

DESCRIPTION

Title of the Invention

CONNECTOR

5 Technical Field

[0001] The present invention relates to a connector used for a connection of a medical instrument such as an infusion tube and a three-way stopcock.

Background Art

10 [0002] Hitherto, as a connector for connecting parts in a medical instrument constituting a three-way stopcock or infusion tubing such as an infusion tube, there has been known a tapered fitting type connector having a locking mechanism (refer to, for example, Patent Literature 1). Such a connector is composed of a male side connector provided with a cylindrical male luer having a tapered outer peripheral surface and a
15 female side connector provided with a cylindrical female luer having a tapered inner peripheral surface. The male luer is inserted into the female luer and fitted to make the connection.

[0003] Further, as a locking mechanism, the male connector has a cylindrical lock ring provided with a female thread on the inner peripheral surface on the outer side of the male
20 luer, and the female connector has a male thread, which is to be screwed with the female thread of the lock ring, on the outer peripheral surface of the female luer. Therefore, the male side connector and the female side connector are fastened to each other by rotating the lock ring after inserting the male luer into the female luer and then screwing the female thread of the lock ring to the male thread of the female side connector. Thus,
25 even when a force is applied in a direction for separating the male side connector and the female side connector, the two connectors will not be easily separated, meaning that the two connectors will be locked.

[0004] However, if the screwing between the female thread of the lock ring and the male thread of the female side connector loosens, then the fastening force will be lost,
30 leading to the loss of the separation prevention function of the locking mechanism. For

this reason, in the connector described in Patent Literature 1, an elastic protruding locking section is provided in the vicinity of the start end of the screw thread of the male thread of the female side connector. When the male thread and the female thread are screwed together, the screw thread of the female thread rides up on this locking section thereby to prevent the screwing from loosening.

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Patent Application Laid-Open No. 2005-466

Summary of Invention

Technical Problem

[0006] However, the connector described in Patent Literature 1 is configured such that, when the screw thread of the female thread rides up on the locking section, the locking section is crushed by the screw thread, so that there have been cases where the function for preventing the loosening is impaired due to the plastic deformation or wear of the locking section when reconnection is made after temporary disconnection. This has been presenting a problem in that the screwing between the female thread of the lock ring and the male thread of the female side connector tends to loosen at the time of reconnection, and the separation prevention function of the locking mechanism is not properly exerted in some cases.

[0007] The present invention has been made in view of the actual circumstance described above, and an object of the invention is to provide a connector capable of stably exerting a separation prevention function even at the time of reconnection.

Solution to Problem

[0008] A connector in accordance with the present invention includes a screw composed of a screw thread and a thread groove, and is configured to be connected to a mating connector having a mating screw to be screwed to the screw, wherein a top of the screw thread is provided along a side surface of a virtual reference columnar body having

a round cross section centered on a predetermined reference central axis, a root of the thread groove has at least two inclined regions partitioned in a direction in which the thread groove extends, one of the inclined regions is provided along a side surface of a first virtual inclined columnar body having a round, elliptical or oval cross section centered on a first inclined central axis obliquely intersecting the reference central axis, and the inclined region adjacent to the one of the inclined regions is provided along a side surface of a second virtual inclined columnar body having a round, elliptical or oval cross section centered on a second inclined central axis obliquely intersecting the reference central axis in a plane different from a plane that includes the reference central axis and the first inclined central axis.

[0009] A connector in accordance with the present invention includes a screw composed of a screw thread and a thread groove, and is configured to be connected to a mating connector that has a mating screw to be screwed to the screw, wherein a root of the thread groove is provided along a side surface of a virtual reference columnar body having a round cross section centered on a predetermined reference central axis, a top of the screw thread has at least two inclined regions partitioned in a direction in which the screw thread extends, one of the inclined regions is provided along a side surface of a first virtual inclined columnar body having a round, elliptical or oval cross section centered on a first inclined central axis obliquely intersecting the reference central axis, and the inclined region adjacent to the one of the inclined regions is provided along a side surface of a second virtual inclined columnar body having a round, elliptical or oval cross section centered on a second inclined central axis obliquely intersecting the reference central axis in a plane different from a plane that includes the reference central axis and the first inclined central axis.

[0010] According to the present invention, the root of the thread groove (or the top of the screw thread) can be tilted with respect to the top of the screw thread (or the root of the thread groove) of the mating connector and also bulged toward the mating side in a plurality of inclined regions. This causes a pressing force to be applied to the screw thread (or the thread groove) of the mating connector in different directions at a plurality of locations, and the frictional force consequently increases, so that it is possible to

minimize the chance of the loosening of screwing.

[0011] Further, it is possible to set a proper size of the area of contact with the top of the screw thread (or the root of the thread groove) of the mating connector by properly setting the shapes of the virtual inclined columnar bodies and the areas of the inclined regions, and to disperse the pressing force in a plurality of directions by providing a plurality of inclined regions, so that plastic deformation and wear of a contact portion can be reduced. Consequently, the loosening prevention function is properly exerted even at reconnection, thus making it possible to stably exert the separation prevention function.

[0012] Further, in the connector according to the present invention, the first inclined central axis preferably tilts in the same inclination direction as that of the second inclined central axis with respect to the reference central axis in the case where the first inclined central axis is rotated around the reference central axis and placed in a plane that includes the reference central axis and the second inclined central axis.

[0013] With this arrangement, by the inclination with respect to the reference central axis, if, for example, one side of an inclined region in the reference central axis direction bulges more than the other side, then one side of an inclined region adjacent to that particular inclined region in the reference central axis direction can also be set to bulge more than the other side. In this way, a change in the amount of bulging at the boundary of two inclined regions is reduced, and local contact, or catch or the like during the progress of screwing is prevented, thus making it possible to reduce the plastic deformation and wear of a contact portion.

[0014] Further, in the connector according to the present invention, a plane that includes the reference central axis and the first inclined central axis, and a plane that includes the reference central axis and the second inclined central axis preferably intersect each other at an angle of 70 degrees or more and 110 degrees or less.

[0015] With this arrangement, when viewed from the reference central axis direction, the direction of a pressing force by one inclined region and the direction of a pressing force by an inclined region adjacent to that particular inclined region can be intersected with each other at an angle of 70 degrees or more and 110 degrees or less. Therefore, it is possible to cause the elastic deformation in the lateral direction (lateral strain) caused

by a pressing force by one inclined region to increase the pressing force by an inclined region adjacent to that particular inclined region, so that the loosening prevention function by a plurality of inclined regions can be synergetically exerted.

[0016] Further, in the connector according to the present invention, the cross section of the first virtual inclined columnar body and the cross section of the second virtual inclined columnar body preferably have the same shape.

[0017] With this arrangement, the loosening prevention function can be enhanced by appropriately balancing the pressing forces of an inclined region and another inclined region adjacent thereto and the resulting deformation.

[0018] Further, in the connector according to the present invention, the first inclined central axis and the second inclined central axis preferably intersect the reference central axis at the same angle.

[0019] With this arrangement, the loosening prevention function can be enhanced by appropriately balancing the pressing forces of an inclined region and another inclined region adjacent thereto and the resulting deformation.

Advantageous Effects of Invention

[0020] The connector in accordance with the present invention can achieve excellent effect that a separation prevention function can be stably exerted even at the time of reconnection.

Brief Description of Drawings

[0021] FIG. 1A is a plan view of a connector according to an embodiment of the present invention, FIG. 1B is a front view of the connector, and FIG. 1C is a right side view of the connector.

FIG. 2A is a sectional view taken along line I-I in FIG. 1A, and FIG. 2B is a sectional view taken along line III-III in FIG. 2A.

FIG. 3A is a sectional view taken along line II-II in FIG. 1A, and FIG. 3B is a sectional view taken along line IV-IV in FIG. 3A.

FIG. 4A and FIG. 4B are diagrams illustrating a state in which a mating

connector has been connected to the connector.

Description of Embodiments

[0022] The following will describe an embodiment of the present invention with
5 reference to the accompanying drawings. FIG. 1A is a plan view of a connector 1
according to an embodiment of the present invention; FIG. 1B is a front view of the
connector 1; and FIG. 1C is a right side view of the connector 1. Further, FIG. 2A is a
sectional view taken along line I-I in FIG. 1A, and FIG. 2B is a sectional view taken
along line III-III in FIG. 2A. Further, FIG. 3A is a sectional view taken along line II-II
10 in FIG. 1A, and FIG. 3B is a sectional view taken along line IV-IV in FIG. 3A.

[0023] In the following description, the horizontal direction in the plan view is defined
as the x-axis direction, the vertical direction in the plan view is defined as the y-axis
direction, and the vertical direction in the front view is defined as the z-axis direction. In
addition, a plane perpendicular to the z-axis is defined as the x-y plane, a plane
15 perpendicular to the y-axis is defined as a z-x plane, and a plane perpendicular to the x-
axis is defined as a y-z plane.

[0024] The connector 1 of the present embodiment is used as a connector to which an
infusion tube, a syringe, or the like for mixed injection is connected in a three-way
stopcock, a T port (mixed injection port), or the like. The connector 1 is made of an
20 appropriate resin and is composed of a cup-shaped base 10, a cylindrical main body 20
protrusively provided upward from the base 10, and a male screw 30 provided on the
outer peripheral surface of the main body 20.

[0025] The base 10 is a section to be fixed to a three-way stopcock or the like, and
includes a disc-shaped upper wall 11 and a side wall 12 formed by protruding the outer
25 peripheral portion of the upper wall 11 downward. A communication hole 13, which
communicates with the inside of the main body 20 is provided at the central portion of the
upper wall 11. Further, an end surface 12a of the side wall 12 is provided with a groove
14 that extends in the circumferential direction. The connector 1 is configured to be
fixed to the main body of a three-way stopcock or the like by inserting a protrusion
30 provided on the main body of the three-way stopcock or the like into the groove 14 and

melting the protrusion by ultrasonic welding or the like.

[0026] The main body 20 is a section into which a male luer 110 of a mating connector 100 (refer to FIGS. 4A and 4B) provided at an end of, for example, an infusion tube is inserted and fitted, and which is configured in a cylindrical shape centered on a reference central axis C0 parallel to the z-axis. The main body 20 includes a female luer tapered section 21 provided on the inner side thereof adjacently to the distal end (opposite side from the base 10) and a housing section 22 provided on the inner side thereof adjacently to the proximal end (adjacent to the base 10).

[0027] The female luer tapered section 21 is formed in a tapered shape according to a predetermined standard, and is configured to fit liquid-tightly with a male luer tapered section 111 of the mating connector 100 (refer to FIGS. 4A and 4B). The housing section 22 has a larger inner diameter than the female luer tapered section 21 and is formed to be continuous with the communication hole 13 of the base 10. The housing section 22 constitutes, together with the inside of the base 10, a space for accommodating an appropriate valve body.

[0028] The male screw 30 is a section that is screwed with a female screw 130 of a lock ring 120 of the mating connector 100 (refer to FIGS. 4A and 4B) so as to be fastened, thereby exercising the function for preventing the separation between the connectors. In other words, the male screw 30 constitutes a locking mechanism together with the female screw 130 of the mating connector 100. The male screw 30 of the present embodiment is a double-threaded trapezoidal screw and includes two screw threads 31 and two thread grooves 32.

[0029] Like a screw thread of a typical screw, the screw thread 31 is provided in such a manner as to protrude in a centrifugal direction from the side surface (the outer peripheral surface) of a first virtual reference columnar body 40a (refer to FIG. 2A or FIG. 3A) centered on the reference central axis C0, which is the central axis of the main body 20, and to extend in a spiral centered on the reference central axis C0. Further, a top 31a of the screw thread 31 is provided along the side surface (the outer peripheral surface) of a second virtual reference columnar body 40b (refer to FIG. 2A or FIG. 3A) centered on the reference central axis C0.

[0030] As illustrated on the lower side in FIG. 2A and FIG. 3A, the first virtual reference columnar body 40a and the second virtual reference columnar body 40b have round cross-sectional shapes (sections orthogonal to the reference central axis C0) having a diameter a1 and a diameter a2, respectively. Therefore, the top 31a keeps a substantially constant distance from the reference central axis C0 and has a surface substantially parallel to the reference central axis C0.

[0031] The thread grooves 32 are formed between the two screw threads 31. In the present embodiment, there are three regions defined in the direction in which the thread grooves 32 extend. To be more specific, in the present embodiment, roots 32a have a reference region 33 provided along the side surface (the outer peripheral surface) of the first virtual reference columnar body 40a, a first inclined region 34 provided along the side surface (the outer peripheral surface) of a first virtual inclined columnar body 41 (refer to FIG. 2A), and a second inclined region 35 provided along the side surface (the outer peripheral surface) of a second virtual inclined columnar body 42 (refer to FIG. 3A).

[0032] The reference region 33 is a region provided along the side surface of the first virtual reference columnar body 40a. Therefore, the reference region 33 is a region formed in the same manner as a root of a thread groove in a typical screw, keeps a substantially constant distance from the reference central axis C0, and has a surface substantially parallel to the reference central axis C0.

[0033] In the present embodiment, the reference region 33 is provided adjacently to the distal end of the main body 20, i.e., the screwing start end. In the present embodiment, the screw threads 31 and the thread grooves 32 are provided over an area of approximately 270 degrees (approximately 3/4 circumference) around the reference central axis C0, wherein the reference region 33 is provided over an area of approximately 20 degrees around the reference central axis C0. Providing the reference region 33 at the distal end side as described above enables a smooth start of screwing.

[0034] The first inclined region 34 is a region provided along the side surface of the first virtual inclined columnar body 41, which has different attitude and shape from those of the first virtual reference columnar body 40a and the second virtual reference columnar body 40b. As illustrated in FIG. 2A and FIG. 2B, the first virtual inclined columnar

body 41 is a columnar body centered on a first inclined central axis C1 that obliquely intersects the reference central axis C0 in a first plane P1 parallel to the y-z plane.

[0035] The first inclined central axis C1 intersects the reference central axis C0 at an angle θ . Further, as illustrated on the upper side of FIG. 2A, the shape of the cross section (the section orthogonal to the first inclined central axis C1) of the first virtual inclined columnar body 41 is an ellipse having a long axis located in the first plane P1, a minor axis a_1 (the same as the diameter of the first virtual reference columnar body 40a), and a major axis b .

[0036] Therefore, the first inclined region 34 is a region that tilts in the y-axis direction at the angle θ with respect to the reference central axis C0 and bulges farther outward (in the centrifugal direction of the reference central axis C0) than the reference region 33 along the side surface of the first virtual reference columnar body 40a.

[0037] In the present embodiment, the first inclined region 34 is provided over an area of approximately 125 degrees around the reference central axis C0 at a position adjacent to the reference region 33. Further, since the male screw 30 of the present embodiment is a double-threaded screw, the first inclined regions 34 provided at the roots 32a of the two thread grooves 32 are each positioned on both sides in the x-axis direction in the main body 20.

[0038] In the case where the cross section of the first virtual inclined columnar body 41 is formed to be circular with the same diameter a_1 as that of the first virtual reference columnar body 40a, the first inclined region 34 can also be bulged farther than the reference region 33 by tilting the first virtual inclined columnar body 41 with respect to the reference central axis C0; however, in the present embodiment, the amount of bulging is increased by forming the cross section of the first virtual inclined columnar body 41 into an elliptical shape as described above.

[0039] As with the first virtual inclined columnar body 41, the second inclined region 35 is a region provided along the side surface of the second virtual inclined columnar body 42 having different attitude and shape from those of the first virtual reference columnar body 40a and the second virtual reference columnar body 40b. As illustrated in FIGS. 3A and 3B, the second virtual inclined columnar body 42 is a columnar body

centered on a second inclined central axis C2 that obliquely intersects the reference central axis C0 in a second plane P2 parallel to the z-x plane.

[0040] The second inclined central axis C2 intersects the reference central axis C0 at the same angle θ as that of the first inclined central axis C1. Further, the shape of the cross section (the section orthogonal to the second inclined central axis C2) of the second virtual inclined columnar body 42 is an ellipse having a long axis located in the second plane P2, a minor axis a1 (the same as the diameter of the first virtual reference columnar body 40a), and a major axis b. In other words, the second virtual inclined columnar body 42 has a different attitude from that of the first virtual inclined columnar body 41 but has the same shape.

[0041] Consequently, the second inclined region 35 is a region that tilts in the x-axis direction, which is different by 90 degrees from the first inclined region 34, by the angle θ with respect to the reference central axis C0, and bulges farther outward (in the centrifugal direction of the reference central axis C0) than the reference region 33 along the side surface of the first virtual reference columnar body 40a. In the present embodiment, the second inclined region 35 is provided over an area of approximately 125 degrees around the reference central axis C0 at a position adjacent to the first inclined region 34 on the opposite side from the reference region 33.

[0042] In the present embodiment, since the male screw 30 is a double-threaded screw, the second inclined regions 35 provided at the roots 32a of the two thread grooves 32 are each positioned on both sides in the y-axis direction in the main body 20. In addition, as with the first virtual inclined columnar body 41, the amount of bulging of the second inclined region 35 is increased by forming the cross section of the second virtual inclined columnar body 42 into the elliptical shape as described above.

[0043] Further, in the present embodiment, the inclination of the first inclined central axis C1 is upward to the left in a right side view, and the inclination of the second inclined central axis C2 is upward to the left in a front view. Consequently, if the first inclined central axis C1 is rotated around the reference central axis C0 and placed in the second plane P2, then the first inclined central axis C1 tilts in the same direction as that of the second inclined central axis C2 with respect to the reference central axis C0, and is

upward to the left in the front view. In other words, the first inclined central axis C1 and the second inclined central axis C2 tilt in such a manner as to incline in the same direction with respect to the reference central axis C0 when the first inclined central axis C1 and the second inclined central axis C2 are rotated around the reference central axis C0 and placed in the same plane.

[0044] In this way, the second inclined region 35 having its distal end side bulging more than its proximal end side can be placed adjacently to the first inclined region 34 having its distal end side bulging more than its proximal end side in one of the two thread grooves 32, and the second inclined region 35 having its proximal end side bulging more than its distal end side can be placed adjacently to the first inclined region 34 having its proximal end side bulging more than its distal end side in the other. This reduces a change in the amount of bulging at the boundary between the first inclined region 34 and the second inclined region 35, thus making it possible to prevent an extreme level difference or the like from taking place.

[0045] In the present embodiment, the second inclined region 35 is provided closer to the proximal end of the main body 20 than the first inclined region 34, so that the second inclined central axis C2 is positioned closer to the proximal end of the main body 20 than the first inclined central axis C1. Consequently, the intersection of the reference central axis C0 and the second inclined central axis C2 is positioned closer to the proximal end of the main body 20 than the intersection of the reference central axis C0 and the first inclined central axis C1.

[0046] FIGS. 4A and 4B are diagrams illustrating a state in which a mating connector 100 has been connected to the connector 1. FIG. 4A is a sectional view taken along line I-I in FIG. 1A, and FIG. 4B is a sectional view taken along line II-II in FIG. 1A. Further, FIG. 4A and FIG. 4B indicate the mating connector 100 by the two-dot chain line and illustrate an undeformed state in a virtual manner.

[0047] The mating connector 100 is composed of an appropriate resin, and includes the stepped cylindrical male luer 110 and the bottomed cylindrical lock ring 120 loosely fitted around the outer periphery of the male luer 110 as illustrated in FIGS. 4A and 4B.

[0048] The distal end of the male luer 110 is provided with the male luer tapered

section 111 to be fitted with the female luer tapered section 21, and the proximal end has an infusion tube or the like (not illustrated) connected thereto. Further, the proximal end of the male luer tapered section 111 is provided with a flange 112 that comes in contact with the lock ring 120 in the axial direction.

5 [0049] A female screw 130 to be screwed to the male screw 30 is provided in the inner peripheral surface of the lock ring 120. The female screw 130 is composed of a screw thread 131 matched to the thread groove 32 of the male screw 30, and a thread groove 132 matched to the screw thread 31 of the male screw 30. A through hole 122, through which the male luer 110 is inserted, is provided at the central portion of a bottom section 10 121 of the lock ring 120, and the edge of the through hole 122 comes in contact with the flange 112 from the proximal end side of the male luer 110. The lock ring 120 may be formed integrally with the male luer 110.

[0050] To connect the mating connector 100 to the connector 1, the male luer tapered section 111 is first inserted into and fitted with the female luer tapered section 21 along the reference central axis C0, and then the lock ring 120 is rotated to screw the male screw 30 and the female screw 130 together. At this time, as the screwing of the male screw 30 and the female screw 130 together progresses, the bottom section 121 of the lock ring 120 presses the flange 112 of the male luer 110 toward the connector 1, so that the fitting between the male luer tapered section 111 and the female luer tapered section 21 is enhanced, and a fastening force is generated between the connector 1 and the mating connector 100. Thus, the separation prevention function for preventing the separation between the connector 1 and the mating connector 100 is exerted.

20 [0051] Further, as illustrated in FIG. 4A, when the male screw 30 and the female screw 130 are screwed together, a top 131a of the screw thread 131 of the female screw 130 comes in contact with and is pressed by the first inclined region 34 at the distal end side of the main body 20, thus causing the lock ring 120 to be subjected to a force that pushes and opens the lock ring 120 mainly in the y-axis direction and to a moment for rotating around an axis parallel to the x-axis.

25 [0052] Similarly, as illustrated in FIG. 4B, the top 131a of the screw thread 131 of the female screw 130 comes in contact with and is pressed by the second inclined region 35 30

at the proximal end side of the main body 20, thus causing the lock ring 120 to be subjected to a force that pushes and opens the lock ring 120 mainly in the x-axis direction and to a moment for rotating around an axis parallel to the y-axis.

[0053] Thus, the lock ring 120 and the main body 20 elastically deform accordingly, and the force of restoration from the elastic deformation causes the contact portion between the male screw 30 and the female screw 130 to be subjected to a larger pressing force than that of a typical screw. As a result, the frictional force between the male screw 30 and the female screw 130 increases, leading to a state that minimizes the chance of loosening of the screwing. In other words, the loosening prevention function for preventing the loosening of the screwing of the male screw 30 and the female screw 130 together is exerted.

[0054] The first inclined region 34 and the second inclined region 35 are provided along the side surfaces of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42, each of which has an elliptical cross section, and are provided over a relatively wide area, approximately 125 degrees, around the reference central axis C0, thus providing an appropriate size of the area of contact with the top 131a of the screw thread 131 of the female screw 130.

[0055] In other words, in the first inclined region 34 and the second inclined region 35, unlike the conventional case where the protrusion is provided, the local contact with the female screw 130 of the mating connector 100 does not take place, thus making it possible to reduce the plastic deformation and wear in the first inclined region 34, the second inclined region 35 or the top 131a of the screw thread 131. Further, in the present embodiment, whether the distal end side or the proximal end side is more bulged matches in the first inclined region 34 and the second inclined region 35 of one thread groove 32, thus preventing local contact, or catch or the like from taking place even at the boundary of the first inclined region 34 and the second inclined region 35.

[0056] Further, a pressing force can be distributed in a plurality of directions by bulging two places of the first inclined region 34 and the second inclined region 35, so that the plastic deformation and wear of a contact portion can be further reduced. Especially in the present embodiment, the directions of the pressing forces by the first

inclined region 34 and the second inclined region 35, which are adjacent to each other, are set to be orthogonal to each other. Therefore, the elastic deformation in the lateral direction of the lock ring 120 by one pressing force (e.g., if the lock ring 120 elastically deforms to be pushed and spread in the y-axis direction, then the lock ring 120 elastically deforms to be pushed and contracted in the x-axis direction) works to enhance the other pressing force, thus making it possible to synergetically exert the loosening prevention function by the first inclined region 34 and the second inclined region 35.

[0057] Further, in the present embodiment, the cross sections of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42 are formed to be the same, and the inclination angles of the first inclined central axis C1 and the second inclined central axis C2 with respect to the reference central axis C0 are set to be the same, thereby appropriately balancing the pressing forces of the first inclined region 34 and the second inclined region 35 so as to enhance the loosening prevention function.

[0058] Thus, the connector 1 can reduce the plastic deformation and wear of a contact portion while properly exerting the loosening prevention function, so that the loosening prevention function can be properly exerted even when the connection with the mating connector 100 is temporarily released and then reconnection is made.

[0059] In the present embodiment, the minor axes of the cross sections of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42 are set to the same dimension (a_1) as the diameter of the first virtual reference columnar body 40a, but may be set to a different dimension. In addition, the shapes of the cross sections of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42 are not limited to the elliptical shape, but may be the round shape as described above, or an oval shape, which is a shape similar to an elliptical shape, such as an oblong shape or an egg-like shape. Further, the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42 may have cross sections having dimensions or shapes that are different from each other.

[0060] Further, the area of the first inclined region 34 and the second inclined region 35 around the reference central axis C0 is not limited to approximately 125 degrees, and may be a different area. Similarly, the area of the reference region 33 around the

reference central axis C0 may be an area other than approximately 20 degrees, or the reference region 33 may not be provided. In addition, the screw threads 31 and the thread grooves 32 of the male screw 30 may be provided over an area other than approximately 270 degrees around the reference central axis C0.

5 [0061] Further, the first inclined region 34 and the second inclined region 35 are not limited to be adjacent to each other in one thread groove 32, but the reference region 33 may be provided between the first inclined region 34 and the second inclined region 35. In other words, the first inclined region 34 and the second inclined region 35 may be adjacent to each other through the intermediary of the reference region 33 in one thread
10 groove 32.

[0062] Further, the first inclined region 34 of one thread groove 32 and the first inclined region 34 of the other thread groove 32 may be provided along the side surfaces of different first virtual inclined columnar bodies 41 (of different positions, attitudes, or cross-sectional shapes). Similarly, the second inclined region 35 of one thread groove
15 32 and the second inclined region 35 of the other thread groove 32 may be provided along the side surfaces of different second virtual inclined columnar bodies 42.

[0063] Further, the first plane P1, which includes the first inclined central axis C1 and the reference central axis C0, and the second plane P2, which includes the second inclined central axis C2 and the reference central axis C0 are not limited to be orthogonal to each
20 other, but may intersect each other at a different angle. However, in order to effectively utilize the elastic deformation in the lateral direction of the lock ring 120 by one pressing force as described above, the first plane P1 and the second plane P2 preferably intersect each other at an angle of 70 degrees or more and 110 degrees or less, more preferably intersect each other at an angle of 80 degrees or more and 100 degrees or less, and most
25 preferably intersect each other at an angle of 85 degrees or more and 95 degrees or less.

[0064] Further, the angle θ at which the first inclined central axis C1 and the second inclined central axis C2 intersect the reference central axis C0 is not particularly limited, but is preferably an angle at which the amounts of bulging of the first inclined region 34 and the second inclined region 35 do not exceed the top 31a of the screw thread 31. In
30 addition, the first inclined central axis C1 and the second inclined central axis C2 may

intersect the reference central axis C0 at angles that are different from each other.

[0065] Further, the first inclined central axis C1 and the second inclined central axis C2 are preferably inclined in the same direction with respect to the reference central axis C0 when the first inclined central axis C1 and the second inclined central axis C2 are rotated
5 around the reference central axis C0 and placed within the same plane, but are not limited thereto. More specifically, the first inclined central axis C1 and the second inclined central axis C2 may be inclined in opposite directions with respect to the reference central axis C0 when the first inclined central axis C1 and the second inclined central axis C2 are rotated around the reference central axis C0 and placed within the same plane, depending
10 on the shapes of the cross sections, the attitudes, or the like of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42, and various settings of the areas or the like of the first inclined region 34 and the second inclined region 35.

[0066] Further, in the present embodiment, the central axis of the main body 20 is the reference central axis C0, but the reference central axis C0 may obliquely intersect the
15 central axis of the main body 20. In this case, the first inclined central axis C1 or the second inclined central axis C2 may coincide with the central axis of the main body 20.

[0067] Further, in the present embodiment, the case where the two inclined regions, namely, the first inclined region 34 and the second inclined region 35, are provided has been described; however, three or more inclined regions may be provided in one thread
20 groove 32, depending on the area of the screw thread 31 and the thread groove 32 about the reference central axis C0, the dimension of the main body 20 in the axial direction, or the like.

[0068] Further, the male screw 30 is not limited to a double-threaded screw, but may be a single-threaded screw or a multi-threaded screw having three or more threads. In
25 addition, the male screw 30 is not limited to the trapezoidal screw, and may be a screw having other shapes such as a triangular screw, a square screw, a serrated screw and a round screw.

[0069] Further, the first inclined region 34 and the second inclined region 35 may be provided at the top 31a of the screw thread 31 in place of the root 32a of the thread
30 groove 32. In this case, it is possible to provide the top 31a of the screw thread 31 with

the first inclined region 34 and the second inclined region 35 that bulge outward beyond the side surface of the second virtual reference columnar body 40b by, for example, providing the root 32a of the thread groove 32 along the side surface of the first virtual reference columnar body 40a, and by setting the major axes of the cross sections of the first virtual inclined columnar body 41 and the second virtual inclined columnar body 42 to be larger than their minor axes, which are denoted by a_2 . In this case, the reference region 33 provided along the side surface of the second virtual reference columnar body 40b may be provided adjacently to the distal end of the top 31a of the screw thread 31.

[0070] Also in the case where the first inclined region 34 and the second inclined region 35 are provided at the top 31a of the screw thread 31, the first inclined region 34 and the second inclined region 35 press a root 132a of a thread groove 132 in the female screw 130 of the mating connector 100, so that the same effect as when the first inclined region 34 and the second inclined region 35 are provided at the root 32a of the thread groove 32 can be obtained. Needless to say, also in this case, each of the above-described modified forms can be applied. Further, the first inclined region 34 and the second inclined region 35 may be provided at both the root 32a of the thread groove 32 and the top 31a of the screw thread 31.

[0071] In addition, although not illustrated, the connector 1 may include a female screw in place of the male screw 30, and may be connected to a mating connector having a male screw. In other words, the connector 1 may have the same structure as that of the mating connector 100 in the example described above.

[0072] In this case, the root of a thread groove or the top of a screw thread of a female screw can be bulged toward a mating male screw by, for example, providing the first inclined region 34 along the side surface of the first virtual inclined columnar body 41 having a cross section of an elliptical shape in which its minor axis is positioned in the first plane P1, and the second inclined region 35 along the side surface of the second virtual inclined columnar body 42 having a cross section of an elliptical shape in which its minor axis is positioned in the second plane P2. Therefore, the same effect obtained in the case where the male screw 30 described above is provided can be obtained also in the connector 1 having a female screw in place of the male screw 30. Further, in this case

also, the modified forms described above can be applied.

[0073] In addition, the connector 1 may include a male luer tapered section in place of the female luer tapered section 21, or may include both the female luer tapered section 21 and a male luer tapered section, or may include neither the female luer tapered section 21 nor a male luer tapered section.

[0074] Further, the connector 1 is not limited to being provided in a three-way stopcock, a T-port, or the like, but may be provided in, for example, other medical instruments, infusion tubes, or the like. Needless to say, any shapes can be adopted for the shape of the base 10 and the internal shape of the main body 20.

[0075] The above has described an embodiment of the present invention, but the connector of the present invention is not limited to the embodiment described above, but various modifications can be of course added within a scope that does not depart from the gist of the present invention.

[0076] Further, the operations and effects shown in the aforesaid embodiment are merely most preferred operations and effects resulting from the present invention, and the operations and effects obtained by the present invention are not limited thereto.

Description of Reference Numerals

[0077]	1	connector
	30	male screw
	31	screw thread
	31a	top of screw thread
	32	thread groove
	32a	root of thread groove
	34	first inclined region
	35	second inclined region
	40b	second virtual reference columnar body
	41	first virtual inclined columnar body
	42	second virtual inclined columnar body
	100	mating connector

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130	female screw
C0	reference central axis
C1	first inclined central axis
C2	second inclined central axis
P1	first plane
P2	second plane

CLAIMS

1. A connector comprising a screw composed of a screw thread and a thread groove, and being configured to be connected to a mating connector that has a mating screw to be screwed to the screw,

wherein a top of the screw thread is provided along a side surface of a virtual reference columnar body having a round cross section centered on a predetermined reference central axis,

a root of the thread groove has at least two inclined regions partitioned in a direction in which the thread groove extends,

one of the inclined regions is provided along a side surface of a first virtual inclined columnar body having a round, elliptical or oval cross section centered on a first inclined central axis obliquely intersecting the reference central axis, and

the inclined region adjacent to the one of the inclined regions is provided along a side surface of a second virtual inclined columnar body having a round, elliptical, or oval cross section centered on a second inclined central axis obliquely intersecting the reference central axis in a plane different from a plane that includes the reference central axis and the first inclined central axis.

2. A connector comprising a screw composed of a screw thread and a thread groove, and being configured to be connected to a mating connector that has a mating screw to be screwed to the screw,

wherein a root of the thread groove is provided along a side surface of a virtual reference columnar body having a round cross section centered on a predetermined reference central axis,

a top of the screw thread has at least two inclined regions partitioned in a direction in which the screw thread extends,

one of the inclined regions is provided along a side surface of a first virtual inclined columnar body having a round, elliptical or oval cross section centered on a first inclined central axis obliquely intersecting the reference central axis, and

the inclined region adjacent to the one of the inclined regions is provided along a side surface of a second virtual inclined columnar body having a round, elliptical or oval cross section centered on a second inclined central axis obliquely intersecting the reference central axis in a plane different from a plane that includes the reference central axis and the first inclined central axis.

3. The connector according to claim 1 or 2,
wherein the first inclined central axis tilts in a same inclination direction as that of the second inclined central axis with respect to the reference central axis in a case where the first inclined central axis is rotated around the reference central axis and placed in a plane that includes the reference central axis and the second inclined central axis.

4. The connector according to any one of claims 1 to 3,
wherein a plane that includes the reference central axis and the first inclined central axis and a plane that includes the reference central axis and the second inclined central axis intersect each other at an angle of 70 degrees or more and 110 degrees or less.

5. The connector according to any one of claims 1 to 4,
wherein the cross sections of the first virtual inclined columnar body and the second virtual inclined columnar body have a same shape.

6. The connector according to any one of claims 1 to 5,
wherein the first inclined central axis and the second inclined central axis intersect the reference central axis at a same angle.