

ROTATABLE INFUSION DEVICE AND METHODS THEREOF

BACKGROUND

[0001] Subcutaneous infusion devices allow users to place and use infusion sets outside of a doctor or hospital setting. Infusion devices allow delivery of medications, coupled with subsequent programmable delivery of the medication, including, for example insulin delivery. Parallel monitoring of medication levels is also possible where, for example, sensors are accommodated on the infusion devices.

[0002] Re-connection and changing of infusion sets can vary between different systems. In infusion sets having a fixed orientation, a user is presented a single orientation and thus does not need to know how to position a base or a connector of the infusion set for connection. In infusion sets having multiple orientations, a user does not need to position the connector or base in a predefined orientation in order to connect the infusion set to the base. For multiple orientation connections, available devices include fluid orientation infusion sets that connect in parallel to the cannula entering the user (*see* US 2014/0088550 and US 2017/0185441), fixed orientation, where the device includes predefined orientations for connection usually in the base part (WO 2005/046780, US 2016/0121046, US 2014/0350485), and multiple orientation ports in the connectors, which may be combined into a single or multipart connector (US 2016/0121046 and WO 2005/046780). Connectors have in common a means for helping to guide the connector in place and a means for locking the connector once the connector has been properly positioned.

SUMMARY

[0003] Changing an infusion set to allow for continuous delivery of medications can be difficult where orientation of an injection part challenges the user to position the infusion set correctly. The present embodiments disclosed herein solve this problem by providing a rotatable base that allows a connector to be guided into place, allowing fluid communication between the infusion set and the base.

[0004] In some embodiments, disclosed herein are infusion sets comprising: a) a base having an opening to receive a cannula device, the base comprising i) a lower base part, and ii) an upper base part, wherein the upper base part is coupled to the lower base part and is rotatable relative to the lower base part; and b) a connector comprising a fluid connector tube and a connection part, wherein

the fluid connector tube and the connection part are configured to be in fluid communication, wherein the connector prevents the upper base from substantially rotating relative to the lower base and the fluid connector tube is in fluid connection with the cannula device when the connector is coupled to the base. In some instances, the lower base part does not move once the cannula device is in place. In other instances, the cannula device guides the connector in place when the connector is coupled to the base. In yet other instances, the upper base is rotatable at 360 degrees relative to the lower base. In some instances, the upper base is rotated to a user-friendly position and the connector is coupled to the base to lock the upper base in the user-friendly position.

[0005] In some embodiments, the connector comprises at least one snap hook, wherein the snap hook secures the connector to the base when the connector is coupled to the base. In some instances, the lower base comprises a guiding protrusion, wherein the guiding protrusion abuts the snap hook of the connector when the connector is coupled to the base. In yet other instances, the lower base comprises at least one guiding protrusion. In yet other embodiments, the lower base comprises at least three guiding protrusions. In still other instances, the guiding protrusions are radially symmetric.

[0006] In some instances, the connector comprises at least one locking protrusion. In some embodiments, the lower base comprises grooves, wherein at least one of the grooves receives the locking protrusion of the connector when the connector is coupled to the base. In yet other embodiments, the lower base comprises at least one groove. In still other embodiments, the lower base comprises at least three grooves. In some embodiments, the grooves of the lower base are radially symmetric.

[0007] In some embodiments, the upper base comprises a rotatable connection and the lower base comprises a rotation groove, wherein rotatable connection sits and rotates in the rotation groove. In some instances, the upper base comprises rotation guides, wherein the rotation guides receive the lower base to keep the upper base connected to the lower base and guides the rotation of the upper base relative to the lower base. In some instances, the upper base comprises at least two openings in fluid communication with the cannula device and at least two membranes covering the openings. In still other instances, the membranes comprise an elastomeric material. In some instances, the upper base comprises at least one o-ring, wherein the o-ring provides a fluid seal between the cannula device and the opening of the base, and/or between the cannula device, the upper base and the lower base.

[0008] In some embodiments, the cannula device is configured to be inserted into the opening in the base of the infusion devices disclosed herein. the cannula device comprise an cannula housing, wherein the cannula housing is secured by the lower base and wherein the upper base is rotatable relative to the cannula housing. In some embodiments, an opening to receive the cannula device in the upper base decreases in diameter from distal to proximal direction toward the lower base. In some instances, the upper base and the cannula device maintain a fluid seal when the upper base rotates relative to the cannula housing. In yet other instances, the lower base comprises a protrusion to secure the cannula device. In some instances, the cannula device is not rotated when the upper base is rotated relative to the lower base. In some embodiments, the opening in the base for the cannula device is at or near the center of the base. In some instances, the opening in the base for the cannula device is off-center of the base. In some embodiments, the cannula device is placed transdermally through skin of a user. In some embodiments, the fluid connector tube is stainless steel.

[0009] In some instances, the connector comprises an opening to receive a connection tube in the infusion devices disclosed herein. In some instances, the lower base comprises an adhesive on a proximal surface, wherein the adhesive secures the base to skin of a user. In one instance, the lower base comprises a clear portion to provide a view of condition of the skin of the user. In another instance, the opening to receive the cannula device in the upper base comprises a tapered coned opening. In still other instances, the connection tube connects to the insulin pump, the external pump, the wearable pump or combinations thereof.

[0010] Also disclosed herein are infusions set comprising: a) a base having an opening to receive a cannula device, the base comprising i) a lower base, and ii) an upper base, wherein the upper base is coupled to the lower base and is rotatable relative to the lower base; and b) a cannula device; and a connector comprising a fluid connector tube, wherein the connector prevents the upper base from substantially rotating relative to the lower base and the fluid connector tube is in a fluid connection with the cannula device when the connector is coupled to the base.

Incorporation by Reference

[0011] All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The novel features of the disclosure are set forth with particularity in the appended claims. A better understanding of the features and advantages of the present disclosure will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the disclosure are utilized, and the accompanying drawings of which:

[0013] **FIG. 1:** Depicts a first embodiment of the infusion system, including connection tube **90**, connector part **30**, lower base part **10** and upper base part **20**.

[0014] **FIG. 2:** Depicts details of lower base part **10** of the infusion systems disclosed herein.

[0015] **FIG. 3:** Depicts details of upper base part **20** of the infusion systems disclosed herein.

[0016] **FIG. 4:** Depicts alternate views of lower base part **10** and upper base part **20** of the infusion systems disclosed herein.

[0017] **FIG. 5:** Depicts details of upper base part **20** of the infusion systems disclosed herein.

[0018] **FIG. 6:** Depicts a snap hook and connection included within upper base part **20**.

[0019] **FIG. 7:** Depicts guide to connection of upper base part and lower base part.

[0020] **FIG. 8:** Depicts alternate view of guide for connector part to connect lower base part and upper base part.

[0021] **FIG. 9:** Depicts bottom and side view of upper base part **20**.

[0022] **FIG. 10:** Exploded view of upper base part **20**, lower base part **10** and connector part **30**.

[0023] **FIG. 11:** Detail of upper base part **20** and lower base part **10** with cannula needle.

[0024] **FIG. 12:** Details of connector part **30**.

[0025] **FIG. 13:** Alternative embodiments and views of lower base part.

[0026] **FIG. 14:** Alternative embodiments and views of upper base part.

[0027] **FIG. 15:** Alternative embodiments and views of connector part.

[0028] **FIG. 16:** Alternative embodiments and views of lower base part.

[0029] **FIG. 17:** Alternative embodiments and views of lower base part.

[0030] **FIG. 18:** Exploded view of an alternative embodiment of the infusion systems disclosed.

[0031] **FIG. 19:** Alternative embodiment of the infusion systems disclosed, including a hole for viewing of the skin condition of the patient.

[0032] **FIG. 20:** Depicts cannula and space for cannula connection with connector part, and guides for insertion of the cannula with the infusion systems disclosed herein. The guides maintain position and orientation of the cannula when inserted.

[0033] FIG. 21: Details of the guides including arms for retaining the cannula housing and guide for maintaining position and orientation of the cannula when inserted.

[0034] FIG. 22: Alternative embodiments and views of upper base part.

[0035] FIG. 23: Alternative embodiments and views of lower base part, upper base part and alignment shell.

[0036] FIG. 24: Details of alternative embodiments of alignment shell having alignment pegs on and securing tabs.

[0037] FIG. 25: Alternative embodiments and views of upper base part and lower base part with cannula.

[0038] FIG. 26: Alternative embodiments and views of upper base part and lower base part with cannula.

[0039] FIG. 27: Alternative embodiments and views of upper base part.

[0040] FIG. 28: Depicts lower base part.

[0041] FIG. 29: Depicts an exemplary embodiment of cannula housing.

DETAILED DESCRIPTION

[0042] Changing an infusion set to allow for continuous delivery of medications can be difficult where orientation of an injection part challenges a user to position the infusion set correctly. For example, with the extension of infusion set wear time (for example, 3 days to 7 or 10 days), patients use the very same infusion site for much longer durations. As different patients carry their wearable pump at different places during the wear time of an infusion set (for example, in the pocket of a coat or trousers, or in other clothing or placements on the body), it would be advantageous to adjust the site connection angle to the varying places, and by that, ensure product performance and increase patient comfort. The present embodiments disclosed herein solve this problem by providing a rotatable base that allows a connector to be guided into place, allowing fluid communication between the infusion set and the base.

[0043] Accordingly, disclosed herein are methods and devices for an infusion set where a user does not require predetermined locations of the base position in order to connect the infusion set to the base. In some embodiments, a means of providing an upper and lower base communicating by way of a circular pathway radially about an axis perpendicular to a proximal surface to the lower base is provided herein. In some instances, the base will rotate into an orientation that makes it capable of

guiding the connector into place. In yet other instances, the base comprises at least two parts. In still other instances, the two parts comprise an upper base and a lower base. In yet other instances, the upper base and the lower base are capable of communicating with each other by rotating about a circular pathway. In still other instances, the communication of the upper base and lower base parts radially rotates about an axis perpendicular to a proximal surface to the lower base.

[0044] In some embodiments, the rotatable infusion sets disclosed herein do not change the way an end user connects an existing infusion set to a base. The familiarity of the connection interface of the rotatable base part or the connector part to the infusion set for the end user provides ease of use and a lower learning curve for the end user. In some embodiments, an infusion set connects to a rotatable base in the same way the infusion set connects to a non-rotatable base. In other instances, the methods and devices disclosed herein create a multiple orientation infusion set with an already placed cannula housing without limiting the orientation possibilities. In still other instances, the methods and devices disclosed herein provide an infusion set with the functionality of both multiple orientation and inserted cannula housing, while giving the end user the same interactions they are comfortable and experienced with. In still other instances, the methods and devices disclosed herein provide a locking mechanism that partially restricts movement of a part the base. In yet other embodiments, the methods and devices disclosed herein provide a user a substantially covered infusion site that is capable of providing fluid flow to the puncture site. In still other instances, the methods and devices disclosed herein provide to the user a set with a substantially low side profile. In yet other instances, the methods and devices disclosed herein provide a user with an infusion set having an injection port where the set is kept multiple days, with a cannula housing that can be removed and the set turned to provide a fresh site for a new cannula injection port. In still other instances, the methods and devices disclosed herein provide a user with an infusion set comprising a track in the lower base part that guides the upper base part around it.

[0045] Provided herein are methods and devices for an infusion set comprising an upper base part and a lower base part, where the base parts connect and are able to move relative to one another. In some embodiments, the movement of the base parts is a circular pathway about an axis perpendicular to a proximal surface, to the lower base. In some instances, the proximal surface refers to the surface that is closer to a skin surface of a user. In some instances, the upper base part can rotate freely relative to the lower base part. In some instances, the upper base part can rotate 360

degrees relative to the lower base part. In some instances, the upper base part can rotate at least 90, 180, or 270 degrees relative to the lower base part.

[0046] Provided herein are rotatable infusion systems or devices comprising a base and a connector. In some embodiments, the base comprises a lower base part and an upper base part. In some instances, the lower base part holds catheter and has a surface that adheres to the skin of the user using an adhesive. In some instances, the upper base part can freely rotate to the desired orientation. In some instances, the upper base part can rotate 360 degrees relative to the lower base part. In some cases, the upper base part is oriented after the infusion system is placed on the user. In some cases, the upper base part is oriented before a catheter or a cannula device is placed on the user. In some instances, the lower and upper base parts form a sealed chamber that is sealed by at least one membrane and o-rings. In some instances, there are two membranes that seal the sealed chamber. In some instances, the membrane comprises a self-sealing material. In some instances, the membrane comprises an elastomeric polymer. In some instances, the membrane comprises silicone. In some instances, the o-rings comprise a compressible material. In some instances, the o-rings comprise an elastomeric polymer. In some instances, the o-rings comprise silicone. The membranes and o-rings help to ensure a good seal of the fluid connection that when the connector is coupled to the base parts a free flow of the fluid (e.g. medication, insulin) is provided to the user. In some embodiments, the fluid comprises a medication. In some embodiments, the fluid comprises insulin.

[0047] In some embodiments, the base part comprises multiple parts that are assembled for use. In some instances, the base comprises a lower part, an upper base part, and a cannula housing, where the base parts secure the infusion set. The lower base part has a surface that adheres to the skin of the user using an adhesive. The cannula housing can be inserted into the base parts using an opening in the base parts for the cannula housing when the patient is applying the infusion set, which hides the needle from the user. Hiding the needle from the view of the user can help alleviate anxiety or discomfort in the user in inserting a needle into their skin. In some embodiments, the cannula housing comprises guides for insertion, a space for cannula insertion, or a fastener. In some embodiment, the lower base part comprises arms for retaining cannula housing, which secures the cannula housing in position and maintains its orientation. In some embodiments, the cannula housing forms a sealed chamber with the upper base part when inserted into the base parts. In some embodiments, the sealed chamber is sealed by membranes and is in fluid communication with a medication reservoir only when the connector is coupled to the base parts and the fluid connector

tube penetrates through the membrane to establish a fluid communication with the sealed chamber. In some embodiments, when the connector is coupled to the base parts having a cannula housing, the medication (e.g. insulin) from the reservoir can flow to through the fluid path to the user. In some embodiments, the upper base part allows the infusion set to freely orientate after the infusion set has been placed on the user. In some embodiments, the upper base part allows the infusion set to freely orientate before the infusion set has been placed on the user.

[0048] In various embodiments disclosed herein, the various base parts are coupled to each other by a number of mechanisms. In some embodiments, the upper and the lower base parts connect to each other by with at least one central placed snap-hook. Alternatively or in combination, the upper and the lower base parts connect to each other by at least one edge placed snap hook. In some embodiments, the upper and the lower base parts connect to each other by a plurality of edge placed snap hook.

[0049] The connector disclosed herein comprises of a connector body, a fluid connector tube, a connection tube, and an opening for the connection tube. In some embodiment, the fluid connector tube is a steel cannula. In some embodiments, the fluid connector tube penetrates one of the membranes on the upper base part. In some embodiments, the connection tube inserts through an opening in the connector body and forms a fluid connection with the fluid connector tube. In some embodiments, the connection tube connects to an insulin pump, providing the user with insulin.

[0050] The infusion set disclosed herein comprises a sealed chamber. In some embodiments, the sealed chamber is formed in a cavity in the upper base part that is bound by membranes and the cannula device.

[0051] In some cases, the rotatable base parts are designed to be compatible with existing infusion sets. In some instances, the rotatable base parts are compatible with commonly used methods to connect the infusion set to the base parts. In some instances, the connector part provides the site for connecting the infusion set to the base parts.

[0052] In some embodiments, the infusion set connects to the base using a connector tube placed into an opening in a body of a connector that is already coupled to the base. In some embodiments, the infusion set connects to the base by coupling the connector to the base, where the connector is connected to the infusion set by a connection tube before the connector couples to the base.

[0053] The methods and devices disclosed herein provide an infusion set with the functionality of both multiple orientation and inserted cannula housing, while giving the end user the same

interactions they are comfortable and experienced with. In some instances, the methods and devices provide an infusion set where the user can easily change the orientation of the infusion set without changing the infusion set or dislodging the infusion set from the skin surface of the user. In some embodiments, the dimensions, including but not limited to height, width, length, and shape, of the rotatable infusion set is substantially similar to that of a non-rotatable infusion set. The similar dimensions between the rotatable infusion set and the non-rotatable infusion set may aid the user by providing familiarity of use and wear.

[0054] In some instances, the methods and devices disclosed herein provide a locking mechanism that partially restricts movement of a part the base. In some embodiments, the infusion set comprises a connector having a locking protrusion that partially restricts movement of a part the base. In some embodiments, the locking protrusion of the connector fits into one of the grooves in between the guiding protrusion parts on one of the surfaces of the lower base part when the connector is coupled to the base parts. In some embodiments, the snap hooks of the connector fits securely into the openings of the upper base part. When the connector is coupled to the base parts, the locking protrusion fits into the groove of the lower base part and the snap hooks fit into the upper base part, thereby restricting the movement of the base parts relative to each other. In some embodiments, the locking mechanism comprises the locking protrusion. Alternatively or in combination, the locking mechanism comprises the snap hooks. In some embodiments, the locking mechanism restricts the movement of the base parts completely. In some embodiments, the complete restriction of the movement of the base parts refers to movement of near 0 degrees of rotation. In some embodiments, the locking mechanism restricts the movement of the base parts partially. In some embodiments, the partial restriction of the movement of the base parts refers movement of no more than 5 degrees, 10 degrees, 15 degrees, 20 degrees, 25 degrees, 30 degrees, 35 degrees, 40 degrees, or 45 degrees of rotation.

[0055] In some instances, the methods and devices disclosed herein provide a user a substantially covered infusion site that is capable of providing air flow to the skin around the infusion site. The infusion set partly covers the skin around the infusion site to allow the skin to breathe and reduce skin irritation while having enough of a contact surface area to provide a good adhesive seal of the infusion set to the skin around the infusion site. In some embodiments, the proximal surface of the infusion set in contact with the skin of the user partly covers the skin near the infusion site. In some embodiments, the proximal surface of the infusion set covers at least 50%, 60%, 70%, 80%, 90%,

95%, 99% of the infusion site. In some embodiments, the proximal surface of the infusion set covers no more than 50%, 60%, 70%, 80%, 90%, 95%, 99% of the infusion site. In some embodiments, the proximal surface of the infusion set has at least one hole or opening on the lower base part to provide a view of the skin of the user. In some embodiments, the upper base part also has at least one hole or opening to view the skin of the user. In some embodiments, the hole or opening on the lower base part is covered with a clear or transparent material. In some embodiments, the hole or opening on the lower base part is covered with a breathable material. The opening allows the user to view the condition of the skin without disconnecting the infusion set from the skin.

[0056] In some embodiments, the infusion set covers various distances away and over the infusion site. In some embodiments, the infusion set covers at least 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 9 cm, or 10 cm away from the infusion site on the skin of the user.

[0057] In some instances, the methods and devices disclosed herein provide to the user a set with a substantially low side profile. The low side profile of the infusion set allows the infusion set to be close to the skin of the user and provides a less obtrusive wear for an extended period of time for the user. In some embodiments, the infusion set has a side profile of no more than 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 9 cm, 10 cm, 11 cm, 12 cm, 13 cm, 14 cm, or 15 cm. In some embodiments, the infusion set has a side profile of at least 1 cm, 2 cm, 3 cm, 4 cm, 5 cm, 6 cm, 7 cm, 8 cm, 9 cm, 10 cm, 11 cm, 12 cm, 13 cm, 14 cm, or 15 cm.

[0058] In some instances, the methods and devices disclosed herein provide a user with an infusion set having an injection port where the set is kept multiple days, with a cannula housing that can be removed and the set turned to provide a fresh site for a new cannula injection port. In some embodiments, the infusion set is kept for at least 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days, 8 days, 9 days, 10 days, 11 days, 12 days, 13 days, 14 days, 15 days, 16 days, 17 days, 18 days, 19 days, 20 days, 21 days, or 30 days at a single infusion site. In some embodiments, the infusion set is kept for at least 1 week, 2 weeks, 3 weeks, or 4 weeks at a single infusion site. In some embodiments, the infusion set is kept for no more than 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days, 8 days, 9 days, 10 days, 11 days, 12 days, 13 days, 14 days, 15 days, 16 days, 17 days, 18 days, 19 days, 20 days, 21 days, or 30 days at a single infusion site. In some embodiments, the infusion set is designed to maintain sterility and fluid seal for the predetermined, extended period of use.

[0059] In some instances, the lower base part has grooves for coupling to the locking protrusion of the connector. In some embodiments, the grooves are radially symmetric. In some embodiments, the grooves are not radially symmetric. In some embodiments, the lower base part has at least 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 grooves. In some embodiments, the lower base part has no more than 2, 3, 4, 5, 6, 7, 8, 9, or 10 grooves. In some embodiments, the lower base part has 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 grooves. In some embodiments, the grooves are sized to be close to the dimension of the locking protrusion of the connector. In some embodiments, having grooves that are sized to be close to the dimension of the locking protrusion of the connector substantially limits the rotation of the base parts after the connector is coupled to the base parts.

[0060] In some instances, the lower base part has guiding protrusions for forming the grooves that couple to the locking protrusion of the connector. In some embodiments, the guiding protrusions are radially symmetric. In some embodiments, the guiding protrusions are not radially symmetric. In some embodiments, the lower base part has at least 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 guiding protrusions. In some embodiments, the lower base part has no more than 2, 3, 4, 5, 6, 7, 8, 9, or 10 guiding protrusions. In some embodiments, the lower base part has 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 guiding protrusions.

[0061] In some instances, the upper base part has a rotation guides for keeping the upper base part connected to the lower base part. The rotation guides may hook onto the perimeter of the lower base part. In some embodiments, the rotation guides are continuous along the perimeter of the upper base part. In some embodiments, the rotation guides are not continuous along the perimeter of the upper base part. In some embodiments, the rotation guides are radially symmetric. In some embodiments, the rotation guides are not radially symmetric. In some embodiments, the upper base part has at least 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 rotation guides. In some embodiments, the upper base part has no more than 2, 3, 4, 5, 6, 7, 8, 9, or 10 rotation guides. In some embodiments, the upper base part has 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 rotation guides.

[0062] In some instances, the fluid connector tube on the connector has a diameter compatible medical grade tubes commonly used for infusion sets. In some embodiments, the fluid connector tube is 23 gauge, 24 gauge, 25 gauge, 26 gauge, 27 gauge, 28 gauge, 29 gauge, 30 gauge, 31 gauge, 32 gauge, or 33 gauge.

[0063] In some instances, the cannula on the cannula device has various diameters. In some embodiments, the cannula is 23 gauge, 24 gauge, 25 gauge, 26 gauge, 27 gauge, 28 gauge, 29 gauge, 30 gauge, 31 gauge, 32 gauge, or 33 gauge.

[0064] The lower base part and the upper base part may be various sizes relative to each other. In some embodiments, the lower base part and the upper base part have similar diameters. In some embodiments, the lower base part is smaller in diameter than the upper base part. In some embodiments, the lower base part comprises a back tap to prevent the lower base part from tipping or wobbling relative to the upper base part. In some embodiments, the lower base part has sufficient contact area to adhere to the skin of the user. In some embodiments, the connector has a shortened notch to allow the lower base part to have a larger contact area.

[0065] In some embodiments, the cannula device is held by a cannula housing. In some embodiments, the cannula housing is inserted in to the base parts. In some embodiments, the cannula housing is integrated in to the base parts. In some embodiments, the cannula of the cannula device does not turn as the orientation of the base part changes. In some embodiments, coupling of the connector does not damage the seal of the fluid chamber. In some embodiments, the cannula does not turn after it has been inserted into the skin of the user. In some embodiments, the cannula housing is locked and secured by the locking arms on the lower base part. Alternatively or in combination, the cannula housing is not locked around the central axis by the upper base part. In some embodiments, the upper base part has a coned collar to help secure the cannula housing. Alternatively or in combination, the upper base part has a recessed portion to align the cannula house for insertion. In some embodiments, the cannula housing comprises a collar to protect the cannula device body. In some embodiments, the cannula housing is compatible with an inserter, which can be used to place the cannula device and cannula housing into the base parts. In some embodiments, the cannula housing forms a sealed chamber in the upper base part, where the fluid seal of the sealed chamber is secured by at least one o-ring. In some embodiments, two o-rings secure the fluid seal. In some embodiments, the cannula housing comprises at least one of a fastener, a tab, or a protrusion part to help secure the cannula housing to the base parts. In some embodiments, the fastener comprises a flexible material. In some embodiments, the fastener comprises a plastic. In some embodiments, the protrusion part sits on a recessed portion of the lower base part.

EXAMPLES

[0066] FIG. 1 depicts a first embodiment of the infusion systems disclosed herein. Connection tube **90** connects with connector **30**, which is fluidly connected to fluid connector tube **80**. Fluid connector tube **80** connects to upper base **20**, which includes a first membrane **50**, which maintains fluid connection between the upper base part **20** and connection tube **90** via connector **30**. Upper base part **20** connects to lower base part **10**, via second membrane **40**, o-ring **60** within opening **100** on upper base. Lower base part **10** aligns with upper base part **20** through hole **110** and rotation groove **120** through which a cannula device **70** passes through upper base part **20** and lower base part **10** and inserts into patient.

[0067] FIG. 2 depicts further details of the connector **30**, lower base part **10** and upper base part **20**. The assembled infusion system is shown from underneath the lower base part **10**. Locking protrusion **150** on connector **30** limits movement of lower base part **10** and guiding protrusion parts **130** via grooves within lower base part **10** and rotation groove **120**. Snap hook **160** on connector **30** secures upper base part **20** and lower base part **10** in the infusion system and allows fluid connection to connection tube (not shown). Upper base part includes rotation guides **170** to further limit movement of the infusion device while allowing swiveling of the upper base part within the device.

[0068] FIG. 3 depicts further details of the connector **30**, lower base part **10** and upper base part **20** of the assembled infusion system as shown from the top or opposite side of **FIG. 2**. The connector **30** is inserted in to the lower base part **10** that is aligned with the upper base part **20**, where the snap hooks **160** of the connector **30** help to secure the connector to the lower base part **10** and upper base part **20**. The opening for connection tube **180** on the connector may receive the connection tube **90**, in order to have the connection tube **90** in fluid connection to the fluid connector tube **80** and the cannula device **70** when the connector **30** is coupled to the lower and upper base parts **10**, **20**. In some cases, the opening of the cannula device on the upper base part **100** allows placing a cannula device **70** to the base parts. In some cases, the opening of the opening of the cannula device on the upper base part **100** is covered by a membrane **70**.

[0069] FIG. 4 depicts various views of an embodiment of the assembled infusion systems disclosed herein. The top image shows a view from underneath the lower base part **10**. The lower base part **10** is aligned with the upper base part **20**, and the aligned base parts are coupled to the connector **30**. The rotation guides **170** of the upper base part **20** helps to secure the alignment of the upper base part **20** to the lower base part **10** and limit the wobbling of the lower base part **10** relative to the upper base part **20**. The locking protrusion **150** of the connector **30** helps to limit the rotation of the

lower base part **10** when placed in the groove **140** in between the guiding protrusion parts **130** of the lower base part **10**. The snap hooks **160** of the connector **30** helps to secure the connector in the aligned base parts. The side view of the assembled infusion systems show an opening for the connection tube **180** on the connector **30** that can be inserted with a connection tube connected to a medication reservoir. The side view also shows guides **190** on the upper base part for coupling of the connector, snap hooks **160** on the connector that fit into the assembled base parts, and the rotation guides **170** on the upper base part **20** that wraps around the edge of the lower base part **10**. The view from the top shows the upper base part **20** having an opening for a cannula device **100**, the lower base part **10**, and the connector **30** having an opening for connection tube **180** and snap hooks **160** that is coupled to the base parts.

[0070] FIG. 5 depicts a cross-sectional view of an embodiment of the infusion system across the section line D-D. The cross-sectional view shows inner cavities within the assembled infusion system comprising the lower base part **10** aligned to the upper base part **20** and coupled with the connector **30**. The opening for connection tube **180** of the connector **30** is fluid communication with the lumen of the fluid connector tube **80**, which can puncture through a membrane **50** on the upper base part **20** covering one of the openings on the upper base part. The fluid connector tube **80** connects to the cannula device **70**, and the lumen of the fluid connector tube **80** is in fluid communication with the sealed chamber **200** of the cannula device **70**. In some cases, a cannula of the cannula device **70** penetrates through the skin of a user of the infusion system, and the sealed chamber is in fluid communication through the cannula into the skin of the user. In some cases, the upper base part has a membrane **40** covering one of the openings **100** on the upper base part **20** for the cannula part **70**. An o-ring **60** can help to secure the fluid seal of the cannula device **70** within the upper base part **20**. The lower base part has an opening **110** for the cannula device. In cross-sectional view also shows the rotation guides **170** on the upper base part and locking protrusion **150** of the connector **30** that fits in the groove **140** of the lower base to limit movement of the infusion device.

[0071] FIG. 6 depicts details of the connector **30** having two snap hooks **160** on either side of the connector and a notch **210**, which provides space for the connector **30** to be placed adjacent to the lower base part **10** when the connector is coupled to the base parts.

[0072] FIG. 7 depicts details of the lower base part **10**. The lower base part **10** may have a plurality of grooves **140** in between a plurality of guiding protrusions **130**. The grooves **140** and the guiding

protrusions **130** are on the side of the lower base part **10** that adheres to the skin of the user of the device. A cross-sectional view of the lower base part **10** across section A-A shows the opening **110** for a cannula device **70** on the lower base part **10** and a rotation groove **120** at or near the center of the lower base part **10**. The opening **110** provides a space in the lower base part for a catheter or a cannula of the cannula device to pass through. The rotation groove **120** may be concentric to the opening **110** or surround the opening **110** partially or fully. The rotation groove **120** provides a guide for a notched rotatable part of the upper base part **20** to fit into and rotate relative to the lower base part **10** within the rotation groove. The lower base part **10** also has recessed ends **220** at or near its perimeter that fit into the rotation guide of the upper base part to keep the upper base part connected to the lower base part.

[0073] **FIG. 8** depicts details of upper base part **20**. The upper base part **20** has a plurality of rotation guides **170** that help to keep the upper base part **20** connected to the lower base part **10** and an opening **100** for a cannula device. A cross-sectional view of the upper base part **20** across section A-A shows that the rotation guides **170**, the guides **190** for the connector to insert into, and a tapped rotatable part **230** that fits into the rotation groove **120** on the lower base part **10**. The A-A cross section also shows a seal chamber **200** that can be in fluid connection with the lumen of the fluid connector tube **80** and connection tube **90** of the connector **30** and to a reservoir of a drug. A cross-sectional view of the upper base part **20** across section B-B shows an alternate view of the sealed chamber **200**, rotation guides **170**, an opening **100** for a cannula device, along with a space **240** at the top of the upper base part **20** for a membrane **40** and a space **250** on the side of the upper base part **20** for a membrane **50** that can be penetrated by the fluid connector tube **80** of the connector **30**. [0074] **FIG. 9** depicts further views of the upper base part **20**. The side profile view of the upper base part **20** shows the rotation guides **170** and a space **250** on the side of the upper base part **20** for a membrane **50**. The view from underneath of the upper base part **20** shows the rotation guides **170**, the guides **190** for the connector to insert into, the tapped rotatable part **230** that fits into the rotation groove **120** on the lower base part **10** and spaces **240** and **250** for membranes **40** and **50**, respectively.

[0075] **FIG. 10** depicts a second embodiment of the infusion systems disclosed herein. Lower base part **10** aligns with upper base part **20** through rotation groove **120** and an opening **110** through which a cannula device **70** passes through upper base part **20** and lower base part **10** and inserts into patient. The upper base part **20** has a space **240** for membrane **40** on top and a space **250** for

membrane 50 on its side. The lower base part 10 has a number of grooves 140 in between the guiding protrusions 130 on the top side, or the same side as the rotation groove 120, of the lower base part 10. The upper base part 20 and the lower base part 10 house a cannula device 70 held in place by a cannula holder 260 through the openings 110, 240 at or near the center of the base parts. An o-ring may be placed in between the membrane 40 and top of the cannula housing 260 to provide a secure fluid seal in the base part. The base parts are coupled to the connector 30, where the snap hooks 160 fits into the upper base part 20 and the fluid connector tube 80 penetrates through membrane 50 to fluidly connect to the cannula device 70. The connector 30 has an opening 180 for connection tube to fluidly connect a reservoir of a medicament to the fluid connector tube 80 and the cannula device 70.

[0076] FIG. 11 depicts details of assembled upper base part 20 and lower base part 10 with cannula needle. The cross-sectional view across section A-A of the assembled upper base part 20 and lower base part 10 with a cannula device 70 shows a sealed chamber 200 in fluid communication with the cannula device 70 held in place in the base parts by the cannula housing 260. The fluid seal is secured by the o-ring 60, membrane 40, and membrane 50 in space 250 that can couple to a connector 30. The lower base part has recessed ends 220 that couples to the rotation guides 170 of the upper base part 20 to keep the upper and lower base parts together. The tapped rotatable part 230 on the upper base part 20 fits into the rotation groove 120 on the lower base part 10 to allow the upper base part 20 to rotate relative to the lower base part 10. An exploded view of the assembly and alternate assembled views are also shown.

[0077] FIG. 12 depicts details of connector part 30. The cross-sectional view of section A-A of the connector part 30 shows snap hook 160, a notch 210, which provides space for the connector 30 to be placed adjacent to the lower base part 10 when the connector is coupled to the base parts, an opening 180 for connection tube, and a fluid connector tube 80 that can penetrate membrane 50 in the upper base part to establish a fluid connection to the sealed chamber in the upper base part 20. An exploded view and alternate views of the connector are also shown.

[0078] FIG. 13 depicts alternative embodiments and views of lower base part 10. The view from underneath the lower base part 10 shows the opening 110 for cannula device. The side view and cross-sectional view of section A-A shows the opening 110 for cannula device, rotation groove 120 surrounding the opening 110, and the groove 140 on the perimeter that couples to the locking protrusion on the connector to secure the coupling between the connector and the base parts. The

view from the top of the lower base part **10** shows opening **110** for cannula device, rotation groove **120** surrounding the opening **110**, a plurality of guiding protrusion parts **130**, and grooves **140** on the perimeter in between the protrusion parts.

[0079] FIG. 14 depicts alternative embodiments and views of upper base part **20**. The cross-sectional view of section A-A and the detailed view B show the sealed chamber **200** connected to the opening **100** for the cannula device and spaces **240**, **250** that can be sealed with membranes **40**, **50** to provide a fluid seal to the sealed chamber **200**. The view from underneath the upper base part **20** shows the a plurality of rotation guides **170** that help to keep the upper base part **20** connected to the lower base part **10**, the guides **190** for the connector to insert into, a tapped rotatable part **230** that fits into the rotation groove **120** on the lower base part **10**, and an opening **100** for a cannula device. The cross-sectional view from section C-C and detailed view D show the rotation guides **170** protruding inwards on the underside of the upper base part **20** near its perimeter and the guides **190** that are interior to the rotation guides, which provides a space in between the rotation guides and the guides for the snap hooks of the connector to fit into.

[0080] FIG. 15 shows alternative embodiments and views of connector part **30**. The connector part **30** has an opening **180** for connection tube and two snap hooks **160**. The cross-sectional view of section AI-AI offset from the center shows a snap hook **160** extending out from the body of connector **30** and a locking protrusion **150** underneath the snap hook **160**. The cross-sectional view of section A-A and detailed view B show the snap hook **160** and an opening **180** for connection tube in connection with the space for fluid connector tube and a locking protrusion **150** on the side of the connector that couples to the lower base part **10**.

[0081] FIG. 16 illustrates alternative embodiments and views of lower base part **10**. The lower base part **10** may have a number and/or dimensions of guiding protrusion parts **130** such that the size of the grooves **140** offers enough space for a locking protrusion **150** on the connector to fit into the groove with little to no extra space in the groove. A portion of the locking protrusion **150** may come into contact with a portion of the adjacent guiding protrusions **130**. The lower base part may be designed to have the grooves **140** that offer little to no room for the lower base part to move or rotate when the lower base part is coupled to the connector and the locking protrusion of the connector is placed into one of the grooves **140**. The cross-sectional view of section A-A and the detailed view B and C show the rotation groove **120** surrounding the opening **110** for the cannula part and the

recessed ends **220** that fit into the rotation guides **170** of the upper base part **20** to keep the upper and lower base parts together.

[0082] FIG. 17 shows alternative embodiments and views of lower base part **10**. The cross-sectional view of section B-B shows the rotation groove **120** surrounding the opening **110** for the cannula part and the recessed ends **220** that fit into the rotation guides **170** of the upper base part **20** to keep the upper and lower base parts together.

[0083] FIG. 18 shows exploded view of an alternative embodiment of the infusion systems disclosed. The cannula housing **260** can be inserted into an assembly of the upper base part **20** and the lower base part **10** through the opening **110** of the upper base part for the cannula device. The cannula housing **260** may be sealed at the top with a membrane **40** and hold the cannula device **70** to extend out from the lower portion of the cannula housing **260**. The fluid seal between the wall of the opening **110** of the upper base part and the cannula housing **260** may be secured by at least one o-ring **60** or two o-rings as shown. A membrane **50** can provide a fluid seal to the sealed chamber within the upper base part **20**, where the membrane can be penetrated by the fluid connector tube **80** when the connector **30** is coupled to the upper and the lower base parts **20, 10** and forms a fluid connection from the cannula device **70** through the sealed chamber in the upper base part to a reservoir connected to the fluid connector tube.

[0084] FIG. 19 shows alternative embodiment of the infusion systems disclosed, including a viewing hole for monitoring the skin condition of the patient. The viewing hole **270** on the lower base part **10** allows for viewing and monitoring of the condition of the skin underneath the infusion system once placed on the skin of a patient. In some cases, the viewing hole **270** may comprise a clear, transparent material. In some cases, the viewing hole **270** is left open and uncovered.

[0085] FIG. 20 depicts cannula device **70** and cannula housing **260** and space **280** for cannula connection with connector part **30**, and guides **290** for insertion of the cannula with the infusion systems disclosed herein. The guides **290** maintain position and orientation of the cannula device **70** when inserted. The guides **290** may be notches on the outer wall of the cannula housing **260** or the body portion of the cannula device **70** that a portion of the upper or lower base parts can fit into and secure the orientation of the cannula housing. The cross-sectional view of section B-B shows a space **280** for the fluid connector tube **80** fit into to establish a fluid connection to the sealed chamber and the cannula device. The cannula housing **260** or the cannula device **70** may have at

least one fastener **300** to provide a surface for the cannula housing or the cannula to fit into the openings for the cannula device on the base parts.

[0086] FIG. 21 shows details of the lower base part **10** including arms **310** for retaining the cannula device **70** or cannula housing **260**. The arms **310** provide a guide for maintaining position and orientation of the cannula device **70** or the cannula housing **260** when inserted into the lower base part **10** and into the skin of the patient. The opening **120** on the lower base part **10** for the cannula device may be flanked by the arms **310** that retain the cannula device **70** or cannula housing **260** in place once inserted into the lower base part to be inserted into the skin of the patient. The lower base part **10** can have guiding protrusions **130** and grooves **140** in between the guiding protrusions around the arms **310**. In some cases, the arms **310** are flexible and bend. In some cases, the arms **310** comprise flexible polymers or plastics. The cross-sectional view of section C-C shows the arms **310** in the lower base part **10**.

[0087] FIG. 22 shows alternative embodiments and views of upper base part **20**. The upper base part **20** shown can accommodate a cannula housing **260** or a cannula device **70** that is inserted through an opening **110** of the upper base part as shown in **FIG. 18**. The upper base part **20** has opening **110** sized to accommodate a cannula housing **260** or a cannula device **70**. The view from underneath the upper base part **20** shows the opening **110** connected to a space **250** for the membrane **50** and a plurality of rotation guides **170** near the perimeter of the upper base part **20** and guides **190** for connector to fit the upper base part. The cross-sectional view of section D-D and the detailed view of E show the sealed chamber **200** in connection with the spaces **240**, **250** for membranes **40**, **50**, respectively, that can form a sealed chamber once the membranes **40**, **50** seal the spaces **240**, **250**.

[0088] FIG. 23 shows alternative embodiments and views of lower base part **10**, upper base part **20**, and alignment shell **320**. The alignment shell **320** is placed over the upper base part **20** and helps to align the upper base part **20** and the lower base part **10**. The alignment of the base parts helps to ensure the sealed chamber **200** has a good fluid seal and the fluid connection from the fluid connector tube of the connector through the sealed chamber and the cannula device is sealed and maintained. The view from underneath the assembly of the alignment shell **320**, upper base part **20**, and the lower base part **10** shows that the arms **310** at the opening to receive the cannula device or the cannula housing, along with the guiding protrusion parts **130** and the grooves **140** in between the

guiding protrusion parts, and the rotation guides **170** from the upper base part **20** securing the connection to the lower base part **10**.

[0089] FIG. 24 depicts details of an embodiment of an alignment shell **320**, including alignment pegs **330** and securing tabs **340** on alignment shell. The alignment pegs **330** are protrusions or pegs on the inner surface of the alignment shell and fits into a recessed portion of the upper base part **20**. **320**. The alignment pegs **330** helps to align the alignment shell **320** with the upper base part **20**. The securing tabs **340** secure the alignment shell **320** the lower base part **10** by fitting into a recessed portion of the lower base part **10**.

[0090] FIG. 25 shows alternative embodiments and views of upper base part **20** and lower base part **10** with cannula device **70**. In some instances, the cannula device is placed off the center of the upper and lower base parts. The lower base part **10** may not need an opening **110** for the cannula device when the lower base part is smaller than the upper base part **20** and the cannula device is inserted through the upper base part in the space between the upper base part and the lower base part. The cannula devices that are placed off center can be placed after the upper base part and lower base part have been rotated and secured to the desired position.

[0091] FIG. 26 shows detailed views of upper base part **20** and lower base part **10** with cannula device **70** and a cannula housing **260** that are placed off center of the base parts. The cannula housing **260** can have a tab **360** that latches to the a protrusion part **380** on the upper base part **20** and a protrusion part **370** on the cannula housing that fit into a recessed groove on the upper base part to secure the cannula housing **260** into the upper base part **20**. The details are shown in cross-section A-A and detailed views B and C.

[0092] FIG. 27 shows alternative embodiments and views of upper base part **20**. In some instances, the upper base part **20** has opening **100** for the cannula device that is off center, where the opening has a recessed portion and a protrusion part to fit with the cannula housing. The upper base part **20** has a plurality of holes **390** alternated with inner surface tabs **400** on the inner surface of the upper base part **20** to secure the connection to the lower base part **10**.

[0093] FIG. 28 depicts an embodiment of a lower base part **10** that fits with an upper base part **20** having an off center opening for a cannula device.

[0094] FIG. 29 depicts an embodiment of a cannula housing **260**. The cannula housing has a tab **360** that is flexible and can bend to fit under a protrusion portion of the upper base part. The cannula housing has a protrusion part **370** on an opposite side to the tab **360** that can fit into a recessed

portion of the upper base part. The tab **360** and the protrusion part **370** help the cannula housing to maintain its orientation and position when the cannula device is inserted into the housing parts. The cannula housing has a central lumen that narrows in increments toward the lower base part when assembled together. The narrowing provides a secure fluid seal and maintains orientation of the cannula device in the cannula housing.

[0095] While preferred embodiments of the present disclosure have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the disclosure. It should be understood that various alternatives to the embodiments of the disclosure described herein may be employed in practicing the disclosure. It is intended that the following claims define the scope of the disclosure and that methods and structures within the scope of these claims and their equivalents be covered thereby.

CLAIMS

What is claimed is:

1. An infusion set comprising:

a base having an opening to receive a cannula device, the base comprising a lower base part, and an upper base part, wherein the upper base part is coupled to the lower base part and is rotatable relative to the lower base part; and

a connector comprising a fluid connector tube;

wherein the connector prevents the upper base from substantially rotating relative to the lower base and the fluid connector tube is in fluid connection with the cannula device when the connector is coupled to the base.
2. The infusion set of claim 1, wherein the lower base part does not substantially move once the cannula device is in place.
3. The infusion set of any one of claims 1-2, wherein the cannula device guides the connector in place when the connector is coupled to the base.
4. The infusion set of any one of claims 1-3, wherein the upper base is rotatable at 360 degrees relative to the lower base.
5. The infusion set of any one of claims 1-2, wherein the upper base is rotatable to a user-friendly position and the connector is coupled to the base to lock the upper base in the user-friendly position.
6. The infusion set of any one of claims 1-5, wherein the connector comprises at least one snap hook, wherein the snap hook secures the connector to the base when the connector is coupled to the base.

7. The infusion set of any one of claims 2-6, wherein the lower base comprises a guiding protrusion, wherein the guiding protrusion abuts the snap hook of the connector when the connector is coupled to the base.
8. The infusion set of claim 7, wherein the lower base comprises at least one guiding protrusion.
9. The infusion set of claim 7, wherein the lower base comprises at least three guiding protrusions.
10. The infusion set of claim 7, wherein the guiding protrusions are radially symmetric.
11. The infusion set of any one of claims 1-10, wherein the connector comprises at least one locking protrusion.
12. The infusion set of any one of claims 1-11, wherein the lower base comprises at least one groove, wherein at least one of the grooves receives the locking protrusion of the connector when the connector is coupled to the base.
13. The infusion set of claim 12, wherein the lower base comprises at least one groove.
14. The infusion set of claim 12, wherein the lower base comprises at least three grooves.
15. The infusion set of claim 14, wherein the grooves of the lower base are radially symmetric.

16. The infusion set of any one of claims 1-15, wherein the upper base comprises a rotatable connection and the lower base comprises a rotation groove, wherein rotatable connection sits and rotates in the rotation groove.
17. The infusion set of any one of claims 1-16, wherein the upper base comprises at least one rotation guide, wherein the rotation guide receives the lower base to keep the upper base connected to the lower base and guide the rotation of the upper base relative to the lower base.
18. The infusion set of any one of claims 1-17, wherein the upper base comprises at least two openings in fluid communication with the cannula device and at least two membranes covering the openings.
19. The infusion set of claim 18, wherein the membranes comprise an elastomeric material.
20. The infusion set of any one of claims 1-18, wherein the upper base comprises at least one o-ring, wherein the o-ring provides a fluid seal between the cannula device and the opening of the base, and/or between the cannula device, the upper base and the lower base.
21. The infusion set of any one of claims 1-20, wherein the cannula device is configured to be inserted into the opening in the base.
22. The infusion set of any one of claims 1-21, wherein the cannula device comprise an cannula housing, wherein the cannula housing is secured by the lower base and wherein the upper base is rotatable relative to the cannula housing.
23. The infusion set of claim 22, wherein an opening to receive the cannula device in the upper base decreases in diameter from distal to proximal direction toward the lower base.

24. The infusion set of any one of claims 1-23, wherein the upper base and the cannula device maintain a fluid seal when the upper base rotates relative to the cannula housing.
25. The infusion set of any one of claims 1-24, wherein the lower base comprises at least one arm to secure the cannula device.
26. The infusion set of any one of claims 1-25, wherein the cannula device is not rotated when the upper base is rotated relative to the lower base.
27. The infusion set of any one of claims 1-26, wherein the opening in the base for the cannula device is at or near about the center of the base.
28. The infusion set of any one of claims 1-27, wherein the opening in the base for the cannula device is off-center of the base.
29. The infusion set of any one of claims 1-28, wherein the cannula device is placed transdermally through skin of a user.
30. The infusion set of any one of claims 1-29, wherein the fluid connector tube is stainless steel.
31. The infusion set of any one of claims 1-30, wherein the connector comprises an opening to receive a connection tube.
32. The infusion set of any one of claims 1-31, wherein the lower base comprises an adhesive on a proximal surface, wherein the adhesive secures the base to skin of a user.

33. The infusion set of any one of claims 1-32, wherein the lower base comprises a clear portion to provide a view of condition of the skin of the user.

34. The infusion set of claim 23, wherein the opening to receive the cannula device in the upper base comprises a tapered coned opening.

35. The infusion set of claim 31, wherein the connection tube connects to at least one of an insulin pump, an external pump, a wearable pump or combinations thereof.

36. An infusion set comprising:

a base having an opening to receive a cannula device, the base comprising a lower base, and an upper base, wherein the upper base is coupled to the lower base and is rotatable relative to the lower base;

a cannula device; and

a connector comprising a fluid connector tube;

wherein the connector prevents the upper base from substantially rotating relative to the lower base and the fluid connector tube is in a fluid connection with the cannula device when the connector is coupled to the base.