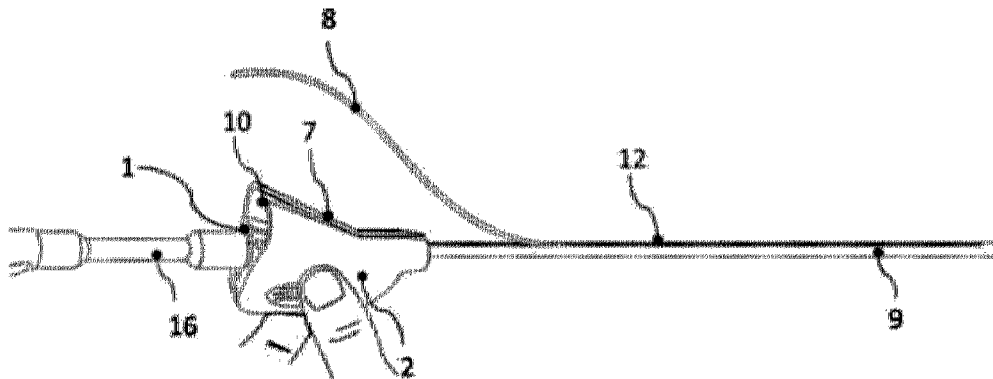




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(72) Inventeurs/Inventors:
LI, XIAOCHUN, CN;
XU, CHAOWEI, CN;
LI, CHANGQING, CN;
LENG, DERONG, CN;
LIU, CHUNJUN, CN
(73) Propriétaire/Owner:
MICRO-TECH (NANJING) CO., LTD., CN
(74) Agent: BLAKE, CASSELS & GRAYDON LLP

(54) Titre : RACCORD DE FIL DE GUIDAGE
(54) Title: GUIDE WIRE JOINT



(57) **Abrégé/Abstract:**

Disclosed is a guide wire joint, comprising: a first cover board (1), a second cover board (2), a connecting part (3) connecting the first cover board and the second cover board, and a connecting piece (4); the connecting piece (4) can connect the guide wire joint to a medical device; a side of the first cover board (1) and a side of the second cover board (2), both are away from the connecting part (3), are contacted with or separated from each other to adjust closing and opening of the guide wire joint. When the guide wire joint is closed, a cavity (10) is formed between the first cover board (1) and the second cover board (2) allowing the guide wire to pass through and penetrate into a guide wire cavity of a medical device having a C-shaped groove; and when the guide wire joint is opened, the guide wire can be rapidly detached from the guide wire joint, and can be rapidly separated from the medical device.

ABSTRACT

Disclosed is a guide wire joint, comprising: a first cover board (1), a second cover board (2), a connecting part (3) connecting the first cover board and the second cover board, and a connecting piece (4); the connecting piece (4) can connect the guide wire joint to a medical device; a side of the first cover board (1) and a side of the second cover board (2), both are away from the connecting part (3), are contacted with or separated from each other to adjust closing and opening of the guide wire joint. When the guide wire joint is closed, a guide wire passage (10) is formed between the first cover board (1) and the second cover board (2) allowing the guide wire to pass through and penetrate into a guide wire cavity of a medical device having a C-shaped groove; and when the guide wire joint is opened, the guide wire can be rapidly detached from the guide wire joint, and can be rapidly separated from the medical device.

(Fig. 6)

GUIDE WIRE JOINT

FIELD OF THE PRESENT DISCLOSURE

[0001] The invention relates to the field of a medical device, an in particular to a guide wire joint.

5 BACKGROUND OF THE PRESENT DISCLOSURE

[0002] Endoscopic sphincterotomy (EST) is a further developed treatment technique based on the diagnostic technique of endoscopic retrograde cholangiopancreatography (ERCP), in which the duodenal papillary sphincter and the end portion of the common bile duct are incised under an endoscope by using a high-frequency electric incision knife.

10 **[0003]** Clinically, EST is widely used in the treatment of choledocholithiasis, biliary pancreatitis, acute obstructive suppurative cholangitis, periampullary tumor, biliary ascaris, benign stricture of the end of the common bile duct, Oddi sphincter dysfunction, and the like. After the endoscopic papillary sphincterotomy is implemented, combining with lithotripsy, calculus removal, ascaris removal, nasobiliary drainage, stent drainage,
15 etc., the disease can be partially or completely treated.

[0004] The incision is mainly performed by inserting an insulating guide wire into a common bile duct, adhering a negative plate of a high-frequency electric generator to the skin of the buttocks of a patient, connecting a connecting joint of a control handle of an incision knife to a corresponding electrode joint of the high-frequency electric
20 generator, and adjusting the electric incision, the electric coagulation power and the

mixing proportion thereof. EST can also be performed by using a simple electric incision current, which can reduce the coagulation effect on nearby tissues in the incision process, thereby being beneficial to maintaining a clear endoscopic field.

[0005] In conventional ERCP, a general papillotomy knife generally requires retaining
5 the position of a guide wire (4.5 m) while slowly withdrawing the papillotomy knife from the endoscope after the intubation of the pancreaticobiliary system and the sphincterotomy, which requires the cooperation between doctors and nurses, with an exchange distance of about 1.6 to 2 m. After the papillotomy knife is withdrawn from the endoscope, a withdrawal distance of more than 2 m from the guide wire is required
10 outside the body. In the process, the withdrawal distance of the incision knife is long, so that the operation time is long; the proficiency of the cooperation between doctors and nurses is highly required.

[0006] At present, most rapid exchange incision knife products on the market are provided with a guide wire insertion hole on the side wall of a guide wire cavity of an
15 outer tube of an incision knife, or after the hole is provided, a slotted guide wire joint is added to serve as a guide wire pre-assembly inlet. Due to the fact that the opening structure of the side wall of the guide wire of the outer tube is limited by the size of the tube, the opening size is small, and the penetrating pre-assembly operation of the guide wire is inconvenient. Because the slotted guide wire joint is not closed, when a J-shaped
20 guide wire is used in the pre-assembly, there is a certain probability that the guide wire can extend out of the slotted position, although the slotted guide wire joint has a certain guiding effect.

[0007] Therefore, in order to save the operation time, realize the single-person operation of a doctor, and ensure good guidance of the guide wire penetrating into the guide wire cavity of the incision knife, there is an urgent need for a guide wire joint which can rapidly separate the guide wire from the side wall of the guide wire cavity of the incision knife to the distal end of the papilla incision knife and shorten the exchange distance of the papilla incision knife to withdraw from the endoscope along the guide wire by slotting the side wall of the guide wire cavity and adding the opening and closing function of the guide wire channel on the guide wire joint in cooperation with a guide wire locking a rapid exchange apparatus.

10

SUMMARY OF THE PRESENT DISCLOSURE

[0008] The object of the invention is to design a guide wire joint, so that the guide wire has good guiding property when penetrating into a guide wire cavity, and the penetrating efficiency of the guide wire is improved; secondly, a doctor can realize single-person operation when performing ERCP; finally, shortening the exchange distance of the rapid exchange apparatus to withdraw from the endoscope along the guide wire effectively shortens the operation time and the relieves the pain of a patient.

15

[0009] The invention provides a guide wire joint which comprises a first cover board, a second cover board, a connecting part for connecting the first cover board and the second cover board, and a connecting piece; the connecting piece can connect the guide wire joint to a medical device, and a side of the first cover board and a side of the second cover board that are away from the connecting part can be in a contact state or a

20

separated state, so that the guide wire joint can be closed and opened; when in the contact state, a guide wire passage is formed between the first cover board and the second cover board, allowing the guide wire to pass through, and when in the separated state, the guide wire can be detached from the guide wire joint.

5 **[0010]** According to the guide wire joint of the invention, the medical device is a rapid exchange apparatus and the guide wire joint can be used in cooperation with the rapid exchange apparatus to achieve the rapid separation of the guide wire from the rapid exchange apparatus.

10 **[0011]** According to the guide wire joint of the invention, sides of the first cover board and a side of the second cover board away from the connecting part are contacted to form a cylinder-like structure, and the distal end diameter of the cylinder-like structure is smaller than that of the proximal end.

15 **[0012]** According to the guide wire joint of the invention, the guide wire joint further comprises a switch, and the guide wire joint can be opened by changing or pressing the switch to realize guide wire separation.

[0013] According to the guide wire joint of the invention, the switch is located on a side of the first cover board away from the connecting part and has an arch structure.

[0014] According to the guide wire joint of the invention, the switch is located between the first cover board and the second cover board and comprises a pressure spring.

20 **[0015]** According to the guide wire joint of the invention, the first cover board and the second cover board are formed by plastic injection molding.

[0016] According to the guide wire joint of the invention, the connecting part is of a

hinge structure.

[0017] According to the guide wire joint of the invention, the second cover board has a rough surface on the outer surface thereof.

[0018] According to the guide wire joint of the invention, a rapid exchange apparatus
5 for use in cooperation with a guide wire joint includes an outer sheath tube.

[0019] According to the guide wire joint of the invention, the outer sheath tube comprises a guide wire cavity with a C-shaped groove formed in a side thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Fig. 1 is a schematic view of a right side opening and closing guide wire joint
10 when it is closed.

[0021] Fig. 2 is a schematic view of the right side opening and closing guide wire joint shown in Fig. 1 after it is opened.

[0022] Fig. 3 is an enlarged view of the schematic view of the right side opening and closing guide wire joint after it is opened as shown in Fig. 2.

[0023] Fig. 4 is a cross-sectional view of the right side opening and closing guide wire joint shown in Fig. 1.

[0024] Fig. 5 is a schematic view of an upside opening and closing guide wire joint when it is closed.

[0025] Fig. 6 is a schematic view showing an open state of the upside opening and
20 closing guide wire joint shown in Fig. 5.

[0026] Fig. 7 is an enlarged view of the schematic view of the upside opening and

closing guide wire joint after it is opened as shown in Fig. 6.

[0027] Fig. 8 is a schematic view of the upside opening and closing guide wire joint shown in Fig. 5 with the second cover board and the connecting part removed.

[0028] Fig. 9 is a cross-sectional view of the upside opening and closing guide wire joint shown in Fig. 5.

[0029] Fig. 10 is a front view of an outer sheath tube for use in cooperation with a guide wire joint.

[0030] Fig. 11 is a cross-sectional view of an outer sheath tube for use in cooperation with the guide wire joint as shown in Fig. 10.

[0031] List of reference numerals in the drawings:

[0032] 1 first cover board 2 second cover board

[0033] 3 connecting part 4 connecting piece

[0034] 5 rough surface 6 switch

[0035] 7 first cover board side edge 8 guide wire

[0036] 9 outer sheath tube 10 guide wire passage

[0037] 11 guide wire cavity 12 C-shaped groove

[0038] 13 upper half part 14 lower half part

[0039] 15 pressure spring 16 outer tube

[0040] 17 triangular opening

DESCRIPTION OF THE EMBODIMENTS

[0041] The technical means adopted by the invention for achieving the purpose preset

for the invention is further described with reference to the following drawings and preferred embodiments of the invention.

[0042] The invention provides a guide wire joint which comprises a first cover board, a second cover board, a connecting part for connecting the first cover board and the second cover board, and a connecting piece; the connecting piece can connect the guide wire joint to a medical device; a side of the first cover board and a side of the second cover board that are away from the connecting part are in a contact state or a separated state to adjust closing and opening of the guide wire joint; when in the contact state, a guide wire passage is formed between the first cover board and the second cover board so that a guide wire can be allowed to pass through, and the guide wire joint is in a closed state; when in the separated state, the guide wire may be detached from the guide wire joint, with the guide wire joint in an open state.

[0043] According to the guide wire joint provided by the invention, the medical device is a rapid exchange apparatus. The guide wire joint can be used in cooperation with the rapid exchange apparatus to realize the rapid separation of the guide wire and the rapid exchange apparatus, and the specific rapid exchange apparatus can be a papilla incision knife, a stone removing balloon, a radiography tube, a stone removing basket, an expansion balloon, and the like.

[0044] According to the guide wire joint provided by the invention, a side of the first cover board and a side of the second cover board that are away from the connecting part are contacted to form a cylinder-like structure, and the distal end diameter of the cylinder-like structure is smaller than that of the proximal end.

[0045] According to the guide wire joint provided by the invention, the guide wire joint further comprises a switch, and the guide wire joint can be opened by changing or pressing the switch to realize guide wire separation.

[0046] Preferably, the switch is located on a side of the first cover board away from the connecting part and has an arch structure. The switch may also be located between the first cover board and the second cover board, including at least one pressure spring.

[0047] According to the guide wire joint provided by the invention, the first cover board and the second cover board are formed by plastic injection molding.

[0048] According to the guide wire joint provided by the invention, the connecting part is a hinge structure.

[0049] According to the guide wire joint provided by the invention, a rough surface is arranged on the outer surface of the second cover board. The rough surface is a finger clamping position during use such that the friction resistance is increased while the clamping falling off during the opening of the guide wire joint or the separation of the guide wire can be prevented.

[0050] According to the guide wire joint provided by the invention, the rapid exchange apparatus for use in cooperation with the guide wire joint includes an outer sheath tube.

[0051] Preferably, the outer sheath tube includes a guide wire cavity with a C-shaped groove on a side so that the guide wire can penetrate into the guide wire cavity of the outer sheath tube from the guide wire passage of the guide wire joint.

[0052] Figs. 1 to 9 illustrate a guide wire joint according to an embodiment of the present invention. Figs. 10 to 11 illustrate an outer sheath tube structure according to the

present invention.

[0053] In a non-limiting embodiment of the present invention, a guide wire joint is as shown in FIGS. 1-9, including a first cover board 1, a second cover board 2, a connecting part 3 connecting the first cover board 1 and the second cover board 2, and a connecting piece 4. A side of the first cover board 1 and a side of the second cover board 2 that are away from the connecting part 3 may be contacted to form a cylinder-like structure. At the moment, the guide wire joint is in a closed state, a guide wire passage 10 is formed between the first cover board 1 and the second cover board 2 of the guide wire joint, and a guide wire 8 enters the guide wire joint from the proximal end of the guide wire joint through the guide wire passage 10; the distal end diameter of the cylinder-like structure is smaller than that of the proximal end, a side of the first cover board 1 and a side of the second cover board 2 that are away from the shaft tube 3 can be separated to form an opening, at the time the guide wire joint is in an open state, and the guide wire 8 is separated from the guide wire joint from the opening.

[0054] The connecting piece 4 is arranged on the second cover board 2 and fixedly connected with the second cover board 2; the connecting piece 4 can also be formed by protruding the inner sides of the first cover board 1 and the second cover board 2 outwards, so that when the guide wire joint is closed, the protrusions on the inner sides of the two cover boards are in contact to form a complete connecting piece 4. The connecting piece 4 can be connected with the rapid exchange apparatus with the thickness from the proximal end of the guide wire joint to the distal end of the guide wire joint getting gradually reduced. The connecting piece 4 can form one guiding channel

with the first cover board 1 while being connected to the rapid exchange apparatus to guide the guide wire 8 .

[0055] A rough surface 5 is arranged on the outer surface of the second cover board 2, and the rough surface 5 can be a point-shaped protrusion, a stripe-shaped inner concave, and the like. The rough surface is a finger clamping position during use, such that the friction resistance is increased while the clamping falling off during the opening of the guide wire joint or the separation of the guide wire 8 can be prevented.

[0056] The guide wire joint can be connected with the outer tube 16 of the rapid exchange apparatus through the connecting piece 4, so that the guide wire 8 penetrates through the guide wire passage 10 of the guide wire joint and extends to the distal end, and finally extends out from the distal end of the outer tube 16. The distal end of the outer tube 16 is provided with an opening to facilitate the rapid separation of the guide wire 8 from the guide wire joint when the guide wire 8 is separated from the rapid exchange apparatus, and preferably, the opening arranged at the distal end of the outer tube 16 is a triangular opening 17. When the guide wire 8 enters the guide wire joint from the guide wire passage 10, the guide wire 8 is guided to rapidly enter the cavity of the rapid exchange apparatus and extends out of the distal end outlet of the rapid exchange apparatus to play a guiding role. When the guide wire 8 is retained within the guide wire cavity 11, the distal end of the triangular opening 17 contacts to retain the guide wire 8 within the guide wire cavity 11. When the guide wire 8 is detached from the rapid exchange apparatus, pulled by a certain force, the guide wire 8 is caused to penetrate through the distal end of the triangular opening 17, thereby separating the guide wire 8

from the guide wire joint.

[0057] In particular, the outer tube 16 can be designed to be connected to the outer sheath tube 9, wherein one side of the outer sheath tube 9 is provided with a C-shaped groove 12 so that the guide wire 8 can penetrate from the guide wire passage 10 of the guide wire joint into the guide wire cavity 11 of the outer sheath tube 9. The outer diameter of the outer sheath tube 9 can be designed to be equal to or slightly smaller than the inner diameter of the distal end of the guide wire joint, so that when the guide wire joint is closed, the guide wire 8 can be smoothly inserted into the guide wire cavity 11 of the outer sheath tube 9 from the guide wire passage 10 of the guide wire joint in a better way, reaches the distal end of the rapid exchange apparatus along the guide wire cavity 11, and extends out from the distal end outlet of the rapid exchange apparatus. So that the effect of accurately guiding the advancing direction of the guide wire 8 is achieved and the penetration efficiency of the guide wire 8 is effectively improved.

[0058] The connecting part 3 in the guide wire joint can be a hinge structure to fixedly connect the first cover board 1 to the second cover board 2.

[0059] The guide wire joint also includes a switch 6 that opens the guide wire passage 10 by changing or pressing to form one opening. When the guide wire joint is opened, the guide wire 8 is separated from the opening of the guide wire joint and the rapid exchange apparatus, thereby achieving rapid exchange.

[0060] The switch 6 can be located on one side edge 7 of the first cover board 1 away from the connecting part 3, and has an arch structure. Specifically, it arches out towards the outer side of the guide wire joint to form an arc surface. When the guide wire joint is

opened, by changing the switch 6, the side edge 7 of the first cover board is gradually moved away from the second cover board 2 to form an opening, and the guide wire 8 arranged in the guide wire joint is separated from the guide wire joint from the opening.

[0061] The switch 6 can also be located between the first cover board 1 and the second cover board 2 and comprises at least one pressure spring 15. The first cover board 1 of the guide wire joint can be opened to form an opening by pressing the second cover board 2 of the guide wire joint, and the guide wire 8 arranged in the guide wire joint is released from the opening.

[0062] Therefore, the guide wire joint of the invention is simple and convenient to operate. The guide wire joint can be opened only by changing or pressing the switch 6, and the guide wire 8 is thus separated from the guide wire joint, so that the guide wire 8 is rapidly separated from the rapid exchange apparatus to the far end portion of the rapid exchange apparatus. It is suitable for the rapid exchange process of the rapid exchange apparatus, comprising a papilla incision knife, a stone removing balloon, a radiography tube, a stone removing basket, an expansion balloon, and the like. In addition, the guide wire joint of the invention effectively shortens the exchange distance of the rapid exchange apparatus for withdrawing from the endoscope along the guide wire 8, realizing the rapid withdrawal of the rapid exchange apparatus and effectively shortening the operation time.

[0063] In a non-limiting embodiment of the present invention, as shown in Figs. 1 and 5 which are schematic views of a guide wire joint when it is closed, when the guide wire joint is closed, a side of the first cover board 1 and a side of the second cover board 2

that are away from the connecting part 3 are contacted to form a cylinder-like structure. The guide wire 8 penetrates through the interior of the cylinder-like structure. The distal ends of the first cover board 1 and the second cover board 2 are gradually closed towards the connecting part 3, so that the distal end diameter of the cylinder-like structure is smaller than the proximal end diameter.

[0064] As shown in Figs. 1 to 4, the first cover board 1 is an arch structure with a large proximal end diameter and a small distal end diameter. As shown in Fig. 3, the diameter of the first cover board 1 is firstly reduced, then unchanged and finally reduced from the proximal end to the distal end. An angled structure with a certain radian is formed at the joint of the proximal end surface of the second cover board 2 and the side wall of the second cover board 2, and the diameter of the second cover board 2 is firstly unchanged and then reduced from the proximal end to the distal end. The initial positions where the diameters of the first cover board 1 and the second cover board 2 are reduced coincide. Because the distal end diameter of the cylinder-like structure is smaller than the proximal end diameter, when the guide wire joint is closed, the guide wire 8 can be more conveniently transmitted to the distal end of the rapid exchange apparatus after entering the guide wire joint from the guide wire passage 10. As one side of the outer sheath tube 9 of the rapid exchange apparatus is provided with a C-shaped groove structure, the guide wire 8 can be smoothly inserted into the guide wire cavity 11 of the outer sheath tube 9 from the guide wire passage 10 of the guide wire joint so as to enter the distal end of the rapid exchange apparatus, and the exchange distance between the guide wire 8 and the rapid exchange apparatus can be shortened.

[0065] A switch 6 is arranged on one side 7 of the first cover board 1 of the guide wire joint away from the connecting part 3, and the switch 6 is arranged on the side edge 7 of the first cover board, and the outer side of the guide wire joint is arched to form an arc surface. When the guide wire joint is opened, by changing the switch 6, the side edge 7 of the first cover board is gradually moved away from the second cover board 2 to form an opening, and the guide wire 8 provided in the guide wire joint is released from the opening.

[0066] In another embodiment of the present invention, as shown in Figs. 5 to 9, the first cover board 1 and the second cover board 2 are symmetrical structures. As shown in Figs. 8 to 9, the connecting part 3 is located in the middle of the first cover board 1 to divide the first cover board 1 into a curved upper half part 13 and a planar lower half part 14. The upper half part 13 is an arch structure with a large proximal end diameter and a small distal end diameter. The upper half part 13, from proximal end to distal end, decreases in diameter first, then does not change, and finally decreases. The lower half part 14 has one planar structure with two symmetrically distributed grooves for arranging a pressure spring 15. When the second cover board 2 and the first cover board 1 which are symmetrical to the first cover board 1 are combined in the guide wire joint, a cylinder-like structure is formed, and the guide wire joint is in a closed state.

[0067] As shown in Figs. 5 to 9, the switch 6 in the guide wire joint is located between the first cover board 1 and the second cover board 2 and comprises at least one pressure spring 15, preferably two pressure springs 15 symmetrically distributed between the lower half parts 14 of the first cover board 1 and the second cover board 2 of the guide

wire. By pressing the second cover board 2 of the guide wire joint, the distance between the lower half parts 14 of the two cover boards is reduced. Because the first cover board 1 and the second cover board 2 are connected by the connecting part 3 provided between the upper half parts 13 and the lower half parts 14, when the distance between the two lower half parts 14 is reduced, the upper half parts 13 tend to move away from each other, so that the guide wire joint opens to form an opening, and the guide wire 8 provided in the guide wire joint is released from the opening.

[0068] Referring to Fig. 7, which shows the connecting piece 4 in the guide wire joint, wherein the proximal end tip of which terminates at the proximal end tips of the first cover board 1 and the second cover board 2, in which case the guide wire joint is clamped on the outer sheath tube 9 or the outer tube 16. The connecting piece 4 may also be shown in Figs. 8 and 9, wherein the proximal end tip of which is located outside the proximal ends of the first cover board 1 and the second cover board 2, and the outwardly extending portions are fixedly connected to the outer sheath tube 9 or the outer tube 16.

[0069] The above are only the preferred embodiments of the present invention, and do not limit the present invention in any form. Although the present invention has been disclosed as the preferred embodiments, it is not intended to limit the present invention. Any person skilled in the art familiar with the profession, without departing from the scope of the technical solution of the present invention, can use the technical content disclosed above to make some changes or modifications to equivalent embodiments with equivalent changes. Any content that does not deviate from the technical solution of the present invention, and any simple modifications, equivalent changes and modifications

made to the above embodiments based on the technical essence of the present invention still fall within the scope of the technical solution of the present invention.

WHAT IS CLAIMED IS:

1. A guide wire joint, characterized by comprising a first cover board, a second cover board, a connecting part for connecting the first cover board and the second cover board, and a connecting piece for connecting the guide wire joint to a medical device; one side of the first cover board and one side of the second cover board are connected together via the connecting part, while the other side of the first cover board and other side of the second cover board are not connected, so that when the other side of the first cover board and other side of the second cover board are in a contact state, the guide wire joint is in a closing state, and when the other side of the first cover board and other side of the second cover board are in a separated state, the guide wire joint is an opening state; when in the contact state, a guide wire passage is formed between the first cover board and the second cover board for passing through of a guide wire, and when in the separated state, the guide wire is detached from the medical device at said other sides of the first cover board and the second cover board that are not connected in a state where the medical device is not separated from the guide wire joint.

2. The guide wire joint of claim 1, characterized in that the medical device is a rapid exchange apparatus used in cooperation with the guide wire joint.

3. The guide wire joint of claim 1, characterized in that a distal end diameter of a structure formed by contacting sides of the first cover board and the second cover board away from the connecting part is smaller than a proximal end diameter of the structure.

4. The guide wire joint of claim 1, characterized in that the guide wire joint further comprises a switch for separating said other side of the first cover board and said other side of the second cover board that are away from the connecting part to separate the guide wire.

5. The guide wire joint of claim 4, characterized in that the switch is located on said other side of the first cover board that is away from the connecting part.

6. The guide wire joint of claim 4, characterized in that the switch is located between the first cover board and the second cover board and comprises a pressure spring.

7. The guide wire joint of claim 1, characterized in that the first cover board and the second cover board are formed by plastic injection molding.

8. The guide wire joint of claim 1, characterized in that the connecting part is a hinge structure.

9. The guide wire joint of claim 1, characterized in that the second cover board has a rough surface on an outer surface thereof.

10. The guide wire joint of claim 2, characterized in that the rapid exchange apparatus used in cooperation with the guide wire joint comprises an outer sheath tube.

11. The guide wire joint of claim 10, characterized in that the outer sheath tube comprises a guide wire cavity, wherein a C-shaped groove is formed in a side of the guide wire cavity.

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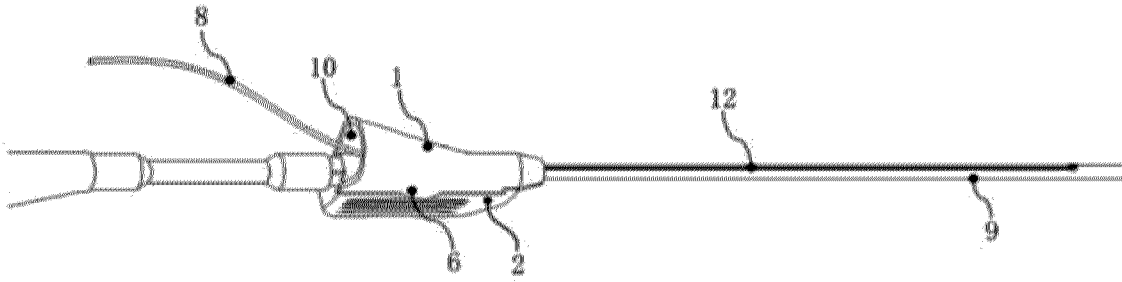


Fig. 1

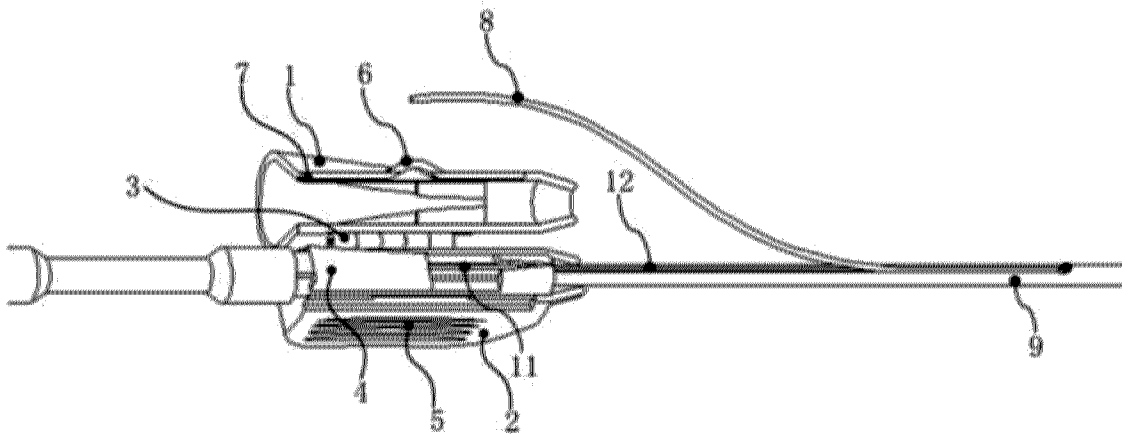


Fig. 2

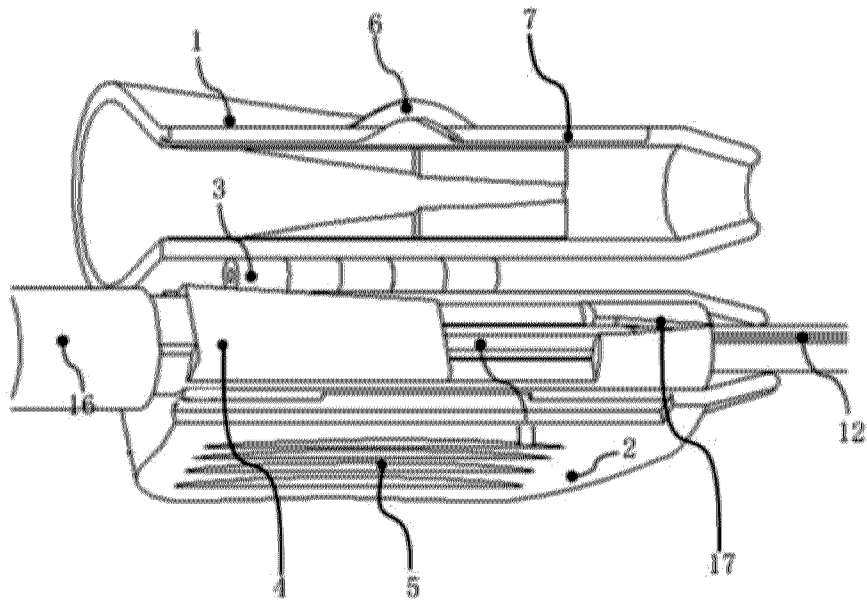


Fig. 3

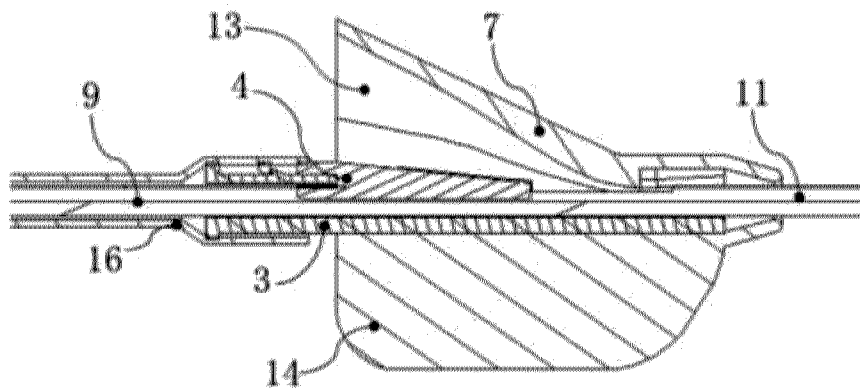


Fig. 4

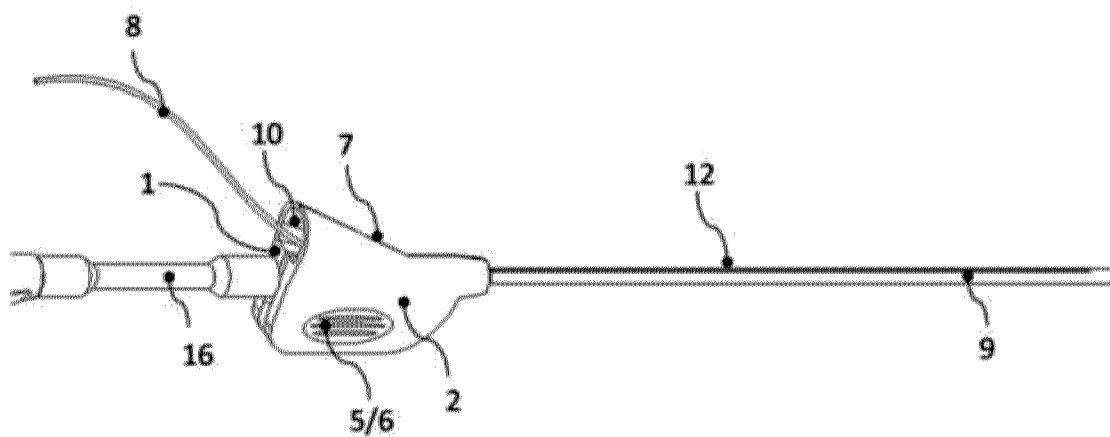


Fig. 5

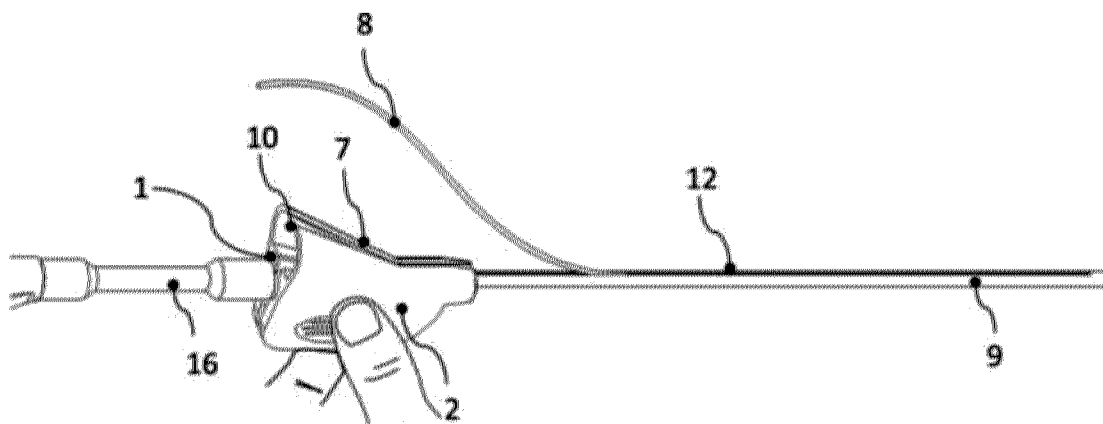


Fig. 6

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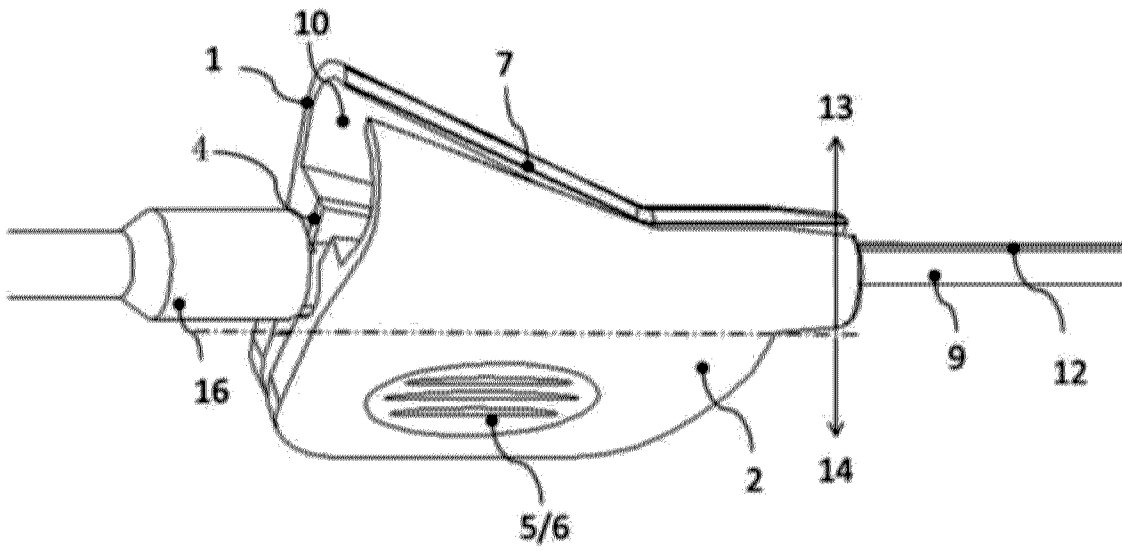


Fig. 7

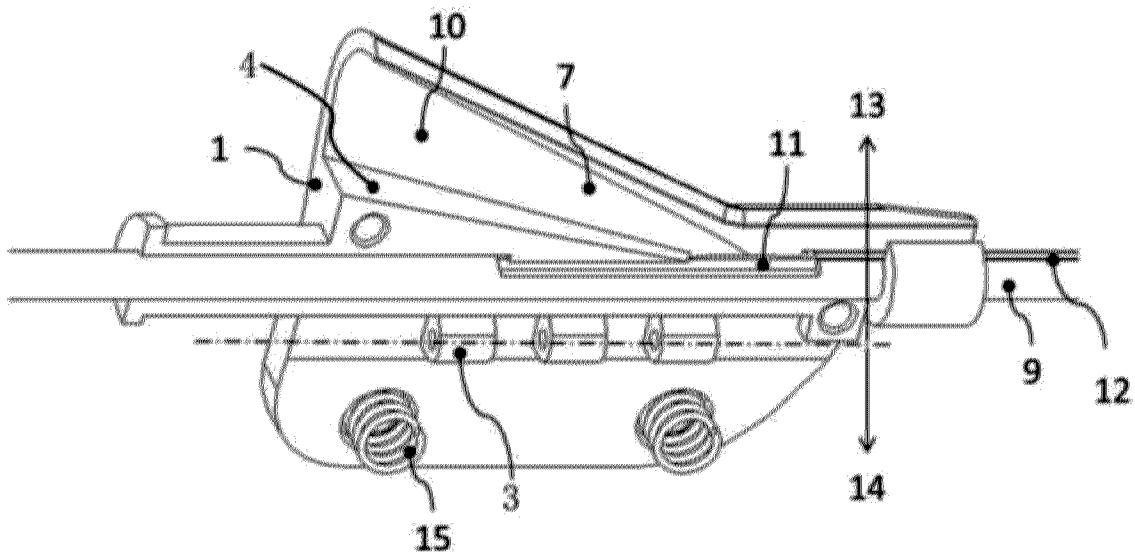


Fig. 8

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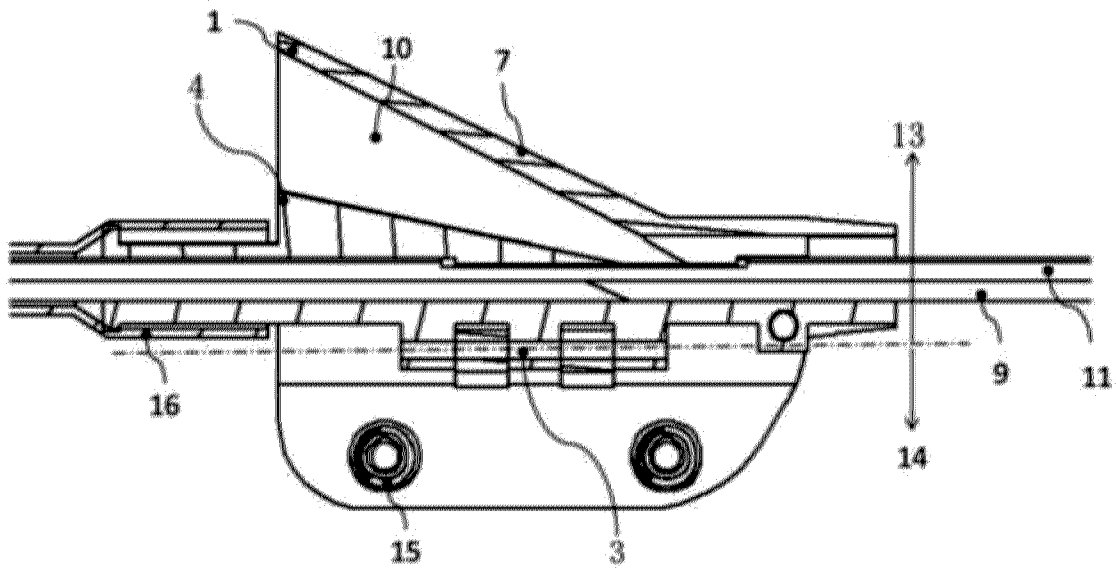


Fig. 9

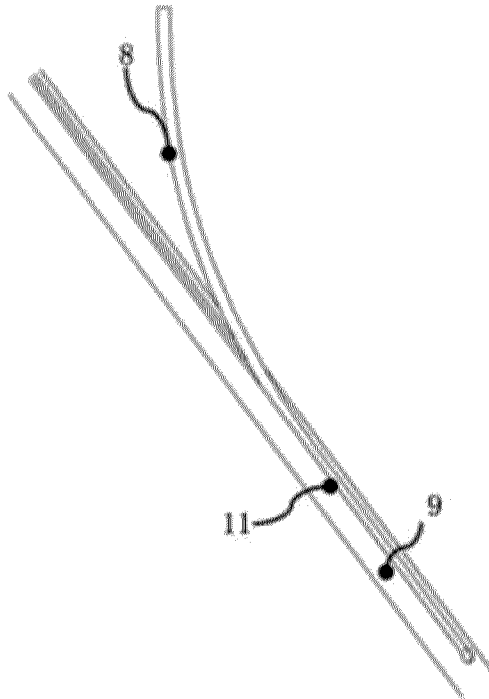


Fig. 10

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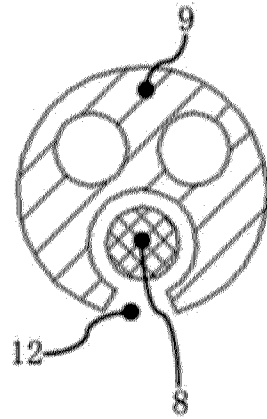


Fig. 11

