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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an impact tool in accordance with the preamble of claim 1 that performs a predetermined operation on a workpiece by a striking movement of a tool bit in its axial direction.

BACKGROUND OF THE INVENTION

[0002] DE 93 20 653 U1 describes such a tool holder for a power tool.
In an impact tool, such as a hammer or a hammer drill, a shank of a hammer bit is held by a tool holder so as to be movable in an axial direction. For this purpose, a slight clearance large enough to allow insertion of the shank is provided between an inner wall surface of a bit holding hole of the tool holder and an outer surface of the shank of the hammer bit inserted into the bit holding hole. Therefore, during hammering or hammer drill operation on a workpiece such as concrete, concrete dust generated by the operation adheres to the outer surface of the shank of the hammer bit and enters the above-described clearance. The hammer bit then moves with respect to the tool holder with the dust existing therebetween. As a result, the inner wall surface of the bit holding hole of the tool holder wears, which causes runout of the hammer bit and thus makes the operation difficult. Accordingly, WO02/20224 discloses an impact tool having a tool holder designed to resist wear. In this impact tool, a sleeve made of a material harder than a body of the tool holder is provided as a separate member and press-fitted into the body in order to reduce wear of the inner wall surface of the bit holding hole.
[0003] Typically, an impact tool is configured such that steel balls arranged on the tool holder prevent removal of a hammer bit inserted into a bit holding hole of a tool holder. Therefore, an axial impact force is applied from the hammer bit to the tool holder via the steel balls during striking movement of the hammer bit. Accordingly, in the above-described known technique in which a hard sleeve is formed along the entire length of the bit holding hole into which a shank of the hammer bit is inserted, the sleeve is acted upon by an impact force. The sleeve made of a hard material however may crack on impact due to its high hardness. Further, slots in which the steel balls are disposed are formed through the sleeve in the radial direction. It is however difficult to form the slots by machining because the sleeve is hard. Therefore, in the known impact tool, further improvements are required in durability and machinability.

SUMMARY OF THE INVENTION

[0004] It is, accordingly, an object of the invention to provide an effective technique for improving the durability and machinability of a tool holder for holding a tool bit in an impact tool.
[0005] The above-described object can be achieved by the claimed invention. The present invention provides an impact tool having the features of claim 1 which includes a tool holder having a bit holding hole. A tool bit is inserted into the bit holding hole and the tool bit is held so as to be movable in an axial direction to perform a predetermined operation on a workpiece at least by striking movement of the tool bit in an axial direction. The manner "at least by striking movement of the tool bit in an axial direction" here includes the manner of driving the tool bit only by striking movement, and the manner of driving the tool bit by combination of striking movement and rotation.
The impact tool according to this invention has a bit holding region which is held in contact with an outer surface of the tool bit inserted into the bit holding hole and which holds the tool bit such that the tool bit can move in the axial direction. The bit holding region has a first holding region, a second holding region and a third holding region, arranged in this order in the bit holding hole from the side of a bit insertion opening toward the far side from the opening. The first holding region is provided as a region for holding the tool bit inserted into the bit holding hole, while allowing the tool bit to move in the axial direction with respect to the bit holding hole. The second holding region is provided as a region to dispose a removal preventing member which engages with the tool bit and thereby prevents the tool bit from becoming slipped out of the bit holding hole. Further, the third holding region is provided as a region for holding an inserted end of the tool bit inserted into the bit holding hole, while allowing it to move in the axial direction with respect to the bit holding hole. The hardness of the first holding region is higher than that of the second holding region. The "hardness of the first holding region" is preferably set to a hardness of 60 Rockwell Hardness C-Scale (HRC) or higher, and the first holding region is suitably formed of alloy tool steels (SKD), high speed tool steels (SKH) or high-carbon chrome bearing steels (SUJ).
[0006] In connection with wear of the bit holding region for holding the tool bit, an area of the bit holding region which dust generated during operation easily enters, or an area on the bit insertion opening side, is located in an environment in which wear most easily occurs. According to this invention, the first holding region on the bit insertion opening side where wear most easily occurs has a higher hardness than the second holding region, so that wear resistance of the first holding region can be increased. Thus, wear of the first holding region can be reduced and its durability can be increased. Wear of the bit holding region causes runout of the tool bit. Then, for example, in the case of a hammer drill, in which the rotating force of the tool holder is transmitted to the tool bit, torque transmitting projections formed on the tool holder may suffer wear. As a result, operation using the hammer drill may become difficult due to the runout of the tool bit. According to this invention, wear of the first holding region

is reduced, so that runout of the tool bit can be reduced and thus wear of the torque transmitting projections can also be reduced.

In the second holding region of the tool holder, a removal preventing member (for example, steel balls) is arranged and provided to prevent the tool bit inserted into the bit holding hole from becoming slipped out of the bit holding hole. Therefore, the tool holder is acted upon by an axial impact force via the removal preventing member during striking movement of the tool bit. According to this invention, in the bit holding region, the regions other than the first holding region preferably have as high a hardness as in a conventional technique. Specifically, the second holding region in which the removal preventing member is disposed can preferably have as high a hardness as in a conventional technique. Therefore, cracks which might be produced due to too high hardness can be prevented from being produced on impact during striking movement of the hammer bit. Moreover, the machinability in forming a radial through hole for receiving the removal preventing member in the second holding region, for example, by machining, is not impaired because the hardness of the second holding region can preferably be as high as in a conventional technique.

[0007] In one aspect of the present invention, the hardness of the third holding region is higher than that of the second holding region. Preferably, the "hardness of the third holding region" is equal to that of the first holding region. When the tool bit performs a striking movement during operation, the tool bit is acted upon not only by a reaction force from the workpiece in the axial direction, but by an external force in a direction transverse to the axial direction. The bit holding region supports this transverse force acting upon the tool bit particularly on the first and third holding regions. According to this invention, portions that are subjected to the above-described transverse force, or the first and third holding regions, are designed to have a higher hardness than the second holding region, so that wear of the first and third holding regions can be reduced and their durability can be increased. Further, by reduction of wear of the first and third holding regions, runout of the tool bit can be further prevented and thus, if the impact tool is embodies as a hammer drill, wear of the torque transmitting projections can be effectively reduced.

[0008] In another aspect of the invention, at least the first holding region of the first and third holding regions is formed of a material having a higher hardness than the second holding region and as a separate member. The "separate member" in this invention typically represents a ring-like member. Further, the manner of being "formed" here typically represents the manner in which the ring-like member is press-fitted into the bore of the tool holder, but it also suitably includes manners other than press-fitting, such as fixing by screws or by welding. According to this invention, the bit holding hole having the bit holding region of different hardnesses in the axial direction can be easily produced by forming the first holding region as a separate member, so that ease of production can be enhanced.

[0009] In another aspect of the invention, the removal preventing member in the second holding region prevents removal of the tool bit by moving in a radially inward direction of the bit holding hole and engaging with the tool bit, and allows removal of the tool bit by moving in a radially outward direction of the bit holding hole. Further, an opening is formed in the second holding region and the removal preventing member is disposed in the opening so as to be movable in the radial direction. According to this invention, the opening in which the removal preventing member is disposed is formed in the second holding region having a lower hardness than the first holding region. Therefore, the opening can be easily formed, for example, by machining, and thus the machinability can be increased.

[0010] According to this invention, an effective technique for improving the durability and machinability of a tool holder for holding a tool bit in an impact tool is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a sectional view showing an entire electric hammer drill according to an embodiment of the invention.

FIG. 2 is a sectional view showing a bit removal preventing part of a hammer bit holding mechanism part.

FIG. 3 is a sectional view showing a torque transmitting part of the hammer bit holding mechanism part..

REPRESENTATIVE EMBODIMENT OF THE INVENTION

[0012] A representative embodiment of the present invention is now described with reference to FIGS. 1 to 3. In this embodiment, an electric hammer drill is explained as a representative example of an impact tool according to the present invention. FIG. 1 is a sectional side view showing an entire electric hammer drill 101 according to this embodiment. As shown in FIG. 1, the hammer drill 101 mainly includes a body 103 that forms an outer shell of the hammer drill 101, a hammer bit 119 detachably coupled to the tip end region (on the left side as viewed in FIG. 1) of the body 103 via a tool holder 137, and a grip 109 connected to the body 103 on the side opposite to the hammer bit 119 and designed to be held by a user. The hammer bit 119 is mounted such that it is allowed to reciprocate with respect to the tool holder 137 in its axial direction and prevented from rotating with respect to the tool holder in its circumferential direction. The hammer bit 119 is a feature that corresponds to the "tool bit" according to the present invention. In the present embodiment, for the sake of convenience of explanation, the side of the hammer bit 119 is taken as the front side

and the side of the grip 109 as the rear side.

[0013] The body 103 mainly includes a motor housing 105 that houses a driving motor 111, and a gear housing 107 that houses a motion converting mechanism 113, a power transmitting mechanism 114 and a striking mechanism 115. The motor housing 105 and the gear housing 107 are connected together, for example, by screws (not shown)

[0014] The rotating output of the driving motor 111 is appropriately converted into linear motion via the motion converting mechanism 113 and transmitted to the striking mechanism 115. Then, an impact force is generated in the axial direction of the hammer bit 119 via the striking mechanism 115. Further, the power transmitting mechanism 114 appropriately reduces the speed of the rotating output of the driving motor 111 and then transmits the rotating output as a rotating force to the hammer bit 119. As a result, the hammer bit 119 is caused to rotate in the circumferential direction. The driving motor 111 is driven when a trigger 117 on the grip 109 is depressed.

[0015] The motion converting mechanism 113 mainly includes a driving gear 121 that is disposed on a tip end (front end) of an armature shaft 112 of the driving motor 111 and rotated in a vertical plane by the driving motor 111, a driven gear 123 that engages with the driving gear 121, a rotating element 127 that rotates together with the driven gear 123 via an intermediate shaft 125, a swash plate 129 that is caused to swing in the axial direction of the hammer bit 119 by rotation of the rotating element 127, and a cylindrical piston 141 that is caused to reciprocate by swinging movement of the swash plate 129. The intermediate shaft 125 is arranged parallel (horizontally) to the axial direction of the hammer bit 119. The outer surface of the rotating element 127 that is fitted onto the intermediate shaft 125 is inclined at a predetermined angle with respect to the axis of the intermediate shaft 125. The swash plate 129 is fitted on the inclined outer surface of the rotating element 127 via a ball bearing 126 such that it can rotate with respect to the rotating element 127. The swash plate 129 is caused to swing in the axial direction of the hammer bit 119 by rotation of the rotating element 127. Further, the swash plate 129 has a swinging rod 128 extending upward (in the radial direction) from the swash plate 129. The swinging rod 128 is connected to a rear end of the cylindrical piston 141 via a connecting shaft 124 such that it can rotate with respect to the piston 141. The cylindrical piston 141 is slidably disposed within a sleeve 135 that is disposed within the gear housing 107, and the rear end of the bore of the piston is closed.

[0016] The power transmitting mechanism 114 mainly includes a first transmission gear 131 that is caused to rotate in a vertical plane by the driving motor 111 via the driving gear 121 and the intermediate shaft 125, a second transmission gear 133 that engages with the first transmission gear 131, a sleeve 135 that is caused to rotate together with the second transmission gear 133, and a tool holder 137 that is caused to rotate together with the sleeve 135 in a vertical plane.

[0017] As shown in FIG. 1, the striking element 115 mainly includes the cylindrical piston 141, a striker 143 slidably disposed within the bore of the cylindrical piston 141, and an impact bolt 145 that is slidably disposed within the tool holder 137 and serves to transmit the kinetic energy of the striker 143 to the hammer bit 119.

[0018] In the hammer drill 101 thus constructed, when the driving motor 111 is driven by the user's depressing operation of the trigger 117, the driving gear 121 is caused to rotate in a vertical plane by the rotating output of the driving motor 111. Then, the rotating element 127 is caused to rotate in a vertical plane via the driven gear 123 that engages with the driving gear 121 and via the intermediate shaft 125. Thus, the swash plate 129 and the swinging rod 128 are then caused to swing in the axial direction of the hammer bit 119, which in turn causes the cylindrical piston 141 to slide linearly. The striker 143 is then caused to linearly move within the piston 141 by pressure fluctuations of air or the action of an air spring within an air chamber 141 a of the cylindrical piston 141 as a result of the sliding movement of the piston 141. The striker 143 then collides with the impact bolt 145 and transmits the kinetic energy to the hammer bit 119.

[0019] When the first transmission gear 131 rotates together with the intermediate shaft 125, the sleeve 135 is caused to rotate in a vertical plane via the second transmission gear 133 that engages with the first transmission gear 131. Further, the tool holder 137 and the hammer bit 119 supported by the tool holder 137 rotate together with the sleeve 135. Thus, the hammer bit 119 performs a drilling operation on a workpiece (concrete) by a hammering movement in the axial direction and a drilling movement in the circumferential direction.

[0020] The hammer drill 101 according to this embodiment can be switched between a hammer drill mode in which the hammer bit 119 is caused to perform a hammering movement and a drilling movement as described above and a drill mode in which the hammer bit 119 is caused to perform only a drilling movement. A mechanism for such mode changing is not directly related to this invention and therefore will not be described.

[0021] Now, a bit holding mechanism 151 for holding the hammer bit 119 inserted into the tool holder 137 is described with reference to FIGS. 2 and 3. The bit holding mechanism 151 mainly includes the tool holder 137 having a bit holding hole 137a which has a circular section and into which a shank 119a of the hammer bit 119 is removably inserted, an engagement member in the form of a plurality of steel balls 153 which prevent or allow removal of the hammer bit 119 inserted into the bit holding hole 137a, and a tool sleeve 155 that switches the steel balls 153 between a bit removal preventing position and a bit removal allowing position. The tool holder 137 has a bit holding part 137A through which the bit holding hole 137a is formed in the axial direction and an impact bolt housing part 137B in which a space for housing the impact bolt 145 is formed. The impact bolt housing part

137B is integrally formed with the bit holding part 137A on its rear in the axial direction. The impact bolt housing part 137B is connected to the above-described sleeve 135 so that the tool holder 137 rotates together with the sleeve 135. The tool holder 137 and the sleeve 135 may be formed in one piece. The bit holding part 137A of the tool holder 137 is a feature that corresponds to the "bit holding region" according to this invention.

[0022] The bit holding hole 137a has an open front end as a bit insertion opening and a rear end open to the space of the impact bolt housing part 137B. A plurality of slots 137b are formed through the bit holding part 137A of the tool holder 137 in the radial direction. The slots 137b have a predetermined length extending in the axial direction of the bit holding part 137A and are arranged at predetermined intervals in the circumferential direction of the bit holding part 137A. The steel balls 153 are each disposed in the associated slots 137b. Each of the steel balls 153 can move in the associated slot 137b in the axial direction and can be moved (displaced) in the radial direction of the bit holding part 137A. The slot 137b is a feature that corresponds to the "opening" according to this invention.

[0023] The tool sleeve 155 is fitted on the bit holding part 137A such that it can move in the axial direction of the hammer bit. A stopper ring 157 for preventing the steel balls 153 from being displaced radially outward is fitted in the inside of the tool sleeve 155 on the bit holding part 137A. Further, a stopper plate 159 is disposed on the rear of the stopper ring 157 such that it can move in the axial direction of the tool sleeve 155 with respect to the tool sleeve 155. The stopper plate 159 is pressed against a rear surface of the stopper ring 157 by a biasing spring 161 disposed between the tool sleeve 155 and the bit holding part 137A. The biasing force of the biasing spring 161 acts as a force of pushing the tool sleeve 155 forward. Therefore, the tool sleeve 155 is normally held in a position in which its front end is in contact with a cap 163 fitted over a front end portion of the bit holding part 137A, or in a bit removal preventing position.

[0024] In this state, when the shank 119a of the hammer bit 119 is inserted into the bit holding hole 137a of the bit holding part 137A, the steel balls 153 are pushed rearward by the rear end of the shank 119a of the hammer bit 119. Then, the steel balls 153 move radially outward while pushing the stopper plate 159 rearward against the biasing force of the biasing spring 161, which allows further insertion of the hammer bit 119. When the rear end of the shank 119a of the hammer bit 119 passes the steel balls 153, the steel balls 153 are moved radially inward via the stopper plate 159 by the biasing force of the biasing spring 161 and engaged with an engagement groove 119b formed in the outer surface of the shank of the hammer bit 119, so that removal of the hammer bit 119 is prevented. The engagement groove 119b of the hammer bit 119 has a predetermined length extending in the axial direction.

[0025] Further, a plurality of radially extending projections 137c are formed as a torque transmitting part on the inner surface of the bit holding hole 137a of the bit holding part 137A and arranged at predetermined intervals in the circumferential direction. The torque transmitting projections 137c have a predetermined length extending in the axial direction of the bit holding part 137A and fitted (engaged) in torque transmission grooves 119c (see FIG. 3) formed in the outer surface of the shank 119a of the hammer bit 119 which is inserted into the bit holding hole 137a. In this state, the rotating force of the bit holding part 137A is transmitted to the hammer bit 119. The torque transmission grooves 119c are open to a rear end of the shaft 119a such that they are used to position the hammer bit 119 in the circumferential direction when inserting the hammer bit 119 into the bit holding hole 137a. Thus, the bit holding mechanism 151 holds the hammer bit 119 in the bit holding hole 137a of the tool holder 137 while allowing the hammer bit 119 to move in the axial direction.

[0026] In order to remove the hammer bit 119 from the bit holding part 137A, the tool sleeve 155 is moved to the rear bit removal allowing position against the biasing force of the biasing spring 161. As a result, the stopper ring 157 is released from the steel balls 153, so that the steel balls 153 are no longer prevented from moving radially outward. In this state, when the hammer bit 119 is pulled forward, the steel balls 153 are pushed radially outward. Therefore, the hammer bit 119 can be removed from the bit holding hole 137a.

[0027] Holding rings 165, 167 are press-fitted into the bit holding part 137A of the tool holder 137 on the bit insertion opening side of the bit holding hole 137a and on the far side of the bit holding hole 137a in the bit inserting direction or the side adjacent to the impact bolt housing part 137B, respectively. The holding rings 165, 167 are formed of materials having a higher hardness than the bit holding part 137A, such as alloy tool steels (SKD), high speed tool steels (SKH) and high-carbon chrome bearing steels (SUJ), having a hardness of 60 Rockwell Hardness C-Scale (HRC) or higher. The holding ring 165 on the bit insertion opening side is provided as a region for holding the hammer bit 119 inserted into the bit holding hole 137a, while allowing the hammer bit 119 to move in the axial direction with respect to the bit holding hole 137a. The holding ring 167 on the far side in the bit inserting direction is provided as a region for holding an inserted end of the hammer bit 119 inserted into the bit holding hole 137a, while allowing it to move in the axial direction with respect to the bit holding hole 137a. A region between the two holding rings 165, 167 is provided as a region to dispose a mechanism for preventing removal of the hammer bit 119 and a mechanism for transmitting a rotational driving force of the tool holder 137 to the hammer bit 119.

[0028] As described above, in this embodiment, as for the inner wall surface of the bit holding hole 137a which contacts the outer surface of the shank 119a of the hammer bit 119, the hardnesses of a bit insertion opening

side inner wall surface 165a and a far side inner wall surface 167a are higher than that of an intermediate inner wall surface 166a between the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a. The bit insertion opening side inner wall surface 165a, the far side inner wall surface 167a and the intermediate inner wall surface 166a are features that correspond to the "first holding region", the "third holding region" and the "second holding region", respectively, according to this invention. The slots 137b in which the steel balls 153 are disposed as a removal preventing member, and the torque transmitting projections 137c are formed in the bit holding part 137A which forms the intermediate inner wall surface 166a between the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a.

[0029] The hammer drill 101 according to this invention is thus constructed. In the inner wall surface of the bit holding hole 137a into which the shank 119a of the hammer bit 119 is inserted, the bit insertion opening side inner wall surface 165a is located in an environment in which wear most easily occurs because dust generated during operation easily enters it. In this embodiment, in the inner wall surface of the bit holding hole 137a, the bit insertion opening side inner wall surface 165a susceptible to wear is formed by the holding ring 165 having a higher hardness (of 60 Rockwell Hardness C-Scale (HRC) or higher), so that wear resistance of the bit insertion opening side inner wall surface 165a is increased. Thus, wear of the bit insertion opening side inner wall surface 165 can be reduced and its durability can be increased.

[0030] Further, when the hammer bit 119 performs a striking movement during operation, the hammer bit 119 is acted upon not only by a reaction force from the workpiece in the axial direction, but by an external force including a radial component in a radial direction transverse to the axial direction. The inner wall surface of the bit holding hole 137a supports this transverse force acting upon the hammer bit 119 mainly on the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a. According to this embodiment, portions that are subjected to the above-described transverse force, or the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a, are formed by the holding rings 165, 167 having a higher hardness. Thus, the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a which are subjected to higher load can have a higher durability, so that wear of the inner wall surfaces 165a, 167a can be reduced in a rational manner.

[0031] Wear of the inner wall surface of the bit holding hole 137a may cause runout of the hammer bit 119. Then, particularly in the case of the hammer drill 101, in which the rotating force of the tool holder 137 is transmitted to the hammer bit 119, the torque transmitting projections 137c formed on the tool holder 137 may suffer wear. As a result, drilling or other operation may become difficult due to the runout of the hammer bit 119. According to this embodiment, as described above, in the inner wall surface of the bit holding hole 137a, wear of the bit insertion opening side inner wall surface 165a and the far side inner wall surface 167a is reduced, so that runout of the hammer bit 119 can be reduced and thus wear of the torque transmitting projections 137c can also be reduced.

[0032] If the inner wall surface of the bit holding hole 137a is formed by a sleeve having a higher hardness along its entire axial length, an axial impact force which acts upon a front end region (left end region as viewed in FIG. 2) of the slots 137b of the bit holding part 137A via the steel balls 153 during striking movement of the hammer bit 119 may produce cracks in the bit holding part 137A in the vicinity of the front end region due to its higher hardness. Moreover, in this case, the machinability in forming the slots 137b of the bit holding part 137A by machining may be reduced. According to this embodiment, however, in the inner wall surface of the bit holding hole 137a, the bit holding part 137A forming the intermediate inner wall surface 166a can have as high a hardness as in a conventional technique. Therefore, the above-described problems of cracks and reduction in machinability can be solved. Further, in this embodiment, the bit holding hole 137a having the inner wall surface of different hardnesses can be easily produced by press-fitting the holding rings 165, 167 having a higher hardness than the bit holding part 137A, into the bit holding hole 137a on the bit insertion opening side and on the far side, respectively.

[0033] Further, although, in this embodiment, the holding rings 165, 167 are described as being provided in the bit holding hole 137a on the bit insertion opening side and on the far side, respectively, it may be changed such that the holding ring 165 is provided only on the bit insertion opening side. Further, the holding rings 165, 167 may be fixed by means other than press fitting, such as by welding and by using screws.

Description of Numerals

[0034]

101 hammer drill (impact tool)
103 body
105 motor housing
107 gear housing
109 grip
111 driving motor
112 armature shaft
113 motion converting mechanism
115 striking mechanism
117 trigger
119 hammer bit (tool bit)
119a shank
119b engagement groove
119c torque transmission groove
121 driving gear

123 driven gear
124 connecting shaft
125 intermediate shaft
126 ball bearing
127 rotating element
128 swinging rod
129 swash plate
131 first transmission gear
133 second transmission gear
135 sleeve
137 tool holder
137A bit holding part (bit holding region, second holding region)
137B impact bolt housing part
137a bit holding hole
137b slot (opening)
137c torque transmitting projection
141 cylindrical piston
141 a air chamber
143 striker
145 impact bolt
151 bit holding mechanism
153 steel ball
155 tool sleeve
157 stopper ring
159 stopper plate
161 biasing spring
163 cap
165 holding ring on the bit insertion opening side
165a bit insertion opening side inner wall surface (first holding region)
166a intermediate inner wall surface (second holding region)
167 holding ring on the far side in the bit inserting direction
167a far side inner wall surface (third holding region)

Claims

1. An impact tool which includes a tool holder (137) having a bit holding hole, (137a) wherein a detachably coupled tool bit (119) is inserted into the bit holding hole (137a), the tool bit (119) movably held in an axial direction to perform a predetermined operation on a workpiece at least by striking movement of the tool bit (119) in an axial direction, wherein the tool holder (137) has a bit holding region (137A) which is held in contact with an outer surface of the tool bit (119) inserted into the bit holding hole (137a), the tool holder (137) holding the tool bit (119) such that the tool bit can move in the axial direction and,
wherein the bit holding region (137A) has a first holding region (165a), a second holding region (166a) and a third holding region (167a), arranged in this order in the bit holding hole (137a) from a bit insertion opening toward the far side from the opening and,
wherein the first holding region (165a) is provided as a region for holding the tool bit (119) inserted into the bit holding hole (137a), while allowing the tool bit (119) to move in the axial direction with respect to the bit holding hole (137a), the second holding region (166a) is provided as a region to dispose a removal preventing member (153) which enrages with the tool bit (119) and thereby prevents the tool bit (119) from becoming slipped out of the bit holding hole (137a), and the third holding region (167a) is provided as a region for holding an inserted end of the tool bit (119) inserted into the bit holding hole (137a), while allowing it to move in the axial direction with respect to the bit holding hole (137a),
wherein the hardness of the first holding region (165a) or the hardnesses of the first and third holding regions (165a, 167a) are higher than that of the second holding region (166a)
characterized in that a rotatting force of the bit holding region (137A) is transmitted to the tool bit (119) via the second holding region (166a).

2. The impact tool as defined in claim 1, wherein the first holding region (165a) or the first and third holding regions (165a, 167a) are formed by a separate member having a higher hardness than the second holding region (166a).

3. The impact tool as defined in claim 1 or 2, wherein:

a ring-like member (165) is mounted to the tool holder (137), the ring-like member (165) being formed of a material having a higher hardness than the second holding region (166a) and separately from the tool holder (137), and
an inner circumferential surface of the ring-like member (165) mounted to the tool holder (137) forms the first holding region (165a).

4. The impact tool as defined in claim 3, wherein:

in addition to the ring-like member (165), a second ring-like member (167) is mounted to the tool holder (137), the second ring-like member (167) being formed of a material having a higher hardness than the second holding region (166a) and separately from the tool holder (137), and
an inner circumferential surface of the second ring-like member (167) mounted to the tool holder (137) forms the third holding region (167a).

5. The impact tool as defined in claim 3 or 4, wherein one or both of the ring-like members (165, 167) are mounted to the tool holder (137) by press fitting.

6. The impact tool as defined in any one of claims 1 to 5, wherein the removal preventing member (153) in the second holding region (166a) prevents removal of the tool bit (119) by moving in a radially inward

direction of the bit holding hole (137a) and engaging with the tool bit (119), and allows removal of the tool bit (119) by moving in a radially outward direction of the bit holding hole (137a), and wherein an opening (137b) is formed in the second holding region (166a) and the removal preventing member (153) is disposed in the opening (137b) so as to be movable in the radial direction.

Patentansprüche

1. Schlagwerkzeug, welches einen Werkzeughalter (137) enthält, der ein Bithalteloch (137a) hat, wobei ein lösbar gekoppeltes Werkzeugbit (119) in das Bithalteloch (137a) eingesetzt ist, wobei das Werkzeugbit (119) zum Ausführen eines vorbestimmten Arbeitsganges an einem Werkstück durch zumindest eine schlagende Bewegung des Werkzeugbits (119) in einer axialen Richtung bewegbar in einer axialen Richtung gehalten ist, wobei der Werkzeughalter (137) einen Bithaltebereich (137A) hat, der in Berührung mit einer äußeren Oberfläche des Werkzeugbits (119), das in das Bithalteloch (137a) eingesetzt ist, gehalten ist, wobei der Werkzeughalter (137) das Werkzeugbit (119) so hält, dass das Werkzeugbit in die axiale Richtung sich bewegen kann, und
wobei der Bithaltebereich (137A) einen ersten Haltebereich (165a), einen zweiten Haltebereich (166a) und einen dritten Haltebereich (167a) hat, die in dieser Anordnung von einer Biteinsetzöffnung in Richtung zu der von der Öffnung entfernten Seite in dem Bithalteloch (137a) angeordnet sind, und
wobei der erste Haltebereich (165a) als ein Bereich zum Halten des Werkzeugsbits (119), das in das Bithalteloch (137a) eingesetzt ist, vorgehen ist, während er es dem Werkzeugbit (119) ermöglicht, sich in die axiale Richtung mit Bezug auf das Bithalteloch (137a) zu bewegen, der zweite Haltebereich (166a) als ein Bereich zum Anordnen eines Demontageverhinderungsbauteils (153), welches mit dem Werkzeugbit (119) in Eingriff kommt und **dadurch** das Werkzeugbit (119) an einem Herausrutschen aus dem Bithalteloch (137a) hindert, vorgesehen ist, und der dritte Haltebereich (167a) als ein Bereich zum Halten eines eingesetzten Endes des Werkzeugbits (119), das in das Bithalteloch (137a) eingesetzt ist, vorgesehen ist, während er es ihm ermöglicht, in die axiale Richtung mit Bezug auf das Bithalteloch (137a) sich zu bewegen,
wobei die Härte des ersten Haltebereichs (165a) oder die Härte des ersten und dritten Haltebereichs (165a, 167a) höher ist als die des zweiten Haltebereichs (166a),
dadurch gekennzeichnet, dass eine Drehkraft des Bithaltebereichs (137A) über den zweiten Haltebereich (166a) an das Werkzeugbit (119) übertragen wird.

2. Schlagwerkzeug nach Anspruch 1, bei dem der erste Haltebereich (165a) oder der erste und dritte Haltebereich (165a, 167a) durch ein separates Bauteil, das eine höhere Härte als der zweite Haltebereich (166a) hat, gebildet sind.

3. Schlagwerkzeug nach Anspruch 1 oder 2, bei dem ein ringähnliches Bauteil (165) an den Werkzeughalter (137) montiert ist, wobei das ringähnliche Bauteil (165) aus einem Material, das eine höhere Härte als der zweite Haltebereich (166a) hat und getrennt von dem Werkzeughalter (137) gebildet ist, und
eine innere Umfangsoberfläche des ring-ähnlichen Bauteils (165), das an den Werkzeughalter (137) montiert ist, den ersten Haltebereich (165a) bildet.

4. Schlagwerkzeug nach Anspruch 3, bei dem
zusätzlich zu dem ringähnlichen Bauteil (165) ein zweites ringähnliches Bauteil (167) an den Werkzeughalter (137) montiert ist, wobei das zweite ringähnliche Bauteil (167) aus einem Material, das eine höhere Härte als der zweite Haltebereich (166a) hat, und getrennt von dem Werkzeughalter (137) gebildet ist, und
eine innere Umfangsoberfläche des zweiten ringähnlichen Bauteils (167), das an dem Werkzeughalter montiert ist, den dritten Haltebereich (167a) bildet.

5. Schlagwerkzeug nach Anspruch 3 oder 4, bei dem eines oder beide der ringähnlichen Bauteile (165, 167) an den Werkzeughalter (137) durch Presspassung montiert sind.

6. Schlagwerkzeug nach einem der Ansprüche 1 bis 5, bei dem das Demontageverhinderungsbauteil (153) in dem zweiten Haltebereich (166a) die Demontage des Werkzeugbits (119) durch Bewegen in eine radiale Richtung des Bithaltelochs (137a) nach innen verhindert und mit dem Werkzeugbit (119) in Eingriff steht, und eine Demontage des Werkzeugbits (119) durch Bewegen in eine radiale Richtung des Bithaltelochs (137a) nach außen ermöglicht, und wobei eine Öffnung (137b) in dem zweiten Haltebereich (166a) gebildet ist und das Demontageverhinderungsbauteil (153) in der Öffnung (137b) so angeordnet ist, dass es in die radiale Richtung bewegbar ist.

Revendications

1. Outil à percussion qui comprend un porte-outil (137) ayant un orifice porte-mèche (137a) dans lequel une mèche d'outil (119) couplée de manière amovible est insérée dans l'orifice porte-mèche (137a), la mè-

che d'outil (119) étant maintenue mobile dans une direction axiale pour effectuer une opération prédéterminée sur une pièce au moins par un mouvement de percussion de la mèche d'outil (119) dans une direction axiale, dans lequel le porte-outil (137) a une région porte-mèche (137A) qui est maintenue en contact avec une surface externe de la mèche d'outil (119) insérée dans l'orifice porte-mèche (137a), le porte-outil (137) supportant la mèche d'outil (119) de sorte que la mèche d'outil puisse se déplacer dans la direction axiale, et
dans lequel la région porte-mèche (137A) a une première région de support (165a), une deuxième région de support (166a) et une troisième région de support (167a) aménagées dans cet ordre dans l'orifice porte-mèche (137a) d'une ouverture d'insertion de mèche vers le côté éloigné de l'ouverture, et
dans lequel la première région de support (165a) se présente comme une région pour supporter la mèche d'outil (119) insérée dans l'orifice porte-mèche (137a) tout en permettant à la mèche d'outil (119) de se déplacer dans la direction axiale par rapport à l'orifice porte-mèche (137a), la deuxième région de support (166a) se présente comme une région pour disposer un élément d'empêchement de retrait (153) qui s'engage sur la mèche d'outil (119) et empêche ainsi la mèche d'outil (119) de glisser hors de l'orifice porte-mèche (137a), et la troisième région de support (167a) se présente comme une région pour supporter une extrémité insérée de la mèche d'outil insérée dans l'orifice porte-mèche (137a), tout en lui permettant de se déplacer dans la direction axiale par rapport à l'orifice porte-mèche (137a),
dans lequel la dureté de la première région de support (165a) ou les duretés des première et troisième régions (165a, 167a) sont supérieures à celle de la deuxième région de support (166a),
caractérisé en ce qu'une force de rotation de la région' porte-mèche (137A) est transmise à la mèche d'outil (119) via la deuxième région de support (166a).

2. Outil à percussion selon la revendication 1, dans lequel la première région de support (165a) ou les première et troisième régions de support (165a, 167a) sont formées par un élément séparé ayant une dureté supérieure à celle de la deuxième région de support (166a).

3. Outil à percussion selon la revendication 1 ou 2, dans lequel :

un élément de type annulaire (165) est monté sur le porte-outil (137), l'élément annulaire (165) étant formé d'un matériau ayant une dureté supérieure à celle de la deuxième région de support (166a) et séparément du porte-outil (137), et

une surface circonférentielle interne de l'élément annulaire (165) monté sur le porte-outil (137) forme la première région de support (165a).

4. Outil à percussion selon la revendication 3, dans lequel :

en plus de l'élément annulaire (165), un second élément annulaire (167) est monté sur le porte-outil (137), le second élément annulaire (167) étant formé d'un matériau ayant une dureté supérieure à celle de la deuxième région de support (166a) et séparément du porte-outil (137), et

une surface circonférentielle interne du second élément annulaire (167) monté sur le porte-outil (137) forme la troisième région de support (167a).

5. Outil à percussion selon la revendication 3 ou 4, dans lequel un des deux éléments annulaires (165, 167) ou les deux est ou sont montés sur le porte-outil (137) par ajustement serré.

6. Outil à percussion selon l'une quelconque des revendications 1 à 5, dans lequel l'élément d'empêchement de retrait (153) dans la deuxième région de support (166a) empêche le retrait de la mèche d'outil (119) par déplacement dans une direction radiale vers l'intérieur de l'orifice porte-mèche (137a) et engagement sur la mèche d'outil (119), et permet le retrait de la mèche d'outil (119) par déplacement dans une direction radiale vers l'extérieur de l'orifice porte-mèche (137a), et dans lequel une ouverture (137b) est formée dans la deuxième région de support (166a) et l'élément d'empêchement de retrait (153) est disposé dans l'ouverture (137b) pour pouvoir se déplacer dans la direction radiale.

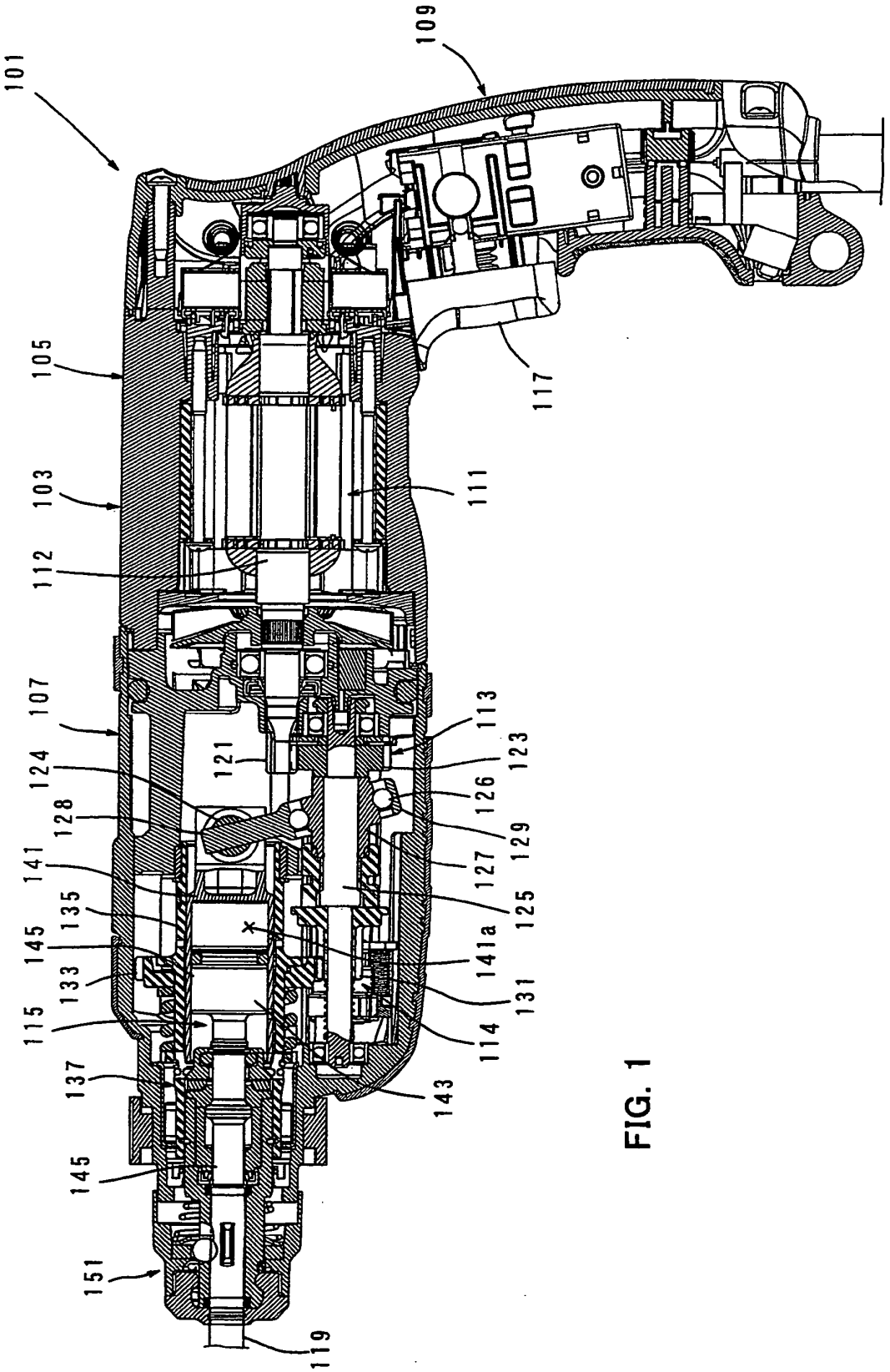
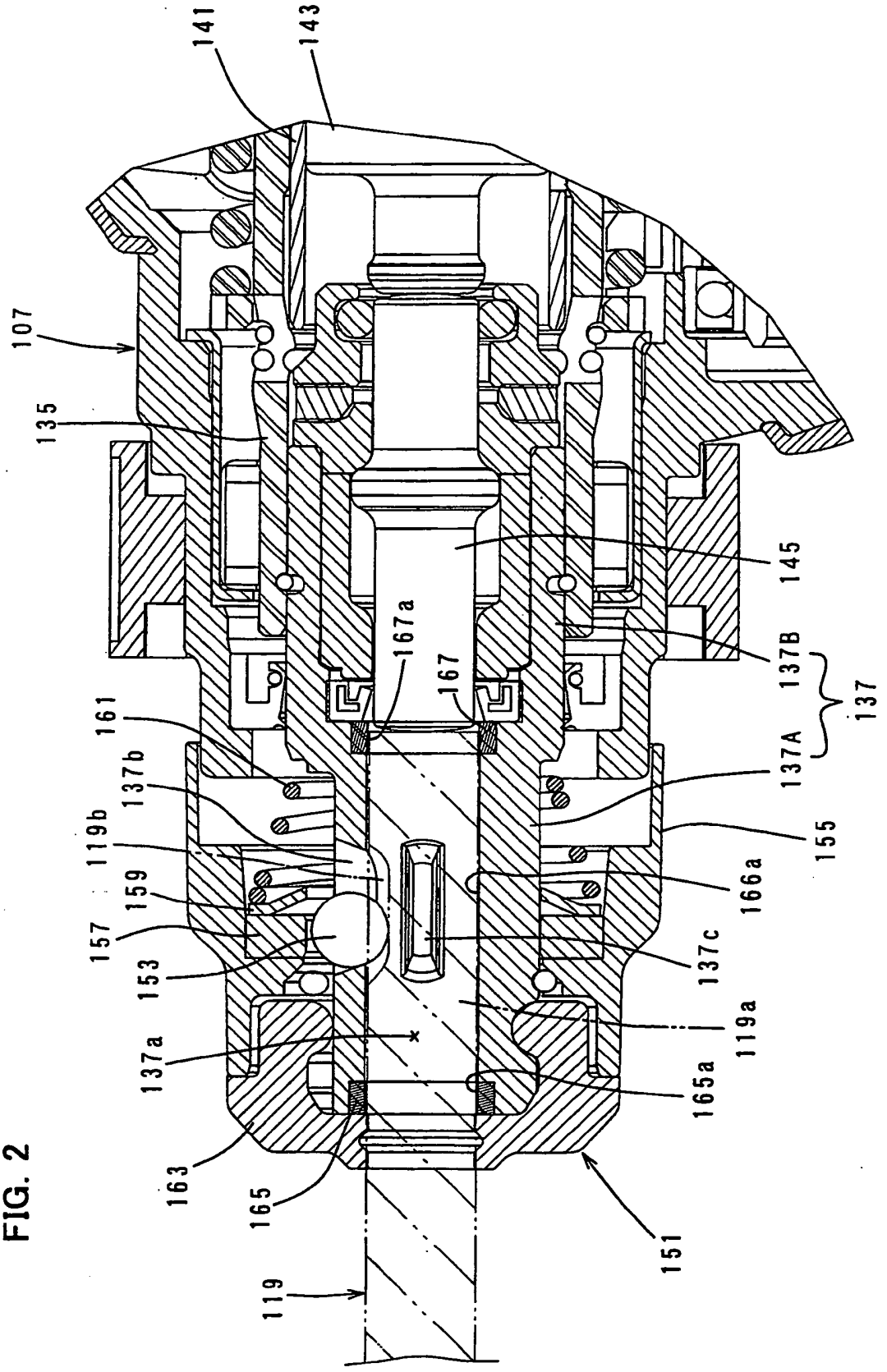

101
109
105
103
112
107
124
128
141
135
145
133
115
137
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151
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123
121
126
129
127
125
141a
131
114
143

FIG. 1

FIG. 2


141
143
107
135
145
167a
167
137B
137
137A
161
137b
119b
159
157
153
137a
155
166a
137c
119a
165a
163
165
151
119

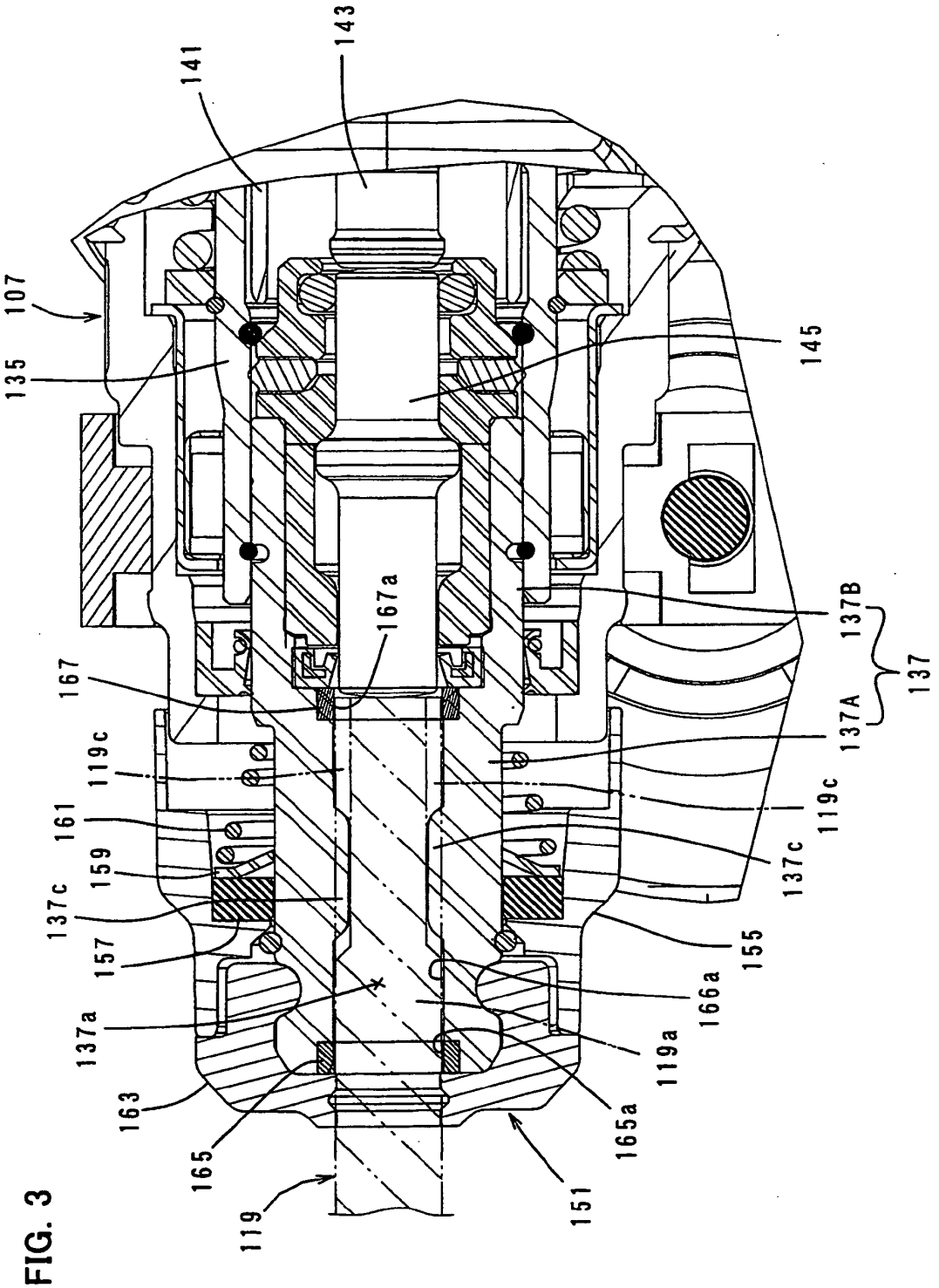

143
141
107
135
145
167a
137B
137
137A
167
119c
161
159
137c
157
155
166a
119a
137a
163
165a
165
119
151

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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