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(54) **METHOD AND DEVICE FOR POSITIONING A LENS MEMBER ON A MANUFACTURING APPARATUS**

(57) The invention relates to a method comprising:  
- detecting (S3), using an optical sensor, an intrinsic optical feature of a lens member to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to the lens member; and  
- determining (S4), using a processing unit, the position or orientation of the lens member in a framework of the manufacturing apparatus based on the intrinsic optical feature.

The method can be used to position and block a lens member, i.e. a lens blank or a finished lens, on any type of manufacturing apparatus used for the manufacture of an optical lens.

The intrinsic optical features have not been intentionally etched or engraved onto the lens member for the specific purpose of determining the position or orientation of the lens member.

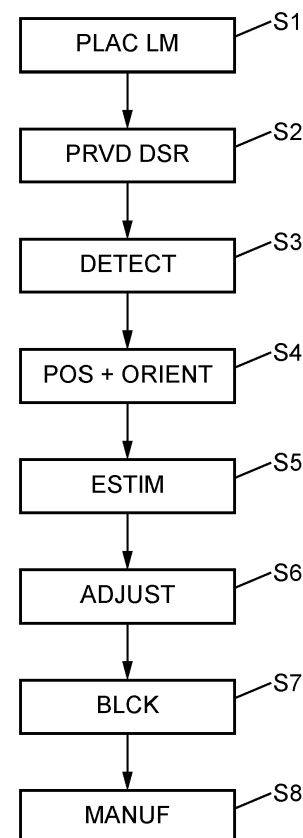


**FIG. 2**

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## Description

### FIELD OF INVENTION

[0001] The invention relates to the field of optical lens manufacturing, and more particularly to the positioning and blocking of a lens member on a manufacturing apparatus.

[0002] The lens member can be a lens blank, also called a semi-finished lens, or a finished lens and the manufacturing apparatus can be any apparatus used to manufacture an optical lens.

### BACKGROUND OF THE INVENTION

[0003] Optical lenses help correct vision disorders or refractive errors, also called ametropia, such as myopia, hyperopia, astigmatism and presbyopia. An optical lens is manufactured on the basis of a wearer's ophthalmic prescription. The prescription includes different information such as the sphere value, the cylinder value, the prism and the addition power.

[0004] To reduce the complexity of the manufacture of the optical lenses, it is now common to manufacture upstream semi-finished lenses, i.e. lenses whose only one of the surfaces is already finished and machined. When an ophthalmic prescription is received, the most suited semi-finished lens to satisfy this prescription is chosen and it is then sufficient to machine the unfinished surface. In addition, the use of semi-finished lenses makes it possible to increase the lenses manufacturing speed.

[0005] The manufacture of an optical lens is now largely automated, and apparatus are used in series for the different manufacturing steps applied to a lens member. For example, the steps include blocking, surfacing or polishing the lens member. For each step, it is necessary to position the lens member correctly on the manufacturing apparatus. In such a case, the lens member is a lens blank or semi-finished lens.

[0006] The positioning of a lens member is also an issue for the optician whose work consists in mounting a lens member in a spectacle frame selected by a customer. In particular, it is necessary to block the lens member by attaching a blocking accessory to the lens member to engage the lens member in an edging apparatus. An edging apparatus allows the lens member to be machined into the desired shape corresponding to the spectacle frame. In such a case, the lens member is a finished lens.

[0007] However, such positioning is complicated since a lens member may appear rotationally symmetrical to the naked eye.

[0008] To facilitate the positioning of the lens member, a preliminary step of engraving markings according to a chosen geometrical figure is usually performed before the manufacturing process. These markings allow the lens to be positioned and oriented correctly throughout the manufacturing process. However, this engraving operation presents several drawbacks. Indeed, this step

lengthens the duration of the manufacturing process and can have an impact on the quality of optical lenses.

[0009] The present invention seeks to improve the situation.

### SUMMARY OF THE INVENTION

[0010] The present invention concerns a method comprising:

- detecting, using an optical sensor, at least one intrinsic optical feature of a lens member to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to said lens member; and
- determining, using a processing unit, the position or orientation of the lens member in a framework of the manufacturing apparatus based on the at least one intrinsic optical feature.

[0011] In the context of the invention, the considered optical features are "intrinsic", which means that the optical features have not been intentionally etched or engraved onto the lens member for the specific purpose of determining the position or orientation of the lens member.

[0012] Typically, the at least one intrinsic optical feature provides an optical function for correcting vision disorders or refractive errors of a wearer.

[0013] The determination of the position or orientation of the lens member based on an intrinsic optical feature improves the accuracy of the positioning and manufacturing an optical lens. Moreover, it is no longer necessary to engrave markings on the surface of the lens member in order to position it at each stage of the manufacturing process.

[0014] The elimination of this preliminary operation simplifies the process.

[0015] Advantageously, the method further comprises:

- providing a desired position or orientation of the lens member in the framework of the manufacturing apparatus;
- estimating a difference between the desired position and the determined position of the lens member or between the desired orientation and the determined orientation of the lens member; and
- adjusting the position or orientation of the lens member on the manufacturing apparatus by moving the lens member translationally from the determined position or rotationally from the determined orientation of the lens member in order to compensate the difference.

[0016] It should be noted that these additional steps accommodate both the case in which the lens member is previously placed on the manufacturing apparatus and the opposite case in which the lens member is not pre-

viously placed on the manufacturing apparatus. These two distinct cases will be detailed in the description, with two alternative devices.

**[0017]** The method can also comprise blocking the lens member on the manufacturing apparatus in the adjusted position or orientation by using blocking means.

**[0018]** The position of the lens member in the framework of the manufacturing apparatus is for instance characterized by the location of a reference positioning point in the framework of the manufacturing apparatus.

**[0019]** For instance, the at least one intrinsic optical feature includes a curvature distribution. The curvature distribution is detected by acquiring, using an image sensor, an image of the lens member. The position of the lens member in the framework of the manufacturing apparatus is determined as follows:

- providing a theoretical surface characterized by a desired curvature distribution and a location of the reference positioning point on the theoretical surface;
- applying a curvature mapping function to the acquired image by the processing unit to generate a map of the curvature distribution of the lens member; and
- comparing the desired curvature distribution and the generated map of the curvature distribution of the lens member to determine, based on the location of the reference positioning point on the theoretical surface, the location of the reference positioning point of the lens member in the framework of the manufacturing apparatus.

**[0020]** According to an embodiment, the at least one intrinsic optical feature includes several distinct characteristics forming a pattern. The distinct characteristics are detected by acquiring, using an image sensor, an image of the lens member. The position or orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:

- processing, using the processing unit, the acquired image to find the location of a plurality of distinct characteristics; and
- deducing therefrom the position or orientation of the lens member in the framework of the manufacturing apparatus.

**[0021]** The processing of the acquired image comprises for example the positioning of a predetermined geometrical figure on the acquired image so that the predetermined geometrical figure passes through the plurality of found distinct characteristics. In such a case, the position or orientation of the lens member in the framework of the manufacturing apparatus is deduced respectively from the position or orientation of the geometrical figure on the processed image.

**[0022]** Preferably, at least one intrinsic optical feature

is a rotation variant of the lens member. The orientation of the lens member in the framework of the manufacturing apparatus can be determined on the basis of the rotation variant.

5 **[0023]** The use of a rotation variant allows to determine with certainty the orientation of the lens member, modulo 360°.

**[0024]** According to an embodiment, the at least one intrinsic optical feature includes a polarization axis. The polarization axis is detected as follows:

- determining a polarization of a light ray incident on the lens member;
- determining a polarization of the light ray after refraction by the lens member; and
- 15 - deducing therefrom the polarization axis of the lens member by comparing the polarization of the light ray before and after refraction.

20 **[0025]** In such a case, the orientation of the lens member in the framework of the manufacturing apparatus is determined on the basis of the polarization axis.

**[0026]** According to an embodiment, the at least one intrinsic optical feature includes a tint gradient. The tint gradient is detected by acquiring, using an image sensor, an image of a surface of the lens member. In such a case, the orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:

- 30 - providing a predetermined function of variation of the tint on the surface of the lens member;
- processing the acquired image to calculate a function characterizing the variation of the tint on the surface of the lens member; and
- 35 - deducing therefrom the orientation of the lens member in the framework of the manufacturing apparatus by comparing the calculated function with the predetermined function.

40 **[0027]** According to an embodiment, the at least one intrinsic optical feature includes a cylinder axis. In such a case, the cylinder axis is detected as follows:

- placing a pattern image in front of the lens member;
- 45 - acquiring, using an image sensor, a refracted image of the pattern image through the lens member; and
- deducing therefrom the cylinder axis of the lens member by comparing the pattern image before refraction with the refracted image of the pattern image.

**[0028]** The orientation of the lens member in the framework of the manufacturing apparatus is determined on the basis of the cylinder axis.

55 **[0029]** According to an embodiment, the lens member comprises at least one optical element. The at least one intrinsic optical feature includes an optical function of the at least one optical element for preventing focusing on

the retina of an eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye. In such a case, the optical function is detected by acquiring, using an image sensor, an image of the lens member. The position or orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:

- processing, using the processing unit, the acquired image to find the location of the at least one optical element; and
- deducing therefrom the position or orientation of the lens member in the framework of the manufacturing apparatus.

**[0030]** The optical element is for instance a micro-lens, a diffusing element or a  $\pi$ -Fresnel element.

**[0031]** The  $\pi$ -Fresnel element is described in the European patent application EP 3785072 A1 and can be defined as a diffractive Fresnel lens whose phase function has  $\pi$  phase jumps at the nominal wavelength, as opposed to unifocal Fresnel lenses whose phase jumps are multiple values of  $2\pi$ . If the lens member comprises a plurality of optical element, a plurality of micro-lenses can take the form of an array of micro-lenses.

**[0032]** The invention also relates to a manufacturing process of an optical lens from a lens member comprising one or more optical lens manufacturing operations implemented using at least one manufacturing apparatus. The at least one optical lens manufacturing operation is performed using the method mentioned above.

**[0033]** The invention also concerns a computer program comprising instructions for implementing the method or the manufacturing process, when the instructions are executed by at least one processor.

**[0034]** Finally, the invention relates to a device comprising:

- an optical sensor configured to detect at least one intrinsic optical feature of a lens member to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to the lens member; and
- a processing unit configured to determine the position or orientation of the lens member in a framework of the manufacturing apparatus based on the at least one intrinsic optical feature.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0035]** Other features and advantages of the invention will become apparent from the following description provided for indicative and non-limiting purposes, with reference to the accompanying drawings, wherein:

- **FIG. 1A** illustrates a device for positioning a lens member according to the invention;
- **FIG. 1B** illustrates a device for determining the po-

sition or orientation of a lens member according to the invention;

- **FIG. 2** illustrates a method for positioning a lens member according to the invention;
- **FIG. 3** illustrates steps of detecting an intrinsic optical feature of a lens member and determining the position or orientation of the lens member of the method illustrated in **FIG. 2**;
- **FIG. 4** illustrates the detection of optical characteristics on a lens member and the determination of a reference positioning point of the lens member; and
- **FIG. 5** illustrates the detection of a cylinder axis of a lens member.

#### **15 DETAILED DISCLOSURE**

**[0036]** **FIG. 1A** illustrates a device 1 for positioning a lens member 3 on a manufacturing apparatus.

**[0037]** It should be noted that **FIG. 1A** is schematic and only shows the structural components of the device 1. Therefore, **FIG. 1A** is not optically accurate, particularly in the tracing of light rays.

**[0038]** The manufacturing apparatus is not shown in **FIG. 1A**. Indeed, the manufacturing apparatus can be any apparatus configured to apply an optical lens manufacturing operation to the lens member 3.

**[0039]** For example, the manufacturing apparatus may be an apparatus for blocking, surfacing or polishing the lens member 3. In such a case, the lens member 3 is typically a lens blank or a semi-finished lens. A semi-finished lens is a lens whose only one surface is machined prior to the manufacturing process. The other surface, i.e. the unfinished surface, is intended to be machined according to an ophthalmic prescription.

**[0040]** The manufacturing apparatus may also be an edging apparatus used by an optician to shape the lens member 3 into a desired form for mounting in a spectacle frame. In such a case, the lens member 3 is typically a finished lens.

**[0041]** Consequently, the term "optical lens" is a generic term that can refer to a lens obtained after the application of a manufacturing operation, a finished lens obtained after the complete process of manufacturing an ophthalmic lens or even a spectacle lens obtained after mounting the finished ophthalmic lens in a spectacle frame.

**[0042]** Furthermore, it should be noted that the optical lens to be manufactured may typically be intended to correct myopia. Such an optical lens is, for example, manufactured to satisfy an ophthalmic prescription if at least one eye of the wearer suffers from a refractive problem so that an image seen by the wearer focuses on the retina of the eye. The optical elements are micro-structures.

**[0043]** The optical lens to be manufactured can comprise one or more optical elements which are for example micro-lenses. The optical lens typically comprises an array of micro-lenses. The optical elements provide an optical function for preventing focusing on the retina of an

eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye.

**[0044]** In such a case, the optical elements induce a physical deformation of a surface of the optical lens or lens member 3. The surface of the optical lens or lens member 3 thus has an altitude (also called sag in the literature) within the range  $[0,1\ \mu\text{m}; 50\ \mu\text{m}]$  and a width within the range  $[0,5\ \mu\text{m}; 1,5\ \text{mm}]$  at the level of the deformations caused by the presence of one or more optical elements. The optical elements provide wavefront modification on the intensity, curvature or light deviation of the optical lens or lens member 3.

**[0045]** The optical elements, which are for instance micro-lenses, have preferably a periodical or pseudo-periodical layout in the optical lens or lens member 3. Conversely, the optical elements may also have randomized positions in the optical lens or lens member 3.

**[0046]** The optical elements can be diffusing micro-structures configured to locally scatter light in a range of angles from  $1^\circ$  to  $30^\circ$ .

**[0047]** In the embodiment illustrated in **FIG. 1A**, the device 1 is used to position the lens member 3. However, more generally, the device 1 is used to determine the position or orientation of the lens member 3. Determining the position or orientation of the lens member 3 has several practical applications, including positioning the lens member 3 on a manufacturing apparatus, which is the case here. Furthermore, the skilled person should understand here that the determination of the position or orientation means that the device 1 can allow to determine both position and orientation of the lens member 3. Thus, the term "or" means "and/or".

**[0048]** As illustrated in **FIG. 1A**, the device 1 comprises illuminating means, placing means and processing means.

**[0049]** The illuminating means comprise a light source 5 and a mirror 7. The light source 5 is configured to emit a light ray or a light beam towards the mirror 7. The mirror 7 is configured to reflect the light ray or the light beam emitted by the light source 5 towards the lens member 3. Typically, the mirror 7 is inclined at  $45^\circ$  with respect to an axis A1 orthogonal to a surface portion of the lens member 3.

**[0050]** Optionally, in the embodiment illustrated in **FIG. 1A**, the device 1 may include a filter 9 within which an image pattern may be mounted for projection onto a surface of the lens member 3.

**[0051]** The placing means comprise a support plate 11 at the center of which a holder 13 is provided for holding the lens member 3. Advantageously, the support plate 11 is planar and made of a transparent material. The holder 13 is for instance a rod having a widened head to support the lens member 3. Of course, the holder 13 can have a different shape or may be formed by the support plate 11.

**[0052]** The placing means allow the lens member 3 to be placed in order to expose it to the light rays or light

beams emitted by the light source 5 and reflected by the mirror 7. As previously mentioned, the light rays or the light beams can also be filtered by the filter 9 according to a particular pattern image. The placing means are configured to place the lens member 3 on the manufacturing apparatus configured to apply an optical lens manufacturing operation to the lens member 3.

**[0053]** In the embodiment illustrated in **FIG. 1A**, the device 1 also comprises a mirror 15. The mirror 15 is configured to reflect the light rays or the light beams refracted by the lens member 3 towards the processing means. As previously explained, the support plate 11 is made of a transparent material to let the light rays or the light beams refracted by the lens member 3 pass through.

**[0054]** The processing means comprise an optical sensor 17 and a processing unit 19. The optical sensor 17 is configured to detect at least one intrinsic optical feature of the lens member 3 placed on the manufacturing apparatus. The optical sensor 17 can comprise a plurality of sensors.

**[0055]** The intrinsic optical features are inherent to the lens member 3 and allow to characterize or define one or more of its optical properties. Such intrinsic optical features may or may not result from a prior manufacturing operation. In any case, it must be understood here that such an intrinsic optical feature has not been specifically provided to the lens member 3 to enable its positioning on the manufacturing apparatus.

**[0056]** The one or more intrinsic optical features can comprise for instance a curvature distribution, a pattern formed by several distinct characteristics, a polarization axis, a tint gradient, a cylinder axis or an optical function provided by at least one element for preventing focusing on the retina of an eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye.

**[0057]** Advantageously, at least one intrinsic optical feature is a rotation variant of the lens member 3.

**[0058]** The optical sensor 17 can comprise an image sensor, for instance a camera, arranged to acquire an image of the lens member 3. The acquired image can be processed in order to detect one or more intrinsic optical features of the lens member 3 placed on the manufacturing apparatus.

**[0059]** The processing unit 19 is configured to determine the position or orientation of the lens member 3 in a framework of the manufacturing apparatus based on at least one intrinsic optical feature. Of course, the processing unit 19 can be configured to determine both the position and orientation of the lens member 3 in the framework of the manufacturing apparatus.

**[0060]** It must be noted that the position of the lens member 3 in the framework of the manufacturing apparatus can be characterized by the location of a reference positioning point in the framework of the manufacturing apparatus.

**[0061]** In particular, the processing unit 19 is arranged to analyze data acquired by the optical sensor 17. For

example, when the optical sensor 17 comprises an image sensor, the processing unit 19 is arranged to analyze the image of the lens member 3 acquired by the image sensor. The processing unit 19 can obviously also be arranged to analyze light rays or light beams refracted by the lens member 3 and captured by the optical sensor 17. As previously detailed, the light rays or light beams refracted by the lens member 3 are for instance reflected by the mirror 15 towards the optical sensor 17.

**[0062]** In the particular case where the optical sensor 17 comprises an image sensor and where one or more images of the lens member 3 are transmitted by the optical sensor 17 to the processing unit 19, the latter may be arranged to apply image processing to the received images. The image processing techniques are conventional techniques widely known to the skilled person for modifying for instance the definition, resolution or bitrate of the received images, and more generally any type of parameters relating to the quality of the images.

**[0063]** In the embodiment illustrated in **FIG. 1A**, the processing unit 19 comprises a memory 21 and a processor 23.

**[0064]** The memory 21 is configured to store instructions whose implementation by the processor 23 results in the operation of the processing unit 19. Furthermore, the memory 21 is also configured to store measurements or data collected by the optical sensor 17. The memory 21 may be a volatile or non-volatile memory, and the stored measurements or data may be erased after using these measurements or data to determine the position or orientation of the lens member 3.

**[0065]** Furthermore, the memory 21 can be configured to store information received by the processing unit 19. Such information can be received by a communication interface of the processing unit 19. The received information comprises for instance a desired position or orientation of the lens member 3 in the framework of the manufacturing apparatus. In such a case, the processing unit 19, and more particularly the processor 23, can be configured to estimate a difference between the desired position and the determined position of the lens member 3 or between the desired orientation and the determined orientation of the lens member 3.

**[0066]** According to an embodiment, the device 1 comprises positioning means arranged to adjust the position or orientation of the lens member 3 on the manufacturing apparatus. The positioning means are for instance configured to move the lens member 3 translationally from the determined position or rotationally from the determined orientation of the lens member 3. In the particular embodiment in which the processing unit 19 receives information relating to a desired position or a desired orientation of the lens member 3 in the framework of the manufacturing apparatus, the positioning means can be used to compensate the estimated difference between the desired position and determined position of the lens member 3 or between the desired orientation and the determined orientation of the lens member 3.

**[0067]** Moreover, the device 1 may also comprises blocking means (not shown in **FIG. 1A**) arranged to block the lens member 3 on the manufacturing apparatus in the adjusted position or orientation.

**[0068]** Alternatively, **FIG. 1B** illustrates a device 2 for determining the position or orientation of the lens member 3.

**[0069]** In this embodiment, the lens member 3 is not necessarily placed on a manufacturing apparatus. Therefore, the device 2 is configured to determine the position and orientation of the lens member 3 in a known framework, which may be a framework attached to the device 2. However, the transition from a framework, for example the framework of the device 2, to another framework, for example the framework of a manufacturing apparatus, is known such that determining the position or orientation of the lens member 3 in the framework attached to the device 2 is equivalent to determining the position or orientation of the lens member 3 in the framework of a manufacturing apparatus.

**[0070]** As illustrated in **FIG. 1B**, the device 2 comprises a displaying unit 4, a holder 6, an image-capturing unit 8 and a processing unit 10.

**[0071]** The displaying unit 4 is configured to display one or more images that can be refracted by the lens member 3. For example, as illustrated in **FIG. 1B**, the displaying unit 4 takes the form of a planar screen positioned so that the screen is orthogonal to the axis A1, which is orthogonal to a surface portion of the lens member 3.

**[0072]** The displaying unit 4 is configured for instance to illuminate the lens member 3 according to a plurality of successive specific patterns comprising a bright area and a dark area. The displaying unit 4 may also be suitable for displaying at least one scrolling pattern and for making this pattern scroll in at least one predetermined scrolling direction with respect to the holder 6. Of course, the displaying unit 4 can also be suitable for displaying one or more stationary patterns, for example a Hartmann matrix.

**[0073]** The displaying unit 4 is for example a backlit LCD screen that plays the role of the light source of the device 2. Such a light source can be compared to the light source 5 of the device 1 illustrated in **FIG. 1A**. This LCD screen is then suitable for making this scrolling pattern scroll in the predetermined scrolling direction with respect to the holder 6.

**[0074]** The holder 6 illustrated in **FIG. 1B** can be compared to the placing means of the device 1 illustrated in **FIG. 1A**, namely the support plate 11 and the holder 13.

**[0075]** Advantageously, the holder 6 is planar and made of a transparent material. The holder 6 allows the lens member 3 to be placed in order to expose it to the image displayed by the displaying unit 4.

**[0076]** The image-capturing unit 8 of the device 2 can be compared to the optical sensor 17 of the device 1 illustrated in **FIG. 1A**. In the embodiment illustrated in **FIG. 1B**, the image-capturing unit 8 is arranged to acquire

an image of the lens member 3. The acquired image can be processed in order to detect one or more intrinsic optical features of the lens member 3 held by the holder 6 in order to determine the position or orientation of the lens member 3 in the framework attached to the device 2. The image-capturing unit 8 is for instance a digital camera or a digital video camera.

[0077] As previously detailed, the intrinsic optical features are inherent to the lens member 3 and allow to characterize or define one or more of its optical properties. Such intrinsic optical features may or may not result from a prior manufacturing operation. In any case, it must be understood here that such an intrinsic optical feature has not been specifically provided to the lens member 3 to enable its positioning on the manufacturing apparatus.

[0078] Finally, the processing unit 10 is configured to determine the position or orientation of the lens member 3 in a framework attached to the device 2 based on at least one intrinsic optical feature. Of course, the processing unit 10 can be configured to determine both the position and orientation of the lens member 3 in the framework of the device 2.

[0079] The position of the lens member 3 in the framework of the device 2 can be characterized by the location of a reference positioning point in the framework of the device 2.

[0080] In particular, the processing unit 10 is arranged to analyze image acquired by the image-capturing unit 8.

[0081] As for the processing unit 19 of the device 1, the processing unit 10 of the device 2 can be arranged to apply image processing to the received images. The image processing techniques are conventional techniques widely known to the skilled person for modifying for instance the definition, resolution or bitrate of the received images, and more generally any type of parameters relating to the quality of the images.

[0082] In the embodiment illustrated in FIG. 1B, the processing unit 10 comprises a memory (not shown in FIG. 1B) and a processor 12.

[0083] The memory is configured to store instructions whose implementation by the processor 12 results in the operation of the processing unit 10. Furthermore, the memory of the processing unit 10 is also configured to store images captured by the image-capturing unit 8. The memory of the processing unit 10 may be a volatile or non-volatile memory, and the stored images may be erased after using these images to determine the position or orientation of the lens member 3.

[0084] Furthermore, the memory of the processing unit 10 can be configured to store information received by the processing unit 10. Such information can be received by a communication interface of the processing unit 10. The received information can comprise formulas for changing the framework, for example from the framework of the device 2 to the framework of a manufacturing apparatus. The processor 12 is thus configured to determine, based on the position or orientation of the lens member 3 in the framework attached to the device 2, the corresponding

position or orientation of the lens member 3 in the manufacturing apparatus framework.

[0085] Of course, the operation of the processing unit 10 of the device 2 is comparable to the operation of the processing unit 19 of the device 1, and information that can be received by the processing unit 19 can also be received by the processing unit 10, in particular a desired position or orientation of the lens member 3 in the framework of a manufacturing apparatus.

[0086] Furthermore, the device 2 illustrated in FIG. 1B may also include a mechanical system, including for example an articulated arm, for positioning the lens member 3 on a manufacturing apparatus. The mechanical system is configured to grip the lens member 3 placed on the holder 6 and move it to the manufacturing apparatus. Such a mechanical system is well known to the skilled person and is widely described in the literature relating to moving a lens member from one equipment to another.

[0087] A method for positioning a lens member will now be described in more detail below with reference to FIG. 2 and FIG. 3.

[0088] Generally speaking, the method illustrated in FIG. 2 can be considered as a method for positioning a lens member, such as the lens member 3. However, the skilled person understands from the various steps or operations described below that the method may be a method for determining the position or orientation of the lens member 3, but also a method for positioning the lens member 3 or even a method for applying an optical lens manufacturing operation to the lens member 3. The nature of the method depends on which of the steps illustrated in FIG. 2 is performed last. The same considerations also apply to the device 1 described above.

[0089] In the context of the method, the lens member 3 is intended to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to lens member 3.

[0090] If the lens member 3 is a lens blank or a semi-finished lens, the manufacturing apparatus can be an apparatus for blocking, surfacing, inking, engraving or polishing the lens member 3. Conversely, if the lens member 3 is a finished lens, the manufacturing apparatus can be an edging apparatus used by an optician to shape the lens member 3 into a desired form for mounting in a spectacle frame.

[0091] It should be noted that the method is described hereinafter primarily with reference to the device 1 shown in FIG. 1A. Of course, the skilled person understands that the same method can also be performed with the device 2 illustrated in FIG. 1B. There remain some minor differences. For example, the device 2 determines the position or orientation of the lens member 3 first in the framework of the device 2 and then determines the corresponding position or orientation in the framework of the manufacturing apparatus on which the lens member 3 is to be placed. Furthermore, the images or patterns displayed by the displaying unit 4 are directly refracted by the lens member 3 without using a mirror to reflect the

light rays or light beams emitted by the displaying unit 4.

**[0092]** More specifically, in the following description of the method, it appears that the device 1 can be replaced with the device 2. Thus, the light source 5, possibly combined with the filter 9, can be replaced with the displaying unit 4. The optical sensor 17 can be replaced with the image-capturing unit 8. Finally, the processing unit 19 can be replaced with the processing unit 10 while the processor 23 can be replaced with the processor 12.

**[0093]** In a step S1, the lens member 3 is placed on the manufacturing apparatus configured to apply an optical lens manufacturing operation to the lens member 3.

**[0094]** In the embodiment described with reference to **FIG. 1A**, the lens member is placed on the manufacturing apparatus using placing means of the device 1. More particularly, the lens member 3 is held by the holder 13 provided at the center of the support plate 11. Typically, the support plate 11 is planar and made of a transparent material.

**[0095]** In the embodiment shown in **FIG. 1B**, the lens member 3 is placed on the holder 6 of the device 2 and not on the manufacturing apparatus. The lens member 3 is in fact only placed on the manufacturing apparatus after the position or orientation of the lens member 3 in the framework of the device 2 has been determined.

**[0096]** In a step S2, a desired position or orientation of the lens member 3 in the framework of the manufacturing apparatus is provided. Of course, both desired position and orientation of the lens member 3 in the framework of the manufacturing apparatus can be provided.

**[0097]** The desired position or orientation of the lens member 3 in the framework of the manufacturing apparatus are for instance received by the processing unit 19 and can be stored in the memory 21 of the processing unit 19.

**[0098]** In a step S3, the optical lens 17 of the device 1 detects at least one intrinsic optical feature of the lens member 3. The optical sensor 17 can detect a single intrinsic optical feature as well as a plurality of intrinsic optical features of the lens member 3.

**[0099]** As explained above, the optical sensor 17 can comprise an image sensor arranged to acquire an image of the lens member 3. More generally, the optical sensor 17 acquires data or measurements related to the light rays or light beams refracted by the lens member 3.

**[0100]** In a step S4, the processing unit 19 determines the position or orientation of the lens member 3 in the framework of the manufacturing apparatus based on at least one intrinsic optical feature.

**[0101]** The processing unit 19 can determine both position and orientation of the lens member 3 in the framework of the manufacturing apparatus. Of course, the processing unit 19 may use a single intrinsic optical feature or multiple intrinsic optical features of the lens member 3.

**[0102]** Step S3 of detecting one or more intrinsic optical features of the lens member 3 and step S4 of determining the position or orientation of the lens member 3 will now

be described in more detail with reference to **FIG. 3**, which describes different embodiments corresponding to different intrinsic optical features.

**[0103]** In a first case in which the optical sensor 17 comprises an image sensor, for instance a camera, step S3 corresponds to a single sub-step S31.

**[0104]** In the sub-step S31, the image sensor acquires an image of the lens member 3. In such a case, the intrinsic optical feature can be a curvature distribution, several distinct optical characteristics, a tint gradient or an optical function provided by at least one element for preventing focusing on the retina of an eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye.

**[0105]** Of course, the device 2 illustrated in **FIG. 1B** can also be used. In this embodiment, the image of the lens member 3 is acquired by the image-capturing unit 8.

**[0106]** For instance, an intrinsic optical feature of the lens member 3 is a curvature distribution. The curvature distribution is detected by acquiring, using the image sensor, an image of the lens member 3.

**[0107]** When the considered intrinsic optical feature is the curvature distribution of the lens member 3, step S4 corresponds to the determination of the position of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a set of sub-steps S41, S42, S43, S44 and S47.

**[0108]** In the sub-step S41, the processing unit 19 receives information relating to both the reference positioning point and the theoretical desired curvature of the lens member 3. The received information can be stored in the memory 21.

**[0109]** According to an embodiment, the information includes a theoretical surface which is provided to the processing unit 19. The theoretical surface is characterized by a desired curvature distribution. This curvature distribution has been determined before the implementation of the method in order to satisfy a prescription and to correct a vision disorder. Furthermore, the information received by the processing unit 19 includes the location of the reference positioning point on the theoretical surface. This location can be defined as a set of coordinates.

**[0110]** Additionally or alternatively, the information can include a predetermined curvature value at the reference positioning point, in particular when this predetermined curvature value is reached by the theoretical surface only at the reference positioning point. The reference positioning point can advantageously be selected so that the value of the curvature reached by the theoretical surface at this point is not reached at any other point on the theoretical surface.

**[0111]** In the sub-step S42, a curvature mapping function is applied to the image acquired by the image sensor of the optical sensor 17 to generate a map of the curvature distribution of the lens member 3.

**[0112]** In the sub-step S43, the processing unit 19 determines the location of the reference positioning point in the framework of the manufacturing apparatus.

**[0113]** In the embodiment in which the information includes the desired curvature distribution and the location of the reference positioning point on the theoretical surface, the processing unit 19 determines which position and orientation of the generated curvature distribution of the lens member 3 best coincides or fits with the desired curvature distribution. In other words, the processing unit 19 compares the desired curvature distribution and the generated map of the curvature distribution of the lens member 3 to determine, based on the location of the reference positioning point on the theoretical surface, the location of the reference positioning point of the lens member 3 in the framework of the manufacturing apparatus.

**[0114]** The processing unit 19 applies for instance successive translations and rotations to the generated map of the curvature distribution of the lens member 3 and calculates, after each displacement, a deviation of the generated curvature distribution of the lens member 3 from the desired curvature distribution of the theoretical surface. This calculation may include a least squares method, i.e. the sum of the squares of the curvature differences between the generated curvature distribution of the lens member 3 and the desired curvature distribution.

**[0115]** Thus, once the processing unit 19 has determined a position and orientation of the generated map of the curvature distribution of the lens member 3 that minimizes the deviation from the desired curvature distribution of the theoretical surface, the location of the reference positioning point in the framework of the manufacturing apparatus can be determined.

**[0116]** Reference is now made to the embodiment in which the information includes the predetermined curvature value at the reference positioning point. In such a case, it is sufficient to determine at which point of the generated map of the curvature distribution this predetermined value of curvature is reached by the surface of the lens member 3 to deduce the location of the reference positioning point by unique correspondence.

**[0117]** The generated map allows for example to associate each point of a surface of the lens member 3 with the corresponding measured curvature value. Each point of a surface of the lens member 3 can be characterized by three-dimensional coordinates in the framework of the manufacturing apparatus while the curvature is characterized by a value corresponding to the inverse of the radius of curvature at the associated point. Since the curvature of the reference positioning point is predetermined and is reached, in a particular case, by the surface of the lens member 3 only at the reference positioning point, this curvature value can be found in the generated map and the three-dimensional coordinates of the reference positioning point are then directly determined.

**[0118]** Finally, in the sub-step S47, the processing unit 19 determines the position of the lens member 3 in the framework of the manufacturing apparatus on the basis of the location of the reference positioning point.

**[0119]** As mentioned above, the intrinsic optical feature can correspond to several distinct characteristics forming a pattern. Here again, the distinct characteristics are detected by acquiring, using the image sensor, an image of the lens member 3.

**[0120]** An example of the embodiment in which the considered intrinsic optical feature correspond to several distinct characteristics forming a pattern of the lens member 3 is illustrated in more detail in **FIG. 4**.

**[0121]** More particularly, **FIG. 4** illustrates a cross-sectional view of the lens member 3 having a plurality of distinct characteristics CH. The cross-section of the lens member 3 shown is for instance orthogonal to the axis A1 shown in **FIG. 1A**. In the context of the invention, the optical characteristics CH are intrinsic, which means that the optical characteristics CH have not been intentionally etched or engraved onto the lens member 3 for the specific purpose of determining the position or orientation of the lens member 3. This embodiment aims here to exploit intrinsic optical characteristics CH, which correspond to diffusing elements.

**[0122]** In the example illustrated in **FIG. 4**, the image sensor detects the optical characteristics CH by acquiring an image of the lens member 3 in the sub-step S31. More particularly, the image sensor detects three optical characteristics of the lens member 3.

**[0123]** Still referring to the embodiment in which the intrinsic optical feature considered corresponds to several distinct optical characteristics CH, step S4 corresponds to the determination of both position and orientation of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a set of sub-steps S44, S47 and S48.

**[0124]** In the sub-step S44, the processing unit 19 processes the image acquired by the image sensor of the optical sensor 17 to find the location of a plurality of distinct characteristics CH.

**[0125]** Advantageously, the processing of the acquired image comprises the positioning of a predetermined geometrical figure on the acquired image so that the predetermined geometrical figure passes through the plurality of found distinct characteristics.

**[0126]** In the embodiment illustrated in **FIG. 4**, three optical characteristics CH have been detected by the image sensor of the optical sensor 17. In the sub-step S44, the processing unit 19 positions a predetermined geometrical figure GF which corresponds here to a rectangle. This rectangle passes through the three optical characteristics CH as well as through the other optical characteristics which, potentially, have not been detected by the image sensor.

**[0127]** Advantageously, the processing unit 19 determines the location of a reference positioning point RPP based on the position of the predetermined geometrical figure. In the example illustrated in **FIG. 4**, the reference positioning point RPP corresponds to the geometrical center of the geometrical figure GF, which is here a rectangle.

**[0128]** In the sub-step S47, the processing unit 19, and more exactly the processor 23, deduces the position of the lens member 3 in the framework of the manufacturing apparatus from the position of the geometrical figure on the processed image. The position of the lens member 3 in the framework of the manufacturing apparatus is for instance determined based on the location of the reference positioning point RPP. In the particular embodiment illustrated in **FIG. 4** in which the intrinsic optical feature corresponds to several distinct optical characteristics CH and in which the processing unit 19 processes the acquired image to position a geometrical figure GF corresponding to a rectangle, the position of the lens member 3 in the framework of the manufacturing apparatus based on the location of the reference positioning point RPP.

**[0129]** In the sub-step S48, the processing unit 19 can also deduce the orientation of the lens member 3 in the framework of the manufacturing apparatus from the orientation of the geometrical figure on the processed image.

**[0130]** Moreover, an intrinsic optical feature can be a tint gradient. The tint gradient is also detected by acquiring, using the image sensor, an image of a surface of the lens member 3.

**[0131]** When the intrinsic optical feature is a tint gradient, step S4 corresponds to the determination of the orientation of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a set of sub-steps S45, S46 and S48.

**[0132]** In the sub-step S45, a predetermined function of variation of the tint on the surface of the lens member 3 is provided. The predetermined function of variation of the tint is for instance received by the processing unit 19 and then stored in the memory 21.

**[0133]** In the sub-step S46, the processing unit 19 processes the image acquired by the image sensor of the optical sensor 17 to calculate a function characterizing the variation of the tint on the surface of the lens member 3.

**[0134]** In the sub-step S48, the processing unit 19 deduces the orientation of the lens member 3 in the framework of the manufacturing apparatus by comparing the calculated function with the predetermined function of variation of the tint of the surface of the lens member 3.

**[0135]** Finally, as previously mentioned, an intrinsic optical feature of the lens member 3 can be an optical function provided by at least one element for preventing focusing on the retina of an eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye. In such a case, each optical element is for instance a micro-lens. The optical function is detected by acquiring, using the image sensor, an image of the lens member 3.

**[0136]** As explained above, when the device used to implement the method is the device 2 illustrated in **FIG. 1B**, the image of the lens member 3 is acquired by the image-capturing unit 8.

**[0137]** When the considered intrinsic optical feature is

the optical function of the lens member 3, step S4 corresponds to the determination of both position and orientation of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a set of sub-steps S44, S47 and S48. Consequently, this embodiment is similar to the one in which the intrinsic optical feature corresponds to several distinct optical characteristics CH.

**[0138]** In the sub-step S44, the processing unit 19 processes the image acquired by the image sensor of the optical sensor 17 to find the location of one or more optical elements.

**[0139]** Advantageously, the processing unit 19 determines the location of a reference positioning point RPP based on the location of the found optical elements.

**[0140]** In the sub-step S47, the processing unit 19, and more exactly the processor 23, deduces the position of the lens member 3 in the framework of the manufacturing apparatus from the location of the optical elements on the processed image. The position of the lens member 3 in the framework of the manufacturing apparatus is for instance determined based on the location of the reference positioning point RPP.

**[0141]** The image processing is particularly effective when each optical element is a micro-lens so that the lens member 3 has an array of micro-lenses.

**[0142]** In the sub-step S48, the processing unit 19 can also deduce the orientation of the lens member 3 in the framework of the manufacturing apparatus from the orientation of the optical elements on the processed image.

**[0143]** In a second case in which an intrinsic optical feature of the lens member 3 is a polarization axis, step S3 corresponds to a set of sub-steps S32, S33 and S34.

**[0144]** In the sub-step S32, a polarization of a light ray incident on the lens member 3 is determined. The information about the polarization of the incident light ray is known, for example, at the light source 5 of the device 1. This information is then transmitted to the processing unit 19 and can be stored in the memory 21 to be used by the processor 23.

**[0145]** In the sub-step S33, a polarization of the same light ray, but after refraction by the lens member 3, is determined. Typically, the polarization of the refracted light ray is measured by the optical sensor 17. Indeed, as illustrated in **FIG. 1A**, the refracted light ray can be reflected by the mirror 15 towards the optical sensor 17.

**[0146]** Finally, in the sub-step S34, the polarization axis of the lens member 3 is deduced by comparing the polarization of the light ray before and after refraction by the lens member 3. Such a comparison is for example performed by the processing unit 19, and more precisely by the processor 23, after receiving the information about the polarization of the emitted light ray from the light source 5 and after receiving the measured polarization of the light ray refracted by the lens member 3 from the optical sensor 17.

**[0147]** When the intrinsic optical feature is a polarization axis, step S4 corresponds to the determination of

the orientation of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a single sub-step S48.

**[0148]** In the sub-step S48, the processing unit 19 determines the orientation of the lens member 3 in the framework of the manufacturing apparatus on the basis of the polarization axis.

**[0149]** In a third case in which an intrinsic optical feature of the lens member 3 is a cylinder axis, step S3 corresponds to a set of sub-steps S35, S36 and S37.

**[0150]** An example of the embodiment in which the considered intrinsic optical feature is a cylinder axis of the lens member 3 is illustrated in more detail in **FIG. 5**.

**[0151]** In the sub-step S35, a pattern image PI is placed in front of the lens member 3. As illustrated in **FIG. 1A**, the pattern image can be mounted in the filter 9. The filter 9 received the light rays or light beams emitted by the light source 5 and reflected by the mirror 7. The filter 9 is arranged between the mirror 5 and the lens member 3. The filter 9 is for example orthogonal to the axis A1, which is orthogonal to a surface portion of the lens member 3.

**[0152]** In the embodiment illustrated in **FIG. 5**, the pattern image PI has the shape of a circle. Of course, multiple other patterns can be used.

**[0153]** In the sub-step S36, an image sensor of the optical sensor 17 acquires a refracted image of the pattern image PI through the lens member 3. As illustrated in the example shown in **FIG. 5**, the pattern image PI is refracted due to the cylinder axis of the lens member 3. The circle then appears as an inclined ellipse, i.e. the circle seen at a certain angle, due to the cylinder axis of the lens member 3. The inclination of the axis of the ellipse makes it possible to determine the cylinder axis.

**[0154]** In the sub-step S37, the processing unit 19 deduces the cylinder axis of the lens member 3 by comparing the pattern image PI before refraction with the refracted image of the pattern image PI. The pattern image PI before refraction is typically known by the processing unit 19. For instance, an information relating to the pattern image PI can be transmitted to the processing unit 19 and stored in the memory 21 to be used by the processor 23.

**[0155]** When the intrinsic optical feature is a cylinder axis, step S4 corresponds to the determination of the orientation of the lens member 3 in the framework of the manufacturing apparatus and is implemented according to a single sub-step S48.

**[0156]** In the sub-step S48, the processing unit 19 determines the orientation of the lens member 3 in the framework of the manufacturing apparatus on the basis of the cylinder axis.

**[0157]** The skilled person understands that several intrinsic optical features can be detected to determine both the position and orientation of the lens member 3 in the manufacturing apparatus framework. By exploiting an additional intrinsic optical feature, the determined position or orientation may be corrected. Alternatively, if an

intrinsic optical feature is used to determine only the position of the lens member 3 in the framework of the manufacturing apparatus, another intrinsic optical feature may be used in addition to determine the orientation of the lens member 3. Accordingly, the previously described embodiments may be combined.

**[0158]** For example, the optical sensor 17 may detect the cylinder axis of the lens member 3 to determine the orientation of the lens member 3 in the framework of the manufacturing apparatus and may detect the curvature distribution of the lens member 3 to also determine the position of the lens member 3 in the framework of the manufacturing apparatus.

**[0159]** Reference is again made to **FIG. 2** below to describe the rest of the method. At this point in the method, the position or orientation of the lens member 3 in the framework of the manufacturing apparatus is determined. Advantageously, both the position and the orientation are determined by the processing unit 19.

**[0160]** If the device used is the device 1 shown in **FIG. 1A**, the position or orientation of the lens member 3 is determined in the framework of the manufacturing apparatus on which the lens member 3 is placed. However, if the method is carried out using the device 2 shown in **FIG. 1B**, the position or orientation of the lens member 3 is determined in the framework of the device 2. This position or orientation is then converted into the framework of the device 2 using the processing unit 10.

**[0161]** Moreover, according to an embodiment, a desired position or orientation of the lens member 3 in the framework of the manufacturing apparatus have been provided in the step S2. It must be noted that the step S2 of providing the desired position or orientation of the lens member 3 in the framework of the manufacturing apparatus can be provided after the step S4 of determining the position or orientation of the lens member 3 in the framework of the manufacturing apparatus.

**[0162]** In a step S5, the processing unit 19 estimates a difference between the desired position and the determined position of the lens member 3 or between the desired orientation and the determined orientation of the lens member 3.

**[0163]** Advantageously, the processing unit 19 estimates the difference between the desired position and the determined position of the lens member 3 and the difference between the desired orientation and the determined orientation of the lens member 3. In a step S6, the position of the lens member 3 on the manufacturing apparatus is adjusted by moving the lens member 3 translationally from the determined position of the lens member 3 in order to compensate the estimated difference between the desired position and the determined position of the lens member 3. Alternatively or additionally, the orientation of the lens member 3 on the manufacturing apparatus is adjusted by moving the lens member 3 rotationally from the determined orientation of the lens member 3 in order to compensate the estimated difference between the desired orientation and the de-

terminated orientation of the lens member 3.

**[0164]** As previously explained, the device 1 can comprise positioning means arranged to adjust the position or orientation of the lens member 3 on the manufacturing apparatus. The positioning means are for instance configured to move the lens member 3 translationally from the determined position or rotationally from the determined orientation of the lens member 3. In the step S6, the positioning means can be used to position the lens member 3 on the manufacturing apparatus.

**[0165]** Optionally, in a step S7, the lens member 3 is blocked on the manufacturing apparatus in the adjusted position or orientation by using blocking means.

**[0166]** The blocking means prevent movement of the lens member 3 during the manufacturing operation applied by the manufacturing apparatus to the lens member 3.

**[0167]** The blocking means can comprise a blocking accessory to be attached to the lens member 3, so that the lens member 3 can be detachably fastened to the manufacturing apparatus. After the manufacturing operation, the blocking accessory, still attached to the lens member 3, can be removed from the manufacturing apparatus and placed on another manufacturing apparatus.

**[0168]** Finally, in a step S8, the manufacturing apparatus on which the lens member is blocked applies a manufacturing operation to the lens member.

**[0169]** The manufacturing apparatus is for instance an apparatus for blocking, surfacing or polishing the lens member 3, especially when the lens member 3 is a lens blank or a semi-finished lens. The manufacturing apparatus can also be an edging apparatus used by an optician to shape the lens member 3 into a desired form for mounting in a spectacle frame, when the lens member is a finished lens.

## Claims

### 1. A method comprising:

- detecting (S3), using an optical sensor (17, 8), at least one intrinsic optical feature of a lens member (3) to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to said lens member; and
- determining (S4), using a processing unit (19, 10), the position or orientation of the lens member in a framework of the manufacturing apparatus based on said at least one intrinsic optical feature.

### 2. The method of claim 1, further comprising:

- providing (S2) a desired position or orientation of the lens member in the framework of the manufacturing apparatus;

- estimating (S5) a difference between the desired position and the determined position of the lens member or between the desired orientation and the determined orientation of the lens member; and

- adjusting (S6) the position or orientation of the lens member on the manufacturing apparatus by moving the lens member translationally from the determined position or rotationally from the determined orientation of the lens member in order to compensate said difference.

### 3. The method of claim 2, further comprising blocking (S7) the lens member on the manufacturing apparatus in the adjusted position or orientation by using blocking means.

### 4. The method of one of the previous claims, wherein the position of the lens member in the framework of the manufacturing apparatus is **characterized by** the location of a reference positioning point (RPP) in the framework of the manufacturing apparatus.

### 5. The method of claim 4, said at least one intrinsic optical feature including a curvature distribution, wherein the curvature distribution is detected by acquiring (S31), using an image sensor, an image of the lens member, and wherein the position of the lens member in the framework of the manufacturing apparatus is determined as follows:

- providing (S41) a theoretical surface **characterized by** a desired curvature distribution and a location of the reference positioning point on said theoretical surface;
- applying (S42) a curvature mapping function to the acquired image by the processing unit to generate a map of the curvature distribution of the lens member; and
- comparing (S43) the desired curvature distribution and the generated map of the curvature distribution of the lens member to determine, based on the location of the reference positioning point on the theoretical surface, the location of the reference positioning point of the lens member in the framework of the manufacturing apparatus.

### 6. The method of one of the previous claims, said at least one intrinsic optical feature including several distinct characteristics (CH) forming a pattern, wherein said distinct characteristics are detected by acquiring (S31), using an image sensor, an image of said lens member, and wherein the position or orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:

- processing (S44), using the processing unit, the acquired image to find the location of a plurality of distinct characteristics; and
  - deducing (S47, S48) therefrom the position or orientation of the lens member in the framework of the manufacturing apparatus.
7. The method of claim 6, wherein the processing of the acquired image comprises the positioning of a predetermined geometrical figure (GF) on the acquired image so that said predetermined geometrical figure passes through the plurality of found distinct characteristics, and wherein the position or orientation of the lens member in the framework of the manufacturing apparatus is deduced respectively from the position or orientation of said geometrical figure on the processed image.
8. The method of one of the previous claims, said at least one intrinsic optical feature being a rotation variant of the lens member, wherein the orientation of the lens member in the framework of the manufacturing apparatus is determined on the basis of said rotation variant.
9. The method of claim 8, said at least one intrinsic optical feature including a polarization axis, wherein the polarization axis is detected as follows:
- determining (S32) a polarization of a light ray incident on the lens member;
  - determining (S33) a polarization of said light ray after refraction by the lens member; and
  - deducing (S34) therefrom the polarization axis of the lens member by comparing the polarization of said light ray before and after refraction; wherein the orientation of the lens member in the framework of the manufacturing apparatus is determined (S48) on the basis of the polarization axis.
10. The method of claims 8 or 9, said at least one intrinsic optical feature including a tint gradient, wherein the tint gradient is detected by acquiring (S31), using an image sensor, an image of a surface of said lens member, and wherein the orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:
- providing (S45) a predetermined function of variation of the tint on said surface of the lens member;
  - processing (S46) the acquired image to calculate a function characterizing the variation of the tint on said surface of the lens member; and
  - deducing (S48) therefrom the orientation of the lens member in the framework of the manufacturing apparatus by comparing the calculated
- function with the predetermined function.
11. The method of one of claims 8 to 10, said at least one intrinsic optical feature including a cylinder axis, wherein the cylinder axis is detected as follows:
- placing (S35) a pattern image (PI) in front of the lens member;
  - acquiring (S36), using an image sensor, a refracted image of the pattern image through the lens member; and
  - deducing (S37) therefrom the cylinder axis of the lens member by comparing the pattern image before refraction with the refracted image of said pattern image;
- wherein the orientation of the lens member in the framework of the manufacturing apparatus is determined (S48) on the basis of the cylinder axis.
12. The method of one of the previous claims, wherein the lens member comprises at least one optical element, said at least one intrinsic optical feature including an optical function of said at least one optical element for preventing focusing on the retina of an eye of a wearer under standard wearing conditions, so as to reduce the progression of an abnormal refraction of the eye, wherein said optical function is detected by acquiring (S31), using an image sensor, an image of said lens member, and wherein the position or orientation of the lens member in the framework of the manufacturing apparatus is determined as follows:
- processing, (S44), using the processing unit, the acquired image to find the location of the at least one optical element; and
  - deducing (S47, S48) therefrom the position or orientation of the lens member in the framework of the manufacturing apparatus.
13. A manufacturing process of an optical lens from a lens member comprising one or more optical lens manufacturing operations implemented using at least one manufacturing apparatus, wherein at least one optical lens manufacturing operation (S8) is performed using the method of one of the previous claims.
14. A computer program comprising instructions for implementing the method of one of claims 1 to 12 or the manufacturing process of claim 13, when said instructions are executed by at least one processor (23, 12).
15. A device (1, 2) comprising:
- an optical sensor (17, 8) configured to detect

at least one intrinsic optical feature of a lens member (3) to be positioned on a manufacturing apparatus configured to apply an optical lens manufacturing operation to said lens member; and

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- a processing unit (19, 10) configured to determine the position or orientation of the lens member in a framework of the manufacturing apparatus based on said at least one intrinsic optical feature.

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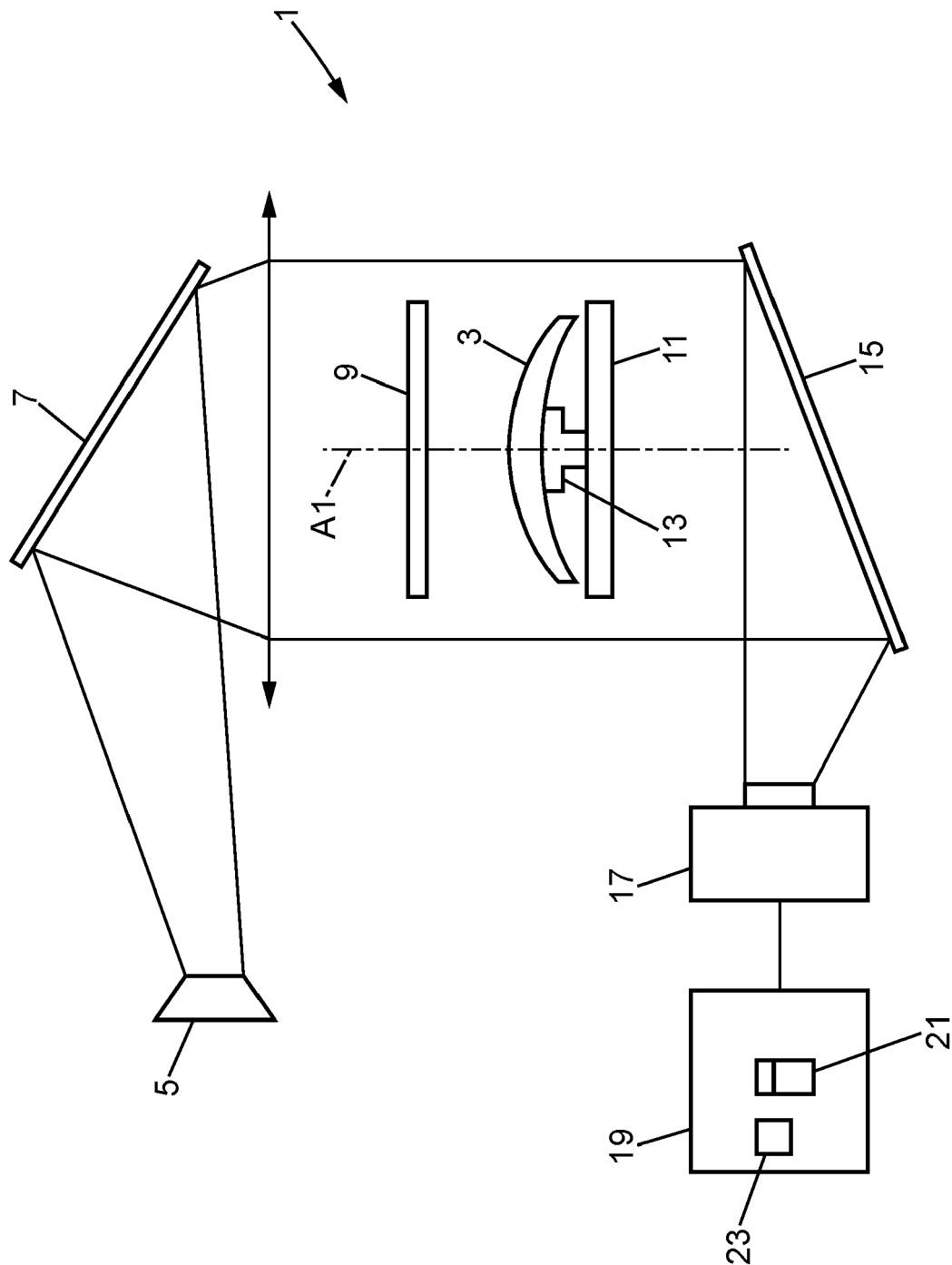


FIG. 1A

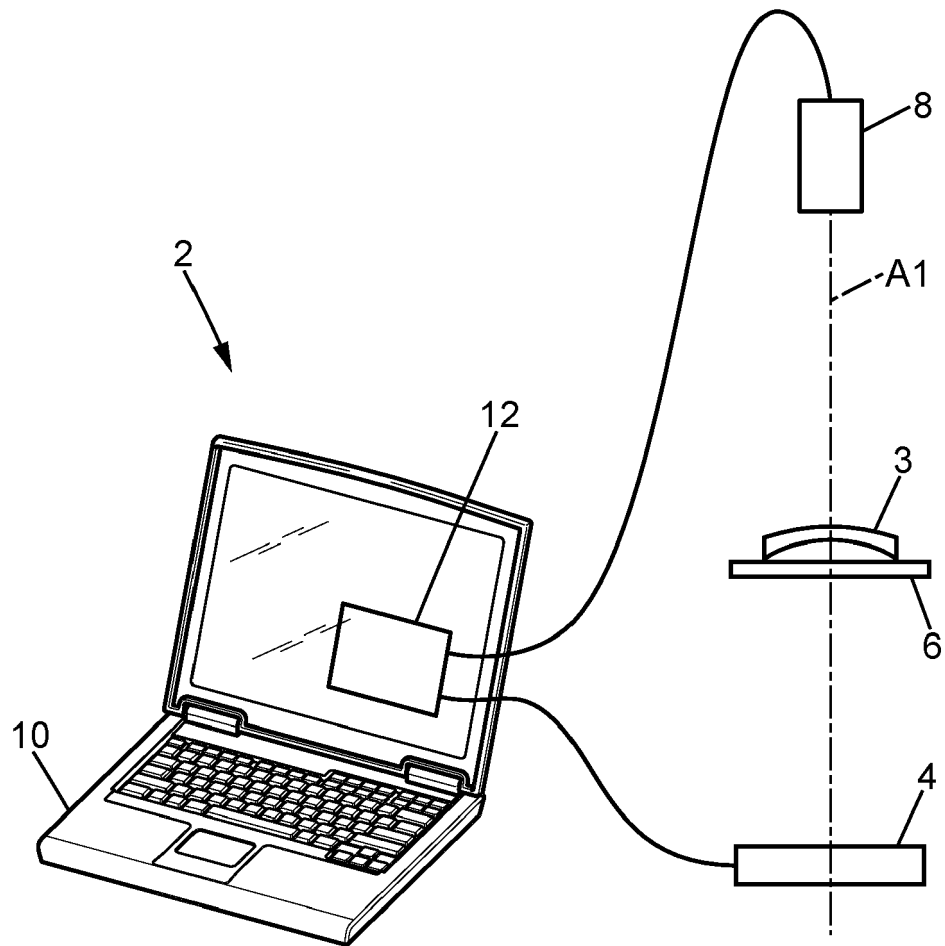


**FIG. 1B**

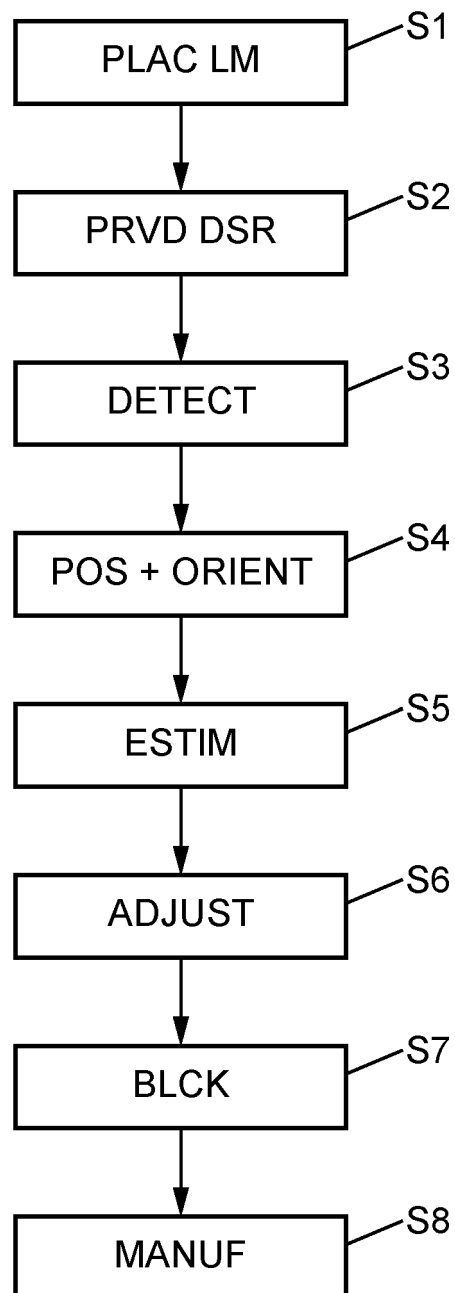


**FIG. 2**

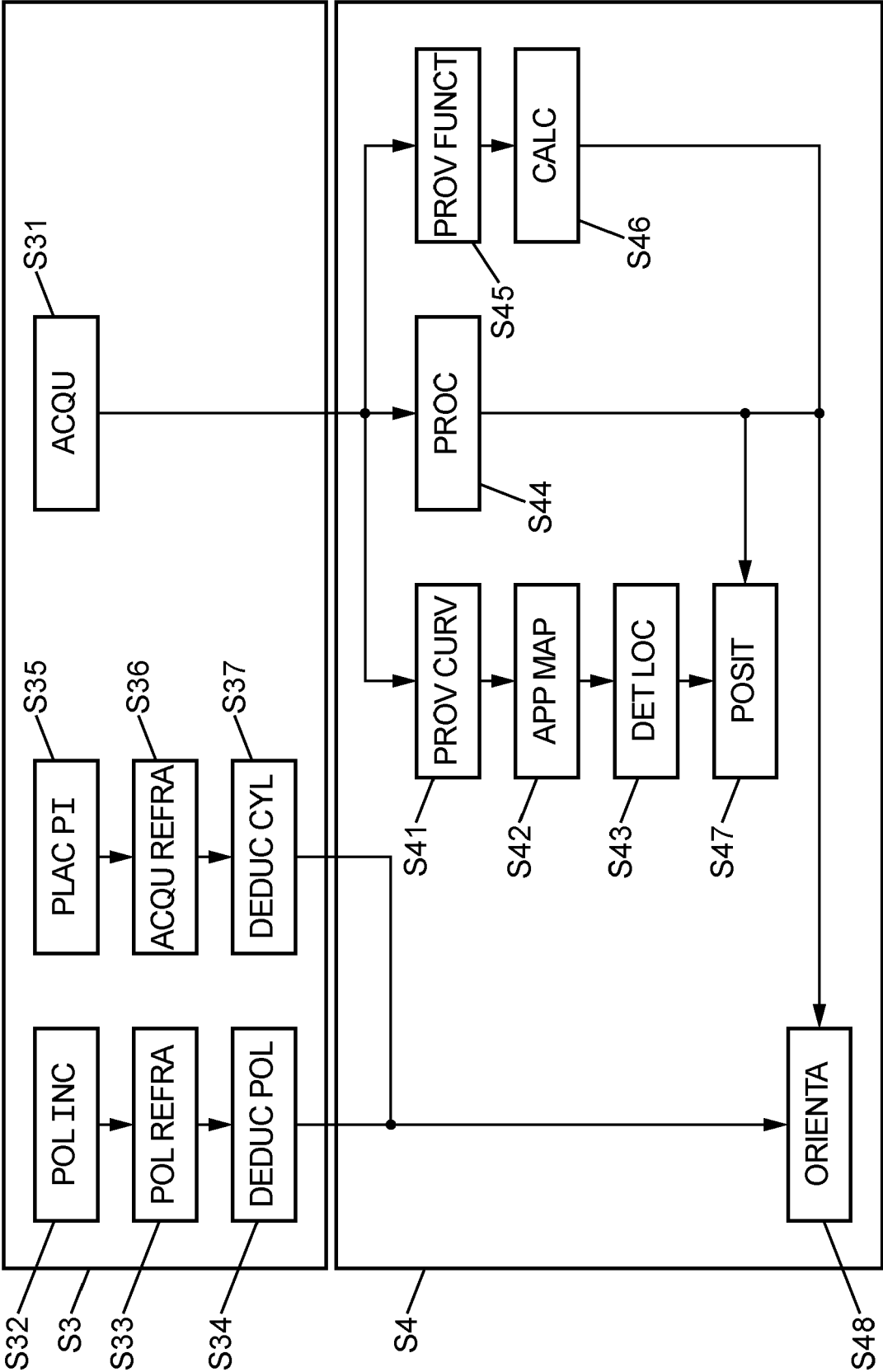


FIG. 3

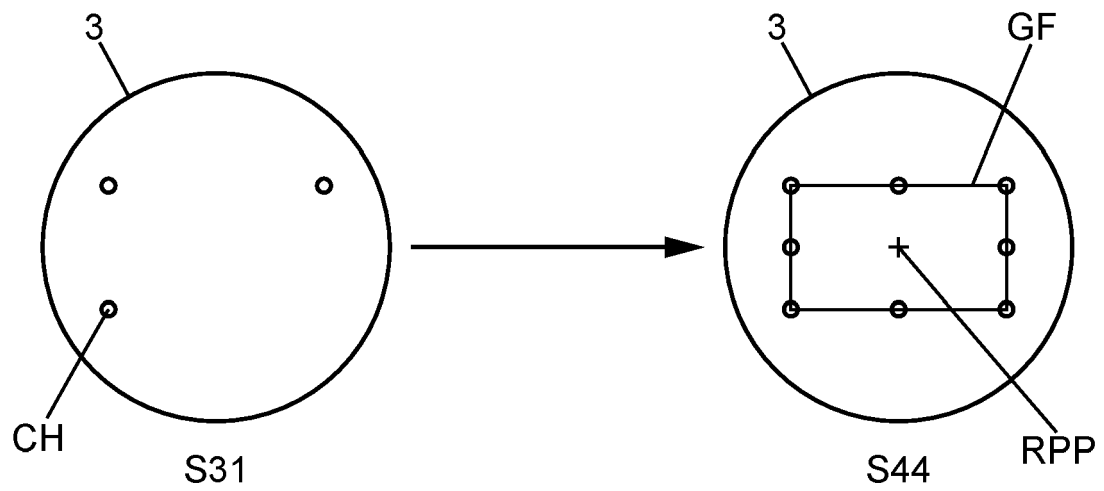


FIG. 4

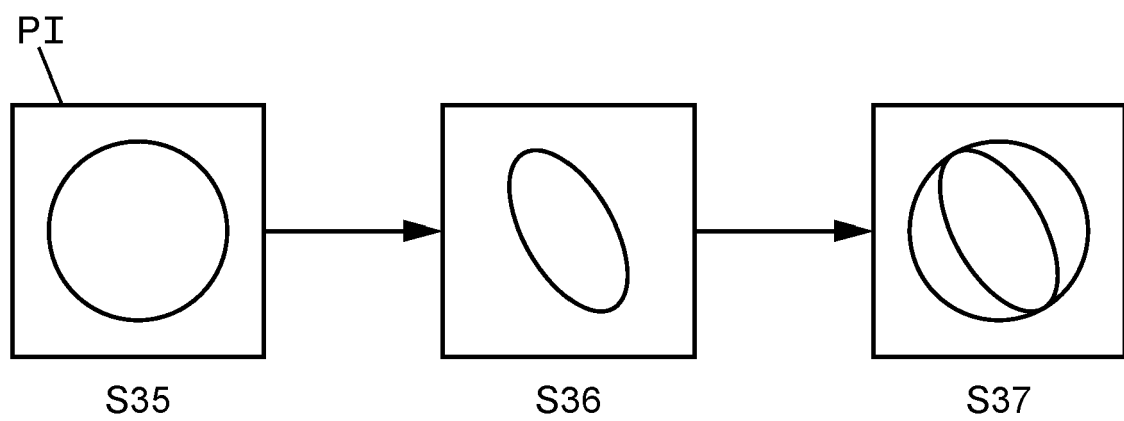


FIG. 5



## EUROPEAN SEARCH REPORT

 Application Number  
 EP 21 30 5742

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                               |                                                                                                                                                                                                                                                                              |                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                 | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC)      |
| X<br>A                                                                                                                                                                                                                                                 | US 2018/195931 A1 (LEMAIRE CEDRIC [FR] ET AL) 12 July 2018 (2018-07-12)<br>* par. 80, 98, 130-132, 146-147, 168, 179-193, 201-219, 237, 240;<br>figures 1-2 * | 1-4,6-15<br>5                                                                                                                                                                                                                                                                | INV.<br>B24B13/005<br>B24B51/00<br>B24B49/12 |
| X                                                                                                                                                                                                                                                      | -----<br>EP 3 226 067 A1 (ESSILOR INT [FR])<br>4 October 2017 (2017-10-04)<br>* paragraphs [0041], [0051] - [0062],<br>[0067] - [0071], [0075] *              | 1,14,15                                                                                                                                                                                                                                                                      |                                              |
| X                                                                                                                                                                                                                                                      | -----<br>US 2011/066276 A1 (DUBOIS FREDERIC [FR] ET AL) 17 March 2011 (2011-03-17)<br>* paragraphs [0079] - [0085]; claim 1;<br>figure 4 *                    | 1,14,15                                                                                                                                                                                                                                                                      |                                              |
|                                                                                                                                                                                                                                                        | -----                                                                                                                                                         |                                                                                                                                                                                                                                                                              |                                              |
|                                                                                                                                                                                                                                                        |                                                                                                                                                               |                                                                                                                                                                                                                                                                              | TECHNICAL FIELDS SEARCHED (IPC)              |
|                                                                                                                                                                                                                                                        |                                                                                                                                                               |                                                                                                                                                                                                                                                                              | B24B                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                               |                                                                                                                                                                                                                                                                              |                                              |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                       |                                                                                                                                                               | Date of completion of the search<br><b>18 November 2021</b>                                                                                                                                                                                                                  | Examiner<br><b>Bonetti, Serena</b>           |
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