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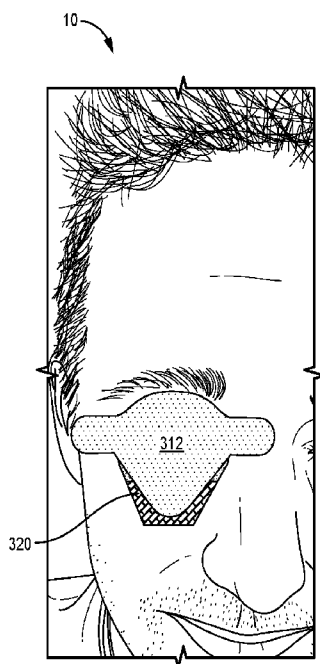


FIG. 5B

(57) Abstract: This disclosure relates to a device, and related systems and methods, for treating exposure keratopathy by way of administering an upper member and lower member to the afflicted eye region of the patient. The upper member and lower member may then be reversibly fastened together to completely and durably close the eyelids to preserve eye health.



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CLOSURE DEVICE AND RELATED SYSTEMS AND METHODS

CROSS-REFERENCES & RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 63/523,207 filed June 26, 2023, and entitled CLOSURE DEVICE AND RELATED SYSTEMS AND METHODS which is hereby incorporated by reference in its entirety under 35 U.S.C. §119(e).

TECHNICAL FIELD

[0002] The disclosure relates to medical devices generally and ocular devices specifically.

BACKGROUND

[0003] The medical term encompassing all forms of damage to the cornea due to incomplete eyelid closure is exposure keratopathy. If the eye is left unprotected because the eyelids are incompletely closed, the corneal epithelial cells dry out, break down, and slough off, causing a corneal abrasion, which can cause reversible vision loss, and if inflamed or infected, irreversible vision loss. Corneal abrasions do not heal in the context of persistent exposure, which, in turn, cause the abrasion to worsen into a sterile corneal melt or worse, an infectious microbial keratitis, both of which can cause severe, permanent vision loss that is reparable only with a corneal transplant.

[0004] Exposure keratopathy can occur in many settings but is most frequent in the context of obtunded and sedated patients, intubated and sedated patients, and paralyzed and sedated patients in the intensive care unit (ICU) or in the operating theatre. ICUs may include neuro, surgical, medical, cardiovascular, pediatric, neonatal, and veterinary ICUs. The morbidity of exposure keratopathy is highest in the intensive care unit because patients are sedated/intubated for long stretches of time (days to months).

[0005] Problematically, current methods of preventing exposure keratopathy and iatrogenic eye injury are insufficient. There are three common methods of protecting the eyes of sedated ICU patients, namely: 1) manually closing the eyes, 2) taping the eyes

closed; and 3) fashioning lubricant-filled moisture chambers over the eyes. Taping the eyelids closed has a high risk of incomplete eyelid closure because of poor tape adhesion and because of operator error (it is difficult to apply a band of tape to the eyelids and achieve complete closure). Moisture chambers, by virtue of employing large occlusive skin dressings, improve eyelid closure but they are also subject to operator error and adhesive limitations; moisture chambers are also labor intensive because they are not easily reversible without remaking a new moisture chamber.

[0006] Both tape and moisture chambers are significantly limited by two customary practices in the intensive care unit: 1) the application of either or both liquid or oily ocular lubricants, which have a tendency to reduce the efficacy of adhesives found in tape and occlusive skin dressings; and 2) pupil examinations performed at least once every 12 hours but sometimes as frequently as every 1-2 hours. After the first application of a piece of tape or a moisture chamber, serial applications typically require fastidious cleanup of the skin to remove all of the oils and moisture from the prior application to promote a good bond of the tape or occlusive skin dressing adhesive in subsequent applications. Repeated removal of adhesives from the periocular skin can lead to injury of the skin, which is the thinnest and most delicate skin on the entire body. [0007] What is needed are systematic, efficient, and reliable methods, systems, and apparatuses for ocular closure support.

BRIEF SUMMARY OF THE INVENTION

[0008] Described herein are various implementations relating to devices, systems and methods for the patching of an eye using an ocular closure support device to prevent exposure keratopathy.

[0009] Example 1 is an ocular closure support device comprising an upper member constructed to adhere to a supraorbital rim of a patient; and a lower member constructed to adhere to an infraorbital rim of the patient, wherein the upper member is configured to reversibly fasten to the lower member.

[0010] Example 2 shows Examples 1 and 3-10, wherein the upper member comprises an upper eyelid adhesive.

[0011] Example 3 shows Examples 1-2 and 4-10, wherein the upper member further comprises one or more non-adhesive touch points that are not covered by upper eyelid adhesive.

[0012] Example 4 shows Examples 1-3 and 5-10, wherein there are three non-adhesive touch points.

[0013] Example 5 shows Examples 1-4 and 6-10, wherein the lower member comprises a lower eyelid adhesive.

[0014] Example 6 shows Examples 1-5 and 7-10, wherein further comprising a posterior release liner in contact with the upper eyelid adhesive.

[0015] Example 7 shows Examples 1-6 and 8-10, further comprising a release liner in contact with the lower eyelid adhesive.

[0016] Example 8 shows Examples 1-7 and 9-10, wherein one of the one or more non-adhesive touch points is a handle.

[0017] Example 9 shows Examples 1-8 and 10, wherein two of the one or more non-adhesive touch points are non-adhesive tabs.

[0018] Example 10 shows Examples 1-9, wherein the ocular closure support device is configured to create a moisture chamber when the upper member is reversibly fastened to the lower member.

[0019] Example 11 is An ocular closure support device, comprising an upper member having an upper edge conforming to a least a portion of a supraorbital rim and upper eyelid regions of a patient, a lower edge, a medial edge, a lateral edge, and an adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the upper member to the supraorbital rim and upper eyelid regions of the patient, a lower member having an upper edge conforming to at least a portion of the infraorbital rim and lower eyelid regions of a patient, a lower edge, a medial edge, a lateral edge, and an adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the lower member to the infraorbital rim and lower eyelid regions of the patient, wherein a width of the upper edge of the lower member is greater than a width of the lower edge of the lower member, wherein a width of the upper edge of the upper member is greater than a width of the lower edge of the upper member, wherein the lower edge of the upper member is part of a lower portion

of the upper member having a surface configured to releasably engage with the lower member for palpebral closure and opening.

[0020] Example 12 shows Examples 11 and 12-34, wherein the medial edge conforms to a region medial to a medial canthus of the patient.

[0021] Example 13 shows Examples 11-12 and 13-34, wherein the medial edge conforms to a nose of the patient.

[0022] Example 14 shows Examples 11-13 and 14-34, wherein the lateral edge conforms to a region lateral to a lateral canthus of the patient.

[0023] Example 15 shows Examples 11-14 and 16-34, wherein the lower edge of the upper member is part of a connecting piece coupled superiorly to an extension, wherein the connecting piece is configured to releasably attach to the lower member, wherein the upper edge of the lower member is reversibly adhered to the infraorbital rim and lower eyelid regions of the patient, wherein the upper edge of the upper member is reversibly adhered to the supraorbital rim and upper eyelid regions of the patient.

[0024] Example 16 shows Examples 11-15 and 17-34, wherein the lower edge of the upper member is part of a flap configured to reversibly engage with the lower member.

[0025] Example 17 shows Examples 11-16 and 18-34, wherein the lateral edge and/or medial edge of the ocular closure device comprise tabs.

[0026] Example 18 shows Examples 11-17 and 19-34, wherein the tabs are non-adhesive touchpoints configured to be grabbed for one or more of: positioning the upper member on the supraorbital rim and upper eyelid regions of the patient, anchoring the transverse projection of the medial edge to a nose of the patient, and removing the device from the skin of the patient.

[0027] Example 19 shows Examples 11-18 and 20-34, wherein a removable low-tack carrier is affixed over the lower member, wherein the removable low-tack carrier is configured for grabbing and positioning the lower member on the patient, wherein the removable low-tack carrier is removable from the lower member after applying a skin adhesive of the lower member to the infraorbital rim and lower eyelid regions of the patient.

[0028] Example 20 shows Examples 11-19 and 21-34, wherein a textured surface of at least a portion of the flap of the upper member is configured to reversibly fasten to a counterpart textured surface of at least a portion of a lower portion of the lower member.

[0029] Example 21 shows Examples 11-20 and 22-34, wherein the adhesive backing comprises one or more of: silicone, hydrogel, and acrylic.

[0030] Example 22 shows Examples 11-21 and 23-34, wherein the adhesive backing of the upper member and/or lower member is affixed to a removable release liner.

[0031] Example 23 shows Examples 11-22 and 24-34, wherein the removable release liner is larger than the upper member and/or lower member.

[0032] Example 24 shows Examples 11-23 and 25-34, wherein the removable release liner is a two-piece release liner affixed to the upper member, wherein a vertical line separates the two pieces of the removable release liner, wherein one or both of the two pieces of the removable release liner may be removed by peeling toward the vertical line.

[0033] Example 25 shows Examples 11-24 and 26-34, wherein the upper and/or lower member are reversibly connected via a fastener including one or more of: hook and loop, snap, button, clasp, buckle, zipper, magnet, and string.

[0034] Example 26 shows Examples 11-25 and 27-34, wherein the lower portion of the upper member having the surface configured to releasably engage with the lower member for a palpebral closure exerts a reversible downward tension on the supraorbital rim and upper eyelid regions of the patient when engaged with the lower member, resulting in palpebral closure and moisture chamber formation over a interpalpebral fissure.

[0035] Example 27 shows Examples 11-26 and 28-34, wherein the reversible downward tension and palpebral closure is reversible by disengaging the surface of the lower portion of the upper member from the lower member.

[0036] Example 28 shows Examples 11-27 and 29-34, wherein at least a portion of the upper member is transparent and configured to visualize one or more of an eye of the patient and palpebral closure status.

[0037] Example 29 shows Examples 11-28 and 30-34, further comprising an aperture on the upper member, wherein the aperture is overlaid on a palpebral fissure of the

patient, wherein the aperture is configured to transmit treatment to an eye of the patient, wherein the treatment is injected fluid.

[0038] Example 30 shows Examples 11-29 and 31-34, wherein the upper member and/or lower member further comprising one or more layers, including one or more of: structural, skin adhesive, fastener, non-adhesive, release liner, low tack adhesive carrier, and structural adhesive layers.

[0039] Example 31 shows Examples 11-30 and 32-34, wherein one or more of the layers are at least partially transparent.

[0040] Example 32 shows Examples 11-31 and 33-34, further comprising perforated portions of the upper member and/or lower member, wherein the perforated portions are configured to be separated from the upper member and/or lower member.

[0041] Example 33 shows Examples 11-32 and 34, wherein the device is ambidextrous for use with a right or left eye of the patient.

[0042] Example 34 shows Examples 11-33, further comprising graphical and/or text instructions for using the device.

[0043] Example 35 is an ocular closure support device according to any of the above claims, further comprising a moisture chamber over an interpalpebral fissure of the patient, the moisture chamber bounded superiorly at least in part by the lower portion of the upper member and bounded inferiorly at least in part by an upper portion of the lower member when the upper member is releasably engaged with the lower member.

[0044] Example 36 is a method of using an ocular closure support device, the method comprising exposing an adhesive backing of a medial side of the ocular closure support device; applying the medial side of the ocular closure support device to the medial aspect of an eyelid of a patient; reversibly anchoring an edge of the medial side of the ocular closure support device to a nose of a patient; exposing an adhesive backing of a lateral side of the ocular closure support device; and pressing from the medial side to an edge of the lateral side of the ocular closure support device over an eyelid of the patient.

[0045] Example 37 shows Example 36, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

[0046] Example 38 is A method of using an ocular closure support device, the method comprising: exposing an adhesive backing of the ocular closure support device; reversibly adhering the ocular closure device to an eyelid of a patient; and pressing from a medial side to an edge of a lateral side of the ocular closure support device.

[0047] Example 39 shows Examples 38 and 40, wherein the eyelid is an upper eyelid or a lower eyelid of the patient.

[0048] Example 40 shows Examples 38 and 39, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

[0049] Example 41 is a method of using an ocular closure support device, the method comprising: reversibly adhering a medial side of an upper member of the ocular closure support device to a skin of a medial aspect of the supraorbital rim and upper eyelid regions of a patient; reversibly anchoring a medial edge of the upper member of the ocular closure support device to a region medial to a medial canthus of the patient; reversibly affixing a lateral side of the upper member of the ocular closure support device to a skin of a lateral aspect of the supraorbital rim and upper eyelid regions of the patient; reversibly affixing a lower member of the ocular closure support device to a skin of the infraorbital rim and lower eyelid regions of the patient; and reversibly engaging a lower portion of the upper member with the lower member.

[0050] Example 42 shows Examples 41 and 43-47, further comprising decoupling the lower portion of the upper member from the lower member to inspect or treat an eye of the patient covered by the ocular closure support device.

[0051] Example 43 shows Examples 41-42 and 44-47, further comprising inspecting an eye of the patient and/or palpebral closure status via at least a portion of the upper member of the ocular closure support device being transparent

[0052] Example 44 shows Examples 41-43 and 45-47, wherein the ocular closure support device is placed and removed without disrupting a line of sight of the patient

[0053] Example 45 shows Examples 41-44 and 46-47, further comprising reversibly closing an upper eyelid of the patient via applied downward tension from the lower portion of the upper member of the ocular closure support device reversibly engaging with the lower member of the ocular closure support device.

[0054] Example 46 shows Examples 41-45 and 47, further comprising reversibly engaging with the lower member of the ocular closure support device to form a moisture chamber over a interpalpebral fissure.

[0055] Example 47 shows Examples 41-46, further comprising treating an eye of the patient via injecting fluid through an aperture on the upper member of the ocular closure support device, wherein the aperture is overlaid on a palpebral fissure of the patient.

[0056] Example 48 is an ocular closure support device for use with a patient, comprising: an upper member, comprising: an upper member upper edge conforming to a least a portion of a supraorbital rim and upper eyelid regions of a patient: an upper member lower edge; an upper member medial edge; an upper member lateral edge; and an upper member adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the upper member to the supraorbital rim and upper eyelid regions of the patient; a lower member, comprising: a lower member upper edge conforming to at least a portion of the infraorbital rim and lower eyelid regions of a patient; a lower member lower edge; a lower member medial edge; a lower member lateral edge; and a lower member adhesive backing on at least the upper edge configured to releasably adhere at least the lower member upper edge to the infraorbital rim and lower eyelid regions of the patient, wherein: a width of the lower member upper edge is greater than a width of the lower member lower edge, a width of the upper member upper edge is greater than a width of the upper member lower edge, and the upper member lower edge is part of a lower portion of the upper member having a surface configured to releasably engage with the lower member for palpebral closure and opening.

[0057] Example 49 shows Examples 48 and 50-74, wherein the medial edge conforms to a region medial to a medial canthus of the patient.

[0058] Example 50 shows Examples 48-49 and 51-74, wherein the medial edge conforms to a nose of the patient.

[0059] Example 51 shows Examples 48-50 and 52-74, wherein the lateral edge conforms to a region lateral to a lateral canthus of the patient.

[0060] Example 52 shows Examples 48-51 and 53-74, wherein the upper member lower edge is part of a connecting piece coupled superiorly to an extension, the connecting

piece is configured to releasably attach to the lower member, the upper edge of the lower member is reversibly adhered to the infraorbital rim and lower eyelid regions of the patient, and the upper edge of the upper member is reversibly adhered to the supraorbital rim and upper eyelid regions of the patient.

[0061] Example 53 shows Examples 48-52 and 54-74, wherein the lateral edge and/or medial edge of the ocular closure device comprise tabs.

[0062] Example 54 shows Examples 48-53 and 55-74, wherein the tabs are non-adhesive touchpoints configured to be grabbed for one or more of: positioning the upper member on the supraorbital rim and upper eyelid regions of the patient, anchoring the transverse projection of the medial edge to a nose of the patient, and removing the device from the skin of the patient.

[0063] Example 55 shows Examples 48-54 and 56-74, wherein a removable low-tack carrier is affixed over the lower member, wherein the removable low-tack carrier is configured for grabbing and positioning the lower member on the patient, wherein the removable low-tack carrier is removable from the lower member after applying a skin adhesive of the lower member to the infraorbital rim and lower eyelid regions of the patient.

[0064] Example 56 shows Examples 48-55 and 57-74, wherein the adhesive backing comprises one or more of: silicone, hydrogel, and acrylic.

[0065] Example 57 shows Examples 48-56 and 58-74, wherein the adhesive backing of the upper member and/or lower member is affixed to a removable release liner.

[0066] Example 58 shows Examples 48-57 and 59-74, wherein the removable release liner is larger than the upper member and/or lower member.

[0067] Example 59 shows Examples 48-58 and 60-74, wherein the removable release liner is a two-piece release liner affixed to the upper member, wherein a vertical line separates the two pieces of the removable release liner, wherein one or both of the two pieces of the removable release liner may be removed by peeling toward the vertical line.

[0068] Example 60 shows Examples 48-59 and 61-74, wherein the upper and/or lower member are reversibly connected via a fastener.

[0069] Example 61 shows Examples 48-60 and 62-74, wherein the fastener is a hook and loop, a snap, a button, a clasp, a buckle, a zipper, a magnet, or string.

[0070] Example 62 shows Examples 48-61 and 63-74, wherein the upper member lower portion is configured such that the surface can releasably engage with the lower member for a palpebral closure exerts a reversible downward tension on the supraorbital rim and upper eyelid regions of the patient when engaged with the lower member, resulting in palpebral closure and moisture chamber formation over a interpalpebral fissure.

[0071] Example 63 shows Examples 48-62 and 64-74, wherein the reversible downward tension and palpebral closure is reversible by disengaging the surface of the lower portion of the upper member from the lower member.

[0072] Example 64 shows Examples 48-63 and 65-74, herein at least a portion of the upper member is transparent and configured to visualize one or more of an eye of the patient and palpebral closure status.

[0073] Example 65 shows Examples 48-64 and 66-74, further comprising an aperture defined on the upper member, wherein the aperture is overlaid on a palpebral fissure of the patient and is configured to transmit injected fluid to an eye of the patient.

[0074] Example 66 shows Examples 48-65 and 67-74, wherein the upper member and/or lower member further comprising one or more layers, including one or more of: structural, skin adhesive, fastener, non-adhesive, release liner, low tack adhesive carrier, and structural adhesive layers.

[0075] Example 67 shows Examples 48-66 and 68-74, wherein one or more of the layers are at least partially transparent.

[0076] Example 68 shows Examples 48-67 and 69-74, further comprising perforated portions of the upper member and/or lower member, wherein the perforated portions are configured to be separated from the upper member and/or lower member.

[0077] Example 69 shows Examples 48-68 and 70-74, wherein the device is configured for ambidextrous use with either a right or a left eye of the patient.

[0078] Example 70 shows Examples 48-69 and 71-74, further comprising graphical and/or text instructions for using the device.

[0079] Example 71 shows Examples 48-70 and 72-74, wherein the ocular closure support device is configured to create a moisture chamber when the upper member is reversibly fastened to the lower member.

[0080] Example 72 shows Examples 48-71 and 73-74, wherein the moisture chamber is at least partially bounded superiorly at least in part by the upper member lower portion and is at least partially bounded inferiorly by the lower member upper portion when the upper member is releasably engaged with the lower member.

[0081] Example 73 shows Examples 48-72 and 74, wherein the upper member lower edge is part of a flap configured to reversibly engage with the lower member.

[0082] Example 74 shows Examples 48-73 wherein a textured surface of at least a portion of the flap of the upper member is configured to reversibly fasten to a counterpart textured surface of at least a portion of a lower portion of the lower member.

[0083] Example 75 is a method of using an ocular closure support device, comprising: exposing an adhesive backing of a medial side of the ocular closure support device; applying the medial side of the ocular closure support device to the medial aspect of an eyelid of a patient; reversibly anchoring an edge of the medial side of the ocular closure support device to a nose of a patient; exposing an adhesive backing of a lateral side of the ocular closure support device; and pressing from the medial side to an edge of the lateral side of the ocular closure support device over an eyelid of the patient

[0084] Example 76 shows Example 75, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

[0085] Example 77 is A method of using an ocular closure support device, comprising exposing an adhesive backing of the ocular closure support device; reversibly adhering the ocular closure device to an eyelid of a patient; and pressing from a medial side to an edge of a lateral side of the ocular closure support device.

[0086] Example 78 shows Example 77 and 79, wherein the eyelid is an upper eyelid or a lower eyelid of the patient.

[0087] Example 79 shows Example 77 and 78, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

[0088] Example 80 is a method of using an ocular closure support device, comprising reversibly adhering a medial side of an upper member of the ocular closure support

device to a skin of a medial aspect of the supraorbital rim and upper eyelid regions of a patient; reversibly anchoring a medial edge of the upper member of the ocular closure support device to a region medial to a medial canthus of the patient; reversibly affixing a lateral side of the upper member of the ocular closure support device to a skin of a lateral aspect of the supraorbital rim and upper eyelid regions of the patient; reversibly affixing a lower member of the ocular closure support device to a skin of the infraorbital rim and lower eyelid regions of the patient; and reversibly engaging a lower portion of the upper member with the lower member.

[0089] Example 81 shows Examples 80 and 82-86, further comprising decoupling the lower portion of the upper member from the lower member to inspect or treat an eye of the patient covered by the ocular closure support device.

[0090] Example 82 shows Examples 80-81 and 83-86, further comprising inspecting an eye of the patient and/or palpebral closure status via at least a portion of the upper member of the ocular closure support device being transparent.

[0091] Example 83 shows Examples 80-82 and 84-86, wherein the ocular closure support device is placed and removed without disrupting a line of sight of the patient.

[0092] Example 84 shows Examples 80-83 and 85-86, further comprising reversibly closing an upper eyelid of the patient via applied downward tension from the upper member lower portion of the ocular closure support device reversibly engaging with the lower member of the ocular closure support device.

[0093] Example 85 shows Examples 80-84 and 86, further comprising reversibly engaging with the lower member of the ocular closure support device to form a moisture chamber over a interpalpebral fissure.

[0094] Example 86 shows Examples 80-85, further comprising treating an eye of the patient via injecting fluid through an aperture on the upper member of the ocular closure support device, wherein the aperture is over a palpebral fissure of the patient

[0095] While multiple implementations are disclosed, still other implementations of the disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative implementations of the disclosed apparatus, systems and methods. As will be realized, the disclosed apparatus, systems and methods are capable of modifications in various obvious aspects, all without

departing from the spirit and scope of the disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF DRAWINGS

[0096] FIG. 1A depicts an anterior view of an upper member of an ocular closure support device on a release liner, according to one implementation.

[0097] FIG. 1B shows a horizontal cross section of the upper portions of FIGS. 1A and 1C without release liner, according to one implementation.

[0098] FIG. 1C depicts a posterior view of an upper member of an ocular closure support device on a release liner, according to one implementation.

[0099] FIG. 1D shows a vertical cross section of an upper member, according to one implementation.

[0100] FIG. 1E shows an anterior view of a lower member of the ocular closure support device, according to one implementation.

[0101] FIG. 1F shows a posterior view of a lower member of the ocular closure support device, according to one implementation.

[0102] FIG. 1G shows a vertical cross section of a lower member of the ocular closure support device, according to one implementation.

[0103] FIG. 1H shows an anterior view of assembled upper and lower members of the first implementation of the ocular closure support device, according to one implementation.

[0104] FIG. 1I shows a posterior view of assembled upper and lower members of the ocular closure support device, according to one implementation.

[0105] FIG. 2A shows an anterior view of an ocular closure support device, according to one implementation.

[0106] FIG. 2B shows a posterior view of an ocular closure support device, according to one implementation.

[0107] FIG. 2C shows a horizontal cross section of an ocular closure support device, according to one implementation.

[0108] FIG. 2D shows a vertical cross section of an ocular closure support device, according to one implementation.

[0109] FIG. 2E shows an anterior view of the lower member of an ocular closure support device, according to one implementation.

[0110] FIG. 2F shows a posterior view of the lower member of an ocular closure support device, according to one implementation.

[0111] FIG. 2G shows a vertical cross section of an ocular closure support device, according to one implementation.

[0112] FIG. 2H shows an anterior view of the lower member of an ocular closure support device, according to one implementation.

[0113] FIG. 2I shows a vertical cross section of an ocular closure support device, according to one implementation.

[0114] FIG. 2J shows an anterior view of assembled upper and lower members of an ocular closure support device, according to one implementation.

[0115] FIG. 2K shows a posterior view of assembled upper and lower members of an ocular closure support device, according to one implementation.

[0116] FIG. 3A shows an anterior view of an ocular closure support device, according to one implementation.

[0117] FIG. 3B shows a posterior view of an ocular closure support device, according to one implementation.

[0118] FIG. 3C shows a horizontal cross section of an ocular closure support device, according to one implementation.

[0119] FIG. 3D shows a vertical cross section of an ocular closure support device, according to one implementation.

[0120] FIG. 3E shows an anterior view of the lower member of an ocular closure support device with release liner, according to one implementation.

[0121] FIG. 3F shows a posterior view of the lower member of an ocular closure support device with a release liner, according to one implementation.

[0122] FIG. 3G shows a vertical cross section of an ocular closure support device with a release liner, according to one implementation.

[0123] FIG. 3H shows an anterior view of assembled upper and lower members of an ocular closure support device, according to one implementation.

[0124] FIG. 3I shows a posterior view of assembled upper and lower members of an ocular closure support device, according to one implementation.

[0125] FIG. 3J shows a vertical cross section of assembled upper and lower members of an ocular closure support device, according to one implementation.

[0126] FIG. 4 shows an ocular closure support device removably adhered to an eyelid skin of a patient to close the eyelids, according to one implementation.

[0127] FIG. 5A shows anatomic landmarks on an eye of a patient, according to one implementation.

[0128] FIG. 5B shows the ocular closure support device removably adhered to an eyelid skin of a patient to close the eyelids, according to one implementation.

[0129] FIG. 5C shows an ocular closure support device removably adhered to an eyelid skin of a patient with the upper member unfastened from the lower member and reflected upward to expose the open eye of the patient, according to one implementation.

[0130] FIG. 6A shows a method for use of an ocular closure support device, according to one implementation.

[0131] FIG. 6B shows a diagram of an ocular closure support device applied to the eye of a patient, according to one implementation.

[0132] FIG. 6C shows a see-through diagram of an ocular closure support device applied to the eye of a patient, according to one implementation.

[0133] FIG. 7A shows a method for use of an ocular closure support device according to one implementation.

[0134] FIG. 7B shows a diagram of an ocular closure support device applied to the eye of a patient, according to one implementation.

[0135] FIG. 7C shows a see-through diagram of an ocular closure support device applied to the eye of a patient, according to one implementation.

[0136] FIG. 8 is a flow chart illustrating one method of using the ocular closure support device, according to one implementation.

[0137] FIG. 9 is a flow chart illustrating one method of using the ocular closure support device, according to one implementation.

[0138] FIG. 10 is a flow chart illustrating one method of using the ocular closure support device, according to one implementation.

DETAILED DESCRIPTION

[0139] In use, the device, and related methods and systems, is applied to the periocular skin of a patient around the eye. The eyelid closure device according to these implementations may be designed for use in the intensive care unit setting and contemplates use in other settings as well, including in the operating room, in an outpatient clinic, and even in the home for patients to use on themselves.

[0140] In various implementations, a lower device member is placed over the infraorbital rim and lower eyelid regions and a further upper device member is placed over the supraorbital rim and upper eyelid regions. The device achieves eyelid closure and forms a moisture chamber by connecting or overlapping the upper and lower members to each other.

[0141] In certain implementations, such as shown in FIGS. 1A-1I, the device 10 contemplates securing the upper member and lower members to each other semi-permanently, for example with a strong adhesive such as polyacrylate. The device 10, in some implementations, contemplates connecting the upper member 120 and lower members 135 to each other reversibly with various approaches, including but not limited to a hook and loop modification, elastic band and button modification, string and cinch modification, magnetic modification, via a belt loop secured with hook and loop, adhesive, snap, clasp, buckle, zipper and/or a button configuration.

[0142] In certain implementations, the device 10 contemplates various types of skin adhesives for each member, including but not limited to silicone-based adhesives, hydrogel-based adhesives, and acrylic-based adhesives, depending on the duration of adhesion necessary for the specific clinical application.

[0143] It is understood that reversible closure permits the operator to open the eyelids to examine the pupils and apply eye lubricants and medications. In addition to being reversible, these closure modifications permit the operator to adjust how tightly the upper eyelid is pulled down to the lower eyelid without unsticking the members from the skin.

[0144] In various implementations, such as those in FIGS. 2A-2C, non-adhesive tabs 213 can be disposed as touchpoints on either side of the upper or lower members to assist in application of the members, as would be appreciated. In various implementations, the non-adhesive tabs 213 may be referred to as transverse projections 213 or as non-adhesive touchpoints 213.

[0145] In various implementations, such as in FIGS. 2E-2G, low-tack carriers 204 can be disposed with non-adhesive tabs 213 on either side of the upper or lower members to assist in the application of the members followed by removal of the carriers 204, as would be appreciated.

[0146] In various implementations, such as shown in FIGS. 1A-1D, a non-adhesive handle 122 can be disposed as a touchpoint on the lower portion of the upper member to assist in disengagement of the upper member fastener from the lower member fastener.

[0147] In various implementations, the device incorporates non-adhesive touchpoints on at least one aspect of the device to permit easy application of the skin adhesive.

[0148] In certain implementations, such as is shown in FIGS. 1A-1D, the device 10 can incorporate a peel-off or posterior release liner 211, wherein the peel-off or posterior release liner 211 is divided horizontally by a vertical line into two symmetric or asymmetric pieces to facilitate ergonomic application starting from the nasal (medial) side of the eyelid toward the temporal (lateral) side of the eyelid. According to certain examples, the posterior release liner 211 has ears 285 that are ergonomically pullable from the front-side of the member without having to flip the member upside-down.

[0149] The device 10 according to certain implementations contemplates a semi-rigid applicator sponge that can be used to apply even pressure on the infraorbital rim and lower eyelid regions to create a good bond between the skin adhesive and the periocular skin.

[0150] The device 10 may be ambidextrous and not right or left-side specific. Each member is shaped to conform to the periocular anatomy on either side of the face, including optionally the inclusion of non-adhesive tabs to serve as touchpoints on both sides of the face. Each member is about 3cm in length, 5.5cm in width.

[0151] Unlike a piece of tape or an occlusive dressing, this device 10 is designed to be used on the periocular skin for eyelid closure and to comprise two separate members. Durability of the adhesive depends on the clinical application. In the ICU, the adhesive is selected to provide a secure bond to the skin for 3-5 days, corresponding to a length of average ICU stays.

[0152] The device 10 according to certain implementations contemplates integration of an ocular lubricant system into the upper member. The lubricant system includes but is not limited to a dissolvable carboxymethylcellulose coating on the side of the device facing the ocular surface, perforations in the device to permit application of carboxymethylcellulose gel or petrolatum ointment through the device onto the eyelid margin, and a port into which carboxymethylcellulose drops can be applied such that the drops drain onto the caruncle.

[0153] In various implementations, the device can be opened such that no part of the device is in the line of sight of the patient, as would be appreciated for nursing care and patient comfort and awareness in the ICU environment.

[0154] In yet other implementations or implementations, at least a portion of the upper member or layer of the ocular closure support device may be transparent and configured to visualize one or more of an eye of the patient and palpebral closure status.

[0155] In still other implementations or implementations, there may be an aperture on the upper member configured to be overlaid on a palpebral fissure of the patient, and the aperture further configured to transmit treatment such as injected fluid to an eye of the patient.

[0156] FIGS. 1A and 1C depict anterior and posterior views, respectively, of an upper member of an implementation of an ocular closure support device 10 on an upper release liner 111.

[0157] FIG. 1A shows an anterior view of an implementation of the ocular closure support device 10 on an upper release liner 111 with upper member 120 and handle 122. The upper member 120 further consists of an upper portion 120A and a lower portion 120B. In various implementations, the handle 122 may be a non-adhesive touchpoint 213, as will be discussed below.

[0158] In various implementations, the upper member 120 may have an upper edge 160A, which is optionally intended to be adhered to the portion of the supraorbital rim (560 in FIG. 5A, discussed below) and upper eyelid regions of a patient. In some implementations, the upper member 120 may also have a medial edge 160B, which is optionally intended to be adhered to the eyelid of a patient near the bridge of the nose, i.e. the medial canthus. In some implementations, the upper member 120 may have a lateral edge 160C, which is optionally intended to be adhered to the eyelid of a patient near the corner of the eye, i.e. the lateral canthus. In some implementations, the upper member 120 may have a lower edge 160D, which is optionally intended to releasably engage with the lower member 135 (discussed below).

[0159] In various implementations, the upper edge 160A may also be referred to as the upper side 160A. In various implementations, the medial edge 160B may also be referred to as the medial side 160B. In various implementations, the lateral edge 160C may also be referred to as the lateral side 160C. In various implementations, the lower edge 160D may also be referred to as the lower side 160D.

[0160] In various implementations, the upper edge 160A, medial edge 160B, lateral edge 160C, and lower edge 160D may be said to conform to body parts, such as a nose or medial canthus. As would be understood, the upper member 120 may be flexible, and as such, the various edges 160A, 160B, 160C, 160D may flex to ensure solid adhesion to these body parts, which is referred to as conforming.

[0161] As would be understood, width of an edge, such as an upper edge 160A or lower edge 160D would be measured in the direction intersection the medial edge 160B and lateral edge 160C at about right angles.

[0162] FIG. 1C shows a posterior view of an implementation of the ocular closure support device 10 on an upper release liner 111 with an upper eyelid adhesive 123 on the upper member 120, on the lower portion 120B' of the upper member 120, fastener 125, and handle 122. In various implementations, the upper eyelid adhesive 123 may also be referred to as an adhesive backing 123. In some implementations, the lower portion 120B' may be referred to as an extension 120B'. In various implementations the fastener 125 may be referred to as a textured surface. In various implementations, the

textured surface may be a surface capable of adhering to a corresponding surface, such as a surface with an adhesive or a hook and loop surface.

[0163] FIG. 1B shows a horizontal cross section of the upper portion 120A of the upper member 120 as in FIGS. 1A and 1C, with upper eyelid adhesive 123 facing a posterior side and upper member 120 facing an anterior side.

[0164] FIG. 1D shows a vertical cross section of FIGS. 1A and 1C, with upper release liner 111 facing a posterior side, upper eyelid adhesive 123 facing a posterior side, fastener 125 facing a posterior side, handle 122 facing an anterior side, and lower portion 120B of the upper member 120. In various implementations, the fastener 125 may be referred to as a connecting piece 125.

[0165] FIG. 1E shows an anterior view of a lower member 135 of an implementation of the ocular closure support device 10 on a lower release liner 130. In various implementations, the lower member 135 may have an upper edge 170A, which is optionally intended to be adhered to the portion of the infraorbital rim (550 in FIG. 5A, discussed below) and lower eyelid regions of a patient. In some implementations, the lower member 135 may also have a medial edge 170B, which is optionally intended to be adhered below the eyelid of a patient near the nose. In some implementations, the lower member 135 may have a lateral edge 170C, which is optionally intended to be adhered below the eyelid of a patient near the cheek. In some implementations, the lower member 135 may have a lower edge 170D.

[0166] As would be understood, width of an edge, such as an upper edge 170A or lower edge 170D would be measured in the direction intersection the medial edge 170B and lateral edge 170C at about right angles.

[0167] In various implementations, the upper edge 170A may also be referred to as the upper side 170A. In various implementations, the medial edge 170B may also be referred to as the medial side 170B. In various implementations, the lateral edge 170C may also be referred to as the lateral side 170C. In various implementations, the lower edge 170D may also be referred to as the lower side 170D.

[0168] In various implementations, the upper edge 170A, medial edge 170B, lateral edge 170C, and lower edge 170D may be said to conform to body parts, such as a nose or medical canthus. As would be understood, these lower member 135 may be flexible,

and as such, the various edges 170A, 170B, 170C, 170D may flex to ensure solid adhesion to these body parts, which is referred to as conforming.

[0169] In various implementations, the lower member 135 may have a counterpart textured surface 136. In various implementations, the counterpart textured surface may be a surface capable of adhering to a corresponding surface, such as a surface with an adhesive or a hook and loop surface.

[0170] FIG. 1F shows a posterior view of a lower member 135 of an implementation of the ocular closure support device 10 on a release liner 130' with a lower eyelid adhesive 135'.

[0171] FIG. 1G shows a vertical cross section of FIGS. 1E and 1F without release liner 130/130' with lower member 135 facing an anterior side and lower eyelid adhesive 135' facing a posterior side. In various implementations, the lower eyelid adhesive 135' may also be referred to as an adhesive backing 135'. In various implementations, the lower eyelid adhesive 135' may be a silicone-based adhesive, hydrogel-based adhesive, or acrylic-based adhesive. As would be understood, this means the lower eyelid adhesive 135' may contain silicone, hydrogel, and / or acrylic.

[0172] FIG. 1H shows an anterior view of assembled upper members 120 and lower members 135 of an implementation of the ocular closure support device 10 with the handle 122 fastened to the lower member 135.

[0173] FIG. 1I shows a posterior view of assembled upper members 120 and lower members 135 of an implementation of the ocular closure support device 10 with the upper eyelid adhesive 123 and the lower eyelid adhesive 135'.

[0174] FIG. 2A shows an anterior view of an implementation of the ocular closure support device 10 with a posterior release liner 211 accessible from an anterior approach and an upper member 220 flap extension 212 and non-adhesive touchpoints 213. In various implementations, the flap extension 212 may also be referred to as a flap 212. In various implementations, the posterior release liner 211 may also be referred to as a removable release liner 211.

[0175] FIG. 2B shows a posterior view of an implementation of the ocular closure support device 10 with a posterior release liner 211 divided into two pieces at vertical line 290 that covers the upper eyelid 215. The flap extension 212, in various

implementations, has a flap fastener 214, and the upper member 220 has non-adhesive touchpoints 213.

[0176] FIG. 2C shows a horizontal cross section of one implementation of the ocular closure support device 10 with release liner 211 facing a posterior side, and the upper eyelid adhesive 215 and non-adhesive touchpoints 213 facing a posterior side.

[0177] FIG. 2D shows a vertical cross section of one implementation of the ocular closure support device 10 with release liner 211, an upper eyelid adhesive 215 facing a posterior side, flap fastener 214 facing a posterior side, and flap extension 212 facing an anterior side.

[0178] FIG. 2E shows an anterior view of the lower member 230 of an implementation of the ocular closure support device 10 with a release liner 211 and a removable low-tack carrier 204 reversibly adhered to the anterior surface of a semirigid layer 206 on the lower member 230. The anterior surface of the lower portion 230 of the lower member semirigid layer 206 has a fastener 208.

[0179] FIG. 2F shows a posterior view of the lower member 230 of an implementation of the ocular closure support device 10 without a release liner (such as release liner 211 from FIG. 2E). Shown here is a removable low-tack carrier 204 with lower eyelid adhesive 202.

[0180] FIG. 2G shows a vertical cross section of one implementation of the ocular closure support device 10 with release liner 211 facing a posterior side, low tack carrier 204 facing an anterior side and reversibly adhered to the anterior surface of the semirigid layer 206, and fastener 208 on the lower portion of the semirigid layer 206 of the lower member facing an anterior side, with skin adhesive for the lower eyelid 202' facing a posterior side.

[0181] FIG. 2H shows an anterior view of the lower member of an implementation of the ocular closure support device 10 as in FIGS. 2E and 2F without a release liner and after removal of the low-tack carrier from the anterior surface of the upper portion of the semirigid layer 206 of the lower member, with a fastener 208 on the lower portion of the semirigid layer 206.

[0182] FIG. 2I shows a vertical cross section one implementation of the ocular closure support device 10 without a release liner 211, with lower eyelid adhesive 202 facing a posterior side, and semirigid layer 206 and fastener 208 facing an anterior side.

[0183] FIG. 2J shows an anterior view of assembled upper member 220 and lower member 230 of an implementation of the ocular closure support device 10 without release liners 211 and without a low-tack carrier 204, with the upper member 220 flap extension 212 fastened to the lower member 230 fastener 208, as well as non-adhesive touchpoints 213.

[0184] FIG. 2K shows a posterior view of assembled upper and lower members of an implementation of the ocular closure support device 10 without release liners and without a low-tack carrier as in FIG. 2H with an upper member skin adhesive for the upper eyelid 215', a lower member skin adhesive for the lower eyelid 202', and non-adhesive touch points 213'.

[0185] In certain implementations, the ocular closure support device 10 may be configured for use with either a left or right eye of a patient given symmetry of upper member 220 and lower member 230 as in FIGS. 2J-2K, as well as non-adhesive touchpoints 213 and low tack carrier 204.

[0186] FIG. 3A shows an anterior view of an implementation of an upper member 330 of the ocular closure support device 10 with a posterior release liner 311 accessible from an anterior approach and an upper member 330 flap extension 312, as well as non-adhesive touchpoints 322.

[0187] FIG. 3B shows a posterior view of an implementation of an upper member 330 of the ocular closure support device 10 with a posterior release liner 311 divided into two pieces at vertical line 390 that covers an upper eyelid adhesive 315. The flap extension 312, in some implementations, has a fastener 314 and handle 325. In some implementations, the upper member 330 has non-adhesive touchpoints 322'.

[0188] FIG. 3C shows a horizontal cross section of the upper member 330 of the ocular closure support device 10 with release liner 311 and a skin adhesive for the upper eyelid 315 facing a posterior side. In various implementations, the handle 325 may also be a non-adhesive touchpoint 322.

[0189] Throughout various implementations, any component that does not contain an adhesive may be used as a non-adhesive touchpoint 213, 322.

[0190] FIG. 3D shows a vertical cross section of the upper member 330 of the ocular closure support device 10 with release liner 311 facing a posterior side, a skin adhesive for the upper eyelid 315 facing a posterior side, fastener 314' of flap extension 312 facing a posterior side, and flap extension 312 facing an anterior side.

[0191] FIG. 3E shows an anterior view of the lower member 340 of an implementation of the ocular closure support device 10 with a release liner 321 and a fastener 320 on the semirigid layer 319 of the lower member 340.

[0192] FIG. 3F shows a posterior view of the lower member 340 of an implementation of the ocular closure support device 10 with a release liner 321 and with lower eyelid adhesive 339.

[0193] FIG. 3G shows a vertical cross section of the lower member 340 of the ocular closure support device 10 with release liner 321 and lower eyelid adhesive 339 both facing a posterior side, and semirigid layer 319 and fastener 320 on the semirigid layer 319 of the lower member 340 both facing an anterior side.

[0194] FIG. 3H shows an anterior view of assembled upper member 330 and lower member 340 of an implementation of the ocular closure support device 10 without release liners 321 and with the flap extension 312 fastened to the fastener 320.

[0195] FIG. 3I shows a posterior view of assembled upper member 330 and lower member 340 of an implementation of the ocular closure support device 10 without release liners 321 and with the upper eyelid adhesive 315, lower eyelid skin adhesive 339, non-adhesive touch points 322, flap 326, and handle 325.

[0196] FIG. 3J shows a vertical cross section of the assembled upper member 330 and lower member 340 of an implementation of the ocular closure support device 10 with upper member fastener 314 facing a posterior side fastened to lower member fastener 320 facing an anterior side, upper member skin adhesive for the upper eyelid 315, lower member skin adhesive for the lower eyelid 339, and handle 325 facing a posterior side, and semi rigid layer of the lower member 319 facing an anterior side. In certain examples, an implementation of the ocular closure support device 10 may be configured

for use with either a left or right eye of a patient given symmetry of upper member 330 and lower member 340 as in FIGS. 3H-3I, as well as non-adhesive touchpoints 322.

[0197] In various implementations, the upper member 120, 330 may be made of a structural layer 120, 330; an upper eyelid adhesive 123 layer (known also as a skin adhesive layer 123); a fastener 314, 320 layer; a non-adhesive layer 213; a low-tack adhesive layer 204; and a structural adhesive layer.

[0198] FIG. 4 shows an implementation of the ocular closure support device 10 applied to a patient to close the eyelids, with fastener 122 of the lower portion 120B of the upper member 120 fastened to the lower member 135. According to certain examples, an implementation of the ocular closure support device 10 may be customized in shape or orientation to one or more of a right or left eye. For example, the medial angle of lower member 135 may be oriented to a right or left eye.

[0199] FIG. 5A shows anatomic landmarks on an eye of a patient including infraorbital rim 550 and supraorbital rim 560.

[0200] FIG. 5B shows an implementation of the ocular closure support device 10 of FIGS. 3A-3J removably adhered to an eyelid skin of a patient to close the eyelids, with upper member 330 flap extension 312 secured to the fastener 320 of the lower member 340 to pull down an eyelid of the patient, for example by exerting a reversible downward tension on the supraorbital rim and upper eyelid regions of the patient when engaged with the fastener 320 of the lower member 340, resulting in palpebral closure and formation of a moisture chamber over the interpalpebral fissure. In certain implementations, the moisture chamber may be bounded superiorly by a lower portion 120B of the upper member 330 and inferiorly by the lower member 340. As would be understood, the moisture chamber is a pocket that results from the sealed assembly of the upper member 330 and lower member 340.

[0201] FIG. 5C shows an implementation of the ocular closure support device 10 of FIGS. 3A-3J removably adhered to an eyelid skin of a patient to close the eyelids, with a fastener 314 of the extension flap 312 of the upper member 330 unfastened from the fastener 320 of the lower member 340 and reflected upward with handle 325 to expose the open eye of the patient by disengaging the surface of the lower portion 120B of the upper member 330 from the lower member 340.

[0202] FIG. 5D shows an implementation of the ocular closure support device 10 with two apertures 500 located on the upper member that allow fluid to be introduced to the moisture chamber, which is formed between the eye of the patient and the device 10. In various implementations, there may be more or fewer apertures 500 than two. In certain implementations with two apertures 500, one aperture 500 is primarily used when the device 10 is administered to the right eye, while the other aperture 500 is primarily used when the device 10 is administered to the left eye.

[0203] FIGS. 6A-6C illustrate text and graphical instructions for use of an implementation of the ocular closure support device 10 similar to the upper member of an implementation of the ocular closure support device 10, such as those shown in FIGS. 2A-2K.

[0204] FIG. 6A provides step-wise instructions for use of an implementation of the ocular closure support device 10 similar to the upper member of an implementation of the ocular closure support device 10, such as those shown in FIGS. 2A-2K. As would be understood, each step of these instructions is optional and may be performed or omitted as would be deemed necessary by those skilled in the art. Additionally, the order of the steps is meant to be illustrative and not limiting, such that the listed steps may be performed in any order that would be understood as reasonable by those skilled in the art. Step 1 begins with exposing an adhesive backing on the medial side of the ocular closure support device 10, such as removing release liner 211 medial to line 290 from FIG. 2B to expose upper member 220 skin adhesive 215 for the upper eyelid from FIG. 2B. Step 2 involves anchoring a medial edge such as medial non-adhesive touch point 213 from FIG. 2B to a patient's nose. In step 3, an adhesive backing on the lateral side of the ocular closure support device 10 is exposed, for example by removing release liner 211 lateral to line 290 from FIG. 2B to expose upper member 220 skin adhesive 215 for the upper eyelid from FIG. 2B. In step 4, a finger may be pressed on a medial side of the ocular closure support device 10, such as on medial non-adhesive touchpoint 213 from FIG. 2A and run along to the lateral edge which may be lateral non-adhesive touchpoint 213 from FIG. 2A.

[0205] FIG. 6B shows a diagram depicting an implementation of the ocular closure support device 10 similar to the upper member 220 of an implementation of the ocular

closure support device 10 placed over an eye of the patient with numerals corresponding to the steps in FIG. 6A.

[0206] FIG. 6C shows a diagram depicting a transparent implementation of the ocular closure support device 10 similar to the upper member 220 of an implementation of the ocular closure support device 10 placed over an eye of the patient with numerals corresponding to the steps in FIG. 6A.

[0207] FIGS. 7A-7C illustrate text and graphical instructions for use of an implementation of the ocular closure support device 10, such as those shown in FIGS. 1A-1I.

[0208] FIG. 7A provides step-wise instructions for use of an implementation of the ocular closure support device 10, such as those shown in FIGS. 1A-1I. As would be understood, each step of these instructions is optional and may be performed or omitted as would be deemed necessary by those skilled in the art. Additionally, the order of the steps is meant to be illustrative and not limiting, such that the listed steps may be performed in any order that would be understood as reasonable by those skilled in the art. Step 1 begins with exposing an adhesive backing, for example by removing release liner 111 to expose upper member 120 upper eyelid adhesive 123 from FIG. 1C. In step 2, a finger may be pressed on a medial side of upper member 120 from FIG. 1A and run along to the lateral edge, for example the lateral side of upper member 120 from FIG. 1A.

[0209] FIG. 7B shows a diagram depicting the upper member 120 of an implementation of the ocular closure support device 10 placed over an eye of the patient with numerals corresponding to the steps in FIG. 7A.

[0210] FIG. 7C shows a diagram depicting a transparent implementation of the upper member 120 of the first implementation of the ocular closure support device 10 placed over an eye of the patient with numerals corresponding to the steps in FIG. 7A.

[0211] FIGS. 8-10 are flow charts illustrating various methods of using various implementations of the ocular closure support device. These specific methods represent various aspects of the same method 100, and as such, each step of the individually listed methods may be introduced into other methods. Similarly, any listed step in any particular method may be omitted, as each step is intended to be illustrative and not

limiting. Finally, the order of each method is also illustrative, meaning the order of steps in each method may be changed while remaining within the scope of the overall method 100.

[0212] [0134] FIG. 8 illustrates one implementation of the method 100 of using an ocular closure support device.

[0213] The method 100, according to one implementation, begins at block 805 with exposing an adhesive backing of a medial side of the ocular closure support device 10.

[0214] The method 100, according to one implementation, continues at block 810 with applying the medial side of the ocular closure support device 10 to an eyelid.

[0215] The method 100, according to one implementation, continues at block 815 with reversibly anchoring an edge of the medial side of the ocular closure support device 10 to the nose of a patient.

[0216] The method 100, according to one implementation, continues at block 820 with exposing an adhesive backing of a lateral side of the ocular closure support device 10.

[0217] The method 100, according to one implementation, continues at block 825 with pressing from the medial side to an edge of the lateral side of the ocular closure support device to apply the ocular closure support device 10 over an eyelid of the patient.

[0218] According to certain implementations of the method 100, the pressing reversibly adheres the ocular closure support device 10 over an eye of the patient.

[0219] FIG. 9 illustrates another implementation of the method 100 for using an ocular closure support device 10.

[0220] The method 100, according to one implementation, begins at block 905 with exposing an adhesive backing of an ocular closure support device 10.

[0221] The method 100, according to one implementation, continues at block 910 with applying the ocular closure support device 10 to an eyelid.

[0222] The method 100, according to one implementation, ends at block 915 with firmly pressing from a medial side to a lateral side of the ocular closure support device 10.

[0223] According to certain implementations of the method 100, the eyelid is an upper eyelid or a lower eyelid of the patient.

[0224] According to certain implementations of the method 100, the pressing reversibly adheres the ocular closure support device 10 over an eye of the patient.

[0225] FIG. 10 illustrates yet another implementation of the method 100 of using an ocular closure support device 10.

[0226] The method 100, according to one implementation, begins at block 1005 with reversibly adhering an upper member 120 of the ocular closure support device 10 to a supraorbital rim and upper eyelid regions of a patient.

[0227] The method 100, according to one implementation, continues at block 1010 with reversibly adhering a lower member 135 of the ocular closure support device 10 to an infraorbital rim and lower eyelid regions of the patient.

[0228] The method 100, according to one implementation, ends at block 1015 with securing the ocular closure support device 10 in place on the patient by pressing from a medial side to a lateral side of the upper and lower members of the ocular closure support device 10.

[0229] According to certain implementations of the method 100, the method 100 further includes decoupling the lower portion 120B of the upper member 120 from the lower member 135 to inspect or treat an eye of the patient closed by the ocular closure support device 10.

[0230] According to certain implementations of the method 100, the method 100 further includes inspecting an eye of the patient and/or palpebral closure status via at least a portion of the upper member 120 of the ocular closure support device 10 being transparent.

[0231] According to certain implementations of the method 100, the method 100 further includes the ocular closure support device 10 being placed and removed without disrupting a line of sight of the patient.

[0232] According to certain implementations of the method 100, the method 100 further includes reversibly closing an upper eyelid of the patient via applied downward tension from the lower portion 120B of the upper member 120 of the ocular closure support device 10 reversibly engaging with the lower member of the ocular closure support device 10.

[0233] According to certain implementations of the method 100, the method 100 further includes reversibly forming a moisture chamber over the interpalpebral fissure via

engagement of the lower portion of the upper member of the ocular closure support device 10 with the lower member of the ocular closure support device 10.

[0234] According to certain implementations of the method 100, the method 100 further includes treating an eye of the patient via injecting fluid through an aperture on the upper member 120 of the ocular closure support device 10, in which the aperture is overlaid on a palpebral fissure of the patient.

[0235] Although the disclosure has been described with reference to preferred implementations, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the disclosed apparatus, systems and methods.

[0236] It should be appreciated that all combinations of the foregoing concepts and additional concepts discussed in greater detail below (provided such concepts are not mutually inconsistent) are contemplated as being part of the inventive subject matter disclosed herein and may be used to achieve the benefits described herein.

[0237] The process parameters and sequence of steps described and/or illustrated herein are given by way of example only and can be varied as desired. For example, while the steps illustrated and/or described herein may be shown or discussed in a particular order, these steps do not necessarily need to be performed in the order illustrated or discussed. The various example methods described and/or illustrated herein may also omit one or more of the steps described or illustrated herein or include additional steps in addition to those disclosed.

[0238] When a feature or element is herein referred to as being "on" another feature or element, it can be directly on the other feature or element or intervening features and/or elements may also be present. In contrast, when a feature or element is referred to as being "directly on" another feature or element, there are no intervening features or elements present. It will also be understood that, when a feature or element is referred to as being "connected", "attached" or "coupled" to another feature or element, it can be directly connected, attached or coupled to the other feature or element or intervening features or elements may be present. In contrast, when a feature or element is referred to as being "directly connected", "directly attached" or "directly coupled" to another feature or element, there are no intervening features or elements present. Although

described or shown with respect to one implementation, the features and elements so described or shown can apply to other implementations. It will also be appreciated by those of skill in the art that references to a structure or feature that is disposed "adjacent" another feature may have portions that overlap or underlie the adjacent feature.

[0239] Terminology used herein is for the purpose of describing particular implementations only and is not intended to be limiting of the invention. For example, as used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items and may be abbreviated as "/".

[0240] Spatially relative terms, such as "under", "below", "lower", "over", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if a device in the figures is inverted, elements described as "under" or "beneath" other elements or features would then be oriented "over" the other elements or features. Thus, the exemplary term "under" can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly. Similarly, the terms "upwardly", "downwardly", "vertical", "horizontal" and the like are used herein for the purpose of explanation only unless specifically indicated otherwise.

[0241] Although the terms "first" and "second" may be used herein to describe various features/elements (including steps), these features/elements should not be limited by these terms, unless the context indicates otherwise. These terms may be used to

distinguish one feature/element from another feature/element. Thus, a first feature/element discussed below could be termed a second feature/element, and similarly, a second feature/element discussed below could be termed a first feature/element without departing from the teachings of the present invention.

[0242] Throughout this specification and the claims which follow, unless the context requires otherwise, the word “comprise”, and variations such as “comprises” and “comprising” means various components can be co-jointly employed in the methods and articles (e.g., compositions and apparatuses including device and methods). For example, the term “comprising” will be understood to imply the inclusion of any stated elements or steps but not the exclusion of any other elements or steps.

[0243] In general, any of the apparatuses and methods described herein should be understood to be inclusive, but all or a sub-set of the components and/or steps may alternatively be exclusive and may be expressed as “consisting of” or alternatively “consisting essentially of” the various components, steps, sub-components or sub-steps.

[0244] As used herein in the specification and claims, including as used in the examples and unless otherwise expressly specified, all numbers may be read as if prefaced by the word “about” or “approximately,” even if the term does not expressly appear. The phrase “about” or “approximately” may be used when describing magnitude and/or position to indicate that the value and/or position described is within a reasonable expected range of values and/or positions. For example, a numeric value may have a value that is +/- 0.1% of the stated value (or range of values), +/- 1% of the stated value (or range of values), +/- 2% of the stated value (or range of values), +/- 5% of the stated value (or range of values), +/- 10% of the stated value (or range of values), etc. Any numerical values given herein should also be understood to include about or approximately that value, unless the context indicates otherwise. For example, if the value “10” is disclosed, then “about 10” is also disclosed. Any numerical range recited herein is intended to include all sub-ranges subsumed therein. It is also understood that when a value is disclosed that “less than or equal to” the value, “greater than or equal to the value” and possible ranges between values are also disclosed, as appropriately understood by the skilled artisan. For example, if the value “X” is disclosed the “less

than or equal to X" as well as "greater than or equal to X" (e.g., where X is a numerical value) is also disclosed. It is also understood that throughout the application, data is provided in a number of different formats, and that this data, represents endpoints and starting points, and ranges for any combination of the data points. For example, if a particular data point "10" and a particular data point "15" are disclosed, it is understood that greater than, greater than or equal to, less than, less than or equal to, and equal to 10 and 15 are considered disclosed as well as between 10 and 15. It is also understood that each unit between two particular units are also disclosed. For example, if 10 and 15 are disclosed, then 11, 12, 13, and 14 are also disclosed.

[0245] Although various illustrative implementations are described above, any of a number of changes may be made to various implementations without departing from the scope of the invention as described by the claims. For example, the order in which various described method steps are performed may often be changed in alternative implementations, and in other alternative implementations one or more method steps may be skipped altogether. Optional features of various device and system implementations may be included in some implementations and not in others.

Therefore, the foregoing description is provided primarily for exemplary purposes and should not be interpreted to limit the scope of the invention as it is set forth in the claims.

[0246] The examples and illustrations included herein show, by way of illustration and not of limitation, specific implementations in which the subject matter may be practiced. As mentioned, other implementations may be utilized and derived there from, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. Such implementations of the inventive subject matter may be referred to herein individually or collectively by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept, if more than one is, in fact, disclosed. Thus, although specific implementations have been illustrated and described herein, any arrangement calculated to achieve the same purpose may be substituted for the specific implementations shown. This disclosure is intended to cover any and all adaptations or variations of various implementations. Combinations of the above implementations, and

other implementations not specifically described herein, will be apparent to those of skill in the art upon reviewing the above description.

CLAIMS

What is claimed is:

1. An ocular closure support device comprising:
 - (a) an upper member constructed to adhere to a supraorbital rim of a patient;and
 - (b) a lower member constructed to adhere to an infraorbital rim of the patient, wherein the upper member is configured to reversibly fasten to the lower member.
2. The ocular closure support device of claim 1, wherein the upper member comprises an upper eyelid adhesive.
3. The ocular closure support device of claim 1, wherein the upper member further comprises one or more non-adhesive touch points that are not covered by upper eyelid adhesive.
4. The ocular closure support device of claim 1, wherein there are three non-adhesive touch points.
5. The ocular closure support device of claim 1, wherein the lower member comprises a lower eyelid adhesive.
6. The ocular closure support device of claim 2, further comprising a posterior release liner in contact with the upper eyelid adhesive.
7. The ocular closure support device of claim 5, further comprising a release liner in contact with the lower eyelid adhesive.

8. The ocular closure support device of claim 3, wherein one of the one or more non-adhesive touch points is a handle.
9. The ocular closure support device of claim 3, wherein two of the one or more non-adhesive touch points are non-adhesive tabs.
10. The ocular closure support device of claim 1, wherein the ocular closure support device is configured to create a moisture chamber when the upper member is reversibly fastened to the lower member.
11. An ocular closure support device, comprising:
 - an upper member having:
 - an upper edge conforming to at least a portion of a supraorbital rim and upper eyelid regions of a patient,
 - a lower edge,
 - a medial edge,
 - a lateral edge, and
 - an adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the upper member to the supraorbital rim and upper eyelid regions of the patient,
 - a lower member having:
 - an upper edge conforming to at least a portion of the infraorbital rim and lower eyelid regions of a patient,
 - a lower edge,
 - a medial edge,
 - a lateral edge, and
 - an adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the lower member to the infraorbital rim and lower eyelid regions of the patient,
 - wherein a width of the upper edge of the lower member is greater than a width of the lower edge of the lower member,

wherein a width of the upper edge of the upper member is greater than a width of the lower edge of the upper member,

wherein the lower edge of the upper member is part of a lower portion of the upper member having a surface configured to releasably engage with the lower member for palpebral closure and opening.

12. The ocular closure support device of claim 11, wherein the medial edge conforms to a region medial to a medial canthus of the patient.

13. The ocular closure support device of claim 12, wherein the medial edge conforms to a nose of the patient.

14. The ocular closure support device of claim 11, wherein the lateral edge conforms to a region lateral to a lateral canthus of the patient.

15. The ocular closure support device of claim 11, wherein the lower edge of the upper member is part of a connecting piece coupled superiorly to an extension, wherein the connecting piece is configured to releasably attach to the lower member, wherein the upper edge of the lower member is reversibly adhered to the infraorbital rim and lower eyelid regions of the patient, wherein the upper edge of the upper member is reversibly adhered to the supraorbital rim and upper eyelid regions of the patient.

16. The ocular closure support device of claim 11, wherein the lower edge of the upper member is part of a flap configured to reversibly engage with the lower member.

17. The ocular closure support device of claim 15, wherein the lateral edge and/or medial edge of the ocular closure device include transverse projections.

18. The ocular closure support device of claim 17, wherein the transverse projections are non-adhesive touchpoints configured to be grabbed for one or more of: positioning the upper member on the supraorbital rim and upper eyelid regions of the patient,

anchoring the transverse projection of the medial edge to a nose of the patient, and removing the device from the skin of the patient.

19. The ocular closure support device of claim 15, wherein a removable low-tack carrier is affixed over the lower member, wherein the low-tack carrier is configured for grabbing and positioning the lower member on the patient, wherein the low-tack carrier is removable from the lower member after applying the skin adhesive of the lower member to the infraorbital rim and lower eyelid regions of the patient.

20. The ocular closure support device of claim 16, wherein a textured surface of at least a portion of the flap of the upper member is configured to reversibly fasten to a counterpart textured surface of at least a portion of a lower portion of the lower member.

21. The ocular closure support device of claim 11, wherein the adhesive backing comprises one or more of: silicone, hydrogel, and acrylic.

22. The ocular closure support device of claim 11, wherein the adhesive backing of the upper member and/or lower member is affixed to a removable release liner.

23. The ocular closure support device of claim 22, wherein the release liner is larger than the upper member and/or lower member.

24. The ocular closure support device of claim 22, wherein the release liner is a two-piece release liner affixed to the upper member, wherein a vertical line separates the two pieces of the release liner, wherein one or both of the two pieces of the release liner may be removed by peeling toward the vertical line.

25. The ocular closure support device of claim 11, wherein the upper and/or lower member are reversibly connected via a fastener including one or more of: hook and loop, snap, button, clasp, buckle, zipper, magnet, and string.

26. The ocular closure support device of claim 11, wherein the lower portion of the upper member having the surface configured to releasably engage with the lower member for palpebral closure exerts a reversible downward tension on the supraorbital rim and upper eyelid regions of the patient when engaged with the lower member, resulting in palpebral closure and moisture chamber formation over the interpalpebral fissure.

27. The ocular closure support device of claim 26, wherein the downward tension and palpebral closure is reversible by disengaging the surface of the lower portion of the upper member from the lower member.

28. The ocular closure support device of claim 11, wherein at least a portion of the upper member is transparent and configured to visualize one or more of an eye of the patient and palpebral closure status.

29. The ocular closure support device of claim 11, further comprising an aperture on the upper member, wherein the aperture is overlaid on a palpebral fissure of the patient, wherein the aperture is configured to transmit treatment to an eye of the patient, wherein the treatment is injected fluid.

30. The ocular closure support device of claim 11, wherein the upper member and/or lower member further comprising one or more layers, including one or more of: structural, skin adhesive, fastener, non-adhesive, release liner, low tack adhesive carrier, and structural adhesive layers.

31. The ocular closure support device of claim 30, wherein one or more of the layers are at least partially transparent.

32. The ocular closure support of device of claim 11, further comprising perforated portions of the upper and/or lower members, wherein the perforated portions are configured to be separated from the upper and/or lower members.

33. The ocular closure support device of claim 11, wherein the device is ambidextrous for use with a right or left eye of the patient.
34. The ocular closure support device of claim 11, further comprising graphical and/or text instructions for using the device.
35. An ocular closure support device according to any of the above claims, further comprising a moisture chamber over an interpalpebral fissure of the patient, the moisture chamber bounded superiorly at least in part by the lower portion of the upper member and bounded inferiorly at least in part by an upper portion of the lower member when the upper member is releasably engaged with the lower member.
36. A method of using an ocular closure support device, the method comprising:
exposing an adhesive backing of a medial side of the ocular closure support device;
applying the medial side of the ocular closure support device to the medial aspect of an eyelid of a patient;
reversibly anchoring an edge of the medial side of the ocular closure support device to a nose of a patient;
exposing an adhesive backing of a lateral side of the ocular closure support device; and
pressing from the medial side to an edge of the lateral side of the ocular closure support device over an eyelid of the patient.
37. The method of claim 36, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.
38. A method of using an ocular closure support device, the method comprising:
exposing an adhesive backing of the ocular closure support device;
reversibly adhering the ocular closure device to an eyelid of a patient; and
pressing from a medial side to an edge of a lateral side of the ocular closure support device.

39. The method of claim 38, wherein the eyelid is an upper eyelid or a lower eyelid of the patient.

40. The method of claim 28, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

41. A method of using an ocular closure support device, the method comprising:
reversibly adhering a medial side of an upper member of the ocular closure support device to a skin of a medial aspect of the supraorbital rim and upper eyelid regions of a patient;
reversibly anchoring a medial edge of the upper member of the ocular closure support device to a region medial to a medial canthus of the patient;
reversibly affixing a lateral side of the upper member of the ocular closure support device to a skin of a lateral aspect of the supraorbital rim and upper eyelid regions of the patient;
reversibly affixing a lower member of the ocular closure support device to a skin of the infraorbital rim and lower eyelid regions of the patient; and
reversibly engaging a lower portion of the upper member with the lower member.

42. The method of claim 41, further comprising decoupling the lower portion of the upper member from the lower member to inspect or treat an eye of the patient covered by the ocular closure support device.

43. The method of claim 41, further comprising inspecting an eye of the patient and/or palpebral closure status via at least a portion of the upper member of the ocular closure support device being transparent.

44. The method of claim 41, wherein the ocular closure support device is placed and removed without disrupting a line of sight of the patient.

45. The method of claim 41, further comprising reversibly closing an upper eyelid of the patient via applied downward tension from the lower portion of the upper member of the ocular closure support device reversibly engaging with the lower member of the ocular closure support device.
46. The method of claim 41, further comprising reversibly engaging with the lower member of the ocular closure support device to form a moisture chamber over the interpalpebral fissure.
47. The method of claim 41, further comprising treating an eye of the patient via injecting fluid through an aperture on the upper member of the ocular closure support device, wherein the aperture is overlaid on a palpebral fissure of the patient.
48. An ocular closure support device for use with a patient, comprising:
- a) an upper member, comprising:
 - i) an upper member upper edge conforming to at least a portion of a supraorbital rim and upper eyelid regions of a patient;
 - ii) an upper member lower edge;
 - iii) an upper member medial edge;
 - iv) an upper member lateral edge; and
 - v) an upper member adhesive backing on at least the upper edge, configured to releasably adhere at least the upper edge of the upper member to the supraorbital rim and upper eyelid regions of the patient;
 - b) a lower member, comprising:
 - i) a lower member upper edge conforming to at least a portion of the infraorbital rim and lower eyelid regions of a patient;
 - ii) a lower member lower edge;
 - iii) a lower member medial edge;
 - iv) a lower member lateral edge; and

- v) a lower member adhesive backing on at least the upper edge configured to releasably adhere at least the lower member upper edge to the infraorbital rim and lower eyelid regions of the patient, wherein:
 - i) a width of the lower member upper edge is greater than a width of the lower member lower edge,
 - ii) a width of the upper member upper edge is greater than a width of the upper member lower edge, and
 - iii) the upper member lower edge is part of a lower portion of the upper member having a surface configured to releasably engage with the lower member for palpebral closure and opening.

49. The ocular closure support device of claim 48, wherein the medial edge conforms to a region medial to a medial canthus of the patient.

50. The ocular closure support device of claim 49, wherein the medial edge conforms to a nose of the patient.

51. The ocular closure support device of claim 48, wherein the lateral edge conforms to a region lateral to a lateral canthus of the patient.

52. The ocular closure support device of claim 48, wherein:

- i) the upper member lower edge is part of a connecting piece coupled superiorly to an extension,
- ii) the connecting piece is configured to releasably attach to the lower member,
- iii) the upper edge of the lower member is reversibly adhered to the infraorbital rim and lower eyelid regions of the patient, and
- iv) the upper edge of the upper member is reversibly adhered to the supraorbital rim and upper eyelid regions of the patient.

53. The ocular closure support device of claim 52, wherein the lateral edge and/or medial edge of the ocular closure device comprise tabs.
54. The ocular closure support device of claim 53, wherein the tabs are non-adhesive touchpoints configured to be grabbed for one or more of: positioning the upper member on the supraorbital rim and upper eyelid regions of the patient, anchoring the transverse projection of the medial edge to a nose of the patient, and removing the device from the skin of the patient.
55. The ocular closure support device of claim 52, wherein a removable low-tack carrier is affixed over the lower member, wherein the removable low-tack carrier is configured for grabbing and positioning the lower member on the patient, wherein the removable low-tack carrier is removable from the lower member after applying a skin adhesive of the lower member to the infraorbital rim and lower eyelid regions of the patient.
56. The ocular closure support device of claim 48, wherein the adhesive backing comprises one or more of: silicone, hydrogel, and acrylic.
57. The ocular closure support device of claim 48, wherein the adhesive backing of the upper member and/or lower member is affixed to a removable release liner.
58. The ocular closure support device of claim 57, wherein the removable release liner is larger than the upper member and/or lower member.
59. The ocular closure support device of claim 57, wherein the removable release liner is a two-piece release liner affixed to the upper member, wherein a vertical line separates the two pieces of the removable release liner, wherein one or both of the two pieces of the removable release liner may be removed by peeling toward the vertical line.

60. The ocular closure support device of claim 48, wherein the upper and/or lower member are reversibly connected via a fastener.
61. The ocular closure support device of claim 60, wherein the fastener is a hook and loop, a snap, a button, a clasp, a buckle, a zipper, a magnet, or string.
62. The ocular closure support device of claim 48, wherein the upper member lower portion is configured such that the surface can releasably engage with the lower member for a palpebral closure exerts a reversible downward tension on the supraorbital rim and upper eyelid regions of the patient when engaged with the lower member, resulting in palpebral closure and moisture chamber formation over a interpalpebral fissure.
63. The ocular closure support device of claim 62, wherein the reversible downward tension and palpebral closure is reversible by disengaging the surface of the lower portion of the upper member from the lower member.
64. The ocular closure support device of claim 48, wherein at least a portion of the upper member is transparent and configured to visualize one or more of an eye of the patient and palpebral closure status.
65. The ocular closure support device of claim 48, further comprising an aperture defined on the upper member, wherein the aperture is overlaid on a palpebral fissure of the patient and is configured to transmit injected fluid to an eye of the patient.
66. The ocular closure support device of claim 48, wherein the upper member and/or lower member further comprising one or more layers, including one or more of: structural, skin adhesive, fastener, non-adhesive, release liner, low tack adhesive carrier, and structural adhesive layers.

67. The ocular closure support device of claim 66, wherein one or more of the layers are at least partially transparent.

68. The ocular closure support of device of claim 48, further comprising perforated portions of the upper member and/or lower member, wherein the perforated portions are configured to be separated from the upper member and/or lower member.

69. The ocular closure support device of claim 48, wherein the device is configured for ambidextrous use with either a right or a left eye of the patient.

70. The ocular closure support device of claim 48, further comprising graphical and/or text instructions for using the device.

71. The ocular closure support device of claim 48, wherein the ocular closure support device is configured to create a moisture chamber when the upper member is reversibly fastened to the lower member.

72. The ocular closure support device of claim 71, wherein the moisture chamber is at least partially bounded superiorly at least in part by the upper member lower portion and is at least partially bounded inferiorly by the lower member upper portion when the upper member is releasably engaged with the lower member.

73. The ocular closure support device of claim 48, wherein the upper member lower edge is part of a flap configured to reversibly engage with the lower member.

74. The ocular closure support device of claim 73, wherein a textured surface of at least a portion of the flap of the upper member is configured to reversibly fasten to a counterpart textured surface of at least a portion of a lower portion of the lower member.

75. A method of using an ocular closure support device, comprising:
exposing an adhesive backing of a medial side of the ocular closure support device;

applying the medial side of the ocular closure support device to the medial aspect of an eyelid of a patient;
reversibly anchoring an edge of the medial side of the ocular closure support device to a nose of a patient;
exposing an adhesive backing of a lateral side of the ocular closure support device; and
pressing from the medial side to an edge of the lateral side of the ocular closure support device over an eyelid of the patient.

76. The method of claim 75, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

77. A method of using an ocular closure support device, comprising:
exposing an adhesive backing of the ocular closure support device;
reversibly adhering the ocular closure device to an eyelid of a patient; and
pressing from a medial side to an edge of a lateral side of the ocular closure support device.

78. The method of claim 76, wherein the eyelid is an upper eyelid or a lower eyelid of the patient.

79. The method of claim 77, wherein the pressing reversibly adheres the ocular closure support device over an eye of the patient.

80. A method of using an ocular closure support device, comprising:
reversibly adhering a medial side of an upper member of the ocular closure support device to a skin of a medial aspect of the supraorbital rim and upper eyelid regions of a patient;
reversibly anchoring a medial edge of the upper member of the ocular closure support device to a region medial to a medial canthus of the patient;
reversibly affixing a lateral side of the upper member of the ocular closure

support device to a skin of a lateral aspect of the supraorbital rim and upper eyelid regions of the patient;

reversibly affixing a lower member of the ocular closure support device to a skin of the infraorbital rim and lower eyelid regions of the patient; and

reversibly engaging a lower portion of the upper member with the lower member.

81. The method of claim 80, further comprising decoupling the lower portion of the upper member from the lower member to inspect or treat an eye of the patient covered by the ocular closure support device.

82. The method of claim 81, further comprising inspecting an eye of the patient and/or palpebral closure status via at least a portion of the upper member of the ocular closure support device being transparent.

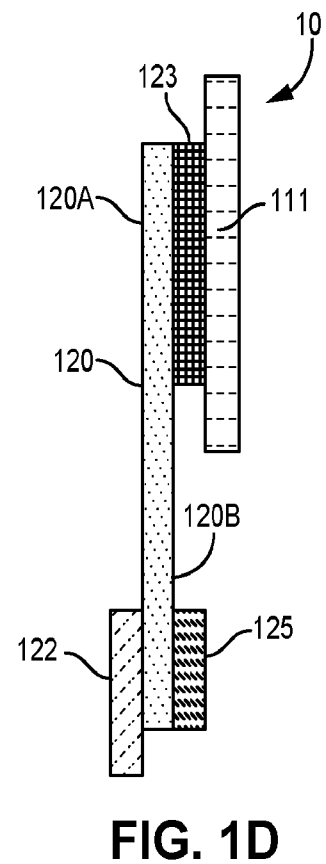
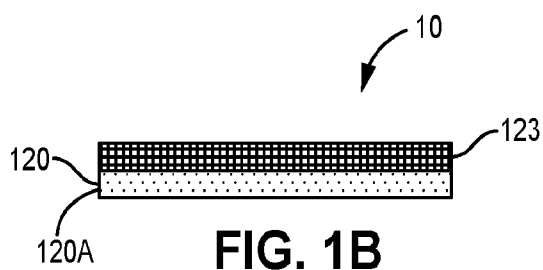
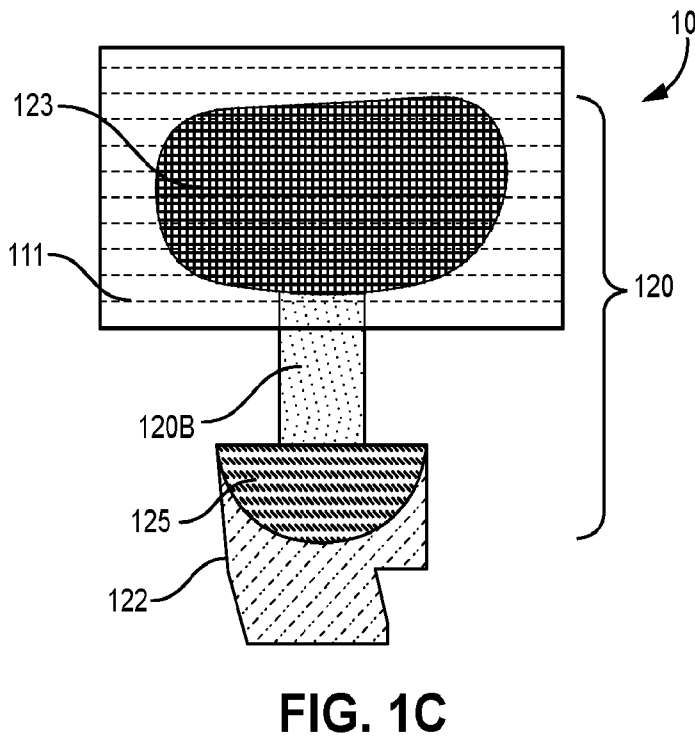
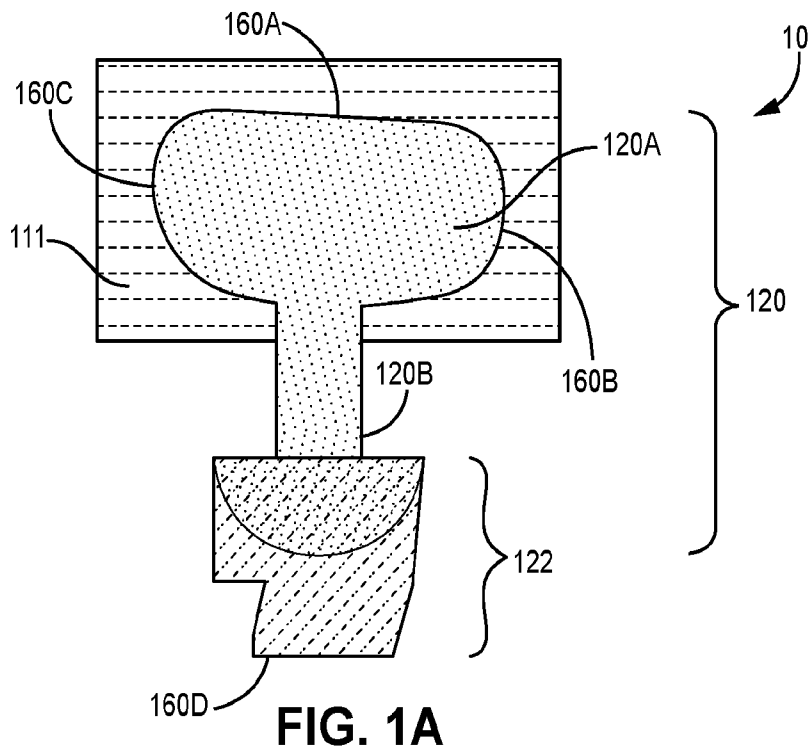
83. The method of claim 81, wherein the ocular closure support device is placed and removed without disrupting a line of sight of the patient.

84. The method of claim 81, further comprising reversibly closing an upper eyelid of the patient via applied downward tension from the upper member lower portion of the ocular closure support device reversibly engaging with the lower member of the ocular closure support device.

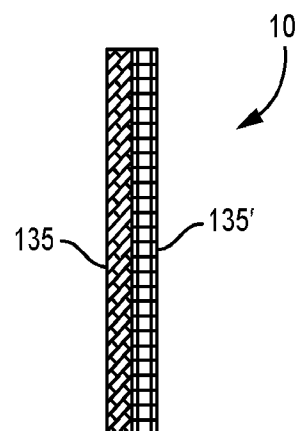
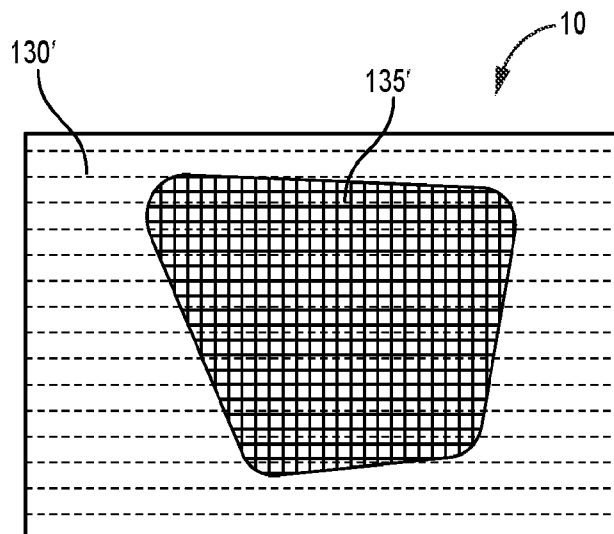
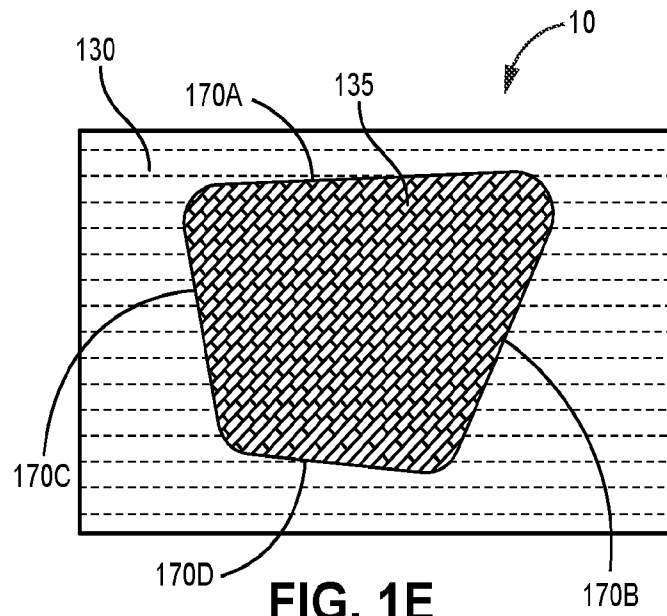
85. The method of claim 81, further comprising reversibly engaging with the lower member of the ocular closure support device to form a moisture chamber over a interpalpebral fissure.

86. The method of claim 81, further comprising treating an eye of the patient via injecting fluid through an aperture on the upper member of the ocular closure support device, wherein the aperture is over a palpebral fissure of the patient.

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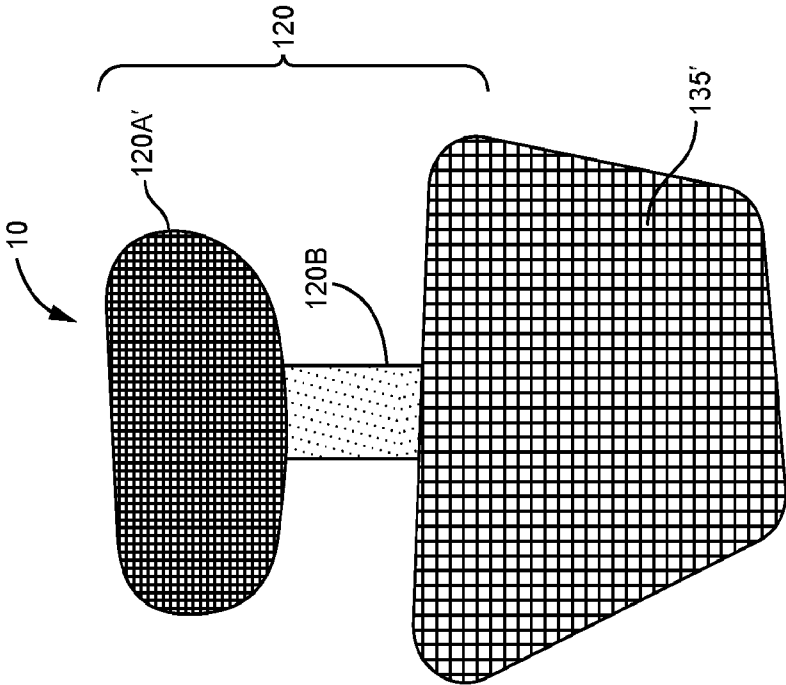


FIG. 1I

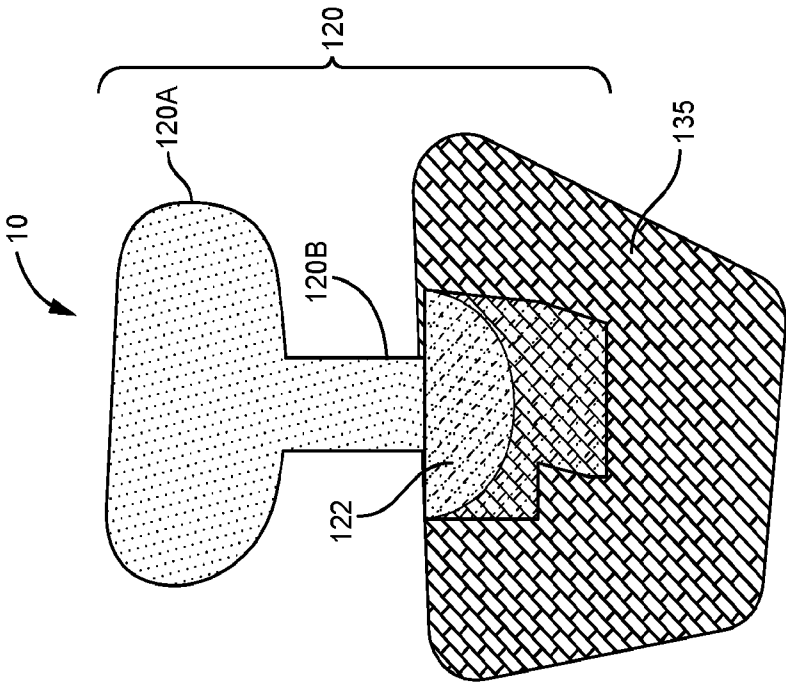


FIG. 1H

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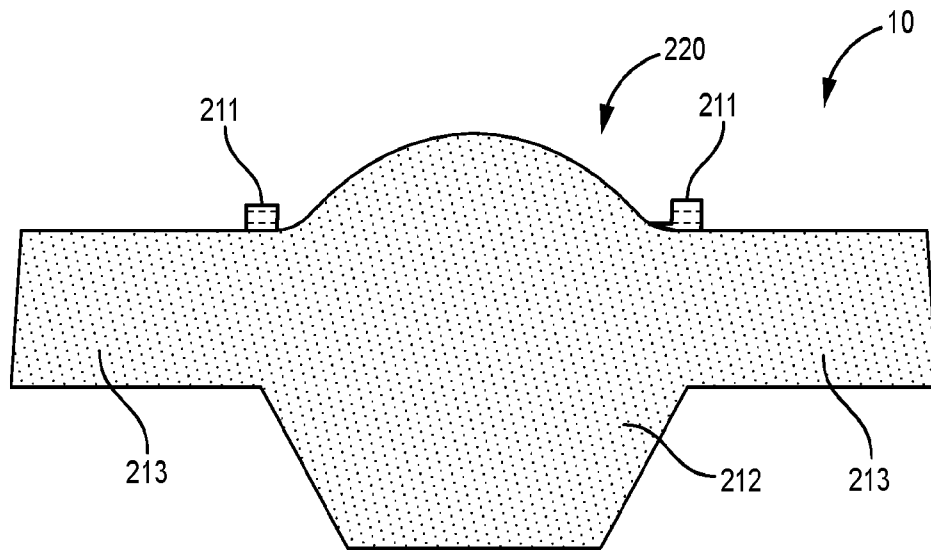


FIG. 2A

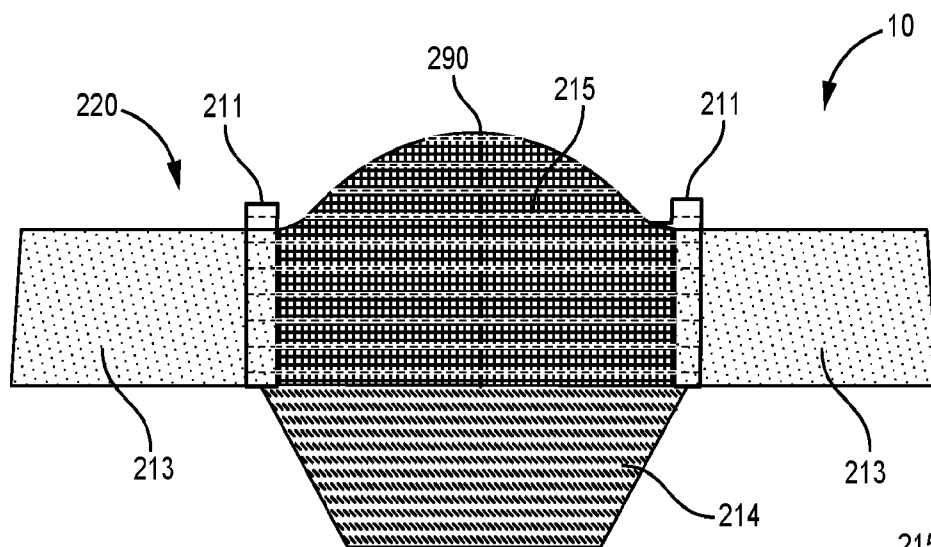


FIG. 2B

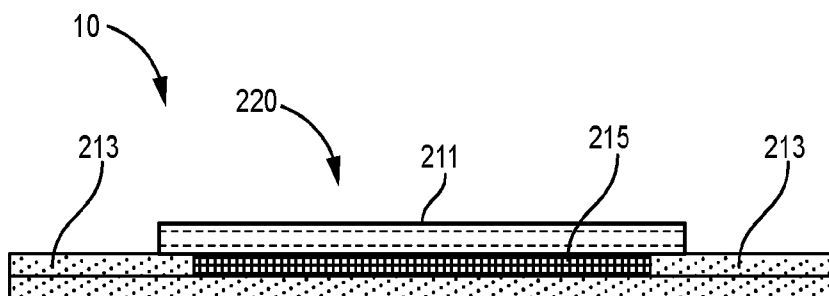


FIG. 2C

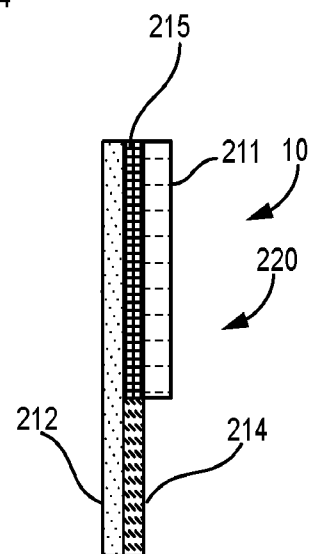


FIG. 2D

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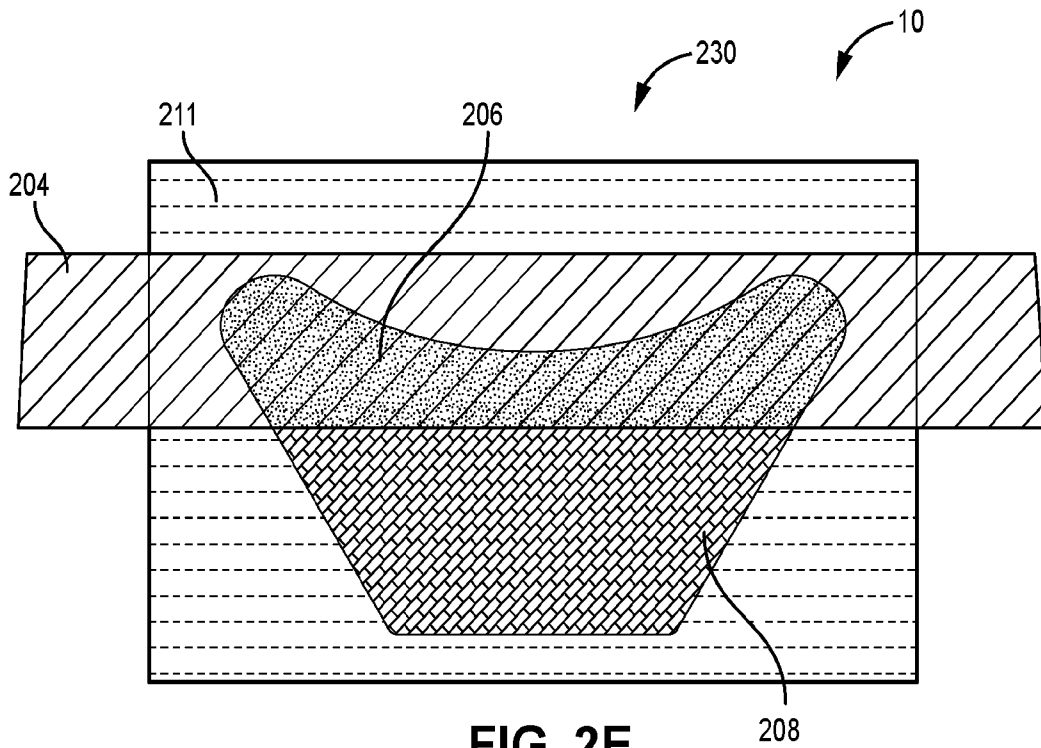


FIG. 2E

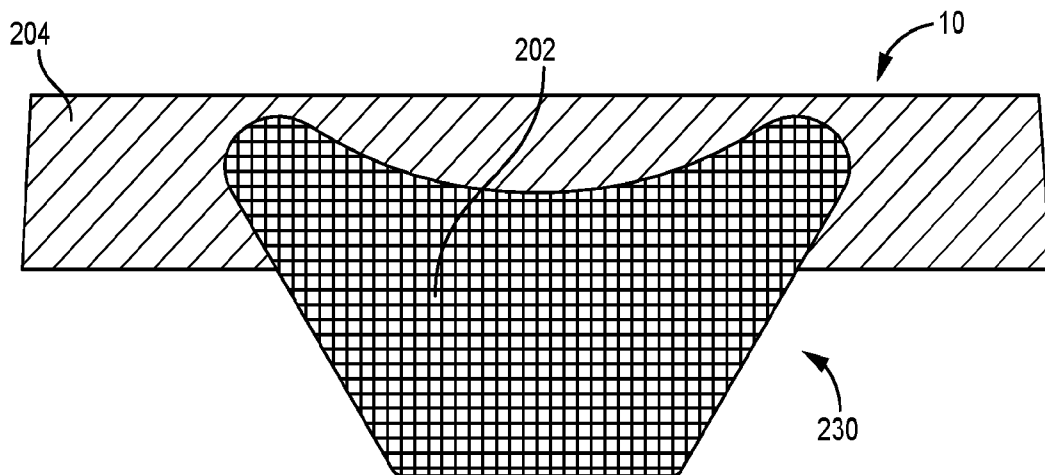


FIG. 2F

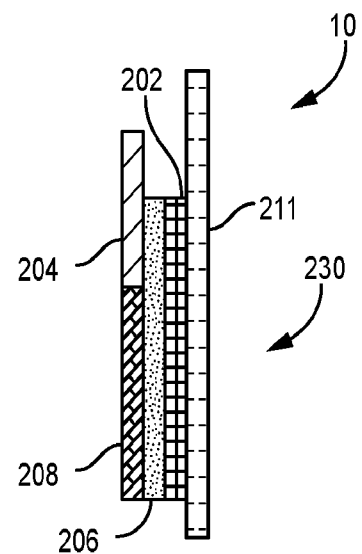


FIG. 2G

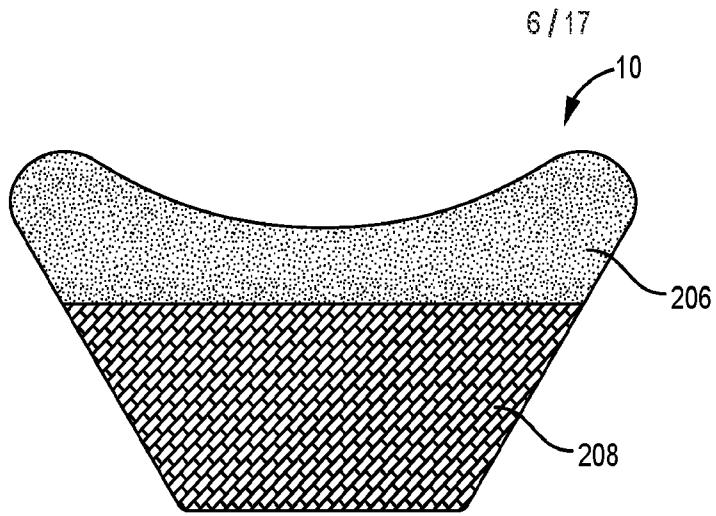


FIG. 2H

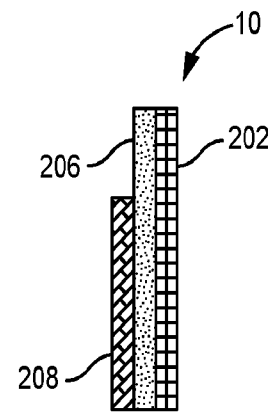


FIG. 2I

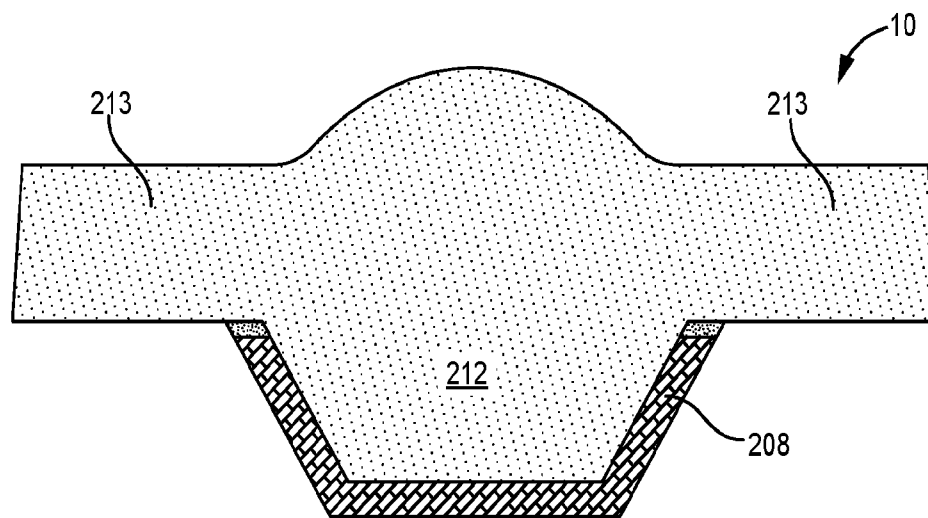


FIG. 2J

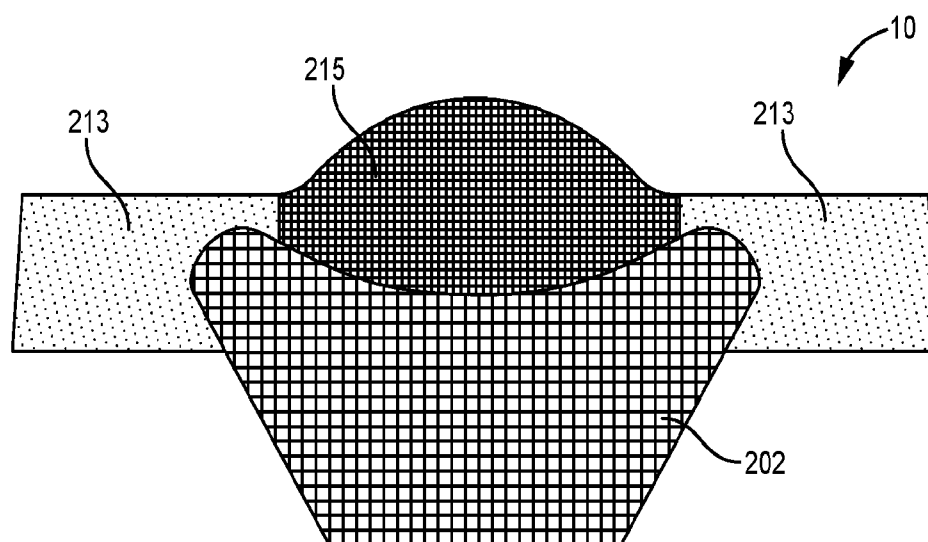


FIG. 2K

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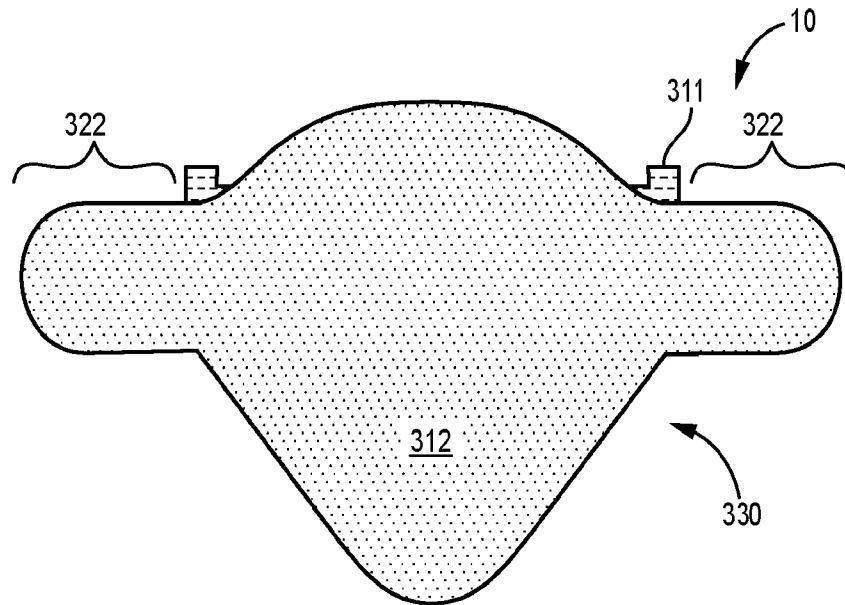


FIG. 3A

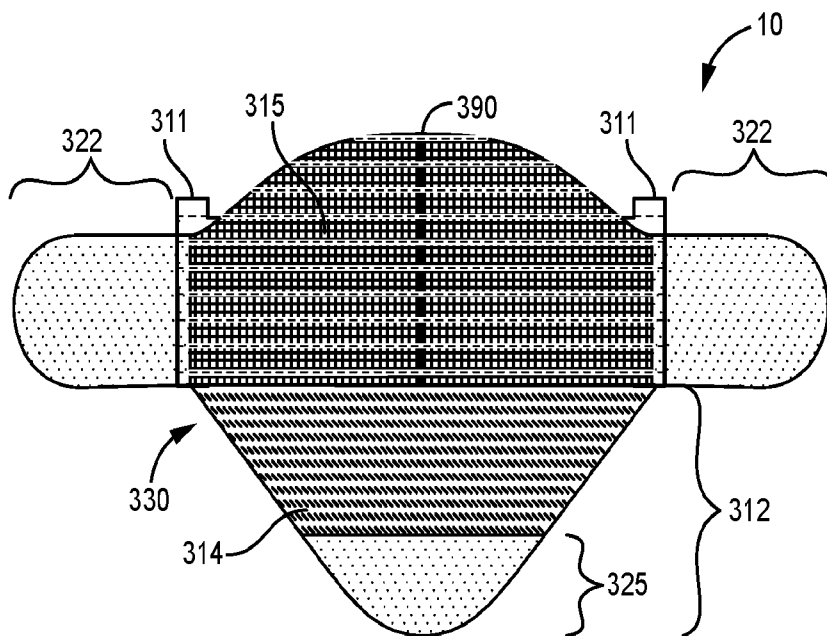


FIG. 3B

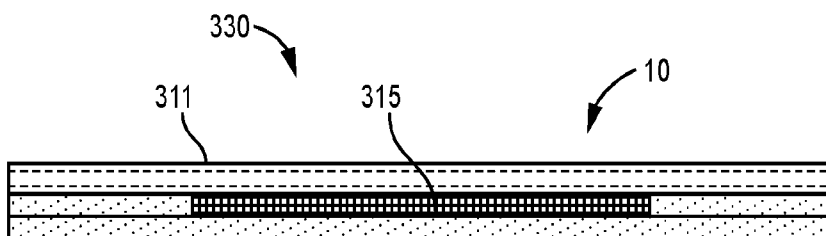


FIG. 3C

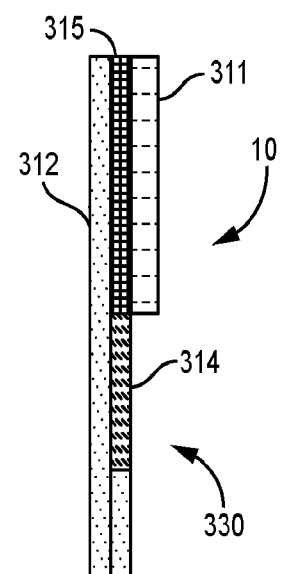


FIG. 3D

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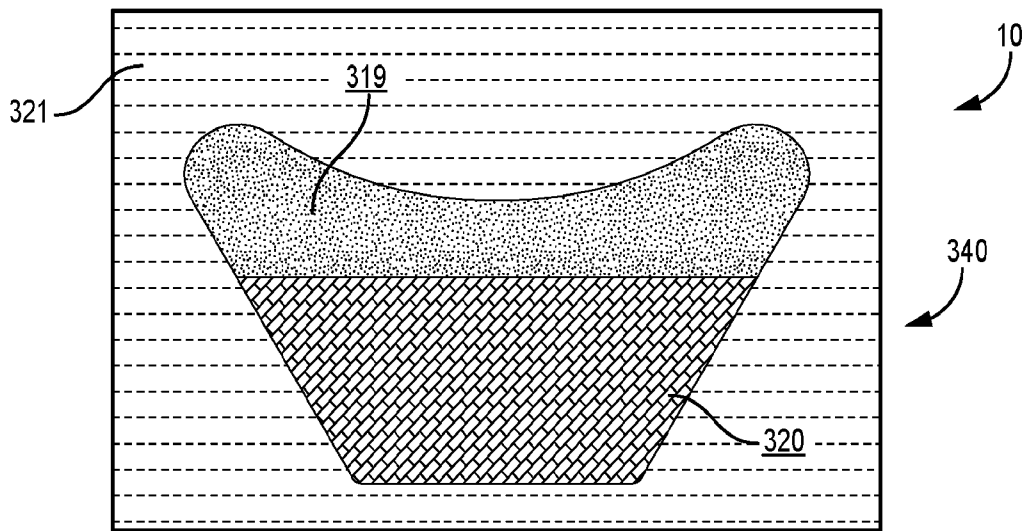


FIG. 3E

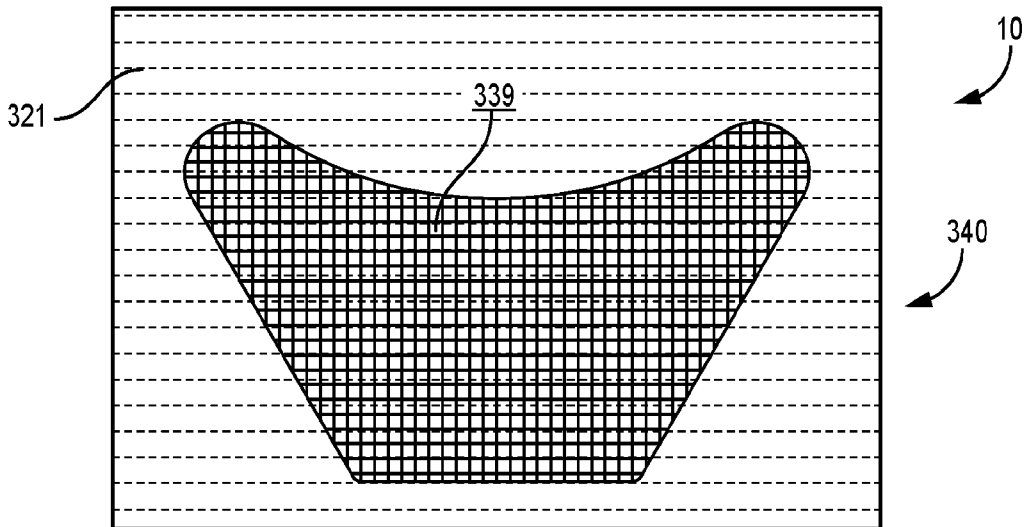


FIG. 3F

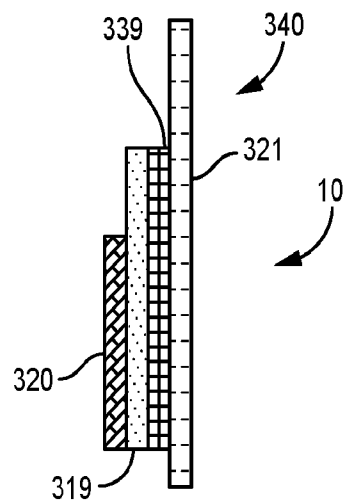


FIG. 3G

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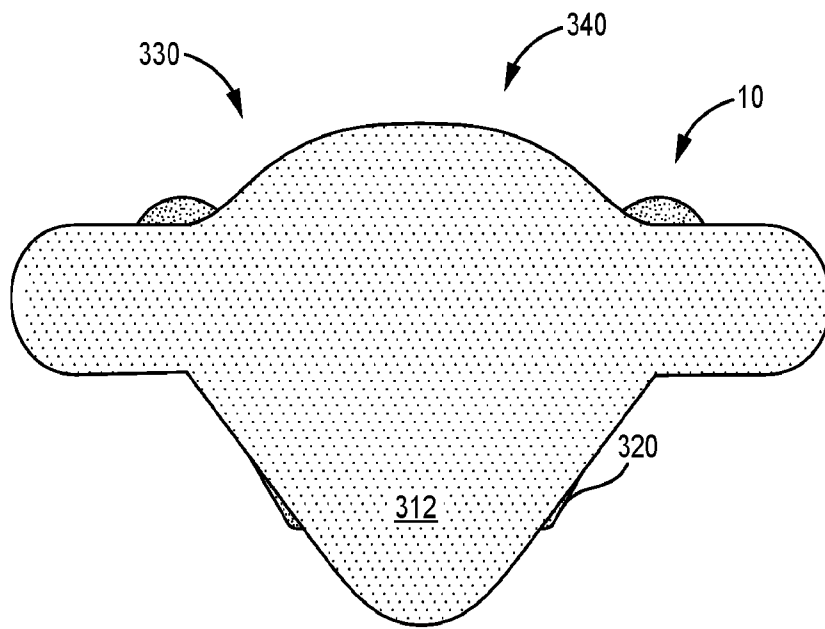


FIG. 3H

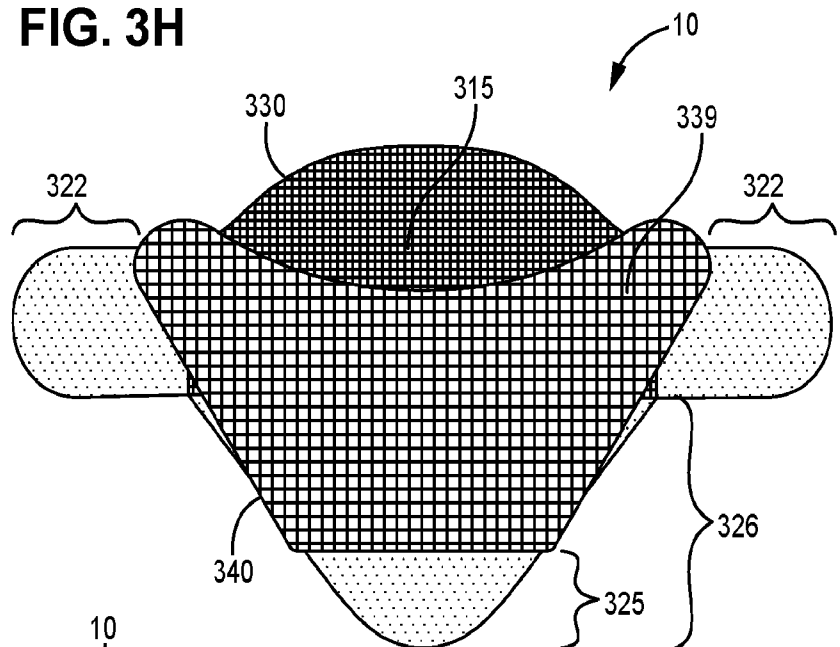


FIG. 3I

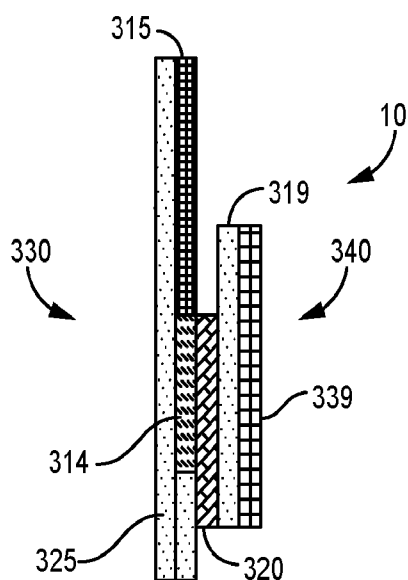


FIG. 3J

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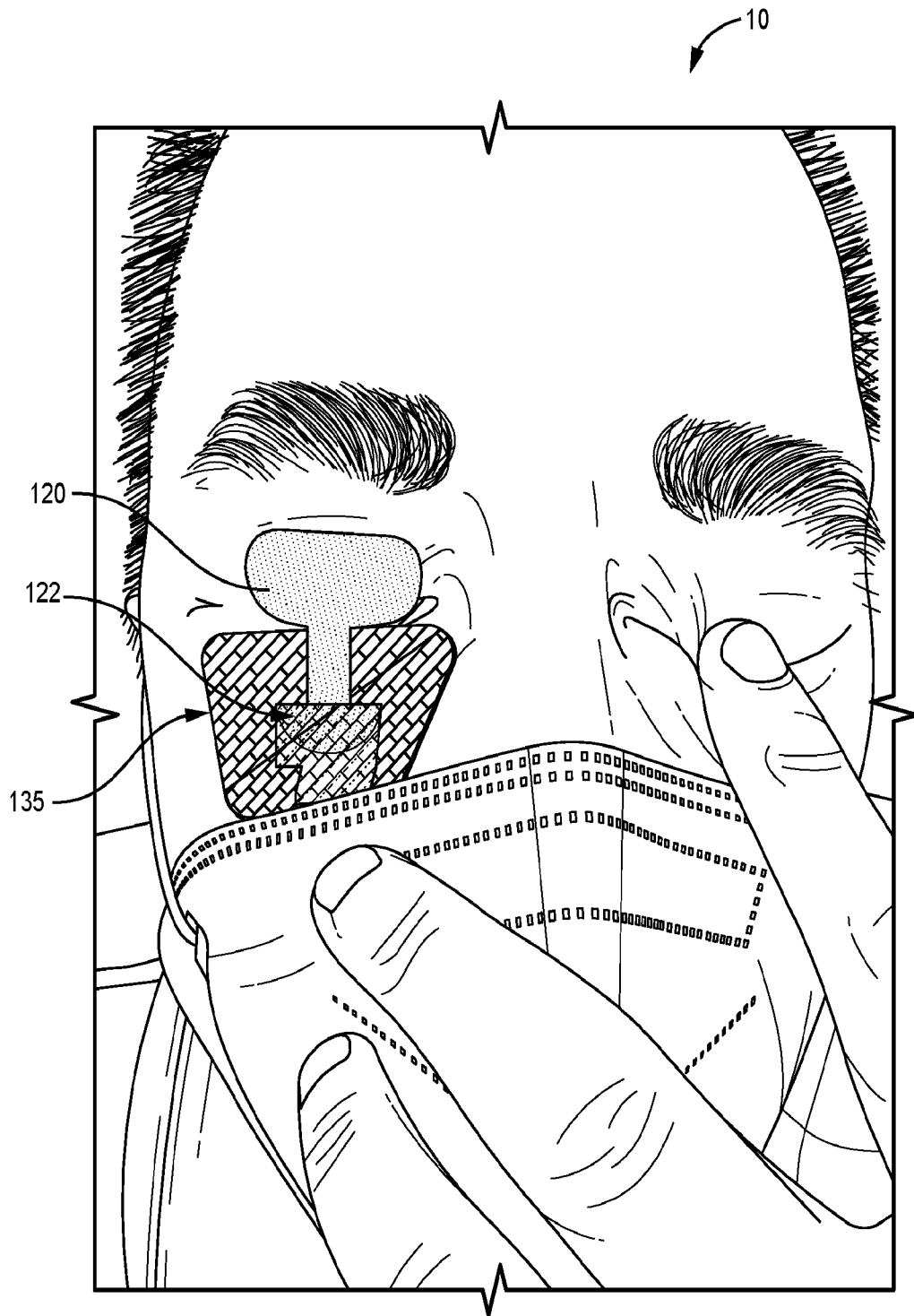


FIG. 4

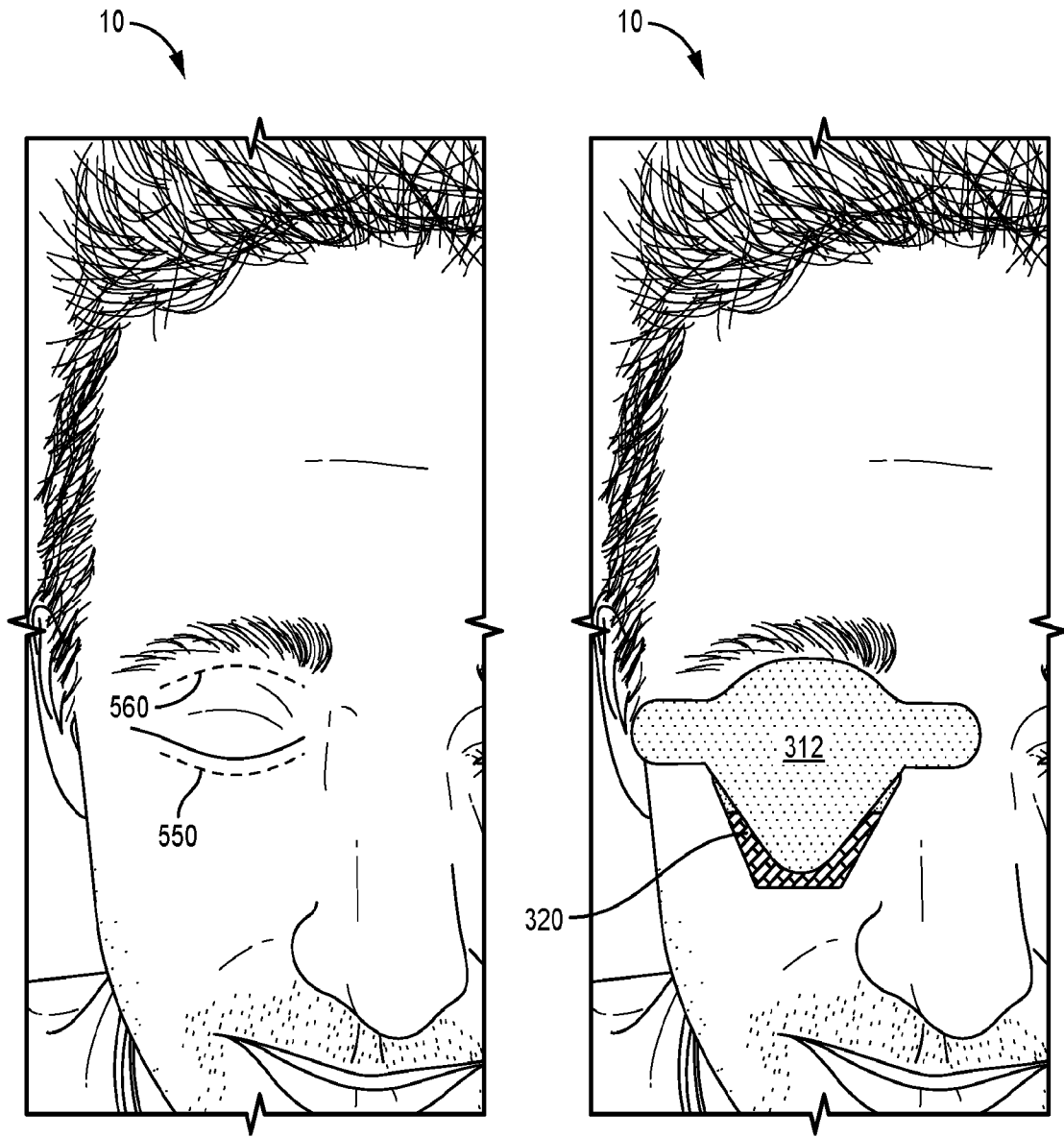


FIG. 5A

FIG. 5B

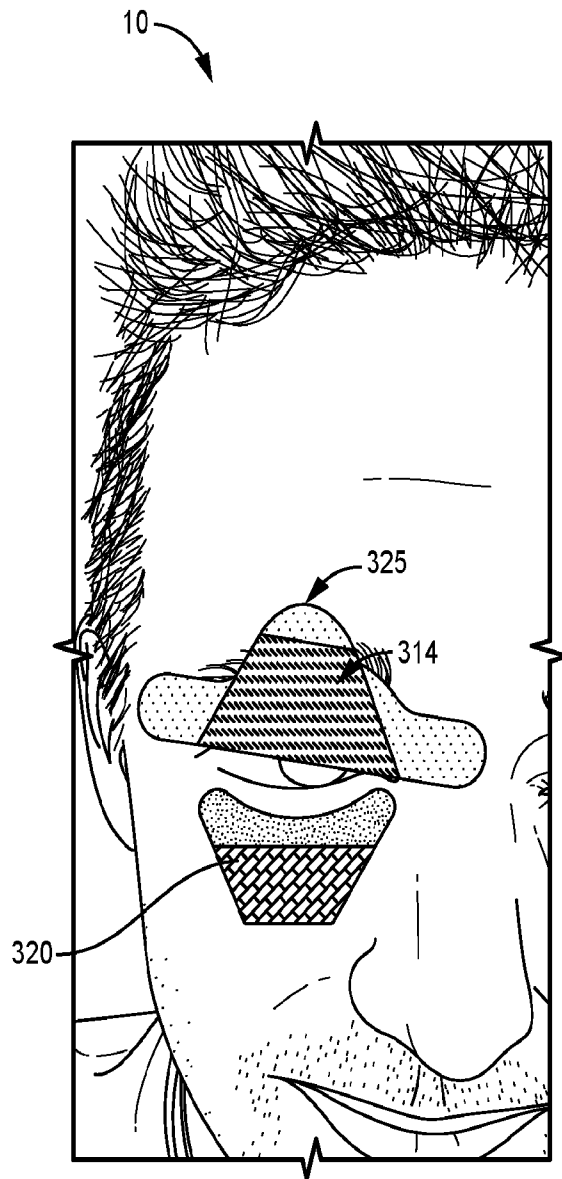


FIG. 5C

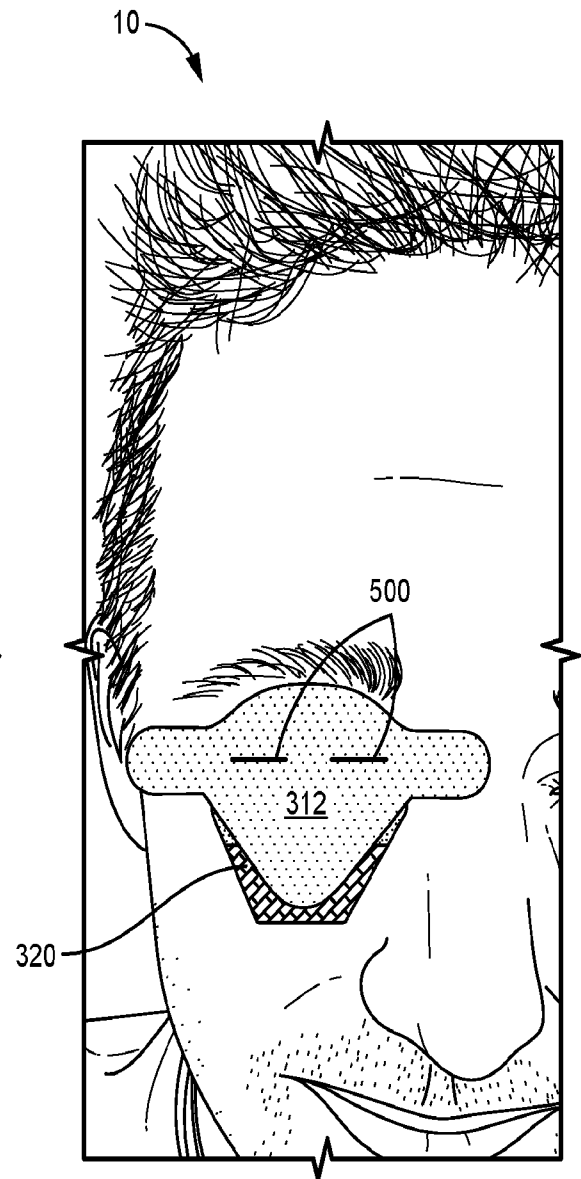


FIG. 5D

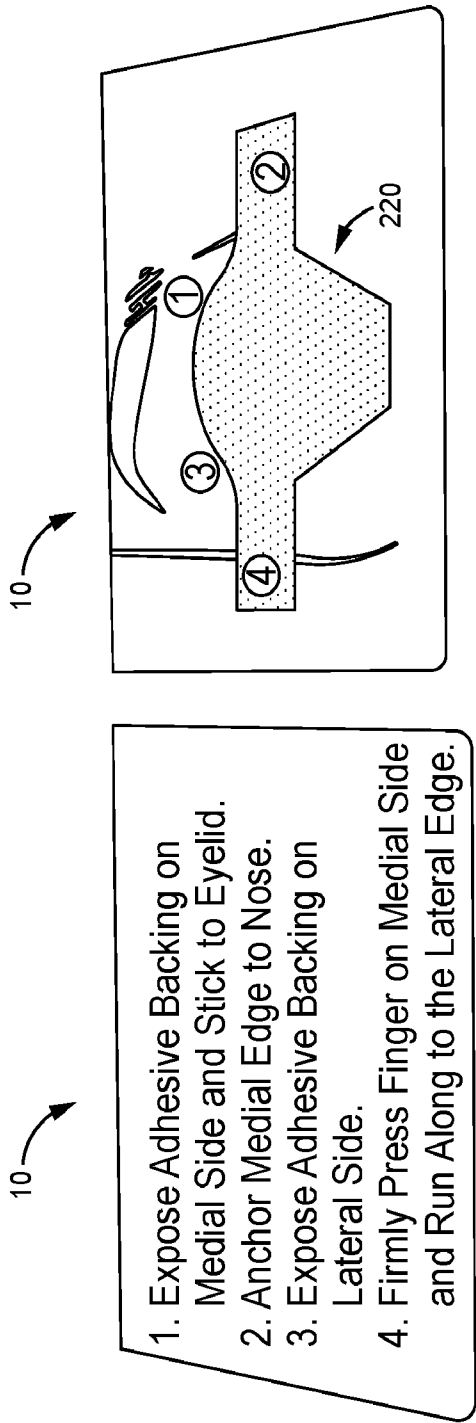


FIG. 6B

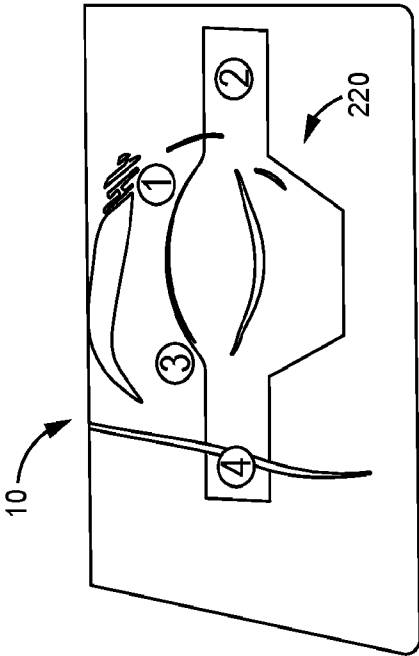


FIG. 6C

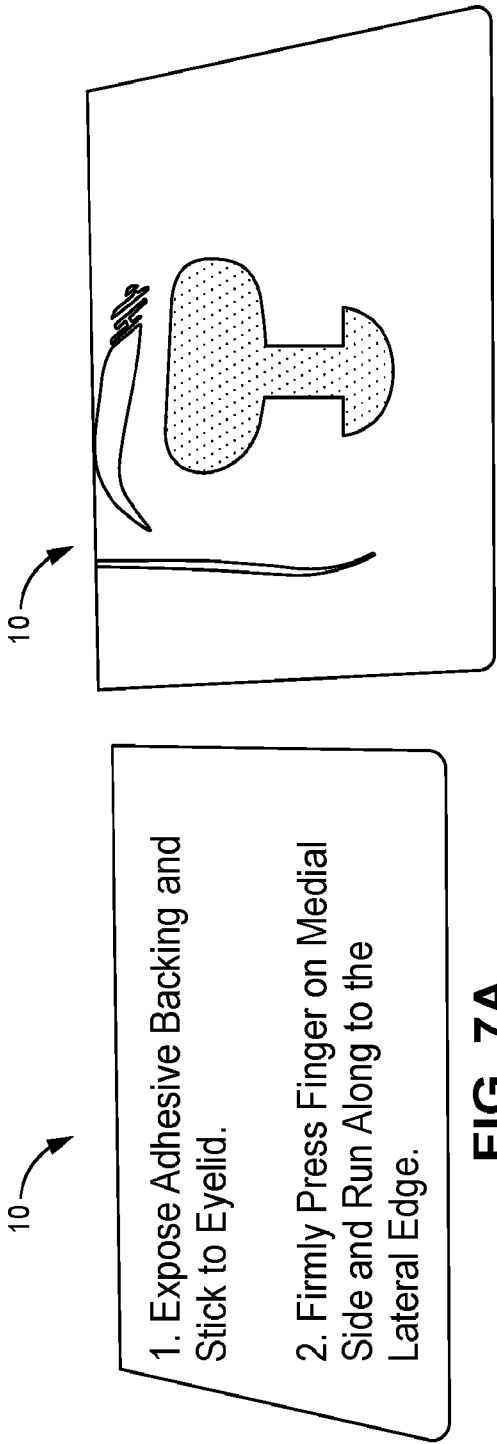
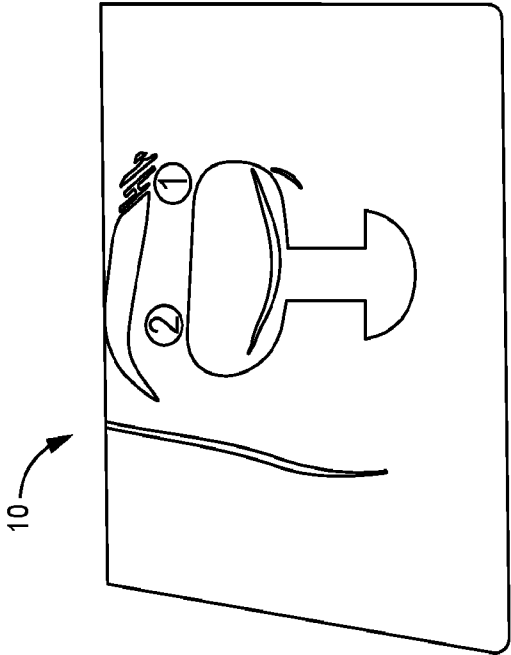
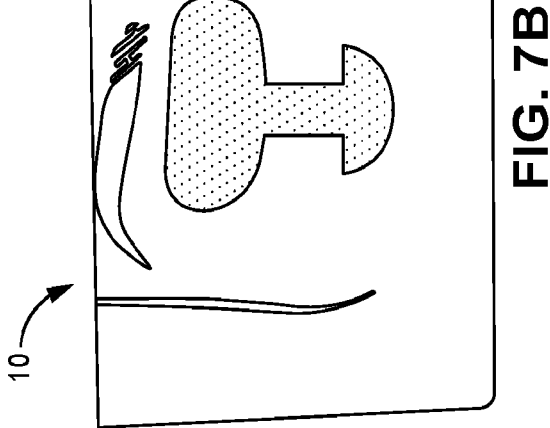
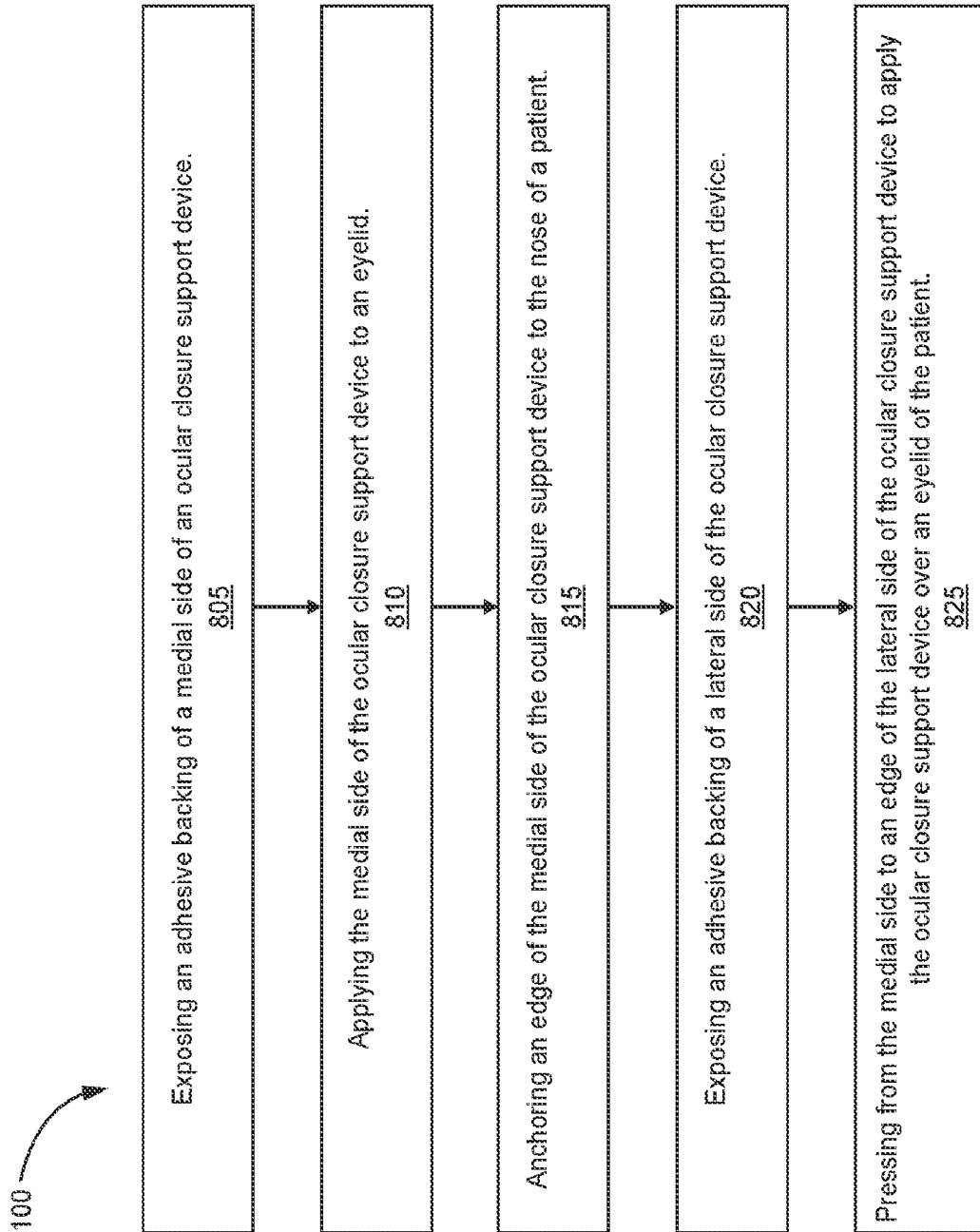


FIG. 7A



**FIG. 8**

100

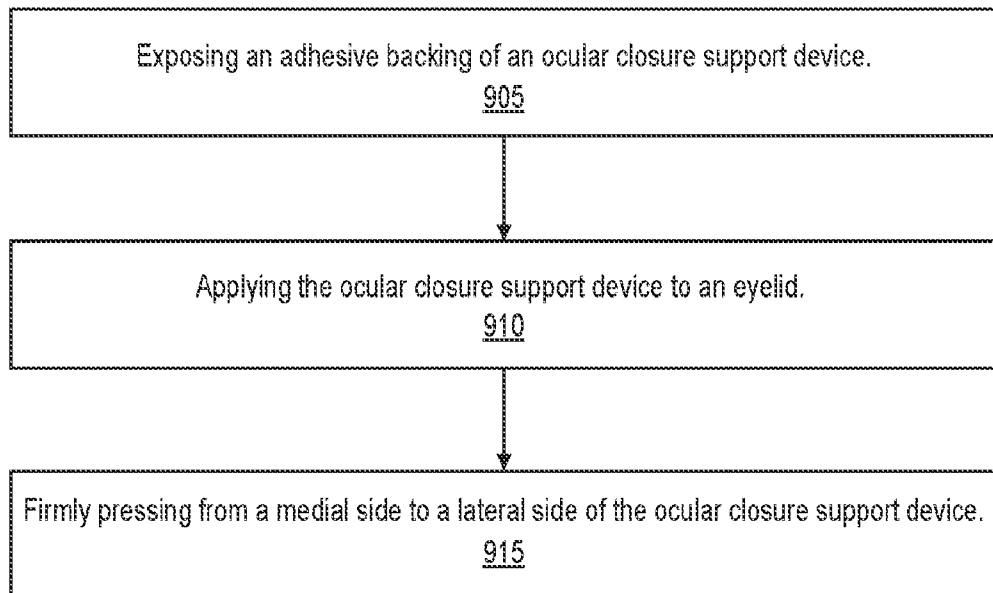


FIG. 9

100

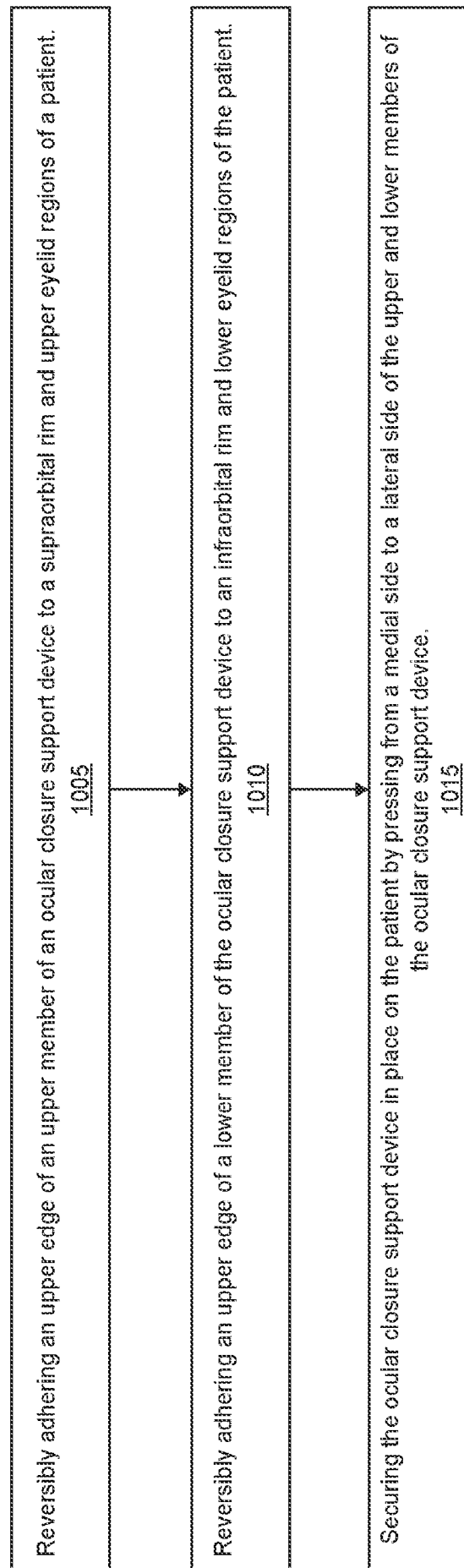
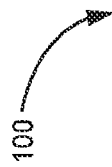


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/035676

A. CLASSIFICATION OF SUBJECT MATTERIPC: **A61F 9/04** (2024.01); **B32B 7/06** (2024.01); **B32B 7/12** (2024.01); **C09J 7/40** (2024.01); **A61F 13/0246** (2024.01); **A61F 13/12** (2024.01)CPC: **A61F 9/045**; **A61F 13/0246**; **A61F 13/124**; **B32B 7/06**; **B32B 7/12**; **C09J 7/40**; A61F 2013/0057

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

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

See Search History Document

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

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/0085257 A1 (MASKET) 26 March 2015 (26.03.2015)	1-7
Y	entire document	8-10, 35
Y	US 4,709,695 A (KOHN et al.) 01 December 1987 (01.12.1987)	8-10, 35
Y	entire document	
A	US 2021/0387000 A1 (I-LUMEN SCIENTIFIC, INC.) 16 December 2021 (16.12.2021)	1-10, 35
A	entire document	

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

25 September 2024 (25.09.2024)

Date of mailing of the international search report

05 November 2024 (05.11.2024)

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Telephone No. 571-272-4300

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claim 40 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claim 40 is indefinite for the following reason(s): Claim 40 depends from claim 28 which lacks antecedent basis for “the pressing” recited therein. For the purpose of this written opinion, claim 40 is interpreted as depending from claim 38 which provides proper antecedent basis for “the pressing”.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-10 and also claim 35 “in part”, is drawn to an ocular closure support device comprising: the upper member being configured to reversibly fasten to the lower member.

Group II, claims 11-34, 48-74 and also claim 35 “in part”, is drawn to an ocular closure support device, comprising: a width of the upper edge of the lower member being greater than a width of the lower edge of the lower member.

Group III, claims 36-47 and 75-86, is drawn to a method of using an ocular closure support device, the method comprising: exposing an adhesive backing of a medial side of the ocular closure support device.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: the upper member is configured to reversibly fasten to the lower member as claimed therein is not present in the invention of Groups II or III. The special technical feature of the Group II invention: a width of the upper edge of the lower member is greater than a width of the lower edge of the lower member, wherein a width of the upper edge of the upper member is greater than a width of the lower edge of the upper member, wherein the lower edge of the upper member is part of a lower portion of the upper member having a surface configured to releasably engage with the lower member for palpebral closure and opening as claimed therein is not present in the invention of Groups I or III. The special technical feature of the Group III invention: exposing an adhesive backing of a medial side of the ocular closure support device; applying the medial side of the ocular closure support device to the medial aspect of an eyelid of a patient; reversibly anchoring an edge of the medial side of the ocular closure support device to a nose of a patient; exposing an adhesive backing of a lateral side of the ocular closure support device; and pressing from the medial side to an edge of the lateral side of the ocular closure support device over an eyelid of the patient as claimed therein is not present in the invention of Groups I or II.

Groups I-III lack unity of invention because even though the inventions of these groups require the technical feature of an ocular closure support device comprising: (a) an upper member constructed to adhere to a supraorbital rim of a patient; and (b) a lower member constructed to adhere to an infraorbital rim of the patient, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2021/0387000 to i-Lumen Scientific, Inc. teaches an ocular closure support device comprising: (a) an upper member constructed to adhere to a supraorbital rim of a patient; and (b) a lower member constructed to adhere to an infraorbital rim of the patient (FIG. 2A is a schematic front-view diagram of a disposable appliance partially encircling eye strip system 201, using, on each eye, a single partially encircling eye strip 215 with electrodes for both upper and lower eye lid showing position of electrodes 111 and cable 114 to a micro-current stimulation controller apparatus (not shown here—see FIG. 1A for an example), according to some embodiments of the present invention, para. 0070. In some embodiments, an elastic band (not shown here, but similar to band 662 of FIG. 6A) wraps around the head of the patient to snugly hold the electrodes 111 against the skin of the patient around the patient's eyes (e.g., on the upper and lower eyelids, and/or on the supraorbital bone (the supraorbital foramen of the frontal bone of the skull) and/or infraorbital bone (the front of the zygomatic bone and/or maxilla)), para. 0080).

Since none of the special technical features of the Group I-III inventions are found in more than one of the inventions, unity of invention is lacking.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/035676

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: **1-10, 35**

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.