[Technical Problem]

[0011]

In view of the above circumstances, embodiments~~an object~~ of the present invention seek~~is~~ to provide a suturing apparatus for endoscope capable of suturing a wound similarly to a surgical operation by using an endoscope inserted into cavity of a digestive tract.

[0012]

(Suturing)

A suturing apparatus attached to an endoscope and inserted into a body for use according to a first aspect~~feature~~ of the present invention includes: a front arm; a rear arm provided movably closer to or away from the front arm; arm moving means for causing the front arm and the rear arm to move closer to or away from each other; and rocking means for relatively rocking the front arm and the rear arm around a rocker shaft in parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other, wherein the rear arm includes: a needle-like member attached to the rear arm so that a tip of the needle-like member faces to the front arm and a central axis thereof becomes parallel with the direction in which the front arm and the rear arm are moved closer to or away from each other, the front arm includes: a pair of branch portions whose base ends are connected to each other, the pair of branch portions each being provided with a housing space capable of housing the tip of the needle-like member when the front arm and the rear arm are moved closer to each other, each of the housing spaces houses each of a pair of engagement members capable of being engaged with the needle-like member, and the pair of engagement members housed in the housing spaces are connected to each other by a suture thread.

A~~P~~referably, the suturing apparatus ~~according to a third feature of the present invention is the first feature of the present invention~~ further includes~~ing~~: a connection mechanism including a front connection member and a rear connection member provided engageably/removably each other, wherein the rear connection member is provided on the rear arm, the front connection member is provided on the front arm, and the connection mechanism is formed so that the front connection member and the rear connection member fix relative rocking of the front arm and the rear arm at a predetermined position, and, in the fixed state at the predetermined position, are engaged with each other relatively movable along the direction in which the front arm and the rear arm are moved closer to or away from each other, the predetermined position being a position where a central axis of each housing space corresponds to a central axis of the needle-like member.

Preferably,~~A suturing apparatus according to a fourth feature of the present invention is the third feature of the present invention, wherein~~ the front connection member is provided with a guide groove engaged with the rear

connection member and guiding a movement of the rear connection member along an axial direction of the rocker shaft.

Preferably,~~A suturing apparatus according to a fifth feature of the present invention is the fourth feature of the present invention, wherein~~ the front arm is provided with a pair of housing spaces, the guide groove formed in the front connection member includes: a pair of intersecting surfaces in parallel with the axial direction of the rocker shaft and intersecting each other, the rear connection member includes: a reference side face in parallel with the axial direction of the rocker shaft; and a pair of positioning side faces in parallel with the axial direction of the rocker shaft and intersecting with the reference side face, the rear connection member is provided so that, when the reference side face is engaged with the guide groove so as to come in surface contact with one intersecting surface, one positioning side face comes in contact with the other intersecting surface, on the other hand, when the reference side face is engaged with the guide groove so as to come in surface contact with the other intersecting surface, the other positioning side face comes in contact with the one intersecting surface, and the pair of housing spaces is formed so that, when the rear connection member is engaged with the guide groove so that the reference side face comes in surface contact with one intersecting surface, a central axis of one housing space corresponds to the central axis of the needle-like member, on the other hand, when the rear connection member is engaged with the guide groove so that the reference side face comes in surface contact with the other intersecting surface, a central axis of the other housing space corresponds to the central axis of the needle-like member.

A suturing apparatus attached to an endoscope and inserted into a body for use according to a second aspect~~sixth feature~~ of the present invention includes: a front arm; a rear arm provided movably closer to or away from the front arm; and arm moving means for causing the front arm and the rear arm to move closer to or away from each other, wherein the rear arm includes: a pair of branch portions whose base ends are connected to each other, the pair of branch portions includes: a pair of needle-like members provided so that tips of the needle-like members face to the front arm and central axes thereof become parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other, the front arm includes: a pair of branch portions whose base ends are connected to each other, the pair of branch portions being provided with a pair of housing spaces capable of respectively housing the tips of the pair

of needle-like members when the front arm and the rear arm are moved closer to each other, the pair of housing spaces are provided so that, when a central axis of one housing space becomes coaxial with a central axis of one needle-like member, a central axis of the other housing space becomes coaxial with a central axis of the other needle-like member, each of the housing spaces houses each of a pair of engagement members capable of being engaged with the needle-like member, and the pair of engagement members housed in the housing spaces are connected to each other by a suture thread.

Preferably, theA suturing apparatus ~~according to an eighth feature of the present invention is the sixth feature of the present invention,~~ further includesing: a connection mechanism including a front connection member and a rear connection member provided engageably/removably each other, wherein the rear connection member is provided on the rear arm, the front connection member is provided on the front arm, and the connection mechanism is formed so that the front connection member and the rear connection member are engaged with each other relatively movable along the direction in which the front arm and the rear arm are moved closer to or away from each other, and, in the engaged state, each central axis of the plurality of needle-like members is coaxial with each central axis of the plurality of housing spaces and rocking of the rear arm is fixed.

Preferably,~~A suturing apparatus according to a ninth feature of the present invention is the eighth feature of the present invention, wherein~~ the front connection member is provided with a guide groove engaged with the rear connection member and guiding a movement of the engaged rear connection member along an axial direction of a rocker shaft.

A suturing apparatus attached to an endoscope and inserted into a body for use according to a third aspect~~tenth feature~~ of the present invention includes: a front arm; a rear arm provided movably closer to or away from the front arm; and arm moving means for causing the front arm and the rear arm to move closer to or away from each other, wherein the rear arm includes: a needle-like member attached to the rear arm so that a tip of the needle-like member faces to the front arm and a central axis thereof becomes parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other, the front arm is provided with a housing space capable of housing the tip of the needle-like member when the front arm and the rear arm are moved closer to each other, the front arm houses a suturing instrument including a pair of

engagement members connected by a suture thread and capable of being engaged with the needle-like member, and the front arm is provided with a supply mechanism in which, when one engagement member is engaged with the needle-like member, the other engagement member can be housed outside the housing space, and then, the other engagement member can be supplied to the housing space after the one engagement member is engaged with the needle-like member.

Preferably,~~A suturing apparatus according to an eleventh feature of the present invention is the tenth feature of the present invention, wherein~~ the engagement member includes: a through hole through which the tip of the needle-like member can be inserted, the supply mechanism includes: a suturing-instrument holding space formed in the front arm, communicating with the housing space and housing the suturing instrument, and the housing space houses the engagement member of the suturing instrument supplied from the suturing-instrument holding space so that an axial direction of the through hole of the engagement member becomes parallel with a direction of movement of the needle-like member.

Preferably,~~A suturing apparatus according to a twelfth feature of the present invention is any one of the first to eleventh features of the present invention, wherein~~ the engagement member includes: a through hole through which the tip of the needle-like member is inserted, and the tip of the needle-like member is provided with a falling-off prevention portion preventing the engagement member from coming out of the tip when the tip is inserted through the through hole of the engagement member.

Preferably,~~A suturing apparatus according to a thirteenth feature of the present invention is the twelfth feature of the present invention, wherein~~ the falling-off prevention portion is an expanded diameter portion formed on a side face of the needle-like member.

Preferably,~~A suturing apparatus according to a fourteenth feature of the present invention is the twelfth or thirteenth feature of the present invention, wherein~~ the engagement member includes: an engagement portion with the through hole; and a connection piece for connection with the suture thread, and an axial direction of the connection piece is in parallel with a central axis of the through hole.

Preferably,~~A suturing apparatus according to a fifteenth feature of the present invention is the fourteenth feature of the present invention, wherein~~ a

connection-piece housing groove is provided on a side face of the front arm along an axial direction of the housing space.

Preferably,~~A suturing apparatus according to a sixteenth feature of the present invention is the twelfth, thirteenth, fourteenth or fifteenth feature of the present invention, wherein~~ an engagement piece engaged with the expanded diameter portion is provided on an inner face of the through hole in the engagement member.

Preferably,~~A suturing apparatus according to a seventeenth feature of the present invention is any one of the first to sixteenth features of the present invention, wherein~~ the rear arm includes: a hollow needle provided on a surface on a side of the front arm so that an axial direction of the hollow needle becomes parallel with the direction in which the front arm and the rear arm are moved closer to or away from each other, and the needle-like member is provided in the hollow needle.

Preferably,~~A suturing apparatus according to an eighteenth feature of the present invention is any one of the first to seventeenth features of the present invention, wherein~~ the suturing apparatus is attached to an endoscope for use so that both of the front arm and the rear arm are located ahead of a tip face of the endoscope and the rear arm is located on a side of the tip face of the endoscope with respect to the front arm.

(Thread-Fastening)

Preferably, the~~A~~ suturing apparatus ~~according to a nineteenth feature of the present invention is any one of the first to eighteenth features of the present invention,~~ further includes~~ing~~: a thread-fastening member including a hollow tubular member, and a linear member having a loop portion inserted through the tubular member and protruding from one end of the tubular member, wherein the thread-fastening member is provided with the tubular member movably along the linear member, and the front arm and/or the rear arm is inserted through the loop portion.

Preferably,~~A suturing apparatus according to a twentieth feature of the present invention is any one of the first to eighteenth features of the present invention, wherein~~ the rear arm is provided with a through hole extending through the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other, the needle-like member is attached to the rear arm so as to be located in the through hole, when the through hole is viewed from an axial direction thereof, the suturing apparatus includes: a thread-fastening

member fastening the suture thread ahead of the tip of the needle-like member, while the pair of engagement members in the suturing instrument is engaged with the tip of the needle-like member, the thread-fastening member includes: a clamp member having a thread-housing groove through which the suture thread passes, the clamp member capable of holding the suture thread provided in the thread-housing groove when a width of the thread-housing groove becomes narrower, and the clamp member is formed into such a shape as to be able to pass the through hole of the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other, and as to allow the needle-like member to pass through the thread-housing groove, when passing the through hole of the rear arm.

Preferably,~~A suturing apparatus according to a twenty-first feature of the present invention is the twentieth feature of the present invention, wherein~~ the thread-fastening member includes: the tubular member formed into such a shape as to be able to pass the through hole of the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other, a section of the tubular member is formed into such a shape as to allow the needle-like member to be housed thereinside at the time of passing the through hole of the rear arm, the tubular member houses the clamp member provided so that an axial direction of the thread-housing groove corresponds to an axial direction of the tubular member, and a ring-shaped fastening member provided between the clamp member and an inner face of the tubular member, an outside diameter of the clamp member becomes shorter from a base end thereof toward a tip, and an inside diameter of the fastening member is not less than an outside diameter of the tip of the clamp member and not more than an outside diameter of the base end of the clamp member.

Preferably,~~A suturing apparatus according to a twenty-second feature of the present invention is the twenty-first feature of the present invention, wherein~~ the tubular member includes: a holding mechanism holding the fastening member at a tip of the tubular member, the holding mechanism holds the fastening member not to move toward the tip of the tubular member, when the clamp member relatively moves toward the tip of the tubular member, until a stress generated between the clamp member and the fastening member reaches a predetermined magnitude, and the fastening member is discharged from the tip of the tubular member when the stress generated between the clamp member and the fastening member reaches the predetermined magnitude or more.

Preferably,~~A suturing apparatus according to a twenty-third feature of the present invention is the twentieth, twenty-first or twenty-second feature of the present invention, wherein~~ the clamp member includes: a gripper provided on an inner face of the thread-housing groove, and nipping and holding the suture thread; and a cutting edge provided on the inner face of the thread-housing groove and located on a side of a base end with respect to the gripper, and the cutting edge may cut the suture thread when a width of the thread-housing groove becomes narrower in a state of the gripper holding the suture thread.

[Advantageous Effects of Invention]

[0013]

(Suturing)

According to embodiments~~the first feature~~ of the present invention, the tip of the needle-like member can be inserted into one housing space, when the front arm and the rear arm are provided so that the needle-like member faces to the one housing space and the arm moving means causes the front arm and the rear arm to move closer to each other. Since the engagement member is provided in the one housing space, the engagement member (one engagement member) can be engaged with the tip of the needle-like member. After the front arm and the rear arm are moved away from each other with the one engagement member engaged with the tip of the needle-like member, by rocking the rear arm, the front arm and the rear arm are provided so that the needle-like member faces the other housing space. When the arm moving means causes the front arm and the rear arm to move closer to each other in such a state, the tip of the needle-like member can be inserted into the other housing space. Therefore, the engagement member (the other engagement member) in the other housing space can be engaged with the tip of the needle-like member. Then, the suture thread connecting the engagement members to each other can be formed into a loop because the plurality of the engagement members are engaged with the needle-like member. Accordingly, the suturing apparatus attached to the endoscope is inserted into a body, one edge is sandwiched between the front arm and the rear arm in an incised part such as a gastric wall, and then the front arm and the rear arm are once moved closer to each other and then moved away from each other. In that case, the suture thread can pass through the one edge. Then, when the other edge is sandwiched between the front arm and the rear arm, and the front arm and the rear arm are once moved closer to each other and then moved away from each other, the suture thread can pass through

the other edge. Consequently, the suture thread that has passed through the pair of edges in the incised part and whose both end portions (parts connected to the engagement members) are located on a side of the rear arm can be formed into a loop. When the both end portions of the suture thread having a loop shape are fastened, the incised part can be sutured with end faces (incised surfaces) of the pair of edges butting against each other, similarly to suturing in a normal surgical operation. Moreover, each of the pair of the branch portions is provided with the housing space. The central axis of the housing space in one branch portion corresponds to the central axis of the needle-like member, and the front arm and the rear arm are once moved closer to each other and then moved away from each other. Then, the central axis of the housing space in the other branch portion corresponds to the central axis of the needle-like member, and the front arm and the rear arm are once moved closer to each other and then moved away from each other. In that case, the suture thread that has passed through the pair of edges in the incised part and whose both end portions are located on the side of the rear arm can be formed into a loop.

According to embodiments~~the third feature~~ of the present invention, when the front connection member and the rear connection member of the connection mechanism are engaged with each other, relative rocking of the front arm and the rear arm can be fixed. Moreover, the central axis of the needle-like member can easily correspond to the central axis of the housing space. Consequently, an operation of inserting the tip of the needle-like member into the housing space can be simplified when the arm moving means causes the front arm and the rear arm to move closer to each other.

According to embodiments~~the fourth feature~~ of the present invention, a structure of the connection mechanism can be simplified because the rear connection member is simply required to be engaged with the guide groove.

According to embodiments~~the fifth feature~~ of the present invention, since the rear connection member comes in surface contact with the guide groove at two faces, the rear connection member can be certainly in a predetermined posture and can be moved in such a posture. Therefore, the tip of the needle-like member can be certainly and easily inserted into the housing space.

According to embodiments~~the six feature~~ of the present invention, the tip of each needle-like member can be inserted into each housing space, when the front arm and the rear arm are provided so that one needle-like member faces to one housing space and the arm moving means causes the front arm and the rear

arm to move closer to each other. Then, the engagement member in each housing space can be engaged with the tip of each needle-like member. When the front arm and the rear arm are moved away from each other in such a state, the needle-like members can be connected to each other by the suture thread. The suturing apparatus attached to the endoscope is inserted into the body, one edge is provided between the one needle-like member and the one housing space in the incised part such as a gastric wall, and the other edge is provided between the other needle-like member and the other housing space. Then, the front arm and the rear arm are once moved closer to each other and then moved away from each other. Consequently, the suture thread that has passed through the pair of edges in the incised part and whose both end portions (parts connected to the engagement members) are located on the side of the rear arm can be formed into a loop. When the both end portions of the suture thread are fastened in such a state, the incised part can be sutured with end faces (incised surfaces) of the pair of edges butting against each other, similarly to suturing in a normal surgical operation. The loop of the suture thread passing through the pair of edges in the incised part can be formed simply by moving the front arm and the rear arm closer to and away from each other once. Time for the suturing operation can therefore be reduced. Moreover, each of the pair of the branch portions is provided with the housing space. The central axis of the housing space corresponds to the central axis of the needle-like member, and the front arm and the rear arm are once moved closer to each other. In that case, the suture thread that has passed through the pair of edges in the incised part and whose both end portions are located on the side of the rear arm can be formed into a loop.

According to embodiments~~the eighth feature~~ of the present invention, the central axis of the needle-like member can correspond to the central axis of the housing space simply by rocking the rear arm. Consequently, the operation of inserting the tip of the needle-like member into the housing space can be simplified when the arm moving means causes the front arm and the rear arm to move closer to each other.

According to embodiments~~the ninth feature~~ of the present invention, a structure of the connection mechanism can be simplified because the rear connection member is simply required to be engaged with the guide groove.

According to embodiments~~the tenth feature~~ of the present invention, the tip of the needle-like member can be inserted into the housing space, when the front arm

and the rear arm are provided so that the needle-like member faces to the housing space and the arm moving means causes the front arm and the rear arm to move closer to each other. Since one engagement member of the suturing instrument is provided in the housing space, the one engagement member can be engaged with the tip of the needle-like member. When the front arm and the rear arm are moved away from each other with the one engagement member of the suturing instrument engaged with the tip of the needle-like member, the supply mechanism supplies the other engagement member of the suturing instrument into the housing space. When the arm moving means causes the front arm and the rear arm to move closer to each other in such a state, the other engagement member of the suturing instrument can be engaged with the tip of the needle-like member. Since both of the pair of engagement members are engaged with the needle-like member, the suture thread connecting the pair of engagement members to each other can be formed into a loop. Accordingly, the suturing apparatus attached to the endoscope is inserted into the body, one edge is sandwiched between the front arm and the rear arm in the incised part such as a gastric wall, and the front arm and the rear arm are once moved closer to each other and then moved away from each other In that case, the suture thread can pass through the one edge. Then, when the other edge is sandwiched between the front arm and the rear arm, and the front arm and the rear arm are once moved closer to each other and then moved away from each other, the suture thread can pass through the other edge. Consequently, the suture thread that has passed through the pair of edges in the incised part and whose both end portions (end portions connected to the pair of engagement members) are located on the side of the rear arm can be formed into a loop by the suturing instrument. When the both end portions of the suture thread are fastened, the incised part can be sutured with end faces (incised surfaces) of the pair of edges butting against each other, similarly to suturing in a normal surgical operation.

According to embodiments~~the eleventh feature~~ of the present invention, when the one engagement member is removed from the housing space, the other engagement member of the suturing instrument is supplied from the suturing-instrument holding space into the housing space. When the engagement member is supplied into the housing space, an axial direction of the through hole of the engagement member in the suturing instrument becomes substantially parallel with a direction of movement of the needle-like member in the housing space.

Therefore, the tip of the needle-like member can be certainly inserted through the through hole of the engagement member when the front arm and the rear arm are moved closer to each other.

According to embodiments~~the twelfth feature~~ of the present invention, the falling-off prevention portion prevents the engagement member from falling off from the needle-like member. Therefore, even if the needle-like member having the engagement member engaged therewith is stuck into a gastric wall or the like, or the needle-like member having the engagement member engaged therewith and stuck into the gastric wall or the like is pulled out from the gastric wall or the like, the engagement member can be prevented from falling off from the needle-like member. Consequently, the suture thread that has passed through the pair of edges in the incised part and whose both end portions are located on the side of the rear arm can be certainly formed into a loop.

According to embodiments~~the thirteenth feature~~ of the present invention, a structure of the needle-like member can be simplified because the needle-like member is simply provided with the expanded diameter portion.

According to embodiments~~the fourteenth feature~~ of the present invention, the connection piece is in parallel with the central axis of the through hole. Therefore, when the engagement member is connected to the tip of the needle-like member, the connection piece can be along a side face of the needle-like member. Consequently, a resistance due to the connection piece can be reduced at the time of passing the needle-like member through the gastric wall or the like.

According to embodiments~~the fifteenth feature~~ of the present invention, the engagement member can be stably held in the housing space. This can happen if the engagement member is provided in the housing space so that the connection piece is provided in the connection-piece housing groove.

According to embodiments~~the sixteenth feature~~ of the present invention, a structure of the engagement member can be simplified because the engagement piece is simply provided. Moreover, since a resistance can be reduced at the time of passing the needle-like member through the through hole of the engagement member, the needle-like member can be engaged with the engagement member more certainly.

According to embodiments~~the seventeenth feature~~ of the present invention, the needle-like member is provided in the hollow needle. The hollow needle can therefore protect the needle-like member, thereby reducing a possibility of

damaging the needle-like member.

According to embodiments~~the eighteenth feature~~ of the present invention, when the suturing apparatus is attached to the endoscope for use, the incised part formed on a digestive tract such as a stomach can be sutured at the digestive tract such as a stomach. Therefore, surgery for removing a tumor or the like from a digestive tract or various organs, or surgery for incising a digestive tract or the like can be performed without forming a scar on a body surface.

(Thread-Fastening)

According to embodiments~~the nineteenth feature~~ of the present invention, the suture thread can be bundled with the loop portion of the linear member by reducing the loop portion in size. This can happen if the suture thread is provided in the loop portion, followed by pulling the linear member or moving the tubular member toward the loop portion with the plurality of the engagement members engaged with the needle-like member. When the linear member is further pulled or the tubular member is further moved toward the loop portion in such a state, both end portions of the suture thread can be drawn into the tubular member together with the linear member. Since the end portions of the suture thread are fixed by the tubular member in close contact with each other, the suture thread can be fastened.

According to embodiments~~the twentieth feature~~ of the present invention, the both end portions of the suture thread can be provided in the thread-housing groove of the clamp member when the clamp member is provided ahead of the needle-like member through the through hole. When a width of the thread-housing groove of the clamp member is narrowed in such a state, the clamp member can nip and hold the both end portions of the suture thread. Therefore, the both end portions can be in the same state as the case of connecting (fastening) the both end portions of the suture thread. The suture thread is then cut between the clamp member and the engagement member, and thereby the pair of edges in the incised part can be sutured.

According to embodiments~~the twenty-first feature~~ of the present invention, the clamp member can be provided ahead of the needle-like member when the tubular member passes the through hole of the rear arm with the clamp member housed in the tubular member. An outside diameter of the clamp member becomes shorter from the base end toward the tip, and further, an inside diameter of the fastening member is not less than the outside diameter of the tip of the clamp member and not more than the outside diameter of the base end of the clamp

member. Therefore, when the clamp member is pushed into the fastening member, the clamp member is deformed so that the width of the thread-housing groove becomes narrower as the clamp member is pushed into the fastening member. Consequently, the suture thread is nipped by the inner face of the thread-housing groove. That is, the clamp member can nip and hold the both end portions of the suture thread. The both end portions can be in the same state as the case of connecting (fastening) the both end portions of the suture thread simply by passing the tubular member through the through hole of the rear arm and pushing the clamp member into the fastening member. The thread-fastening can therefore be performed quickly and easily.

According to embodiments~~the twenty-second feature~~ of the present invention, the holding mechanism holds the fastening member so as not to move toward the tip of the tubular member until a predetermined stress is generated between the clamp member and the fastening member. Then, the clamp member can be certainly deformed until the width of the thread-housing groove becomes narrower so as to be able to nip the suture thread. Therefore, the clamp member can certainly nip and hold the both end portions of the suture thread.

According to embodiments~~the twenty-third feature~~ of the present invention, the gripper of the clamp member can hold the suture thread and the suture thread can be cut simply by pushing the clamp member into the fastening member. The incised part can therefore be sutured more quickly.

[Document Name] Claims

[Claim 1]

A suturing apparatus attached to an endoscope and inserted into a body for use comprising:

a front arm;

a rear arm provided movably closer to or away from the front arm;

arm moving means for causing the front arm and the rear arm to move closer to or away from each other; and

rocking means for relatively rocking the front arm and the rear arm around a rocker shaft in parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other,

wherein the rear arm includes: a needle-like member attached to the rear arm so that a tip of the needle-like member faces to the front arm and a central axis thereof becomes parallel with the direction in which the front arm and the rear arm are moved closer to or away from each other,

the front arm includes: a pair of branch portions whose base ends are connected to each other, the pair of branch portions each being provided with a housing space capable of housing the tip of the needle-like member when the front arm and the rear arm are moved closer to each other,

each of the housing spaces houses each of a pair of engagement members capable of being engaged with the needle-like member, and

the pair of engagement members housed in the housing spaces are connected to each other by a suture thread.

~~[Claim 2] (Canceled)~~

[Claim 23] ~~(Amended)~~

The suturing apparatus according to claim 1, further comprising:

a connection mechanism including a front connection member and a rear connection member provided engageably/removably each other,

wherein the rear connection member is provided on the rear arm,

the front connection member is provided on the front arm, and

the connection mechanism is formed so that the front connection member and the rear connection member fix relative rocking of the front arm and the rear arm at a predetermined position, and, in the fixed state at the predetermined position, are engaged with each other relatively movable along the direction in which the front arm and the rear arm are moved closer to or away from each other, the predetermined position being a position where a central

axis of each housing space corresponds to a central axis of the needle-like member.

[Claim 34]

The suturing apparatus according to claim 23, wherein the front connection member is provided with a guide groove engaged with the rear connection member and guiding a movement of the rear connection member along an axial direction of the rocker shaft.

[Claim 45]

The suturing apparatus according to claim 34,

wherein the front arm is provided with a pair of housing spaces,

the guide groove formed in the front connection member includes: a pair of intersecting surfaces in parallel with the axial direction of the rocker shaft and intersecting each other,

the rear connection member includes:

a reference side face in parallel with the axial direction of the rocker shaft; and

a pair of positioning side faces in parallel with the axial direction of the rocker shaft and intersecting with the reference side face,

the rear connection member is provided so that, when the reference side face is engaged with the guide groove so as to come in surface contact with one intersecting surface, one positioning side face comes in contact with the other intersecting surface, on the other hand, when the reference side face is engaged with the guide groove so as to come in surface contact with the other intersecting surface, the other positioning side face comes in contact with the one intersecting surface, and

the pair of housing spaces is formed so that, when the rear connection member is engaged with the guide groove so that the reference side face comes in surface contact with one intersecting surface, a central axis of one housing space corresponds to the central axis of the needle-like member, on the other hand, when the rear connection member is engaged with the guide groove so that the reference side face comes in surface contact with the other intersecting surface, a central axis of the other housing space corresponds to the central axis of the needle-like member.

[Claim 56] ~~(Amended)~~

A suturing apparatus attached to an endoscope and inserted into a body for use comprising:

a front arm;

a rear arm provided movably closer to or away from the front arm; and

arm moving means for causing the front arm and the rear arm to move closer to or away from each other,

wherein the rear arm includes: a pair of branch portions whose base ends are connected to each other,

the pair of branch portions includes: a pair of needle-like members provided so that tips of the needle-like members face to the front arm and central axes thereof become parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other,

the front arm includes: a pair of branch portions whose base ends are connected to each other, the pair of branch portions being provided with a pair of housing spaces capable of respectively housing the tips of the pair of needle-like members when the front arm and the rear arm are moved closer to each other,

the pair of housing spaces are provided so that, when a central axis of one housing space becomes coaxial with a central axis of one needle-like member, a central axis of the other housing space becomes coaxial with a central axis of the other needle-like member,

each of the housing spaces houses each of a pair of engagement members capable of being engaged with the needle-like member, and

the pair of engagement members housed in the housing spaces are connected to each other by a suture thread.

~~[Claim 7] (Canceled)~~

[Claim 6~~8~~] ~~(Amended)~~

The suturing apparatus according to claim 5~~6~~, further comprising:

a connection mechanism including a front connection member and a rear connection member provided engageably/removably each other,

wherein the rear connection member is provided on the rear arm,

the front connection member is provided on the front arm, and

the connection mechanism is formed so that the front connection member and the rear connection member are engaged with each other relatively movable along the direction in which the front arm and the rear arm are moved closer to or away from each other, and, in the engaged state, each central axis of the plurality of needle-like members is coaxial with each central axis of the plurality of housing spaces and rocking of the rear arm is fixed.

[Claim 7~~9~~]

The suturing apparatus according to claim 6~~8~~, wherein the front connection member is provided with a guide groove engaged with the rear connection member and guiding a movement of the engaged rear connection member along an axial direction of a rocker shaft.

[Claim 8~~10~~] ~~(Amended)~~

A suturing apparatus attached to an endoscope and inserted into a body for use comprising:

a front arm;

a rear arm provided movably closer to or away from the front arm; and

arm moving means for causing the front arm and the rear arm to move closer to or away from each other,

wherein the rear arm includes: a needle-like member attached to the rear arm so that a tip of the needle-like member faces to the front arm and a central axis thereof becomes parallel with a direction in which the front arm and the rear arm are moved closer to or away from each other,

the front arm is provided with a housing space capable of housing the tip of the needle-like member when the front arm and the rear arm are moved closer to each other,

the front arm houses a suturing instrument including a pair of engagement members connected by a suture thread and capable of being engaged with the needle-like member, and

the front arm is provided with a supply mechanism in which, when one engagement member is engaged with the needle-like member, the other engagement member can be housed outside the housing space, and then, the other engagement member can be supplied to the housing space after the one engagement member is engaged with the needle-like member.

[Claim 9~~11~~]

The suturing apparatus according to claim 8~~10~~,

wherein the engagement member includes: a through hole through which the tip of the needle-like member can be inserted,

the supply mechanism includes: a suturing-instrument holding space formed in the front arm, communicating with the housing space and housing the suturing instrument, and

the housing space houses the engagement member of the suturing instrument supplied from the suturing-instrument holding space so that an axial direction of the through hole of the engagement member becomes parallel with a

direction of movement of the needle-like member.

[Claim 1012]

The suturing apparatus according to any one of claims 1 to 911,

wherein the engagement member includes: a through hole through which the tip of the needle-like member is inserted, and

the tip of the needle-like member is provided with a falling-off prevention portion preventing the engagement member from coming out of the tip when the tip is inserted through the through hole of the engagement member.

[Claim 1113]

The suturing apparatus according to claim 1012, wherein the falling-off prevention portion is an expanded diameter portion formed on a side face of the needle-like member.

[Claim 1214]

The suturing apparatus according to claim 1012 or 1113,

wherein the engagement member includes:

an engagement portion with the through hole; and

a connection piece for connection with the suture thread, and

an axial direction of the connection piece is in parallel with a central axis of the through hole.

[Claim 1315]

The suturing apparatus according to claim 1214, wherein a connection-piece housing groove is provided on a side face of the front arm along an axial direction of the housing space.

[Claim 1416]

The suturing apparatus according to claim 102, 113, 124 or 135, wherein an engagement piece engaged with the expanded diameter portion is provided on an inner face of the through hole in the engagement member.

[Claim 1517]

The suturing apparatus according to any one of claims 1 to 146,

wherein the rear arm includes: a hollow needle provided on a surface on a side of the front arm so that an axial direction of the hollow needle becomes parallel with the direction in which the front arm and the rear arm are moved closer to or away from each other, and

the needle-like member is provided in the hollow needle.

[Claim 168]

The suturing apparatus according to any one of claims 1 to 157, wherein

the suturing apparatus is attached to an endoscope for use so that both of the front arm and the rear arm are located ahead of a tip face of the endoscope and the rear arm is located on a side of the tip face of the endoscope with respect to the front arm.

[Claim 17~~19~~]

The suturing apparatus according to any one of claims 1 to 16~~8~~, further comprising:

a thread-fastening member including a hollow tubular member, and a linear member having a loop portion inserted through the tubular member and protruding from one end of the tubular member,

wherein the thread-fastening member is provided with the tubular member movably along the linear member, and

the front arm and/or the rear arm is inserted through the loop portion.

[Claim 18~~20~~]

The suturing apparatus according to any one of claims 1 to 16~~18~~,

wherein the rear arm is provided with a through hole extending through the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other,

the needle-like member is attached to the rear arm so as to be located in the through hole, when the through hole is viewed from an axial direction thereof,

the suturing apparatus includes: a thread-fastening member fastening the suture thread ahead of the tip of the needle-like member, while the pair of engagement members in the suturing instrument is engaged with the tip of the needle-like member,

the thread-fastening member includes: a clamp member having a thread-housing groove through which the suture thread passes, the clamp member capable of holding the suture thread provided in the thread-housing groove when a width of the thread-housing groove becomes narrower, and

the clamp member is formed into such a shape as to be able to pass the through hole of the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other, and as to allow the needle-like member to pass through the thread-housing groove, when passing the through hole of the rear arm.

[Claim 19~~21~~]

The suturing apparatus according to claim 18~~20~~,

wherein the thread-fastening member includes: the tubular member formed into such a shape as to be able to pass the through hole of the rear arm along the direction in which the front arm and the rear arm are moved closer to or away from each other,

a section of the tubular member is formed into such a shape as to allow the needle-like member to be housed thereinside at the time of passing the through hole of the rear arm,

the tubular member houses the clamp member provided so that an axial direction of the thread-housing groove corresponds to an axial direction of the tubular member, and a ring-shaped fastening member provided between the clamp member and an inner face of the tubular member,

an outside diameter of the clamp member becomes shorter from a base end thereof toward a tip, and

an inside diameter of the fastening member is not less than an outside diameter of the tip of the clamp member and not more than an outside diameter of the base end of the clamp member.

[Claim 2022]

The suturing apparatus according to claim 1921,

wherein the tubular member includes: a holding mechanism holding the fastening member at a tip of the tubular member,

the holding mechanism holds the fastening member not to move toward the tip of the tubular member, when the clamp member relatively moves toward the tip of the tubular member, until a stress generated between the clamp member and the fastening member reaches a predetermined magnitude, and

the fastening member is discharged from the tip of the tubular member when the stress generated between the clamp member and the fastening member reaches the predetermined magnitude or more.

[Claim 2123]

The suturing apparatus according to claim 1820, 1921 or 2022,

wherein the clamp member includes:

a gripper provided on an inner face of the thread-housing groove, and nipping and holding the suture thread; and

a cutting edge provided on the inner face of the thread-housing groove and located on a side of a base end with respect to the gripper, and

the cutting edge may cut the suture thread when a width of the thread-housing groove becomes narrower in a state of the gripper holding the