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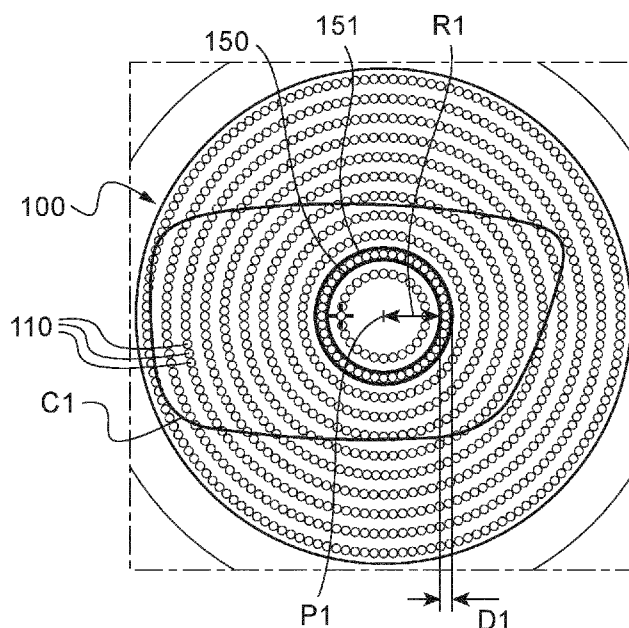
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(54) Title: CENTERING APPARATUS AND PROCESS

Fig.2



(57) Abstract: The invention relates to a centering apparatus including: - a chassis, - a holder mounted on the chassis, which is suitable for receiving an ophthalmic lens, and - centering means mounted on the chassis, which include: • a camera for acquiring images of the ophthalmic lens when received on the holder, and • a screen for displaying the images acquired by the camera and a centering target superimposed onto said images, said centering target comprising two coaxial and parallel outlines (150, 151).



CENTERING APPARATUS AND PROCESS

TECHNICAL FIELD OF THE INVENTION

The present invention generally relates to the field of eyeglasses.

5 It more particularly relates to a centering apparatus including:

- a chassis,
- a holder mounted on the chassis, which is suitable for receiving an ophthalmic lens, and
- centering means mounted on the chassis, which include:

- 10 • a camera for acquiring images of the ophthalmic lens when received on the holder, and
- a screen for displaying the images acquired by the camera and a centering target (also called "reticle") superimposed onto said images.

15 BACKGROUND INFORMATION AND PRIOR ART

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
20 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,
25 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
30 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.

Here, the centering and blocking operations are more particularly of

interest.

These operations are generally carried out by an optician, using a centering-blocking apparatus.

5 These apparatuses are generally configured in the same way, with means for holding the ophthalmic lens, optical means for centering the ophthalmic lens, and blocking means for depositing the blocking accessory on the lens.

10 An exemplary centering-blocking apparatus is sold by the Applicant under the reference Delta2. In this apparatus, the optical centering means include a camera and a screen on which the optician may observe the lens superposed on a centering reticle, thereby allowing him to move the lens with respect to this reticle so as to center it correctly. The blocking means for their part include an arm that is stationary and that supports the blocking accessory. The lens support is movable along an axis parallel to the axis of the camera, so that the optician can press the lens and its support towards the blocking accessory when the lens is
15 centered. The position of the blocking accessory on the lens then depends on the position of the lens with respect to the reticle.

This reticle has usually a cross shape, that is perfectly adapted when the lens markings comprise a point or a cross to be centered on the reticle.

20 For instance, document EP1149664 relates to a cup attaching apparatus for blocking a lens, comprising two cameras and a color monitor. The monitor displays the target lens shape, a cup figure having a circle shape, and a cross mark indicating the position of the optical center of the lens. This cross mark is displayed such that the center of a circle "O" depicted in the center conforms to the detected position of the optical center of the lens.

25 But this kind of reticle does not always guarantee a great precision when the lens markings are different.

Indeed, the lens markings have sometimes shapes that make the centering operation difficult to implement. For instance, lens markings can be round micro-engravings, very numerous, and distributed along concentric circles.

30 With such lens markings, it is difficult for the optician to center the reticle on the center of the concentric circles because this center is not marked.

SUMMARY OF THE INVENTION

In this context, the present invention provides a centering apparatus as disclosed in the introduction, having a reticle (named "centering target") that

comprises two coaxial and parallel outlines.

These outlines have a shape that depends on the shape of the lens markings. When the lens markings are formed by round micro-engravings, very numerous, and distributed along concentric circles, these outlines are circular and
5 designed to be placed on either sides of one of the concentric circles, which enables to center more accurately the lens relative to the reticle.

The principle of a reticle composed of at least two outlines could be applied to lenses whose micro-engravings have (or are distributed along a contour having) a round shape, a square shape, or at least an enclosing shape (not a
10 cross for example).

Other preferred features of the invention are the following ones:

- at least one of said outlines comprises a solid line,
- each outline has a circular shape,
- each outline has a square shape,
- 15 - the size of at least one outline is modifiable,
- the distance between the outlines is adjustable,
- the sizes of both outlines are modifiable,
- the apparatus comprises means for manually modifying the sizes of one of the outlines displayed on the screen,
- 20 - the apparatus comprises means for determining the shape of the centering markings situated on the lens, and means for automatically modifying the size of the outlines displayed on said screen as a function of the shape of the centering markings,
- the apparatus comprises blocking means mounted on the chassis,
- 25 which are suitable for receiving a blocking accessory arranged to attach to the ophthalmic lens.

The invention also applies to a method for centering an ophthalmic lens, comprising steps of:

- positioning the ophthalmic lens on a holder,
- 30 - acquiring images of the ophthalmic lens received on the holder by means of a camera,
- displaying the images acquired by the camera together with a centering target superimposed onto said images, said centering target comprising two coaxial and parallel outlines, and

- manually modifying the position of the ophthalmic lens on the holder.

In a preferred embodiment, the ophthalmic lens comprises centering markings and the method comprises, before or during the step of manually modifying the position of the ophthalmic lens, a step of adjusting the distance
5 between the two outlines as a function of the geometry of said centering markings.

Preferably, these two steps of manually modifying the position of the ophthalmic lens and of adjusting the distance between the two outlines are performed simultaneously by the optician. Indeed, the optician shall first position roughly the lens so that it could be possible to adapt the scale of the outlines to the
10 size of the centering marks. When the scale of the outlines has been adapted, the optician can use them to position the lens more accurately.

In a preferred embodiment, the centering markings comprising patterns distributed along a contour centered on a point, the distance between said two outlines is adjusted so as to be comprised between once and twice the pattern
15 width, said width being radially measured relative to said point.

In a preferred embodiment, the centering markings comprise patterns distributed along concentric circles, and each outline has a circular shape.

DETAILED DESCRIPTION OF EXAMPLE(S)

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

In the accompanying drawings:

- Figure 1 is a schematic view of a centering-blocking apparatus according to the invention, and
25 - Figure 2 is an example of view displayed by a screen of the centering-blocking apparatus represented in figure 1.

Figure 1 shows an example of centering-blocking apparatus 1.

Such an apparatus is used by an optician to prepare an ophthalmic lens for edging to a given outline, with a view to mounting this ophthalmic lens in a
30 spectacle frame selected by a customer.

This apparatus is generally used after the optician has acquired the shape of the outline C1 to which the lens must be edged (see Fig.2). This apparatus is then employed to carry out the operations of centering and blocking the ophthalmic lens.

The objective of the centering operation is to locate the frame of reference of the ophthalmic lens, and to determine the position that the aforementioned outline must occupy in this frame of reference so that the lens, once edged to this outline then mounted in the spectacle frame, is suitably centered facing the corresponding eye of the customer (in order to fulfil as best as possible the optical function for which it was designed).

The objective of the blocking operation is to place an accessory (called the "blocking accessory") on the ophthalmic lens, thereby making it easier to provide a stable coordinate system allowing the position of the frame of reference of the lens to be located after it has been transported from the centering-blocking apparatus 1 to an edging apparatus.

The ophthalmic lens 100 to be edged is shown in Figure 2. This lens has two optical faces (namely a convex front face and a concave back face) and an edge, the shape of which is initially circular. The shapes of the front and back faces of this ophthalmic lens 100 are designed such that the lens has optical characteristics allowing defects in the vision of the customer to be corrected.

Here, the ophthalmic lens 100 includes a first optical correction for providing correct vision to the wearer at a determined distance, and a second optical correction for changing the natural evolution of Myopia.

The first optical correction consists, in our example, in a spherical power for providing correct far vision to the wearer (for looking at objects situated at more than 6 meters). This first optical correction could also include a cylindrical and/or a prismatic power.

The optical center of the lens is defined as the point of the lens where the light rays are not deviated when they pass through the lens.

In a first embodiment, it can be assumed that the centering point P1 of the ophthalmic lens 100, that is the point where the blocking accessory has to be deposited, is formed by this optical center.

In a second embodiment, the centering point P1 is formed by the geometric center (called "boxing center") of a virtual rectangular box circumscribing the outline C1 along which the lens will be edged.

In both embodiments, the centering and blocking apparatus 1 shall inform the edging apparatus in which point the blocking accessory is positioned.

The second optical correction provides an additional optical feature. This

correction is specifically designed to limit or to stop the evolution of myopia.

In our example, the ophthalmic lens 100 contains to this end micro-lenses. Such an ophthalmic lens is described in document WO2019166654.

5 The ophthalmic lens 100 is provided with centering markings 110 allowing its frame of reference to be located.

These markings may take the form of temporary marks printed in ink and/or permanent marks engraved into the lens (micro-engravings are spoken of).

Provisional markings generally allow the optical frame of reference of the lens to be suitably located prior to its mounting in the spectacle frame whereas
10 permanent markings allow the nature and characteristics of the ophthalmic lens to be identified and, after the provisional markings have been removed, the exact location of said lens to be identified or reestablished.

Here, the ophthalmic lens 100 has only permanent markings for determining the centering point P1 of the lens.

15 As shown in Figure 2, these micro-engraved markings 110 are each round, they are very numerous, and they are distributed along concentric circles about the centering point P1 of the ophthalmic lens 100.

The lens comprises more than three circles. Each circle comprises more than ten markings 110.

20 The markings of a single circle have all the same diameter D2. Here, all the markings have the same diameter D2. This diameter is lower than 1 mm.

In the disclosed embodiment, these centering markings 110 are formed by the contours of the microlenses that are engraved in one of the optical faces of the lens to fulfill the second optical correction.

25 Here, and preferably, the ophthalmic lens 100 is intended to be centered and blocked manually.

As figure 1 shows, the centering-blocking apparatus 1 includes for this purpose at least:

- a chassis 10,
- 30 - a holder 20 mounted on the chassis 10 and suitable for receiving the ophthalmic lens 100, that is to say for supporting it or for blocking it,
- blocking means 30 mounted on the chassis 10 and suitable for receiving the blocking accessory 200, and
- centering means 40 mounted on the chassis 10, which include a

sighting objective thanks to which the optical frame of reference of the ophthalmic lens 100 can be viewed.

This centering-blocking apparatus may have several shapes. For instance, the holder could be fixedly mounted on the chassis and the blocking means could include a movable arm that is manually maneuverable so that the optician can force the arm to deposit the blocking accessory on the lens.

But in the shown embodiment, the blocking means 30 are fixedly mounted on the chassis 10, and it is the holder 20 that is movably mounted on the chassis 10.

The represented centering-blocking apparatus 1 can now be briefly described.

As figure 1 shows, in the described embodiment, the chassis 10 includes a dome 11. This dome 11 has a sidewall the top face of which is apertured with a large circular aperture centered on a main axis A1 that here is vertical. It also includes a bottom that lies in a horizontal plane and that closes the back of the sidewall. It lastly includes, at mid-height, a false bottom 14.

This false bottom 14 is visible through the large circular aperture 12. It has in its center a circular hole centered on the main axis A1.

The blocking means 30 (which are designed to hold the blocking accessory 200) includes a vertical shaft that is centered on the main axis A1. This vertical shaft has a lower end that is secured to the chassis and a free upper end for accommodating the blocking accessory 200.

The holder 20 is a transparent and vertical tube mounted on the chassis 10 so as to be able to slide along the main axis A1.

The upper end 22 of the holder 20 is circular and extends in a horizontal plane, such that it is suitable to support the ophthalmic lens 100.

This holder 20 is more precisely mounted so as to be movable between:

- a centering position in which the ophthalmic lens 100 rested on the upper end 22 of the holder 20 is located a distance away from the blocking accessory 200, and
- a blocking position in which the ophthalmic lens 100 bears against the blocking accessory 200.

An elastic element, suitable for automatically returning the holder 20 to the centering position, is provided inside the dome 11.

As a variant, the holder could comprise three protruding pins forming a tripod for accommodating the ophthalmic lens.

Advantageously, the centering means 40 are intended to observe the ophthalmic lens 100 along a viewing axis A2 that is parallel (here coincident) with
5 the main axis A1.

As figure 1 shows, these centering means 40 include here means 50 for illuminating the ophthalmic lens 100 and means 60 for viewing the ophthalmic lens 100 illuminated by the illuminating means 50.

The illuminating means 50 are distributed all around the holder 20, so as
10 to generate light of grazing incidence on the optical face of the lens that is placed on the holder 20 (here on the convex front face, in which the centering markings 110 are engraved).

These illuminating means 50 in this instance include a plurality of light-emitting diodes that are regularly distributed around the holder 20.

15 The viewing means 60 comprise a mirror 63 that is inclined at 45° with respect to the main axis A1 and that allows the image of the ophthalmic lens 100 to be redirected toward the objective 61 of a digital video camera 62. This mirror 63 allows the centering-blocking apparatus 1 to be made more compact.

The digital video camera 62 is then designed to acquire an image of the
20 ophthalmic lens 100 and to transmit it to a viewing screen 70 that is oriented toward the face of the optician. This viewing screen 70 may be of any kind (for instance LCD, TFT...). It is preferably mounted onto the chassis 10 but it could be remoted from it.

Thus, the optician may observe in real-time on this viewing screen 70 the
25 image of the ophthalmic lens 100, in which the centering markings 110 provided on the lens clearly appear.

The centering-blocking apparatus also comprises a processing unit programmed to help the optician in centering the ophthalmic lens 100.

To this end, the processing unit comprises a central processing unit
30 (CPU), a memory and input/output components.

Thanks to its memory, the processing unit stores information used in the process described below. It stores in particular a computer application, consisting of computer programs comprising instructions, the execution of which allowing the implementation by the processing unit of the method described below.

This processing unit is connected to the viewing screen 70 so as to display a reticle superimposed to the images acquired by the camera 62.

A reticle is defined as a centering target or as a fixed coordinate system that indicates the position of the blocking accessory 200.

5 According to the invention, this reticle comprises two coaxial and parallel outlines 150, 151.

Each outline is preferably a line (a curve or a succession of segments) extending along a closed contour.

10 These outlines 150, 151 are parallel in the sense in that the shortest distance between these two outlines is constant in any point all along the closed contour.

In practice, the outer outline 151 is the image of the inner outline 150 after a homothety.

15 Because in the embodiment shown in Figure 2 the centering markings 110 comprise patterns distributed along concentric circles, each outline 150, 151 here has a circular shape.

In a variant where the centering markings would comprise patterns distributed along concentric squares, each outline 150, 151 would have a square shape.

20 These outlines 150, 151 are displayed on the viewing screen 70 in the form of solid lines, but they could be displayed in the form of dotted lines or dashed lines.

These outlines extend along closed contours, but they could also be opened on a part of their contour.

25 It could be envisaged that the outlines have a size that cannot be changed. But in a preferred embodiment, the size of at least one of the outlines 150, 151 is modifiable. Here the size of both outlines are modifiable.

This is preferable for the following reasons.

30 The size of the centering markings 110 displayed on the viewing screen 70 can vary because of scale modifications due to the lens power; so, depending on the lens spherical power, the distance between the outlines can change.

Moreover, lenses of different brands may show centering markings having different sizes, that is why it is advantageous to enable the size of the outlines to be scalable.

Here, the radius $R1$ of the inner outline 150 is adjustable and the distance $D1$ between the two outlines 150, 151 is also modifiable.

Thanks to this, the two outlines 150, 151 can be sized so that:

- a single circle of centering markings 110 extends therebetween, and
- 5 - the two outlines are tangent to all the centering markings 110 of this circle.

To this end, the distance $D1$ between the two outlines 150, 151 has to be adjusted so as to be comprised between once and twice the diameter of the engraved microlenses.

- 10 In this position, the optician is sure to have well centered the lens relative to the blocking accessory 200.

In a first embodiment, the apparatus 1 comprises an HMI (Human-Machine Interface) enabling the optician to manually modify the sizes of the outlines 150, 151 displayed on the viewing screen 70.

- 15 This HMI can be formed by the screen if the latter is a touch screen. In this embodiment, two buttons associated to each outline are displayed, one for increasing the size of the associated outline and the second to decrease its size.

In a second embodiment, the processing means are programmed to:

- process the acquires images of the lens in order to identify the
- 20 characteristics of the centering markings 110, and to
- automatically modify the sizes and/or the shapes of the outlines 150, 151 displayed on the screen 70 as a function of these characteristics.

More specifically, the processing means are programmed to determine in a first step, the shape and the position of each centering marking 110.

- 25 Then, they determine if some of the centering markings are distributed along a closed contour.

If it is not the case, a cross-shape reticle is displayed on the screen. The exact shape of this reticle depends on the shape of the centering markings. In other words, the shape of the reticle depends on the lens kind:

- 30 - unifocal,
- progressive,
- multifocal (an example of bifocal lens being an unifocal lens fitted with a near vision lens stuck on the front face of the unifocal lens),
- executive (an example of executive lens being a bifocal lens where the

near vision correction is performed by the bottom part of the lens and where the far vision is performed by the upper part of the lens, said parts being separated by a line),

- interview (an example of interview lens being a progressive lens having no far vision correction, but only a near vision correction and an intermediate vision correction).

If it is the case, the processing means determine the shape of the detected closed contour (here, this shape is circular). Then, they determine the mean diameter of one of the detected circles along which markings are distributed, and the diameters of these markings. Finally, they display on the screen two outlines 150, 151 adapted to the shapes of the centering markings.

In other words, in this second embodiment, the processing means are programmed to propose a reticle shape that is adapted to the family of the current lens and that is selected among six different shapes.

To center and then block the ophthalmic lens 100, the centering-blocking apparatus 1 is used by the optician in the following way.

In a first step, the optician loads a blocking accessory 200 on the vertical shaft.

In a second step, the optician deposits the ophthalmic lens 100 on the upper end 22 of the holder 20, in such a way that the convex front face of the lens bears against this holder 20.

At this step, the camera 60 acquires images of the lens and these images are displayed on the viewing screen 70. These images are displayed together with the two outlines 150, 151.

In the second embodiment, the sizes and shapes of the two outlines 150, 151 are automatically modified to be adapted to the shape of the centering markings 110.

In a third step, the optician manually moves the ophthalmic lens transversely, i.e. by sliding it over the holder 20, until the ophthalmic lens 100 is placed on the axis of the blocking accessory 200. To do this, the optician observes the images of the ophthalmic lens 100 on the viewing screen 70, which images are displayed in superposition with the outlines 150, 151. The optician then seeks in this step to place the two outlines 150, 151 on each side of a single circle of centering markings 110.

At this step, in the first embodiment, the sizes of the two outlines can be manually modified by the optician in order to achieve this aim.

Once this position has been reached, the optician presses the ophthalmic lens 100 downward, while taking care not to move it transversely, so as to lower
5 the holder 20. This operation allows the lens to bear against a double-sided self-adhesive provided on the blocking accessory 200. In this way, the latter automatically bonds to the lens, in a desired position (with a precision better than half a millimeter).

The present invention is in no way limited to the embodiment described
10 and shown.

In particular, it would be possible to automate the blocking operation, by equipping the holder with a pneumatic or mechanical maneuvering mechanism, and by equipping the centering-blocking apparatus with electronic means for controlling this maneuvering mechanism.

15 This invention also applies to an automatic blocking system (having a motorized arm that can deposit the blocking accessory to a specific point of the lens and having centering means helping the optician with the camera's help to manually position the lens taking into account this blocking point). According to another variant of the invention, the holder could take a different form from that
20 shown in the figures. It could thus take the form of a tripod mounted so as to be able to slide on the chassis in a plane orthogonal to the main axis A1.

According to another variant of the invention, the centering and blocking apparatus may operate automatically for centering and blocking the lens (without the help of the optician). With such an apparatus, the use of two outlines enables
25 the centering of the lens by the processing means to be more accurate.

CLAIMS

1. A centering apparatus (1) including:
 - a chassis (10),
 - 5 - a holder (20) mounted on the chassis (10), which is suitable for receiving an ophthalmic lens (100), and
 - centering means (40) mounted on the chassis (10), which include:
 - a camera (60) for acquiring images of the ophthalmic lens (100) when received on the holder (20), and
 - 10 • a screen (70) for displaying the images acquired by the camera (60) and a centering target superimposed onto said images, characterized in that said centering target comprises two coaxial and parallel outlines (150, 151), and wherein the size of at least one outline (150, 151) is modifiable so that the distance between the outlines (150, 151) is adjustable.
- 15 2. The centering apparatus (1) according to claim 1, wherein at least one of said outlines (150, 151) comprises a solid line.
3. The centering apparatus (1) according to claim 1 or 2, wherein each outline (150, 151) has a circular shape.
4. The centering apparatus (1) according to claim 1 or 2, wherein each
20 outline (150, 151) has a square shape.
5. The centering apparatus (1) according to any one of claims 1 to 4, wherein the sizes of both outlines (150, 151) are modifiable.
6. The centering apparatus (1) according to claim 5, comprising means
25 for manually modifying the sizes of one of the outlines (150, 151) displayed on said screen (70).
7. The centering apparatus (1) according to claim 5, comprising means programmed for determining the shape of centering markings (110) situated on the lens (100), and means programmed for automatically modifying the size of the outlines (150, 151) displayed on said screen (70) as a function of the shape of the
30 centering markings (110).
8. The centering apparatus (1) according to any one of claims 1 to 7, comprising blocking means (30) mounted on the chassis (10), which are suitable for receiving a blocking accessory (200) arranged to attach to the ophthalmic lens (100).

9. Method for centering an ophthalmic lens, comprising steps of:

- positioning the ophthalmic lens (100) on a holder (20),
- acquiring images of the ophthalmic lens (100) received on the holder (20) by means of a camera (60), and

5 - displaying the images acquired by the camera (60) together with a centering target superimposed onto said images,

- manually modifying the position of the ophthalmic lens (100) on the holder (20),

 characterized in that said centering target comprises two coaxial and
10 parallel outlines (150, 151) and in that, the size of at least one outline (150, 151) being modifiable, the distance between the outlines (150, 151) is adjusted before the step of manually modifying the position of the ophthalmic lens (100).

 10. Method according to claim 9, wherein the ophthalmic lens (100) comprises centering markings (110) and wherein said method comprises a step of
15 adjusting the distance between the two outlines (150, 151) as a function of the geometry of said centering markings (110).

 11. Method according to claim 10, wherein, the centering markings (110) comprising patterns distributed along a contour centered on a point (P1), the distance between said two outlines (150, 151) is adjusted so as to be comprised
20 between once and twice the pattern width, said width being radially measured relative to said point (P1).

 12. Method according to claim 10 or 11, wherein, the centering markings (110) comprising patterns distributed along concentric circles, each outline (150, 151) has a circular shape.

1/1

Fig.1

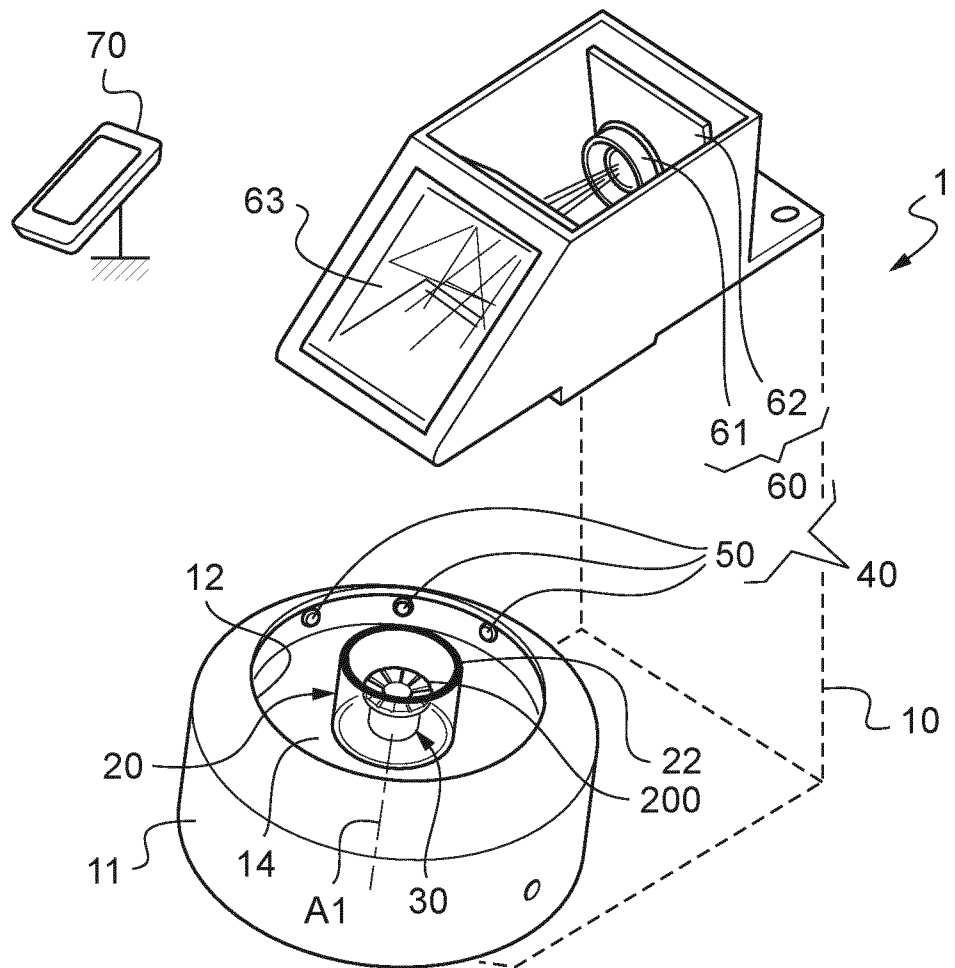
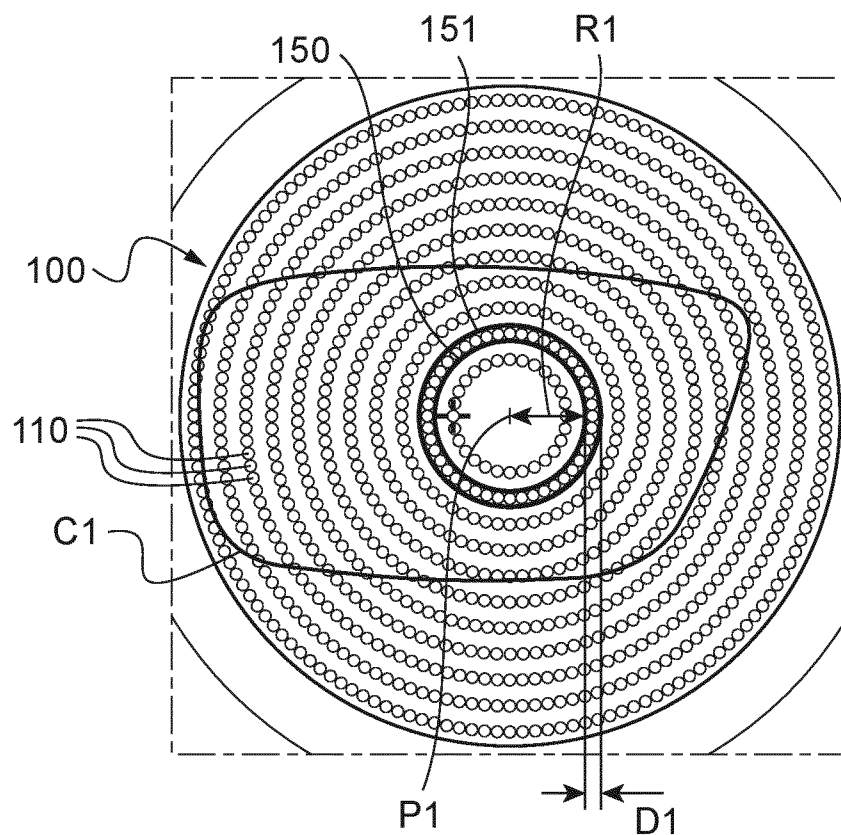


Fig.2



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B24B13/005 B24B9/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B24B B24D B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 149 664 A2 (NIDEK KK [JP]) 31 October 2001 (2001-10-31) paragraphs [0009], [0010], [0011], [0022], [0031]; figures 1, 5 -----	1-12
A	US 2002/026262 A1 (OKADA HIROYUKI [JP] ET AL) 28 February 2002 (2002-02-28) paragraph [0245]; figures 41, 48 -----	1-12
A	US 9 645 043 B2 (ALLIONE PASCAL [FR]) 9 May 2017 (2017-05-09) col. 21, l. 13-18; figures 11-17 -----	1-12
A	US 2017/163857 A1 (TANG DAVID C [FR] ET AL) 8 June 2017 (2017-06-08) paragraphs [0015], [0055] - [0059], [0116] - [0120]; figure 1 ----- -/--	1-12



Further documents are listed in the continuation of Box C.



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