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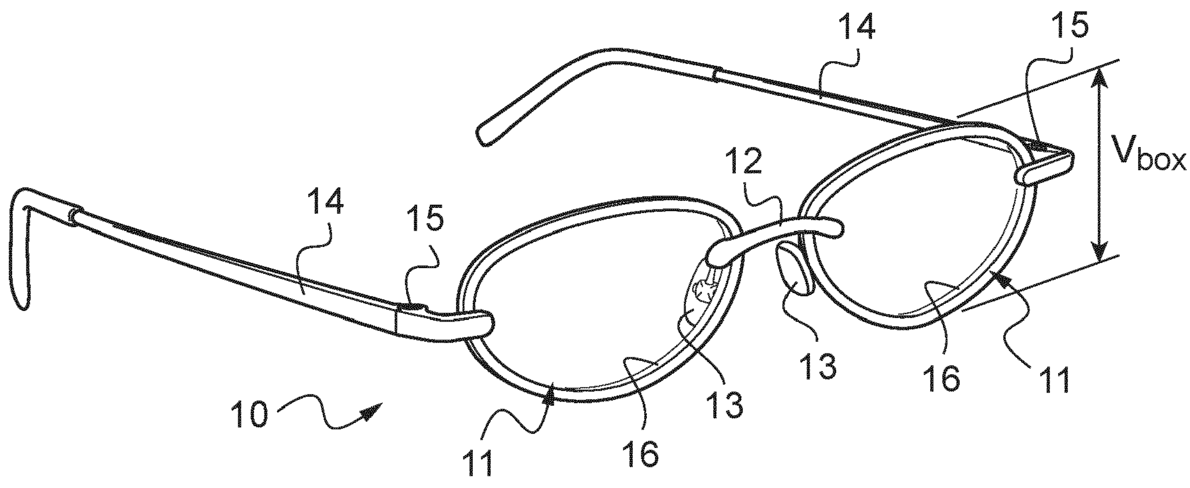
(54) PROCESS FOR GENERATING A MACHINING SETPOINT FOR BEVELLING AN OPHTHALMIC LENS

(57) The invention relates to a process for generating a machining setpoint for bevelling an ophthalmic lens to be fitted into a bezel (16) of a rim (11) of an eyeglass frame 10), said process comprising:
- a step of acquiring frame parameters relative at least to the shape of a longitudinal contour of the bezel,
- a step of acquiring lens parameters relative at least to the shape of the ophthalmic lens, and
- a step of deducing therefrom the machining setpoint, said machining setpoint defining an inclination angle for a bevel to be machined on an edge of the ophthalmic lens.

According to the invention, said inclination angle is determined as a function of the lens parameters and the frame parameters.

Fig.1



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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention generally relates to the field of eyeglasses.

[0002] It more particularly relates to a process for generating a machining setpoint for bevelling an ophthalmic lens to be fitted into a bezel of a rim of an eyeglass frame, said process comprising:

- a step of acquiring frame parameter(s) relative at least to the shape of a longitudinal contour of the bezel,
- a step of acquiring lens parameter(s) relative at least to the shape of the ophthalmic lens (before or after machining), and
- a step of deducing therefrom the machining setpoint, said machining setpoint defining an inclination angle for a bevel to be machined on an edge of the ophthalmic lens.

BACKGROUND INFORMATION AND PRIOR ART

[0003] The technical part of the work of an optician, which consists in mounting a pair of ophthalmic lenses in a spectacle frame selected by a customer, may be split into four main operations:

- the acquisition of the shapes of the outlines of the rims of the spectacle frame selected by the customer,
- the centering of each ophthalmic lens, which consists in determining the frame of reference of the lens using centering markings provided thereon, then in suitably positioning the outline of the rim acquired beforehand in the frame of reference of the lens so that, once edged to this outline then mounted in its frame, the lens is correctly positioned with respect to the corresponding eye of the customer and fulfils as best as possible the optical function for which it was designed,
- the blocking of each lens, which consists in attaching a blocking accessory to the lens, so that the lens can be easily extracted from the centering station and then be engaged in the edging station without loss of frame of reference, then
- the edging of each lens, which consists in machining this lens to the outline centered beforehand.

[0004] If the lens is to be mounted in a rim of an eyeglass frame, the edging of the lens consists in machining a bevel all around the edge face of the lens by means of a bevelling tool.

[0005] It is known to machine this bevel in a three-axes machining appliance. In such an appliance, the axis of the bevelling tool remains parallel to the axis of the shafts that block the lens. Consequently, the obtained bevel has the same inclination all around the lens.

[0006] It is also known to machine the bevel in a five-axes machining appliance. In such an appliance, the tilt of the axis of the bevelling tool relative to the axis of the shafts that block the lens can vary. Consequently, the inclination of the obtained bevel can be adjusted all around the lens.

[0007] For instance, if the base of the lens (the radius of curvature of its front face) is greater than a threshold, it is known to machine the lens so that the bevel is oriented as an extension of the lens edge. To be more precise, we can introduce the notion of "closest bevel sphere", defined as the sphere that is the nearest from the apex curve of the bevel to be edged. The edge is to be machined normal to this closest bevel sphere at all points around the lens. In this case, the bevel extends perpendicularly from this tilted edge and has a varying inclination.

[0008] But such a process suffers from several problems.

[0009] First, it is difficult to manage the risks of collision between the lens and the frame. Moreover, the tilt of the bevel can be unnecessarily too high. It can also generate bad aesthetic aspect.

[0010] For instance, if the apex curve of the bevel to be edged has a shape of a circle, there are an infinite number of closest bevel spheres, so that the inclination of the bevel is often randomly determined.

SUMMARY OF THE INVENTION

[0011] In this context, the present invention provides a new process for generating a machining setpoint for bevelling an ophthalmic lens.

[0012] According to the invention, the bevel inclination angle is determined as a function of lens parameters and frame parameters.

[0013] In other words, the inclination of the bevel will depend not only on the shape of the frame, but also of the shape of the lens (its shape before or after edging). Consequently, constraints relative to possible collision between lens and frame can be taken into account.

[0014] Other preferred features of the invention are the following ones:

- one of the acquired lens parameters, from which the inclination angle is determined, is a value of curvature of the lens.
- one of the acquired frame parameters, from which the inclination angle is determined, is an approximated value of curvature of the longitudinal contour of the bezel.
- given another value of curvature of a longitudinal contour of a bezel of another rim of said frame, said bevel angle is determined according to said other value.
- one of the acquired frame parameters, from which the inclination angle is determined, is a vertical

height of the longitudinal contour of the bezel.

- one of the acquired frame parameters, from which the inclination angle is determined, is a data according to which the longitudinal contour of the bezel is of a round type or not.
- if the longitudinal contour of the bezel is not of the round type and if the vertical height is greater than a threshold value, said inclination angle is determined as a function of the difference between the approximated value of curvature of the longitudinal contour of the bezel and the value of curvature of the lens.
- one of the acquired frame parameters, from which the inclination angle is determined, is a gap between a temple of the frame and the rim of the frame.
- if a potential collision between the lens and the frame is detected on the basis of the frame parameters and the lens parameters, said inclination angle is determined as a function of said potential collision.
- if a potential collision is detected, said inclination angle is increased of a percentage or of an added value that is constant all around the lens.
- said inclination angle is constant all around the lens.
- the frame is of a non-standard category.
- the ophthalmic lens is to be machined by a five axes bevelling device.

[0015] The invention also relates to a bevelling device for bevelling an ophthalmic lens, comprising:

- a blocking support for blocking the ophthalmic lens,
- a bevelling tool for bevelling the ophthalmic lens, the bevelling tool being movable relative to said blocking support with at least five distinct mobilities, and
- an electronic or computer unit for controlling the position of said bevelling tool relative to said blocking support, said electronic or computer unit is programmed to perform a process as defined above.

DETAILED DESCRIPTION OF EXAMPLE(S)

[0016] The following description with reference to the accompanying drawings, given by way of non-limiting example makes it clear what the invention consists in and how it can be reduced to practice.

[0017] In the accompanying drawings:

- Figure 1 is a perspective view of a rimmed eyeglass frame;
- Figure 2 is a cross-view of the edge of a lens, showing its bevel;
- Figure 3 is a diagrammatic view of a process according to the invention.

[0018] FIG. 1 shows a rimmed eyeglass frame 10 having two rims 11 (or surrounds), each serving to receive an ophthalmic lens and to be positioned in front of a respective one of the two eyes of a wearer when said frame is being worn. The two rims 11 are connected together by a bridge 12. They are also each fitted with a nose pad 13 suitable for resting on the wearer's nose and a temple (earpiece) 14 suitable for resting on one of the wearer's ears. Each temple 14 is hinged to the corresponding rim by means of a hinge 15.

[0019] Each rim 11 of the eyeglass frame 10 presents an inside face including an inside groove, commonly referred to as a bezel 16. In this embodiment, the bezel 16 presents a V-shaped cross-section. In a variant, the bezel could be shaped so as to present a profile of some other shape.

[0020] The bottom of the bezel 16 defines an outline in two or three dimensions (the third dimension being roughly orthogonal to the mean plane of the rim).

[0021] When this shape is acquired (for instance by means of a tracer), it is possible to determine the position of a rectangle that is circumscribed to the 2D outline and that has two horizontal side (considering the frame worn by a wearer). This rectangle is called "boxing rectangle".

[0022] Relative to each of the rims 11, there is defined a mean sphere, referred hereinafter as the "rim sphere". This rim sphere is defined as the sphere that comes closest to the set of points making up the bottom edge of the bezel 16. The characteristics of this sphere may be obtained, for example, by applying the least squares method to the coordinates of a plurality of points of the bottom of the bezel 16.

[0023] At this step, we can note that, in the following of the text, we will consider only one rim and one lens to be mounted in this rim (the process being the same for the other one).

[0024] As shown in FIG. 2, the ophthalmic lens 20 machined to be engaged in this rim 11 presents front and rear optical faces 21 and 22, together with an edge face 23.

[0025] The ophthalmic lens 20 presents optical characteristics and geometrical characteristics.

[0026] Amongst its optical characteristics, there is defined in particular the spherical refringent power of the lens, which is the magnitude that characterizes and quantifies the "magnifying glass" effect of the lens on the beam under consideration.

[0027] Amongst its geometrical characteristics, the edge face 23 of the lens initially presents an outline that is circular. Nevertheless, the lens is designed to be shaped to match the shape of the corresponding rim of the eyeglass frame 10, so as to enable it to be engaged therein.

[0028] As shown in FIG. 2, the lens is more precisely designed to be shaped so as to present on its edge face 23 an engagement ridge (named "bevel 26"). The bevel 26 described herein presents a V-shaped section with a top edge 27 that runs along the edge face 23 of the lens, with front and rear flanks on either side of the top edge 27.

[0029] The bevel 26 is for instance located so as to remain at a constant distance from the front face of the lens, all around the lens. Therefore, the shape of its top edge cannot follow exactly the one of the bottom of the bezel 16 (unless the mounting of the lens in the rim deforms the frame). Here, the shape of the top edge of the bevel is deduced from the 2D outline of the bezel 16 and (for the third dimension) from the curvature of the lens.

[0030] Here, the bevel 26 to be shaped will be characterized by the 3D outline of its top edge 27, and by an inclination angle.

[0031] Relative to the lens, there is defined a mean sphere, referred hereinafter as the "lens sphere". This lens sphere is defined as the sphere that comes closest to the set of points making up the top edge 27 of the bevel 26. The characteristics of this sphere may be obtained, for example, by applying the least squares method to the coordinates of a plurality of points on the top edge 27 of the bevel 26.

[0032] As shown in Figure 2, the ophthalmic lens 20 has a main axis A1, that can be formed by the axis where the magnifying glass effect is null (also called optical axis).

[0033] The edge face 23 of the lens can be machined so as to present an inclination relative to this main axis A1 that is not null. In each cross-view of the lens (defined as a section in a plane passing through the main axis A1), the edge face 23 defines a straight line (if we do not consider the bevel) oriented along an axis A2 that is tilted relative to the main axis A1 by said inclination angle, name hereinafter "angle α".

[0034] This angle α defines the inclination of the bevel 26. Indeed, the bevel 26 rising here perpendicularly to the edge face 23, and it is therefore oriented along an axis that is tilted relative to the main axis A1 with an angle equal to $90°-\alpha$.

[0035] The shaper appliance used to machine the bevel 26 on the ophthalmic lens 20 may be in the form of any machine for cutting or removing material and that is suitable for modifying the outline of the ophthalmic lens 20 in order to match it to the rim 11 of a selected frame, and that is suitable to make the angle α varying.

[0036] The shaper appliance is constituted, in known manner, by an automatic grinder (no shown) that comprises:

- means for blocking the lens, including for instance two shafts for clamping and rotating the ophthalmic lens 20 about the main axis A1,
- at least one bevelling tool 200 that is constrained to rotate on a tool axis A3 parallel to the axis A2, and that is also suitably driven in rotation by a motor, and
- a control unit that is suitable to control the positions, angles and speed of the components of this appliance.

[0037] As shown in FIG. 2, the bevelling tool 200 may have a cylindrical working face 201 with, at its center, a V-shaped ridge 202 able to generate the bevel 26, all faces constituting respective surfaces of revolution about the tool axis A3.

[0038] Here, the shaper appliance can be described as a "five-axes edger" since its bevelling tool is carried by a carriage (not shown) that is movable not only in translation along the axis A1 or A3, but also in rotation about an axis perpendicular to this tool axis A3 in order to adjust the angle α.

[0039] We can note that a three-axes edger does not have the mobility enabling this angle α to vary.

[0040] The shaping method is implemented by means of this shaper appliance.

[0041] The method consists in machining the edge face 23 of the ophthalmic lens 20 to reduce it to the shape of the rim 11 of the eyeglass frame 10.

[0042] To this end, a processing unit has to generate a machining setpoint. This machining setpoint is a list of instructions enabling the shaper appliance to machine the lens. To elaborate this machining setpoint, the shape of the bevel to be machined has to be characterized.

[0043] This processing unit comprises a processor or a controller, or any combination thereof. It also comprises a memory and various input and output interfaces.

[0044] Thanks to its input interfaces, the processing unit is suitable for receiving parameters relative to the frame, to the lens and, if any, other required information.

[0045] Thanks to its output interfaces, the processing unit is suitable for sending the machining setpoint to the controller of the shaper appliance.

[0046] Thanks to its memory, the processing unit stores a computer application, consisting of computer programs comprising instructions, the execution of which by the processor enables the processing unit to implement the process described below.

[0047] As it will be explained in more details hereinafter, this process comprises a first acquisition operation that consists in acquiring frame parameters and lens parameters.

[0048] The frame parameters comprise the shape of the bezel 16, here in the form of the coordinates of a great number of points located in the bottom of the bezel 16.

[0049] The lens parameters comprise information relative to the shape of the ophthalmic lens, for instance its base and its thickness at several points.

[0050] Thanks to these parameters, the processing unit can determine the shape of the top edge 27 of the bevel 26 to be machined, here in the form of the coordinates of a great number of points located on this top edge 27.

[0051] The second operation consists in deducing the angle α for shaping the bevel. Here, this angle α can be the same all around the lens, for aesthetic reasons.

[0052] The third operation consists in determining the machining setpoint so that, once machined, the lens bevel has the required inclination.

[0053] The second operation, that form the core of the invention, is illustrated in Figure 3. It comprises many steps successively performed by the processing unit.

[0054] The first step S1 consists in determining if a five-axes edger is available or not.

[0055] If not, this second operation ends and another kind of process is used to determine the machining setpoint. This other process, performed with a three-axes edger, is well known from the one skilled in the art and will not be described here.

[0056] On the contrary, if a five-axes edger is available to machine the ophthalmic lens 20, the processing unit determines during a second step S2 if this lens is of a non-standard category. In other words, it checks whether the machining of the lens requires a five-axes edger or not.

[0057] If not, this second operation ends.

[0058] On the contrary, if a five-axes edger is required, the processing unit determines if the mounting of the lens in the rim will have to face any constraint. The constraint(s) are relative to possible collision(s) between the lens and frame.

[0059] To this end, in this embodiment, the processing unit has to answer at least one of the following questions (here, it has to answer all these questions):

- is there a risk of collision between the lens and the associated nose pad 13 of the frame 10?
- is there a risk of a collision between the lens and the associated temple 14 of the frame 10?
- is the "temple closure clearance" less than a defined threshold (this clearance being defined as the distance between the temple 14 and the corresponding rim 11 when this temple is in a closed position)?

[0060] To respond to these questions, the processing unit uses the lens and frame parameters acquired during the first operation.

[0061] If the response at one of these questions is yes, the processing units considers in the following that the mounting is constraining and the value "1" is assigned to a Boolean μ. Else, this Boolean is considered equal to zero.

[0062] Then, during a following step, the processing unit successively determines which one of ten successive conditions is fulfilled. As soon as one condition is fulfilled, a determined value is assigned to the angle α, which enables to generate the searched setpoint. As long as none of the previously verified conditions is fulfilled, the processing unit continues to check if one of the following conditions is fulfilled.

[0063] These conditions are designed to distinguish three main cases, namely the case of the narrow rims (in height), the case of the round-shaped rims, and the case of the other rims (these conditions are verified in this order).

[0064] Indeed, the lenses to be engaged into narrow rims are difficult to machine since there is a risk of collision between the bevelling tool 200 and the shafts that hold the ophthalmic lens 20. Consequently, it is preferable to have a non-zero angle α to avoid such collisions.

[0065] The lenses to be engaged into round-shaped rims are difficult to design since there is an infinite number of rim spheres passing through the bezel bottom, so that there is many solutions for the angle α. Therefore, it is better to select a priori an angle α that is neither too high nor too low.

[0066] The other lenses are here designed by adapting the angle α to the rim shape and to the lens shape. The result is that this angle α can be, depending on the configuration:

- a predetermined angle (constant all around the lens),
- a varying angle enabling the bevel to be normal at all points to the top edge 27 outline (that is to say an angle enabling the bevel to be oriented as an extension of the lens), or
- an angle deduced from the latter.

[0067] Moreover, according to the invention, the angle is increased (by a fixed value or by a percentage of inclination) all around the lens when a constraint is detected (showing a potential collision between the lens edge and the frame).

[0068] We can now define more precisely the ten conditions.

[0069] The first condition relates to the vertical length V_{box} of the boxing rectangle.

[0070] Indeed, as explained above, the probability of problem in machining the lens is higher when this length is small.

[0071] Consequently, if the vertical length V_{box} is less than a first threshold T1, the first condition is considered fulfilled.

[0072] Therefore, the value assigned to the angle α is equal to $\alpha 1$ if no constraint is detected (μ=0) or to $\alpha 2$ if at least one constraint is detected (μ=1).

[0073] Here the first threshold T1 is comprised between 22 and 27 millimetres and is equal to 25 millimetres.

[0074] The values $\alpha 1$ and $\alpha 2$ are constant and predetermined. The value $\alpha 1$ is less than the value $\alpha 2$ of at least 0.5°.

[0075] This value $\alpha 1$ is comprised between 2 and 3°.

[0076] The value $\alpha 2$ is comprised between 3 and 6°.

[0077] Then, (if the first condition is not fulfilled), the processing unit determines if the vertical length V_{box} is less than a second threshold T2 greater than the first threshold T1.

[0078] Indeed, in this embodiment, it was deemed preferable to compare this vertical length V_{box} with two thresholds T1, T2 so as not to assign an unnecessarily high value to the angle α.

[0079] If the vertical length V_{box} is less than the second threshold T2, the second condition is considered fulfilled.

[0080] Therefore, the value assigned to the angle α is equal to $\alpha 3$ if no constraint is detected (μ=0) or to $\alpha 4$ if at least one constraint is detected (μ=1).

[0081] Here the second threshold T2 is comprised between the first threshold T1 and 30 millimetres, and is equal to 27 millimetres.

[0082] The values $\alpha3$ and $\alpha4$ are constant and predetermined. The value $\alpha3$ is less than the value $\alpha4$ of at least 0.5°. It is fewer than the value $\alpha1$.

[0083] This value $\alpha3$ is comprised between 2.5 and 3.5°.The value $\alpha4$ is almost equal to the value $\alpha2$.

[0084] The third condition relates to the general shape of the rim. It consists in determining (if no previous condition is fulfilled) whether the rim is round-shaped or not. Indeed, as explained above, problems often occur when it is round-shaped.

[0085] Consequently, if the general shape is round, the third condition is considered fulfilled.

[0086] To determine if a rim is approximately round or not, several methods can be used. One method consists in determining the center of the boxing rectangle, and to verify if the distances between this center and each point of the 2D outline of the bezel 16 are sensibly the same, for instance with an accuracy of a few percent.

[0087] If the general shape is round, the value assigned to the angle α is equal to $\alpha5$ if no constraint is detected (μ=0) or to $\alpha6$ if at least one constraint is detected (μ=1).

[0088] The values $\alpha5$ and $\alpha6$ are constant and predetermined. Here, the value $\alpha5$ is less than the value $\alpha6$ of at least 1 ° (here 2°).

[0089] This value $\alpha5$ is comprised between 2 and 4°.The value $\alpha6$ is comprised between 4 and 6°.

[0090] All the other conditions relate to the shape of the frame and the difference in shapes between the lens and the frame.

[0091] It is considered that these two data, once combined, make it possible to know whether the best angle α should be a predetermined constant or a variable.

[0092] Here, these data result to two distinct parameters, namely a frame curve FCRV and a bevel curve BEVC.

[0093] The bevel curve BEVC may be equal to the radius of the lens sphere. But here, it is preferably the closest radius to the frame curve FCRV considering the lens base (i.e. the lens curvature) and the lens edge thickness.

[0094] The frame curve FCRV is here calculated according to a standard commercial index. This curve could be converted into the radius of the rim sphere or may be equal to the latter. But here, to avoid any non-aesthetical disparity, the frame curve depends on the radius of the two rim spheres (the sphere of the right rim and the one of the left rim). In practice, the frame curve FCRV is here equal to the average of the frame curves of both rims.

[0095] We can note here that these two rim frame curves can differ, for instance due to a frame deformation during tracing (the tracing being an operation of feeling the bezel to determine its contour), or when the frame is not new and is deformed...

[0096] At this step, we can introduce the concept of gap Δ, that is the difference between the bevel curve BEVC and the frame curve FCRV.

[0097] Here, the probability of problem in the mounting of the lens into the frame rim is considered as depending on these curves and this gap, that is why they are considered.

[0098] In practice, the fourth condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is low (lower than a third threshold T3) and if the gap Δ is negative or null.

[0099] The third threshold is comprised between 3 and 5 and is here equal to 4.

[0100] If so, the fourth condition is considered fulfilled, and the value assigned to the angle α is equal to $\alpha7$ if no constraint is detected (μ=0) or to $\alpha8$ if at least one constraint is detected (μ=1).

[0101] The values $\alpha7$ and $\alpha8$ are constant and predetermined. Here, the value $\alpha7$ is less than the value $\alpha8$ of at least 1°.

[0102] This value $\alpha7$ is comprised between 2.5 and 4.5°.

[0103] The value $\alpha8$ is comprised between 4.5 and 6.5°.

[0104] These values are constant to ensure a sufficient inclination.

[0105] The fifth condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is low (lower than a third threshold T3) and if the gap Δ is positive.

[0106] If so, the fifth condition is considered fulfilled, and the value assigned to the angle α is equal to $\alpha9$ if no constraint is detected (μ=0) or to $\alpha10$ if at least one constraint is detected (μ=1).

[0107] Here, the value $\alpha9$ is less than the value $\alpha10$ of at least 1°.

[0108] If the bevel curve BEVC is lower than 4, the values $\alpha9$ and $\alpha10$ are constant.

[0109] The value $\alpha9$ is comprised between 2.5 and 4.5° and the value $\alpha10$ is comprised between 4.5 and 6.5°.

[0110] Else these values $\alpha9$ and $\alpha10$ are variable along the contour of the lens, and adjusted thanks to an auto-inclination process that takes into account only the bevel curve BEVC.

[0111] This auto-inclination process consists in orientating the bevel so that it arises, in all points of the edge around the lens, perpendicularly to the outline of the top edge 27 of the bevel 23 (that is to say as an extension of the lens edge).

[0112] In other words, fixe or variable values are used according to the bevel curve BEVC: below a certain threshold, the auto-inclination process would give an inclination value that would not be high enough to be visible, so that a fixed angle value is required. Over another threshold, the auto-inclination process would give a too high inclination value to obtain an aesthetic result, so that a fixed angle value is needed. Between these two thresholds, the auto-inclination process can be used (with some limitations depending on the cases that have been evaluated and tested to get the best aesthetic as possible).

[0113] The sixth condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is comprised between the third threshold T3 and a fourth threshold T4 and if the gap Δ is lower than -1 or equal to -1.

[0114] The fourth threshold T4 is greater than the third one and is comprised between 5 and 7 and is here equal to 6.

[0115] If so, the sixth condition is considered fulfilled, and the value assigned to the angle α is equal to α11 if no constraint is detected (μ=0) or to α12 if at least one constraint is detected (μ=1).

[0116] Here, the value α11 is less than the value α12 of at least 1°.

[0117] If the bevel curve BEVC is lower than 4, the values α11 and α12 are constant.

[0118] The value α11 is comprised between 2.5 and 4.5° and the value α12 is comprised between 4.5 and 6.5°.

[0119] Else these values α11 and α12 are variable and adjusted thanks to the auto-inclination process, that provides good results.

[0120] The seventh condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is comprised between the third threshold T3 and the fourth threshold T4 and if the gap Δ is comprised between -1 and 1.

[0121] If so, the seventh condition is considered fulfilled, and the value assigned to the angle α is equal to α13 if no constraint is detected (μ=0) or to α14 if at least one constraint is detected (μ=1).

[0122] Here, these values α13 and α14 are adjusted thanks to the auto-inclination process, that produces good results.

[0123] The height condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is comprised between the third threshold T3 and the fourth threshold T4 and if the gap Δ is greater than 1 or equal to 1.

[0124] If so, the height condition is considered fulfilled, and the value assigned to the angle α is equal to α15 if no constraint is detected (μ=0) or to α16 if at least one constraint is detected (μ=1).

[0125] Here, the value α15 is less than the value α16 of at least 1°.

[0126] If the bevel curve BEVC is greater than 7, the values α15 and α16 are constant.

[0127] The value α15 is comprised between 2.5 and 4.5° and the value α16 is comprised between 4.5 and 6.5°.

[0128] Else these values α15 and α16 are variable and adjusted thanks to the auto-inclination process.

[0129] Here, fixe or variables values are used, considering whether the auto-inclination process provides good results or not.

[0130] The ninth condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is higher than the fourth threshold T4 and if the gap Δ is negative or null.

[0131] If so, the ninth condition is considered fulfilled, and the value assigned to the angle α is equal to α17 if no constraint is detected (μ=0) or to α18 if at least one constraint is detected (μ=1).

[0132] Here, the value α17 is less than the value α18 of at least 1°.

[0133] If the bevel curve BEVC is greater than 7, the values α17 and α18 are constant. The value α17 is comprised between 2.5 and 4.5° and the value α18 is comprised between 4.5 and 6.5°.

[0134] Else these values α17 and α18 are variable and adjusted thanks to the auto-inclination process.

[0135] The tenth condition consists in determining (if no previous condition is fulfilled) if the frame curve FCRV is higher than the fourth threshold T4 and if the gap Δ is positive. We note that, at this step, this condition will necessarily be fulfilled, so that it is not required to check whether it is fulfilled or not.

[0136] So, the value assigned to the angle α is equal to α19 if no constraint is detected (μ=0) or to α20 if at least one constraint is detected (μ=1).

[0137] Here, the value α19 is less than the value α20 of at least 1°. These values are constant (all around the lens).

[0138] This value α19 is comprised between 2.5 and 4.5° and the value α20 is comprised between 4.5 and 6.5°.

[0139] At this final step, the value of the angle α is determined and can be used to generate the setpoint for bevelling the lens according to a well-known method that will not be described here.

[0140] In a preferred variant, this value can be corrected depending on the detected constraints. For instance, if at least two constraints are detected, the angle α value can be increased of a percentage or of a predetermined value.

Claims

1. Process for generating a machining setpoint for bevelling an ophthalmic lens (20) to be fitted into a bezel (16) of a rim (11) of an eyeglass frame (10), said process comprising:

   - a step of acquiring at least one frame parameter relative at least to the shape of a longitudinal contour of the bezel (16),
   - a step of acquiring at least one lens parameter relative at least to the shape of the ophthalmic lens (20), and
   - a step of deducing therefrom the machining setpoint, said machining setpoint defining an inclination angle (α) for a bevel (26) to be machined on an edge of the ophthalmic lens (20),

   characterized in that said inclination angle (α) is determined as a function of the at least one lens parameter and the at least one frame parameter.

2. Process according to claim 1, wherein the at least one lens parameter, from which the inclination angle (α) is determined, is a value of curvature of the ophthalmic lens (20) or of the bevel (26) to be machined.

3. Process according to claim 1 or 2, wherein the at least one frame parameters, from which the inclination angle (α) is determined, is an approximated value of curvature of the longitudinal contour of the bezel (16).

4. Process according to claim 3, wherein, given another value of curvature of a longitudinal contour of a bezel (16) of another rim (11) of said frame (10), said inclination angle (α) is determined according to said other value.

5. Process according to any one of claims 1 to 4, wherein the at least one frame parameters, from which the inclination angle (α) is determined, is a vertical height (V_{box}) of the longitudinal contour of the bezel.

6. Process according to any one of claims 1 to 5, wherein the at least one frame parameters, from which the inclination angle (α) is determined, is a data according to which the longitudinal contour of the bezel (16) has a rounded shape or not.

7. Process according to claims 2, 3, 5 and 6, wherein, if the longitudinal contour of the bezel (16) has not a rounded shape and if the vertical height (V_{box}) is greater than a threshold (T2), said inclination angle (α) is determined as a function of the difference between the approximated value of curvature of the longitudinal contour of the bezel (16) and the value of curvature of the ophthalmic lens (20) or of the bevel (26) to be machined.

8. Process according to any one of claims 1 to 7, wherein the at least one frame parameters, from which the inclination angle (α) is determined, is a gap between a temple (14) of the frame (10) and the rim (11) of the frame (10) when the temple (14) is in a folded position.

9. Process according to any one of claims 1 to 8, wherein, if a potential collision between the ophthalmic lens (20) and the frame (10) is detected on the basis of the frame parameter and the lens parameter, said inclination angle (α) is determined as a function of said potential collision.

10. Process according to claim 9, wherein, if a potential collision is detected, said inclination angle (α) is increased of a percentage or of an added value that is constant all around the lens.

11. Process according to any one of claims 1 to 10, wherein said inclination angle (α) is constant all around the lens.

12. Process according to any one of claims 1 to 11, wherein the frame (10) is of a non-standard category.

13. Process according to any one of claims 1 to 12, wherein the ophthalmic lens (20) is to be machined by a five-axes bevelling device.

14. A bevelling device for bevelling an ophthalmic lens, comprising:

- a blocking support for blocking the ophthalmic lens,
- a bevelling tool for bevelling the ophthalmic lens (20), the bevelling tool being movable relative to said blocking support with at least five distinct mobilities, and
- an electronic or computer unit for controlling the position of said bevelling tool relative to said blocking support,

characterized in that said electronic or computer unit is programmed to perform a process according to any one of claims 1 to 13.

Fig.1

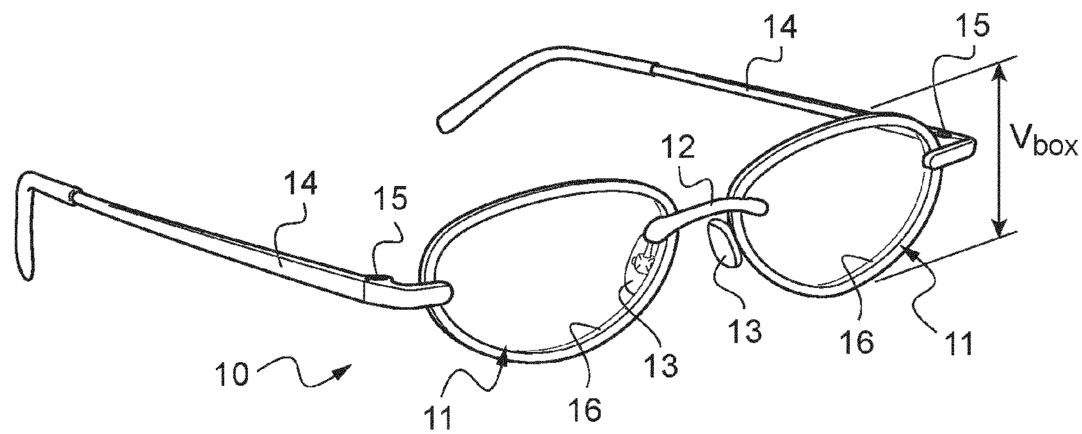

14
15
14
15
12
Vbox
10
11
16
13
13
16
11

Fig.2

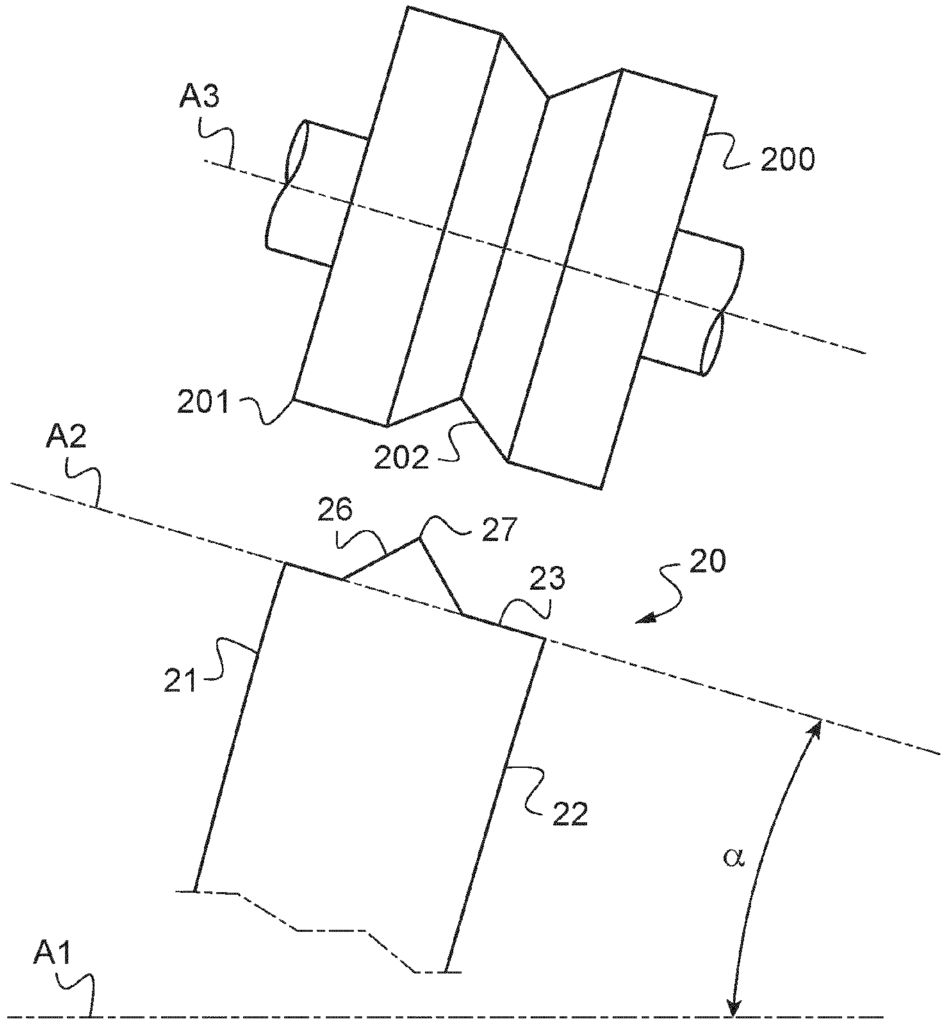
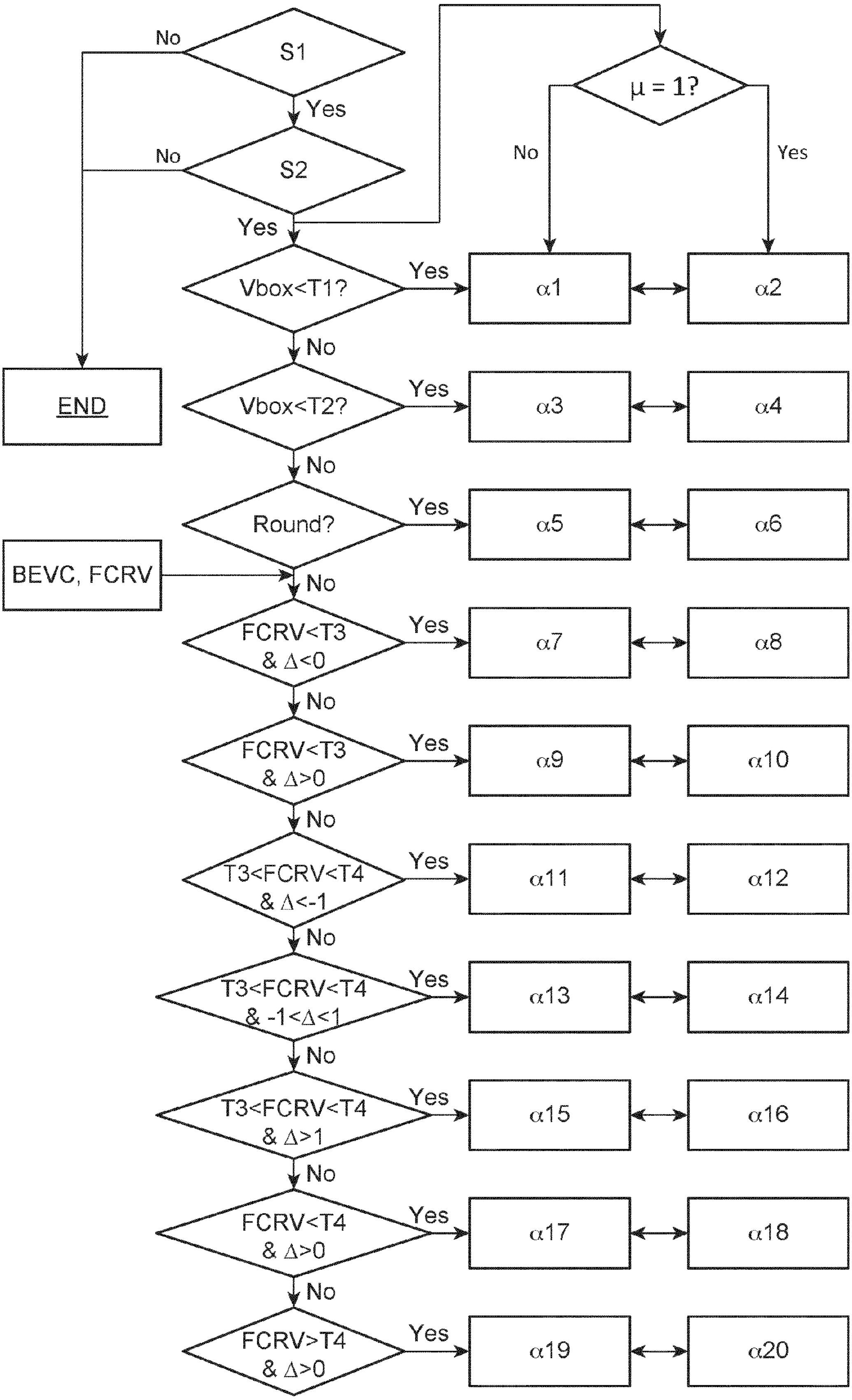

A3
200
201
202
A2
26
27
23
20
21
22
α
A1

Fig.3


S1
No
Yes
S2
No
Yes
μ = 1?
No
Yes
Vbox<T1?
Yes
No
α1
α2
END
Vbox<T2?
α3
α4
Round?
α5
α6
BEVC, FCRV
FCRV<T3 & Δ<0
α7
α8
FCRV<T3 & Δ>0
α9
α10
T3<FCRV<T4 & Δ<-1
α11
α12
T3<FCRV<T4 & -1<Δ<1
α13
α14
T3<FCRV<T4 & Δ>1
α15
α16
FCRV<T4 & Δ>0
α17
α18
FCRV>T4 & Δ>0
α19
α20

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EUROPEAN SEARCH REPORT

Application Number
EP 22 30 6806

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B24B
G02C

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	24 May 2023	Kornmeier, Martin

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