# HEADGEAR CLIP ARRANGEMENT

## INCORPORATION BY REFERENCE TO ANY PRIORITY APPLICATIONS

**[0001]** Any and all applications to which priority is claimed are hereby incorporated by reference herein and made a part of the present disclosure.

## BACKGROUND

Technical Field

**[0002]** The present disclosure generally relates to masks for use in providing respiratory therapies such as, but not limited to, constant positive airway pressure (CPAP) and non-invasive ventilation (NIV). More particularly, the present disclosure relates to a headgear connection assembly configured to provide improved reliability and ease of use for full face, nasal, nasal pillows, cannulas, and other masks or interfaces.

Description of Related Art

**[0003]** Respiratory masks are used to provide therapies for the treatment of a variety of respiratory conditions including but not limited to CPAP and NIV. The present disclosure will be described in relation to CPAP therapy, however it is to be understood that it may be equally applicable to other therapies.

**[0004]** CPAP therapy is used in the treatment of obstructive sleep apnea (OSA), a condition in which the back of the throat relaxes so much while sleeping that it narrows or entirely blocks the airway. With the constriction or closure of the airway, breathing can stop or become very shallow for a few seconds or longer. CPAP splints open the airway by providing a constant flow of pressurized air to the airway via an interface such as a mask. For the therapy to be effective, a substantially leak free seal ideally should be maintained between the mask and a user's face. In order to achieve this, a headgear system can be used to secure the mask to a user's face. It is commonly known in the art for there to be a headgear connection assembly between a headgear and a mask. The headgear connection may include a fastening means, such as but not limited to, hooks, loops and clips that allow the headgear to be selectively attached and detached.

**[0005]** Some characteristics that exist with prior headgear connection assemblies include fasteners being difficult to attach to and/or detach from the mask, fasteners detaching undesirably during use, resulting in leaks and/or loss of therapy, or fasteners providing too much or too little mobility in the connection between headgear and mask, which may impact the ease with which a mask is fitted and/or user comfort. These characteristics may lead to the mask and headgear system lacking a desirable level of ease of use, reliability and/or comfort, which in turn may result in less-than-ideal user compliance.

**[0006]** It is an objective of one or more embodiments disclosed herein to at least partially address one or more of these characteristics. Alternatively, it is an object to at least provide a useful choice to the public.

## BRIEF SUMMARY

**[0007]** According to a first aspect of the presently disclosed subject matter, there is provided a headgear connection assembly for a respiratory mask, the headgear connection including a clip and a clip attachment portion. The clip attachment portion includes a post and a clip receiving opening. The clip includes a hook configured to engage with the post, a headgear attachment loop, and one or more finger grips. The hook includes a central portion, two outer portions and an interference bump.

**[0008]** According to a second aspect of the presently disclosed subject matter, the clip attachment portion further comprises a stop bump configured to restrict unwanted rotation of the clip when assembled.

**[0009]** Further aspects of the presently disclosed subject matter, which should be considered in all its novel aspects, will become apparent to those skilled in the art upon reading of the following description which provides at least one example of a practical application of the invention.

**[0010]** In some configurations, a clip connector for connecting a headgear to a mask body includes a body portion configured for attachment to the headgear. A hook portion defines a U-shape having a first leg, a second leg and an entrance to a space between the first leg and the second leg. The hook portion can comprise a central portion, a pair of outer portions positioned on opposing sides of the central portion. Each of the central portion

and the pair of outer portions define a portion of both the first leg and the second leg. An interference bump can be provided on at least one of the central portion and the pair of outer portions. The interference bump extends into the entrance to the space. The central portion and the pair of outer portions are configured to flex independently of one another.

**[0011]** In some configurations, a width of the entrance at the interference bump is smaller than a width of an attachment structure of the mask body configured to be received within the space of the hook portion.

**[0012]** In some configurations, only the central portion includes the interference bump and flexes to allow an attachment structure of the mask body to be introduced into the space of the hook portion.

**[0013]** In some configurations, only the outer portions include the interference bumps and flex to allow an attachment structure of the mask body to be introduced into the space of the hook portion.

**[0014]** In some configurations, at least the ones of the central portion and outer portions without the interference bump accommodates a tension force of the headgear in use.

**[0015]** In some configurations, a slot is provided between the central portion and each of the outer portions.

**[0016]** In some configurations, the slot extends through first leg and second leg of the hook portion.

**[0017]** In some configurations, the slots are filled with an elastic filler material.

**[0018]** In some configurations, the filler material is overmolded onto the clip connector.

**[0019]** In some configurations, at least one finger grip portion is disposed on the body portion. The finger grip portion can be formed from a soft or elastic material.

**[0020]** In some configurations, the soft or elastic material of the finger grip portion is overmolded onto the body portion.

**[0021]** In some configurations, the at least one finger grip portion comprises first and second finger grip portions on opposing edges of the body portion of the clip connector.

**[0022]** In some configurations, the central portion is more flexible than the outer portions.

**[0023]** In some configurations, a mask assembly includes a mask body comprising a post and an opening adjacent the post and a clip connector, such as any of the clip connectors described in the preceding paragraphs. The post can be configured to be received within the space of the hook portion of the clip connector. The mask body can comprise a limitation bump within the opening that contacts the clip connector to limit rotation of the clip connector relative to the mask body.

**[0024]** In some configurations, the limitation bump limits one or both of rotation about an axis of the post and rotation normal to the axis of the post.

**[0025]** In some configurations, the limitation bump is located on an upper edge of the opening.

**[0026]** In some configurations, a respiratory mask is configured to deliver pressurized gas to a user. The mask is configured to attach to headgear by a connector clip having a body portion and a hook portion. The respiratory mask comprises a post configured to be received within a space of the hook portion of the connector clip. An opening is adjacent the post. A limitation bump is associated with the opening and is configured in use to contact the connector clip to limit rotation of the connector clip relative to the mask.

**[0027]** In some configurations, the limitation bump is located on an upper side of the opening and in use limits upward rotation of the connector clip, but permits downward rotation and disconnection of the connector clip from the post.

**[0028]** In some configurations, a width of the opening is configured to be equal to or smaller than a width of the body portion.

**[0029]** In some configurations, the limitation bump is configured to contact the body portion of the clip to limit rotation.

**[0030]** In some configurations, the limitation bump limits forward rotation of the connector clip.

**[0031]** In some configurations, rotation is limited to no more than 90 degrees.

**[0032]** In some configurations, a respiratory mask assembly includes a headgear, a connector clip having a body portion and a hook portion, and a respiratory mask, such as any of the respiratory masks described in the preceding paragraphs. The connector clip is

configured to connect the headgear to the mask. The body portion is connected to the headgear. The hook portion is narrower than the body portion.

**[0033]** In some configurations, a connector arrangement comprising a connector clip for connecting a headgear to a mask body includes an attachment portion disposed on one of the mask body and the connector clip. A deflectable hook is disposed on the other of the mask body and the connector clip. A width of an entrance of the deflectable hook is narrower than a width of the attachment portion. The attachment portion is inserted through the entrance of the deflectable hook to connect the headgear to the mask body. An interference bump is disposed on the deflectable hook and protrudes in a direction that narrows the entrance of the deflectable hook. The interference bump inhibits the attachment portion from exiting through the entrance.

**[0034]** The deflectable hook can be selectively attached over the attachment portion via an interference fit between the attachment portion and the deflectable hook to connect the headgear to the mask body.

**[0035]** The interference bump can extend along the entire width of the deflectable hook.

**[0036]** The deflectable hook can include a center hook portion positioned between, adjacent to, and in alignment with outer hook portions. The center hook portion can be flexible independent of the outer hook portions.

**[0037]** An interference bump can be disposed on the center hook portion and protrude in a direction that narrows the entrance into the deflectable hook. The interference bump can prevent the attachment portion from exiting through the entrance.

**[0038]** An interference bump can be disposed on each of the center hook portion and the outer hook portions and protrude in a direction that narrows the entrance into the deflectable hook. Each interference bump can inhibit the attachment portion from exiting through the entrance.

**[0039]** Slots can separate the center hook portion and the outer hook portions.

**[0040]** The slots can be filled with elastic material.

**[0041]** The deflectable hook can further comprise elastic material over-molded onto outer surfaces of the deflectable hook.

**[0042]** The attachment portion can further comprise a cylindrical column, wherein the deflectable hook attaches over the cylindrical column.

**[0043]** The center hook portion can be more flexible than the outer hook portions.

**[0044]** In some configurations, a connection system for connecting a headgear to a mask body includes an attachment portion disposed on the mask body. The attachment portion can further comprise an opening disposed on the mask body, and a post disposed along an outer extent of the opening. A connector is disposed on the headgear. The connector can further comprise a body portion and a deflectable hook portion. The deflectable hook portion of the connector can be selectively attached over the post to connect the headgear to the mask body. The attachment portion can further comprise at least one stop bump positioned adjacent to the post along an extent of the opening. The stop bump can protrude a distance into the opening. The at least one stop bump can contacts the connector and block rotation of the connector to prevent the connector from rotating and detaching from the post.

**[0045]** A width of the body portion along a direction parallel to an axis of the post when the deflectable hook portion is connected to the post can be greater than a width of the opening along the direction parallel to the axis of the post.

**[0046]** A width of the body portion along a direction parallel to an axis of the post when the deflectable hook portion is connected to the post can be greater than a width of the deflectable hook portion along the direction parallel to the axis of the post when the deflectable hook portion is connected to the post.

**[0047]** The body portion can contact the mask body to limit a range of rotation of the connector about the post.

**[0048]** The range of rotation of the connector about the post can be 90 degrees or less.

**[0049]** The at least one stop bump can be positioned along an upper extent of the opening.

**[0050]** The at least one stop bump can extend a distance into the opening that is greater than the difference between the width of the opening along the direction parallel to an

axis of the post and the width of the body portion along a direction parallel to the axis of the post when the deflectable hook portion is connected to the post.

**[0051]** The body portion can contact the at least one stop bump to limit a range of rotation of the connector about the post.

**[0052]** The range of rotation of the connector about the post can be 90 degrees or less.

**[0053]** An interference bump can be disposed on the deflectable hook portion and protrude in a direction towards a lower surface of the body portion. A distance between the interference bump and the lower surface of the body portion can be less than a width of the post.

**[0054]** The interference bump can extend along the entire width of the deflectable hook portion.

**[0055]** The deflectable hook portion can include a center hook portion positioned between, adjacent to, and in alignment with outer hook portions. The center hook portion can be flexible independent from the outer hook portions.

**[0056]** An interference bump can be disposed on the center hook portion and protrude in a direction towards a lower surface of the body portion. A distance between the interference bump and the lower surface of the body portion can be less than a width of the post.

**[0057]** An interference bump can be disposed on each of the center hook portion and the outer hook portions and protrude in a direction towards a lower surface of the body portion. A distance between each interference bump and the lower surface of the body portion can be less than a width of the post.

**[0058]** Slots can separate the center hook and the outer hooks.

**[0059]** The slots are filled with elastic material.

**[0060]** Finger grip portions can be disposed on the body portion. The finger grip portions can be formed from an elastic material.

**[0061]** The post can have a cylindrical cross-sectional shape.

**[0062]** The post can have a vertical orientation relative to the orientation of the mask body in use.

**[0063]** A protrusion can be disposed on the body portion and extend away from an outer surface of the body portion. The protrusion can contact the mask and limit rotation of the connector about the post to less than 90 degrees.

**[0064]** The deflectable hook portion can be narrower than the body portion.

**[0065]** Elastic material can be over-molded onto outer surfaces of the deflectable hook portion.

**[0066]** In some configurations, a method for attaching a headgear to a mask body, in which the mask body has an attachment portion including an opening disposed on the mask body and a post disposed along an outer extent of the opening, the headgear having a connector including a body portion and a hook portion connected to the body portion, and the hook portion having an entrance that is narrower than a width of the post, the method comprising aligning an entrance of the hook portion with the post, inserting the post through the entrance of the hook portion, the hook portion deflecting in a direction away from the post as the post travels through the entrance of the hook portion, selectively securing the hook portion onto the post to connect the headgear and the mask body, the hook portion deflecting to an undeflected shape after the post has traveled through the entrance of the hook portion, the entrance narrowing to block the post from exiting through the entrance, and limiting rotation of the connector about the post via at least one stop bump positioned adjacent to the post along an extent of the opening, the stop bump contacting the body portion and blocking rotation of the connector beyond a range of rotation.

**[0067]** The method can further comprise limiting rotation of the connector about the post, the body portion contacting the mask body and blocking rotation of the connector beyond a range of rotation.

**[0068]** The body portion can limit the range of rotation of the connector about the post to 90 degrees or less.

**[0069]** The method can further comprise restricting rotation of the connector within the opening via at least one stop bump positioned adjacent to the post along an extent of the opening, the stop bump contacting and blocking rotation of the connector to prevent the hook portion from rotating and detaching from the post.

**[0070]** The at least one stop bump can limit the range of rotation of the connector about the post to 90 degrees or less.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0071]** Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

**[0072]** Figure 1 shows a perspective view of a respiratory mask;

**[0073]** Figure 2 shows a closer view of the clip attachment portion;

**[0074]** Figure 3A shows a side view of the clip of the present disclosure;

**[0075]** Figure 3B shows a top view of the clip of the present disclosure;

**[0076]** Figure 3C shows a front view of the clip of the present disclosure;

**[0077]** Figure 4A shows a cross-sectional view of the clip of the present disclosure;

**[0078]** Figure 4B shows a side view of the clip of the present disclosure;

**[0079]** Figure 5A shows a perspective view of a second embodiment of the clip of the present disclosure;

**[0080]** Figure 5B shows an end view of a variation of the second embodiment of the clip of the present disclosure;

**[0081]** Figure 6A shows a perspective view of the respiratory mask of Figure 2, with the headgear connection assembly shown in close up;

**[0082]** Figure 6B shows a perspective view of mask embodiment that includes a stop bump;

**[0083]** Figure 7 shows a perspective view of the respiratory mask of Figure 2, with the headgear connection assembly shown in a different position;

**[0084]** Figure 8 shows a close up perspective view of a headgear connection embodiment that includes a stop bump and the first clip embodiment;

**[0085]** Figure 9A shows a close up rear view of a clip attachment embodiment including the second clip embodiment; and

**[0086]** Figure 9B shows a plan view of a clip attachment embodiment including the second clip embodiment.

## DETAILED DESCRIPTION

**[0087]** As used herein the term 'over-molded' may be used to refer to any injection molding process, such as co-molding or two-shot molding, that combines two or more separate materials to create a single part, wherein the separate materials are permanently bonded to each other.

**[0088]** Figure 1 shows a perspective view of a respiratory mask 100 comprising a mask body 105, a headgear 110 and a headgear connection assembly 115. The headgear connection assembly 115 is configured to provide a means of easily connecting and disconnecting at least a portion of the headgear 110 to the mask body 105. The headgear connection assembly 115 includes a clip 120 and a clip attachment portion 125, wherein the clip 120 is configured to provide a connection between a headgear strap 130 and the clip attachment portion 125. The clip attachment portion 125 can be defined by, carried by or attached to a portion of the mask, such as the mask body 105.

**[0089]** Figure 2 shows the clip attachment portion 125. As shown, the clip attachment portion 125 is configured to be a part of the mask body 105. The clip attachment portion comprises a post 200 and a clip receiving opening 205. The post 200 is generally vertical, with respect to the orientation of the mask in use, when the user is sitting upright. However, the post 200 is not limited to a vertical position and may be oriented at various angles with respect to the orientation of the mask in use. The clip receiving opening 205 is forward of the post 200 (i.e., in a direction away from the user) and/or laterally inward of the post 200 (i.e., in a direction toward a centerline of the mask 100. The post 200 provides a location for the clip 120 to attach or be retained to the mask body 105.

**[0090]** The post 200 may be cylindrical in geometry (i.e., a circular cross-sectional shape) to allow easy connection of the clip 120 to the post 200. The cylindrical geometry is also configured to allow rotation of the clip 120 around the post 200. The post 200 is not limited to a circular cross-sectional shape and may include elliptical, polygonal, or a combination of several shapes. The cross-sectional shape of the post 200, in combination with the shape of the clip 120, may be configured to allow only a range of rotation of the clip

120 or bias the clip 120 towards preferred angles of rotation with respect to the post 200, if desired. The clip receiving opening 205 provides an opening for at least a portion of the clip 120 to pass through the clip attachment portion 125 and connect or attach to the post 200. This is just one configuration that can enable a clip 120 to be attached to a mask body 105.

**[0091]** In another embodiment, the post 200 may be positioned or configured such that an opening 205 may be unnecessary. For example, the post 200 may be attached to the mask body but positioned a distance away from a surface of the mask body. The distance away from the mask body may provide clearance for the clip 120 to connect or attach to the post 200. Other variations on geometry may provide improved functionality and will be described herein.

**[0092]** Figures 3A-3C show a non-limiting exemplary embodiment of the clip 120. As shown, the clip 120 includes a hook 300, an interference bump 310, a central portion 315 and two outer portions 320, a headgear attachment loop 330 and one or more finger grips 335. The hook 300 is configured to fit around and attach to the corresponding post 200 of the clip attachment portion 125. The hook 300 can have a first leg portion and a second leg portion defining a U-shape or J-shape in cross-section, for example, to define a space for receiving the post 200. The first leg can be attached to the body portion of the clip 120 and the second leg can define a free end of the hook 300. In some configurations, the cross-sectional shape of the hook 300 can allow the hook 300 to wrap around a majority of post 200. However, the hook 300 is not limited to any specific cross-sectional shape. The hook 300 includes an inner surface 305, which can be configured to be at least partially cylindrical to match the cylindrical geometry of the post 200. The inner surface 305 is not limited to a partial cylindrical shape and may interface with the corresponding shape of the post 200.

**[0093]** At the end of the hook 300, the inner surface 305 can be connected to and/or merge into an interference bump 310 that is configured to narrow the hook entrance 312 relative to the diameter of the post 200. When attaching the hook 300 to the post 200, the hook 300 transitions from an undeflected state to a deflected state. In other words, the narrower hook entrance 312 created by the interference bump 310 requires the hook 300 to deflect outward in a direction away from the post 200 in order to widen the hook entrance 312 as the post 200 passes through the hook entrance 312. When the post 200 has fully

passed through the hook entrance 312 and the clip 120 and the clip attachment portion 125 are connected, the hook 300 transitions back toward or to the undeflected state and the hook entrance 312 narrows. The interference bump 310 can act as a stop that retains the clip 120 on the post 200 by inhibiting or preventing the post 200 from passing through the hook entrance 312 in response to relatively low forces, such as those typically encountered during normal use, but that allows deliberate disconnection.

**[0094]** Further, in at least some configurations, the interference bump 310 may contact the post 200 to provide an interference fit between the post 200 and the clip attachment portion 125 when hook 300 is attached to the post 200. In addition or in the alternative, the hook 300 may have an inner diameter smaller than a diameter of the post 200 such that the hook 300 may have an interference fit with post 200. Such arrangements can assist in retaining the clip 120 in a desired rotational position. However, an interference fit connection is not necessarily utilized in all embodiments. In some configurations, when the hook 300 is in an undeflected state, the inner surface 305 and the interference bump 310 may define a diameter that is larger than the diameter of the post 200. With such an arrangement, the narrower hook entrance 312 created by interference bump 310 inhibits or prevents the post 200 from exiting through the entrance 312, but the clip 120 might otherwise have a relatively loose fit on the post 200 to allow rotational and/or sliding movement of the clip 120 relative to the post 200.

**[0095]** In the embodiment of Figures 3A-3C, the interference bump 310 has a constant geometry that extends along the width of the central portion 315. In other embodiments, the geometry of the interference bump 310 may extend along the entire width of the hook 300. Further, the geometry of the interference bump 310 and may be constant or varied along the width of the central portion 315 and/or the entire width of the hook 300.

**[0096]** The clip 120 can be made from a substantially rigid material, such as, but not limited to, polypropylene, nylon or polycarbonate. This material selection will provide the clip 120 with the structural integrity to support at least normal or expected retention forces applied by the headgear 110 to the mask body 105. The material can be capable of some elastic deformation so that the hook 300 can deflect when being attached to the post 200.

**[0097]** Figures 3B and 3C show an end view and a plan view, respectively, of the clip 120. It can be seen that the hook 300 comprises a central portion 315 and two outer portions 320. The central and outer portions 315, 320 can be configured to flex independently of each other. In one non-limiting exemplary embodiment, the central and outer portions are at least partially separated by one or more slots 325 (see also Figure 5B). In the embodiment shown, the slots 325 extend through both sides of the U-shaped hook 300, however, the length of the slots may be varied to provide a level of flexibility that enables an easy connection between the clip 120 and the clip attachment portion 125 whilst reducing or eliminating the likelihood of unwanted disconnection during use.

**[0098]** Figure 4A shows a cross-sectional view of the clip 120 along a line 4A-4A in FIG. 3C. This view shows that, in one non-limiting exemplary embodiment, the interference bump 310 can be more pronounced or only located on the central portion 315 (see also Figure 3A). As a result of the interference bump 310 reducing the size of the hook entrance 312 to a size that is narrower than the diameter of the post 200, the central portion 315 may be configured to be more flexible than the outer portions 320 in order to deflect and allow the post 200 to move past the interference bump 310. A portion or an entire length of the central portion 315 of the hook 300 may have a reduced cross-sectional thickness x, in comparison to corresponding locations of the outer portions 320, which have a thickness of y. The reduced thickness may result in increased flexibility in the central portion 315, which may allow it to deflect more readily when passing over the post 200, thus improving ease of use. Alternatively, the width W, as shown in Figure 3C, of the central portion 315 may be defined to provide the desired level of flexibility. The relatively thicker outer portions 320 can be more rigid or stronger than the central portion 315 and can accommodate or can be capable of accommodating a majority or a substantial entirety of the tension force of the headgear 110. In some configurations, the portions 315 and 320 can have the same or approximately the same thickness. In some configurations, the outer portions 320 may not flex or may not be required to flex to allow the post 200 to enter the space of the hook 300 through the entrance 312. The illustrated arrangement can also be reversed and the outer portions 320 can be thinner than the central portion 315 and/or can have interference bumps 310, as shown in Figure 4B. In such arrangements, the outer portions 320 can flex and the

central portion 315 may not flex or may not be required to flex for the post 200 to enter the space of the hook 300 through the entrance 312. Moreover, the entire arrangement can be reversed between the clip 120 and the mask body 105 such that the post 200 is defined or carried by the clip 120 and the hook 300 is defined or carried by the mask body 105.

**[0099]** In another non-limiting exemplary embodiment, as shown in Figure 5A, a clip 400 can comprise a substrate 410 and one or more over-molded portions 420. The substrate 410 can comprise the functional features of the clip being the hook 500 and headgear attachment loop 330. The substrate 410 can be made from a substantially rigid material as per the clip 120 of the previous embodiments. The over-molded portions 420 can be made from a soft and/or flexible material, such as, but not limited to, silicone rubber or a thermoplastic elastomer. The over-molded portions 420 can be configured to provide finger grips 430 on the sides of the clip 400. The finger grips 430 may be non-slip and comfortable to hold.

**[0100]** In a further variation of this embodiment, shown in Figure 5B, the hook 500 of the substrate 410 includes slots 440. The slots 440 can be configured to provide flexibility to the hook 500 in the same way that the slots 325 have been previously described. In this embodiment, the slots 440 can also be configured to be filled with over-molded filler 450. The over-molded filler 450 can be configured to be bonded to the surfaces of the slots 440, thus providing a webbing-like structure between the central and outer portions 460 and 470 of the hook. The over-molded filler 450 can be made from a soft, flexible material that has at least some elasticity, such as silicone rubber or a thermoplastic elastomer; in some embodiments, the over-molded portions 420 and the over-molded filler 450 can be the same material. The flexible over-molded filler 450 allows the hook 500 to maintain the flexibility provided by the slots 440 whilst providing additional strength.

**[0101]** In an alternative embodiment (not shown), the outer portions 470 of the hook 500 may be created by an over-molding process. The outer portions 470 may have substantially the same geometry as the central portion 460 and be made of a material substantially the same as that described in relation to the over-molded filler 450. The over-molded outer portions 470 can provide increased flexibility during attachment of the clip as a result of the more flexible material.

**[0102]** Figure 6A demonstrates one of the modes of separation that can occur in conventional hook and post attachment configurations. The clip 120 can rotate upwards off the post 200 (i.e., in the direction indicated by the arrow). This rotation can occur when there is an upwards force applied to the headgear which causes the clip 120 to rotate and an upper portion of the clip 120 to rotate away from the post 200. This can occur when a user moves his/her head whilst lying down or during fitting and adjustment of the mask. The upwards force and rotation of the clip 120 can result in the headgear 110 becoming detached from the mask body 105. Disconnection of the headgear during use of the mask can result in a loss of therapy for the user.

**[0103]** Figure 6B shows a non-limiting exemplary embodiment of a clip attachment portion 600 configured to address the aforementioned mode of separation. It can be seen that clip attachment portion 600 can be configured to include a stop bump 605 on its upper surface 610 (with respect to the orientation of the mask in use) when the user is sitting upright. The stop bump 605 is configured to be positioned adjacent to the post 200 and having a peak (lowermost point or portion) just forward of the clip 120 (i.e., away from the user) when the clip 120 is attached to the post 200. This positioning is such that, when an upwards force is applied to the headgear or clip 120, the clip 120 will come into contact with the stop bump 605 to stop rotation of clip 120. This will limit any further rotation and reduce or minimize the likelihood of the clip 120 becoming detached from the post 200. In at least some configurations, such an arrangement still permits movement of the clip 120 along the longitudinal axis of the post 200. In at least some configurations, the stop bump 605 can permit downward rotation of the clip 120 to permit disconnection of the clip 120 from the post 200.

**[0104]** The geometry of the stop bump 605 can be configured such that it does not impede the ability of a user to connect the clip 120 to the clip attachment portion 600. This is achieved by the stop bump 605 not extending too far into the clip receiving opening 205. The stop bump 605 may extend into the clip receiving opening 205 a distance that is close to, equal to or greater than a difference between the width of the clip receiving opening 205 along the direction parallel to an axis of the post 200 and the width of the clip 120 along a direction parallel to the axis of the post 200 when the clip 120 is connected to the post 200.

Further, the stop bump 605 is depicted as a rounded convex protrusion extending into the opening 205. However, the stop bump 605 is not limited to any particular shape.

**[0105]** In further embodiments, there may be different stop bump 605 configurations. In one possible configuration, there may be more than one stop bump 605 in each clip attachment portion 600. For instance, there may be stop bumps 605 on both the upper and lower surfaces of the clip attachment portion 600. Each stop bump 605 may have a different size, shape and position to inhibit, limit or prevent rotation of the clip 120 while still allowing the clip 120 to be attached to the post 200. In some configurations, vertical movement of the clip 120 along the longitudinal axis of the post 200 is permitted. In another configuration, there may be a single stop bump 605 located on the lower surface of the clip attachment portion 600.

**[0106]** A further orientation of the clip 120 relative to the clip attachment portion 125 that can occur in conventional hook and post attachment configurations is shown in Figure 7. It can be seen that the clip 120 has been over-rotated on the post 200 such that it is directed in the opposite direction to which headgear retention forces need to be applied (i.e., away from the user). Over-rotation of the clip 120 on the post 200, which can occur for example when the mask 100 is not fitted to a user, can make it difficult to fit the mask 100, as the headgear 110 may lose its shape and the headgear straps 130 may tangle. Over-rotation of the clip 120 may also reduce the circumference of the headgear 110 and mask body 105 loop, thereby making the headgear 110 too small for the user and, thus, difficult to fit.

**[0107]** As shown in Figure 8, the stop bump 605 as described in relation to Figure 6B may be configured to limit rotation of the clip 120 on the post 200. During rotation of the clip 120 on the post 200, a surface 800 of the clip 120, such as an outer and/or upper surface, can come into contact with the stop bump 605, which may limit, inhibit or prevent any further rotation of the clip 120 on the post 200. In a preferred embodiment, the clip 120 and the stop bump 605 can be designed such that a maximum angle of rotation R may be up to approximately 90° relative to a normal position of the clip 120 during use of the mask 100. In other words, a maximum range of rotation of the clip 120 on the post 200 may be limited to approximately 90° relative to a normal position of the clip 120 during use of the mask 100.

The size, shape and position of the stop bump 605 may be varied to vary the range of rotation of the clip 120 on the post 200.

**[0108]** The clip embodiment of Figures 5A and 5B provides an alternative non-limiting exemplary embodiment that may restrict or minimize over-rotation of the clip 120. The hook 500 extends from a lower surface 510 of the clip body 505 at or near one end. The hook is substantially narrower than the clip body. Figure 9A shows a rear view of the clip 400 or 405 attached to a clip attachment portion 600. It can be seen that at least a portion of the clip body 505 is substantially the same width or, preferably, wider than the width W of the clip receiving opening 910. The width of the hook 500 can be less than at least a portion of the body 505 such that the hook 500 can pass through a clip receiving opening 910 of the clip attachment portion 600 to attach to a post 200. The clip body 505 width allows it to come into contact with the clip attachment portion 600 before rotating too far, as shown in Figure 9B. Figure 9B shows the clip 400 or 405 attached to a mask frame 900 viewed from above. The clip is rotated until the clip body contacts the clip attachment portion 600 and cannot rotate any further. In a preferred embodiment, the width of the clip body 505 and the width W of the clip receiving opening 910 can be designed such that the maximum angle of rotation R may be up to approximately 90° relative to a normal position of the clip 120 during use of the mask 100. In other embodiments, more or less rotation may be desirable. In alternative embodiments, there may be a bump or other suitable geometry on the clip 400 or 500 that limits rotation rather than width of the clip body 505. Even further, the clip embodiment of Figures 5A and 5B may also be combined with a stop bump on an upper surface 610 of the clip attachment portion 600, as shown in Figure 9A. When the clip body 505 is rotated on the post 200, the clip body 505 may contact the stop bump 605 to limit rotation of the clip body 505.

**[0109]** Unless the context clearly requires otherwise, throughout the description and the claims, the words “comprise”, “comprising”, and the like, are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense, that is to say, in the sense of “including, but not limited to”.

**[0110]** Reference to any prior art in this specification is not, and should not be taken as, an acknowledgement or any form of suggestion that that prior art forms part of the common general knowledge in the field of endeavour in any country in the world.

**[0111]** The invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, in any or all combinations of two or more of said parts, elements or features.

**[0112]** Where, in the foregoing description reference has been made to integers or components having known equivalents thereof, those integers are herein incorporated as if individually set forth.

**[0113]** It should be noted that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the invention and without diminishing its attendant advantages. For instance, various components may be repositioned as desired. It is therefore intended that such changes and modifications be included within the scope of the invention. Moreover, not all of the features, aspects and advantages are necessarily required to practice the present invention. Accordingly, the scope of the present invention is intended to be defined only by the claims that follow.

**WHAT IS CLAIMED IS:**

1. A respiratory mask assembly, comprising:

a respiratory mask configured to deliver pressurized gas to a user; and

a connector clip (120) having a body portion and a hook portion, wherein the mask is configured to attach to

headgear, in use, by the body portion,

the respiratory mask comprising:

a post (200) configured to be received within a space of the hook portion of the connector clip (120); and

an opening (205) adjacent the post (200),

characterised in that

the hook portion is narrower than the body portion, and in that

the respiratory mask further comprises:

a limitation bump (605) positioned adjacent to the post (200) on an upper surface (610) of the opening (205), with respect to the orientation of the mask in use when the user is sitting upright, wherein the limitation bump (605) is configured to have a lowermost point or portion forward of the connector clip (120) when the connector clip (120) is attached to the post (200), and wherein the limitation bump (605) is configured in use to contact the connector clip (120) to limit upward rotation of the connector clip (120) relative to the mask but permit downward rotation of the connector clip (120) to permit disconnection of the connector clip (120) from the post (200).

2. The respiratory mask assembly of Claim 1, wherein the post (220) is generally vertical with respect to the orientation of the mask in use when the user is sitting upright.

3. The respiratory mask assembly of either one of Claims 1 and 2, wherein a width of the opening (205) along the direction parallel to an axis of the post (200) is configured to be equal to or smaller than a width of the body portion.

4. The respiratory mask assembly of any one of Claims 1-3, wherein the limitation bump (605) is configured to contact the body portion of the connector clip (120) to limit rotation of the connector clip (120) relative to the mask.

5. The respiratory mask assembly of any one of Claims 1-4, wherein the limitation bump (605) limits forward rotation of the connector clip (120), with respect to the orientation of the mask in use when the user is sitting upright.

6. The respiratory mask assembly of Claim 5, wherein forward rotation of the connector clip (120) is limited by the limitation bump (605) to no more than 90 degrees.

7. A respiratory mask assembly, comprising:

a headgear (110); and

a respiratory mask assembly of any one of Claims 1-6;

wherein the body portion of the connector clip (120) is connected to the headgear (110).