintain the periphery of the lens at the position directly above the diamond cutter; the lens rotation speed control section including the lens-engageable rocking member, the light projecting and receiving members, the light shielding lugs, the decision device, the DC servomotor drivers and the DC servomotors for controlling the rotation speed of the lens so that the lens can be rotated at the predetermined peripheral speed regardless of the shape of the lens; the lens cutting pressure adjusting section including a load-bearing tension spring for maintaining a uniform contact pressure between the lens and the diamond cutter so that the peripheral groove can be cut with a predetermined cutting pressure; and the unusual-operation responsive shutting-down section including a limit switch, the decision device and the DC servomotor drivers for automatically stopping the operation of the DC servometers and AC main motor to shut down the apparatus thereby ensuring the safety of the apparatus in the event of occurrence of an unusual operation including an excessive inclination of the lens-engageable rocking member with which the lens is engageable during its rotation.

Other objects, features and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a preferred embodiment of the apparatus according to the present invention;

Figure 2 is a partly cut-away, schematic perspective view of the apparatus when viewed from the side opposite to that in Figure 1;

Figures 3 and *4* are partly cut-away, schematic perspective views showing the structure of the lens position adjusting section of the apparatus according to the present invention;

Figures 5a, 5b and *5c* show schematically the relation between a rimless frame and a spectacle lens formed with a peripheral groove for mounting on such a rimless frame;

Figure 6 is a schematic vertical sectional view showing the structure of portions of the lens holding and rotating section, lens position adjusting section and lens cutter driving section of the apparatus according to the present invention;

Figures 7a, 7b and *7c* show the rotation of the lens relative to the lens-engageable rocking member, light projecting and receiving members and diamond cutter in the apparatus according to the present invention;

Figure 8 is a schematic vertical sectional view showing how the groove is cut on the periphery of the lens with the diamond cutter while the lens is guided at its peripheral portion between the lens guides;

Figure 9 is a block diagram of the electrical circuit incorporated into the apparatus according to the present invention;

Figure 10 is a schematic axial sectional view of part of the lens retaining shaft in the apparatus according to the present invention; and

Figures 11a, 11b, 11c and *11d* show schematically the distances from the lens holding center to various points on the periphery and axis of the lens in the apparatus according to the present invention.

A preferred embodiment of the apparatus for cutting a peripheral groove on a lens according to the present invention will now be described in detail with reference to the drawings. The apparatus comprises a lens holding and rotating section, a lens cutter driving section, a lens position adjusting section, a lens rotation speed control section, a lens cutting pressure adjusting section and an unusual-operation responsive shutting-down section.

Referring to Figures 1 and 2, the lens holding and rotating section includes a DC servomotor 9 coupled to a bevel gear 10 meshing with another bevel gear 11, a box 13, an arm 14 extending from the box 13, a threaded lens push rod 15 applying a holding pressure to a lens 17 releasably held between annular lens abutments 16, 18, a lens retaining shaft 19, a holder 4 holding a pair of supporting members 8, 8′ supporting the DC servomotor 9, a tubular shaft 6, a guide pin 35 and an adjusting ring 7. The threaded lens push rod 15 extends through a corresponding threaded hole of the arm 14 extending from one of the sides of the box 13. The threaded lens push rod 15 is journalled at its non-threaded inner end portion in a bearing 15′ fixedly mounted in the lens abutment 16 of head rubber as best shown in Figure 6 so that the lens abutment 16 is freely rotatable on the non-threaded inner end portion of the lens push rod 15. The lens retaining shaft 19 extends slidably through the axial bore of the tubular shaft 6 journalled in a pair of bearings 6′ fixedly mounted in the opposite legs respectively of the box 13. The other lens abutment 18 is fixedly mounted on the inner end portion of the lens retaining shaft 19 as best shown in Figure 6, and an adjusting scale 60 having graduations corresponding to the mean radii of curvature of various powers of lenses is provided on the outer end portion of the lens retaining shaft 19. As best shown in Figure 10, the guide pin 35 is fixed to the lens retaining shaft 19 at a position inner relative to the scale 60. The tubular shaft 6 is provided with an axial slot 35′ with which the guide pin 35 engages, and the guide pin 35 is received in a radial groove 35′ formed in the adjusting ring 7 internally threaded for making threaded engagement with the externally threaded portion of the tubular shaft 6.

Lenses having different power have different mean radii of curvature of their convex and concave surfaces. Therefore, when a lens 17 having a specific mean radius of curvature is selected and sandwiched between the lens abutment 16 and 18, the position of the lens 17 is to be suitably adjusted so that its periphery is positioned directly above a diamond cutter 41. For this purpose, the adjusting ring 7 making threaded engagement with the tubular shaft 6 supported in the legs of the box 13 by the bearings 6′ is turned to cause rotation of the groove 7′ along the guide pin 35. The adjusting ring 7 can rotate along the threads of the tubular shaft 6 to be advanced or retracted on the tubular shaft 6 as desired. Consequently, the guide pin 35 is moved along the axial slot 35′ of the tubular shaft 6, and the lens retaining shaft 19 to which the guide pin 35 is fixed can be advanced or retracted as desired. The lens retaining shaft 19 is thus advanced or retracted until the outer end face of the tubular shaft 6 registers with one of the graduations of the scale 60 corresponding to the mean radius of curvature of the power of the specific lens 17, thereby accurately positioning the periphery of the lens 17 in the position directly above the diamond cutter 41.

All of the tubular shaft 6, the lens push rod 15, the lens abutments 16, 18 and the lens retaining shaft 19 are disposed in coaxial relation.

When a start switch 56 shown in Figure 9 is turned on or off, the DC servomotor 9 is driven or stopped from rotation by a signal applied through a decision device 58 to a DC servomotor driver 55′ shown in Figure 9.The decision device 58 includes an integrated logical decision circuit. Therefore, the lens 17 sandwiched between the lens abutment 16 freely rotatably mounted on the lens push rod 15 and the lens abutment 18 fixedly mounted on the lens retaining shaft 19 is rotated or stopped from rotation while being maintained in the state sandwiched between the lens abutments 16 and 18.

The lens cutter driving section includes the diamond cutter 41, an AC main motor 40, the start switch 56, the decision devices 58, an AC main motor driver 59, and a light projecting and receiving member 34 for projecting light toward a slitted counter disc 12 and receiving light passed through the slits of the counter disc 12. Another DC servomotor driver 55 shown in Figure 9 is provided for driving another DC servomotor 30 shown in Figure 2. The rotation of the AC main motor 40 is transmitted via a pulley 22, a belt 23 and another pulley 21 to a shaft 24 which carries the diamond cutter 41 at its inner end, that is, at the position opposite to the lens 17. The AC main motor 40 and the shaft 24 are covered with a covering 20.

When the start switch 56 shown in Figure 9 is turned on, the motor drivers 55, 55′ and 59 are actuated via the decision device 58 to drive the DC servomotor 30, DC servomotor 9 and AC main motor 40 respectively. Due to the rotation of the AC main motor 40, the diamond cutter 41 starts to cut a peripheral groove 49 on the lens 17 (Figures 1, 2, 3, 5C and 6) The counter disc 12 is formed with a plurality of, for example, ten equally circumferentially spaced slits on its entire periphery to periodically intercept the light projected from the projecting element of the light projecting and receiving member 34. The quantity of light passed through the slits of the counter disc 12 and received by the receiving element of the light projecting and receiving member 34 is converted into an electrical signal which is applied via the decision device 58 to the motor drivers 55, 55' and 59. Upon completion of cutting of the peripheral groove 49 on the lens 19 due to one complete revolution of the lens 17, the motor drivers 55, 55' and 59 are disabled via the decision device 58 to stop the rotation of the respective motors 30, 9 and 40 thereby ending the groove cutting operation on the lens 17.

The lens position adjusting section includes a pair of slide rods 2, 2', a slider 3, a cylindrical casing 3', the holder 4, a holder retainer 5, the shaft 5' of the DC servomotor 30, the supporting members 8, 8', the box 13, a lens-engageable rocking member 26, a pair of lens guides 27, 27', a pair of guide arms 28, 29, the DC servomotor 30, a tension spring 38, a post 39, a pair of light projecting and receiving members 42, 42', a pair of light shielding lugs 43, 43', DC amplifiers 51, 51', 53, 54, a differential amplifier 52 and the DC servomotor driver 55, as shown in Figures 1, 2, 3, 6, 7 and 9. The lens-engageable rocking member 26 is rockably received in a casing 25 and is formed with a slit through which the diamond cutter 41 protrudes partly to make cutting engagement with the periphery of the lens 17, as shown in Figures 1, 2, 3 and 4.

The shape of the lens 17 is not always circular and may be such as that shown in Figures 7a to 7c. Therefore, when the lens 17 sandwiched between the lens abutments 16 and 18 is rotated in a predetermined direction as shown by the arrow in Figures 7a - 7c by the rotation of the DC servomotor 9, the point A of engagement between the lens 17 and the diamond cutter 41 will be located directly above the diamond cutter 41 protruding through the slit of the lens-engageable rocking member 26 in one phase of the rotation of the lens 17, as shown in Figure 7b. In another phase of the rotation of the lens 17, the point A of engagement between the lens 17 and the diamond cutter 41 will be biased to the right or left relative to the pivotal point of the rocking member 26 rockably supported by a pair of pivot pins 44 and 44', as shown in Figure 7a or 7c and Figure 3.

When the point A of engagement between the lens 17 and the diamond cutter 41 is situated directly above the position of the pivot pins 44 and 44' rockably supporting the rocking member 26, that is, directly above the diamond cutter 41 as shown in Figure 7b, the rocking member 26 does not incline relative to the vertical and is maintained in its horizontal position by a pair of balancing springs 45 and 45' shown in Figure 3. In such a state, the quantity of light projected from the projecting element and shielded by the light shielding lug 43 in the light projecting and receiving member 42 is equal to that projected from the projecting element and shielded by the light shielding lug 43' in the light projecting and receiving member 42', that is, there is no difference between the quantity of light shielded by the light shielding lug 43 and that shielded by the light shielding lug 43'. Consequently, the output voltage from the light receiving element in the light projecting and receiving member 42 is equal to that from the light receiving element in the light projecting and receiving member 42'. The output from the differential amplifier 52 is null, and the DC servomotor 30 does not rotate in any direction.

When, on the other hand, the point A of engagement between the lens 17 and the diamond cutter 41 is biased to the right or left relative to the pivotal point of the rocking member 26, the member 26 inclines to the right or left around its pivotal point. Figure 7a shows that the rocking member 26 inclines to the right around its pivotal point. In this case, the output voltage from the receiving element in the light projecting and receiving member 42 is lower than that from the receiving element in the light projecting and receiving member 42'. (The former output voltage is higher than the latter output voltage when the rocking member 26 inclines to the left around its pivotal point as shown in Figure 7c.) The output voltages above described are applied through the respective DC amplifiers 51 and 51' to the differential amplifier 52. A negative output voltage appears from the differential amplifier 52 when the rocking member 26 takes the position shown in Figure 7a, while a positive output voltage appears from the differential amplifier 52 when the member 26 takes the position shown in Figure 7c. The voltage level is proportional to the inclination of the rocking member 26. The output voltage from the differential amplifier 52 is applied through the DC amplifier 53 to the DC servomotor driver 55 shown in Figure 9 so that the DC servomotor 30 housed within the cylindrical casing 3' makes clockwise or counterclockwise rotation. The rotation of the shaft 5' of the DC servomotor 30 causes corresponding horizontal movement of the slider 3 carrying the holder 4, supporting member 8, 8', box 13 and lens retaining shaft 19 thereon, thereby causing horizontal displacement of the lens 17 sandwiched between the lens abutments 16 and 18, so that the point A of engagement between the lens 17 and the diamond cutter 41 can always be situated directly above the pivotal point of the rocking member 26, that is, directly above the diamond cutter 41.

As shown in Figure 5a, the lens 17 is previously shaped to conform at least partly to the configuration of an auxiliary frame portion of a spectacle frame 50 to which the lens 17 is to be fixed by a nylon thread 49'. Therefore, the shape of the lens 17 is not generally circular as shown in Figures 7a to 7c and Figures 11a to 11d. Figure 11a shows that the distance r_1 between the center 0 of the lens 17 and a peripheral point A of the lens 17 is longest, and the distance r_2 between the center 0 and another peripheral point B is shortest. Therefore, when the lens 17 is held around its center 0 shown in Figure 11b between the lens abutments 16 and 18 and is rotated in such a state, the lens 17 is engaged by the diamond cutter 41 at the periphery including these points A and B, and a peripheral groove 49 as shown in Figure 5c is cut with the diamond cutter 41. Figure 11c shows that the distance between the center 0 of the lens 17 and a point H_2 on the extension of its axis is X_1 when the point A of the lens 17 is engaged by the diamond cutter 41. Figure 11d shows that the distance between the center 0 of the lens 17 and another point H_1 on the extension of its axis is X_2 when the point B is engaged by the diamond cutter 41. Thus, there is a difference $X_1 - X_2 = X_3$ as will be apparent from Figures 11b, 11c, 11d, 3 and 5, and such a difference X_3 results from the fact that the peripheral contour of the lens 17 is not a true circle. Since this difference X_3 represents the axial displacement of the peripheral point A relative to the peripheral point B during the rotation of the lens 17 being cut with the diamond cutter 41 at the position directly above the diamond cutter 41, it is necessary to suitably compensate this difference X_3.

As shown in Figure 4, the guide arms 28 and 29 are operatively connected to levers 46 and 47 by means of pivots 36, 36′ and brackets 28′, 29′ respectively so that they can move toward and away from each other in interlocking relation. The follower lever 46 is formed with a slot 46′ into which a connection pin 37 upstanding from the main lever 47 extends so that the main lever 47 can move along the slot 46′ of the follower lever 46. The tension spring 38 anchored at one end thereof to the post 39 is anchored at the other end thereof to the common-connected ends of the main and follower levers 47 and 46. The force of the tension spring 38 causes simultaneous movement of the main and follower levers 47 and 46, thereby causing relative rotation of the pivots 36 and 36′ over the same distance. Therefore, the lens guides 27 and 27′ pivoted to the guide arms 28 and 29 at points of the same distance from the pivots 36 and 36′ respectively can be urged toward each other over the same distance so as to maintain the engaging point of the lens 17 at the position directly above the diamond cutter 41.

The holding force of the lens guides 27 and 27′ is such that it does not affect or obstruct the free rotation of the lens 17 and is also such that it prevents escaping movement of the lens 17 away from the diamond cutter 41 due to the cutting force imparted by the diamond cutter 41 during cutting the peripheral groove 49 on the lens 17, so that the groove 49 can be cut along the desired track on the periphery of the lens 17.

In the manner above described, the periphery of the lens 17 can always be maintained in the position directly above the diamond cutter 41. Referring to Figure 2, the slide rods 2 and 2′ causing sliding movement of the slider 3 are each journalled in a pair of slide bearings 61 and 61′ as shown. The combination of the slider 3, cylindrical casing 3′, holder retainer 5, holder 4, supporting members 8, 8′, box 13, arm 14, lens push rod 15, lens retaining shaft 19 and lens abutments 16, 18 acts to cause horizontal displacement of the lens 17 in the axial direction of the diamond cutter 41 as desired. The above function cooperates with the aforementioned holding force of the lens guides 27 and 27′ so as to compensate the difference $X_3 = X_1 - X_2$ which appears necessarily during the rotation of the lens 17.

The lens rotation speed control section includes the DC servomotor 9, DC servomotor driver 55′, DC amplifier 51′, 54, differential amplifier 52, light projecting and receiving members 42, 42′, light shielding lugs 43, 43′ and lens-engageable rocking member 26, as shown in Figures 1, 2, 3, 6, 7a to 7c and 9. When the lens-engageable rocking member 26 includes to the right or left relative to the vertical, as described already in the part of the specification relating to the lens position adjusting section, the resultant output from the differential amplifier 52 is applied through the DC amplifier 54 to the DC servomotor driver 55′ to increase or decrease the rotation speed of the DC servomotor 9. More precisely, the rotation speed of the DC servomotor 9 is increased when the rocking member 26 makes a large inclination, while its is decreased when the member 26 makes a small inclination, so that the peripheral speed of the rotating lens 17 can be made uniform throughout the cutting operation.

The cutting pressure adjusting section includes a load-bearing tension spring 33 anchored at one end thereof to the box 13 and at the other end thereof to the holder 4 as shown in Figure 1 and 2. As described hereinbefore, the distances between the center 0 of the lens 17 and various peripheral points of the lens 17 are not the same during the cutting operation on the lens 17 with the diamond cutter 41, and, therefore, the load imparted to the lens abutments 16 and 18 holding the lens 17 therebetween as well as those imparted to the members including the lens push rod 15, lens retaining shaft 19, level gears 10, 11, box 13 and arms 14 varies depending on the point being engaged by the diamond cutter 41. The tension spring 33 acts to uniformalize the contact pressure between the lens 17 and the diamond cutter 41, that is, to eliminate excessive variations in the cutting pressure. More precisely, the tension spring 33 imparts a large tension thereby preventing an excessive increase in the cutting pressure when the load is large, while its imparts a small tension when the load is not large, so that the cutting pressure can be adjusted to be generally constant.

The electrical elements such as the DC amplifiers 51, 51′, 53, 54, differential amplifier 52 decision device 58, DC servomotor drivers 55, 55′, AC main motor driver 59, start switch 56, manual switch (not shown) and limit switch 32 are incorporated in the circuits printed on a printed circuit board which is built in the base 1 of the apparatus, and the DC power sources for the individual circuit are also mounted in the base 1 of the apparatus.

The unusual-operation responsive shutting-down section includes a disc 31 mounted on the shaft 5′ of the DC servomotor 30 within the cylindrical casing 3′ and a limit switch 32 disposed opposite to the disc 31 within the casing 3′ as shown in Figure 2. When the disc 31 rotates beyond a predetermined limit angle as a result of excessive rotation of the DC servomotor 30 to restore the rocking member 26 to its horizontal position from its excessively inclined state, the limit switch 32 is actuated by the disc 31, and the output signal from the limit switch 32 is applied through the decision device 58 to the motor drivers 55, 55′ and 59 to automatically stop the rotation of the respective motors 30, 9 and 40 to shut down the apparatus thereby ensuring the safety of the apparatus.

It will be understood from the foregoing detailed description that the apparatus according to the present invention can successfully cut a peripheral groove of uniform depth and width at a predetermined location of any one of various lenses without requiring the skill and experience of the operator and without regard to the shape or contour of the lenses. The present invention is therefore advantageous in that the yield rate of the processed lenses can be greatly improved.

CLAIMS

1. An apparatus for cutting a peripheral groove on a lens of spectacles comprising a lens holding and rotating section, a lens cutter driving section, a lens position adjusting section and a lens rotation speed control section, said lens holding and rotating section including means for holding the lens therebetween at a central area of the lens and means for rotating the lens at a predetermined peripheral speed, said lens cutter driving section including means for driving a diamond cutter while maintaining the point of engagement between the lens and the diamond cutter at a position directly above the diamond cutter throughout a groove cutting cycle and means for automatically stopping the operation of the apparatus upon completion of the groove cutting cycle, said lens position adjusting section including means for adjusting the position of the lens in both the axial direction and the radial direction so as to maintain the periphery of the lens at the position directly above the diamond cutter, and said lens rotation speed control section including means for controlling the rotation speed of the lens so that the lens can be rotated at the predetermined peripheral speed regardless of the shape of the lens.

2. An apparatus for cutting a peripheral groove on a lens of spectacles comprising a lens holding and rotating section, a lens cutter driving section, a lens position adjusting section, a lens rotation speed control section and a lens cutting pressure adjusting section, said lens holding and rotating section including means for holding the lens therebetween at a central area of the lens and means for rotating the lens at a predetermined peripheral speed, said lens cutter driving section including means for driving a diamond cutter while maintaining the point of engagement between the lens and the diamond cutter at a position directly above the diamond cutter throughout a groove cutting cycle and means for automatically stopping the operation of the apparatus upon completion of the groove cutting cycle, said lens position adjusting section including means for adjusting the position of the lens in both the axial direction and the radial direction so as to maintain the periphery of the lens at the position directly above the diamond cutter, said lens rotation speed control section including means for controlling the rotation speed of the lens so that the lens can be rotated at the predetermined peripheral speed regardless of the shape of the lens, and said lens cutting pressure adjusting section including means for maintaining a uniform contact pressure between the lens and the diamond cutter so that the peripheral groove can be cut with a predetermined cutting pressure.

3. An apparatus for cutting a peripheral groove on a lens of spectacles comprising a lens holding and rotating section, a lens cutter driving section, a lens position adjusting section, a lens rotation speed control section, a lens cutting pressure adjusting section and an unusual-operation responsive shutting-down section, said lens holding and rotating section including means for holding the lens therebetween at a central area of the lens and means for rotating the lens at a predetermined peripheral speed, said lens cutter driving section including means for driving a diamond cutter while maintaining the point of engagement between the lens and the diamond cutter at a position directly above the diamond cutter throughout a groove cutting cycle and means for automatically stopping the operation of the apparatus upon completion of the groove cutting cycle, said lens position adjusting section including means for adjusting the position of the lens in both the axial direction and the radial direction so as to maintain the periphery of the lens at the position directly above the diamond cutter, said lens rotation speed control section including means for controlling the rotation speed of the lens so that the lens can be rotated at the predetermined peripheral speed regardless of the shape of the lens, said lens cutting pressure adjusting section including means for maintaining a uniform contact pressure between the lens and the diamond cutter so that the peripheral groove can be cut with a predetermined cutting pressure, and said unusual-operation responsive shutting-down section including means for automatically stopping the operation of DC and AC motors to shut down the apparatus thereby ensuring the safety of the apparatus in the event of occurrence of an unusual operation including an excessive inclination of a lens-engageable rocking member with which the lens is engageable during its rotation.

4. A groove cutting apparatus substantially as described with reference to and illustrated by any one or more of the accompanying drawings.

5. A method of cutting a groove on the periphery of a lens carried out on an apparatus as claimed in any one of claims 1 to 4.

6. A lens having a peripheral groove cut on an apparatus as claimed in any one of claims 1 to 4, or by a method as claimed in claim 5.

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