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(54) **Lens blocking and deblocking method and related device**

(57) A method for blocking and/or deblocking an optical lens (100) on a heat conducting holding unit (200) comprising an upper assembling surface (210) comprising the steps of:
a) providing first layer consisting of an adhesive tape (330) on the upper assembling surface (210) of the holding unit;
b) providing a second layer consisting of a layer (310 comprising a thermoplastic material arranged on said adhesive tape (330);
c) providing the optical lens (100) with a third layer consisting of an adhesive tape (320) arranged on the bottom surface (120) of said optical lens;
d) placing the optical lens (100) with the third layer (320) on the second layer (310) consisting of a layer comprising a thermoplastic material when the thermoplastic material is soften or melted.

A method for deblocking said optical lens (100) thanks to heating the holding unit (200).

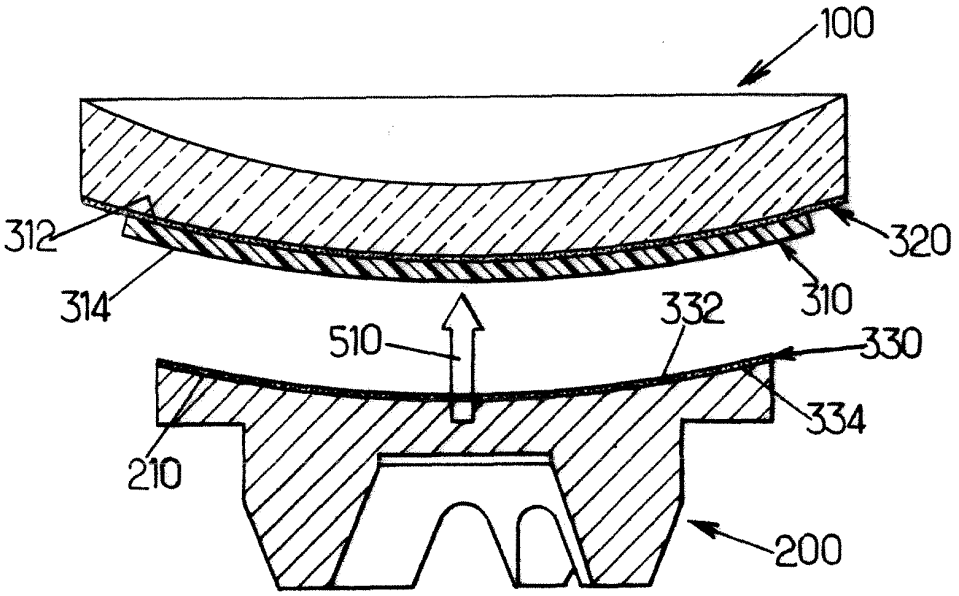

FIG.3.

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Description

[0001] This invention relates to a lens blocking and deblocking method and device for use in adhering an optical lens to a lens blocking device employed with machining, grinding and processing equipment in the generation of optical, namely ophthalmic, lenses.

[0002] The process of preparing optical or ophthalmic lenses begins usually with an unfinished or semi-finished glass or plastic lens blank. Typically a semi-finished lens blank has a finished polished front surface and an unfinished back surface. By grinding away material from the back surface of the lens blank the required corrective prescription is generated. Thereafter the surface having had the corrective prescription imparted thereto is polished and the peripheral edge of the thus processed lens blank is provided with a final desired contour thereby establishing a finished optical or ophthalmic lens. According to other processing methods, the finished ophthalmic lens can be directly processed from a lens blank using for example three directional machining. The lens blank can be either a plastic or a glass lens blank.

[0003] It is necessary during these various processing operations to securely maintain the lens blank in accurate alignment and in place on the lens blocking device. This procedure is often referred to as "lens blocking".

[0004] Heretofore various materials were employed to secure the lens blank to the lens blocking device. These materials include glues, pitch and low temperature fusible metal alloys. The use of glues and pitch, in addition to being messy, suffers the further disadvantage of generally being non-reusable or non-reclaimable. While the prior art use of low temperature metal alloys eliminated some of these disadvantages experienced with the use of glues and pitch, nonetheless, the use of these metal alloys, both in their preparation and their reclamation caused significant environmental and health hazards especially since these alloys were most often fabricated from such metals as cadmium, tin, lead and bismuth. Of these metals, lead and cadmium are the most toxic. Lead is strong protoplasmic poison and can be introduced into the body by ingestion, inhalation and skin absorption. Cadmium poisoning is similar to lead in many ways and is introduced into the body in the same way as lead. Like lead, cadmium is stored in the liver, kidney and bone. Procedures for the formulation of such alloys and reclamation processes so as to enable its re-use as a material to secure a lens blank to a lens block thus exposes workers to serious environmental and health hazards. The formation of these alloys often is accomplished through the use of powdered or particulate metals which are subjected to a sintering and heat treating process. Fumes and/or dust particles of these metals are released to the ambient atmosphere thereby creating environmental and health hazards for those formulating these alloys. The same hazards exist for those attempting to reclaim the used low temperature metal alloy blocking material.

[0005] To overcome these issues, organic low shrinkage materials have been developed to be used as lens blocking materials.

[0006] Patent US 6,036,313 in the name of 3M Innovative Properties Company discloses examples of compound families suitable for lens blocking with thermoplastic materials.

[0007] The disclosed blocking compositions have many advantages over traditional metal alloy materials. For example, the lens blocking compositions are non-toxic, environmentally safe, and preferably biodegradable. The materials preferably can be used with existing processing equipment and may be recycled. An optical lens blocking device can be used that comprises a solidified mass of a thermoplastic blocking composition. The blocking composition is solid at 21°C and has a low melting or softening point.

[0008] However the inventors have noticed that separating the thermoplastic blocking composition from the lens blank is an issue. This deblocking step comprises ordinarily a hammering step and a crack is generated at the interface between the thermoplastic blocking composition and the lens blank.

[0009] Said step needs an operator, is often made after separating the ophthalmic lens block from the machine, is time consuming and may introduce defects on the final lens.

[0010] Accordingly, there remains a need for improving deblocking a lens secured to a lens blocking device thanks to a thermoplastic material.

[0011] Thus, the goal of the present invention is to improve blocking and/or deblocking methods to enhance the quality of resulting lens.

[0012] This object is obtained according to the invention by a method for blocking an optical lens on a heat conducting holding unit comprising a bottom part to be inserted and fixed in a lens machining tool and an upper part comprising an upper assembling surface comprising the steps of:

a) providing first layer consisting of an adhesive tape on the upper assembling surface of the holding unit;

b) providing a second layer consisting of a layer comprising a thermoplastic material arranged on said adhesive tape ;

c) providing the optical lens with a third layer consisting of an adhesive tape arranged on the bottom surface of said optical lens;

d) placing the optical lens with the third layer on the second layer consisting of a layer comprising a thermoplastic material when the thermoplastic material is soften or melted.

[0013] According to another embodiment, the third layer consisting of an adhesive tape is arranged on the second layer consisting of a layer comprising a thermoplastic

material and the optical lens is arranged on the third layer when the thermoplastic material of the second layer is soften or melted.

[0014] The invention also relates to an optical lens blocking device comprising:

- a heat conducting holding unit comprising a bottom part to be inserted and fixed in a lens machining tool and an upper part comprising an upper assembling surface;
- a first layer consisting of an adhesive tape placed on the upper assembling surface of the holding unit;
- a second layer consisting of a layer comprising a thermoplastic material stacked on the first layer;
- a third layer consisting of an adhesive tape stacked on the second layer.

[0015] An optical lens can be placed on the third layer of said optical lens blocking device before or after placing the third layer on the second layer consisting of a layer comprising a thermoplastic material.

[0016] According to further embodiments of the lens blocking device of the invention, which can be considered alone or in all possible combinations:

- the upper assembling surface of the holding unit is a spherical surface;
- the melting or softening point of the thermoplastic material of the second layer is between 45°C and 75°C;
- the adhesive tapes have a pressure-sensitive adhesive surface arranged to contact a bottom surface of an optical lens or the upper assembling surface of the holding unit and a tack-free adhesion promoting surface arranged to contact the surfaces of the second layer;
- the thickness of the second layer is between 0.5 mm and 2 mm, as for an example equal or less to 1 mm.

[0017] The invention also relates to a method for deblocking an optical lens which bottom surface is secured on a previously mentioned optical lens blocking device or according to previously mentioned method for blocking, comprising the steps of:

a) heating the holding unit so as to soften or melt the thermoplastic material of the second layer;

b) separating the bottom surface of the second layer form the upper surface of the adhesive tape of the first layer;

c) separating the bottom surface of the optical lens from the upper surface of the adhesive tape of the third layer.

According to embodiments of the deblocking method, the method further comprises one or two of following steps:

d) separating the bottom surface of the adhesive tape of the third layer from the upper surface of the second layer;

e) separating the bottom surface of the adhesive tape of the first layer form the upper assembling surface of the holding unit.

[0018] According to an embodiment of the deblocking method, step a) of the deblocking method consists in heating only the bottom part of the holding unit.

[0019] This invention also relates to a method of machining, such as for example grinding and/or polishing and/or edging and/or engraving, an optical lens comprising the steps of:

- blocking the bottom surface of the optical lens on a previously mentioned optical lens blocking device or according to previously mentioned method for blocking an optical lens;
- inserting and fixing the bottom part of the holding unit in a lens machining tool;
- machining the upper surface of the optical lens and/or edging said optical lens;
- deblocking the machined optical lens according to previously mentioned deblocking method.

[0020] According to the present invention, a "layer comprising a thermoplastic material" is a layer of material that can melt or soften when being heated. A thermoplastic material can be remelted or softened when heated and remoulded when cooling after melting or softening. Most thermoplastics are high molecular weight polymers whose chains associate through weak van der Waals forces (polyethylene); strong dipole-dipole interactions and hydrogen bonding (nylon); or even stacking of aromatic rings (polystyrene). Many thermoplastic materials are addition polymers; e.g., vinyl chain-growth polymers such as polyethylene and polypropylene. The layer comprising a thermoplastic material may also comprise additives (such as, for example, plasticizers, stabilizers, pigments, ...) and/or fillers (such as mineral and / or organic fillers, as for examples boron, carbon, clay, glass, cellulose, metals, oxides, aramide, polyamide, ...; fillers may be of different geometry, such as for example grains, lamella, short or long fibers, ...).

[0021] According to the present invention, an "optical lens" may be a lens which surfaces have already been

machined, a semi-finished lens blank with a polished front surface, a lens blank with two unfinished surfaces.

[0022] The optical lens can be made for example, but not limited to, of plastic or glass. More generally, any combination of material suitable to obtain an optical system may be used. One or two surfaces of the optical lens may be coated.

[0023] Thus an "optical lens" of the invention can be every optical part that needs to be machined, as for example to be cut and/or grinded and/or polished and/or edged and/or engraved, in order to provide a machined optical lens.

[0024] A fully machined optical lens according to the present invention is for example an ophthalmic lens which surfaces form an optical system that fits a desired prescription. Said machined optical lens can be edged when blocked according to the present invention or edged in a further processing step, as for an example edged by an eye care practitioner.

[0025] According to the present invention, a "heat conducting holding unit" is a holding unit that can be inserted in the chuck or fixing part of a holding tool. Said holding tool may be part of a lathe or other movement inducing machine. The holding unit of the invention is heat conducting and can be a metallic part or any material suitable to let the heat propagate through said material. According to an embodiment of the present invention, the holding unit is made of aluminium alloy.

[0026] According to the present invention, selected fixing means are provided to fix an optical lens on a holding unit.

[0027] Said fixing means consist of three stacked layers, where the first layer consists of an adhesive tape, the second layer consists of a layer comprising a thermoplastic material and the third layer consists of an adhesive tape. The selected stacked layers afford a simple and efficient blocking device and/or method and afford easy deblocking, namely when heating the holding unit so as to soften or melt the thermoplastic material of the second layer. The optical lens can thus be blocked and/or deblocked without damage and the inventors have noticed that ophthalmic lenses manufactured using the blocking and/or deblocking method according to the present invention have undamaged and quality reliable optical surfaces.

[0028] Furthermore the quantity of material of the second layer may be limited and said material may be reused after deblocking the machined optical lens.

[0029] The layer comprising a thermoplastic material may be prepared as an independent layer arranged on the first layer consisting of an adhesive tape and shaped on said tape by soft heating or be poured from a warm device onto the upper surface of the first layer consisting of an adhesive tape.

[0030] Non limited embodiments of the invention will now be described with reference to the accompanying drawing wherein:

- figure 1 is a cross sectional view of an optical lens fixed on an optical lens blocking device according to the present invention;
- figure 2 to 6 show successive steps of a deblocking method according to the present invention.

[0031] Skilled artisans appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help improve the understanding of the embodiments of the present invention.

[0032] The wording "upper" or "on" and "bottom" or "under" indicates positions relative to the optical lens when it is arranged so as the edge of the optical lens to be machined is substantially situated in a horizontal plane.

[0033] Said position is purely conventional and the optical lens can be machined in a non horizontal position.

[0034] As shown on figure 1, an optical lens 100 is secured on a holding unit 200 thanks to fixing means 300. The edge of said optical lens 100 is substantially situated in a horizontal plane.

[0035] The upper surface 110 of the optical lens 100 is a surface to be machined, as for an example to be grinded and/or polished. The optical lens 100 can be further edged.

[0036] The bottom surface 120 of the optical lens 100 contacts the upper surface of the fixing means 300.

[0037] According to an embodiment, the optical lens 100 is a semi-finished lens blank and the bottom surface 120 is a finished optical surface.

[0038] As for an example, the external diameter of the optical lens 100 is between 50 mm and 100 mm, for example equal to 80 mm.

[0039] The holding unit 200 is a metallic part which comprises a bottom part 230, 220 and an upper part 250.

[0040] The lower part 230 of bottom part comprises means to orientate the holding unit in corresponding orientating means of a tool (not represented) of a lens machining unit such as a lathe or another movement inducing machine. Said tool may be a chuck or another fixing tool.

[0041] Internal surface 240 of the holding unit may contact an upper surface of said tool.

[0042] The bottom part of the holding unit also comprises a central part 220 which is a cylindrical part to be squeezed by said fixing tool of the machining unit.

[0043] Upper part 250 has an external diameter larger than the diameter of the central part 220 and its bottom surface 255 may lay on the upper surface of the tool of the lens machining unit and may comprise positioning means. The upper part 250 also comprises an upper assembling surface 210.

[0044] As for an example the diameter of the upper part 250 is 70 mm, the diameter of the central part 220

is 43 mm and the height of the holding unit 200 is between 20 and 30 mm.

[0045] Fixing means 300 are arranged between the upper assembling surface 210 and the bottom surface 120 of the optical lens and consists of three stacked layers where:

- the first layer is an adhesive tape 330 which bottom surface 334 is fixed on upper assembling surface 210;
- the second layer is a layer 310 of thermoplastic material which bottom surface 314 is arranged on the upper surface 332 of the adhesive tape 330;
- the third layer is an adhesive tape 320 which bottom surface 324 is arranged on the upper surface 312 of the layer 310 of thermoplastic material;
- the bottom surface 120 of the optical lens is fixed on the upper surface 322 of the adhesive tape 320.

[0046] According to an embodiment, the thermoplastic material of the second layer 310 melts or softens at a low temperature, less than the temperature at which the material(s) of the lens component may degrades or flows. Preferably the melting or softening point of the thermoplastic material is between 45°C and 75°C. Suitable thermoplastic material may be selected from the group consisting of polyesters, polyurethanes, ionomer resins of ethylene copolymers, polyester-polysiloxane block copolymers, segmented copolyesters and polyetheresters, ethylene vinyl acetate resins and copolymers, waxes, polycaprolactones, and blends thereof.

[0047] Said thermoplastic material may comprise a homopolymer or copolymer of epsilon-caprolactone.

[0048] Examples of thermoplastic materials are given in previously cited patent US 6,036,313 and are suitable for the present invention.

[0049] According to an embodiment, the adhesive tapes 320, 330 have a pressure-sensitive adhesive surface and a tack-free adhesion promoting surface. The tapes 320, 330 assist in the firm bonding of the optical lens 100 to the thermoplastic material layer 310 and to the holding unit assembling surface 210.

[0050] According to an embodiment, the tapes are conformable, that is, they follow the curvature of the lens blanks without any wrinkles or air bubbles; and translucent, that is, they permit light to pass there through. As a result, the lens may be visually aligned in the appropriate device prior to blocking. Still further, when the tapes are removed from the lens, they leave virtually no adhesive residue. Thus, messy and time consuming cleaning operations need not be performed on the lens before it can be used.

[0051] Despite this clean removability, suitable tapes may exhibit excellent adhesion to the optical lens, to the thermoplastic material and to the holding unit. Additionally, the tapes may be able to withstand the shear forces encountered during the machining operations. As a result, lenses are held in accurate position throughout these operations. An added benefit offered by using an adhesive tape is the protection provided to the optical lenses from thermal and mechanical shock.

[0052] The composition of the exposed surface of the tape (i.e., the non-adhesive surface away from the optical lens or from the upper assembling surface of the holding unit) may be selected so as to achieve the desired degree of adhesion with a particular thermoplastic material.

[0053] Examples of suitable tapes are given in previously cited patent US 6,036,313.

[0054] As for examples, tapes commercialized by the company 3M and referred as 1640 and 1641 are particularly suitable.

[0055] A 1641 adhesive tape commercialized by the company 3M comprises a baking made of polyethylene film covered by an acrylate adhesive.

[0056] According to an embodiment of the present invention, the upper surface 312 of the thermoplastic material layer 310 is heated, for example with UV or IR lamps, so as to let a zone of the thermoplastic material layer melt or soften. The optical lens 100 is then placed onto the adhesive tape 320 arranged on the partly molten or soften thermoplastic material layer and moderate pressure is applied onto the lens component. The optical lens is securely blocked after the cooling of the thermoplastic material and the optical lens is machined using conventional tools to provide grinding and/or polishing and/or edging.

[0057] According to another embodiment of the present invention, the thermoplastic material is previously heated and then poured on the upper surface 332 of the adhesive tape 330, the adhesive tape 320 is arranged on the upper surface 312 of the thermoplastic material layer 310 and moderate pressure is applied on the optical lens 100 arranged on said layer 310 when the thermoplastic material is still at least partly melted or softened.

[0058] According to other embodiments of the present invention, the adhesive tape 320 is previously arranged on the bottom surface 120 of the optical lens 100 and moderate pressure is applied on the optical lens 100 with said adhesive tape 320 when the thermoplastic material of layer 310 is at least partly melted or softened. Melting or softening said thermoplastic material can be achieved by heating it, for example with UV or IR lamps, or by pouring it when warm on the upper surface 332 of the adhesive tape 330.

[0059] After machining the optical lens, the machined optical lens is deblocked and detached from the holding unit 200.

[0060] Consecutive deblocking steps are shown on figures 2 to 6 according to an embodiment of the present invention.

[0061] The holding unit 200 is heated through heating means 400 on figure 2. Heating means can be for example IR or UV lamps, as well as hot liquids, be provided

by contacting a heated metal part or by other conductive heating means.

[0062] According to an embodiment, only the bottom part of the holding unit 200, as for an example the lower part 230 of the bottom part, is directly heated by the heating means and the heat propagates then through the holding unit to the upper part 250 thanks to heat conduction.

[0063] It is thus possible to control precisely the heat amount brought to the layer of thermoplastic material 310 and to avoid thermal shock on the optical lens 100. Optical quality of the optical lens can thus be advantageously preserved.

[0064] Heating the holding unit 200 makes possible to deblock the optical lens without significant heating of the optical lens.

[0065] After heating the bottom surface 314 of the thermoplastic material layer 310 thanks to conductive heating through the holding unit 200, a zone of thermoplastic material close to said surface 314 melts or softens and the separation of the thermoplastic material layer 310 from the adhesive tape 330 is very easy when pulling according to arrow 510 as shown on figure 3. The holding unit 200 and the first layer consisting of the adhesive tape 330 remain together.

[0066] The optical lens 100, the third layer consisting of the adhesive tape 320 and the thermoplastic material layer 310 remain together.

[0067] According to a further step illustrated on figure 4, the third layer consisting of the adhesive tape 320 is peeled or pulled according to arrow 520 and the third layer and the thermoplastic material layer remain together after being separated from the optical lens 100.

[0068] The third layer consisting of the adhesive tape 320 can then be easily removed from the upper surface 312 of the thermoplastic material layer 310 when said layer is pulled according to arrow 530 as shown on figure 5. The thermoplastic material can be rapidly reused to prepare another lens blocking device.

[0069] The first layer consisting of the adhesive tape 330 can be easily removed from the upper assembling surface 210 of the holding unit 200 by peeling or pulling said adhesive tape 330 according to arrow 540 as shown on figure 6.

[0070] The holding unit can be rapidly reused to prepare another lens blocking device.

[0071] Thanks to the adhesive tapes the thermoplastic material as well as the holding unit are not contaminated during the blocking / machining / deblocking steps and are immediately reusable.

[0072] The invention has been described above with the aid of embodiments without limitation of the general inventive concept. In particular the present invention provides a method for blocking and/or deblocking all kinds of optical lenses, particularly ophthalmic lenses, e.g. single vision (spherical, torical), bi-focal, progressive, aspherical lenses (etc..), semi-finished optical lenses and/or blanks, blanks for manufacturing optical lenses.

Claims

1. A method for blocking an optical lens (100) on a heat conducting holding unit (200) comprising a bottom part (220, 230) to be inserted and fixed in a lens machining tool and an upper part (250) comprising an upper assembling surface (210) comprising the steps of:

   a) providing first layer consisting of an adhesive tape (330) on the upper assembling surface (210) of the holding unit;
   b) providing a second layer consisting of a layer (310) comprising a thermoplastic material arranged on said adhesive tape (330);
   c) providing the optical lens (100) with a third layer consisting of an adhesive tape (320) arranged on the bottom surface (120) of said optical lens;
   d) placing the optical lens (100) with the third layer (320) on the second layer (310) consisting of a layer comprising a thermoplastic material when the thermoplastic material is soften or melted.

2. An optical lens blocking device comprising:

   - a heat conducting holding unit (200) comprising a bottom part (220, 230) to be inserted and fixed in a lens machining tool and an upper part (250) comprising an upper assembling surface (210);
   - a first layer consisting of an adhesive tape (330) placed on the upper assembling surface (210) of the holding unit;
   - a second layer consisting of a layer (310) comprising a thermoplastic material stacked on the first layer (330);
   - a third layer consisting of an adhesive tape (320) stacked on the second layer (310).

3. The optical lens blocking device of preceding claim wherein the upper assembling surface (210) of the holding unit is a spherical surface.

4. The optical lens blocking device of claims 2 or 3 wherein the melting or softening point of the thermoplastic material of the second layer (310) is between 45°C and 75°C.

5. The optical lens blocking device of claims 2 to 4 wherein the adhesive tapes (320, 330) have a pressure-sensitive adhesive surface (322, 334) arranged to contact a bottom surface (120) of an optical lens on the upper assembling surface (210) of the holding unit and a tack-free adhesion promoting surface (324, 332) arranged to contact the surfaces (312, 314) of the second layer (310).

6. The optical lens blocking device of claims 2 to 5 wherein the thickness of the second layer (310) is between 0.5 mm and 2 mm, as for an example equal or less to 1 mm.

7. A method for deblocking an optical lens (100) which bottom surface (120) is secured on an optical lens blocking device according to any of claims 2 to 6 or blocked according to claim 1 comprising the steps of:

a) heating the holding unit (200) so as to soften or melt the thermoplastic material of the second layer (310);
b) separating the bottom surface (314) of the second layer (310) from the upper surface (332) of the adhesive tape (330) of the first layer;
c) separating the bottom surface (120) of the optical lens (100) from the upper surface (322) of the adhesive tape (320) of the third layer.

8. The deblocking method of preceding claim further comprising the steps of:

d) separating the bottom surface (324) of the adhesive tape (320) of the third layer from the upper surface (312) of the second layer;
e) separating the bottom surface (334) of the adhesive tape (330) of the first layer from the upper assembling surface (210) of the holding unit.

9. The deblocking method of claims 7 or 8 wherein step a) of the deblocking method consists in heating only the bottom part (220, 230) of the holding unit (200).

10. A method of machining an optical lens (100) comprising the steps of:

- blocking the bottom surface (120) of the optical lens (100) on an optical lens blocking device of any of claims 2 to 6 or blocking according to claim 1;
- inserting and fixing the bottom part (220, 230) of the holding unit (200) in a lens machining tool;
- machining the upper surface (110) of the optical lens (100) and/or edging said optical lens (100);
- deblocking the machined optical lens according to any of claims 7 or 9.

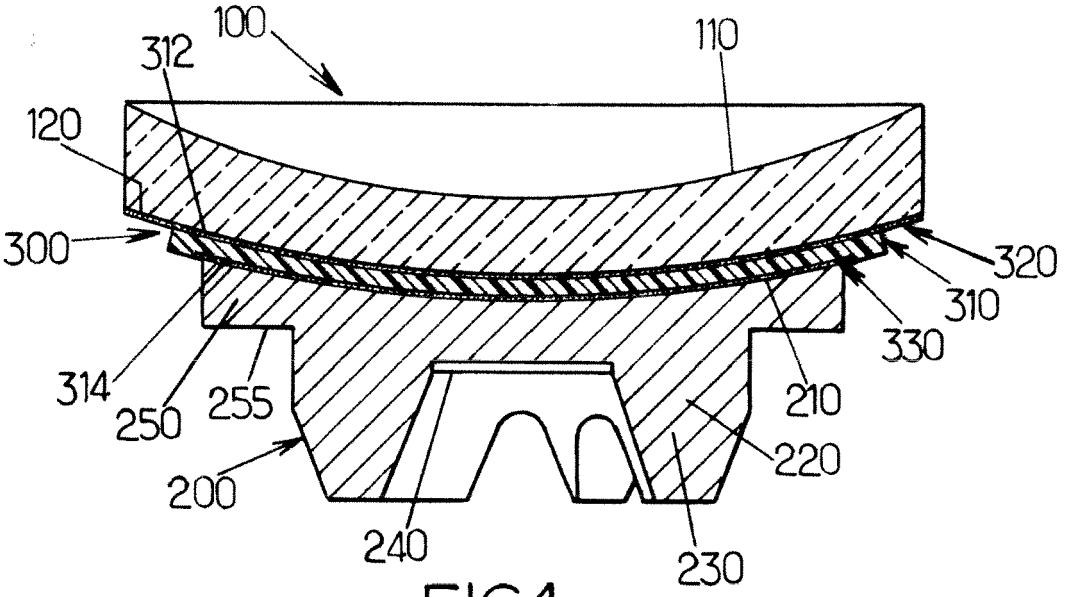
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FIG.1.

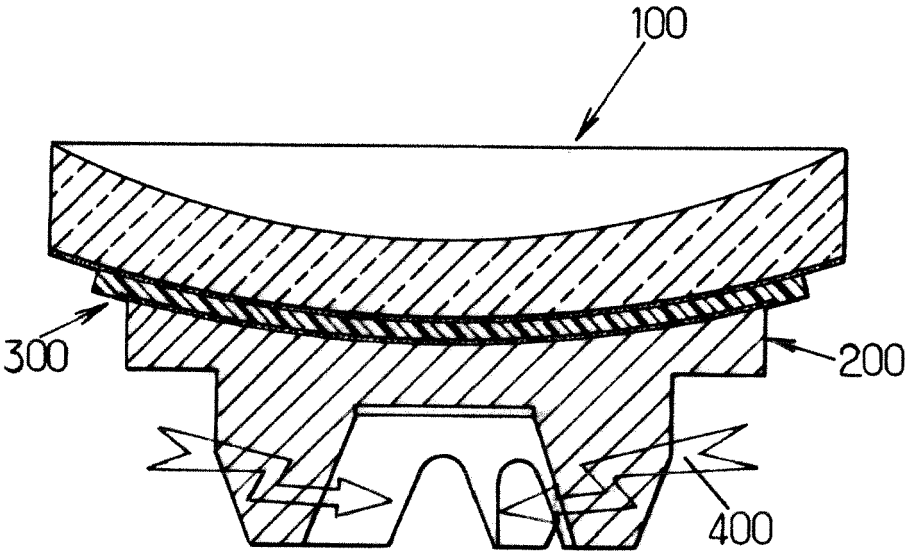
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FIG.2.

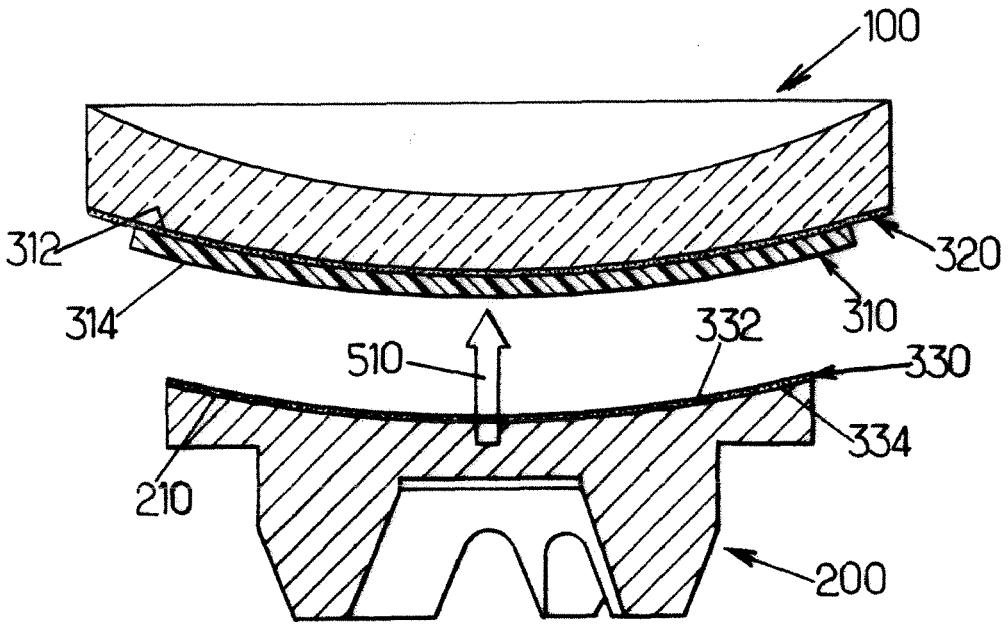
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FIG.3.

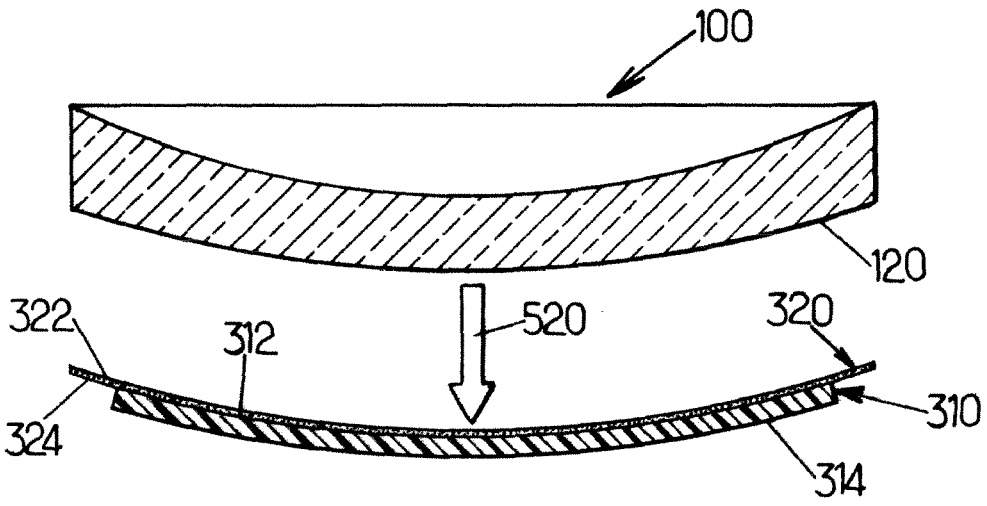
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FIG.4.

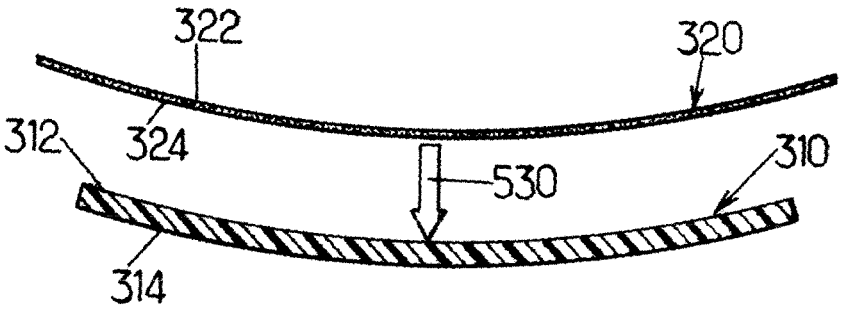

FIG.5.

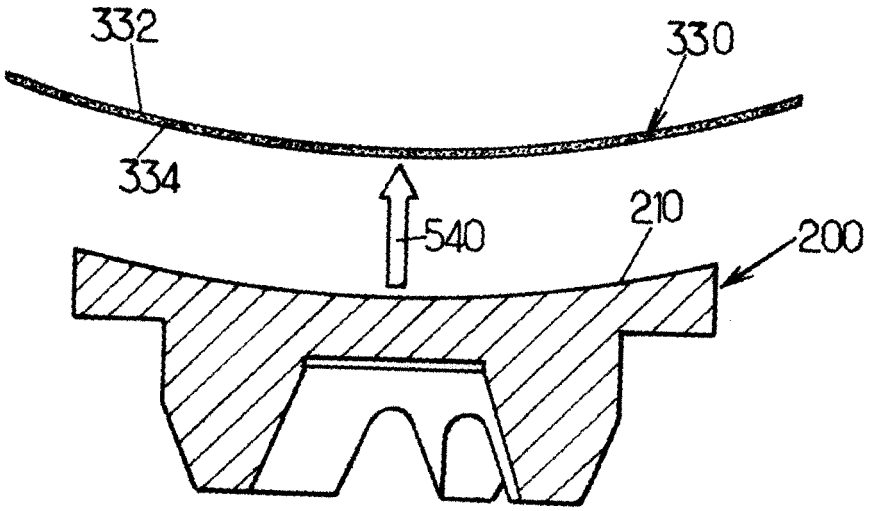

FIG.6.

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 0603

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	US 6 036 313 A (BENJAMIN SHARON R [US] ET AL) 14 March 2000 (2000-03-14) * column 33, lines 1-24; figures 8c,8d * -----	1-10	INV. B24B13/005
A	US 4 328 060 A (TUSINSKI JOSEPH ET AL) 4 May 1982 (1982-05-04) * column 3, line 20 - column 46; figures 5-9 * -----	7-9	

TECHNICAL FIELDS SEARCHED (IPC)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 January 2009	Gelder, Klaus

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		US 5885700 A	23-03-1999
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- US 6036313 A **[0006] [0048] [0053]**