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# Clutch device, drill chuck, power tool, and bidirectional rotation method of drill chuck


## Abstract

Disclosed are a clutch device, a drill chuck, a power tool, and a bidirectional rotation method of the drill chuck. The clutch device comprises a return elastic member, a transmission assembly and a rotating portion, wherein the transmission assembly comprises at least two oppositely arranged engagement portions; the engagement between the two engagement portions enables a front body and a rear body to rotate synchronously; the rotation of the rotating portion in a first direction enables the return elastic member to be compressed, such that the two engagement portions are disconnected; and the rotation of the rotating portion in a second direction enables the compressed return elastic member to return to an initial position such that the two engagement portions are engaged. The drill chuck comprises a front body, a rear body, clamping jaws and the clutch device; and the power tool comprises a driving shaft and the drill chuck.



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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) The present disclosure claims the priority to the Chinese patent application with the filing number 2019103515375 filed on Apr. 28, 2019 with the Chinese Patent Office, and entitled "Clutch Device, Drill Chuck, Power Tool, and Bidirectional Rotation Method of Drill Chuck", the contents of which are incorporated herein by reference in entirety.

TECHNICAL FIELD

(2) The present disclosure relates to the technical field of drill chucks, in particular to a clutch device, a drill chuck, a power tool, and a bidirectional rotation method of the drill chuck.

BACKGROUND ART

(3) When the self-tightening drill chucks currently on the market suddenly start in a vibration working state or in an idling state, and a rotating direction of the idling is a direction of loosening a drilling tool, the drilling tool tends to get loose, and even the drilling tool is caused to detach from the drill chuck.

SUMMARY

(4) The present disclosure aims at providing a clutch device, a drill chuck, a power tool, and a bidirectional rotation method of the drill chuck, so as to solve the technical problems existing in the prior art that when the self-tightening drill chucks suddenly start in a vibration working state or in an idling state and a rotating direction of the idling is a direction of loosening a drilling tool, the drilling tool tends to get loose and even the drilling tool is caused to detach from the drill chuck.

(5) The present disclosure provides a clutch device, which includes a return elastic member, a transmission assembly, and a rotating portion; the transmission assembly includes at least two oppositely arranged engagement portions, one of the engagement portions can rotate in synchronization with a front body of the drill chuck, and the other one of the engagement portions can rotate in synchronization with a rear body of the drill chuck; engagement between the two engagement portions can enable the front body and the rear body to rotate in synchronization; rotation of the rotating portion in a first direction can enable the return elastic member to be compressed, so as to disengage the two engagement portions from each other; and rotation of the rotating portion in the second direction can enable the compressed return elastic member to return to an initial position, so as to make the two engagement portions engaged with each other.

(6) Optionally, engagement or disengagement between the two engagement portions is realized through a tooth structure, the engagement portions may be of a sheet structure, the tooth structure includes a plurality of teeth provided on a sheet surface of the sheet structure, and the plurality of teeth are distributed in a circular shape on the sheet surface.

(7) Optionally, the clutch device further includes a rear sleeve, the rear sleeve is configured for fixed connection with the rear body, and the connection between the rear sleeve and the rear body may be interference fit or key connection.

(8) Optionally, a trigger is further included, wherein rotation of the rotating portion can enable the trigger to push one of the engagement portions to move, so that the return elastic member can be compressed or return to the initial position.

(9) Optionally, the return elastic member is located outside one of the engagement portions, and inner sides of the two engagement portions are opposite to each other.

(10) Optionally, the number of engagement portions is two, and the two engagement portions are a first engagement portion and a second engagement portion, respectively;

(11) the return elastic member is located outside the second engagement portion, and the second engagement portion is located between the return elastic member and the first engagement portion; alternatively, the return elastic member is located outside the first engagement portion, and the first engagement portion is located between the return elastic member and the second engagement portion.

(12) Optionally, when the return elastic member is located outside the second engagement portion, the first engagement portion and the front body are fixedly connected with each other, and the second engagement portion can move along an axial direction of the rear body.

(13) Optionally, the trigger includes a lever; rotation of the rotating portion in the first direction can enable the lever to pry the second engagement portion so as to make the second engagement portion move along the axial direction of the rear body, so that the first engagement portion and the second engagement portion are disengaged from each other.

(14) Optionally, the trigger further includes a connecting rod fixed on the rotating portion, the connecting rod extends along an axial direction of the rotating portion, and the connecting rod is provided with a contact (contact head); the lever includes a first raised portion and a second raised portion connected to the first raised portion, and the first raised portion and the second raised portion are arranged with an angle therebetween.

(15) Optionally, the lever is rotatably mounted in a circumferential direction of the first engagement portion through a pin shaft; the rotating portion is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with a protruding block configured to push

the lever to rotate around the pin shaft.
(16) Optionally, the first engagement portion is provided with positioning holes, and the lever includes an insertion portion and a prying portion; a length extending direction of the insertion portion and a length extending direction of the prying portion have an angle therebetween, the insertion portion is inserted into the corresponding positioning hole, the rotating portion is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with the protruding block configured to push the insertion portion to sway in the positioning hole, so as to enable the prying portion to move.
(17) Optionally, when the return elastic member is located outside the first engagement portion, the first engagement portion can move along an axial direction of the front body, and the second engagement portion is fixedly connected to the rear body.
(18) Optionally, the trigger includes a connecting rod fixed on the rotating portion, the connecting rod extends along the axial direction of the rotating portion, and the connecting rod is provided with a contact; a surface of the first engagement portion is provided with a contact socket; and the contact can enter or leave the contact socket along with the rotation of the rotating portion.
(19) Optionally, the trigger includes a follower portion and a connecting rod fixed on the follower portion, the connecting rod extends along an axial direction of the follower portion, and the connecting rod is provided with a contact; the follower portion and the rotating portion are in threaded transmission; a link guide groove is provided in the circumferential direction of the front body for enabling the connecting rod to move along a length extending direction of the link guide groove.
(20) Optionally, the trigger includes a lever; rotation of the rotating portion in the first direction can enable the lever to pry the first engagement portion so as to make the first engagement portion move along the axial direction of the rear body, so that the first engagement portion and the second engagement portion are disengaged from each other.
(21) Optionally, the first engagement portion is provided with positioning holes, and the lever includes an insertion portion and a prying portion; a length extending direction of the insertion portion and a length extending direction of the prying portion are provided with an angle, the insertion portion is inserted into the corresponding positioning hole, the rotating portion is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with the protruding block configured to push the insertion portion to sway in the positioning hole, so as to enable the prying portion to move.
(22) The present disclosure further provides a drill chuck, which includes a front body, a rear body, at least one clamping jaw, and the clutch device; the rear body can rotate relative to the front body, so as to enable the rear body to drive the at least one clamping jaw to move to clamp or loosen a drilling tool mounted on the drill chuck; one of the engagement portions is connected to the front body, and the other one of the engagement portions is connected to the rear body.
(23) The present disclosure further provides a power tool, which includes a driving shaft and the drill chuck; and the driving shaft is connected to the rear body for driving the rear body to rotate.
(24) The present disclosure further provides a bidirectional rotation method of a drill chuck, wherein the drill chuck includes a rear body, a front body, and at least one clamping jaw, the method includes: enabling the rear body to rotate relative to the front body, so that the rear body can drive the at least one clamping jaw to move; providing a clutch device between the rear body and the front body, so as to make the rear body engaged with or disengaged from the front body, wherein the clutch device includes a return elastic member, a transmission assembly, and a rotating portion; the transmission assembly includes at least two oppositely arranged engagement portions, wherein one of the engagement portions can rotate in synchronization with the front body of the drill chuck, and the other one of the engagement portions can rotate in synchronization with the rear body of the drill chuck; engagement between the two engagement portions can enable the front body and the rear body to rotate in synchronization; rotation of the rotating portion in a first

direction can enable the return elastic member to be compressed, so as to make the two engagement portions disengaged from each other; and rotation of the rotating portion in the second direction can enable the compressed return elastic member to return to an initial position, so as to make the two engagement portions engaged with each other.

(25) Compared with the prior art, beneficial effects of the present disclosure are as follows.

(26) Regarding the clutch device, the drill chuck, the power tool, and the bidirectional rotation method of the drill chuck provided in the present disclosure, it is convenient to realize engagement or disengagement between the two oppositely arranged engagement portions through a rotating operation of the rotating portion, in this way, when one of the engagement portions is configured to be rotatable in synchronization with the front body of the drill chuck, and the other of the engagement portions is configured to be rotatable in synchronization with the rear body of the drill chuck, the engagement or disengagement between the front body and the rear body can be realized by just rotating the rotating portion, thus when the front body and the rear body are in an engagement state, it is advantageous to ensure the drilling tool on the drill chuck to have mounting stability when the drill chuck suddenly starts in a vibration working state or in an idling state, and avoid the occurrence of loosening or detachment. Besides, through the engagement between the front body and the rear body, the bidirectional rotation of the drill chuck is further realized, so as to drive the drilling tool to perform bidirectional operation, and the drilling tool may be replaced more reliably, easily, simply, and conveniently.

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## Description

BRIEF DESCRIPTION OF DRAWINGS

(1) In order to more clearly illustrate technical solutions in specific embodiments of the present disclosure or the prior art, accompanying drawings which need to be used for description of the specific embodiments or the prior art will be introduced briefly below. Apparently, the accompanying drawings in the description below merely show some embodiments of the present disclosure, and those ordinarily skilled in the art still could obtain other accompanying drawings in light of these drawings, without paying creative efforts.

(2) FIG. **1** is an assembled view of a gear self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);

(3) FIG. **2** is a structural schematic view of the gear self-tightening drill chuck in FIG. **1** from another perspective;

(4) FIG. **3** is a sectional view along a line A-A in FIG. **2**;

(5) FIG. **4** is a structural schematic view of a front body of the gear self-tightening drill chuck in FIG. **1**;

(6) FIG. **5** is a structural schematic view of a rotating portion of a clutch device in FIG. **1**;

(7) FIG. **6** is a structural schematic view of a second engagement portion of the clutch device in FIG. **1**;

(8) FIG. **7** is a structural schematic view of a lever of the clutch device in FIG. **1**;

(9) FIG. **8** is an explosive view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;

(10) FIG. **9** is an explosive view of a flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure;

(11) FIG. **10** is an assembled view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);

(12) FIG. **11** is an assembled view of an internal thread self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);

(13) FIG. **12** is an explosive view of the gear self-tightening drill chuck provided in an embodiment

of the present disclosure;
(14) FIG. **13** is a sectional view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(15) FIG. **14** is an assembled view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(16) FIG. **15** is a structural schematic view of a lever of the clutch device in FIG. **12**;
(17) FIG. **16** is an assembled view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(18) FIG. **17** is an explosive view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure;
(19) FIG. **18** is an explosive view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure;
(20) FIG. **19** is an assembled view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(21) FIG. **20** is an assembled view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(22) FIG. **21** is a sectional view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(23) FIG. **22** is a structural schematic view of the lever of the clutch device in FIG. **20**;
(24) FIG. **23** is an explosive view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(25) FIG. **24** is an explosive view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure;
(26) FIG. **25** is an assembled view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(27) FIG. **26** is an assembled view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed);
(28) FIG. **27** is an explosive view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure;
(29) FIG. **28** is an explosive view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(30) FIG. **29** is an assembled view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure (a sleeve body is not installed);
(31) FIG. **30** is a sectional view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(32) FIG. **31** is a structural schematic view of a second engagement portion of the clutch device in FIG. **28**;
(33) FIG. **32** is a sectional view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(34) FIG. **33** is a structural schematic view of a second engagement portion of the clutch device in FIG. **33**;
(35) FIG. **34** is an explosive view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(36) FIG. **35** is an explosive view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure;
(37) FIG. **36** is a sectional view of the flat jaw self-tightening drill chuck provided in an embodiment of the present disclosure;
(38) FIG. **37** is a sectional view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure;
(39) FIG. **38** is an explosive view of the internal thread self-tightening drill chuck provided in an

embodiment of the present disclosure;
(40) FIG. **39** is an explosive view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(41) FIG. **40** is a sectional view of the gear self-tightening drill chuck provided in an embodiment of the present disclosure;
(42) FIG. **41** is a structural schematic view of the rotating portion of the clutch device in FIG. **39**;
(43) FIG. **42** is a structural schematic view of a fixing sleeve of the gear self-tightening drill chuck in FIG. **39**;
(44) FIG. **43** is a structural schematic view of the second engagement portion of the clutch device in FIG. **39**;
(45) FIG. **44** is a schematic view of a first state in which the fixing sleeve cooperates with the rotating portion in FIG. **39**;
(46) FIG. **45** is a schematic view of a second state in which the fixing sleeve cooperates with the rotating portion in FIG. **39**;
(47) FIG. **46** is a sectional view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure;
(48) FIG. **47** is an explosive view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure; and
(49) FIG. **48** is an explosive view of the internal thread self-tightening drill chuck provided in an embodiment of the present disclosure (a rear sleeve is not installed).

REFERENCE SIGNS

(50) **100**—rear body; **101**—front body; **102**—clamping jaw; **103**—clamping jaw slideway; **105**—driven bevel gear; **108**—driving bevel gear; **111**—screw; **115**—front end; **116**—rear end; **118**—return spring; **121**—rear sleeve; **126**—end cap; **127**—drilling tool receiving hole; **132**—inner side surface; **133**—strip-shaped groove; **134**—positioning key; **201**—first engagement portion; **202**—second engagement portion; **203**—rotating portion; **204**—contact; **205**—connecting rod; **206**—tooth; **208**—lever; **209**—rotation convex strip; **210**—rotation groove; **216**—return elastic member; **217**—driving portion; **220**—first raised portion; **221**—second raised portion; **222**—accommodating groove; **223**—spring groove; **224**—shaft shoulder; **225**—pin shaft; **226**—avoiding groove; **227**—pin hole; **228**—main body portion; **229**—additional portion; **231**—protruding block; **232**—insertion portion; **233**—prying portion; **234**—positioning hole; **235**—contact socket; **236**—first arc surface; **301**—disc portion; **302**—axial convex portion; **303**—internal thread; **304**—external thread; **305**—fixing sleeve; **306**—first arc protrusion; **307**—second arc protrusion; **308**—triangular structure; **309**—sleeve body; **310**—follower portion.

DETAILED DESCRIPTION OF EMBODIMENTS

(51) Technical solutions of the present disclosure will be described below clearly and completely in connection with accompanying drawings. Apparently, the embodiments described are only some but not all embodiments of the present disclosure. All of other embodiments obtained by those ordinarily skilled in the art based on the embodiments in the present disclosure without using creative efforts shall fall within the scope of protection of the present disclosure. In the description of the present disclosure, it should be indicated that orientation or positional relations indicated by terms “center”, “upper”, “lower”, “left”, “right”, “vertical”, “horizontal”, “inner”, “outer” and so on are based on orientation or positional relations as shown in the accompanying drawings, merely for facilitating the description of the present disclosure and simplifying the description, rather than indicating or implying that related devices or elements have to be in the specific orientation or configured and operated in a specific orientation, therefore, they should not be construed as limiting the present disclosure. Besides, terms “first”, “second”, and “third” are merely for descriptive purpose, but should not be construed as indicating or implying importance in the relativity. In the description of the present disclosure, it should be indicated that unless otherwise specified and defined explicitly, terms “mount”, “link”, “connect” should be construed in a broad

sense. For example, it may be fixed connection, detachable connection, or integral connection; it may be mechanical connection; it may be direct linking, indirect linking via an intermediate medium, or inner communication between two elements. For those ordinarily skilled in the art, specific meanings of the above-mentioned terms in the present disclosure could be understood according to specific circumstances.

(52) Referring to FIG. **1** to FIG. **48**, an embodiment of the present disclosure provides a clutch device, wherein the clutch device may be applicable to a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck, an internal thread self-tightening drill chuck, or an external thread self-clamping drill chuck. The clutch device includes a return elastic member **216**, a transmission assembly, and a rotating portion **203**; the transmission assembly includes at least two oppositely arranged engagement portions, wherein one engagement portion can rotate in synchronization with a front body **101** of the drill chuck, and the other engagement portion can rotate in synchronization with a rear body **100** of the drill chuck; the engagement between the two engagement portions can enable the front body **101** and the rear body **100** to rotate in synchronization with each other; rotation of the rotating portion **203** in a first direction can enable the return elastic member **216** to be compressed, so as to disengage the two engagement portions from each other; rotation of the rotating portion **203** in the second direction can enable the compressed return elastic member **216** to return to an initial position, so as to make the two engagement portions engaged with each other.

(53) The operation principle of a gear self-tightening drill chuck comprises that a driving bevel gear **108** on the rear body **100** drives a driven bevel gear **105** mounted on the front body **101** to rotate, and the rotation of the driven bevel gear **105** then drives clamping jaws **102** to move along corresponding clamping jaw slideways **103** on the front body **101**, so as to realize clamping or loosening of a drilling tool inserted in a drilling tool receiving hole of the front body **101**.

(54) The operation principle of a flat jaw self-tightening drill chuck comprises that the rear body **100** drives a driving portion **217** having an external thread structure to rotate, and the driving portion **217** drives the clamping jaws **102** connected to the driving portion to move along the corresponding clamping jaw slideways **103** on the front body **101**.

(55) The operation principle of an internal thread self-tightening drill chuck comprises that an external thread structure of the driving portion **217** on the rear body **100** cooperates with thread structures on the clamping jaws **102** to realize transmission, in this way, when the rear body **100** rotates, it may be realized that the clamping jaws **102** move along the corresponding clamping jaw slideways **103** on the front body **101**.

(56) For example, the number of engagement portions is two. The return elastic member **216** may be a wave-shaped gasket, and the rotating portion **203** is of a sleeve-shaped structure. When the transmission assembly includes two oppositely arranged engagement portions, the two engagement portions can be engaged with or disengaged from each other, and the two engagement portions realize engagement or disengagement therebetween through a tooth structure. The engagement portions may be of a sheet structure, the tooth structure refers to a plurality of teeth **206** provided on a sheet surface of the sheet structure, and the plurality of teeth are distributed in a circular shape on the sheet surface. The teeth may be ratches. The first direction is a loosening direction which is just a rotating direction of the rotating portion **203** when the drilling tool on the drill chuck can be loosened; and the second direction is a clamping direction which is just a rotating direction of the rotating portion **203** when the drilling tool on the drill chuck can be clamped. The two engagement portions are a first engagement portion **201** and a second engagement portion **202**, respectively. After the rotating portion **203** rotates along the clamping direction by a certain angle, the engagement between the second engagement portion **202** and the first engagement portion **201** is realized under the action of the return elastic member **216** on the second engagement portion **202**, so as to prevent loosening the drilling tool on the drill chuck; after the rotating portion **203** rotates along the loosening direction by a certain angle, the second engagement portion **202** is disengaged

from the first engagement portion **201**, so that the drilling tool on the drill chuck is loosened. The return elastic member **216** is a wave-shaped spring washer. After the clamping jaws **102** of the drill chuck clamp the drilling tool and when the drill chuck is observed from an operation end (for example, when the drilling tool is a drill bit, the operation end of the drill bit can drill a hole in an object) of the drilling tool towards a direction where the drill chuck is located, counterclockwise rotation is forward rotation of the drill chuck, and clockwise rotation is reverse rotation of the drill chuck. The rear body **100** is rotated forward with respect to the front body **101** so as to realize clamping of the drilling tool by the clamping jaws **102**, and the rear body **100** is rotated reversely with respect to the front body **101** so as to realize loosening of the drilling tool from the clamping jaws **102**. A forward rotating direction of the rear body **100** and a forward rotating direction of the front body **101** are both the same as a forward rotating direction of the drill chuck; and a reverse rotating direction of the rear body **100** and a reverse rotating direction of the front body **101** are both the same as a reverse rotating direction of the drill chuck. The rear body **100** can rotate about an axis of the rear body **100** relative to the front body **101**, and the rear body **100** is provided coaxially with the front body **101**. A clamping direction of the rotating portion **203** is the same as the reverse rotating direction of the drill chuck, and a loosening direction of a switch sleeve is the same as the forward rotating direction of the drill chuck. In this embodiment, the forward rotation of the rear body **100** of the drill chuck may realize clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize loosening of the drilling tool from the clamping jaws **102**; after clamping the drilling tool with the clamping jaws **102** by rotating the rear body **100** forward, the conventional forward rotation may be realized, in this case, the rear body **100** and the front body **101** rotate forward together; in cases where the clamping jaws **102** clamp the drilling tool, after the rear body **100** and the front body **101** are engaged with each other by the clutch device, a relatively stationary fixed connection state is realized by the clutch device between the rear body **100** and the front body **101**, that is, the rear body **100** and the front body **101** rotate reversely together, thus realizing bidirectional rotation of the drill chuck by the clutch device, so as to drive the drilling tool to perform bidirectional operation, and the user experience is relatively good. It should be noted that the return elastic member **216** further may be a spring or the like, and a material of the wave-shaped gasket may be a metal.

(57) Optionally, the clutch device further includes a rear sleeve **121**, wherein the rear sleeve **121** is configured for fixed connection with the rear body **100**, and connection between the rear sleeve **121** and the rear body **100** may be interference fit or key connection. In use, the rear body **100** can be driven to rotate by rotating the rear sleeve **121**.

(58) For the clutch device provided in this embodiment, the engagement or disengagement between two oppositely arranged engagement portions is easily realized through the rotating operation on the rotating portion **203**, in this way, after one of the engagement portions is capable of rotating in synchronization with the front body **101** of the drill chuck, and the other engagement portion is capable of rotating in synchronization with the rear body **100** of the drill chuck, the engagement or disengagement between the front body **101** and the rear body **100** can be realized just by rotating the rotating portion **203**, thus when the front body **101** and the rear body **100** are in an engagement state, it is advantageous to ensure the mounting stability of the drilling tool on the drill chuck if the drill chuck suddenly starts in a vibration working state or in an idling state, and avoid occurrence of loosening or detachment, in addition, bidirectional rotation of the drill chuck is also realized through the engagement between the front body **101** and the rear body **100**, so as to drive the drilling tool to perform bidirectional operation.

(59) Optionally, the clutch device further includes a trigger, and the rotation of the rotating portion **203** can enable the trigger to push one of the engagement portions to move, so that the return elastic member **216** can be compressed or return to the initial position.

(60) For example, when the clutch device is connected to the front body **101** and the rear body **100** of the drill chuck, the rotation of the rotating portion **203** can make the return elastic member **216**

to be compressed or reset; and when the return elastic member **216** is compressed, the two oppositely arranged engagement portions can be disengaged from each other, and when the compressed return elastic member **216** returns to the initial position, the engagement between the two oppositely arranged engagement portions can be realized.

(61) Optionally, the return elastic member **216** is located outside one of the engagement portions, and inner sides of the two engagement portions are opposite to each other. The tooth structure is located inside the engagement portions. The first engagement portion **201** and the second engagement portion **202** may be both of a sheet structure.

(62) This embodiment further provides a bidirectional rotation method of a drill chuck, wherein the drill chuck includes a rear body **100**, a front body **101**, and clamping jaws **102**, the method includes: making the rear body **100** to rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move; providing a clutch device between the rear body **100** and the front body **101**, so as to make the rear body **100** engaged with or disengaged from the front body **101**, wherein the clutch device includes a return elastic member **216**, a transmission assembly, and a rotating portion **203**; the transmission assembly includes at least two oppositely arranged engagement portions, wherein one engagement portion can rotate in synchronization with the front body **101** of the drill chuck, and the other engagement portion can rotate in synchronization with the rear body **100** of the drill chuck; the engagement between the two engagement portions can enable the front body **101** and the rear body **100** to rotate in synchronization with each other; rotation of the rotating portion **203** in a first direction can enable the return elastic member **216** to be compressed, so as to make the two engagement portions disengaged from each other; rotation of the rotating portion **203** in the second direction can enable the compressed return elastic member **216** to return to the initial position, so as to make the two engagement portions engaged with each other.

(63) In an embodiment, the return elastic member **216** is located outside the second engagement portion **202**, and the second engagement portion **202** is located between the return elastic member **216** and the first engagement portion **201**, and the rear sleeve **121** is further configured to limit the return elastic member **216** so as to realize that the return elastic member **216** can be compressed or return to the initial position.

(64) Optionally, when the return elastic member **216** is located outside the second engagement portion **202**, the first engagement portion **201** and the front body **101** are fixedly connected with each other via screws **111**, the second engagement portion **202** can move along an axial direction of the rear body **100**, a rear end **116** of the rear body **100** is circumferentially provided with a strip-shaped groove **133** extending along an axial direction of the rear end, the second engagement portion **202** is sleeved over the rear end **116** of the rear body **100**, an inner wall of an axial hole of the second engagement portion **202** is provided with positioning keys **134** cooperating with the strip-shaped groove **133** on the rear body **100**, and the positioning keys **134** and the hole wall of the axial hole are of an integral structure, thus realizing that the rear body **100** and the second engagement portion **202** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction. The rear sleeve **121** is further configured to limit the return elastic member **216**. By limiting the return elastic member **216** with the rear sleeve **121**, two objectives may be achieved, wherein the first objective is to enable the return elastic member **216** to be compressed; and the second objective is to enable the second engagement portion **202** to move in the direction towards the first engagement portion **201**, when the compressed return elastic member **216** returns to the initial position, so as to achieve the objective of engaging the second engagement portion **202** with the first engagement portion **201**. It should be noted that the rear body **100** and the second engagement portion **202** may also be connected through a special-shaped hole structure, so as to realize that the rear body **100** and the second engagement portion **202** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction, wherein the special-shaped hole may be a waist round hole, a square hole, etc.

(65) Referring to what is shown in FIG. **1** to FIG. **11**, and FIG. **48**, in this embodiment, the trigger includes levers **208**; the rotation of the rotating portion **203** in the first direction can enable the levers **208** to pry the second engagement portion **202** so as to make the second engagement portion move along the axial direction of the rear body **100** (i.e., the levers **208** cause the second engagement portion **202** to move in a direction away from the first engagement portion **201**), so that the first engagement portion **201** and the second engagement portion **202** are disengaged from each other. The rotation of the rotating portion **203** in the second direction can enable the return elastic member **216** to return to the initial position, and enable the second engagement portion **202** to move in a direction close to the first engagement portion **201**, so as to make the first engagement portion **201** and the second engagement portion **202** engaged with each other.
(66) Optionally, the trigger further includes connecting rods **205** fixed on the rotating portion **203**, the connecting rods **205** extend along the axial direction of the rotating portion **203**, and the connecting rods **205** are each provided with a contact **204**; each lever **208** includes a first raised portion **220** and a second raised portion **221** connected to the first raised portion **220**, and the first raised portion **220** and the second raised portion **221** are arranged with an angle therebetween.
(67) For example, the angle formed between the first raised portion **220** and the second raised portion **221** is greater than 90 degrees, and the angle may be 120-170 degrees, etc., for example, the degree may be 150 degrees or 160 degrees. The each lever **208** further includes a rotation convex strip **209**, and the rotation convex strip **209** is located substantially at a junction between the first raised portion **220** and the second raised portion **221**; the rotation convex strip **209** contacts a surface of the rear end **116** of the front body **101**, and the number of levers **208** is three. The number of connecting rods **205** is three. The contact **204** has a triangular structure **308**, and an apex angle of the triangular structure **308** abuts against the first raised portion **220** or the second raised portion **221**. The rotation convex strip **209** may be a cylindrical structure at least having an arc surface. When the rotating portion **203** rotates in the first direction, the apex angle of the triangular structure on the contact **204** moves from the first raised portion **220** to the second raised portion **221**, wherein due to the action of the arc surface of the rotation convex strip **209**, the first raised portion **220** and the second raised portion **221** may rotate around the rotation convex strip **209**, in this way, it may be realized that the second engagement portion **202** moves along the axial direction of the rear body **100**, so that the first engagement portion **201** and the second engagement portion **202** are disengaged from each other.
(68) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, to make the rear body **100** drive the clamping jaws **102** to move, so as to clamp and loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in a circumferential direction, with an accommodating groove **222** for limiting the connecting rod **205**, and the accommodating groove **222** has a groove width greater than the width of the connecting rod **205**, then it may be realized that the connecting rod **205** rotates by a certain angle with the rotating portion **203**, so as to achieve the purpose of making the first engagement portion **201** disengaged from or engaged with the second engagement portion **202**. In order to facilitate rotation of the rotating portion **203** in the second direction after realizing the disengagement of the first engagement portion **201** and the second engagement portion **202** from each other through the rotation of the rotating portion **203** in the first direction, a spring groove **223** may be provided in one accommodating groove **222**, a return spring **118** is installed in the spring groove **223**, and one end of the return spring **118** abuts against one end of the spring groove **223** in a length direction, the other end of the return spring **118** abuts against the connecting rod **205**, and an extending direction of the return spring **118** is perpendicular to a length direction of the accommodating groove **222**; and the length direction of the accommodating groove

**222** is parallel to the axial direction of the front body **101**. The rotating portion **203** is of a sleeve-shaped structure, and the sleeve-shaped structure is sleeved on the front body **101**, and the sleeve-shaped structure is limited by a shaft shoulder **224** on the front body **101**, so as to avoid the sleeve-shaped structure from detaching from the front body **101**. The rear end **116** of the rear body **100** passes through the first engagement portion **201**, and the rear body **100** and the first engagement portion are arranged with a gap therebetween. After the rear end **116** of the rear body **100** passes through the first engagement portion **201**, the rear end **116** of the rear body **100** is connected to the second engagement portion **202**, so as to realize that the rear body **100** and the second engagement portion **202** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction; after passing through the second engagement portion **202**, the rear end **116** of the rear body **100** is fixedly connected to the rear sleeve **121**. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the first engagement portion **201**. An end surface of the rear end **116** of the front body **101** is further provided with a rotation groove **210** for allowing the rotation convex strip **209** to be located therein.

(69) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure allowing the rear body **100** of the self-tightening drill chuck to drive the clamping jaws **102** to move and the installation of the clamping jaws **102** on the front body **101** are prior art, and are not described in detail in this embodiment.

(70) Referring to what is shown in FIG. **12** to FIG. **19**, in this embodiment, the trigger includes levers **208**; the rotation of the rotating portion **203** in the first direction can enable the levers **208** to pry the second engagement portion **202** so as to make the second engagement portion move along the axial direction of the rear body **100** (i.e., the levers **208** cause the second engagement portion **202** to move in a direction away from the first engagement portion **201**), so that the first engagement portion **201** and the second engagement portion **202** are disengaged from each other. The rotation of the rotating portion **203** in the second direction can enable the return elastic member **216** to return to an initial position, and enable the second engagement portion **202** to move in a direction close to the first engagement portion **201**, so as to make the first engagement portion **201** and the second engagement portion **202** engaged with each other.

(71) Optionally, the levers **208** are rotatably mounted in the circumferential direction of the first engagement portion **201** through the pin shafts **225**; the rotating portion **203** is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with protruding blocks **231** configured to push the levers **208** to rotate around the respective pin shafts **225**.

(72) For example, the first engagement portion **201** is provided with a plurality of avoiding grooves **226** in the circumferential direction thereof, the pin shafts **225** are located on groove walls of the respective avoiding grooves **226**, and an axial direction of each pin shaft **225** may be parallel to a radial direction of the rotating portion **203**. Each level **208** is provided with a pin hole **227** for allowing the corresponding pin shaft **225** to pass therethrough. The lever **208** includes a main body portion **228** and an additional portion **229**, and the pin hole **227** is located in the main body portion **228**. The additional portion **229** is configured to contact the second engagement portion **202** so as to pry the second engagement portion **202** so as to make the second engagement portion move. When the rotating portion **203** rotates in a direction that the first engagement portion **201** is disengaged from the second engagement portion **202**, the rotating portion **203** applies a force to the main body portion **228** of each lever **208**, the lever **208** rotates around the pin shaft **225**, and an edge of the additional portion **229** abuts against the second engagement portion **202** so as to

achieve the purpose of prying the second engagement portion **202**; when the rotating portion **203** rotates in a direction of realizing engagement of the first engagement portion **201** and the second engagement portion **202** with each other, the second engagement portion **202** is forced to move in the direction in which the first engagement portion **201** is located due to the action of the return elastic member **216**, and the second engagement portion **202** applies a force to the additional portion **229**, so that the lever **208** is rotated again so that the lever **208** returns to the initial position. The number of avoiding grooves **226**, the number of levers **208**, and the number of protruding blocks **231** are equal to each other, and all of them may be three.

(73) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move, so as to clamp or loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in a circumferential direction, with accommodating grooves **222** for accommodating the levers **208** and the protruding blocks **231**, and the accommodating grooves **222** each should have a width greater than a sum of a width of the main body portion **228** of the lever **208** and a width of the protruding block **231**, in this way, when the rotating portion **203** rotates, the lever **208** can be enabled to rotate in the accommodating groove **222**, so as to achieve the purpose of making the first engagement portion **201** disengaged from or engaged with the second engagement portion **202**. The rotating portion **203** is of a sleeve-shaped structure, and the sleeve-shaped structure is sleeved on the front body **101**, and the sleeve-shaped structure is limited by a shaft shoulder **224** on the front body **101**, so as to avoid the sleeve-shaped structure from detaching from the front body **101**. The rear end **116** of the rear body **100** passes through the first engagement portion **201**, and the rear body **100** and the first engagement portion are arranged with a gap therebetween. After the rear end **116** of the rear body **100** passes through the first engagement portion **201**, the rear end **116** of the rear body **100** is connected to the second engagement portion **202**, so as to realize that the rear body **100** and the second engagement portion **202** are relatively fixed to each other in the circumferential direction and can be displaced in the axial direction; after passing through the second engagement portion **202**, the rear end **116** of the rear body **100** is fixedly connected to the rear sleeve **121**. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the first engagement portion **201**.

(74) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure in which the rear body **100** of the self-tightening drill chuck drives the clamping jaws **102** to move and the installation of the clamping jaws **102** on the front body **101** are prior art, and are not described in detail in this embodiment.

(75) Referring to what is shown in FIG. **20** to FIG. **27**, in this embodiment, the trigger includes levers **208**; the rotation of the rotating portion **203** in the first direction can enable the levers **208** to pry the second engagement portion **202** so as to make the second engagement portion move along the axial direction of the rear body **100** (i.e., the levers **208** causes the second engagement portion **202** to move in a direction away from the first engagement portion **201**), so that the first engagement portion **201** and the second engagement portion **202** are disengaged from each other. The rotation of the rotating portion **203** in the second direction can enable the return elastic member **216** to return to an initial position, and enable the second engagement portion **202** to move

in a direction close to the first engagement portion **201**, so as to make the first engagement portion **201** and the second engagement portion **202** engaged with each other. The rotating portion **203** is of a sleeve-shaped structure.

(76) Optionally, the first engagement portion **201** is provided with positioning holes **234**, and each lever **208** includes an insertion portion **232** and a prying portion **233**; a length extending direction of the insertion portion **232** and a length extending direction of the prying portion **233** have an angle therebetween, the insertion portion **232** is inserted into the corresponding positioning hole **234**, the rotating portion **203** is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with the protruding blocks **231** configured to push the corresponding insertion portion **232** to sway in the corresponding positioning hole **234**, so as to enable the prying portion **233** to move.

(77) For example, the positioning hole **234** may be a rectangular hole, and after the insertion portion **232** is inserted into the rectangular hole, the insertion portion **232** and the rectangular hole are in clearance fit with each other, so that the insertion portion **232** can sway in the rectangular hole. The number of positioning holes **234** and the number of levers **208** may be both plural, for example, three, so that the movement of the second engagement portion **202** may be stable. When the rotating portion **203** rotates in a direction of realizing disengagement of the first engagement portion **201** and the second engagement portion **202** from each other, the rotating portion **203** applies a force to the insertion portion **232** of the lever **208**, so that an end portion of the prying portion **233** is lifted so as to abut against the second engagement portion **202**, thus achieving the purpose of prying the second engagement portion **202**; when the rotating portion **203** rotates in a direction of realizing engagement of the first engagement portion **201** and the second engagement portion **202** with each other, the second engagement portion **202** is forced due to the action of the return elastic member **216** to move in the direction in which the first engagement portion **201** is located, and the second engagement portion **202** applies a force to the prying portion **233**, so that the lever **208** returns to the initial position.

(78) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move, so as to clamp or loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in a circumferential direction, with accommodating grooves **222** for accommodating the protruding blocks **231**, and the accommodating grooves **222** each should have a width greater than a width of the protruding block **231**, in this way, when the rotating portion **203** rotates, the protruding block **231** can be enabled to move in the accommodating groove **222**, so as to achieve the purpose of disengaging or engaging the first engagement portion **201** and the second engagement portion **202**. The rotating portion **203** is of a sleeve-shaped structure, and the sleeve-shaped structure is sleeved on the front body **101**, and the sleeve-shaped structure is limited by a shaft shoulder **224** on the front body **101**, avoiding the sleeve-shaped structure from detaching from the front body **101**. The rear end **116** of the rear body **100** passes through the first engagement portion **201**, and the rear body **100** and the first engagement portion are arranged with a gap therebetween. After the rear end **116** of the rear body **100** passes through the first engagement portion **201**, the rear end **116** of the rear body **100** is connected to the second engagement portion **202**, so as to realize that the rear body **100** and the second engagement portion **202** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction; after passing through the second engagement portion **202**, the rear end **116** of the rear body **100** is fixedly connected to the rear sleeve **121**. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the first

engagement portion **201**.
(79) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure in which the rear body **100** of the self-tightening drill chuck drives the clamping jaws **102** to move and the installation of the clamping jaw **102** on the front body **101** are prior art, and are not described in detail in this embodiment.
(80) Referring to what is shown in FIG. **28** to FIG. **31**, in this embodiment, the return elastic member **216** is located outside the first engagement portion **216**, and the first engagement portion **201** is located between the return elastic member **216** and the second engagement portion **202**. The clutch device further includes an end cap **126**, and compression or returning of the return elastic member **216** is realized through the rotating portion **203**. When the return elastic member **216** is located outside the first engagement portion **201**, the first engagement portion **201** can move along the axial direction of the front body **101**, and the second engagement portion **202** is fixedly connected to the rear body **100**; as the front body and the rear body are coaxially provided, the axial movement of the first engagement portion along the front body is equivalent to the axial movement of the first engagement portion along the rear body.
(81) For example, the end cap **126** includes a disc portion **301** and an axial convex portion **302** connected to the disc portion **301**; the disc portion **301** is fixedly connected to the front body **101** via screws **111**; and the end cap **126** is provided with an axial hole for the rear end **116** of the rear body **100** to pass therethrough. The return elastic member **216** is sleeved outside the axial convex portion **302** of the end cap **126**, and an outer circumferential surface of the axial convex portion **302** is provided with a plurality of strip-shape grooves **133** extending along an axial direction of the axial convex portion **302**, an inner wall of an axial hole of the first engagement portion **201** is provided with positioning keys **134** cooperating with the respective strip-shaped grooves **133** on the axial convex portion **302**, and the positioning keys **134** and the hole wall of the axial hole of the first engagement portion **201** are of an integral structure, thus, it is realized that the axial convex portion **302** and the first engagement portion **201** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction. The rear sleeve includes a sleeve body **309** and a sleeve cover, the sleeve cover and the sleeve body can be fixedly connected to each other by means of an interference fit, the second engagement portion **202** and the sleeve cover of the rear sleeve **121** are of an integral structure, the rear end **116** of the rear body **100**, after passing through the axial hole of the axial convex portion **302**, is inserted into the axial hole of the second engagement portion **202**, and the rear end **116** of the rear body **100** and the second engagement portion **202** are fixedly connected to each other by interference fit, key connection, or pin connection. The return elastic member **216** is located between the disc portion **301** of the end cap **126** and the first engagement portion **201**.
(82) In this embodiment, the trigger includes levers **208**; the rotation of the rotating portion **203** in the first direction can enable the levers **208** to pry the first engagement portion **201** so as to make the first engagement portion move along the axial direction of the front body **101** (i.e., the levers **208** cause the first engagement portion **201** to move in a direction away from the second engagement portion **202**, that is, making the first engagement portion move in a direction close to the rear end of the front body), so that the first engagement portion **201** and the second engagement portion **202** are disengaged from each other. The rotation of the rotating portion **203** in the second direction can enable the return elastic member **216** to return to the initial position, and enable the first engagement portion **201** to move in a direction close to the second engagement portion **202**, so as to make the first engagement portion **201** and the second engagement portion **202** engaged with

each other. The rotating portion **203** is of a sleeve-shaped structure.

(83) Optionally, the first engagement portion **201** is provided with positioning holes **234**, and each lever **208** includes an insertion portion **232** and a prying portion **233**; a length extending direction of the insertion portion **232** and a length extending direction of the prying portion **233** have an angle therebetween, the insertion portion **232** is inserted into the corresponding positioning hole **234**, the rotating portion **203** is of a sleeve-shaped structure, and an inner surface of the sleeve-shaped structure is provided with the protruding blocks **231** configured to push the respective insertion portions **232** to sway in the respective positioning holes **234**, so as to enable the prying portion **233** to move.

(84) For example, each positioning hole **234** may be a rectangular hole, and after the insertion portion **232** is inserted into the rectangular hole, the insertion portion **232** and the rectangular hole are in clearance fit with each other, so that the insertion portion **232** can sway in the rectangular hole. The number of positioning holes **234** and the number of levers **208** may be both plural, for example 3, so that the movement of the first engagement portion **201** may be stable. When the rotating portion **203** rotates in a direction of realizing disengagement of the first engagement portion **201** and the second engagement portion **202** from each other, the rotating portion **203** applies a force to the insertion portion **232** of the lever **208**, so that one end of the prying portion **233** abuts against a surface of the second engagement portion **202**, the other end of the prying portion **233** abuts against a surface of the first engagement portion **201**. As the second engagement portion **202** is fixedly connected to the rear body **100**, and relative axial displacement can occur between the first engagement portion **201** and the front body, the first engagement portion is enabled to move in the direction towards the rear end of the front body since the second engagement portion **202** is stationary and the first engagement portion **201** is pressed against the first engagement portion **201** under the action of the other end of the prying portion **233**; when the rotating portion **203** rotates in a direction of realizing engagement between the first engagement portion **201** and the second engagement portion **202**, the first engagement portion **201** is forced due to the action of the return elastic member **216** to move in the direction in which the second engagement portion **202** is located, and the first engagement portion **201** applies a force to the prying portion **233**, so as to make the lever **208** return to the initial position.

(85) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move, so as to clamp or loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in a circumferential direction, with accommodating grooves **222** for accommodating the protruding blocks **231**, and each accommodating groove **222** should have a width greater than a sum of a width of the protruding block **231** and a width of the insertion portion, in this way, when the rotating portion **203** rotates, each protruding block **231** can be enabled to move in the corresponding accommodating groove **222** and the insertion portion is made to sway in the corresponding accommodating groove, so as to achieve the purpose of disengaging or engaging the first engagement portion **201** and the second engagement portion **202**. The rotating portion **203** is of a sleeve-shaped structure, and the sleeve-shaped structure is sleeved over the front body **101**, and the sleeve-shaped structure is limited by a shaft shoulder **224** on the front body **101**, avoiding the sleeve-shaped structure from detaching from the front body **101**. The rear end **116** of the rear body **100** passes through an axial hole of an axial convex portion **302** of an end cap **126**, and the rear body **100** and the axial convex portion **302** are arranged with a gap therebetween. After the rear end **116** of the rear body **100** passes through the axial hole of the axial convex portion **302** of the end cap **126**, the rear end **116** of the rear body **100** is connected to the second engagement portion **202**, so as to realize that the rear body **100** and the second engagement

portion **202** can be fixedly connected to each other. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the axial hole of the axial convex portion **302**, and relative axial displacement substantially will not occur between the rear body **100** and the front body **101**. The disc portion **301** of the end cap **126** is provided, in a circumferential direction, with a plurality of avoiding grooves **226** for avoiding the insertion portions of the levers, and a width of each avoiding groove **226** is substantially equal to a width of the accommodating groove **222**, thus the swaying of the insertion portion is not affected.

(86) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck, and in this embodiment, the self-tightening drill chuck being a gear self-tightening drill chuck is taken as an example. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure in which the rear body **100** of the self-tightening drill chuck drives the clamping jaws **102** to move and the installation of the clamping jaws **102** on the front body **101** are prior art, and are not described in detail in this embodiment.

(87) Referring to what is shown in FIG. **32** to FIG. **38**, in this embodiment, the return elastic member **216** is located outside the first engagement portion **216**, and the first engagement portion **201** is located between the return elastic member **216** and the second engagement portion **202**. The clutch device further includes an end cap **126**, and compression or returning of the return elastic member **216** is realized through the rotating portion **203**. When the return elastic member **216** is located outside the first engagement portion **201**, the first engagement portion **201** can move along the axial direction of the front body **101**, and the second engagement portion **202** is fixedly connected to the rear body **100**.

(88) For example, the end cap **126** includes a disc portion **301** and an axial convex portion **302** connected to the disc portion **301**; the disc portion **301** is fixedly connected to the front body **101** via screws **111**; and the end cap **126** is provided with an axial hole for the rear end **116** of the rear body **100** to pass therethrough. The return elastic member **216** is sleeved outside the axial convex portion **302** of the end cap **126**, and an outer circumferential surface of the axial convex portion **302** is provided with a plurality of strip-shape grooves **133** extending along an axial direction of the axial convex portion **302**, an inner wall of an axial hole of the first engagement portion **201** is provided with positioning keys **134** cooperating with the strip-shaped grooves **133** on the axial convex portion **302**, and the positioning keys **134** and the hole wall of the axial hole of the first engagement portion **201** are of an integral structure, thus, it is realized that the axial convex portion **302** and the first engagement portion **201** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction. The rear sleeve includes a sleeve body **309** and a sleeve cover, the sleeve cover and the sleeve body can be fixedly connected to each other by means of an interference fit, the second engagement portion **202** and the sleeve cover of the rear sleeve **121** are of an integral structure, the rear end **116** of the rear body **100**, after passing through the axial hole of the axial convex portion **302**, is inserted into the axial hole of the second engagement portion **202**, and the rear end **116** of the rear body **100** and the second engagement portion **202** are fixedly connected to each other by interference fit, key connection, pin connection. The return elastic member **216** is located between the disc portion **301** of the end cap **126** and the first engagement portion **201**.

(89) Optionally, the trigger includes connecting rods **205** fixed on the rotating portion **203**, and each connecting rod **205** extends along the axial direction of the rotating portion **203**, and the each connecting rod **205** is provided with a contact **204**; contact sockets **235** are provided in a surface of

the first engagement portion **201**; and each contact **204** can enter or leave the corresponding contact socket **235** along with the rotation of the rotating portion **203**.

(90) For example, the rotating portion **203** is of a sleeve-shaped structure, and an extending direction of the connecting rod **205** is parallel to an axial direction of the sleeve-shaped structure. One end of each connecting rod **205** is connected to the sleeve-shaped structure, and the other end of the each connecting rod **205** is provided with the contact **204**, and the contact **204** at least has a first arc surface **236**; and the contact pocket **235** is located on an inner side surface **132** of the first engagement portion **201**. The contact socket **235** has a second arc surface matching the first arc surface **236** on the contact **204**, that is, a bottom of the contact socket **235** is of an arc surface structure. When the rotating portion **203** rotates in a direction of realizing disengagement of the first engagement portion **201** and the second engagement portion **202** from each other, the connecting rod **205** rotates with the rotating portion **203**, and the contact **204** on the connecting rod **205** leaves the contact socket **235**, then the contact **204** abuts against the inner side surface **132** of the first engagement portion **201**, in this way, the contacts **204** can enable the first engagement portion **201** to move, and the first engagement portion **201** compresses the return elastic member **216** again, so as to achieve the purpose that the first engagement portion **201** is disengaged from the second engagement portion **202**; when the rotating portion **203** rotates in a direction of realizing engagement between the first engagement portion **201** and the second engagement portion **202**, the connecting rods **205** rotates with the rotating portion **203**, the contacts **204** on the connecting rods **205** then enter the respective contact sockets **235**, and the return elastic member **216** can enable the first engagement portion **201** to move in a direction in which the second engagement portion **202** is located, so as to achieve the purpose of engaging the second engagement portion **202** with the first engagement portion **201**.

(91) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move, so as to clamp or loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in a circumferential direction, with a plurality of accommodating grooves **222** for limiting the connecting rods **205**, and the accommodating grooves **222** each should have a width greater than that of the connecting rod **205**, in this way, when the rotating portion **203** rotates, the connecting rod **205** can have a rotation angle in the corresponding accommodating groove **222**, so as to achieve the purpose of disengaging or engaging the first engagement portion **201** and the second engagement portion **202**. The rotating portion **203** is sleeved over the front body **101**, and the sleeve-shaped structure is limited by a shaft shoulder **224** on the front body **101**, avoiding the sleeve-shaped structure from detaching from the front body **101**. The rear end **116** of the rear body **100** passes through the first engagement portion **201**, and the rear body **100** and the first engagement portion are arranged with a gap therebetween, so as to ensure that the rear body **100** can rotate relative to the first engagement portion **201**. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the first engagement portion **201**.

(92) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure in which the rear body **100** of the self-

tightening drill chuck drives the clamping jaws **102** to move and the installation of the clamping jaw **102** on the front body **101** are prior art, and are not described in detail in this embodiment.

(93) Referring to what is shown in FIG. **39** to FIG. **47**, in this embodiment, the return elastic member **216** is located outside the first engagement portion **216**, and the first engagement portion **201** is located between the return elastic member **216** and the second engagement portion **202**. The clutch device further includes an end cap **126**, and compression or returning of the return elastic member **216** is realized through the rotating portion **203**. When the return elastic member **216** is located outside the first engagement portion **201**, the first engagement portion **201** can move along the axial direction of the front body **101**, and the second engagement portion **202** is fixedly connected to the rear body **100**

(94) For example, the end cap **126** includes a disc portion **301** and an axial convex portion **302** connected to the disc portion **301**; the disc portion **301** is fixedly connected to the front body **101** via screws **111**; and the end cap **126** is provided with an axial hole for the rear end **116** of the rear body **100** to pass therethrough. The return elastic member **216** is sleeved outside the axial convex portion **302** of the end cap **126**, and an outer circumferential surface of the axial convex portion **302** is provided with a plurality of strip-shape grooves **133** extending along an axial direction of the axial convex portion **302**, an inner wall of an axial hole of the first engagement portion **201** is provided with positioning keys **134** cooperating with the strip-shaped grooves **133** on the axial convex portion **302**, and each positioning key **134** and the hole wall of the axial hole of the first engagement portion **201** are of an integral structure, thus it is realized that the axial convex portion **302** and the first engagement portion **201** are relatively fixed to each other in the circumferential direction, and can be displaced in the axial direction. The rear sleeve includes a sleeve body **309** and a sleeve cover, the sleeve cover and the sleeve body can be fixedly connected to each other by means of an interference fit, the second engagement portion **202** and the sleeve cover of the rear sleeve **121** are of an integral structure, the rear end **116** of the rear body **100** is inserted, after passing through the axial hole of the axial convex portion **302**, into the axial hole of the second engagement portion **202**, and the rear end **116** of the rear body **100** and the second engagement portion **202** are fixedly connected to each other by interference fit, key connection, or pin connection. The return elastic member **216** is located between the disc portion **301** of the end cap **126** and the first engagement portion **201**. The rear body **100** has the shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the end cap **126**.

(95) Optionally, the trigger includes a follower portion **310** and connecting rods **205** fixed on the follower portion **310**, each connecting rod **205** extends along the axial direction of the follower portion **310**, and the each connecting rod **205** is provided with a contact **204**; the follower portion **310** and the rotating portion **203** are in threaded transmission with each other; connecting rod guide grooves are provided in the circumferential direction of the front body **101** for enabling the connecting rods **205** to move along the length extending direction of the connecting rod guide groove.

(96) For example, the rotating portion **203** is of a sleeve-shaped structure, and an extending direction of each connecting rod **205** is parallel to an axial direction of the sleeve-shaped structure. The follower portion **310** is of a sleeve-shape. The inner wall of the axial hole of the rotating portion **203** has an internal thread **303**, and an outer surface of the follower portion **310** has an external thread **304** matching the internal thread on the rotating portion **203**. When the rotating portion **203** rotates in a direction of realizing disengagement of the first engagement portion **201** and the second engagement portion **202** from each other, the rotating portion **203** and the follower portion **310** are in threaded transmission with each other, the contact **204** on each connecting rod **205** of the follower portion **310** applies a force to the first engagement portion **201**, so that the first engagement portion **201** compresses the return elastic member **210**, so as to achieve the purpose of disengaging the first engagement portion **201** and the second engagement portion **202** from each

other; when the rotating portion **203** rotates in the direction of realizing engagement between the first engagement portion **201** and the second engagement portion **202**, the return elastic member **216** enables the first engagement portion **201** to move in the direction in which the second engagement portion **202** is located, so as to achieve the purpose of engaging the second engagement portion **202** and the first engagement portion **201** with each other.

(97) The present embodiment further provides a drill chuck, which includes a front body **101**, a rear body **100**, clamping jaws **102**, and the clutch device in this embodiment; the rear body **100** can rotate relative to the front body **101**, so that the rear body **100** can drive the clamping jaws **102** to move, so as to clamp or loosen the drilling tool mounted on the drill chuck; the first engagement portion **201** is connected to the front body **101**, and the second engagement portion **202** is connected to the rear body **100**. The drilling tool may be a drill bit, a honing head, a boring head, or the like. The front body **101** is provided, in the circumferential direction, with a plurality of accommodating grooves **222** for limiting the connecting rods **205**, so that the follower portion **310** moves along the axial direction of the front body **101**, in this way, when the rotating portion **203** rotates, the follower portion **310** moves along the axial direction of the front body **101**, and the contacts **204** on the follower part **310** can compress or release the return elastic member **216**, so as to achieve the purpose of disengaging or engaging the first engagement portion **201** and the second engagement portion **202**. The rotating portion **203** is sleeved over the front body **101**, the front end **115** of the front body **101** is fixed with a fixing sleeve **305**, a surface of the fixing sleeve **305** facing a rear end **116** of the front body **101** is provided with a first arc protrusion **306**, and a second arc protrusion **307** matching the first arc protrusion **306** is provided on an inner wall of an axial hole of the rotating portion **203**, so as to limit the rotation angle of the rotating portion **203**, that is, making the rotation angle of the rotating portion **203** within a set range. The fixing sleeve **305** and the front end **115** of the front body **101** may be fixedly connected to each other by means of an interference fit or screws **111**, and the fixing sleeve **305** may also be used to prevent the rotating portion **203** from leaving the front end **115** of the front body **101**. When the rotating portion **203** rotates a certain rotation angle in the first direction, one end of the second arc protrusion **307** is stopped by one end of the first arc protrusion **306**; when the rotating portion **203** rotates a certain rotation angle in the second direction, the other end of the second arc protrusion **307** is stopped by the other end of the first arc protrusion **306**. The rear end **116** of the rear body **100** passes through the first engagement portion **201**, and the rear body **100** and the first engagement portion are arranged with a gap therebetween, so as to ensure that the rear body **100** can rotate relative to the first engagement portion **201**; the rear body **100** has a shaft shoulder **224** configured in such a manner that the rear body **100** will not leave the front body **101** after the rear end **116** of the rear body **100** passes through the first engagement portion **201**.

(98) For example, the drill chuck may be a self-tightening drill chuck, and the self-tightening drill chuck may be a gear self-tightening drill chuck, a flat jaw self-tightening drill chuck or an internal thread self-tightening drill chuck. When the first engagement portion **201** and the second engagement portion **202** are disengaged from each other, the forward rotation of the rear body **100** may realize the clamping of the drilling tool by the clamping jaws **102**, and the reverse rotation of the rear body **100** may realize the loosening of the drilling tool from the clamping jaws **102**. It should be noted that in this embodiment, the structure in which the rear body **100** of the self-tightening drill chuck drives the clamping jaw **102** to move and the installation of the clamping jaws **102** on the front body **101** are prior art, and are not described in detail in this embodiment.

(99) An embodiment of the present disclosure provides a power tool, which includes a driving shaft and a drill chuck, and the drill chuck may be the drill chuck provided in the above embodiments; and the driving shaft is connected to the rear body **100** for driving the rear body **100** to rotate. The rear body **100** also has an axial threaded hole or a tapered hole for connection with the driving shaft.

(100) Finally, it should be indicated that the various embodiments above are merely used for

illustrating the technical solutions of the present disclosure, rather than limiting the present disclosure. While the detailed description is made to the present disclosure with reference to the various preceding embodiments, those ordinarily skilled in the art should understand that they still could modify the technical solutions recited in the various preceding embodiments, or make equivalent substitutions to some or all of the technical features therein. These modifications or substitutions do not make the essence of the corresponding technical solutions depart from the scope of the technical solutions of the various embodiments of the present disclosure. In the description provided herein, numerous specific details are described.

INDUSTRIAL APPLICABILITY

(101) The clutch device, the drill chuck, the power tool, and the bidirectional rotation method of the drill chuck provided in the present disclosure advantageously ensure the drilling tool on the drill chuck to have mounting stability, avoid the occurrence of loosening or detachment, and also realize the bidirectional rotation of the drill chuck, so as to drive the drilling tool to perform bidirectional operation, and may allow more reliable, easy, simple, and convenient replacement of the drilling tool.

## Claims

1. A clutch device, comprising a return elastic member, a transmission assembly, a rotating portion, and a trigger, wherein the transmission assembly comprises a first engagement portion and a second engagement portion which are oppositely arranged; one of the first engagement portion and the second engagement portion is configured to be rotatable in synchronization with a front body of a drill clutch; and the other one of the first engagement portion and the second engagement portion is configured to be rotatable in synchronization with a rear body of the drill clutch; an engagement between the first engagement portion and the second engagement portion enables the front body and the rear body to rotate in synchronization with each other; wherein rotation of the rotating portion enables the trigger to push the one of the first engagement portion and the second engagement portion to move so as to make the return elastic member compressed or return to an initial position, rotation of the rotating portion in a first direction enables the return elastic member to be compressed, so as to make the first engagement portion and the second engagement portions disengaged from each other; and rotation of the rotating portion in a second direction enables the compressed return elastic member to return to the initial position so as to make the first engagement portion and the second engagement portion engaged with each other; wherein the trigger comprises levers and rotation of the rotating portion in the first direction enables the levers to pry the second engagement portion so as to make the second engagement portion move along the axial direction of the rear body such that the first engagement portion move along the axial direction of the rear body such that the first engagement portion and the second engagement portion are disengaged from each other; wherein the trigger comprises a plurality of connecting rods fixed on the rotating portion and extending along an axial direction of the rotating portion, each connecting rod having a contact and a side surface exposed to an outside of the rotating portion; and wherein the levers are separated and disconnected from each other, each lever having a first raised portion and a second raised portion connected to the first raised portion, where the first raised portion and the second raised portion are arranged with an angle therebetween.

2. The clutch device according to claim 1, wherein the engagement or the disengagement of the two engagement portions is realized through a tooth structure, the engagement portions are of a sheet structure, the tooth structure comprises a plurality of teeth provided on a sheet surface of the sheet structure, and the plurality of teeth are distributed in a circular shape on the sheet surface.

3. The clutch device according to claim 2, wherein the clutch device further comprises a rear sleeve, the rear sleeve is configured for being fixed connected with the rear body, and a manner for connection between the rear sleeve and the rear body is interference fit or key connection.

4. The clutch device according to claim 2, further comprising the trigger, wherein rotation of the rotating portion enables the trigger to push one of the engagement portions to move so as to make the return elastic member compressed or return to the initial position.
5. The clutch device according to claim 1, wherein the clutch device further comprises a rear sleeve, the rear sleeve is configured for being fixed connected with the rear body, and a manner for connection between the rear sleeve and the rear body is interference fit or key connection.
6. The clutch device according to claim 1, wherein the return elastic member is located outside one of the first engagement portion and the second engagement portion, and inner sides of the first engagement portion and the second engagement portion are opposite to each other.
7. The clutch device according to claim 1, wherein the return elastic member is located outside the second engagement portion, and the second engagement portion is located between the return elastic member and the first engagement portion; alternatively, the return elastic member is located outside the first engagement portion, and the first engagement portion is located between the return elastic member and the second engagement portion.
8. The clutch device according to claim 7, wherein when the return elastic member is located outside the second engagement portion, the first engagement portion is fixedly connected with the front body, and the second engagement portion is movable along an axial direction of the rear body.