

Aug. 25, 1953

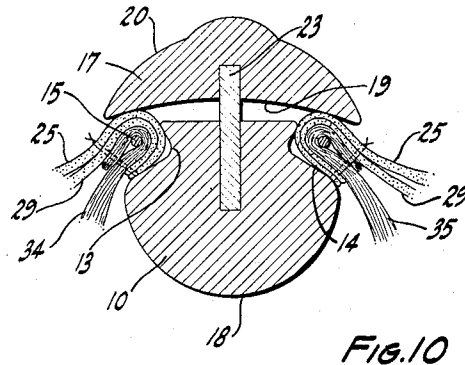
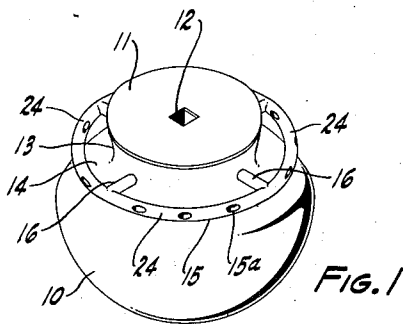
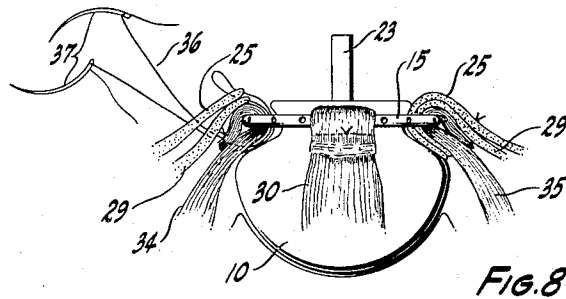
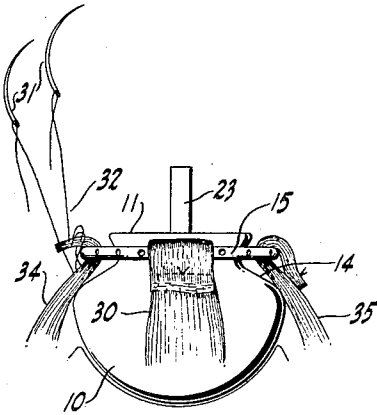
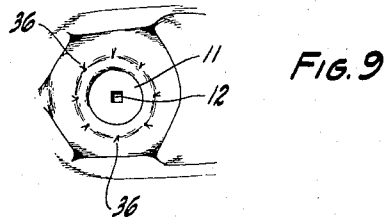
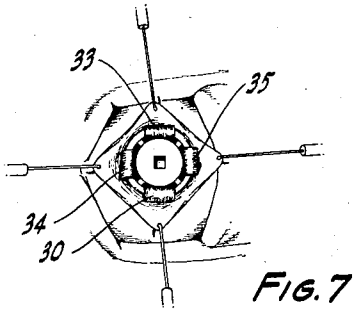
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EYE IMPLANT AND PROSTHESIS

Filed Dec. 9, 1946

2 Sheets-Sheet 1



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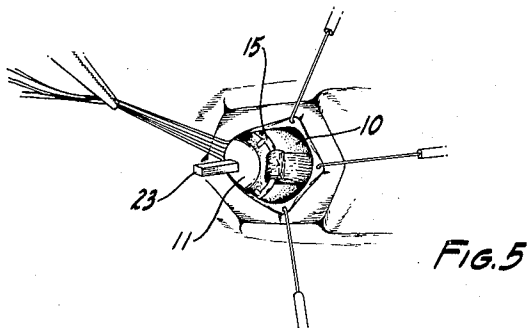
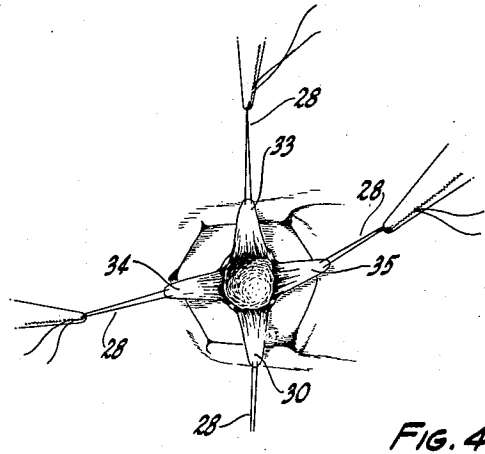
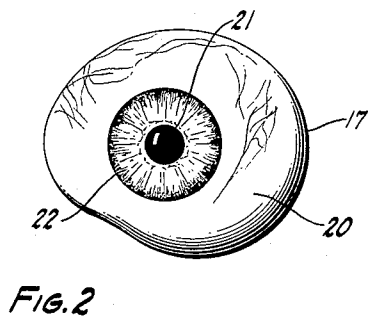
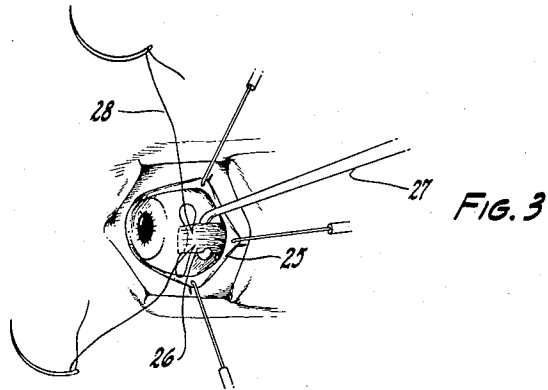
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EYE IMPLANT AND PROSTHESIS

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EYE IMPLANT AND PROSTHESIS

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17 Claims. (Cl. 3—13)

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The present invention relates to eye implants and prostheses adapted to simulate, and serve as a substitute in appearance, for the natural eyeball.

Previous implants have been totally enclosed within the Tenon's capsule and conjunctiva, or, in the case of evisceration, within the sclera and conjunctiva. Under these circumstances, the available conjunctiva left to permit the prosthesis to rotate in the fornices was diminished from the natural eye by the area occupied by the cornea. In addition, part of the support for the prosthesis was furnished by the lower eyelid, resulting in sagging of the latter member. Prevention of the sinking of the upper eyelid was normally accomplished by making the artificial eye of a diameter larger than the natural eye diameter, which created an unnatural appearance because of the dissimilar sizes of the two eyes.

It is, accordingly, an object of the present invention to provide an eye implant and prosthesis providing a wide range and spontaneity of movement, eliminating sagging of the lower lid, and minimizing sinking of the upper lid.

Another object of the invention is to provide an eye implant and prosthesis of such design as to avoid diminution in the available conjunctiva, in order that the prosthesis may rotate in the fornices to substantially the same extent as a natural eye.

A further object of the invention resides in the provision of an improved method of placing an artificial eye in a socket from which the natural eye has been removed.

In its general aspects, the implant is designed for attachment to the four rectus muscles, the Tenon's capsule and the conjunctiva, and is positively connectable by mechanical means to the prosthesis. The anterior face of the implant is exposed to avoid diminishing the fornices, and this face is mechanically connected to the prosthesis to effect transmission of the movement of the implant to the latter, providing a wide range and spontaneity of movement to the prosthesis in response to movement of the eye muscles. The prosthesis is supported directly by the implant, thus preventing sagging of the lower lid, and it also overlaps the muscles, Tenon's capsule and conjunctiva, permitting it to be of such size as to greatly diminish or prevent sinking in of the upper lid.

The invention possesses other advantageous features, some of which, together with the foregoing, will be set forth at length in the following

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description of an embodiment of the invention illustrated in the drawings accompanying and forming part of the present specification. Although only one form of the invention is shown in the drawings, it is to be understood that the invention is not limited to such form, since the invention as set forth in the claims may be embodied in a plurality of forms.

Referring to the drawings:

Fig. 1 is an isometric projection of an eye implant.

Fig. 2 is a front elevation of the implant and prosthesis.

Figs. 3 to 10, inclusive, are views depicting the operational procedure for securing the implant in the eye socket and the prosthesis to the implant.

The implant disclosed in the drawings includes a general spheroidal or spherical body 10, having a flat anterior face 11 provided with a square or other suitably shaped axial socket 12. The body converges inwardly from the peripheral margin of the anterior face 11 to form an annular groove or neck portion 13 in conjunction with an outwardly converging body portion 14 extending from the transverse great circle of the spherical body.

A metal ring 15, to which the four rectus muscles of the eye are attachable, is secured to the narrowed neck 13 of the body, as by means of radial spokes 16 fixed to and extending between the ring 15 and body.

The maximum diameter of the sphere 10 is substantially the same as the diameter of the space, such as the Tenon's space, in which the implant is to be inserted, while the diameter of the attachment ring 15 is approximately the same as the diameter of the eye at the insertion of the recti. The maximum diameter of the body is such as to allow the prosthesis 17 to overlap when fitted and still not be larger than the normal eye. The antero-posterior distance from the anterior face 11 of the body to the rear 18 of the body is smaller than its maximum diameter, to allow space in front of the implant for the prosthesis.

The prosthesis 17 is formed to simulate the natural eye of the person on whom it is to be attached, and is of a size, as indicated above, greater than the maximum diameter of the implant 10, in order to overlap the latter when connected thereto. The inner face 19 of the prosthesis is concave, and its outer face 20 is convex, containing a central cornea 21 under which an iris 22 is depicted. The prosthesis 17 is adapted

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to be removably attached or coupled to the body 10, in order that movement of the body may be transmitted to it. As illustrated in the drawings, such attachment may be obtained by securing a central pin 23 in the rear of the prosthesis adapted to extend snugly within the body socket 12. The pin and socket may have any suitable complementary shape, the cross-section on the drawings of the two parts being square. It is apparent that movement of the implant 10 in any direction, as well as its rotation, is transmittable directly to the prosthesis 17.

As an example of a design of an implant, a sphere made of methyl methacrylate, or other suitable material, has a maximum transverse diameter of 20 mm., and is narrowed anteriorly to provide a neck or grooved portion 13 around which a ring 15 of gold or other suitable material may be placed, whose outside diameter is approximately 19 mm. Four equi-distant gold spokes 16 extend inwardly between the ring and body neck, being placed in alignment with the flat sides of the body socket 12, providing four arcuate ring segments 24 to which the rectus muscles are attachable. The antero-posterior distance is approximately 15 to 16 mm. The ring forms a continuous bar extending entirely around the implant.

The implant and prosthesis may be attached in the person's socket by means of an operational procedure now to be described. The procedure may be performed under local anaesthesia, as in the case of any enucleation. After routine preparation of the field, a Week's speculum is inserted and the conjunctiva 25 is incised at the limbus with Stevens scissors and the dissection carried well back to the fornices. One of the rectus muscles 26 is then picked up with a muscle hook 27, and isolated as in muscle operation. A single armed 00 black silk suture 28 is passed through the tendon and the muscle cut from its insertion (Fig. 3). This procedure is then repeated for the other three rectus muscles, the enucleation is then completed in the usual manner and the eye delivered (Fig. 4).

The Tenon's capsule 29 is inspected by holding the margins forward with fine-toothed forceps, and the implant 10 is then put into the Tenon's space (Fig. 5). The gold prosthesis pin 23, or duplicate thereof, is placed in the implant socket 12, to enable the assistant to hold the implant in place by grasping the pin with Kelly forceps. Four silk muscle sutures are now passed through the ring 15 from below upwards in their proper place. The tendon of the inferior rectus 30 is grasped with Von Graefe fixation forceps and traction made until there is approximately 4 mm. of the muscle through the ring. Both needles 31 of a double-armed 3-0 black nylon mattress suture 32 with one-half inch curved needles are passed through the muscle just below the ring 15 in an upward direction. Both needles are then passed through the tendon. The fixation forceps are then given to the assistant, who holds the muscle downward so that the muscle is looped around the ring (Figs. 5 and 6). The suture is now triple-tied and cut, and the fixation forceps and original black silk suture removed. This procedure results in the muscle being looped around the ring from below in an upward direction and tied upon itself. The superior, external and internal rectus muscles 33, 34, 35 are sutured in a similar manner (Fig. 7). Holes 15a may be provided in the ring 15 through which tissue may

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grow, securing the muscles more firmly to the implant.

Five to eight double-armed 6-0 black silk sutures 36 are now passed through the conjunctival edge from without inwards, and in the same direction through a firm part of the anterior edge of the Tenon's capsule 29. Both needles 37 are then carried under the ring 15 and out through Tenon's capsule 29 and conjunctiva 25 (Fig. 8). When these sutures 36 are pulled and tied, the Tenon's capsule and conjunctiva are rolled inwards around the ring upon themselves, the central part of the implant remaining exposed (see Fig. 9 and right portion of Fig. 8).

The pin 23 is now removed from the socket and a small amount of Vaseline gauze placed inside the eyelids and an adhesive dressing (Wheeler patch) applied. The conjunctival-Tenon sutures 36 are removed on about the twelfth day, or whenever convenient, and the patient is ready for fitting of the prosthesis 17 within from eighteen to twenty-one days.

The pin 23 is attached in the rear portion of the prosthesis 17 and placed within the socket 12 in the anterior face 11 of the implant body 10, with the artificial eye disposed properly within the upper and lower eyelids. The iris 22 should be carefully centered at the time of manufacture of the eye 17, and the diameter of the eye 17 should conform as nearly as possible to the diameter of the other natural eye, for otherwise the rotation of the eye would be unnatural in extreme positions, leaving either a space between the eye and lids, or between the eye and the socket. The artificial eye 17 should, preferably, be trimmed down, prior to its attachment to the implant 10, to a size in which it is just large enough to stay inside the lids and prevent an edge from showing upon its extreme movement to the right or left.

From the foregoing description, it is apparent that the implant 10 is securely attached to the four rectus muscles 30, 33, 34, 35, which may rotate the eye 10, 17 in all directions. These muscles, as well as the Tenon 29 and conjunctiva 25 provide full support for the implant 10 and, correspondingly, give full support for the prosthesis 17 coupled to the implant. As a result, the implant and prosthesis have a wide range and spontaneity of movement, sagging of the lower lid is eliminated, and sinking in of the upper lid minimized to a great extent. In general, since the eye is supported in much the same manner as a natural eye, and since it is made of substantially the same size and possesses the same external physical characteristics as the other eye, a natural appearance and natural movement are obtained.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed and having an antero-posterior distance substantially less than said great circle diameter, rectus muscle attachment means comprising a continuous bar extending entirely around the body, secured to said body between said great circle and the anterior face of said body, and a separate eye prosthesis shell having a diameter larger than the body removably secured to and overlying the anterior face of said body.

2. An artificial eye, including a generally spheroidal body having a transverse great circle whose

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diameter is substantially the same as the eye socket in which said body is to be placed and having an antero-posterior distance substantially less than said great circle diameter, a ring secured to said body between said great circle and the anterior face of said body, said ring being substantially parallel to said great circle and of a lesser diameter than said great circle, and an eye prosthesis removably secured to said body and overlapping the anterior face of said body.

3. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed and having an antero-posterior distance substantially less than said great circle diameter, said body having an anterior face and a peripheral groove between said face and said great circle, a ring to which rectus muscles are attachable encompassing said groove and secured to said body in spaced relation with respect thereto, and an eye prosthesis removably secured to said body and overlapping its anterior face.

4. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed, rectus muscle attachment means secured to said body between said great circle and the anterior face of said body, an eye prosthesis overlying the anterior face of said body, and cooperable axially arranged pin and socket means on said prosthesis and anterior face of said body for removably securing said prosthesis and body together.

5. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed, said body having an anterior face and a peripheral groove between said face and said great circle, a ring to which rectus muscles are attachable encompassing said groove and secured to said body in spaced relation with respect thereto, an eye prosthesis removably secured to said body and overlapping its anterior face, and cooperable axially arranged pin and socket means on said prosthesis and anterior face of said body for rotatably coupling said prosthesis and body together.

6. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed, a ring secured to said body between said great circle and the anterior face of said body, said ring having holes therethrough and being generally parallel to said great circle, and an eye prosthesis secured to said body and overlying the anterior face of said body.

7. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed and having an antero-posterior distance substantially less than said great circle diameter, said body having a flat anterior face whose peripheral diameter is substantially less than the maximum transverse diameter of said body, a ring secured to said body between said great circle and said anterior face, said ring having a greater diameter than said face, an eye prosthesis overlapping said anterior face, said prosthesis having an exterior simulating the cornea and iris of a natural eye and having an interior concave surface, said body having an axial socket extending inwardly from said face, and an axial pin secured to the in-

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terior of said prosthesis and adapted to fit within said socket.

8. An artificial eye, including a generally spheroidal body having a transverse great circle whose diameter is substantially the same as the eye socket in which said body is to be placed and having an antero-posterior distance substantially less than said great circle diameter, said body having a flat anterior face whose peripheral diameter is substantially less than the maximum transverse diameter of said body, said body also having a peripheral groove between said body and said great circle, a ring to which rectus muscles are attachable encompassing said groove and secured to said body in spaced relation with respect thereto, said ring having a greater diameter than said face, an eye prosthesis overlapping said anterior face, said prosthesis having an exterior simulating the cornea and iris of a natural eye and having an interior concave surface, said body having an axial socket extending inwardly from said face, and an axial pin secured to the interior of said prosthesis and adapted to fit within said socket.

9. An artificial eye, including a body shaped to fit an eye socket in which said body is to be placed and having a ring, for attachment of the rectus muscles thereto, secured to said body, an eye prosthesis and means for holding it on the body.

10. In an integrated artificial eye adapted to be associated with and controlled by ocular structure of a living being, an implant having a posterior portion increasing in size forwardly from its posterior extremity toward its anterior extremity and a recess in said anterior portion for receiving an anterior portion of said ocular structure, and a form attached to said anterior portion of said implant forwardly of said recess.

11. In an integrated artificial eye adapted to be associated with and controlled by ocular structure of a living being, an implant having a substantially spherical posterior portion, a tapered anterior portion, a bar surrounding said tapered anterior portion and spaced therefrom, arms connecting said bar to said anterior portion and providing separated spaces between said anterior portion and said bar for the reception of the recti and fascia, and a form connected with the anterior face of said anterior portion.

12. An artificial eye comprising a generally spheroidal implant for emplacement in the natural eye socket of a human being with an anterior portion of the implant facing out of the eye socket, said implant having on its anterior portion an outwardly projecting muscle attachment means extending continuously around the implant for the attachment of the separate live eye moving muscles in said socket, and a separate eye prosthesis removably secured to the anterior portion of said orb by a pin and socket connection.

13. An artificial eye comprising a generally spheroidal implant for emplacement in the natural eye socket of a human being with an anterior portion of the implant facing out of the eye socket, said implant having on its anterior portion an outwardly projecting muscle attachment means extending continuously around the implant, and a separate eye prosthesis removably secured to the anterior portion of said orb, said prosthesis being in the form of a shell that covers and hides the orb and its exposed muscle attachment means.

14. An artificial eye implant including a generally spheroidal body for emplacement in the natural eye socket of a human being, said body carrying an outwardly projecting bar extending

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continuously entirely around it, for the attachment of the separate live eye moving muscles in said socket.

15. An artificial eye implant including an orb for emplacement in the natural eye socket of a human being, said orb carrying an eye muscle attachment ring extending around it.

16. An artificial eye implant including a generally spheroidal body for emplacement in the natural eye socket of a human being, said body carrying outwardly projecting muscle attachment means extending continuously around it, for the attachment of the separate live eye moving muscles in said socket, and a pin-receiving socket in the anterior portion of the body for detachably receiving a prosthesis and moving it as the body is moved by the muscles.

17. An artificial eye implant including a generally spheroidal body for emplacement in the natural eye socket of a human being, said body carrying an outwardly projecting muscle attachment bar extending continuously around it, for

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the attachment of the separate live eye moving muscles in said socket, and a pin-receiving socket in the anterior portion of the body for detachably receiving a prosthesis and moving it as the body is moved by the muscles.

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