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(54) **HAMMER DRILL**

BOHRHAMMER

MARTEAU PERFORATEUR

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(56) References cited:
**EP-A2- 2 364 817 JP-A- H09 272 005
US-A- 5 588 496 US-A1- 2004 074 653
US-A1- 2008 164 041 US-A1- 2010 270 045**

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a hammer drill according to the preamble of claim 1, and more particularly, to a hammer drill capable of executing a mode change by using a single member.

[0002] Such a hammer drill is known from US 2010/0270045 A1.

Background of the Invention

[0003] Generally, a hammer drill is used to create a hole in a wall surface, or to crush a protruding portion. As the hammer drill, a motor hammer drill using electricity as a main supply source is much used.

[0004] As shown in FIG. 1, the conventional hammer drill 1 includes a shaft 4 gear-coupled to a driving motor to which a power source is supplied, and interworking with the driving motor; a clutch gear 6 installed at the shaft 4, and to which a rotary force of the shaft 4 is transmitted; a hammer driving unit 10 to which a rotary force generated from the clutch gear 6 is transmitted, and configured to hit a bit 60 for converting a rotary motion of the shaft 4 into a linear reciprocation; and a drill driving unit 8 to which the rotary force generated from the clutch gear 6 is transmitted, and configured to rotate the bit 60 by rotation of the shaft 4. The hammer drill 1 also includes a lever 2 configured to change a mode of the hammer drill 1, and configured to couple or separate the hammer driving unit 10 or the drill driving unit 8 to or from the shaft 4.

[0005] The drill driving unit 8 includes a drill gear 7 engaged with the drill driving unit 8, and driven together with the drill driving unit 8 when the drill driving unit 8 is driven. A restoration spring 5 is installed between the drill gear 7 and the shaft 4.

[0006] When the hammer drill 1 is in a hammer mode, the drill driving unit 8 and the drill gear 7 are not driven. In this case, the restoration spring 5 has a degraded durability, since the restoration spring 5 installed at the shaft 4 has friction with the shaft 4 rotating when the hammer drill 1 is in the hammer mode.

[0007] Further, the drill gear 7 is in a fixed state to the drill driving unit 8. When the drill driving unit 8 is driven, the drill gear 7 performs a sliding motion in an engaged state with an output unit (not shown) disposed close to the drill gear 7. This may cause durability of the drill gear 7 to be lowered, since a load of the output unit is applied to the drill gear 7.

[0008] Further, since the drill driving unit 8 and the hammer driving unit 10 are different from each other in configuration, shape, etc., the respective components should be manufactured separately. This may lower productivity.

[0009] Document US2010/0270045 discloses a portable power tool, in particular a boring and/or chisel hammer, with an intermediate flange and gear unit which has switch mounted on the intermediate flange. Furthermore, it discloses that the switch be provided to switch at least three gear stages of the gear unit.

[0010] Document EP2364817 discloses a device that has a shifting device, which comprises a drill sleeve, a flap shift sleeve and a locking element that comprises a locking unit. Also, the shifting device comprises a drill drive element, and the locking unit is engaged in the drill drive element.

SUMMARY OF THE INVENTION

[0011] Therefore, an aspect of the detailed description is to provide a hammer drill having a minimized number of components.

[0012] Another aspect of the detailed description is to provide a hammer drill capable of executing a mode change easily.

[0013] Another aspect of the detailed description is to provide a hammer drill having an enhanced durability by minimizing friction between components.

[0014] To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided a hammer drill according to claim 1, including: a shaft rotatable by a driving force of a driving motor, wherein the hammer drill has a mode conversion among a hammer mode for hitting a bit as a rotary motion of the shaft is converted into a linear reciprocation, a drill mode for rotating the bit by rotation of the shaft, and a hammer drill mode for rotating and hitting the bit, wherein the hammer drill further includes: a conversion lever having a lever pin installed thereat such that one of the hammer mode, the drill mode and the hammer drill mode is selected; a main clutch gear fixed to the shaft; a drill driving unit rotatably installed at the shaft which is at one side of the main clutch gear, coupled to an output end, and having a drill clutch gear on an outer circumferential surface thereof; a hammer clutch gear rotatably installed at the shaft which is at another side of the main clutch gear, and fixed to a hammer driving unit for converting a rotary motion of the shaft into a reciprocation of a hammer; a drill moving gear linearly-moveable between a first position where the drill moving gear is engaged with both the main clutch gear and the drill clutch gear, and a second position where the drill moving gear is not engaged with the main clutch gear; a hammer moving gear linearly-moveable between a third position where the hammer moving gear is engaged with both the main clutch gear and the hammer clutch gear, and a fourth position where the hammer moving gear is not engaged with the main clutch gear; a drill side restoration spring installed between the drill driving unit and the drill moving gear, and configured to restore the drill moving gear to the first position; and a hammer side restoration spring installed be-

tween the hammer driving unit and the hammer moving gear, and configured to restore the hammer moving gear to the third position, wherein the lever pin linearly-moves the hammer moving gear and the drill moving gear by operation of the conversion lever.

[0015] The drill moving gear further comprises:

main clutch gear grooves engaged with a plurality of main clutch gear teeth of the main clutch gear; and drill clutch gear grooves engaged with a plurality of drill clutch gear teeth of the drill clutch gear, wherein the number of the drill clutch gear grooves is smaller than the number of the main clutch gear grooves.

[0016] The drill moving gear may include a first stopper for preventing the main clutch gear teeth from passing through the drill moving gear when the drill moving gear is disposed on the first position.

[0017] The hammer moving gear may include: the main clutch gear grooves engaged with the plurality of main clutch gear teeth of the main clutch gear; and hammer clutch gear grooves engaged with a plurality of hammer clutch gear teeth of the hammer clutch gear, wherein the number of the hammer clutch gear grooves is smaller than the number of the main clutch gear grooves.

[0018] The hammer moving gear may include a second stopper for preventing the main clutch gear teeth from passing through the hammer moving gear when the hammer moving gear is disposed on the third position.

[0019] The drill moving gear and the hammer driving gear may be formed to have the same shape.

[0020] The hammer driving unit may be implemented as a swash bearing.

[0021] The present invention can have the following advantages.

[0022] Firstly, as the hammer moving gear and the drill moving gear of the hammer drill are formed in the same shape, a hammer mode and a drill mode of the hammer drill are convertible by using a single member. With such a configuration, usage of components of the hammer drill can be minimized.

[0023] Further, the drill side restoration spring is installed between the drill driving unit engaged with the drill moving gear, and the drill moving gear. And the hammer side restoration spring is installed between the hammer driving unit engaged with the hammer moving gear, and the hammer moving gear. With such a configuration, the gears can be easily engaged with each other by restoration forces of the springs.

[0024] Further, the drill driving unit is fixed to the shaft, and the drill moving gear is installed to be moveable back and forth. With such a configuration, the drill driving unit is not slid even in a driven state, so that an engaged state between the drill driving unit and an output unit disposed close to the drill driving unit is maintained. As a result, a load of the output unit is not applied to the drill driving unit. This can prevent lowering of durability of the drill driving unit.

[0025] Further, the drill side restoration spring is not elastically transformed even when the hammer driving unit is driven in a hammer mode, because it is not installed at the shaft. Thus, since the drill side restoration spring is not rotated by rotation of the shaft in the hammer mode, friction between the drill side restoration spring and the shaft is prevented. This can prevent lowering of durability of the components.

[0026] Further, since the hammer side restoration spring and the drill side restoration spring are formed in the same shape, time taken to manufacture the hammer drill is reduced. This can enhance working efficiency.

[0027] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the scope of the invention as defined by the claims will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

[0029] In the drawings:

FIG. 1 is a view illustrating a hammer drill in accordance with the conventional art;

FIG. 2 is a perspective view illustrating a hammer drill according to the present invention;

FIG. 3 is a perspective view illustrating a hammer drill module for driving the hammer drill of FIG. 2;

FIG. 4 is an exploded perspective view of FIG. 3;

FIG. 5 is a perspective view illustrating a drill moving gear of FIG. 3;

FIG. 6 is an exemplary view illustrating a first operation of a hammer drill according to the present invention;

FIG. 7 is an exemplary view illustrating a second operation of a hammer drill according to the present invention; and

FIG. 8 is an exemplary view illustrating a third operation of a hammer drill according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0030] Hereinafter, preferred embodiments of a hammer drill according to the present invention will be explained in more detail with reference to FIGS. 2 to 8. The hammer drill will be explained with reference to drawings required to understand the operation of the present in-

vention.

[0031] FIG. 2 is a perspective view illustrating a hammer drill according to the present invention. FIG. 3 is a perspective view illustrating a hammer drill module for driving the hammer drill of FIG. 2. FIG. 4 is an exploded perspective view of FIG. 3. FIG. 5 is a perspective view illustrating a drill moving gear of FIG. 3. FIG. 6 is an exemplary view illustrating a first operation of a hammer drill according to the present invention. FIG. 7 is an exemplary view illustrating a second operation of a hammer drill according to the present invention. FIG. 8 is an exemplary view illustrating a third operation of a hammer drill according to the present invention.

[0032] As shown, the hammer drill 1 according to the present invention includes a body 20 where a hammer drill module 100 is installed, a bit mounting unit 40 configured to insert a bit 60 therein, a handle 80, and a mounting unit having the handle 80 installed thereat and configured to support the body 20 and the handle 80.

[0033] The hammer drill 1 may be operated in a hammer mode for hitting the bit 60, a drill mode for rotating the bit 60, and a hammer drill mode for rotating and hitting the bit 60, according to a usage type. For this, the hammer drill module 100 is installed in the body 20.

[0034] The hammer drill module 100 will be explained in more detail. The hammer drill module 100 includes a shaft 110 which is rotatable by a driving force of a driving motor (not shown) for driving the hammer drill 1; a conversion lever 190 having a lever pin 192 installed thereat such that the hammer mode, the drill mode or the hammer drill mode is selected; a main clutch gear 120 fixed to the shaft 110; a drill driving unit 150 rotatably installed at the shaft 110 which is at one side of the main clutch gear 120, coupled to an output end, and having a drill clutch gear 156 on an outer circumferential surface thereof; a hammer clutch gear 186 rotatably installed at the shaft 110 which is at another side of the main clutch gear 120, and fixed to a hammer driving unit 180 for converting a rotary motion of the shaft 110 into a reciprocation of a hammer; a drill moving gear 130 linearly-moveable between a first position (A) (refer to FIG. 6) where the drill moving gear 130 is engaged with both the main clutch gear 120 and the drill clutch gear 156, and a second position (B) (refer to FIG. 7) where the drill moving gear 130 is not engaged with the main clutch gear 120; a hammer moving gear 160 linearly-moveable between a third position (C) (refer to FIGS. 6 and 7) where the hammer moving gear 160 is engaged with both the main clutch gear 120 and the hammer clutch gear 186, and a fourth position (D) (refer to FIG. 8) where the hammer moving gear 160 is not engaged with the main clutch gear 120; a drill side restoration spring 140 installed between the drill driving unit 150 and the drill moving gear 130, and configured to restore the drill moving gear 130 to the first position (A); and a hammer side restoration spring 170 installed between the hammer driving unit 180 and the hammer moving gear 160, and configured to restore the hammer moving gear 160 to the third position (C). The

lever pin 192 linearly-moves the hammer moving gear 160 and the drill moving gear 130 by operation of the conversion lever 190.

[0035] It is assumed that the first position (A) and the third position (C) mean a hammer drill mode where the drill moving gear 130 and the hammer moving gear 160 are engaged with the main clutch gear 120. It is also assumed that the second position (B) means a drill mode where the hammer moving gear 160 is not engaged with the main clutch gear 120, and the fourth position (D) means a hammer mode where the drill moving gear 130 is not engaged with the main clutch gear 120. However, the first to fourth positions may be modified according to conditions.

[0036] The conversion lever 190 is installed at one side of the body 20, and is configured to couple or separate the hammer moving gear 160 or the drill moving gear 130 to or from the shaft 110. For this, the lever pin 192, configured to change a mode of the hammer drill module 100 by pushing the hammer moving gear 160 and the drill moving gear 130 from the shaft 110, is installed at the conversion lever 190.

[0037] The lever pin 192 is linear-moveably installed in a direction parallel to the shaft 110, and a mode of the hammer drill module 100 may be selected among a hammer mode, a drill mode and a hammer drill mode according to rotation of the conversion lever 190.

[0038] The main clutch gear 120, a member fixed to the shaft 110, is a device for transmitting a rotary force of the shaft 110 to a member installed at the shaft 110 and engaged with the main clutch gear 120 when the shaft 110 is rotated. The main clutch gear 120 is provided with a plurality of main clutch gear teeth 122 on an outer surface thereof. When the hammer drill module 100 is driven, the main clutch gear teeth 122 are engaged with the drill moving gear 130 and the hammer moving gear 160 to be explained later, thereby allowing the hammer drill module 100 to be driven in one of a hammer mode, a drill mode and a hammer drill mode.

[0039] The drill driving unit 150 is a member driven when the hammer drill module 100 is in a drill mode or a hammer drill mode. The drill driving unit 150 includes the drill clutch gear 156 with which the drill moving gear 130 to be explained later is engaged; an output end 154 formed at an opposite side to the drill clutch gear 156, and configured to output a rotary force of the shaft 110 when the hammer drill module 100 is in a drill mode or a hammer drill mode; and a 'C'-ring 158 configured to fix the output end 154 to the shaft 110.

[0040] More specifically, a plurality of gear grooves are formed at the drill moving gear 130 installed between the drill driving unit 150 and the main clutch gear 120, such that the drill moving gear 130 is disposed at one of the first position (A) and the second position (B). That is, main clutch gear grooves 132 with which the main clutch gear teeth 122 are engaged, and drill clutch gear grooves 136 with which drill clutch gear teeth 157 are engaged, are formed at the drill moving gear 130. The number of

the drill clutch gear grooves 136 is smaller than the number of the main clutch gear grooves 132.

[0041] Referring to FIGS. 4 and 6, the main clutch gear teeth 122 of the main clutch gear 120 are formed to be more than the drill clutch gear teeth 157 of the drill clutch gear 156 in number. The reason is because the main clutch gear 120 may penetrate the inside of the drill moving gear 130, if the number of the drill clutch gear teeth 157 is larger than the number of the main clutch gear teeth 122. Thus, it is preferable that the main clutch gear teeth 122 are formed in 5~7, and the drill clutch gear teeth 157 are formed in 4~6. It is also preferable that the main clutch gear grooves 132 and the drill clutch gear grooves 136 are formed to correspond to the main clutch gear teeth 122 and the drill clutch gear teeth 157, respectively. In this embodiment of the present invention, it is assumed that the main clutch gear teeth 122 are formed in 6, and the drill clutch gear teeth 157 are formed in 4.

[0042] The drill moving gear 130 includes a first stopper 134 for preventing the main clutch gear teeth 122 from passing through the drill moving gear 130 when the drill moving gear 130 is disposed on the first position (A). In the case where the main clutch gear teeth 122 are formed in 6 and the drill clutch gear teeth 157 are formed in 4, 4 drill clutch gear grooves 136 formed at the drill moving gear 130 pass through 4 main clutch gear grooves 132 among the main clutch gear grooves 132. The first stopper 134 is 2 main clutch gear grooves 132 not passing through the drill clutch gear grooves 136. With such a configuration, when the drill moving gear 130 is disposed on the first position (A), the main clutch gear 120 cannot completely pass through the drill moving gear 130.

[0043] The hammer clutch gear 186 is a member for converting a rotary motion of the shaft 110 into a reciprocation of the hammer when the shaft 110 is rotated. For this, the hammer clutch gear 186 is fixed to the hammer driving unit 180 formed as a swash bearing.

[0044] The hammer moving gear 160 is installed between the main clutch gear 120 and the hammer clutch gear 186. And the hammer moving gear 160 is configured to transmit a rotary force of the shaft 110 to the hammer drill module 100 when the hammer drill module 100 is positioned between a hammer mode and a hammer drill mode, such that the hammer drill module 100 is in a hammer state for hitting the bit 60.

[0045] The hammer moving gear 160 is formed to have the same shape as the drill moving gear 130. With such a configuration, the hammer moving gear 160 may be formed in the same shape as the drill moving gear 130, and may be formed as the same member. That is, since the hammer moving gear 160 and the drill moving gear 130 are implemented as the same member, usage of components for driving the hammer drill module 100 can be minimized.

[0046] As shown in FIG. 3, the hammer moving gear 160 includes the same main clutch gear grooves as the main clutch gear grooves 132 of the drill moving gear

130, and hammer clutch gear grooves (not shown) with which hammer clutch gear teeth 187 are engaged. The main clutch gear teeth 122 may be formed to be more than the hammer clutch gear teeth 187. The hammer moving gear 160 may include a second stopper 164 for preventing the main clutch gear teeth 122 from passing through the hammer moving gear 160 when the hammer moving gear 160 is disposed on the third position (C). That is, the second stopper 164 is configured to prevent the main clutch gear 120 from completely passing through the hammer moving gear 160 when the hammer moving gear 160 is disposed on the third position (C).

[0047] Referring to the drawings back, when the hammer drill module 100 is disposed on the first position (A) and the third position (C) (i.e., in a hammer drill mode) (refer to FIG. 6), the conversion lever 190 is rotated, so that the lever pin 192 of the conversion lever 190 is disposed on the second position (B) (refer to FIG. 7) or the fourth position (D) (refer to FIG. 8) where the hammer moving gear 160 or the drill moving gear 130 is pushed. As a result, the hammer drill mode may be changed into a drill mode or a hammer mode.

[0048] In this case, if the conversion lever 190 is rotated again to the first position (A) and the third position (C), the hammer side restoration spring 170 restores the hammer moving gear 160 to the initial state. If the conversion lever 190 is rotated to the fourth position (D), the hammer side restoration spring 170 is pressed so that the hammer moving gear 160 is separated from the main clutch gear 120. If the conversion lever 190 is rotated again to the first position (A) and the third position (C), the hammer side restoration spring 170 is restored. As a result, the hammer moving gear 160 is engaged with the main clutch gear 120 again, by a restoration force of the hammer side restoration spring 170.

[0049] Similarly, if the conversion lever 190 is rotated to the second position (B) (hammer mode state), the drill side restoration spring 140 is elastically transformed to separate the drill moving gear 130 from the main clutch gear 120. If the conversion lever 190 is rotated again to the first position (A) and the third position (C), the drill moving gear 130 is engaged with the main clutch gear 120 again, by a restoration force of the drill side restoration spring 140.

[0050] Since the drill moving gear 130 and the hammer moving gear 160 are separable from or mountable to the main clutch gear 120 by using the drill side restoration spring 140 and the hammer side restoration spring 170, the gears can be more easily engaged with each other or separated from each other. Further, since the drill side restoration spring 140 and the hammer side restoration spring 170 are formed in the same manner, working efficiency can be enhanced at the time of manufacturing the hammer drill module 100.

[0051] As the hammer moving gear 160 and the drill moving gear 130 of the hammer drill 1 are formed in the same shape, a hammer mode and a drill mode of the hammer drill 1 are convertible by using a single member.

With such a configuration, usage of components of the hammer drill 1 can be minimized.

[0052] Further, the drill side restoration spring 140 is installed between the drill driving unit 150 and the drill moving gear 130, and the hammer side restoration spring 170 is installed between the hammer driving unit 180 and the hammer moving gear 160. With such a configuration, the gears can be easily engaged with each other by restoration forces of the springs.

[0053] Further, the drill driving unit 150 is fixed to the shaft 110, and the drill moving gear 130 is installed to be moveable back and forth. With such a configuration, the drill driving unit 150 is not slid even in a driven state, so that an engaged state between the drill driving unit 150 and an output unit (not shown) disposed close to the drill driving unit 150 is maintained. As a result, a load of the output unit is not applied to the drill driving unit 150. This can prevent lowering of durability of the drill driving unit 150.

[0054] Further, the drill side restoration spring 140 is not elastically transformed even when the hammer driving unit 180 is driven in a hammer mode, because it is not installed at the shaft 110. Thus, since the drill side restoration spring 140 is not rotated by rotation of the shaft 110 in the hammer mode, friction between the drill side restoration spring 140 and the shaft 110 is prevented. This can prevent lowering of durability of the components.

[0055] Further, since the hammer side restoration spring 170 and the drill side restoration spring 140 are formed in the same shape, time taken to manufacture the hammer drill 1 is reduced. This can enhance working efficiency.

[0056] As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, are therefore intended to be embraced by the appended claims.

Claims

1. A hammer drill, comprising:

a shaft (110) rotatable by a driving force of a driving motor,
wherein the hammer drill has a mode conversion among a hammer mode for hitting a bit as a rotary motion of the shaft (110) is converted into a linear reciprocation, a drill mode for rotating the bit by rotation of the shaft (110), and a hammer drill mode for rotating and hitting the bit, wherein the hammer drill further comprises:

a conversion lever (190) having a lever pin (192) installed thereat such that one of the hammer mode, the drill mode and the hammer drill mode is selected;

a main clutch gear (120) fixed to the shaft (110);

a drill driving unit (150) rotatably installed at the shaft (110) which is at one side of the main clutch gear (120), coupled to an output end, and having a drill clutch gear (156) on an outer circumferential surface thereof;

a hammer clutch gear (186) rotatably installed at the shaft (110) which is at another side of the main clutch gear (120), and fixed to a hammer driving unit (180) for converting a rotary motion of the shaft (110) into a reciprocation of a hammer;

a drill moving gear (130) linearly-moveable between a first position where the drill moving gear (130) is engaged with both the main clutch gear (120) and the drill clutch gear (156), and a second position where the drill moving gear (130) is not engaged with the main clutch gear (120);

a hammer moving gear (160) linearly-moveable between a third position where the hammer moving gear (160) is engaged with both the main clutch gear (120) and the hammer clutch gear (186), and a fourth position where the hammer moving gear (160) is not engaged with the main clutch gear (120);

a drill side restoration spring (140) installed between the drill driving unit (150) and the drill moving gear (130), and configured to restore the drill moving gear (130) to the first position; and

a hammer side restoration spring (170) installed between the hammer driving unit and the hammer moving gear (160), and configured to restore the hammer moving gear (160) to the third position,

wherein the lever pin (192) linearly-moves the hammer moving gear (160) and the drill moving gear (130) by operation of the conversion lever (190), wherein the drill moving gear (130) comprises main clutch gear grooves (132)

characterized in that the main clutch gear grooves (132) are engaged with a plurality of main clutch gear teeth (122) of the main clutch gear (120); and **in that** the drill moving gear (130) further comprises drill clutch gear grooves (136) engaged with a plurality of drill clutch gear teeth (157) of the drill clutch gear (156), and

wherein the number of the drill clutch gear grooves (136) is smaller than the number of the main clutch

gear grooves (132).

2. The hammer drill of claim 1, wherein the drill moving gear (130) comprises a first stopper (134) for preventing the main clutch gear teeth (122) from passing through the drill moving gear (130) when the drill moving gear (130) is disposed on the first position. 5
3. The hammer drill of claim 1, wherein the hammer moving gear (160) comprises: 10
 - the main clutch gear grooves (132) engaged with the plurality of main clutch gear teeth (122) of the main clutch gear (120); and
 - hammer clutch gear grooves engaged with a plurality of hammer clutch gear teeth (187) of the hammer clutch gear (186), and 15

wherein the number of the hammer clutch gear grooves is smaller than the number of the main clutch gear grooves (132). 20
4. The hammer drill of claim 4, wherein the hammer moving gear (160) comprises a second stopper (164) for preventing the main clutch gear teeth (122) from passing through the hammer moving gear (160) when the hammer moving gear (160) is disposed on the third position. 25
5. The hammer drill of one of claim 1 and claims 3 to 5, wherein the drill moving gear (130) and the hammer driving gear (160) are formed to have the same shape. 30
6. The hammer drill of claim 1, wherein the hammer driving unit (180) is implemented as a swash bearing. 35

Patentansprüche

1. Bohrhammer, umfassend: 40
 - eine Welle (110), die durch eine Antriebskraft eines Antriebsmotors drehbar ist,
 - wobei der Bohrhammer eine Betriebsartumstellung zwischen einer Hammerbetriebsart zum Schlagen mit einem Bit, wenn eine Drehbewegung der Welle (110) in eine lineare Hin- und Herbewegung umgewandelt wird, einer Bohrerbetriebsart zum Drehen des Bits durch Drehung der Welle (110) und einer Bohrhammerbetriebsart zum Drehen des und Schlagen mit dem Bit(s) aufweist, 50
 - wobei der Bohrhammer ferner umfasst: 55
 - einen Umstellungshebel (190) mit einem Hebelstift (192), der derart daran angebaut ist, dass eine aus der Hammerbetriebsart,

der Bohrerbetriebsart und der Bohrhammerbetriebsart ausgewählt wird;

ein Hauptkupplungszahnrad (120), das an der Welle (110) befestigt ist;

eine Bohrerantriebseinheit (150), die drehbar an der Welle (110) angebaut ist und sich auf einer Seite des Hauptkupplungszahnrad (120) befindet, mit einem Ausgangsende gekoppelt ist und auf einer äußeren Umfangsfläche ein Bohrerkupplungszahnrad (156) aufweist;

ein Hammerkupplungszahnrad (186), das drehbar an der Welle (110) angebaut ist und sich auf einer anderen Seite des Hauptkupplungszahnrad (120) befindet und an einer Hammerantriebseinheit (180) befestigt ist, um eine Drehbewegung der Welle (110) in eine Hin- und Herbewegung eines Hammers umzuwandeln;

ein Bohrerbewegungszahnrad (130), das zwischen einer ersten Position, in der das Bohrerbewegungszahnrad (130) sowohl mit dem Hauptkupplungszahnrad (120) als auch mit dem Bohrerkupplungszahnrad (156) in Eingriff steht, und einer zweiten Position, in der das Bohrerbewegungszahnrad (130) nicht mit dem Hauptkupplungszahnrad (120) in Eingriff steht, linear beweglich ist;

ein Hammerbewegungszahnrad (160), das zwischen einer dritten Position, in der das Hammerbewegungszahnrad (160) sowohl mit dem Hauptkupplungszahnrad (120) als auch mit dem Hammerkupplungszahnrad (186) in Eingriff steht, und einer vierten Position, in der das Hammerbewegungszahnrad (160) nicht mit dem Hauptkupplungszahnrad (120) in Eingriff steht, linear beweglich ist;

eine bohrerseitige Rückstellfeder (140), die zwischen der Bohrerantriebseinheit (150) und dem Bohrerbewegungszahnrad (130) eingebaut und dazu ausgestaltet ist, das Bohrerbewegungszahnrad (130) in die erste Position rückzustellen; und

eine hammerseitige Rückstellfeder (170), die zwischen der Hammerantriebseinheit und dem Hammerbewegungszahnrad (160) eingebaut und dazu ausgestaltet ist, das Hammerbewegungszahnrad (160) in die dritte Position rückzustellen,

wobei der Hebelstift (192) das Hammerbewegungszahnrad (160) und das Bohrerbewegungszahnrad (130) durch Betätigung des Umstellungshebels (190) linear bewegt, wobei das Bohrerbewegungszahnrad (130) Hauptkupplungszahnradnuten (132) umfasst,

dadurch gekennzeichnet, dass die Hauptkupplungszahnradnuten (132) mit mehreren Hauptkupplungszahnradzähnen (122) des Hauptkupplungszahnrads (120) in Eingriff stehen; und dass das Bohrerbewegungszahnrad (130) ferner Bohrerkupplungszahnradnuten (136) umfasst, die mit mehreren Bohrerkupplungszahnradzähnen (157) des Bohrerkupplungszahnrads (156) in Eingriff stehen, und wobei die Anzahl der Bohrerkupplungszahnradnuten (136) kleiner ist als die Anzahl der Hauptkupplungszahnradnuten (132).

2. Bohrhammer nach Anspruch 1, wobei das Hammerbewegungszahnrad (130) einen ersten Anschlag (134) umfasst, um zu verhindern, dass die Hauptkupplungszahnradzähne (122) das Bohrerbewegungszahnrad (130) passieren, wenn das Bohrerbewegungszahnrad (130) auf der ersten Position angeordnet ist.
3. Bohrhammer nach Anspruch 1, wobei das Hammerbewegungszahnrad (160) umfasst:

die Hauptkupplungszahnradnuten (132), die mit den mehreren Hauptkupplungszahnradzähnen (122) des Hauptkupplungszahnrads (120) in Eingriff stehen; und

Hammerkupplungszahnradnuten, die mit mehreren Hammerkupplungszahnradzähnen (187) des Hammerkupplungszahnrads (186) in Eingriff stehen, und

wobei die Anzahl der Hammerkupplungszahnradnuten kleiner ist als die Anzahl der Hauptkupplungszahnradnuten (132).
4. Bohrhammer nach Anspruch 4, wobei das Hammerbewegungszahnrad (160) einen zweiten Anschlag (164) umfasst, um zu verhindern, dass die Hauptkupplungszahnradzähne (122) das Hammerbewegungszahnrad (160) passieren, wenn das Hammerbewegungszahnrad (160) auf der dritten Position angeordnet ist.
5. Bohrhammer nach einem von Anspruch 1 und den Ansprüchen 3 bis 5, wobei das Bohrerbewegungszahnrad (130) und das Hammerantriebszahnrad (160) dazu ausgebildet sind, die gleiche Form aufzuweisen.
6. Bohrhammer nach Anspruch 1, wobei die Hammerantriebseinheit (180) als Taumellager realisiert ist.

Revendications

1. Marteau perforateur, comprenant:

un arbre (110) pouvant être mis en rotation par une force d'entraînement d'un moteur d'entraînement,

dans lequel le marteau perforateur a une conversion de mode entre un mode marteau pour frapper un foret lorsqu'un mouvement rotatif de l'arbre (110) est converti en un va-et-vient linéaire, un mode perforateur pour faire tourner le foret par la rotation de l'arbre (110), et un mode marteau perforateur pour mettre en rotation et frapper le foret,

dans lequel le marteau perforateur comprend en outre :

un levier de conversion (190) ayant une goupille de levier (192) installée sur celui-ci de telle sorte qu'un mode parmi le mode marteau, le mode perforateur et le mode de marteau perforateur est choisi,

un pignon d'embrayage principal (120) fixé à l'arbre (110),

une unité d'entraînement de perforateur (150) installée de manière rotative sur l'arbre (110) qui est d'un côté du pignon d'embrayage principal (120), couplée à une extrémité de sortie, et ayant un pignon d'embrayage de perforateur (156) sur une surface circonférentielle extérieure de celle-ci,

un pignon d'embrayage de marteau (186) installé de manière rotative sur l'arbre (110) qui est de l'autre côté du pignon d'embrayage principal (120), et fixé à une unité d'entraînement de marteau (180) pour convertir un mouvement rotatif de l'arbre (110) en un va-et-vient d'un marteau,

un pignon de mouvement de perforateur (130) linéairement mobile entre une première position où le pignon de mouvement de perforateur (130) s'engrène à la fois avec le pignon d'embrayage principal (120) et le pignon d'embrayage de perforateur (156), et une deuxième position où le pignon de mouvement de perforateur (130) ne s'engrène pas avec le pignon d'embrayage principal (120),

un pignon de mouvement de marteau (160) linéairement mobile entre une troisième position où le pignon de mouvement de marteau (160) s'engrène à la fois avec le pignon d'embrayage principal (120) et le pignon d'embrayage de marteau (186), et une quatrième position où le pignon de mouvement de marteau (160) ne s'engrène pas avec le pignon d'embrayage principal (120),

un ressort de rappel latéral de perforateur (140) installé entre l'unité d'entraînement de marteau (150) et le pignon de mouvement de perforateur (130), et configuré pour

ramener le pignon de mouvement de perforateur (130) à la première position, et un ressort de rappel latéral de marteau (170) installé entre l'unité d'entraînement de marteau et le pignon de mouvement de marteau (160), et configuré pour ramener le pignon de mouvement de marteau (160) à la troisième position,

dans lequel la goupille de levier (192) déplace linéairement le pignon de mouvement de marteau (160) et le pignon de mouvement de perforateur (130) par actionnement du levier de conversion (190),

dans lequel le pignon de mouvement de perforateur (130) comprend des rainures de pignon d'embrayage principal (132),

caractérisé en ce que les rainures de pignon d'embrayage principal (132) sont en prise avec une pluralité de dents de pignon d'embrayage principal (122) du pignon d'embrayage principal (120), et

en ce que le pignon de mouvement de perforateur (130) comprend en outre des rainures de pignon d'embrayage de perforateur (136) en prise avec une pluralité de dents de pignon d'embrayage de perforateur (157) du pignon d'embrayage de perforateur (156), et

dans lequel le nombre des rainures de pignon d'embrayage de perforateur (136) est inférieur au nombre des rainures de pignon d'embrayage principal (132).

2. Marteau perforateur selon la revendication 1, dans lequel le pignon de mouvement de perforateur (130) comprend une première butée (134) pour empêcher les dents de pignon d'embrayage principal (122) de passer à travers le pignon de mouvement de perforateur (130) lorsque le pignon de mouvement de perforateur (130) est disposé sur la première position.

3. Marteau perforateur selon la revendication 1, dans lequel le pignon de mouvement de marteau (160) comprend:

les rainures de pignon d'embrayage principal (132) en prise avec la pluralité de dents de pignon d'embrayage principal (122) du pignon d'embrayage principal (120), et des rainures de pignon d'embrayage de marteau en prise avec une pluralité de dents de pignon d'embrayage de marteau (187) du pignon d'embrayage de marteau (186), et

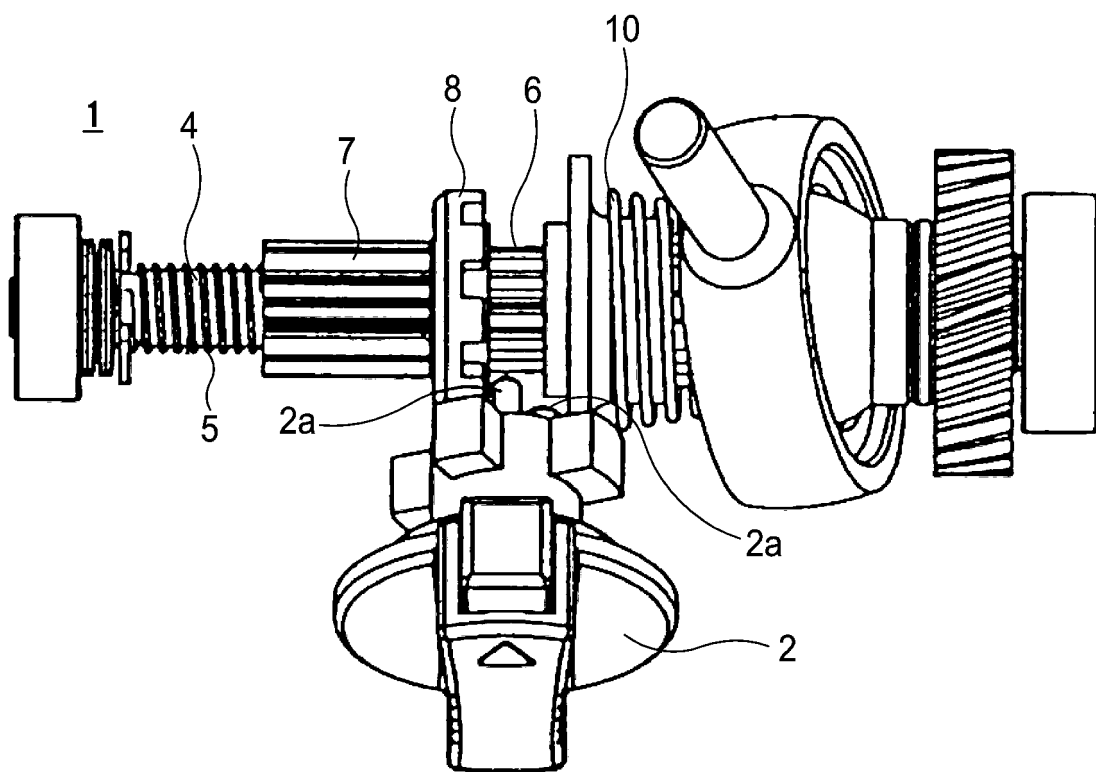
dans lequel le nombre des rainures de pignon d'embrayage de marteau est inférieur au nombre des rainures de pignon d'embrayage principal (132).

4. Marteau perforateur selon la revendication 4, dans lequel le pignon de mouvement de marteau (160) comprend une seconde butée (164) pour empêcher les dents de pignon d'embrayage principal (122) de passer à travers le pignon de mouvement de marteau (160) lorsque le pignon de mouvement de marteau (160) est disposé sur la troisième position.

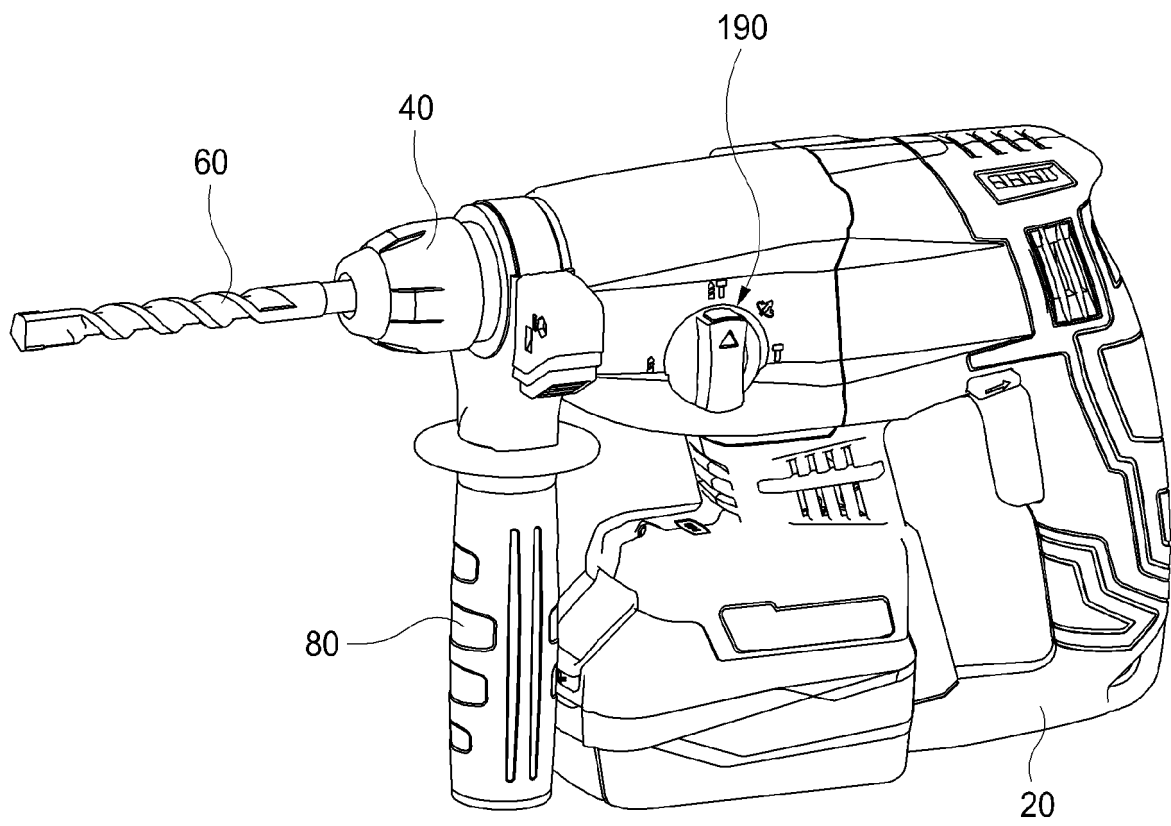
5. Marteau perforateur selon l'une des revendications 1 et 3 à 5, dans lequel le pignon de mouvement de perforateur (130) et le pignon d'entraînement de marteau (160) sont formées de manière à avoir la même forme.

6. Marteau perforateur selon la revendication 1, dans lequel l'unité d'entraînement de marteau (180) est mise en oeuvre sous la forme d'un palier oscillant.

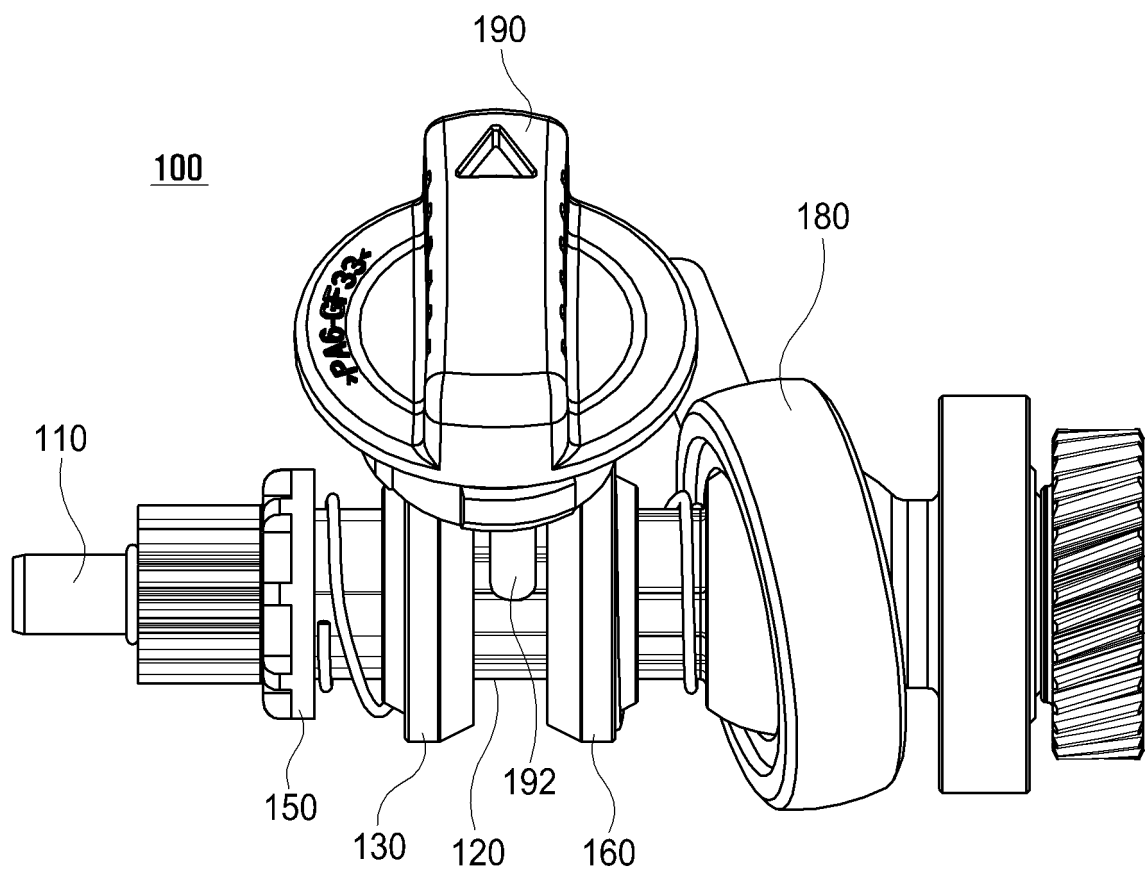
【Figure 1】



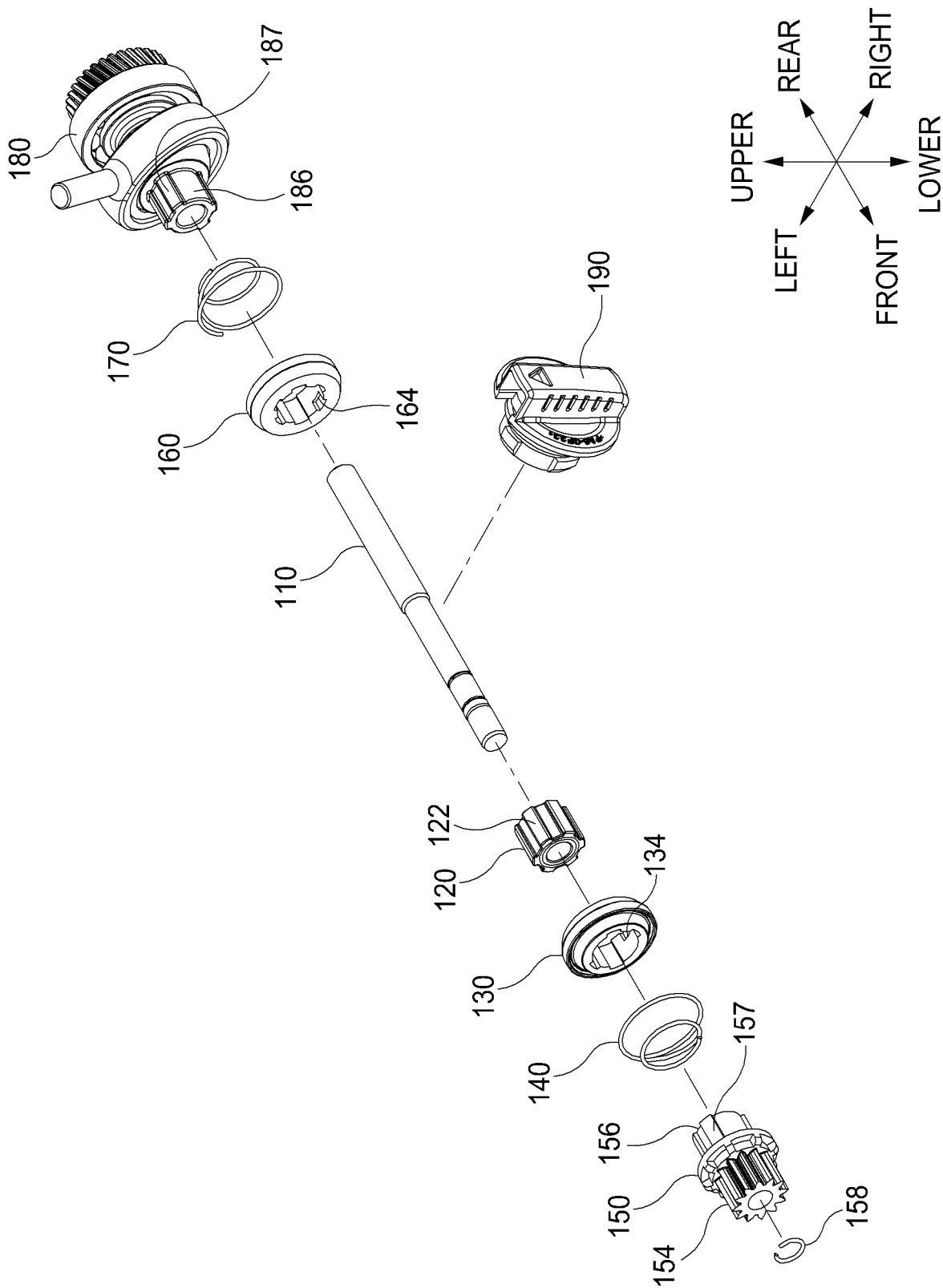
【Figure 2】



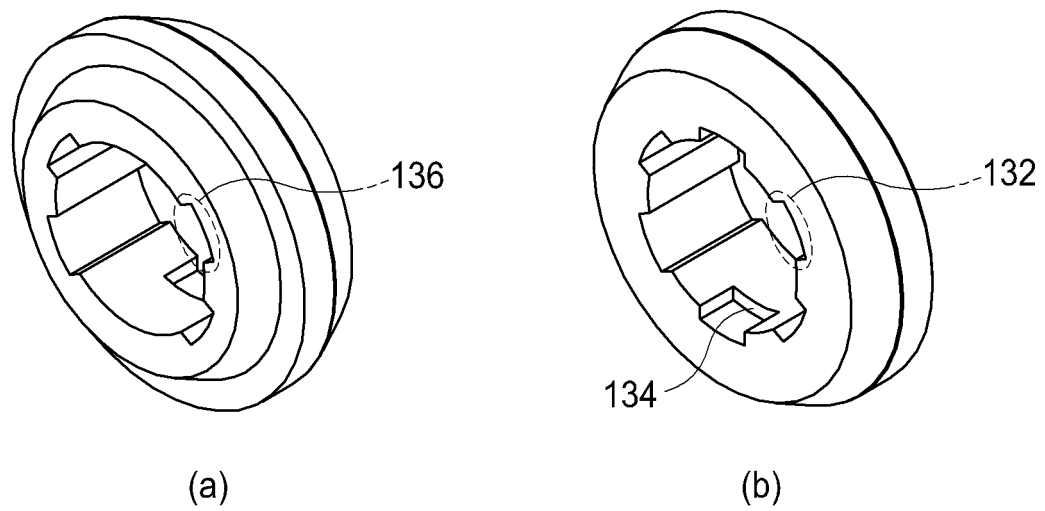
【Figure 3】



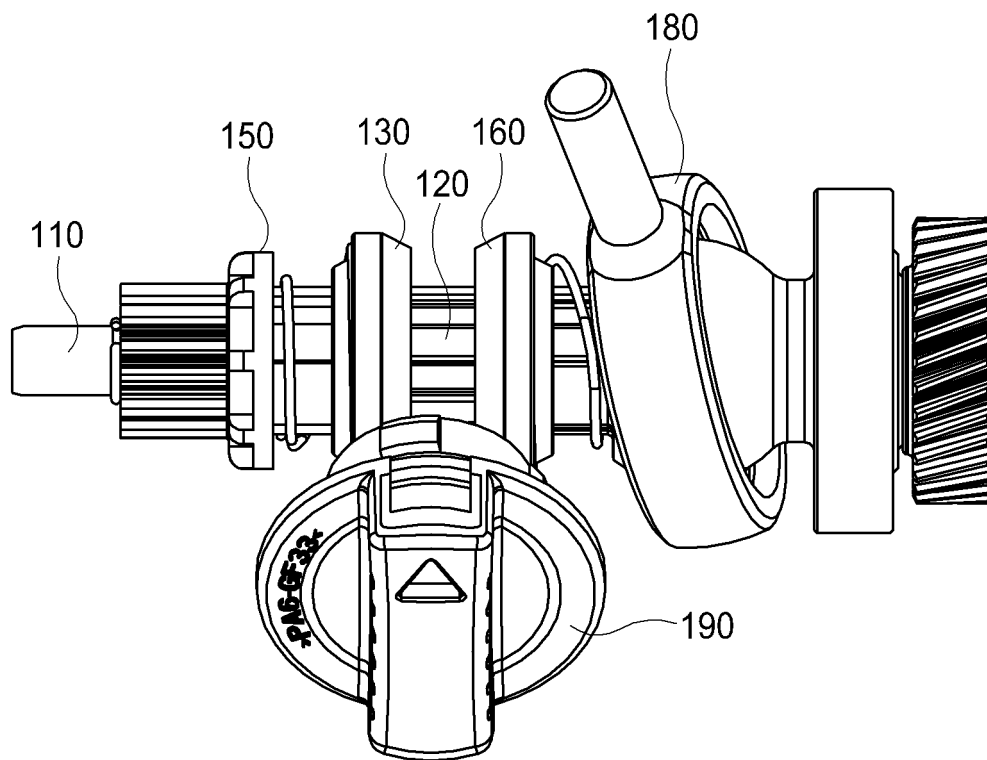
【Figure 4】



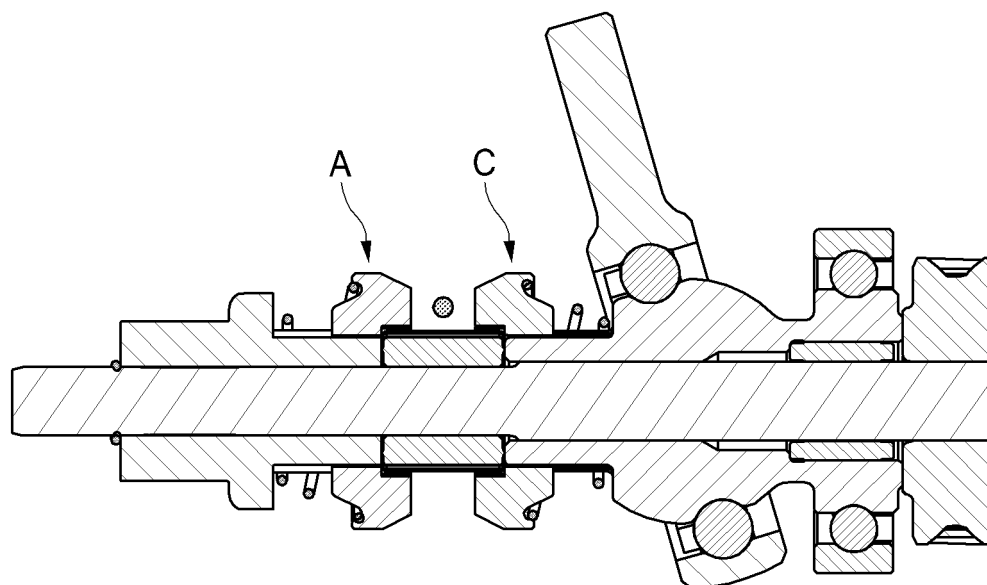
【Figure 5】



【Figure 6】

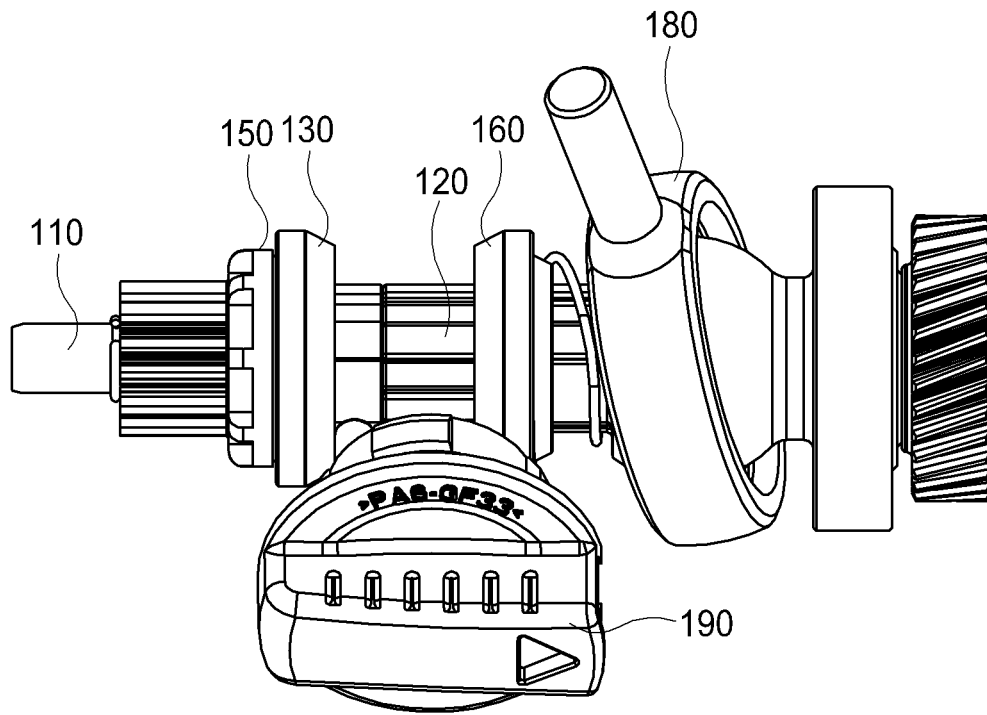


(a)

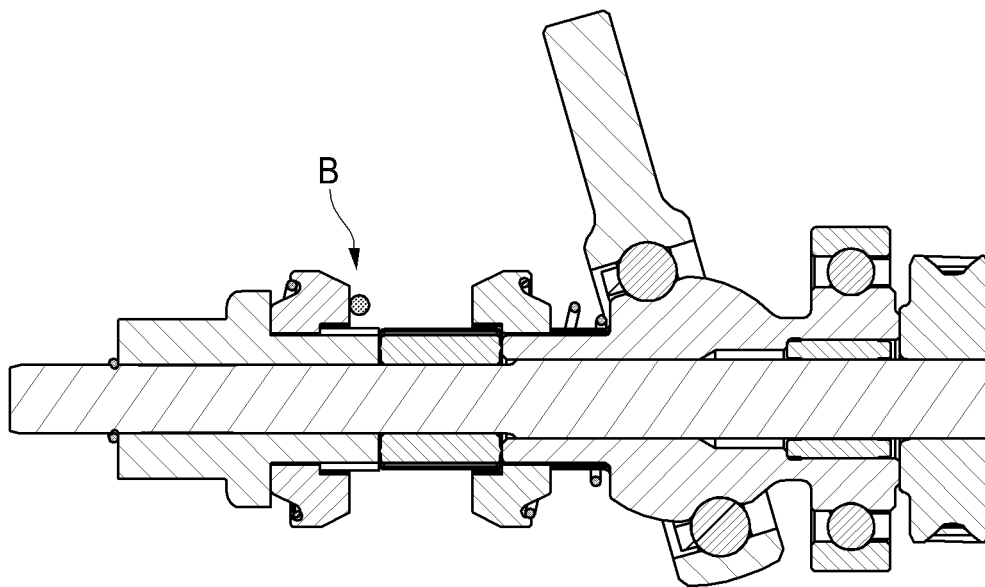


(b)

【Figure 7】

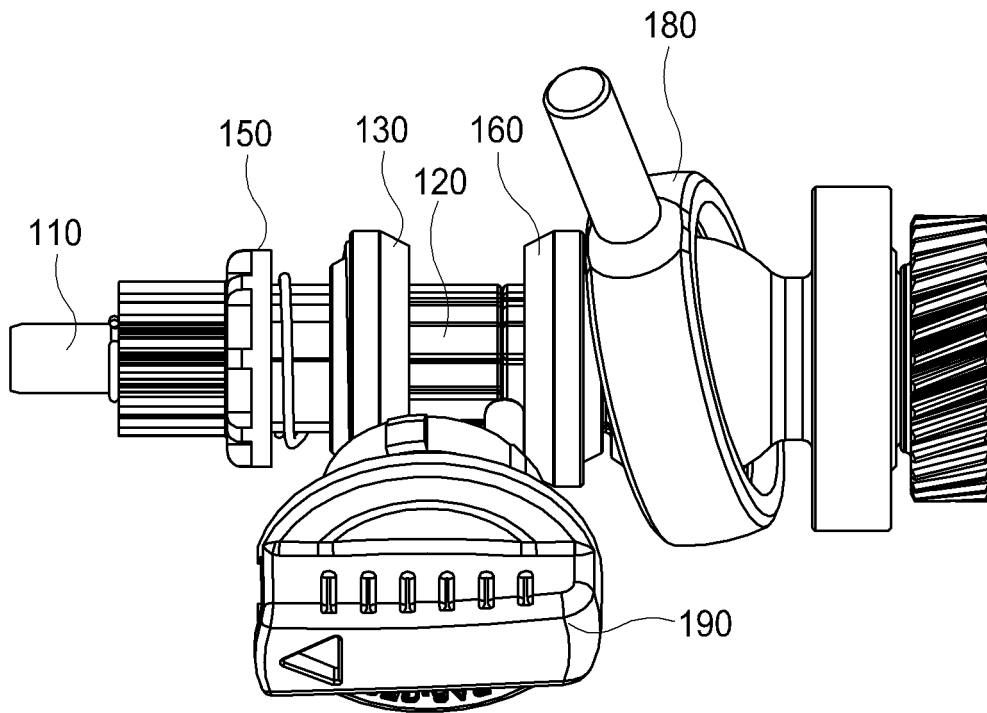


(a)

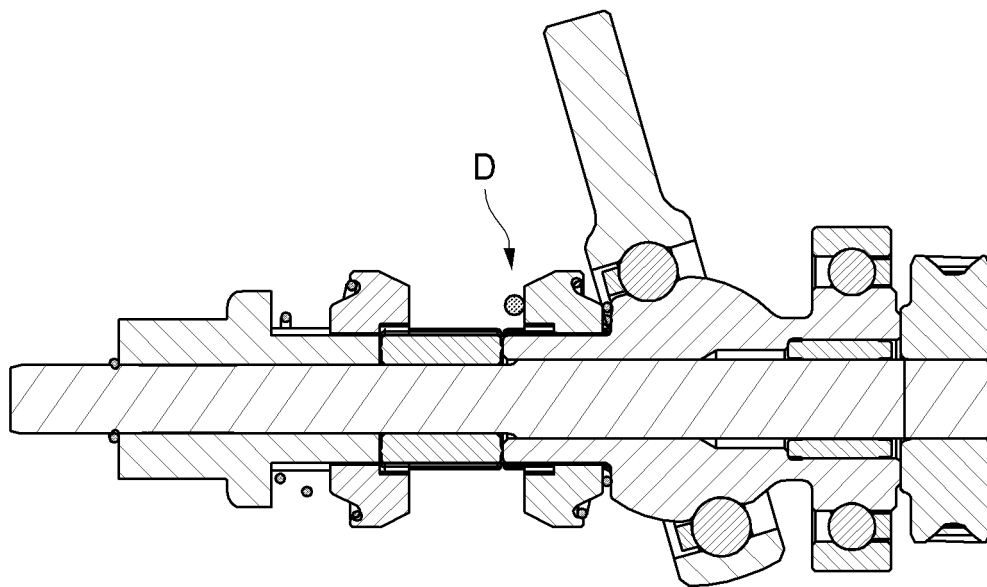


(b)

【Figure 8】



(a)



(b)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20100270045 A1 [0002]
- US 20100270045 A [0009]
- EP 2364817 A [0010]