(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 464 443 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.10.2004 Bulletin 2004/41

(51) Int Cl.[7]: **B24B 9/14**, B24B 47/22

(21) Application number: **04006453.7**

(22) Date of filing: **17.03.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

(30) Priority: **19.03.2003 JP 2003074948**

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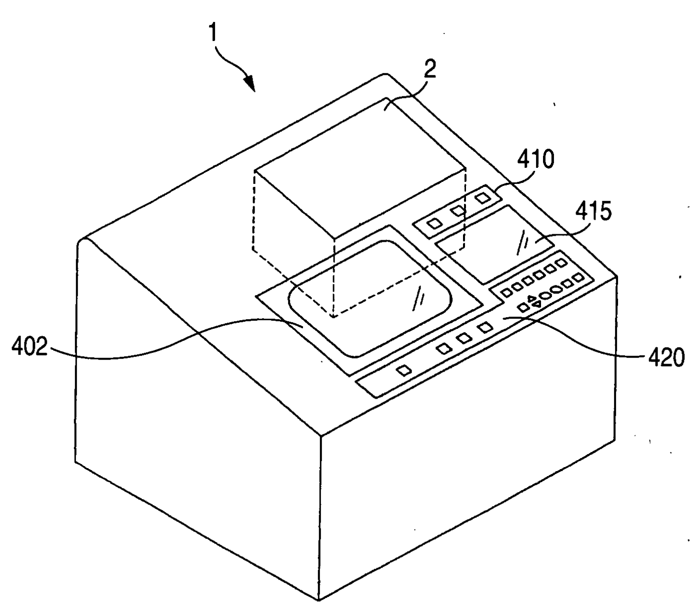
(54) Eyeglass lens processing apparatus

(57) An eyeglass lens processing apparatus for processing a peripheral edge of an eyeglass lens includes: a lens rotating unit including a lens rotating shaft for holding a lens to be processed and rotating the lens rotating shaft; a rotatable processing tool; a center distance changing unit for relatively moving the lens rotating shaft with respect to the processing tool for changing a center distance between a central axis of a rotation of the lens rotating shaft and a central axis of a rotation of the processing tool; a sound collecting unit for detecting a processing sound generated in a processing of the lens; and a control unit connected to the sound collecting unit for controlling a drive of at least one of the lens rotating unit and the center distance changing unit to regulate at least one of a rotating speed of the lens rotating shaft and a processing pressure of the lens based on a sound pressure level of a sound signal sent from the sound collecting unit.

FIG. 1



EP 1 464 443 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an eyeglass lens processing apparatus for processing the periphery of eyeglass lenses.

[0002] A known eyeglass lens processing apparatus is configured such that a lens to be processed is chucked (held) between two lens rotating shafts; the chucked lens is rotated by rotating the lens rotating shafts through use of a motor; and the lens is pressed against an abrasive wheel while the lens is being rotated, to thus process the periphery of the lens.

[0003] In the apparatus of this type, particularly, a loud processing sound (noise) is generated in the processing of a plastic lens in some cases. It is preferable that such processing sound should be suppressed as much as possible. For example, it is possible to reduce the processing sound to some extent by enhancing the sound insulating property of the apparatus. However, the reduction is limited. Furthermore, a manufacturing cost is increased. Further, it is possible to reduce a vibration sound (noise) of the lens by decreasing the particle size of a rough abrasive wheel. On the other hand, a slip sound (noise) is apt to be generated by a processing refuse (waste) sticking to the rough abrasive wheel, and furthermore, a processing performance is also deteriorated so that a time taken for the processing is prolonged.

SUMMARY OF THE INVENTION

[0004] In consideration of the problems of the conventional apparatus, it is a technical object of the invention to provide an eyeglass lens processing apparatus capable of suppressing a processing sound (noise) without deteriorating a processing performance.

[0005] In order to solve the problems, the invention is characterized by the following structures.

(1) An eyeglass lens processing apparatus for processing a peripheral edge of an eyeglass lens, comprising:

lens rotating means including a lens rotating shaft (702L, 702R) for holding a lens (LE) to be processed and rotating the lens rotating shaft;
a rotatable processing tool (602);
center-axis distance changing means for relatively moving the lens rotating shaft with respect to the processing tool for changing a distance between a rotational center axis of the lens rotating shaft and a rotational center axis of the processing tool;
sound collecting means (3) for detecting a processing sound generated in a processing of the lens; and
control means (100) for controlling the drive of at least one of the lens rotating means and the inter-axis distance changing means to regulate at least one of a rotating speed of the lens rotating shaft and a processing pressure of the lens based on a sound pressure level (D) of a sound signal sent from the sound collecting means.

(2) The eyeglass lens processing apparatus according to (1), wherein the control means regulates at least one of the rotating speed and the processing pressure in such a manner that the sound pressure level in processing is lower than an allowable sound pressure level (Do).

(3) The eyeglass lens processing apparatus according to (2), wherein the control means regulates at least one of the rotating speed and the processing pressure in such a manner that the sound pressure level of a predetermined frequency is lower than the allowable sound pressure level.

(4) The eyeglass lens processing apparatus according to (2) or (3), further comprising setting means (420) for variably setting the allowable sound pressure level.

(5) The eyeglass lens processing apparatus according to any one of (1) to (4), wherein the lens rotating means includes a first motor (722) and rotates the lens rotating shaft with a torque of the first motor,
the inter-axis distance changing means includes a second motor (751) and relatively moves the lens rotating shaft with respect to the processing tool with a torque of the second motor, and
the control means controls the drive of at least one of the first motor and the second motor.

(6) The eyeglass lens processing apparatus according to any one of (1) to (5), further comprising processing tool rotating means including a third motor (606) and rotating the processing tool with a torque of the third motor, and

torque detecting means (112) for detecting the torque of the third motor,
wherein the control means regulates the processing pressure based on a result of a detection of the torque detecting means.

(7) The eyeglass lens processing apparatus according to (6), wherein the control means gives priority to detection result of either the sound collecting means or the torque detecting means.

(8) The eyeglass lens processing apparatus according to any one of (1) to (7), wherein the sound collecting means is provided in a housing of the apparatus.

(9) A method of processing a peripheral edge of an eyeglass lens, the method comprising the steps of:

detecting a processing sound generated in a processing of the lens; and
regulating at least one of a rotating speed of a lens rotating shaft which rotates the lens and a processing pressure of the lens based on a sound pressure level of the processing sound.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 is a schematic view showing the appearance of an eyeglass lens processing apparatus according to the invention,
Fig. 2 is a schematic side sectional view showing an apparatus body,
Fig. 3 is a schematic view showing the structure of a lens processing section,
Figs. 4A and 4B are schematic views showing the structure of a carriage section,
Fig. 5 is a view showing the carriage section in Fig. 3 as seen in a direction of E,
Fig. 6 is a view for explaining the chucking of a lens by two lens rotating shafts,
Fig. 7 is a schematic block diagram showing the control system of the apparatus,
Fig. 8 is a chart representing the temporal transition of the sound pressure level of a processing sound, and
Fig. 9 is a chart showing the frequency analysis of each processing sound in a normal processing and the generation of a slip sound (noise).

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0007] An embodiment of the present invention will be described hereinbelow with reference to the drawings. Fig. 1 is a schematic outside view of an eyeglass lens processing apparatus according to the present invention. An eyeglass frame shape measurement device 2 is disposed in an upper right of a main body (unit) 1 of the processing apparatus. An apparatus described in, e.g., US 5333412 (JP-A-4-93164) and US Re. 35898 (JP-A-5-212661) can be used as the measurement device 2. A switch panel section 410 having switches to be used for controlling the measurement device 2; a display 415 for displaying processing information and the like; and a switch panel section 420 having switches to be used for entering processing requirements, issuing a processing instruction and the like are arranged front of the measurement device 2. Reference numeral 402 designates a reclosable window for use with a processing chamber.

[0008] Fig. 2 is a schematic side sectional view showing the apparatus body 1. A processing chamber 5 is covered with a cover 4 and the reclosable window 402 so as to prevent the processing refuse (waste) and grinding water of a lens LE to be processed from leaking out. The processing refuse is discharged, together with the grinding water, from a drain port 5a provided under the processing chamber 5. An abrasive wheel group 602 to be described below is provided in the processing chamber 5. The abrasive wheel group 602 is attached to an abrasive wheel rotating shaft 601. A microphone (a sound collector) 3 for obtaining (detecting) a processing sound (noise) generated in the processing of the lens LE is provided on the outside of the cover 4 in the housing of the body 1.

[0009] Fig. 3 is a schematic structural diagram of a lens processing section to be disposed inside a housing of the body 1. A carriage section 700 is mounted on a base 10. A lens to be processed (hereinafter simply called a "lens") LE chucked (held) between two lens rotating shafts 702L, 702R of a carriage 701 is processed by abrasive wheel group 602 attached to the abrasive wheel rotating shaft 601. The abrasive wheel group 602 includes a rough abrasive wheel 602a for a plastic lens; a rough abrasive wheel 602b for a glass lens; and a finishing abrasive wheel 602c for beveling processing and flat processing. The shaft 601 is rotatably attached to the base 10 by a spindle 603. A pulley 604 is attached to the right end of the shaft 601, and is coupled through a belt 605 to a pulley 607 attached to a rotating shaft of an abrasive wheel rotating motor 606. A lens shape measurement section 500 is disposed rearward of a carriage 701.

[0010] The configuration of the carriage section 700 will now be described with reference to Figs. 3 through 5. Figs. 4A and 4B are schematic structural diagrams of the carriage section 700. Fig. 5 is a view of the carriage section 700 shown in Fig. 3 when viewed in direction E.

[0011] The carriage 701 can cause the shafts 702L, 702R to chuck and rotate the lens LE. Further, the carriage 701 is rotatable and slidable with respect to a carriage shaft 703 fixed to the base 10 and extending parallel to the shaft 601. A lens chuck mechanism, a lens rotation mechanism, a X-axial direction movement mechanism for moving the carriage 701, and a Y-axial direction movement mechanism for moving the carriage 701 will be described hereinafter under the definition that a direction in which the carriage 701 is moved parallel to the shaft 601 is taken as the X-axial direction, and a direction in which a distance between the rotational center axis of the shafts 702L, 702R and the rotational center axis of the shaft 601 is changed by rotation of the carriage 701 is taken as the Y-axial direction.

<Lens chuck mechanism, and lens rotation mechanism>

[0012] The shaft 702L and the shaft 702R are rotatably held coaxially by a left arm 701L and a right arm 701R of the carriage 701,respectively. A cup receiver 303 is attached to the right end of the shaft 702L. A lens presser (retainer) 304 is attached to the left end of the shaft 702R. A chucking motor 710 is fixed to an upper center surface of the right arm 701R, and a pulley 711 attached to a rotating shaft of the motor 710 is coupled through a belt 712 to a feed screw 713 rotatably held inside the right arm 701R. The rotation of the feed screw 713 by the motor 710 causes a feed nut 714 to move in the axial direction of the shaft 702R so that the shaft 702R coupled to the feed nut 714 is moved in the axial direction. As a result of the shaft 702R having been moved toward the shaft 701L, the lens LE is chucked between the shafts 702L, 702R. As shown in Fig. 6, at the time of processing, a cup 50 serving as a fixing jib has previously been fixedly attached to a front refractive surface of the lens LE, and a base section of the cup 50 is fixedly attached to the cup receiver 303 provided on the shaft 702L. The cup 50 encompasses a cup of suction type and a cup to be attached by way of an adhesive tape.

[0013] A motor mount block 720 is attached to the left end portion of the left arm 701L. A gear 721 is attached to the left end of the shaft 702L passing through the block 720. A lens rotating motor 722 is fixed to the block 720. Rotation of the motor 722 is transmitted to the shaft 702L by way of the gear 721 and a gear 724. A servo motor is used for the motor 722, and an encoder 722a is provided for detecting a rotational angle of a rotating shaft of the motor 722.

[0014] A pulley 726 is mounted on the shaft 702L inside the left arm 701L. The pulley 726 is coupled through a timing belt 731a, to a pulley 703a attached to the left end of a rotating shaft 728 rotatably held rearward of the carriage 701. A pulley 703b attached to the right end of the shaft 728 is coupled through a timing belt 731b, to a pulley 733 mounted on the shaft 702R inside the carriage right arm 701R. The pulley 733 is slidable in the axial direction of the shaft 702R. By this configuration, the shaft 702L and the shaft 702R rotate synchronously.

<X-axial direction movement mechanism and Y-axis direction movement Mechanism of carriage>

[0015] A moving arm 740 is attached to the shaft 703 so as to be slidably movable along with the carriage 701 in the X-axial direction. A front portion of the arm 740 is made slidable over a guide shaft 741 fixed to the base 10 in parallel with the shaft 703. A rack 743 extending in parallel with the shaft 703 is attached rearward of the arm 740. A pinion 746 attached to a rotating shaft of an X-axial direction movement motor 745 meshes with the rack 743. The motor 745 is fixed to the base 10, and the carriage 701 is moved in the X-axial direction along with the arm 740 by rotational drive of the motor 745.

[0016] As shown in Fig. 4B, a swingable block 750 is attached to the arm 740 so as to be pivotable around an axis La coinciding with the rotational center axis of the shaft 601. A distance from the center axis of the shaft 703 to the axis La is set so as to be equal to a distance from the center axis of the shaft 703 to the rotational center axis of the shafts 702L, 702R. A Y-axial direction movement motor 751 is fixed to the swingable block 750. A servo motor is used for the motor 751, and an encoder 751a is provided for detecting a rotational angle of a the rotating shaft of the motor 751. Rotation of the motor 751 is transmitted, through a pulley 752 and a belt 753, to a female thread 755 held in a rotatable manner by the block 750. A feed screw 756 is inserted into and meshed with a screw section provided in the female thread 755. The feed screw 756 is vertically moved by the rotation of the female thread 755.

[0017] The upper end of the feed screw 756 is fixed to the block 720. As a result of the feed screw 756 having been vertically moved by rotational drive of the motor 751, the block 720 is vertically moved along guides 758a, 758b, whereby the vertical position of the carriage 701 attached to the block 720 can also be changed. That, the carriage 701 is pivoted around the shaft 703 as the center of rotation, thereby changing a distance L between the rotational center axis of the shafts 702L, 702R and the rotational center axis of the shaft 601. A processing pressure to be exerted on the lens LE (the pressure for pressing the lens LE against the abrasive wheel 602) is adjusted by controlling the torque of the motor 751. The torque of the motor 751 is controlled by a voltage imparted to the motor 751. Incidentally, a compression spring, or the like, is preferably interposed between, for example, the left arm 701L and the arm 740 in order to lessen the downward load imposed on the carriage 701. The mechanism for adjusting the processing pressure can also be constituted by a spring for pulling the carriage 701 toward the abrasive wheel 601 and a mechanism for changing the force of the spring.

[0018] Next, operation of the eyeglass lens processing apparatus will be described with reference to a schematic block diagram of a control system shown in Fig. 7. After an outline shape of lens frames of the eyeglass frame for fitting the lens LE has been measured by the measurement device 2, when a data input switch of the panel section 420 is pressed, data on the obtained frame outline shape are stored in memory 120. The frame outline shape is graphically displayed on a display 415, and an operator inputs layout data pertaining to a wearer by operating switches of the panel section 420. After required input has been completed, the lens LE is chucked with the shafts 702L, 702R and processed.

[0019] When pressing a processing start switch of the panel section 420, a control section 100 obtains radius vector information (rδn, rθn) of the outline shape data where the chucking center of the lens LE is taken as a processing center, on the basis of the input layout data. rδn designates a radius vector length, and rθn designates a radius vector angle. Subsequently, the obtained radius vector information (rδn, r θn) (n = 1, 2, 3, ..., N) is substituted into the following equations, thereby determining the maximum value of L. R denotes the radius of the abrasive wheel 602, and L denotes a distance between the rotational center axis of the shafts 702L, 702R and the rotational center axis of the shaft 601.

Equation 1

$$L = r\delta n \bullet \cos r\theta n + \sqrt{R^2 - (r\delta n \bullet \sin r\,\theta n)^2} \quad (n = 1, 2, 3, ..., N)$$

[0020] Next, the radius vector information (r δn, rθn) is rotated around the processing center by each arbitrary minute unit angle, thereby determining a maximum L obtained at that time in the same manner as mentioned previously. Assuming that the rotational angle is taken as ξi (i = 1, 2, ..., N), the foregoing calculation is performed over the entire circumference of the lens LE, where the maximum L achieved at each ξi is taken as Li, and r θn achieved at that time is taken as Θi. At that time, (ξi, Li, Θi) (i = 1, 2, ..., N) are stored in the memory 102 as processing correction data associated with the inter-axis distance (axis-to-axis distance) L.

[0021] After the computation has been completed, the control section 100 activates the measurement section 500 on the basis of the processing correction data to measure the shapes of a front surface and a rear surface of the lens LE. Subsequently, the control section 100 obtains rough processing data and finishing data on the basis of the processing correction data in accordance with a predetermined program. When beveling processing is performed, bevel locus data are determined on the basis of the shape of the lens LE determined by the measurement section 500. The bevel locus is determined by, e.g., a method for dividing an outer peripheral edge thickness of a lens with a certain ratio; a method for determining curve values from front and rear curves of a lens; a combination of these methods; or the like. Subsequently, the control section 100 sequentially performs rough processing and finishing operations by rotating the abrasive wheel 602 at high speed by controlling the drive of the motor 606 through a driver 112.

[0022] When the lens LE is made of plastic, the control section 100 controls the drive of the motor 745 through a driver 111 to move the carriage 701 in the X-axial direction such that the lens LE comes to a position above the rough abrasive wheel 602a. Next, in accordance with the rough processing data, the lens LE is rotated by controlling the drive of the motor 722 through a driver 115, and the carriage 701 is moved in the Y-axial direction by controlling the drive of the motor 751 through a driver 117, whereby the lens LE is pressed against the rotating rough abrasive wheel 602a and thus rough-processed. The control section 100 controls the drive of the motors 722 and 751 through drivers 115 and 117 in accordance with (ξi, Li) of the processing correction data (ξi, Li, Θi). The rotational angle of the lens LE (shafts 702L, 702R) is detected by the encoder 722a. The inter-axis distance Li, which acts as the position to which the carriage 701 is moved in the Y-axial direction, is detected by the encoder 751a. Incidentally, the processing correction data for the rough processing data are determined while factoring in a region which is to be used for finishing.

[0023] When the lens LE is pushed against the rough abrasive wheel 602a to carry out the processing, a processing sound (noise) is generated. The processing sound is obtained by the microphone 3 and a sound signal thereof is input to the control section 100. Fig. 8 is a chart showing the temporal transition of a sound pressure (volume) level of the processing sound obtained by the microphone 3. In the processing, a force for moving the carriage 701 in the Y-axis direction (a force for pushing the lens LE against the abrasive wheel 602), that is, a processing pressure is generated by the motor 751. For example, if the processing pressure can be changed in seven stages, an intermediate processing pressure corresponding to a fourth stage from the lowest stage is generated when the rough processing is started. When the amount of cut of the lens LE (the amount of the processing) by the rough abrasive wheel 602a is increased, the sound pressure level of the processing sound is gradually raised. When the obtained sound pressure level exceeds an allowable sound pressure level Do to be a preset upper limit sound pressure level, the control section 100 controls the drive of the motor 751 which lowers the carriage 701 to decrease the torque of (including the case in which the rotation is stopped), thereby dropping the processing pressure. By the drop in the processing pressure, the sound pressure level of the processing sound is also reduced gradually. The torque of the motor 751 can be detected from a current flowing to the motor 751 which is detected by a current detecting circuit provided in the driver 117. Moreover, the allowable sound pressure level Do is obtained by an experiment and is thus determined in advance, and is stored in the memory 120.

[0024] When the sound pressure level of the processing sound is reduced to be lower than a processing pressure up permitted sound pressure level D_1 (which is also obtained by an experiment and is thus determined in advance, and is stored in the memory 120) which is set to be lower than the allowable sound pressure level Do, the control section 100 permits an increase in the torque of the motor 751 to raise the processing pressure again. By regulating the processing pressure (controlling the drive of the motor 751) based on the sound pressure level which is obtained, it is possible to suppress the processing sound without greatly deteriorating a processing performance. If the processing progresses so that the amount of the processing is decreased, the sound pressure level of the processing sound is also reduced gradually.

[0025] The allowable sound pressure level Do and the processing pressure up permitted sound pressure level D_1 may be variably set by a sound pressure level set switch provided in the switch panel portion 420. Consequently, it is possible to set the sound pressure level corresponding to a processing environment.

[0026] In Fig. 8, a solid line A indicates the case in which the regulation of a processing pressure is carried out based on the sound pressure level of the processing sound and a dotted line B indicates the case in which the same regulation is not carried out. In this example, the processing pressure is dropped by one stage at a time t_1 that the sound pressure level obtained after the start of the processing exceeds the sound pressure level D_0, and is further dropped by one stage at a time t_2 that the same sound pressure level exceeds the sound pressure level Do again. The processing pressure is raised by one stage at a time t_3 that the sound pressure level becomes lower than the sound pressure level D_1, and is further raised by one stage at a time t_4 that the same sound pressure level becomes lower than the sound pressure level D_1 again.

[0027] The regulation of the processing pressure is carried out based on the detection of the torque of the motor 606 for rotating the abrasive wheel group 602 in order to prevent an overload from being applied to the lens LE. The torque of the motor 606 can be detected from a current flowing to the motor 606 which is detected by a current detecting circuit provided in the driver 112. The control section 100 drops a processing pressure when the torque of the motor 606 exceeds a predetermined upper limit level, and increases the torque to raise the processing pressure when the same torque becomes lower than a predetermined torque up permitted level. At this time, the conditions of the regulation of the processing pressure based on the sound pressure level of the processing sound are taken into consideration. In the example of Fig. 8, even if the torque of the motor 606 is smaller than the torque up permitted level at the times t_1 and t_2, the processing pressure is dropped by giving priority to the sound pressure level of the processing sound. As a matter of course, priority can also be given to the result of the detection of the torque of the motor 606.

[0028] While the sound pressure level of the processing sound is reduced by controlling the drive of the motor 751 to regulate (drop) the processing pressure as described above, it is also possible to reduce the sound pressure level of the processing sound by controlling the drive of the motor 722 to regulate (decrease) the rotating speed of the lens LE (including the case in which the rotation is stopped). Although it is more effective that both the processing pressure and the rotating speed of the lens LE are regulated (controlled), only one of them may be executed.

[0029] Moreover, the processing sound of the lens LE has a low sound and a comparatively high sound in a mixture. Therefore, it is also possible to use a method of suppressing a processing sound (noise) depending on a frequency. Fig. 9 is a chart showing the frequency analysis of each processing sound in a normal processing and the generation of a slip sound (noise). In Fig. 9, a graph C_1 indicates the frequency of a processing sound in the normal processing and a graph C_2 indicates the frequency of a processing sound in the generation of a slip sound. According to this experiment, it is apparent that a sound pressure level is particularly increased in a frequency band of approximately 500 to 1000 Hz when the slip sound is generated. In the case in which the slip sound is to be suppressed, accordingly, it is preferable that the allowable sound pressure level and the processing pressure up permitted sound pressure level should be determined for the frequency band to regulate the processing pressure or the rotating speed of a lens as described above.

[0030] In the case in which the frequency of the processing sound is to be specified, it is preferable that each sound pressure level should be set based on a variation in a tone quality generated depending on the thickness or material of a lens. Moreover, it is also possible to provide a filter circuit for selecting a sound between the microphone 3 and the control section 100.

[0031] When the rough processing is completed, the control section 100 moves the carriage 701 in the X-axis direction to move the lens LE onto the finishing abrasive wheel 602c and then controls the rotation of the lens LE and the movement of the carriage 701 in the X-axis and Y-axis directions in accordance with the finish processing data, thereby carrying out the finish processing over the lens LE. In the finish processing, a processing sound is obtained by the microphone 3 and the control section 100 regulates a processing pressure according to a sound pressure level thereof.

In the case in which an abnormal processing sound (sound pressure level) is obtained or the case in which a processing sound (a sound pressure level) is not lower than an allowable sound pressure level even if a processing pressure is dropped in the rough processing or the finish processing, moreover, the control section 100 displays a message of an abnormality over the display 415, thereby interrupting the lens processing.

[0032] While the lens (the lens rotating shaft) is moved toward the abrasive wheel (the abrasive wheel rotating shaft) side to carry out the processing in the embodiment, the processing may be performed by moving the abrasive wheel (the abrasive wheel rotating shaft) toward the lens (the lens rotating shaft) side. In this case, it is preferable to control the drive of the motor for moving the abrasive wheel (the abrasive wheel rotating shaft), thereby regulating the processing pressure. While the abrasive wheel is used as a lens processing tool in the embodiment, moreover, it is also possible to use a well-known processing tool (for carrying out grinding or cutting with a rotation) in place of the abrasive wheel.

Claims

1. An eyeglass lens processing apparatus for processing a peripheral edge of an eyeglass lens, comprising:

lens rotating means including a lens rotating shaft (702L, 702R) for holding a lens (LE) to be processed and rotating the lens rotating shaft;
a rotatable processing tool (602);
center-axis distance changing means for relatively moving the lens rotating shaft with respect to the processing tool for changing a distance between a rotational center axis of the lens rotating shaft and a rotational center axis of the processing tool;
sound collecting means (3) for detecting a processing sound generated in a processing of the lens; and
control means (100) for controlling the drive of at least one of the lens rotating means and the inter-axis distance changing means to regulate at least one of a rotating speed of the lens rotating shaft and a processing pressure of the lens based on a sound pressure level (D) of a sound signal sent from the sound collecting means.

2. The eyeglass lens processing apparatus according to claim 1, wherein the control means regulates at least one of the rotating speed and the processing pressure in such a manner that the sound pressure level in processing is lower than an allowable sound pressure level (D_0).

3. The eyeglass lens processing apparatus according to claim 2, wherein the control means regulates at least one of the rotating speed and the processing pressure in such a manner that the sound pressure level of a predetermined frequency is lower than the allowable sound pressure level.

4. The eyeglass lens processing apparatus according to claim 2 or 3, further comprising setting means (420) for variably setting the allowable sound pressure level.

5. The eyeglass lens processing apparatus according to any one of claims 1 to 4, wherein the lens rotating means includes a first motor (722) and rotates the lens rotating shaft with a torque of the first motor,
the inter-axis distance changing means includes a second motor (751) and relatively moves the lens rotating shaft with respect to the processing tool with a torque of the second motor, and
the control means controls the drive of at least one of the first motor and the second motor.

6. The eyeglass lens processing apparatus according to any one of claims 1 to 5, further comprising processing tool rotating means including a third motor (606) and rotating the processing tool with a torque of the third motor, and
torque detecting means (112) for detecting the torque of the third motor,
wherein the control means regulates the processing pressure based on a result of a detection of the torque detecting means.

7. The eyeglass lens processing apparatus according to claim 6, wherein the control means gives priority to detection result of either the sound collecting means or the torque detecting means.

8. The eyeglass lens processing apparatus according to any one of claims 1 to 7, wherein the sound collecting means is provided in a housing of the apparatus.

9. A method of processing a peripheral edge of an eyeglass lens, the method comprising the steps of:

detecting a processing sound generated in a processing of the lens; and
regulating at least one of a rotating speed of a lens rotating shaft which rotates the lens and a processing pressure of the lens based on a sound pressure level of the processing sound.

FIG. 1

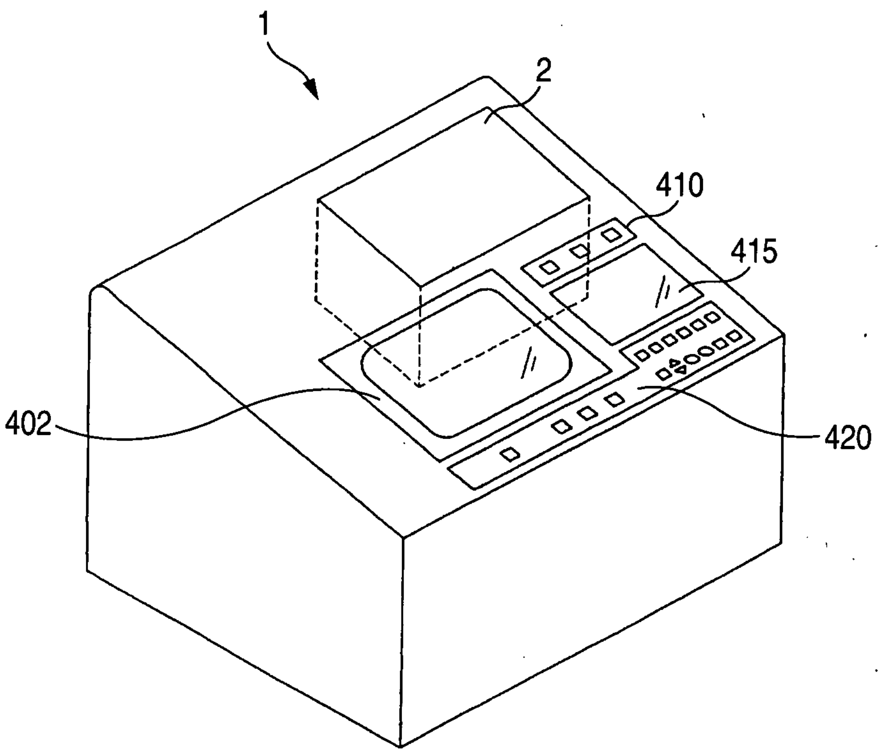


FIG. 2

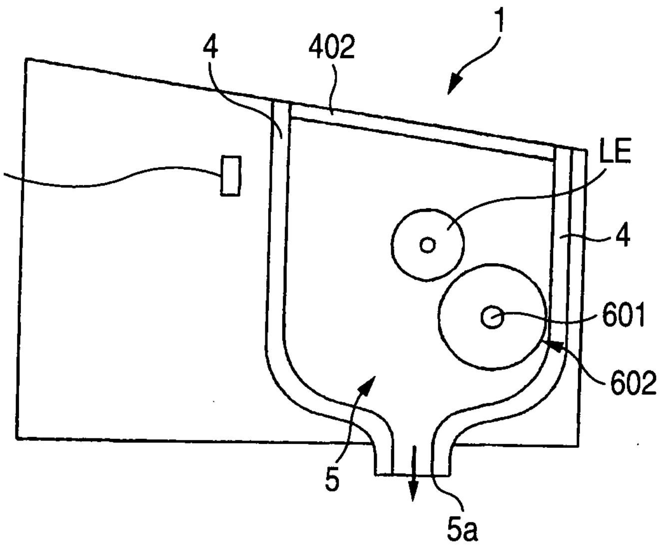

1
4
402
3
LE
4
601
602
5
5a

FIG. 3

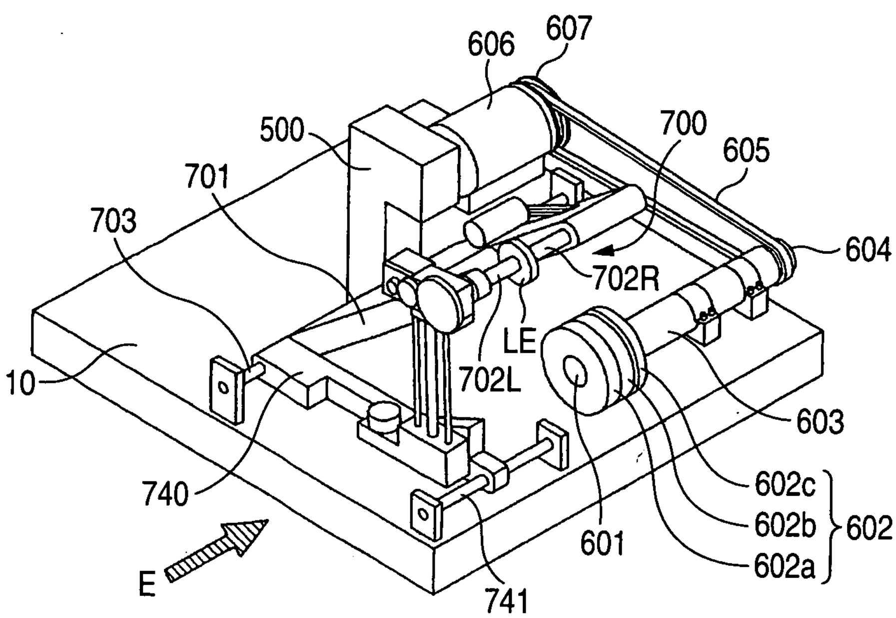

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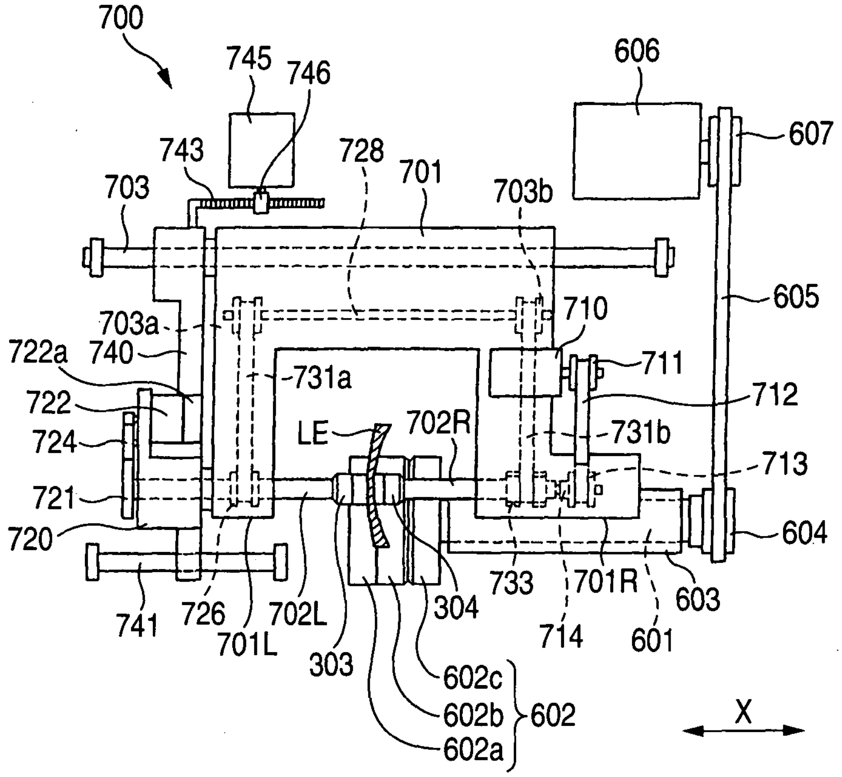
FIG. 4A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LE
702R
724
731b
713
721
604
720
733
701R
603
741
726
702L
304
714
601
701L
303
602c
602b
602
602a
X

FIG. 4B

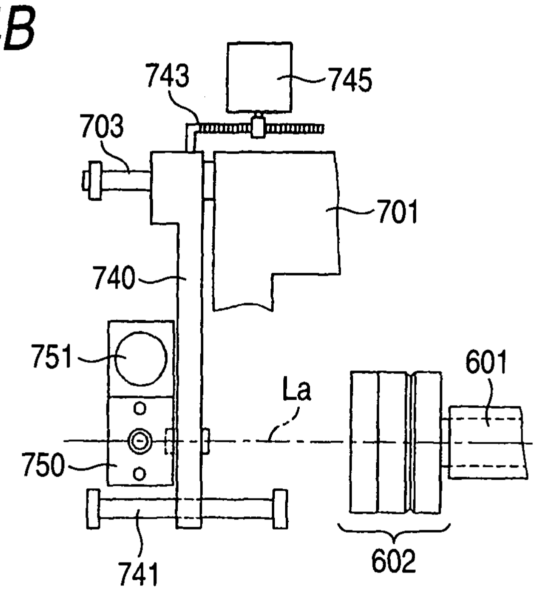

743
745
703
701
740
751
601
La
750
741
602

FIG. 5

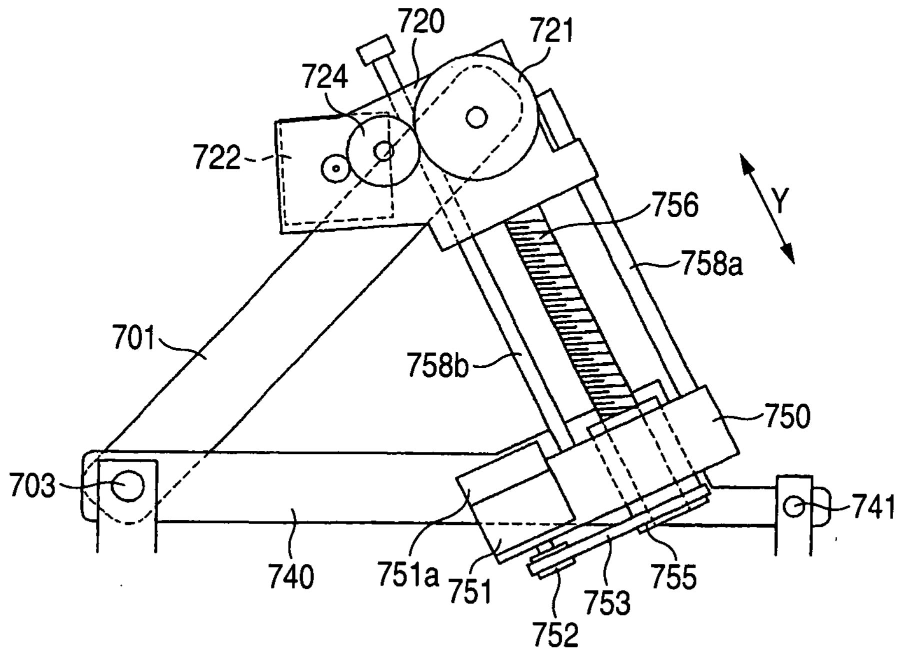

720
721
724
722
756
Y
758a
701
758b
750
703
741
740
751a
751
753
755
752

FIG. 6

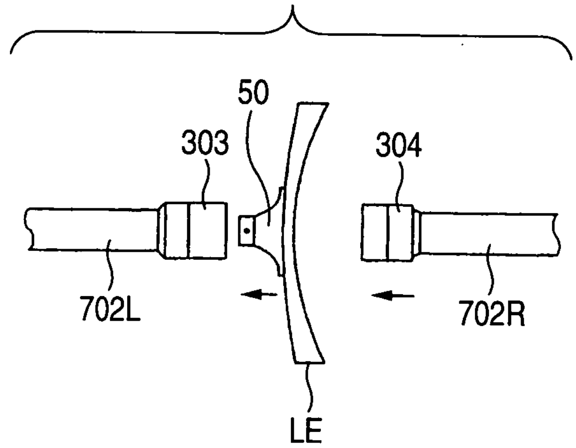

50
303
304
702L
702R
LE

FIG. 7

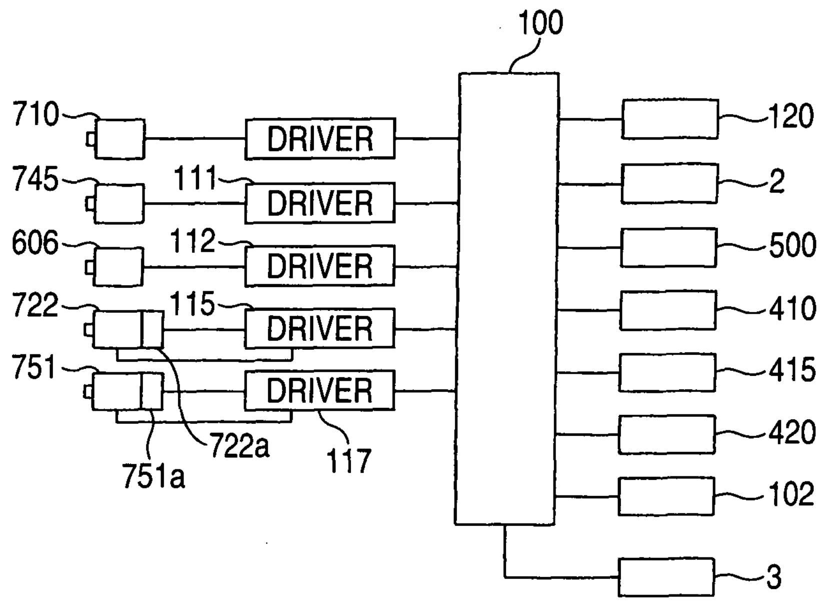

100
710
745
606
722
751
111
112
115
DRIVER
DRIVER
DRIVER
DRIVER
DRIVER
722a
751a
117
120
2
500
410
415
420
102
3

FIG. 8

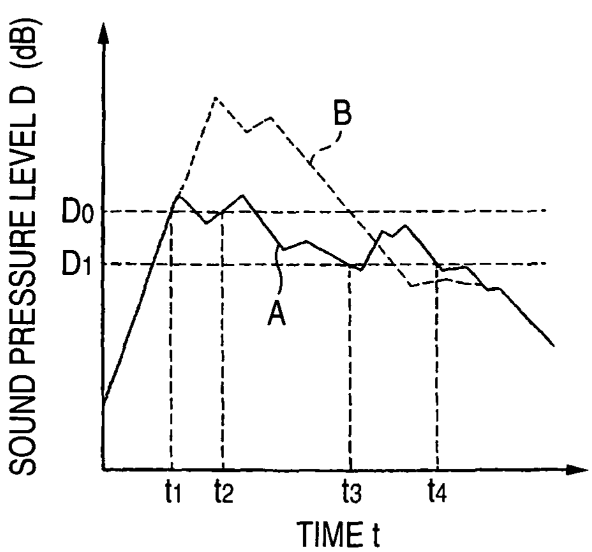
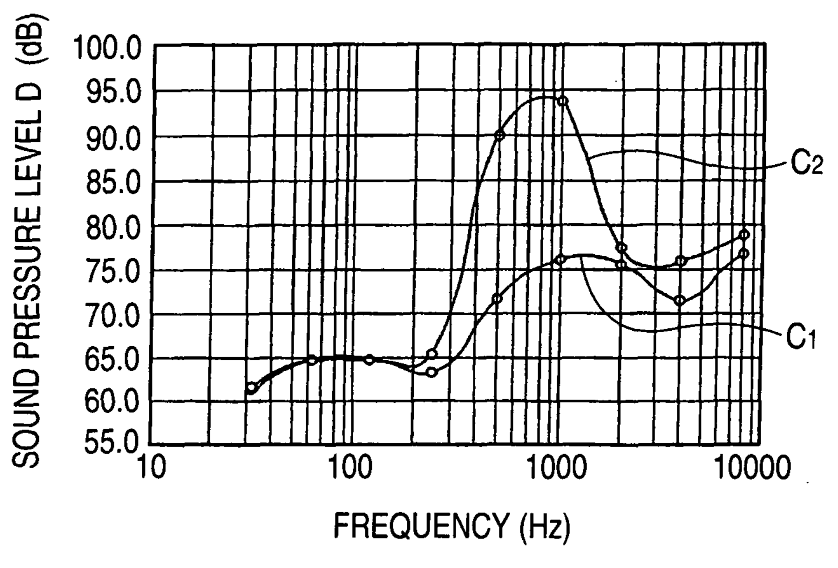

SOUND PRESSURE LEVEL D (dB)
B
D0
D1
A
t1
t2
t3
t4
TIME t

FIG. 9


SOUND PRESSURE LEVEL D (dB)
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
10
100
1000
10000
FREQUENCY (Hz)
C2
C1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 00 6453

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X Y	US 3 814 958 A (HEITMANN K) 4 June 1974 (1974-06-04) * column 1, line 40 - column 4, line 1; figures 1,2 *	1-4,8,9 5,6	B24B9/14 B24B47/22
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Y	DE 198 25 922 A1 (SCHNEIDER GUNTER) 23 December 1999 (1999-12-23) * abstract *	6	
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B24B
G01M
G05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 July 2004	Koller, S

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