INTRAOCULAR LENS INSERTION INSTRUMENT

[Field]

[0001] The present invention relates to an intraocular lens insertion apparatus that inserts an intraocular lens into an eye.

[Background]

[0002] In treatment of a cataract, an intraocular lens that is to be inserted as a substitute lens to replace a human opaque lens for refraction correction has become available. In intraocular lens insertion surgery, an incision of several millimeters is formed on the edge of the cornea or sclera, for example, the lens is pulverized by phacoemulsification or the like and removed through the incision, and thereafter the intraocular lens is inserted through the incision by an intraocular lens insertion apparatus.

[0003] The intraocular lens is inserted into the eye from the incision by an intraocular insertion apparatus. PTL 1 describes an intraocular lens insertion apparatus.

[Citation List]

[Patent Literature]

[0004]

[PTL 1] WO 2020/054641

[Summary of Invention]

[Technical Problem]

[0005] When discharging an intraocular lens by using an intraocular lens insertion apparatus, the intraocular lens is

temporarily moved to a lens standby position, and thereafter a folded state of the intraocular lens is confirmed generally.

[0006] An object of the technology of the present disclosure is to provide an intraocular lens insertion apparatus that facilitates confirmation of a folded state of an intraocular lens.

[Solution to Problem]

[0007] The intraocular lens insertion apparatus according to the present disclosure is an intraocular lens insertion apparatus inserting an intraocular lens through an incision formed in an eye, and includes: an apparatus main body that includes a storage portion that accommodates the intraocular lens, and an insertion tube portion disposed further on a distal end side than the storage portion and communicating with the storage portion and moreover inserted into the incision, and an extruding member that moves the intraocular lens placed in the storage portion to the distal end side, wherein the apparatus main body has a standby state mark serving as a reference of a normal position of the extruding member, for a case of standing by the intraocular lens at a lens standby position between the storage portion and the insertion tube portion. In the intraocular lens insertion apparatus, confirming the standby state mark serving as a reference for the normal position of the extruding member facilitates confirmation of a folded state of the intraocular lens.

[0008] In the intraocular lens insertion apparatus, the standby state mark may have a distal end position indicator serving as a reference of a normal distal end position of the extruding member, when the intraocular lens is at the lens standby position, and an extruding direction indicator serving as a reference of a normal position in a left-right direction that is orthogonal to an extruding direction and is parallel to a bottom face of the storage portion.

[0009] In the intraocular lens insertion apparatus, the distal end position indicator may be formed as a line extending in the left-right direction, the extruding direction indicator may be formed as a pair of lines extending in the extruding direction, and the standby state mark may form a shape in which the distal end position indicator and the extruding direction indicator are connected.

[0010] In the intraocular lens insertion apparatus, the standby state mark may be formed of a transparent material and integrally with the apparatus main body, and a distal end portion of the extruding member may be imparted with a different color from that of the standby state mark.

[Advantageous Effects of Invention]

[0011] According to the technology of the present disclosure, confirmation that the extruding member is in a normal position at the lens standby position is facilitated, and confirmation of the folded state of the intraocular lens is facilitated.

[Brief Description of Drawings]

[0012]

[Fig. 1] Fig. 1 is a perspective diagram of an intraocular lens insertion apparatus according to an embodiment.

[Fig. 2] Fig. 2(a) is a plan view of a nozzle main body of the intraocular lens insertion apparatus according to the embodiment as viewed from above, and Fig. 2(b) is a left-side view of the nozzle main body of the intraocular lens insertion apparatus according to the embodiment as viewed from the left side.

[Fig. 3] Fig. 3(a) is a plan view of a plunger of the intraocular lens insertion apparatus according to the embodiment as viewed from above, and Fig. 3(b) is a left-side view of the plunger of the intraocular lens insertion apparatus according to the embodiment as viewed from the left side.

[Fig. 4] Fig. 4(a) is a plan view of an intraocular lens as viewed from an optical axis side, and Fig. 4(b) is a side view of the intraocular lens as viewed from the side.

[Fig. 5] Fig. 5 is a plan view of a holding member of the intraocular lens insertion apparatus according to the embodiment as viewed from above.

[Fig. 6] Fig. 6(a) is a perspective view of the holding member of the intraocular lens insertion apparatus according to the embodiment as viewed obliquely from above, and Fig.

6(b) is a cross-sectional view of the holding member taken along line AA in Fig. 6(a).

[Fig. 7] Fig. 7 is a perspective view of a stage portion of the intraocular lens insertion apparatus according to the embodiment, illustrated in an enlarged manner.

[Fig. 8] Fig. 8 is a top view of the nozzle main body, illustrating a state in which the intraocular lens is placed in the stage portion of the intraocular lens insertion apparatus according to the embodiment.

[Fig. 9] Fig. 9 is a perspective view illustrating a distal end side of an operating portion of the plunger of the intraocular lens insertion apparatus according to the embodiment, in an enlarged manner.

[Description of Embodiment]

[0013] An intraocular lens insertion apparatus according to an embodiment of the present disclosure will be described below with reference to the drawings. It should be noted that the configuration of the embodiment below is exemplary, and that the present invention is not limited to the configuration of these embodiments.

[0014] Fig. 1 is a perspective view of an intraocular lens insertion apparatus 1 according to the present embodiment, as viewed from obliquely above. The intraocular lens insertion apparatus 1 includes a nozzle main body 10 (example of “apparatus main body”), and a plunger 30 (example of “extruding member”) inserted into the nozzle main body 10. The

nozzle main body 10 has a tubular shape having a substantially rectangular cross-section, has a rear end portion 10d whose entire end face is open at an end portion on one end side, and a distal end portion 10a (example of “insertion tube portion”) on an end portion on another end side thereof, on which is formed a nozzle portion 15 that is tapered to a narrow shape, with an opening portion 10b formed on the distal end thereof.

[0015] In the following description, a direction heading from the rear end portion 10d of the nozzle main body 10 toward the distal end portion 10a will be referred to as “front”, the opposite direction as “rear”, an upper side in the plane of the drawing in Fig. 1 as “up”, an opposite direction as “down”, a left side when facing frontward as “left”, and an opposite direction as “right”. Note that an upper side corresponds to an optical-axis front side of a lens main body 2a that will be described later, a lower side to an optical-axis rear side of the lens main body 2a, and a front side to an extrusion direction of the plunger 30, respectively.

[0016] The distal end portion 10a provided on a front side end portion of the nozzle main body 10 communicates with the nozzle portion 15 internally, and has a circular tube form that is narrower in diameter than the nozzle portion 15. A hold portion 11 that extends upward and downward in a plate form is integrally provided with the nozzle main body 10, on which a surgeon can hook his/her fingers onto when depressing

the plunger 30 into a distal end side of the nozzle main body 10, in a vicinity of the rear end portion 10d of the nozzle main body 10. Also, the nozzle main body 10 has a stage portion 12 that is provided on a rear side of the nozzle portion 15 and accommodates an intraocular lens 2. The nozzle portion 15 and the distal end portion 10a are disposed on a distal end side from the stage portion 12, and communicate with the stage portion 12. The stage portion 12 is linked to a stage lid portion 13, by which an upper side thereof can be opened and closed, via a linking portion 14. The stage portion 12 and the stage lid portion 13 in a closed state make up a storage portion that is a space in which the intraocular lens 2 is stored. A bottom face side of the storage portion is the stage portion 12, and a top face side of the storage portion is the stage lid portion 13. Also, the space accommodating the intraocular lens 2 can be opened by opening the stage lid portion 13. Also, a holding member 50 is attached to the stage portion 12, from a lower side of the nozzle main body 10. This holding member 50 stably holds the intraocular lens 2 within the stage portion 12 even when prior to use (during transportation).

[0017] Also, a confirmation window 17 is formed in a portion of the stage lid portion 13 by making this portion thinner than the surroundings, whereby an inner side of the stage lid portion 13 can be confirmed. Note that how much thinner the confirmation window 17 is to be made than the

surroundings can be decided as appropriate on the basis of a material from which the stage lid portion 13 is formed, and visibility of the intraocular lens 2 through the confirmation window 17. Also, effects of reducing defective forming at the time of molding the stage lid portion 13 can be anticipated by forming the confirmation window 17.

[0018] The intraocular lens insertion apparatus 1 according to the present embodiment is a preset type, in which the intraocular lens 2 is stored in the stage portion 12 when shipping. In intraocular lens insertion apparatus 1 of a preset type, the intraocular lens 2 is placed on the stage portion 12 with the forward side on an optical axis facing upward during manufacturing, in a state in which the stage lid portion 13 is opened and the holding member 50 is attached to the stage portion 12. The intraocular lens insertion apparatus 1 is then shipped after the stage lid portion 13 is closed.

[0019] Also, the stage lid portion 13 is provided with an injection hole 18 for injecting a viscoelastic substance onto the stage portion 12 prior to moving the intraocular lens forward. The viscoelastic substance functions as a lubricant for reducing friction occurring when the intraocular lens moves. The injection hole 18 is a hole that connects the inside of the storage portion with the outside when the stage lid portion 13 is closed. The surgeon, an assistant, or a nurse (hereinafter may be referred to as “surgeon or others”) can inject the viscoelastic substance from the injection hole

18 onto the stage portion 12 using a syringe.

[0020] Also, the stage lid portion 13 is provided with a guide wall 19 for guiding an injection needle, for injecting the viscoelastic substance, to the injection hole 18. The guide wall 19 is provided on the stage lid portion 13 so as to continuously surround the injection hole 18, starting from a left side of an opening end thereof, past a front side of the opening end and to a right side of the opening end. The surgeon or others brings the injection needle of the syringe that injects the viscoelastic substance into contact with the guide wall 19, and further moves a distal end of the injection needle into the injection hole 18. Thus, the guide wall 19 can guide the injection needle for injecting the viscoelastic substance to the injection hole 18. The surgeon or others then wets the intraocular lens 2 with the viscoelastic substance in a state in which the stage lid portion 13 remains closed, and thereafter detaches the holding member 50. Next, the surgeon or others depresses the plunger 30 into the distal end side of the nozzle main body 10. The distal end portion 10a communicates with the stage portion 12 via the nozzle portion 15, and the intraocular lens 2 that is pressed by the plunger 30 can pass through the nozzle portion 15 and move into the distal end portion 10a. The intraocular lens insertion apparatus 1 presses the intraocular lens 2 by the plunger 30 in a state in which the distal end portion 10a is inserted into the incision formed in the eye, and discharges the

intraocular lens 2 from the opening portion 10b into the eye. Thus, the intraocular lens insertion apparatus 1 can insert the intraocular lens 2 into the eye from the incision.

[0021] The plunger 30 is inserted into the nozzle main body 10 from the rear end portion 10d, and is movable forward and rearward. The intraocular lens insertion apparatus 1 discharges the intraocular lens 2 into the eye from the opening portion 10b via the nozzle portion 15 and the distal end portion 10a, by moving the plunger 30 forward.

[0022] The nozzle main body 10, the plunger 30, and the holding member 50 of the intraocular lens insertion apparatus 1 are made of a resin such as polypropylene. Polypropylene is a field-proven material for medical equipment, and is also a material with high reliability in chemical resistance and so forth.

[0023] Figs. 2(a) and 2(b) are diagrams in which the nozzle main body 10 is extracted from the intraocular lens insertion apparatus 1 and illustrated. Fig. 2(a) is a plan view of the nozzle main body 10 as viewed from above, and Fig. 2(b) is a left-side view in which the nozzle main body 10 is viewed from the left side. Note that Fig. 2(a) illustrates a state in which the stage lid portion 13 is open, and Fig. 2(b) illustrates a state in which the stage lid portion 13 is closed.

[0024] A through hole 10c on a front side, of which a cross-sectional shape changes in accordance with change in an

outer form of the nozzle main body 10, and a through hole 10g on a rear side, are provided inside the nozzle main body 10. The through hole 10c is disposed on a front side from the stage portion 12, and the through hole 10g is disposed on a rear side from the stage portion 12. The through hole 10c is a hole serving as a moving path for when the intraocular lens 2 moves by being pressed by the plunger 30, and the through hole 10g is a hole through which the plunger 30 is inserted. The intraocular lens 2 is in a folded state while passing through the inside of the through hole 10c, and is discharged into the eyeball of the patient from the opening portion 10b of the distal end portion 10a. Note that the intraocular lens 2 is folded into a valley fold as viewed from above. Also, the opening end of an opening portion 10b is formed so as to be oblique with respect to a direction in which the distal end portion 10a extends. Specifically, the opening end of the opening portion 10b is formed so as to be inclined toward the upper side from the rear side toward the front side, as illustrated in Fig. 2(b).

[0025] A stage groove 12a, that has a width slightly larger than the diameter of the lens main body of the intraocular lens 2 (lens main body 2a illustrated in Figs. 4(a) and 4(b)), is formed in the stage portion 12. The dimensions of the stage groove 12a in the front-rear direction are set to be larger than the largest dimensions including supports 2b, 2c that extend in both front and rear sides of the intraocular lens 2.

Also, the stage portion 12 accommodates the intraocular lens 2 in a space formed by a bottom face portion 12b of the stage groove 12a, and a top face portion 13a that is situated on the inner side of the storage portion in a state in which the stage lid portion 13 is closed. The bottom face portion 12b and the top face portion 13a form the space in which the intraocular lens 2 is stored in the state in which the stage lid portion 13 is closed. Note that an up-down direction position of the bottom face portion 12b is set to be further upward from the height position of a bottom face of the through hole 10g of the nozzle main body 10, and the bottom face portion 12b and the bottom face of the through hole 10g are linked by a bottom portion inclined face 10e, as illustrated in Fig. 2(b).

[0026] The stage portion 12 and the stage lid portion 13 are integrally formed. The stage lid portion 13 has front-rear direction dimensions that are equivalent to those of the stage portion 12. The stage lid portion 13 is linked by the linking portion 14 that is in a form of a thin plate, by a right side face of the stage portion 12 formed extending to the outer side. The linking portion 14 is formed so as to be bendable at the middle portion, and the stage lid portion 13 is capable of being opened and closed about the middle portion of the linking portion 14, by bending the linking portion 14. The stage lid portion 13 overlays the stage portion 12 from the upper side and can place the stage portion 12 in a closed

state in which the stage portion 12 is shielded from the outside.

[0027] A rib 13b, for reinforcing the stage lid portion 13 and stabilizing the position of the intraocular lens 2, is formed on the top face portion 13a of the stage lid portion 13. Also, a guide groove 13c that is formed in the middle portion of the rib 13b and that extends in the front and rear, for guiding reciprocal movement of the plunger 30, is formed in the top face portion 13a of the stage lid portion 13. The top face portion 13a further has a post-like form protruding from the top face portion 13a, and an upward positioning portion 13d is formed that fixes the lens main body 2a and a rear support 2c of the intraocular lens 2, along with a pair of second positioning portions 67 of the holding member 50, which will be described later.

[0028] Also, a retaining hole 10f that is capable of engaging a claw portion 32a of the plunger 30, which will be described later, is formed on an upper face side of the nozzle main body 10, as illustrated in Fig. 2(a).

[0029] Figs. 3(a) and 3(b) are diagrams in which the plunger 30 is extracted from the intraocular lens insertion apparatus 1 and illustrated. Fig. 3(a) is a plan view of the plunger 30 of the as viewed from above, and Fig. 3(b) is a left-side view in which the plunger 30 is viewed from the left side. The plunger 30 can move the intraocular lens 2 stored. in the stage portion 12 to the distal end portion 10a side by

moving to the front side thereof. The length of the plunger 30 is slightly longer in the front-rear direction than the nozzle main body 10. The plunger 30 also has an operating portion 31 on the front side that presses the intraocular lens 2, and an insertion portion 32 on the rear side that has a rectangular rod shape. The operating portion 31 has a round post portion 31a with a round post form extending in the front-rear direction, and a flat portion 31b that has a thin plate shape, extending in a left-right direction of the round post portion 31a. Details of the operating portion 31 will be described later. Also, a pressing plate portion 33, which is disc-like and spreads in the up-down and left-right directions, is formed at a rear end of the insertion portion 32.

[0030] At portion of the insertion portion 32 on the front side from the middle thereof in the front-rear direction, the claw portion 32a is formed so as to protrude upward from the insertion portion 32, and is vertically deformable due to elasticity of the material of the plunger 30. In a case in which the plunger 30 is inserted into the nozzle main body 10, the retaining hole 10f that is provided on the upper face of the nozzle main body 10 (see Fig. 2(a)) and the claw portion 32a are engaged, and relative positions of the nozzle main body 10 and the plunger 30 in an initial state are decided by this engaging. Note that in a state in which the claw portion 32a and the retaining hole 10f are engaged, the position at which the claw portion 32a and the retaining hole 10f are

formed is set to a position at which a distal end of the operating portion 31 can support the rear support 2c situated on the rear side of the lens main body 2a of the intraocular lens 2 placed on the stage portion 12.

[0031] Figs. 4(a) and 4(b) are diagrams illustrating a schematic configuration of the intraocular lens 2 to be inserted into the eye by the intraocular lens insertion apparatus 1 according to the present embodiment. Fig. 4(a) is a plan view of the intraocular lens 2 as viewed from an optical axis side, and Fig. 4(b) is a side view of the intraocular lens 2 as viewed from the side. The intraocular lens 2 is provided with the lens main body 2a (example of “optical portion”) with a predetermined refractive power, and a front support 2b and the rear support 2c that are linked to the lens main body 2a. The intraocular lens 2 is placed on the stage portion 12 of the nozzle main body 10 such that the front support 2b is situated on the front side in the intraocular lens insertion apparatus 1 and the rear support 2c is situated on the rear side in the intraocular lens insertion apparatus 1. The front support 2b and the rear support 2c are provided for holding the lens main body 2a in the eye, and the supports 2b, 2c are formed having forms of elongated plates. The front support 2b and the rear support 2c are connected to the lens main body 2a via connecting parts 2d. In the present embodiment, the intraocular lens 2 is a so-called one-piece type, in which the lens main body 2a, the front support 2b,

the rear support 2c, and the connecting parts 2d are integrally molded from the same material. The intraocular lens 2 is formed of a flexible resin material, for example. Note that the intraocular lens 2 may be a three-piece type, in which the lens main body 2a and the forward and rear supports 2b, 2c are made of different materials.

[0032] Note that the front support 2b and the rear support 2c of the intraocular lens 2 are subjected to roughening treatment. Thus, the supports 2b, 2c can be prevented from becoming stuck to the lens main body 2a when the intraocular lens 2 is folded in the through hole 10c of the nozzle main body 10.

[0033] Figs. 5 to 6(b) are diagrams illustrating the holding member 50 that is detachably configured on the lower side of the stage portion 12. Fig. 5 is a plan view of the holding member 50 as viewed from above. Fig. 6(a) is a perspective view of the holding member 50 as viewed obliquely from above. Fig. 6(b) is a cross-sectional view of the holding member 50 taken along line AA in Fig. 6(a), as viewed from the front side. The holding member 50 is formed as a separate member from the nozzle main body 10, so as to be detachable from the nozzle main body 10.

[0034] The holding member 50 has a base portion 51 disposed in the middle thereof, and a pair of grip portions 52 disposed on both of left and right sides of the base portion 51. The base portion 51 and the grip portions 52 are linked by linking

members 53. The linking members 53 link the base portion 51 and the pair of grip portions 52 with gap portions 54 provided between the base portion 51 and the pair of grip portions 52. The holding member 50 also has a left and right pair of side wall portions 55 that are provided on both left and right sides of the base portion 51 and that extend in the front-rear direction. Also, outer wall portions 52a that have an upward height such that the holding member 50 is fitted to the left and right outer walls of the stage portion 12, and that extend in the front-rear direction, are formed on respective ones of the pair of grip portions 52. A first placing portion 56 and a second placing portion 66 that protrude to the upper side are formed on the base portion 51. The first placing portion 56 and the second placing portion 66 are an example of a pair of lens fixing portions that have post-like forms. Further, on an upper end face of the first placing portion 56 that is on a far side from the optical axis of the lens main body 2a, a first positioning portion 57 is formed protruding further to the upper side than the upper end face of the first placing portion 56. Also, on an upper end face of the second placing portion 66, the pair of second positioning portions 67, which positions the lens main body 2a and the rear support 2c of the intraocular lens 2, is formed protruding further to the upper side than the upper end face of the second placing portion 66. The first positioning portion 57 is disposed at the right side and also to the front side of the lens main body 2a, the

second positioning portions 67 are disposed at the left side and also to the rear side of the lens main body 2a, and the length of separation of the first positioning portion 57 and the second positioning portion 67 is set to be slightly larger than the diameter dimension of the lens main body 2a of the intraocular lens 2. The pair of second positioning portions 67 is disposed with a gap provided therebetween that is slightly greater than the width of the rear support 2c, and placing the rear support 2c on the connecting part 2d side between the pair of second positioning portions 67 clamps the rear support 2c between the pair of second positioning portions 67, whereby the lens main body 2a and the rear support 2c are positioned as to the holding member 50.

[0035] Also, a pair of third placing portions 58 protruding to the upper side is formed on the base portion 51. The pair of third placing portions 58 is disposed on the front side and also the left side, and on the rear side and also the right side, of the lens main body 2a, respectively. A pair of third positioning portions 59 that protrudes further to the upper side of the third placing portions 58 is formed on upper end faces of the pair of third placing portions 58, on far sides from the optical axis of the lens main body 2a, respectively. The pair of third placing portions 58 and the pair of third positioning portions 59 are an example of a pair of lens fixing portions that have post-like forms. The length of separation between the pair of third positioning portions 59

is set to be slightly larger than the diameter dimension of the lens main body 2a of the intraocular lens 2.

[0036] Also, the holding member 50 has, in a state of being attached to the nozzle main body 10, a tubular protrusion 61 that is provided at a position facing the injection hole 18 illustrated in Fig. 1, and extends to the top face portion 13a side and also is open to the rear side (basal end side) thereof. The tubular protrusion 61 functions as a channel that guides the viscoelastic substance injected from the injection hole 18.

[0037] Also, the holding member 50 has a pair of claw portions 62 extending to inner sides in the left-right direction from each of the pair of third placing portions 58. The claw portions 62 are provided to fix the holding member 50 to the stage portion 12 by being engaged with the stage portion 12.

[0038] Attaching and detaching the holding member 50 to and from the stage portion 12 will be described next by way of Fig. 7, with reference to Fig. 2(a). Fig. 7 is a perspective view of stage portion 12 of the nozzle main body 10, illustrated in an enlarged manner. As illustrated in Fig. 2(a), four through holes 12c and one through hole 12d, which pass through the bottom face portion 12b in the up-down direction, are formed in the bottom face portion 12b of the stage portion 12. The four through holes 12c are formed at positions corresponding to the first to third placing portions

and the first to third positioning portions, respectively, such that the first to third placing portions and the first to third positioning portions can be inserted therein. The through hole 12d is formed at a position corresponding to the tubular protrusion 61, such that the tubular protrusion 61 can be inserted therein. The outer shapes of the through holes 12c are substantially similar to the shapes of the first to third placing portions and the first to third positioning portions of the holding member 50 as viewed from above, but slightly larger. The outer shape of the through hole 12d is formed to be substantially the same size and the same shape as the tubular protrusion 61 of the holding member 50 as viewed from above. As illustrated in Fig. 7, when the holding member 50 is attached to the nozzle main body 10, the first to third placing portions and the first to third positioning portions are inserted into the through holes 12c from the lower side of the bottom face portion 12b, the tubular protrusion 61 is inserted into the through hole 12d from the lower side of the bottom face portion 12b, and the first to third placing portions and first to third positioning portions, and the tubular protrusion 61, protrude to the upper side of the bottom face portion 12b.

[0039] The holding member 50 is fixed to the stage portion 12 by the claw portions 62 provided to the third placing portions 58 engaging the bottom face portion 12b. The holding member 50 is removed from the stage portion 12 before moving

the intraocular lens 2 by the plunger 30. At this time, the pair of grip portions 52 is operated by the surgeon or others so as to be brought closer to each other on the inner side in the left-right direction. The pair of grip portions 52 is linked to the base portion 51 via the linking members 53, and when the surgeon or others grasps the pair of grip portions 52 between finger and thumb so as to be moved toward the inner side in the left-right direction, the pair of claw portions 62 opens toward the outer side in the left-right direction, and the engaging of the pair of claw portions 62 and the bottom face portion 12b is disengaged. Thus, the holding member 50 is configured to be removable from the stage portion 12.

[0040] Fig. 8 is a top view of the nozzle main body 10, illustrating a state in which the intraocular lens 2 is placed in the stage portion 12. Fig. 8 illustrates a state in which the holding member 50 is attached to the stage portion 12. In the state in which the intraocular lens 2 is placed on the stage portion 12, a circumferential portion bottom face of the lens main body 2a is placed on upper faces of the first placing portion 56, the second placing portion 66, and the pair of third placing portions 58. Also, an edge portion of the lens main body 2a is fixed with respect to the front-rear and left-right directions by the first positioning portion 57, the second positioning portions 67, and the pair of third positioning portions 59. Further, the front support 2b of the intraocular lens 2 is placed on a fourth placing portion 12e

that will be described later, the rear support 2c of the intraocular lens 2 is fixed by the pair of second positioning portions 67, and moreover the rear support 2c is retained by a retaining portion provided to the operating portion 31 of the plunger 30. A configuration by which the rear support 2c is retained will be described later.

[0041] This fixation of the lens main body 2a is configured to be capable of being disengaged by the surgeon or others operating the pair of grip portions 52 so as each to be moved toward the inner side in the left-right direction as described above, whereby the first positioning portion 57, the second positioning portions 67, and the pair of third positioning portions 59 that fix the lens main body 2a open toward the outer side in the left-right direction, when removing the holding member 50 from the stage portion 12. Accordingly, the fixing of the intraocular lens 2 by the holding member 50 in the intraocular lens insertion apparatus 1 can be disengaged without applying any unnecessary impact to the intraocular lens 2. Also, the holding member 50 can be easily removed from the stage portion 12 in the intraocular lens insertion apparatus 1.

[0042] Next, marks for the plunger 30 in a case of standing by the intraocular lens 2 at a lens standby position will be described with reference to Figs. 7 and 8. In a case in which the intraocular lens insertion apparatus 1 is used in surgery, the intraocular lens insertion apparatus 1 is handed to the

surgeon in a state in which the intraocular lens 2 has been moved to the lens standby position by an assistant of the surgeon or a nurse moving the plunger 30 forward. The surgeon discharges the intraocular lens 2 into the eye by further moving the plunger 30 forward from the lens standby position, in a state in which the distal end portion 10a is inserted in an incision. In surgery such as this, enabling easy confirmation of whether the intraocular lens 2 has moved to the lens standby position correctly can relieve the burden on medical staff in the operating room, including the surgeon, assistants, and nurses.

[0043] Accordingly, the intraocular lens insertion apparatus 1 according to the present embodiment has standby state marks 80 to serve as a reference for a normal position of the plunger 30, in a case of standing by the intraocular lens 2 at the lens standby position between the stage portion 12 and the distal end portion 10a, as illustrated in Figs. 7 and 8. The standby state marks 80 are provided on the nozzle main body 10. The lens standby position is a position at which the intraocular lens 2 stands by in a state of the intraocular lens 2 having been folded into a valley fold as viewed from above, while moving through the through hole 10c of the nozzle portion 15. The standby state marks 80 are a reference for the normal position of the plunger 30 when the intraocular lens 2 has reached the lens standby position. The plunger 30 being situated at the normal position is a reference that the

intraocular lens 2, which has moved forward under pressing by the plunger 30, is in a state of having been folded appropriately.

[0044] Specifically, the standby state marks 80 are formed integrally with the nozzle portion 15, on an upper face side of the nozzle portion 15. For example, in a case of performing injection molding of the nozzle main body 10 using a resin material, the standby state marks 80 are integrally formed along with the nozzle main body 10 in a state of having been raised by molding on the upper face side of the nozzle portion 15.

[0045] The standby state marks 80 have a distal end position indicator 80a serving as a reference for the normal position of the plunger 30 in the front-rear direction, in a case of standing by the intraocular lens 2 at the lens standby position. The distal end position indicator 80a is formed as a line extending in the left-right direction with respect to the front-rear direction that is the extrusion direction of the plunger 30. Note that the left-right direction is the left-right direction in the present specification, and is a direction orthogonal to the extrusion direction of the plunger 30 and parallel to the bottom face portion 12b, which is the bottom face of the storage portion formed between the stage portion 12 and the stage lid portion 13 in a closed state. Ideally, the distal end position indicator 80a and the distal end of the plunger 30 matching as viewed from above is

preferable, but it is sufficient for the distal end of the plunger 30 to be at a position adequately close to the distal end position indicator 80a, and there is no need that just the position at which the distal end position indicator 80a and the distal end of the plunger 30 match is the normal position of the plunger 30. Also, it is sufficient for the intraocular lens 2 to be maintained in a state of being folded in a valley fold at the lens standby position, and a state in which the intraocular lens 2 is pressed toward the distal end, at which the through hole 10c of the nozzle portion 15 is further tapered, can be an allowable range of the lens standby position. Accordingly, a state in which the entirety of the intraocular lens 2 remains at the rear end side from the opening portion 10b can be an allowable range for the normal position of the plunger 30. Whether or not the intraocular lens 2 or the plunger 30 is within the allowable range may be confirmed by confirming relative positions of the distal end position indicator 80a and the plunger 30.

[0046] The standby state marks 80 also have a pair of extruding direction indicators 80b indicating the extrusion direction of the plunger 30. The extruding direction indicators 80b are formed as a pair of lines extending in the front-rear direction that is the extrusion direction of the plunger 30. A spacing between the pair of extruding direction indicators 80b is set to be somewhat broader than the plunger 30 as viewed from above, and serve as a reference that when

the distal end of the plunger 30 is between this pair of extruding direction indicators 80b, the plunger 30 is at the normal position in the left-right direction. In a situation in which the distal end of the plunger 30 happens to deviate outside past the pair of extruding direction indicators 80b, the extrusion direction of the intraocular lens 2 is inappropriate, and there is concern that the intraocular lens 2 may not be appropriately folded. It is unsuitable for the intraocular lens 2 in such a folded state to be inserted into the eye. In a case in which the position of the plunger 30 in the left-right direction is between the pair of extruding direction indicators 80b, this is a reference for the surgeon, assistant, or nurse to judge that the intraocular lens 2 is appropriately folded. In a situation in which an assistant or a nurse tries to confirm the plunger 30 or the folded state of the intraocular lens by naked eye, for example, but there are no marks whatsoever, confirmation will be difficult or troublesome. By confirming the relative positions of the standby state marks 80 and the plunger 30 by naked eye, the intraocular lens insertion apparatus 1 according to the present embodiment enables confirmation of the folded state of the intraocular lens as well. Accordingly, the intraocular lens insertion apparatus 1 facilitates confirmation of the folded state of the intraocular lens 2.

[0047] Also, in recent years, advances have been made in small-incision surgery, and in a case of inserting the

intraocular lens 2 through a small incision, it is important that the intraocular lens 2 has been folded appropriately. The intraocular lens insertion apparatus 1 according to the present embodiment facilitates confirmation of the folded state of the intraocular lens 2, and accordingly the intraocular lens 2 that has been folded appropriately can be easily inserted through a small incision. Accordingly, the intraocular lens insertion apparatus 1 can contribute to improved safety of surgery.

[0048] Also, in the standby state marks 80, the distal end position indicator 80a and the pair of extruding direction indicators 80b are connected. The distal end position indicator 80a and the pair of extruding direction indicators 80b may be directly connected, or may be connected by one or more straight lines or curves. The distal end position indicator 80a and the pair of extruding direction indicators 80b are connected to form a letter-U shape. Confirmation that the plunger 30 is within a range surrounded by the distal end position indicator 80a and the pair of extruding direction indicators 80b can easily be performed even by the naked eye, by viewing from above. According to this configuration, the intraocular lens insertion apparatus 1 according to the present embodiment enables positional relations of the standby state marks 80 and the plunger 30 to be confirmed even more easily.

[0049] Further, the standby state marks 80 are formed

integrally with the nozzle main body 10, from a transparent material. In contrast, a distal end portion of the plunger 30 is imparted a color (blue in the present embodiment) that differs from the standby state marks 80. Accordingly, the distal end portion of the plunger 30 is more readily visible from the outer side of the nozzle main body 10, and the positional relation of the standby state marks 80 and the plunger 30 is more readily confirmed.

[0050] Further, the intraocular lens insertion apparatus 1 according to the present embodiment has an injection amount mark 81 instructing the injection amount of the viscoelastic substance, provided on the upper face side of the nozzle portion 15, between the stage portion 12 and the distal end portion 10a. The injection amount mark 81 is formed integrally with the nozzle portion 15. For example, in a case of performing injection molding of the nozzle main body 10 using a resin material, the injection amount mark 81 is integrally formed along with the nozzle main body 10 in a state of having been raised by molding on the upper face side of the nozzle portion 15.

[0051] The injection amount mark 81 is formed as a curved line that is convex to the front side thereof, and is connected to the pair of extruding direction indicators 80b. In the present embodiment, the injection amount mark 81 is formed continuously with the standby state marks 80, and is made of a transparent resin material, the same as the standby

state marks 80. When the surgeon or others injects the viscoelastic substance onto the stage portion 12 through the injection hole 18, an amount of the viscoelastic substance that fills up to the injection amount mark 81 is preferably injected. This amount is an amount of the viscoelastic substance that is necessary for the intraocular lens 2 to pass through the nozzle portion 15 and the distal end portion 10a. In the intraocular lens insertion apparatus 1 according to the present embodiment, whether or not the necessary amount of the viscoelastic substance has been injected is easy to tell, and accordingly excessive injection or insufficient injection of the viscoelastic substance can be prevented from occurring.

[0052] Also, as illustrated in Fig. 8, the stage portion 12 has a stage upper end face 12g that serves as the upper end face of the stage portion 12 in a state in which the stage lid portion 13 is open, and the fourth placing portion 12e (example of “front support shelf”), protruding from the stage upper end face 12g toward the stage groove 12a, is formed. The front support 2b is placed on the fourth placing portion 12e in a case in which the intraocular lens 2 is placed. A fourth positioning portion 12f, which protrudes further to the upper side of the fourth placing portion 12e, is formed on the upper end face of the fourth placing portion 12e, on a far side from the optical axis of the lens main body 2a.

[0053] The front support 2b of the intraocular lens 2 is placed on the stage portion 12 in a state of being situated on

the front side from the lens main body 2a, with the fourth placing portion 12e supporting the front support 2b. The fourth placing portion 12e is formed with a height so as to support at least part of the front support 2b further on the top face portion 13a side than a distal end of the lens main body 2a.

[0054] Next, retaining of the rear support 2c of the intraocular lens 2 will be described. Fig. 9 is a perspective view illustrating the distal end side of the operating portion 31 of the plunger 30, in an enlarged manner. The operating portion 31 has two protruding portions 31c, 31d provided on the distal end side thereof. The protruding portions 31c, 31d protrude frontward, and a recessed portion 31e that is recessed further to the rear side from the protruding portions 31c, 31d is formed between the two protruding portions 31c, 31d. An upper end face of the protruding portion 31c is formed as a substantially flat face, and a wall portion 31f that extends upward is formed at the rear side of this flat face. The operating portion 31 is exposed within the stage portion 12 at the initial position of the plunger 30, and the rear support 2c is placed on the protruding portion 31c.

[0055] The intraocular lens 2 assumes a rearward inclined attitude when the plunger 30 starts moving. The protruding portion 31c and the wall portion 31f retain at least part of the rear support 2c in the rearward inclined attitude of the intraocular lens 2, further on the top face portion 13a side

from the rear end of the lens main body 2a. In the intraocular lens insertion apparatus 1, retaining the rear support 2c further on the top face portion 13a side than the lens main body 2a enables the rear support 2c to be placed on the lens main body 2a when the plunger 30 moves forward, and the intraocular lens 2 is appropriately folded in the state in which the rear support 2c is folded upon the lens main body 2a. Accordingly, the intraocular lens insertion apparatus 1 can stabilize the behavior of the intraocular lens. Note that the rear support 2c retained upon the protruding portion 31c can be placed on the upper side of the lens main body 2a more readily by the lens main body 2a being pressed by the recessed portion 31e.

[0056] The intraocular lens insertion apparatus 1 folds the intraocular lens 2 while moving the intraocular lens 2 forward by the plunger 30. In the intraocular lens insertion apparatus 1, confirmation that the plunger 30 is at the normal position in the lens standby position is facilitated by confirming the relative positions of the standby state marks 80 and the plunger 30, and confirmation of whether or not the intraocular lens 2 is appropriately folded is facilitated.

[0057] While the present embodiment has been described above, the intraocular lens insertion apparatus 1 according to the present disclosure is not limited to the above embodiment, and various modifications can be made without departing from the technical spirit of the present invention.

[0058] In the above-described embodiment, the intraocular lens insertion apparatus 1 is of a preset type in which the intraocular lens 2 is stored in the stage portion 12 in advance, but the intraocular lens insertion apparatus 1 disclosed herein is not limited to this. For example, the intraocular lens insertion apparatus 1 may be of a separate type in which the surgeon him/herself places the intraocular lens 2 in the intraocular lens insertion apparatus 1 at the time of use.

[Reference Signs List]

[0059]

1 Intraocular lens insertion apparatus

2 Intraocular lens

2a Lens main body

2b Front support

2c Rear support

2d connecting part

10 Nozzle main body

11 Hold portion

12 Stage portion

13 Stage lid portion

14 Linking portion

15 Nozzle portion

17 Confirmation window

18 Injection hole

19 Guide wall

30 Plunger

50 Holding member

80 Standby state mark

81 Injection amount mark

[CLAIMS]

[Claim 1]

An intraocular lens insertion apparatus inserting an intraocular lens through an incision formed in an eye, the intraocular lens insertion apparatus comprising:

an apparatus main body that includes a storage portion that stores the intraocular lens, and an insertion tube portion disposed further toward a distal end side than the storage portion and communicating with the storage portion and moreover inserted into the incision; and

an extruding member that moves the intraocular lens placed in the storage portion to the distal end side, wherein

the apparatus main body has a standby state mark serving as a reference of a normal position of the extruding member, when the intraocular lens is on standby at a lens standby position between the storage portion and the insertion tube portion.

[Claim 2]

The intraocular lens insertion apparatus according to claim 1, wherein

the standby state mark has a distal end position indicator serving as a reference of a normal distal end position of the extruding member, for a case of standing by the intraocular lens at the lens standby position, and an extruding direction indicator that serves as a reference of a normal position in a left-right direction that is orthogonal

to an extrusion direction and is parallel to a bottom face of the storage portion.

[Claim 3]

The intraocular lens insertion apparatus according to claim 2, wherein

the distal end position indicator is formed as a line extending in the left-right direction,

the extruding direction indicator is formed as a pair of lines extending in the extruding direction, and

the standby state mark forms a shape in which the distal end position indicator and the extruding direction indicator are connected.

[Claim 4]

The intraocular lens insertion apparatus according to claim 1 or 2, wherein

the standby state mark is formed of a transparent material and integrally with the apparatus main body, and

a distal end portion of the extruding member is imparted with a different color from that of the standby state mark.