

INTRAOCULAR LENS INSERTION SYSTEM, INTRAOCULAR LENS
INSERTION APPARATUS, AND TUBE

[Field]

[0001] The embodiments discussed herein relate to an intraocular lens insertion system, an intraocular lens insertion apparatus and a tube.

[Background]

[0002] Intraocular lenses are widely used to be replaced with human opacity crystalline lenses in cataract treatments to compensate the optical powers of the lenses. In intraocular lens insertion surgeries for the cataract treatments, an incision (discission cut) which is several millimeters in length is produced at the edge of the cornea or the sclerocornea, the human crystalline lens is crushed and removed by phacoemulsification and aspiration etc. and what is called viscoelastic material is infused into the capsule of crystalline lens and the capsule is dilated. Next, an intraocular lens insertion apparatus is used to inject an intraocular lens into the eyeball and to arrange the position of the intraocular lens in the eyeball. When the arrangement of the position of the intraocular lens is completed, the infused viscoelastic material is removed from the eyeball.

[0003] Recently, techniques for assisting the

irrigating solution source 2, a driving source 3, a foot pedal 4, an irrigating solution infusion apparatus 5 and an intraocular lens insertion apparatus 6. In addition, the irrigating solution source 2, the driving source 3, the foot pedal 4, the irrigating solution infusion apparatus 5 and the intraocular lens insertion apparatus 6 are connected with the foot pedal 4 via a tube 7a, a tube 7b, a tube 7c and a tube 7d, respectively. On the other hand, the intraocular lens insertion system 101 as illustrated in FIG. 1(b) is provided as a variation of the intraocular lens insertion system 1, and the intraocular lens insertion system 101 includes an irrigating solution source 102, a driving source 103, a foot pedal 104, an irrigating solution infusion apparatus 105 and an intraocular lens insertion apparatus 106. In addition, the irrigating solution source 102 and irrigating solution infusion apparatus 105 are connected with each other via a tube 7g, and the driving source 103 and the intraocular lens insertion apparatus 106 are connected with each other via a tube 7h. Further, the irrigating solution source 102 and the driving source 103 are electrically connected with the foot pedal 104 via a tube (electrical cable) 7e and a tube (electrical cable) 7f, respectively, which have a function of transmitting electrical signals.

[0016] In the intraocular lens insertion system 1, the irrigating solution infusion apparatus 5 is an

as the rightward direction. In this case, the upward direction corresponds to a direction toward a front side along an optical axis of a lens body 8a described later, the downward direction corresponds to a direction toward a rear side along the optical axis of the lens body 8a, the frontward direction corresponds to a direction toward a front side in the pushing direction of the plunger 30, and the rearward direction corresponds to a direction toward a rear side in the pushing direction of the plunger 30.

[0027] A hold member 11 which projects in a plate shape and on which a user hooks the user's fingers when the user pushes the plunger 30 toward the distal end side of the nozzle body 10 is integrally formed on the nozzle body 10 in the vicinity of the rear end member 10b of the nozzle body 10. In addition, the stage member 12 on which the intraocular lens 8 is to be set is formed on the rear end side of the nozzle member 15 of the nozzle body 10. The stage member 12 is configured such that an upper side of the nozzle body 10 is opened by opening the stage lid member 13. Further, the positioning member 50 is mounted on the stage member 12 from below the nozzle body 10. With the use of the positioning member 50, the intraocular lens 8 is stably held on the stage member 12 even before the insertion apparatus 6 is used (during transportation).

[0028] That is, in the intraocular lens insertion

position of the distal end member 10a of the intraocular lens insertion apparatus 6 inserted into the eyeball is appropriate, the user pedals the foot pedal 4 to the second position.

[0044] As a result, the delivery of fluid from the driving source 3 to the intraocular lens insertion apparatus 6 is started by the foot pedal 4. When the foot pedal 4 is pedaled to the second position in the present embodiment, the foot pedal 4 maintains the delivery of irrigating solution from the irrigating solution source 2 to the irrigating solution infusion apparatus 5. Therefore, the infusion of irrigating solution into the eyeball from the irrigating solution infusion apparatus 5 is continued. When fluid is delivered from the driving source 3 to the intraocular lens insertion apparatus 6, the insertion operation of the intraocular lens 8 by the intraocular lens insertion apparatus 6 is started.

[0045] FIG. 5 illustrates an example of the relation between the position of the plunger 30 and the position of the piston 20c of the intraocular lens push assisting apparatus 20 when the intraocular lens 8 is inserted into the eyeball by the intraocular lens insertion apparatus 6. When the user uses the plunger 30 to move the intraocular lens 8 housed in the intraocular lens insertion apparatus 6, the user pedals the foot pedal 4 to deliver fluid with a constant flow from the driving source 3 to

position as illustrated in FIG. 5(b), the delivered fluid drains from the hole 20b to the outside of the tube member 20a. As a result, the piston 20c is not pushed by the fluid thereafter and stops at the position as illustrated in FIG. 5(b). Since the hole 20b is provided for the intraocular lens push assisting apparatus 20 as described above, this configuration can prevent an event in which the piston 20c continues to push the plunger 30 to the side of the distal end member 10a of the nozzle body 10 even when fluid is delivered to the first area 20f by mistake, and prevent, as a result, an event in which the intraocular lens 8 is ejected from the distal end member 10a of the nozzle body 10 despite the user's intentions.

[0049] On the other hand, when the user intentionally pedals the foot pedal 4 to deliver fluid from the driving source 3 to the intraocular lens insertion apparatus 6, it can be assumed that the hole 20b is blocked by the user's hand etc. In this case, when fluid is continued to be delivered to the first area 20f after the piston 20c moves to the position as illustrated in FIG. 5(b), the delivered fluid does not drain from the hole 20b to the outside of the tube member 20a. As a result, when the delivery of fluid to the first area 20f is maintained, the piston 20c is continuously pushed by fluid and moves to the side of the distal end member 10a of the nozzle body beyond the position as illustrated in FIG. 5(b). And the plunger 30 is pushed

and moved by the piston 20c to move the intraocular lens 8 further to the side of the distal end member 10a of the nozzle body 10.

[0050] When the piston 20c moves further to the side of the distal end member 10a of the nozzle body beyond the position as illustrated in FIG. 5(b), the user can releases the user's hand from the hole 20b to allow the delivered fluid to drain from the hole 20b and stop the movement of the piston 20c. Therefore, the user can control the movement of the piston 20c by blocking the hole 20b by the user's hand and releasing the user's hand from the hole 20b. With this configuration, the user does not need to handle the plunger by the user's finger and can concentrate on tasks and treatments including the adjustment of the position of the nozzle body 10 in relative to the incision.

[0051] In addition, when the foot pedal 4 is pedaled to deliver fluid with a constant flow into the intraocular lens push assisting apparatus 20, the piston 20c and furthermore the plunger 30 can be moved at a constant speed. Therefore, the intraocular lens insertion system 1 employing the intraocular lens insertion apparatus 6 according to the present embodiment achieves a more stable ejection of the intraocular lens into the eyeball than a conventional intraocular lens insertion system. In addition, since a more stable movement of the intraocular lens can also