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CATHETER ASSEMBLY AND CATHETER INDWELLING BODY

Abstract

A catheter assembly includes: an inner needle having a blade surface at a distal end; a catheter through which the inner needle is inserted; a catheter hub through which the inner needle is inserted and that is fixed to a proximal end of the catheter; a valve located in an internal space of the catheter hub, wherein the valve includes a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, a front slit formed along a longitudinal direction of the end surface, and a pair of side slits formed on side surfaces between the pair of inclined portions from both ends of the end surface; and an opening member.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. application Ser. No. 17/338,495, filed on Jun. 3, 2021, which is a bypass continuation of PCT Application No. PCT/JP2019/046933, filed on Dec. 2, 2019, which claims priority to Japanese Application No. 2018-227286, filed on Dec. 4, 2018. The contents of these applications are hereby incorporated by reference in their entireties.

BACKGROUND
[0002] The present invention relates to, for example, a catheter assembly and a catheter indwelling body used in a case of performing an infusion, a blood transfusion, or the like.
[0003] In a case of constructing an introduction portion of an infusion or a blood transfusion for a patient, for example, a catheter assembly as disclosed in JP 2018-511439 A is used. This catheter assembly has a catheter (flexible catheter tube), a catheter hub fixed to the catheter, and an inner needle (hollow introducer needle) arranged within the catheter. When the catheter assembly is used, the inner needle is detached from the catheter and the catheter hub after the catheter and the inner needle have been inserted into a patient's body by a user, and a medical device is inserted into the catheter hub after the detachment, thereby functioning as the introduction portion.
[0004] Further, the catheter assembly disclosed in JP 2018-511439 A includes a valve (elastic septum) that can be opened and closed and an opening member (valve actuator) arranged on a proximal side of the valve in the catheter hub. The valve prevents a leakage of blood by blocking a space inside the catheter hub at the time of detaching the inner needle. The opening member penetrates through (opens) the valve along with the insertion of the medical device, thereby enabling a medicinal liquid and blood to flow from the medical device side to the catheter.
SUMMARY OF INVENTION
[0005] Meanwhile, in the configuration in which the opening member penetrates through the valve along with the insertion of the medical device as described above, a space is formed between a distal end of the opening member through which fluid (a medicinal liquid or blood) flows out and the valve, which makes it difficult for the fluid to flow. If such a space exists, the medicinal liquid, blood, or the like is likely to remain, and a risk of growth of bacteria or the like increases.
[0006] The present invention has been made to solve the above-described problems, and an object thereof is to provide a catheter assembly and a catheter indwelling body capable of further enhancing hygiene during use by reducing the retention of the fluid with a simple configuration.
[0007] In order to achieve the above object, a catheter assembly according to a first aspect of the present invention includes: an inner needle having a blade surface at a distal end; a catheter through which the inner needle is inserted; a catheter hub through which the inner needle is inserted and that is fixed to a proximal end of the catheter; a valve that has a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, and a slit formed along a longitudinal direction of the end surface, and is located in an internal space of the catheter hub; and an opening member that is located in the internal space, is formed in a tubular shape having a space inside, is located proximal of the valve in an initial state, and moves in a distal direction to open the valve. The opening

member has a side hole that causes the space to communicate with an outside of the opening member, and the side hole is located distal of a most proximal end of the slit in a state in which the valve is opened.

[0008] Further, in order to achieve the above object, a catheter indwelling body according to a second aspect of the present invention includes: a catheter; a catheter hub that has an internal space and is fixed to a proximal end of the catheter; a valve that has a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, a front slit formed along a longitudinal direction of the end surface, and a side slit formed on a side surface between the pair of inclined portions from both ends of the end surface; and an opening member that is located in the internal space, is formed in a tubular shape having a space inside, is located on a proximal side of the valve in an initial state, and moves in the a direction to open the valve by opening the front slit and the side slit. The opening member has a side hole that causes the space to communicate with an outside of the opening member, and the side hole is located at a position overlapping the open side slit in a state in which the valve is opened.

[0009] Further, in order to achieve the above object, a catheter indwelling body according to a third aspect of the present invention includes: a catheter; a catheter hub fixed to a proximal end of the catheter; a valve that has a slit and is located in an internal space of the catheter hub; and an opening member that is located in the internal space, is formed in a tubular shape having a space inside, and is located on a proximal side of the valve in an initial state, and moves in a distal direction to open the valve. The opening member includes an insertion portion that is insertable into the slit and has an outer peripheral surface and an inner peripheral surface, and at least one of the outer peripheral surface and the inner peripheral surface is formed in a tapered shape having a diameter that becomes smaller in the distal direction. The opening member includes a side hole that is located at a position opposing a site where the slit is open in a state in which the valve is opened, and causes the space to communicate with an outside of the opening member.

[0010] The catheter assembly and the catheter indwelling body have the side hole, and thus, can allow the fluid flowing in the space to flow out to a radially outer space of the opening member or the valve. That is, the side hole allows the fluid to wrap around the valve that is inclined in the distal direction through the opening. Therefore, the fluid is suppressed from remaining in an internal space on the distal side of the valve, the growth of bacteria that is likely to be caused by the retention of the fluid is reduced, and the hygiene during use can be further improved.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0011] FIG. **1** is a perspective view of a catheter assembly according to one embodiment of the present invention.

[0012] FIG. **2** is an exploded perspective view of the catheter assembly of FIG. **1**.

[0013] FIG. **3** is a partial side cross-sectional view illustrating a catheter hub of a catheter indwelling body.

[0014] FIG. **4** is a partial side cross-sectional view illustrating an operation when a medical device is inserted into the catheter hub to cause a medicinal liquid to flow.

[0015] FIG. **5**A is a partial side cross-sectional view schematically illustrating an opening member according to a first modification. FIG. **5**B is a partial side cross-sectional view schematically illustrating an opening member according to a second modification.

[0016] FIG. **6**A is a partial side cross-sectional view schematically illustrating an opening member according to a third modification. FIG. **6**B is a partial side cross-sectional view schematically illustrating an opening member according to a fourth modification.

[0017] FIG. **7**A is a partial side cross-sectional view schematically illustrating an opening member according to a fifth modification. FIG. **7**B is a partial side cross-sectional view schematically illustrating an opening member according to a sixth modification.
[0018] FIG. **8**A is a partial side cross-sectional view schematically illustrating an opening member according to a seventh modification. FIG. **8**B is a partial side cross-sectional view schematically illustrating an opening member according to an eighth modification.
[0019] FIG. **9**A is a partial side cross-sectional view illustrating an opening member and a catheter hub according to a ninth modification. FIG. **9**B is a partial side cross-sectional view illustrating a state in which a medical device is connected to the catheter hub of FIG. **9**A.
[0020] FIG. **10** is a cross-sectional view taken along line X-X of FIG. **9**B.
[0021] FIG. **11** is a perspective view illustrating an opening member according to a tenth modification.
[0022] FIG. **12**A is a partial side cross-sectional view illustrating the opening member and a catheter hub of FIG. **11**.
[0023] FIG. **12**B is a partial side cross-sectional view illustrating a state in which a medical device is connected to the catheter hub of FIG. **12**A.
[0024] FIG. **13**A is a plan view illustrating a catheter assembly according to a first application example. FIG. **13**B is a side view illustrating a catheter assembly according to a second application example.

DESCRIPTION OF EMBODIMENTS

[0025] Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.
[0026] A catheter assembly **10** according to a first embodiment of the present invention has a catheter **12** that is inserted to indwell inside a patient's body (living body) as illustrated in FIG. **1**, and is used to construct an inlet/outlet for a liquid (a medicinal liquid and blood) during an infusion, a blood transfusion, or the like. The catheter **12** is configured as a peripheral venous catheter. Incidentally, the catheter **12** may be a catheter longer than the peripheral venous catheter (for example, a central venous catheter, a PICC, a mid-line catheter, and the like). In addition, the catheter **12** is not limited to a venous catheter, and may be configured as an arterial catheter such as a peripheral arterial catheter.
[0027] As illustrated in FIG. **1**, the catheter assembly **10** has an operating body **18** formed of an inner needle **14** and a needle hub **16** fixed to a proximal end of the inner needle **14**. Further, the catheter assembly **10** has a catheter indwelling body **22** formed of the above-described catheter **12** and a catheter hub **20** fixed to a proximal end of the catheter **12**.
[0028] The catheter assembly **10** is assembled with the operating body **18** from the proximal side of the catheter indwelling body **22** in an initial state (product provided state) before use, thereby forming a multi-structure needle **11** through which the inner needle **14** is inserted in the catheter **12**. In the multi-structure needle **11**, the needle tip **14***a* of the inner needle **14** protrudes, and the inner needle **14** and the catheter **12** can be integrally punctured the patient. Further, a valve **24**, an opening member **26**, and a fixing member **28** are housed inside the catheter hub **20** as illustrated in FIG. **2**.
[0029] In the use of the catheter assembly **10** illustrated in FIG. **1**, a user, such as a doctor and a nurse, grips and operates the needle hub **16** in the puncture state to puncture the multi-structure needle **11** into the patient's body, thereby setting a puncture state in which the needle tip **14***a* reaches a blood vessel. Further, the user inserts the catheter **12** into the blood vessel by advancing the catheter **12** relative to the inner needle **14** while maintaining the puncture state. Thereafter, the inner needle **14** is retracted with respect to the catheter **12** to remove the inner needle **14** from the catheter hub **20** so that the catheter **12** indwells in the blood vessel. The catheter **12** can perform treatment such as administering a medicinal liquid or blood and sampling blood as a medical device **100** (see FIG. **4**) is connected to the catheter hub **20** in the indwelling state. Hereinafter,

each configuration of the catheter assembly **10** will be described in detail.
[0030] As illustrated in FIGS. **1** and **2**, the inner needle **14** of the catheter assembly **10** (the operating body **18**) is configured as a hollow tube having rigidity capable of puncturing a skin of a living body, and has the sharp needle tip **14***a* at a distal end thereof. Inside the inner needle **14**, a hollow portion **15** is provided along the axial direction. The needle tip **14***a* has a blade surface **14***as* that is inclined at a predetermined angle with respect to the axial direction of the inner needle **14** and faces the outer side of the inner needle **14** from a predetermined circumferential position of the inner needle **14**. An outer peripheral surface of the inner needle **14** is provided with a groove **32** for flashback that guides blood to the proximal side when puncturing a blood vessel. Incidentally, the inner needle **14** may have a hole (not illustrated) communicating with the hollow portion **15** instead of the groove **32**.
[0031] Examples of a constituent material of the inner needle **14** include a metal material such as stainless steel, aluminum or an aluminum alloy, and titanium or a titanium alloy, a hard resin, ceramics, and the like. The inner needle **14** is firmly fixed to the needle hub **16** by an appropriate fixing means such as fusion, adhesion, and insert molding.
[0032] The needle hub **16** forms a grip portion to be gripped by the user in the initial state in which the catheter indwelling body **22** and the operating body **18** are assembled. The needle hub **16** includes a tubular hub main body **34** that is directly gripped by the user, and an inner needle support portion **36** that is integrally molded at a distal end of the hub main body **34**.
[0033] The hub main body **34** is formed to have a shape and a size that allow the multi-structure needle **11** to be stably operated. The hub main body **34** is formed in a cylindrical shape on the proximal side and is gradually deformed into a square tube shape toward the distal side, and has a cavity **34***a* having a circular cross section inside. The hub main body **34** is configured such that a cylindrical portion on the proximal side having a ridge is separable from the distal side, and a filter (not illustrated) is provided in the cavity **34***a* in the cylindrical portion on the proximal side.
[0034] The inner needle support portion **36** is formed in a columnar shape protruding from the hub main body **34** in the distal direction, and holds a proximal portion of the inner needle **14** at the central portion thereof. A plurality of ribs **38** are provided at equal intervals along the circumferential direction in a portion on the distal side of an outer surface of the inner needle support portion **36**.
[0035] A constituent material of the needle hub **16** is not particularly limited, but a thermoplastic resin, such as polypropylene, polycarbonate, polyamide, polysulfone, polyarylate, and a methacrylate-butylene-styrene copolymer can be applied.
[0036] On the other hand, the catheter **12** of the catheter assembly **10** is configured as a flexible hollow body in which a lumen **13** is formed inside. An outer shape of the catheter **12** and the lumen **13** are formed in a perfect circular shape in cross-sectional view orthogonal to the axial direction, and extend along the axial direction of the catheter **12**. The lumen **13** communicates with a distal opening **13***a* formed at a distal end of the catheter **12** and a proximal opening **13***b* (see FIG. **3**) formed at a proximal end of the catheter **12**.
[0037] A material forming the catheter **12** is not particularly limited, but a transparent soft resin material may be applied. Examples of a constituent material of the catheter **12** include a fluorine-based resin such as polytetrafluoroethylene (PTFE), an ethylene-tetrafluoroethylene copolymer (ETFE), and a perfluoroalkoxy fluorine resin (PFA), an olefin-based resin such as polyethylene and polypropylene or a mixture thereof, polyurethane, polyester, polyamide, a polyether nylon resin, a mixture of the olefin-based resin and an ethylene-vinyl acetate copolymer, and the like.
[0038] A length of the catheter **12** is not particularly limited, and can be appropriately designed according to the application, various conditions, and the like, and is set to, for example, about 14 to 500 mm. The proximal end of the catheter **12** is inserted and fixed inside the catheter hub **20**.
[0039] The catheter hub **20** is exposed on the patient's skin in a state in which the catheter **12** has been inserted into the patient's blood vessel, and indwells together with the catheter **12** by being

pasted with a tape or the like. A material forming the catheter hub **20** is not particularly limited, but, for example, the materials exemplified in the needle hub **16** may be appropriately adopted.

[0040] As illustrated in FIGS. **2** and **3**, the catheter hub **20** is formed in a tubular shape tapered in a distal direction. An internal space **50** is provided inside the catheter hub **20**, and the internal space **50** communicates with the lumen **13** (the proximal opening **13***b*) of the catheter **12** on the distal side and communicates with a proximal opening portion **52** of the catheter hub **20** on the proximal side. The above-described valve **24**, opening member **26**, and fixing member **28** are housed in the internal space **50**. Further, a flange **54** extending along the circumferential direction is provided on an outer peripheral surface of the catheter hub **20** on the proximal side.

[0041] The catheter **12** and the catheter hub **20** are fixed by an appropriate fixing means such as caulking, fusion, and adhesion. In FIG. **3**, a caulking pin **56** is inserted into the internal space **50** of the catheter hub **20** to caulk the caulking pin **56** by sandwiching the catheter **12** between an inner wall **20***a* of the catheter hub **20** and the caulking pin **56**, thereby fixing the catheter **12**.

[0042] The valve **24** housed in the internal space **50** is configured as a hemostatic valve that blocks blood, which flows into the internal space **50** from the lumen **13** of the catheter **12**, from leaking from the proximal opening portion **52**. An example of the valve **24** is an application of a duckbill valve.

[0043] For example, the valve **24** has an annular portion **58** fixed to the inner wall **20***a* of the catheter hub **20** and a valve main body **60** protruding from the annular portion **58** in the distal direction. On the other hand, the inner wall **20***a* of the catheter hub **20** is provided with a stepped portion **21***a* having a smaller diameter and a locking convex portion **21***b* at a position away from the stepped portion **21***a* on the proximal side, and the valve **24** is immovably fixed by sandwiching the annular portion **58** between the stepped portion **21***a* and the locking convex portion **21***b*.

[0044] The valve main body **60** is formed in a cylindrical shape on the annular portion **58** side and is formed in a tubular shape having a pair of inclined portions **62** that are close to each other in the distal direction. A valve space **25** that narrows in the distal direction is formed inside the valve **24**.

[0045] Further, an end surface **63** extending in the width direction is formed at distal ends of the pair of inclined portions **62**. Further, the valve main body **60** has a slit **64**. The slit **64** includes a front slit **64***a* formed along the longitudinal direction of the end surface **63** when viewed from the front, and a side slit **64***b* on an inner cylinder side portion **66** (side surface) formed between the pair of inclined portions **62** from both ends of the end surface **63**. The front slit **64***a* and the side slit **64***b* are continuous, and the side slit **64***b* extends parallel to the axial direction of the valve **24** and extends to a distal end of the annular portion **58**. The slit **64** is inserted through the inner needle **14** in an initial state and is self-closed as the inner needle **14** is removed from the valve main body **60**. Further, the pair of inclined portions **62** are greatly separated from each other along with the insertion of the opening member **26** arranged on the proximal side of the valve **24** to open the slit **64** (see also FIG. **4**). As a result, a force of inserting the opening member **26**, which will be described later, can be reduced. Further, because the valve **24** includes the pair of inclined portions **62**, the front slit **64***a*, and the side slit **64***b*, it is difficult to generate a force of returning the opening member **26** to the proximal side, and thus, the state of being inserted into the valve **24** can be easily maintained.

[0046] The opening member **26** is arranged proximal of the valve main body **60** of the internal space **50** in an initial state. The opening member **26** includes a cylindrical barrel portion **68**, an insertion portion **70** that is connected to a distal end of the barrel portion **68** and protrudes in the distal direction, and a pair of extending portions **72** that are connected to a proximal end of the barrel portion **68** and protrude in the proximal direction. A space **74** of the opening member **26** is formed inside the barrel portion **68** and the insertion portion **70**.

[0047] The barrel portion **68** is formed to have an outer shape slightly smaller than a diameter of the internal space **50** of the catheter hub **20**, and includes a barrel-portion-side space portion **74***a*, which is a part of the space **74**, inside. The outer shape (outer peripheral surface) of the barrel

portion **68** is formed in a circular shape in cross-sectional view orthogonal to the axial direction of the opening member **26**. The barrel-portion-side space portion **74***a* communicates with a proximal opening **68***a* provided at a proximal end of the barrel portion **68**.

[0048] When the opening member **26** moves in the distal direction relative to the valve **24**, the insertion portion **70** passes through the slit **64** of the valve **24** to push and widen the valve main body **60** (the pair of inclined portions **62**). The insertion portion **70** is formed in a cylindrical shape having an outer diameter sufficiently smaller than an outer diameter of the barrel portion **68**, and has a distal portion arranged on the inner side (the valve space **25**) of the annular portion **58** of the valve **24** in an initial state. Further, a step between the barrel portion **68** and the insertion portion **70** (distal end surface of the barrel portion **68**) is caught by the annular portion **58** of the valve **24** when the opening member **26** moves in the distal direction, thereby restricting the movement of the opening member **26** in the distal direction.

[0049] Inside the insertion portion **70**, an insertion-portion-side space portion **74***b*, which is a part of the space **74**, is formed. The insertion-portion-side space portion **74***b* extends along the axial direction of the insertion portion **70** and has a distal end communicating with a distal opening **78** formed at a distal end of the insertion portion **70** and a proximal end communicating with the barrel-portion-side space portion **74***a*. Further, a tapered surface **71** having a diameter that becomes smaller in the distal direction of the opening member **26** is formed on an outer peripheral surface of the insertion portion **70** on the distal side.

[0050] Further, the insertion portion **70** has a pair of side holes **80** proximal of a site where the tapered surface **71** is formed. The pair of side holes **80** oppose each other with the insertion-portion-side space portion **74***b* interposed therebetween. Each of the side holes **80** is provided at a position away from the distal opening **78** by a predetermined distance, penetrates through an outer peripheral surface **70***a* and an inner peripheral surface **70***b* of the insertion portion **70** (in the thickness direction), and causes the insertion-portion-side space portion **74***b* to communicate with the outside of the insertion portion **70**.

[0051] The opening member **26** sets the positions of the side holes **80** such that the slit **64** formed in the inner cylinder side portion **66** of the valve **24** and the pair of side holes **80** are at the same phase (circumferential position) in an initial state. Each of the side holes **80** formed in this manner opposes a site where the slit **64** of the valve **24** (the inner cylinder side portion **66**) is open when the opening member **26** opens the valve main body **60** along with the insertion of the medical device **100**. That is, the pair of side holes **80** are located distal of the most proximal end of the slit **64** in a state in which the opening member **26** opens the valve **24** (see also FIG. **4**).

[0052] On the other hand, the pair of extending portions **72** provided at the proximal end of the barrel portion **68** oppose each other and are formed as rectangular pieces that extend in the proximal direction by a predetermined length. Each of the extending portions **72** is formed in an arc shape following a shape of the barrel portion **68**, and has a proximal end protruding inward from an inner peripheral surface of the fixing member **28**. As a result, when a male connector **102** (see FIG. **4**) of the medical device **100** is inserted into the catheter hub **20**, the distal end of the male connector **102** comes into contact with proximal ends of the pair of extending portions **72**. Therefore, the opening member **26** moves in the distal direction under a pressing force of the male connector **102**.

[0053] The fixing member **28** is an inner member that prevents detachment of the opening member **26** arranged in the internal space **50** of the catheter hub **20**. Further, the fixing member **28** has a function of restricting the rotation of the opening member **26** in the circumferential direction with respect to the catheter hub **20**. The fixing member **28** is fixed to the catheter hub **20** by fitting the opening member **26** into the inner wall **20***a* of the catheter hub **20** in a state of being housed in the internal space **50**. Incidentally, a fixing means between the catheter hub **20** and the fixing member **28** is not particularly limited, and may be adhesion, fusion, or the like.

[0054] The fixing member **28** includes a fixed tubular body **82** having a through-hole **82***a*, and an

annular convex portion **84** provided at a proximal end of the fixed tubular body **82**. The proximal end of the fixed tubular body **82** forms the proximal opening portion **52** of the catheter hub **20**. The fixed tubular body **82** is formed with a pair of notches **86** in which the pair of extending portions **72** of the opening member **26** are arranged. The pair of notches **86** are provided at opposing positions with the through-hole **82***a* interposed therebetween, and extend in the proximal direction from a distal end of the fixed tubular body **82**. The annular convex portion **84** is arranged in an annular groove portion **54***a* inside the flange **54** formed at the proximal end of the catheter hub **20** to restrict the displacement of the fixing member **28** in the distal direction.

[0055] The catheter assembly **10** according to the present embodiment is basically configured as described above, and operations thereof will be described hereinafter.

[0056] As described above, the catheter assembly **10** is used in a case of constructing the inlet/outlet for the infusion, the blood transfusion, the blood sampling, and the like with respect to the patient. The user grips and operates the needle hub **16** of the catheter assembly **10** in the initial state illustrated in FIG. **1** to puncture the patient with the multi-structure needle **11**.

[0057] When the needle tip **14***a* of the inner needle **14** reaches the blood vessel, blood flows through the groove **32** of the inner needle **14** to the lumen **13** of the catheter **12**. As a result, the user can visually recognize a flashback of blood and confirm that the lumen **13** has secured the blood vessel. When flowing inside the lumen **13** of the catheter **12** in the proximal direction, the blood flows into the internal space **50** of the catheter hub **20** from the proximal opening **13***b*. In the internal space **50**, the valve **24** is inserted through the inner needle **14**, and the circumference of the inner needle **14** is sealed to prevent the blood from flowing out in the proximal direction of the valve **24**.

[0058] In the puncture state, the user advances the catheter **12** relative to the inner needle **14** and inserts the catheter **12** into the blood vessel. At a stage where the catheter **12** is inserted into the blood vessel to some extent, the operating body **18** is retracted with respect to the catheter indwelling body **22**. As a result, the inner needle **14** is detached from the catheter **12**.

[0059] In the catheter hub **20**, when the needle tip **14***a* of the inner needle **14** is pulled out from the valve **24**, the valve main body **60** is elastically restored to close the slit **64**. Accordingly, blood is prevented from moving to the proximal side of the valve **24**. Further, if the inner needle **14** and the needle hub **16** are retracted, the inner needle **14** is detached from the proximal opening **13***b* of the catheter hub **20**. That is, the operating body **18** is separated from the catheter indwelling body **22**, and the user causes the catheter indwelling body **22** in which the inside of the catheter hub **20** is in the state illustrated in FIG. **3** to indwell in the patient.

[0060] In the indwelling state of the catheter indwelling body **22**, the user inserts the male connector **102** of the medical device **100** (a tube of an infusion line, a syringe, or the like) into the internal space **50** through the proximal opening **13***b* of the catheter hub **20** as illustrated in FIG. **4**. When advancing inside the fixing member **28**, the male connector **102** comes into contact with a proximal end of the opening member **26** (the pair of extending portions **72**) protruding radially inward from the inner peripheral surface of the fixing member **28**. As a result, the user pushes the opening member **26** in the distal direction at the time of connecting (inserting) the male connector **102**. The pair of extending portions **72** are guided by the pair of notches **86** of the fixing member **28** to move at the time of pushing the opening member **26**, thereby restricting the rotation of the opening member **26** in the circumferential direction.

[0061] The opening member **26** moves inside the valve **24** as the male connector **102** is pushed, and the insertion portions **70** separate the pair of inclined portions **62** from each other, thereby opening the slit **64**. Then, the insertion portion **70** of the opening member **26** greatly separates the pair of inclined portions **62** in an insertion completion state in which the male connector **102** is fitted to the catheter hub **20** (the fixing member **28**). The slit **64** of the valve **24** is deformed along an outer shape of the opening member **26**, and the side slit **64***b* widens the gap in the distal direction. That is, as the pair of inclined portions **62** are deformed, the side slit **64***b* is deformed

from the proximal end toward the distal end surface in an oblique direction with respect to the axis of the valve **24**. Then, in the insertion completion state, the pair of side holes **80** provided in the insertion portion **70** are arranged at positions opposing each other at the site where the slit **64** (the side slit **64***b*) is open.

[0062] During administration of a medicinal liquid (fluid), the medical device **100** causes the medicinal liquid to flow from a flow path **102***a* of the male connector **102** into the internal space **50** of the catheter hub **20**. This medicinal liquid flows in the distal direction of the internal space **50** and passes through the space **74** of the opening member **26**. Then, a part of the medicinal liquid flows out from the distal opening **78** of the insertion portion **70** into the internal space **50** on the distal side of the valve **24**, and further flows into the lumen **13** of the catheter **12** communicating with the distal side of the internal space **50**. The medicinal liquid flowing into the lumen **13** is administered through the distal opening **13***a* of the catheter **12** inserted into the patient's blood vessel.

[0063] Further, the pair of side holes **80** provided in the insertion portion **70** also move a part of the medicinal liquid to the radially outer side of the insertion portion **70** when the medicinal liquid flows through the opening member **26**. The medicinal liquid flowing out of the side hole **80** hits the inner wall **20***a* of the catheter hub **20** through the open slit **64**. Then, the medicinal liquid hitting the inner wall **20***a* flows around the valve main body **60** (from the inner cylinder side portion **66** to the pair of inclined portions **62**). Here, if the medicinal liquid is allowed to flow out only from the distal opening **78** of the insertion portion **70** around the valve main body **60** of the valve **24** (duckbill valve), there is a retention space **88** (see the alternate long and tow short dashes line in FIG. **4**) where the fluid (medicinal liquid or blood) is likely to remain.

[0064] On the other hand, the medicinal liquid is allowed to flow around the valve main body **60** by allowing the medicinal liquid to flow out from the pair of side holes **80** in the catheter assembly **10** according to the present embodiment. As a result, the medicinal liquid promotes the flow of the fluid, and the retention space **88** can be favorably eliminated. That is, the medicinal liquid flowing out from the opening member **26** is supplied to the lumen **13** while flowing through the internal space **50** on the distal side of the valve **24** as a whole.

[0065] Incidentally, the present invention is not limited to the above-described embodiment, and various modifications can be made in accordance with a gist of the invention. For example, the valve **24** provided in the catheter hub **20** is not limited to the duckbill valve as described above, and may have various configurations. As another example of the valve **24**, a configuration (so-called disc valve) having the slit **64** that can be opened and closed in a flat membrane can be applied instead of the above-described valve main body **60**.

[0066] Further, the opening member **26** may be configured not only to have the two (pair) side holes **80** in the insertion portion **70**, but also to have one or three or more side holes **80**. Further, the opening member **26** may have a configuration in which an outer protruding portion **71***a* (umbrella portion) is provided at the distal end of the insertion portion **70** as indicated by a dotted line in FIG. **3**. The outer protruding portion **71***a* is caught by an edge portion of the valve **24** forming the slit **64** in the state in which the insertion portion **70** has been inserted, so that the opening state of the valve **24** by the opening member **26** can be firmly maintained.

[0067] Hereinafter, other modifications will be described in detail with reference to FIGS. **5**A to **8**B. Incidentally, an element having the same configuration or the same function as that of the above-described embodiment will be denoted by the same reference sign, and the detailed description thereof will be omitted in the following description.

First Modification

[0068] As illustrated in FIG. **5**A, an opening member **26**A according to a first modification is different from the above-described opening member **26** in that a diameter φs of the pair of side holes **80** of the insertion portion **70** is formed to be larger than a diameter φf of the distal opening **78** of the insertion portion **70**. For example, the diameter φs of the pair of side holes **80** is

preferably set to a size of about 1.2 to 2 times the diameter φf of the distal opening **78**. Further, a distal end of the insertion portion **70** has a distal end wall **90** that protrudes to the inner side from a side wall (including the tapered surface **71**) forming the insertion portion **70** to form the distal opening **78**.

[0069] The opening member **26**A configured in this manner suppresses the outflow amount of a medicinal liquid from the distal opening **78** and increases the outflow amount of the medicinal liquid from the pair of side holes **80** when causing the medicinal liquid to flow. Therefore, it is possible to increase the amount of the medicinal liquid that flows around the valve main body **60**, and it is possible to further suppress the retention of the fluid.

Second Modification

[0070] As illustrated in FIG. **5**B, an opening member **26**B according to a second modification is different from the above-described opening members **26** and **26**A in that the entire insertion portion **70** is formed in a tapered conical shape (a tapered portion **92**) from a distal end of the barrel portion **68** in the distal direction. Thus, an inner peripheral surface forming the insertion-portion-side space portion **74***b* is also formed on a tapered inner peripheral surface **92***a* whose diameter becomes smaller in the distal direction according to an outer shape of the insertion portion **70**.

[0071] Further, the diameter φs of the pair of side holes **80** of the insertion portion **70** is formed to be larger than the diameter φf of the distal opening **78**. In particular, the side hole **80** has the diameter φs larger than a diameter φn of the insertion-portion-side space portion **74***b* at a site where the side hole **80** is formed in the present modification. The opening member **26**B configured in this manner increases the outflow amount of a medicinal liquid from the pair of side holes **80** while causing the medicinal liquid to smoothly flow in the insertion-portion-side space portion **74***b*. Therefore, the retention of the fluid can be further suppressed, and the medicinal liquid can be vigorously discharged from the distal opening **78**.

Third Modification

[0072] As illustrated in FIG. **6**A, an opening member **26**C according to a third modification is different from the above-described opening members **26**, **26**A, and **26**B in that a protrusion **94** is provided on the inner peripheral surface **70***b* of the insertion portion **70**. The protrusion **94** is provided proximal of (on an upstream side in a flow direction of a medicinal liquid) the pair of side holes **80**, and slightly protrudes radially inward of the insertion-portion-side space portion **74***b*. Further, the protrusion **94** extends shortly along the circumferential direction of the inner peripheral surface **70***b*, and a plurality of the protrusions **94** are provided along the circumferential direction. Incidentally, the protrusions **94** may be formed in a ring shape that makes a circle on the inner peripheral surface **70***b* in a series in the circumferential direction.

[0073] The opening member **26**C configured in this manner increases a turbulent flow of the medicinal liquid as the medicinal liquid flowing in the insertion-portion-side space portion **74***b* hits the protrusion **94**. Most of the medicinal liquid in which the turbulent flow has increased is guided to the pair of side holes **80** formed on the downstream side of the protrusion **94**. Accordingly, the outflow amount of the medicinal liquid from the pair of side holes **80** increases, and the retention of the fluid can be further suppressed.

[0074] Incidentally, the protrusion **94** is not limited to being formed at a position near the upstream side of the side hole **80**. For example, as indicated by the alternate long and two short dashes line in FIG. **6**A, the opening member **26**C may be provided with a protrusion **94***a* at a position away from the side hole **80** in the proximal direction. This is because the outflow amount of the medicinal liquid to the side hole **80** increases if the turbulent flow of the medicinal liquid is generated by the protrusion **94***a*. Further, for example, the opening member **26**C may have a configuration in which a protrusion **94***b* is provided on the distal side (downstream side in the flow direction of the medicinal liquid) of the side hole **80**. The protrusion **94***b* formed in this manner can easily guide the medicinal liquid to the side hole **80** by allowing the medicinal liquid to flow inward.

Fourth Modification

[0075] As illustrated in FIG. **6**B, an opening member **26**D according to a fourth modification is different from the above-described opening members **26** and **26**A to **26**C in that a spiral groove portion **96** is formed on the inner peripheral surface **70***b* of the insertion portion **70**. The groove portion **96** serves to cause a medicinal liquid to flow in a spiral shape and facilitates the flow of the medicinal liquid toward the pair of side holes **80**. Therefore, even in the opening member **26**D, the outflow amount of the medicinal liquid from the pair of side holes **80** increases, and the retention of the fluid can be further suppressed, which is similar to the above-described opening members **26** and **26**A to **26**C.

Fifth Modification

[0076] As illustrated in FIG. **7**A, an opening member **26**E according to a fifth modification is different from the above-described opening members **26** and **26**A to **26**D in that a wavy groove portion **98** is formed on the inner peripheral surface **70***b* of the insertion portion **70**. Even in the wavy groove portion **98**, a turbulent flow can be generated in a medicinal liquid flowing in the insertion-portion-side space portion **74***b*, and thus, the same effects as those of the opening members **26** and **26**A to **26**D can be obtained.

Sixth Modification

[0077] As illustrated in FIG. **7**B, an opening member **26**F according to a sixth modification is different from the above-described opening members **26** and **26**A to **26**E in terms of including a plurality of side holes **80** (three including a first side hole **80***a*, a second side hole **80***b*, and a third side hole **80***c* in FIG. **7**B) in the axial direction of the insertion portion **70**. Each pair of the first to third side holes **80***a* to **80***c* is provided in the circumferential direction of the insertion portion **70**. Further, a distal end of the insertion portion **70** is provided with the distal end wall **90** such that the diameter φf of the distal opening **78** is set to be smaller than the diameter φn of the insertion-portion-side space portion **74***b*.

[0078] For example, a diameter φs**2** of the second side hole **80***b* located in the middle of the three side holes **80** arrayed in the axial direction is formed to be larger than the diameter pf of the distal opening **78** of the insertion portion **70**. Diameters φs**1** and φs**3** of the first and third side holes **80***a* and **80***c* are formed to be smaller than the diameter φs**2** of the second side hole **80***b*. In this manner, the sizes of the side holes **80** arrayed in the axial direction are different, and thus, it is possible to appropriately change the outflow amount of a medicinal liquid flowing out to the radially outer side of the insertion portion **70**. That is, the first to third side holes **80***a* to **80***c* can distribute the medicinal liquid to the retention space **88** in an appropriate amount to flow.

[0079] Incidentally, the sizes and arrangement of the plurality of side holes **80** provided along the axial direction of the insertion portion **70** are not particularly limited. For example, the first side hole **80***a* may be formed to be larger than the second side hole **80***b* and the third side hole **80***c*. Further, for example, a configuration in which only the first side hole **80***a* and the second side hole **80***b* in FIG. **7**B are provided may be adopted, or a configuration in which only the second side hole **80***b* and the third side hole **80***c* in FIG. **7**B are provided may be adopted. The number of the side holes **80** may be one or larger than the number described in the present modification.

Seventh Modification

[0080] As illustrated in FIG. **8**A, an opening member **26**G according to a seventh modification is formed in an elliptical shape (oval shape) in which a side hole **81**A has a major axis along the axial direction of the insertion portion **70**. Even if the side hole **81**A is formed in this manner, the outflow amount of a medicinal liquid can be increased.

Eighth Modification

[0081] As illustrated in FIG. **8**B, in an opening member **26**H according to an eighth modification, a shape of a side hole **81**B is formed in a rectangular shape that is long along the axial direction of the insertion portion **70**. Further, corners of the rectangular are rounded. In short, shapes of the side holes **80**, **81**A, and **81**B are not particularly limited, and various shapes capable of allowing a medicinal liquid to flow may be adopted.

Ninth Modification

[0082] As illustrated in FIGS. **9**A, **9**B, and **10**, an opening member **26**I according to a ninth modification has a side hole **81**C having an oval shape, and the outer peripheral surface **70***a* and the inner peripheral surface **70***b* of the insertion portion **70** are formed in a tapered shape having a diameter that becomes smaller in the distal direction. The side hole **81**C is provided in an axially intermediate portion of the insertion portion **70**, and is formed so as to occupy a ratio of ½ or more of an axial length of the insertion portion **70**. For example, a major-axis dimension of the side hole **81**C (length along the axial direction of the insertion portion **70**) is set to be longer than (or substantially the same as) a length along the axial direction of the side slit **64***b* of the valve **24**. Further, the major-axis dimension of the side hole **81**C is set to be twice or more an inner diameter of the distal opening **78**. Further, a minor-axis dimension of the side hole **81**C is set to a value close to a diameter of the distal opening **78** of the insertion portion **70**. An area of the side hole **81**C is larger than an area of the distal opening **78**. As a result, fluid easily flows into the side hole **81**C. The insertion portion **70** has a proximal-side portion that is sharply tapered with respect to the barrel portion **68**, and a distal-side portion that is smoothly connected to the proximal-side portion and is gently tapered from the proximal-side portion. An axial length of the distal-side portion of the insertion portion **70** is formed to be longer than an axial length of the valve **24**.

[0083] The opening member **26**I can shift between an initial state as illustrated in FIG. **9**A and an insertion completion state as illustrated in FIG. **9**B. When the male connector **102** of the medical device **100** is inserted into the catheter indwelling body **22** in the initial state, the insertion portion **70** of the opening member **26**I pushes and widens the slit **64**. Then, when the proximal-side portion of the insertion portion **70** and the annular portion **58** of the valve **24** come into contact with each other, the insertion completion state is achieved. In this state, the insertion portion **70** arranges the distal opening **78** close to the distal side to some extent from a distal end of the valve **24**. The side slit **64***b* of the valve **24** is curved so as to be far toward the distal end with respect to the axis of the valve **24**.

[0084] In the insertion completion state, the opening member **26**I opposes the side hole **81**C over the substantially overall length (length along the axial direction) of the side slit **64***b* of the valve **24**. The most proximal end of the side hole **81**C overlaps a vicinity of a proximal portion of the widened side slit **64***b*. In side cross-sectional view of the insertion completion state, there are overlapping portions A**1** and A**2** between the side hole **81**C and the valve **24** in the inner cylinder side portion **66**, and a non-overlapping portion B between the side hole **81**C and the valve **24** in the inner cylinder side portion **66**. The sum of areas of the overlapping portions A**1** and A**2** is smaller than an area of the non-overlapping portion B. As a result, a large amount of a medicinal liquid flowing through the insertion-portion-side space portion **74***b* of the opening member **26**I flows out from the side hole **81**C through the side slit **64***b* into the internal space **50** on the distal side of the valve **24**. Further, the inner peripheral surface **70***b* of the insertion portion **70** causes an appropriate turbulent flow at the proximal-side portion while smoothly guiding the medicinal liquid from the barrel portion **68** in the distal direction. As a result, the outflow amount of the medicinal liquid from the side hole **81**C of the distal-side portion is increased.

[0085] The flow of the medicinal liquid flowing out from the side hole **81**C will be described as follows with reference to FIG. **10**, which is a cross-sectional view taken along line X-X of FIG. **9**B. The medicinal liquid introduced from the medical device **100** flows into the internal space **50** on the distal side of the valve **24** from the pair of side holes **81**C and the distal opening **78** (see FIG. **9**B) through the insertion-portion-side space portion **74***b*. At that time, the medicinal liquid advances to the inner wall **20***a* of the catheter hub **20** from a portion between opposing surfaces **64***c* of the side slit **64***b* in the open state. Here, the flow of the medicinal liquid is divided into upper flows R**1** and L**1** in the drawing and lower flows R**2** and L**2**. Each flow advances along a space between the inner wall **20***a* and an outer surface of the inclined portion **62** of the valve main body **60**. Further, the flows R**1** and L**1** and the flows R**2** and L**2** reach the retention space **88** and merge

with each other to push and cause a liquid in the retention space **88**, which tends to remain, to flow to the distal side (front side in the drawing). Because the medicinal liquid flows around the valve main body **60** in this manner, the medicinal liquid promotes the flow of the fluid, and the retention space **88** can be favorably eliminated.

Tenth Modification

[0086] As illustrated in FIG. **11**, an opening member **26**J according to a tenth modification has one or more ribs **99** (a pair in the present modification) on the outer peripheral surface **70***a* of the insertion portion **70**. Incidentally, a shape of the opening member **26**J other than the rib **99** (including the side hole **81**C) is the same as that of the opening member **26**I of the ninth modification, and thus, a specific description thereof will be omitted.

[0087] The pair of ribs **99** are formed at positions shifted by a phase of 90° with respect to the pair of side holes **81**C in the circumferential direction of the insertion portion **70**. As illustrated in FIGS. **11** and **12**A, the pair of ribs **99** are provided on a distal-side portion of the insertion portion **70** having a gentle inclination, and proximal ends thereof are connected to a proximal-side portion of the insertion portion **70**. Protruding portions **99***a* of the pair of ribs **99** extending at positions separated from the outer peripheral surface **70***a* extend parallel to the axial direction of the opening member **26**J (the insertion portion **70**).

[0088] As illustrated in FIG. **12**B, the opening member **26**J having the ribs **99** described above expands the pair of inclined portions **62** in the valve main body **60** as much as possible in the radial direction as the respective ribs **99** come into contact with inner surfaces of the pair of inclined portions **62** when the insertion portion **70** moves in the valve main body **60** in the distal direction. As a result, when transitioning to the insertion completion state, the side slit **64***b* opposing the pair of side holes **81**C is opened more widely, which has an effect of pushing out remaining blood or medicinal liquid.

First Application Example

[0089] Further, as in a first application example illustrated in FIG. **13**A, the catheter assembly **10** has a configuration in which the side slit **64***b* of the valve **24** opposes a circumferential position of the inner needle **14** corresponding to a direction in which the blade surface **14***as* faces in an assembled state. That is, the side slit **64***b* of the valve **24** and the side hole **80** or **81**A to **81**C of the opening member **26** or **26**A to **26**J are assembled so as to have the same phase as the blade surface **14***as* of the inner needle **14**.

[0090] Here, at the time of assembling the catheter assembly **10**, the inner needle **14** held by the needle hub **16** is inserted from the proximal side of the catheter hub **20**, and the catheter **12** is caused to pass through the opening members **26** and **26**A to **26**J and the valve **24**. In particular, the catheter assembly **10** maintains the above-described phase even if the straightness of the inner needle **14** is reduced, and thus, the needle tip **14***a* (the blade surface **14***as*) can smoothly pass through the front slit **64***a* of the valve **24** by being prevented from piercing the valve **24**. The inner needle **14** is likely to bend (decrease in straightness) toward the circumferential position (or a position opposite to the circumferential position) corresponding to a direction in which the blade surface **14***as* faces at the time of forming the groove **32** or a flashback notch. The catheter assembly **10** can easily allow the insertion of the inner needle **14** because the blade surface **14***as* opposes the side slit **64***b*, and the inner needle **14** whose straightness has decreased bends in a direction along the front slit **64***a* (a direction toward the back of the paper surface or a direction toward the front of the paper surface in FIG. **13**A). Therefore, the catheter assembly **10** can be assembled favorably according to an arrangement relationship in FIG. **13**A.

Second Application Example

[0091] Further, as in a second application example illustrated in FIG. **13**B, the catheter assembly **10** may have a configuration in which one of the pair of inclined portions **62** of the valve **24** opposes a circumferential position of the inner needle **14** corresponding to a direction in which the blade surface **14***as* faces in an assembled state. That is, the side slit **64***b* of the valve **24** and the side hole

80 or **81**A to **81**C of the opening member **26** or **26**A to **26**J are assembled so as to be orthogonal to the blade surface **14***as* of the inner needle **14**.

[0092] In the catheter assembly **10** configured in this manner, the width direction of the needle tip **14***a* (blade surface **14***as*) and the front slit **64***a* of the valve **24** are parallel to each other. Thus, at the time of assembling the catheter assembly **10**, it is possible to prevent the blade surface **14***as* from advancing along the inclined portion **62** and piercing the valve **24**. Therefore, the catheter assembly **10** can be favorably assembled even in an arrangement relationship illustrated in FIG. **13**B.

[0093] Incidentally, it is a matter of course that the above-described configurations of the opening members **26** and **26**A to **26**J can be applied to the other opening members **26** and **26**A to **26**J by taking out some of the configurations. Similarly, the arrangement relationships in the first and second application examples can be applied to various examples.

[0094] Technical ideas and effects that can be grasped from the above-described embodiment are described as follows.

[0095] The catheter assembly **10** has the side hole **80** or **81**A to **81**C located distal of the most proximal end of the slit **64** in the state in which the valve **24** is opened, and thus, can cause the fluid flowing through the space **74** to flow out to the space on the radially outer side of the opening members **26** and **26**A to **26**J and the valve **24**. That is, the side hole **80** allows the fluid to wrap around the valve **24** that is inclined in the distal direction through the opening. Therefore, the fluid is suppressed from remaining in the internal space **50** on the distal side of the valve **24**, the growth of bacteria that is likely to be caused by the retention of the fluid is reduced, and the hygiene during use can be further improved.

[0096] Further, the slit **64** continuously extends to the side surface (the inner cylinder side portion **66**) between the pair of inclined portions **62**. The catheter assembly **10** can cause the fluid to favorably flow around the valve **24** through the side holes **80** and **81**A to **81**C because the slit **64** extends along the inner cylinder side portion **66**.

[0097] Further, the side hole **80** opposes the open slit **64** on the side surface in the state in which the valve **24** is opened. As a result, the opening members **26** and **26**A to **26**J can cause the fluid to flow out through the side hole **80** and the slit **64** on the side surface of the valve **24**, and spread the fluid throughout the internal space **50** on the distal side of the valve **24**. Accordingly, the retention of the fluid can be further suppressed.

[0098] Further, the valve **24** causes the slit **64** extending to the side surface to oppose the circumferential position of the inner needle **14** corresponding to a direction in which the blade surface **14***as* faces. As a result, the catheter assembly **10** can prevent the needle tip **14***a* from piercing the valve **24** during assembly and allow the needle tip **14***a* to favorably pass through the slit **64** even if the straightness of the inner needle **14** is reduced. Therefore, the assembly of the catheter assembly **10** can be performed with good yield and efficiency.

[0099] Further, the valve **24** causes one of the pair of inclined portions **62** to oppose the circumferential position of the inner needle **14** corresponding to a direction in which the blade surface **14***as* faces. Even in this case, the blade surface **14***as* is guided to one of the inclined portions **62** at the time of assembly, so that the catheter assembly **10** can prevent the needle tip **14***a* from piercing the valve **24** and allow the needle tip **14***a* to favorably pass through the slit **64**.

[0100] Further, the opening members **26** and **26**A to **26**J are provided with the insertion portion **70** that can be inserted into the slit **64** and has the outer peripheral surface **70***a* and the inner peripheral surface **70***b*, and at least one of the outer peripheral surface **70***a* and the inner peripheral surface **70***b* is formed in the tapered shape having the diameter that becomes smaller in the distal direction. As a result, the catheter assembly **10** can cause the medicinal liquid to favorably flow out from the side holes **80** and **81**A to **81**C toward the axial center portion in the insertion portion **70**.

[0101] Further, the rib **99** protruding in the opening direction of the valve **24** is provided on the outer peripheral surface **70***a* of the insertion portion **70**. As a result, when the insertion portion **70** passes through the slit **64** (the side slit **64***b*) of the valve **24**, the pair of inclined portions **62** can be

further separated from each other, and the slit **64** is greatly opened. Therefore, the opening member **26**J can cause the medicinal liquid to favorably flow out to the side through the slit **64**.

[0102] Further, the opening members **26**A, **26**B, and **26**F preferably have the distal opening **78** communicating with the space **74**, and the diameter φs of the side hole **80** is preferably larger than the diameter φf of the distal opening **78**. The opening members **26**A, **26**B, and **26**F can discharge more fluid from the side hole **80** because the diameter φs of the side hole **80** is larger than the diameter φf of the distal opening **78**. As a result, the retention of the fluid can be further suppressed.

[0103] Further, the inner peripheral surface (the tapered inner peripheral surface **92***a*) forming the space **74** may be formed in a tapered shape having a diameter that becomes smaller in the distal direction, and the side hole **80** may be provided at a position where the diameter φs of the side hole **80** is larger than the diameter φn of the tapered inner peripheral surface **92***a*. The opening member **26**B can discharge more fluid from the side hole **80** because the diameter φs of the side hole **80** is larger than the diameter φn of the tapered inner peripheral surface **92***a*.

[0104] Further, the opening members **26**C to **26**E may have the protrusion **94** protruding radially inward and/or the groove portions **96** and **98** guiding the fluid in the direction different from the axial direction of the space **74**, on the inner peripheral surface **70***b* forming the space **74**. The opening members **26**C to **26**E can generate the turbulent flow in the fluid flowing through the space **74** by the protrusion **94** and the groove portions **96** and **98**, and this turbulent flow makes it possible to guide a large amount of fluid to the side hole **80**.

[0105] Further, the opening member **26**F may have the plurality of side holes **80** (first to third side holes **80***a* to **80***c*) along the axial direction of the space **74**. As a result, the opening member **26**F can appropriately distribute the fluid to the plurality of side holes **80** to flow out to the radially outer side of the valve **24**, so that the fluid can flow around the outer side of the valve **24**.

[0106] Further, the catheter indwelling body **22** includes: the catheter **12**; the catheter hub **20** that has the internal space **50** and is fixed to the proximal end of the catheter **12**; the valve **24** that has the pair of inclined portions **62** close to each other in the distal direction, the end surface **63** provided at the distal ends of the pair of inclined portions **62** and extending in the width direction, the front slit **64***a* formed along the longitudinal direction of the end surface **63**, and the side slit **64***b* formed on the side surface (inner cylinder side portion **66**) between the pair of inclined portions **62** from both ends of the end surface **63**; and the opening member **26** or **26**A to **26**J that is provided in the internal space **50**, is formed in the tubular shape having the space **74** inside, is located proximal of the valve **24** in the initial state, and moves in the distal direction to open the valve **24** by opening the front slit **64***a* and the side slit **64***b*. The opening member **26** or **26**A to **26**J has the side hole **80** or **81**A to **81**C that causes the space **74** to communicate with the outside of the opening member **26** or **26**A to **26**J, and the side hole **80** or **81**A to **81**C is provided at the position overlapping the open side slit **64***b* in the state in which the valve **24** is opened.

[0107] Further, the valve **24** has the inner cylinder side portion **66**. In the side cross-sectional view of the insertion completion state, the side hole **80** or **81**A to **81**C and the inner cylinder side portion **66** have the overlapping portions A**1** and A**2** and the non-overlapping portion B, and the sum of the areas of the overlapping portions A**1** and A**2** is smaller than the area of the non-overlapping portion B. As a result, the catheter indwelling body **22** can allow a large amount of fluid to flow to the side of the valve **24** through the side hole **80** or **81**A to **81**C.

[0108] Further, the catheter indwelling body **22** includes: the catheter **12**; the catheter hub **20** fixed to the proximal end of the catheter **12**; the valve **24** that has the slit **64** and is provided in the internal space **50** of the catheter hub **20**; and the opening member **26** or **26**A to **26**J that is provided in the internal space **50**, is formed in the tubular shape having the space **74** inside, and is located proximal of the valve **24** in the initial state, and moves in the distal direction to open the valve **24**. The opening member **26** or **26**A to **26**J includes the insertion portion **70** that is insertable into the slit **64** and has the outer peripheral surface **70***a* and the inner peripheral surface **70***b*, and at least

one of the outer peripheral surface **70***a* and the inner peripheral surface **70***b* is formed in the tapered shape having the diameter that becomes smaller in the distal direction. The opening member **26** or **26**A to **26**J includes the side hole **80** or **81**A to **81**C that is located at the position opposing the site where the slit **64** is open in the state in which the valve **24** is opened, and causes the space **74** to communicate with the outside of the opening member **26** or **26**A to **26**J.
[0109] As described above, the catheter indwelling body **22** can further enhance the hygiene during use by reducing the retention of the fluid with the simple configuration.

Claims

1. A catheter assembly comprising: an inner needle having a blade surface at a distal end; a catheter through which the inner needle is inserted; a catheter hub through which the inner needle is inserted and that is fixed to a proximal end of the catheter; a valve located in an internal space of the catheter hub, wherein the valve comprises a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, a front slit formed along a longitudinal direction of the end surface, and a pair of side slits formed on side surfaces between the pair of inclined portions from both ends of the end surface; and an opening member that is located in the internal space, is formed in a tubular shape, has a space inside, is located proximal of the valve in an initial state, and is configured to move in a distal direction to open the valve, the opening member comprising a side hole that causes the space to communicate with an outside of the opening member, wherein: the side hole is located distal of a most proximal end of the front slit in a state in which the valve is opened, and in a cross-sectional view of the valve, at least a portion of each of end faces of a first of the side surfaces defining a first of the side slits diagonally crosses the side hole in the state in which the valve is opened.
2. The catheter assembly according to claim 1, wherein: the side hole opposes a portion of the first of the side slits that is open on the first of the side surfaces in the state in which the valve is opened.
3. The catheter assembly according to claim 1, wherein: the valve causes a portion of the first of the side slits located on the first of the side surfaces to oppose a circumferential position of the inner needle corresponding to a direction in which the blade surface faces.
4. The catheter assembly according to claim 1, wherein: the valve causes one of the pair of inclined portions to oppose a circumferential position of the inner needle corresponding to a direction in which the blade surface faces.
5. The catheter assembly according to claim 1, wherein: the opening member comprises an insertion portion that is insertable into the front slit and has an outer peripheral surface and an inner peripheral surface, and the outer peripheral surface is formed in a tapered shape having a diameter that becomes smaller in the distal direction.
6. The catheter assembly according to claim 1, wherein: the opening member comprises an insertion portion that is insertable into the front slit and has an outer peripheral surface and an inner peripheral surface, and the inner peripheral surface is formed in a tapered shape having a diameter that becomes smaller in the distal direction.
7. The catheter assembly according to claim 6, wherein: a rib protruding in an opening direction of the valve is located on the outer peripheral surface of the insertion portion.
8. The catheter assembly according to claim 1, wherein: the opening member comprises a distal opening that communicates with the space, and a diameter of the side hole is larger than a diameter of the distal opening.
9. The catheter assembly according to claim 1, wherein: an inner peripheral surface forming the space is formed in a tapered shape having a diameter that becomes smaller in the distal direction, and the side hole is located at a position where a diameter of the side hole is larger than a diameter of the inner peripheral surface.
10. The catheter assembly according to claim 1, wherein: the opening member comprises, on an

inner peripheral surface forming the space, a protrusion that protrudes radially inward that is configured to guide fluid in a direction different from an axial direction of the space.

11. The catheter assembly according to claim 1, wherein: the opening member comprises, on an inner peripheral surface forming the space, a groove portion that is configured to guide fluid in a direction different from an axial direction of the space.

12. The catheter assembly according to claim 1, wherein: the opening member comprises a plurality of the side holes along an axial direction of the space.

13. The catheter assembly according to claim 1, wherein: the valve comprises an annular portion fixed to an inner wall of the catheter hub, and a valve main body that protrudes from the annular portion in a distal direction and comprises the pair of inclined portions, the end surface, the front slit, and the pair of side slits, wherein, in a side cross-sectional view of the valve, the side slits extend parallel to an axial direction of the valve from the front slit to a distal end of the annular portion.

14. A method of administering a medicinal liquid into a vessel, the method comprising: providing a catheter assembly that comprises: an inner needle having a blade surface at a distal end; a catheter through which the inner needle is inserted; a catheter hub through which the inner needle is inserted and that is fixed to a proximal end of the catheter; a valve located in an internal space of the catheter hub, wherein the valve comprises a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, a front slit formed along a longitudinal direction of the end surface, and a pair of side slits formed on side surfaces between the pair of inclined portions from both ends of the end surface; and an opening member that is located in the internal space, is formed in a tubular shape, has a space inside, is located proximal of the valve in an initial state, and is configured to move in a distal direction to open the valve, the opening member comprising a side hole that causes the space to communicate with an outside of the opening member, inserting the inner needle and the catheter into a vessel; removing the inner needle from the vessel, the catheter, and the catheter hub; inserting a male connector into the catheter hub so as to cause the opening member to move in the distal direction and open the valve; and providing the medicinal liquid through the male connector into the opening member such that at least a portion of the medicinal liquid flows to the catheter via the side hole, a first of the side slits, and a retention space positioned between the side surfaces and the catheter hub.

15. The method of claim 14, wherein the side hole opposes a portion of the first of the side slits that is open on the first of the side surfaces when the valve is opened by the opening member.

16. The method of claim 14, wherein in a cross-sectional view of the valve, at least a portion of each of end faces of a first of the side surfaces defining a first of the side slits diagonally crosses the side hole when the valve is opened by the opening member.

17. The method of claim 14, wherein: the opening member comprises a distal opening; and at least another portion of the medicinal liquid flows to the catheter via the distal opening.

18. A catheter assembly comprising: a catheter; a catheter hub that defines an internal space and is fixed to a proximal end of the catheter; a valve located in an internal space of the catheter hub, wherein the valve comprises a pair of inclined portions that are inclined so as to become closer to each other in a distal direction, an end surface located at distal ends of the pair of inclined portions, a front slit formed along a longitudinal direction of the end surface, and a pair of side slits formed on side surfaces between the pair of inclined portions from both ends of the end surface; and an opening member that is located in the internal space, is formed in a tubular shape having a space inside, is located proximal of the valve in an initial state, and is configured to move in a distal direction to open the valve by opening the front slit and the side slits, the opening member comprising: a side hole that causes the space to communicate with an outside of the opening member, an insertion portion that is insertable into the front slit and has an outer peripheral surface, and a rib protruding radially from the outer peripheral surface of the insertion portion; wherein: the

rib contacts a first of the pair of inclined portions in a state in which the valve is opened.

19. The catheter assembly of claim 18, wherein: the side hole extends through the opening member in a first direction; and the rib protrudes radially from the outer peripheral surface of the insertion portion in a second direction substantially perpendicular to the first direction.

20. The catheter assembly of claim 18, wherein the rib extends along the insertion portion in a direction substantially perpendicular to the longitudinal direction of the front slit of the end surface of the valve.