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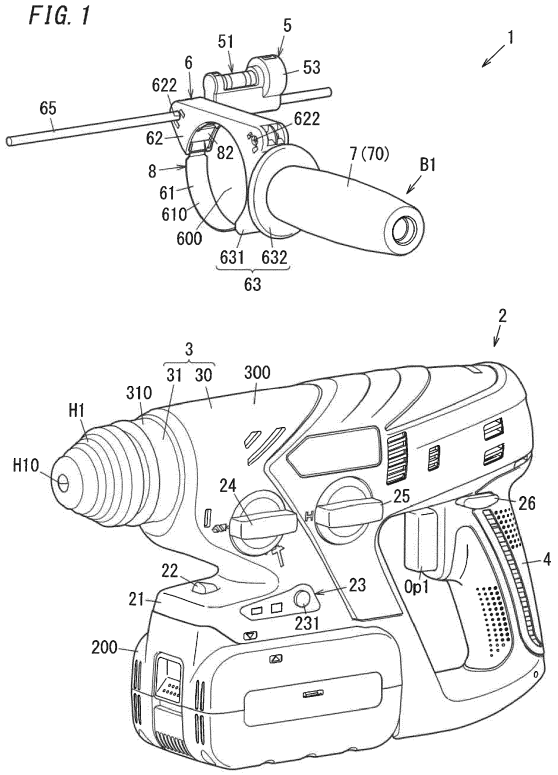
(54) ELECTRIC POWER TOOL, LEVEL, AND AUXILIARY HANDLE BLOCK

(57) Disclosed herein are an electric power tool allowing the user to easily adjust its orientation in such a manner as to align the rotational axis of a tip tool with a predetermined directional axis, and a level and auxiliary handle block for use in such an electric power tool. The electric power tool (1) includes a holder (H1), a barrel (3), a grip (4), a level (5), and a fixing member (6). The holder (HI) fixes a tip tool (T1) thereon so as to allow the tip tool (T1) to rotate in a rotational direction (R1) around a rotational axis (A1). The holder (H1) is fixed to the barrel (3). The grip (4) protrudes from the barrel (3). The fixing member (6) is attached onto the barrel (3) and fixes the level (5) on the fixing member (6). The fixing member (6) is able to turn, along with the level (5), around the barrel (3), in a plane perpendicular to the rotational axis (A1) and in the rotational direction (R1) of the tip tool (T1), or in the opposite direction thereof.

FIG. 1



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Description

Technical Field

[0001] The present disclosure generally relates to an electric power tool, a level, and an auxiliary handle block, and more particularly relates to an electric power tool with a level, and a level and auxiliary handle block provided for the electric power tool.

Background Art

[0002] A known electric power tool is disclosed, for example, in Japanese Unexamined Patent Application Publication No. 2013-107166 (hereinafter referred to as "Document 1"). The electric power tool disclosed in Document 1 has an outer shell made up of a generally cylindrical casing and a generally cylindrical grip, one end of which is pivotally coupled to an end of the casing. The electric power tool disclosed in Document 1 further includes a shaft portion. At a frontend of the shaft portion, provided is a chuck mechanism, which protrudes forward from the frontend of the casing. A tip tool such as a driver bit is detachably attached to the chuck mechanism. The tip tool rotates in such a direction as to fasten or loosen a screw or a nut.

[0003] According to the electric power tool disclosed in Document 1, the orientation adjustment of the electric power tool to align the rotational axis of the tip tool with a predetermined directional axis (such as a horizontal or vertical axis) heavily relies on the user's sense. This often makes it difficult to adjust the orientation of an electric power tool in such a manner as to align the rotational axis of a tip tool with a predetermined directional axis.

Summary of Invention

[0004] The present disclosure provides an electric power tool allowing the user to easily adjust its orientation in such a manner as to align the rotational axis of a tip tool with a predetermined directional axis, and also provides a level and auxiliary handle block for use in such an electric power tool.

[0005] An electric power tool according to an aspect of the present disclosure includes a holder, a barrel, a grip, a level, and a fixing member. The holder fixes a tip tool thereon so as to allow the tip tool to rotate in a rotational direction around a rotational axis. The holder is fixed to the barrel. The grip protrudes from the barrel. The fixing member is attached onto the barrel and fixes the level on the fixing member. The fixing member is able to turn, along with the level, around the barrel, in a plane perpendicular to the rotational axis and in the rotational direction of the tip tool or in an opposite direction thereof.

[0006] A level according to another aspect of the present disclosure is provided for the electric power tool described above.

[0007] An auxiliary handle block according to still another aspect of the present disclosure is for use in an electric power tool including a holder, a barrel, a grip, a level, a fixing member, and an auxiliary handle. The auxiliary handle block includes the level, the fixing member, and the auxiliary handle of the electric power tool. The holder fixes a tip tool thereon so as to allow the tip tool to rotate in a rotational direction around a rotational axis. The holder is fixed to the barrel. The grip protrudes from the barrel. The fixing member is attached onto the barrel to fix the level thereon. The auxiliary handle is coupled to the fixing member. The fixing member is able to turn, along with the level, around the barrel, in a plane perpendicular to the rotational axis and in the rotational direction of the tip tool or in an opposite direction thereof. The auxiliary handle is able to turn, along with the fixing member and the level, in the rotational direction, or in the opposite direction, around the barrel.

Brief Description of Drawings

[0008]

FIG. 1 is an exploded perspective view of an electric power tool according to an embodiment;
FIG. 2 is a front view illustrating how the electric power tool may be used in one mode of operation;
FIG. 3 is a cross-sectional view of a principal part of the electric power tool;
FIG. 4 is a plan view of the electric power tool;
FIG. 5 is a perspective view of a level for the electric power tool;
FIG. 6 is a right side view of the electric power tool; and
FIG. 7 is a right side view illustrating how the electric power tool may operate.

Description of Embodiments

[0009] An exemplary embodiment of an electric power tool, a level, and an auxiliary handle block will now be described with reference to the accompanying drawings. Note that the exemplary embodiment to be described below is only one of numerous embodiments of the present disclosure. The exemplary embodiment to be described below is readily modified, replaced, or combined with any of various embodiments depending on the design choice or any other factor, as long as an object of the present disclosure is achievable.

(Configuration of electric power tool)

[0010] As shown in FIG. 1, the electric power tool 1 includes a holder HI, a body 2, and an auxiliary handle block B1. The body 2 includes a barrel 3 and a grip 4. The auxiliary handle block B1 includes a level 5, a fixing member 6, and an auxiliary handle 7. The electric power tool 1 further includes an operating member (trigger) Op1, a motor, and a transmission mechanism.

[0011] The barrel 3 has a hollow, in which the motor and the transmission mechanism are housed. The grip 4 also has a hollow. The grip 4 protrudes from the barrel 3. The grip 4 and the barrel 3 are formed integrally with each other. The respective hollows of the barrel 3 and grip 4 are continuous with each other. The operating member Op1 is fixed onto the grip 4. The holder HI is secured to the barrel 3. As shown in FIG. 2, a tip tool T1 is fixed onto the holder H1.

[0012] The electric power tool 1 may be configured as a hammer drill, for example. The tip tool T1 may be a drill bit, for example. That is to say, the electric power tool 1 is used to drill, with the tip tool T1, a hole 110 in an object 100 of concrete, wood, a metal, or any other material. The tip tool T1 is formed in an elongate circular cylindrical shape. The tip tool T1 is fixed onto the holder HI so as to be rotatable around a rotational axis A1. The rotational axis A1 is a virtual line passing through the radial center of the circular cylindrical tip tool T1 and extending along the axis of the tip tool T1.

[0013] The holder HI has a truncated cone shape. The axis of the holder H1 is aligned with the rotational axis A1. At one axial end of the holder HI, there is a chuck hole H10 (see FIG. 1). The tip tool T1 is fixed onto the holder H1 with one end thereof inserted into the chuck hole H10. The holder HI has its diameter decreasing toward one end thereof, to which the tip tool T1 is fixed (and which is opposite from the barrel 3), along the axis thereof.

[0014] The operating member Op1 accepts a manual operation of pressing down the operating member Op1. The user's pressing the operating member Op1 activates the motor. The transmission mechanism transmits the power of the motor to the holder HI. This allows the tip tool T1 to rotate, along with the holder HI, around the rotational axis A1. In short, the manual operation of the operating member Op1 triggers rotation of the tip tool T1. When the user stops the manual operation of pressing down the operating member Op1, the motor stops and the tip tool T1 stops rotating as well.

[0015] As shown in FIGS. 1 and 2, the barrel 3 includes a barrel body 30 and a fixing member attachment unit 31. The barrel body 30 and the fixing member attachment unit 31 are formed in a cylindrical shape. The axis of the barrel body 30 and the fixing member attachment unit 31 is aligned with the rotational axis A1. More specifically, the fixing member attachment unit 31 is formed in the shape of a cylinder that is concentric with the tip tool T1. The outer peripheral surface 310 of the fixing member attachment unit 31 is closer in shape to the outer peripheral surface of a circular cylinder, of which the bottom is a perfect circle, than the outer peripheral surface 300 of the barrel body 30 is. In addition, the outer peripheral surface 310 of the fixing member attachment unit 31 has no regions, protrusions, or any other portions forming integral parts of a constituent member other than the fixing member attachment unit 31. One axial end of the fixing member attachment unit 31 is connected to the barrel body 30. To the other axial end of the fixing member attachment unit 31, the holder HI is fixed. That is to say, the fixing member attachment unit 31 is provided between the barrel body 30 and the holder HI.

[0016] The grip 4 is formed in a cylindrical shape. In one directional axis aligned with the rotational axis A1 (i.e., the rightward and leftward directions on the paper on which FIG. 2 is drawn), the grip 4 protrudes from the vicinity of one end, opposite from the other end to which the holder HI is fixed, of the barrel 3 in a direction intersecting with the one directional axis (i.e., downward on the paper on which FIG. 2 is drawn).

[0017] The electric power tool 1 further includes a battery attachment unit 21, a light projector 22, an operating panel 23, a mode switch dial 24, a striking force switch dial 25, and a rotational direction inverting switch 26.

[0018] The battery attachment unit 21 protrudes from the barrel body 30. The battery attachment unit, 21, the barrel body 30, and the grip 4 form integral parts of this electric power tool 1. A battery pack 200 is attached to the battery attachment unit 21. The battery pack 200 houses therein secondary batteries such as lithium-ion batteries. Those secondary batteries supply power to the electric power tool 1.

[0019] The light projector 22 includes some light source such as a light-emitting diode, for example. The light projector 22 projects light along the rotational axis A1 (i.e., leftward on the paper on which FIG. 2 is drawn). The operating panel 23 includes a button 231 for turning ON and OFF the light source of the light projector 22.

[0020] The mode switch dial 24 accepts the operation of switching the operation mode of the electric power tool 1 between a drill mode and a hammer mode. In the drill mode, the electric power tool 1 applies rotational force to the object 100 via the tip tool T1. In the hammer mode, the electric power tool 1 applies rotational force and striking force to the object 100 via the tip tool T1. The striking force switch dial 25 accepts the operation of changing the magnitude of the striking force in the hammer mode. The rotational direction inverting switch 26 accepts the operation of inverting the rotational direction of the tip tool T1.

[0021] FIG. 3 is a cross-sectional view taken along the plane XI-XI shown in FIG. 4. After at least a portion of the fixing member 6 has been put as shown in FIG. 3 so as to surround the fixing member attachment unit 31, the fixing member 6 is attached onto the fixing member attachment unit 31. As shown in FIGS. 1 and 3, the fixing member 6 includes a band 61, a supporting portion 62, a coupling portion 63, a cover 64, and a depth gauge 65.

[0022] The band 61 is formed in the shape of an annular plate with an arc-shaped portion. The supporting portion 62 is formed in the shape of a box with an opening 620 on one side thereof. The one side of the supporting portion 62 is a side that faces the fixing member attachment unit 31 when the fixing member 6 is attached onto the fixing member attachment unit 31. Part of the band 61 is inserted through the opening 620 into the supporting

portion 62. Inside the supporting portion 62, there are ribs 621 in contact with the band 61. The supporting portion 62 has two through holes 622. The depth gauge 65 is inserted into one of the two through holes 622. This allows the depth gauge 65 to be supported by the supporting portion 62.

[0023] The coupling portion 63 includes a box-shaped coupling portion body 631 with an opening 630 on one side thereof, and an annular flange portion 632 protruding from the periphery of the coupling portion body 631. The one side of the coupling portion 63 is a side that faces the fixing member attachment unit 31 when the fixing member 6 is attached onto the fixing member attachment unit 31. Part of the band 61 is inserted through the opening 630 into the coupling portion 63. The supporting portion 62 is fixed onto the coupling portion 63.

[0024] The cover 64 is formed in an arc-shaped plate when viewed perpendicularly to the thickness of the cover 64. The cover 64 is attached to the coupling portion 63 so as to partially cover the opening 630 of the coupling portion 63. In the fixing member 6, a circular opening 600 is formed to be surrounded with the band 61 and the cover 64.

[0025] The auxiliary handle 7 includes a bar 70. In this embodiment, the bar 70 constitutes the entire auxiliary handle 7. The bar 70 is formed in the shape of a circular cylindrical bar. The bar 70 is connected to the coupling portion 63 of the fixing member 6.

[0026] The fixing member 6 is attached onto the fixing member attachment unit 31 of the barrel 3. More specifically, the fixing member attachment unit 31 is inserted into the opening 600 surrounded with the band 61 and the cover 64 such that the inner peripheral surface of the band 61 and the cover 64 are in contact with the outer peripheral surface 310 of the fixing member attachment unit 31. At this time, the band 61, the supporting portion 62, the coupling portion 63, and the cover 64 are arranged so as to surround the fixing member attachment unit 31. That is to say, the fixing member 6 is attached onto the barrel 3 such that at least part of the fixing member 6 surrounds the fixing member attachment unit 31. Also, at this time, the bar 70 faces the fixing member attachment unit 31 of the barrel 3 in a longitudinal direction, which is defined by the longitudinal axis of the bar 70. More specifically, the center axis of the circular cylindrical fixing member attachment unit 31 intersects with a cross section of the bar 70 when the bar 70 is extended along the longitudinal axis thereof.

[0027] The auxiliary handle block B1 includes a locking mechanism 8 including a bolt 81, the band 61, and the bar 70. That is to say, the band 61 serves as not only a constituent member of the fixing member 6 but also a constituent member of the locking mechanism 8. The bar 70 serves as not only a constituent member of the auxiliary handle 7 but also a constituent member of the locking mechanism 8.

[0028] The fixing member 6 turns along the outer peripheral surface 310 of the fixing member attachment unit 31. More specifically, sliding the inner peripheral surface 610 of the band 61 and the cover 64 with respect to the outer peripheral surface 310 of the fixing member attachment unit 31 allows the fixing member 6 to turn along the outer peripheral surface 310 of the fixing member attachment unit 31 circumferentially. This allows the auxiliary handle 7 and the locking mechanism 8 to turn around the fixing member attachment unit 31 as well. Also, the depth gauge 65 of the fixing member 6 fixes the level 5 thereon. That is to say, the level 5, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 (auxiliary handle block B1) together turn around the fixing member attachment unit 31.

[0029] The depth gauge 65 is formed in the shape of a rod (more specifically, in the shape of a circular cylinder). The depth gauge 65 is inserted into one of the two through holes 622 of the supporting portion 62. The depth gauge 65 has a scale, the steps of which are engraved or printed at regular intervals along the longitudinal axis thereof. The longitudinal axis of the depth gauge 65 is aligned with the rotational axis A1 (see FIG. 2). As will be described in detail later, the depth gauge 65 reduces the chances of the hole 110 (see FIG. 2) drilled by the tip tool T1 (see FIG. 2) becoming deeper than a specified depth.

[0030] The locking mechanism 8 changes the force of the band 61 and the cover 64 squeezing the fixing member attachment unit 31 by adjusting the diameter of the opening 600. The locking mechanism 8 regulates the turn of the fixing member 6 with respect to the fixing member attachment unit 31 by increasing the force of the band 61 and the cover 64 squeezing the fixing member attachment unit 31.

[0031] The bolt 81 couples the band 61 and the bar 70 together. The bolt 81 is fastened to the band 61 so as not to turn with respect to the band 61. The bolt 81 is screwed into the bar 70. The axis of the bolt 81 is aligned with the axis of the bar 70. Turning the bar 70 in a first direction D1 (see FIG. 2) around the rotational axis A2 of the bar 70 increases the depth of the bolt 81 screwed into the bar 70. On the other hand, turning the bar 70 in a second direction D2 (see FIG. 2), which is opposite from the first direction D1, around the rotational axis A2 of the bar 70 decreases the depth of the bolt 81 screwed into the bar 70. As can be seen, the bolt 81 may be moved along the longitudinal axis of the bar 70. The rotational axis A2 is a virtual line passing through the radial center of the circular cylindrical bar 70 and extending along the axis of the bar 70.

[0032] Increasing the depth of the bolt 81 screwed into the bar 70 to move the bolt 81 downward on the paper on which FIG 3 is drawn (i.e., away from the opening 600) causes the band 61 to be pulled downward on the paper. This shortens the length of a portion, located outside of the coupling portion 63, of the band 61, thus decreasing the diameter of the opening 600. A decrease in the diameter of the opening 600 causes an increase in the force of the band 61 and the cover 64 squeezing the

fixing member attachment unit 31. This allows the fixing member 6 to be fastened onto the fixing member attachment unit 31 more firmly and regulates the turn of the fixing member 6 with respect to the fixing member attachment unit 31.

[0033] On the other hand, decreasing the depth of the bolt 81 screwed into the bar 70 to move the bolt 81 upward on the paper on which FIG. 3 is drawn (i.e., toward the opening 600) loosens the band 61 with respect to the fixing member attachment unit 31. This increases the length of a portion, located outside of the coupling portion 63, of the band 61, thus increasing the diameter of the opening 600. An increase in the diameter of the opening 600 causes a decrease in the force of the band 61 and the cover 64 squeezing the fixing member attachment unit 31. This allows the fixing member 6 to rotate with respect to the fixing member attachment unit 31.

[0034] To attach the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 onto the fixing member attachment unit 31, first of all, the bar 70 is turned in the second direction D2 (see FIG. 2) to make the diameter of the opening 600 larger than the diameter of the fixing member attachment unit 31, and the fixing member attachment unit 31 is inserted into the opening 600. Then, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 are turned around the circumference of the fixing member attachment unit 31 to adjust the position of the auxiliary handle 7 appropriately. After that, the bar 70 is turned in the first direction D1 (see FIG. 2) to decrease the diameter of the opening 600. This allows the band 61 and the cover 64 to squeeze the fixing member attachment unit 31. Consequently, the fixing member 6 is fastened onto the fixing member attachment unit 31, and is prevented from turning with respect to the fixing member attachment unit 31.

[0035] In FIG. 4, the fixing member 6 and the auxiliary handle 7 are arranged in this order from top to bottom on the paper. The fixing member 6, the auxiliary handle 7, and the locking mechanism 8 are formed symmetrically in the rightward and leftward directions on the paper of FIG. 4 (i.e., symmetric with respect to a plane perpendicular to the rotational axis A1). Therefore, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 may be attached onto the fixing member attachment unit 31 after the assembly including the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 has been rotated 180 degrees around a rotational axis extending in the direction perpendicular to the paper on which FIG. 4 is drawn such that the auxiliary handle 7 and the fixing member 6 are arranged in this order from top to bottom on the paper of FIG. 4.

[0036] Furthermore, as shown in FIG. 3, the locking mechanism 8 further includes two gauge fixing portions 82. These two gauge fixing portions 82 are arranged inside the supporting portion 62. Each of the gauge fixing portions 82 is formed in a U-shape when viewed perpendicularly to the rotational axis A1 (see FIG. 2). One of these two gauge fixing portions 82 is hooked on the band 61 and the other gauge fixing portion 82 is hooked on the band 61 and the cover 64. Each gauge fixing portion 82 has two through holes 820 (only one of which is shown in FIG. 3 per gauge fixing portion 82). In each gauge fixing portion 82, the two through holes 820 are arranged in the direction perpendicular to the paper of FIG. 3 (i.e., along the rotational axis A1). The two through holes 820 are aligned with the through hole 622 of the supporting portion 62 in the direction perpendicular to the paper of FIG 3. The depth gauge 65 is inserted into the two through holes 820 of one of the two gauge fixing portions 82 and into the through hole 622 of the supporting portion 62.

[0037] Turning the bar 70 in the first direction D1 (see FIG 2) to decrease the diameter of the opening 600 allows the band 61 and the cover 64 to pull the two gauge fixing portions 82 toward the center of the opening 600. This causes the depth gauge 65, inserted into the two through holes 820 of one of the two gauge fixing portions 82, to be pulled toward the center of the opening 600. This regulates the movement of the depth gauge 65 along the longitudinal axis thereof with respect to the supporting portion 62.

[0038] As shown in FIG. 5, the level 5 includes a first level body 51, a second level body 52, and a housing 53.

[0039] The first level body 51 includes a first spirit level vial 511. The first spirit level vial 511 is formed in the shape of a hollow circular cylinder. The first spirit level vial 511 is made of a material such as glass and is transparent. Inside the first spirit level vial 511, contained are a liquid 512 such as alcohol and an air bubble 513. Also, a plurality of (e.g., four in FIG. 5) scale lines 514 are provided on the first spirit level vial 511. These scale lines 514 are arranged along the axis of the first spirit level vial 511. If the center C1 of the air bubble 513 is located at the center of a region F1 between two central ones of the scale lines 514 (i.e., the axial center of the first spirit level vial 511), then it can be seen that the axis of the first spirit level vial 511 is aligned with the horizontal axis. That is to say, in such a situation, the first level body 51 may detect that the first level body 51 is in the horizontal state. If an outer edge of the air bubble 513 located in the region F1 is in contact with any of these scale lines 514, then it can be seen that the axis of the first spirit level vial 511 has shifted from the horizontal axis by a predetermined angle. For example, if an outer edge of the air bubble 513 located in the region F1 is in contact with any of the two outer scale lines 514 with respect to the region Fl, then it can be seen that the axis of the first spirit level vial 511 has shifted from the horizontal axis by an angle of approximately 0.57 degrees corresponding to a one-hundredth gradient.

[0040] The second level body 52 includes a second spirit level vial 521. The second spirit level vial 521 is formed in the shape of a hollow circular cylinder. The second spirit level vial 521 is axially compressed compared to the first spirit level vial 511. The second spirit level vial 521 is made of a material such as glass and is transparent. Inside the second spirit level vial 521, con-

tained are a liquid 522 such as alcohol and an air bubble. On one surface 5210 of the second spirit level vial 521, provided is a reference circle 524. If the center of the air bubble is located inside the reference circle 524 when viewed along the rotational axis A1 (see FIG. 2), then it can be seen that a plane perpendicular to the axis of the second spirit level vial 521 is parallel to a horizontal plane. That is to say, in such a situation, the second level body 52 detects that the second spirit level vial 52 is in the horizontal state.

[0041] The housing 53 is a combination of two members. The housing 53 has a groove 531 and a circular hole 532. The housing 53 fixes the first level body 51 and the second level body 52 thereon. More specifically, while the two members of the housing 53 are still separate from each other, the first level body 51 is inserted into the groove 531. After that, the two members are combined together. In this manner, the first level body 51 is fixed onto the housing 53. In addition, while the two members of the housing 53 are still separate from each other, the second level body 52 is inserted into the hole 532. After that, the two members are combined together. In this manner, the second level body 52 is fixed onto the housing 53.

[0042] Each of the first level body 51 and the second level body 52 is supposed to be used in an orientation that has been determined in advance to a certain degree. That is to say, each of the first level body 51 and the second level body 52 is able to detect the horizontal state most accurately when facing a predetermined direction with respect to the vertical direction. Specifically, the first level body 51 is fixed to the housing 53 so as to detect the horizontal state most accurately when located over the groove 531 in the vertical direction. The second level body 52 is fixed to the housing 53 so as to detect the horizontal state most accurately when the one surface 5210 with the reference circle 524 faces upward in the vertical direction.

[0043] The housing 53 fixes the first level body 51 and the second level body 52 such that the axis of the first spirit level vial 511 is aligned with the axis of the second spirit level vial 521. The level 5 is further fixed onto the fixing member 6 (see FIG. 2) such that the axes of the first and second spirit level vials 511 and 521 are aligned with the rotational axis A1 (see FIG. 2). Thus, the first level body 51 is able to detect the horizontal state when the first level body 51 is located over the groove 531 in the vertical direction and when the axis of the first spirit level vial 511 and the rotational axis A1 are aligned with the horizontal axis (corresponding to the first directional axis). On the other hand, the second level body 52 is able to detect the horizontal state when the one surface 5210 faces upward in the vertical direction and when the axis of the second spirit level vial 521 and the rotational axis A1 are aligned with the vertical axis (corresponding to the second direction).

[0044] The housing 53 has the insertion port 530. The insertion port 530 runs through the housing 53 along the respective axes of the first and second spirit level vials 511 and 521. As shown in FIGS. 4 and 6, the depth gauge 65 is inserted into the insertion port 530. Inserting the depth gauge 65 into the insertion port 530 allows the level 5 to be fixed onto the depth gauge 65. Also, pulling the depth gauge 65 out of the insertion port 530 allows the level 5 to be removed from the depth gauge 65. That is to say, the level 5 is readily attachable to, and detachable from, the depth gauge 65 of the fixing member 6.

[0045] The two through holes 622 of the supporting portion 62 (see FIG. 1) are located around both ends of the supporting portion 62 along the axis of the bar 70 (auxiliary handle 7). The depth gauge 65 is inserted into one, located more distant from the bar 70, of the two through holes 622. This allows the fixing member 6 to fix the level 5 such that the barrel 3 is located between the bar 70 and the level 5 along the longitudinal axis of the bar 70 (corresponding to the rightward and leftward directions on the paper of FIG. 6).

[0046] As the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 (see FIG. 3) turn around the fixing member attachment unit 31 of the barrel 3, the level 5 also turns around the fixing member attachment unit 31. The rotational direction of the level 5, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 may be either the same as, or opposite from, the rotational direction R1 of the tip tool T1 (see FIG. 2). The rotational direction R1 of the tip tool T1 may be either the clockwise direction or the counterclockwise direction (see FIGS. 6 and 7). The user is allowed to turn the level 5, along with the auxiliary handle 7, around the fixing member attachment unit 31 by gripping and turning the auxiliary handle 7. The level 5, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 may move, for example, to the rotational position shown in FIG. 7 by turning from the rotational position shown in FIG. 6 around the fixing member attachment unit 31 (see FIG. 1). In this case, as shown in FIGS. 6 and 7, the level 5, the fixing member 6, the auxiliary handle 7, and the locking mechanism 8 may turn in the rotational direction R1, or in the opposite direction, around the fixing member attachment unit 31 (see FIG. 1) in a plane perpendicular to the rotational axis A1 (see FIG. 2). In this embodiment, the level 5 may turn in the rotational direction R1, or in the opposite direction, around the fixing member attachment unit 31 while leaving an arc-shaped trace around the rotational axis A1.

[0047] During the rotation, the respective axes of the first and second spirit level vials 511 and 521 (see FIG. 5) of the level 5 are kept aligned with the rotational axis A1 (see FIG. 2). As can be seen, a portion, which was aligned with the rotational axis A1 before the rotation, of the level 5 is kept aligned with the rotational axis A1 while the level 5 is turning. In addition, the angle (of, e.g., 90 degrees in this embodiment) formed between the direction defined by the level 5 by itself (e.g., the axis of the first spirit level vial 511) independently of the barrel 3 and a plane perpendicular to the rotational axis A1 is also

maintained during the turn of the level 5.

[0048] Furthermore, the level 5 is able to turn in the rotational directions R1, or in the opposite direction, with respect to the fixing member 6. More specifically, the level 5 is able to turn around the depth gauge 65 as shown in FIG. 7. In FIG. 7, the level 5 that has not turned yet with respect to the fixing member 6 is indicated by the two-dot chain circle, and the level 5 that has turned with respect to the fixing member 6 is indicated by the solid profile. The user is allowed to turn the level 5 in the rotational direction R1, or in the opposite direction, with respect to the fixing member 6 by manually applying force directly to the level 5, for example. Also, when turning in the rotational direction R1, or in the opposite direction, with respect to the fixing member 6, the level 5 turns in a plane perpendicular to the rotational axis A1.

[0049] The user is allowed to change, by turning the level 5 in the rotational direction R1, or in the opposite direction, with respect to the fixing member 6, the orientation of the level 5 such that the first level body 51 is located over the groove 531 in the vertical direction. The user may turn the level 5, along with the fixing member 6, in the rotational directions R1, or in the opposite direction, around the fixing member attachment unit 31 and also turn the level 5 with respect to the fixing member 6, either simultaneously or separately from each other, without limitation.

[0050] As described above, turning the bar 70 of the locking mechanism 8 in the first direction D1 (see FIG. 2) to decrease the diameter of the opening 600 reduces the chances of the fixing member 6 turning with respect to the fixing member attachment unit 31 (see FIG 1). On the other hand, turning the bar 70 of the locking mechanism 8 in the second direction D2 (see FIG. 2) to increase the diameter of the opening 600 allows the fixing member 6 to turn with respect to the fixing member attachment unit 31. That is to say, the locking mechanism 8 is able to lock and unlock the fixing member 6 onto/from the barrel 3 so as to allow and prevent the turn of the fixing member 6 in the rotational direction R1, or in the opposite direction, around the barrel 3. This allows the locking mechanism 8 to lock and unlock the level 5 onto/from the barrel 3 so as to allow and prevent the turn of the level 5 in the rotational direction R1, or in the opposite direction, around the barrel 3.

[0051] The two through holes 622 of the supporting portion 62 are located at respective positions shifted in the rotational direction R1, or in the opposite direction, around the barrel 3 with respect to an extension of the longitudinal axis of the bar 70 (corresponding to the rightward and leftward directions on the paper of FIG. 6). Thus, the fixing member 6 fixes the level 5 at a position shifted in the rotational direction R1, or in the opposite direction, around the barrel 3 with respect to the extension of the longitudinal axis of the bar 70. In other words, the fixing member 6 fixes the level 5 at a position shifted in a direction substantially perpendicular to the longitudinal axis of the bar 70 and the rotational axis A1 (see FIG. 2) (i.e., the upward and downward directions on the paper of FIG 6) with respect to the extension of the longitudinal axis of the bar 70. In this case, the first level body 51 of the level 5 is viewable at least partially without having its view blocked by the barrel 3 when viewed along the longitudinal axis of the bar 70 as shown in FIG. 2.

[0052] The longitudinal axis of the depth gauge 65 is aligned with the rotational axis A1. The level 5 may be fixed anywhere on the depth gauge 65. In this embodiment, the depth gauge 65 (or the fixing member 6) fixes the level 5 thereon such that the level 5 is adjacent to the portion PI, located between the grip 4 and the holder HI in the one direction aligned with the rotational axis A1 (i.e., the rightward and leftward directions on the paper of FIG. 2), of the barrel 3. The portion PI, located between the grip 4 and the holder HI in the one direction aligned with the rotational axis A1, of the barrel 3 is a portion, adjacent to the supporting portion 62 of the fixing member 6, of the barrel body 30. That is to say, the level 5 is fixed in the vicinity of the supporting portion 62.

(Exemplary work using electric power tool)

[0053] Next, an example of machine work using the electric power tool 1 will be described. First of all, exemplary work of drilling a hole 110 in an object 100, which may be a wall material, such that the depth axis of the hole 110 is aligned with the horizontal axis will be described. For this work, the first level body 51 is used, out of the first and second level bodies 51 and 52.

[0054] First, the user turns the bar 70 in the second direction D2 (see FIG. 2) to increase the diameter of the opening 600 (see FIG. 1), thus unlocking the level 5 and allowing the level 5 to turn in the rotational direction R1 or in the opposite direction. In addition, at this time, a decrease in the force of the band 61 (see FIG. 3) pulling the gauge fixing portion 82 (see FIG. 3) toward the center of the opening 600 allows the depth gauge 65 to move along the longitudinal axis thereof with respect to the supporting portion 62.

[0055] Next, the user specifies in advance, using the depth gauge 65, the depth of the hole 110 to be drilled by the tip tool T1. Specifically, the tip T10 of the tip tool T1 is brought into contact with the object 100. In addition, the depth gauge 65 is moved along the rotational axis A1 with respect to the supporting portion 62 such that the tip 650 of the depth gauge 65 is brought into contact with the object 100. In this state, the depth gauge 65 may be moved along the rotational axis A1 with respect to the supporting portion 62 to a position away from the object 100 by as long a distance as the depth of the hole 110 to be drilled by the tip tool T1 (i.e., the depth, specified by the user, of the hole 110). The user is allowed to move the depth gauge 65 for his or her desired distance by looking at the scale on the depth gauge 65. In this manner, the depth of the hole 110 is specified.

[0056] Next, the user moves the level 5 to an easily viewable position by turning the auxiliary handle 7 in the

rotational direction R1, or in the opposite direction (see FIG. 6), around the fixing member attachment unit 31. The auxiliary handle block B1 may be arranged as shown in FIG. 2, for example.

[0057] Subsequently, the user turns the bar 70 in the first direction D1 to decrease the diameter of the opening 600 (see FIG. 1), thus locking the level 5 and preventing the level 5 from turning in the rotational direction R1 or in the opposite direction. In the meantime, pulling the gauge fixing portion 82 (see FIG. 3) toward the center of the opening 600 reduces the chances of the depth gauge 65 moving along the longitudinal axis thereof with respect to the supporting portion 62.

[0058] Furthermore, the user turns the level 5 in the rotational direction R1, or in the opposite direction, with respect to the depth gauge 65 such that the first level body 51 is located over the groove 531 (see FIG. 5) in the vertical direction.

[0059] The user, who is located in front of the electric power tool 1 shown in FIG. 2, may hold the electric power tool 1 on the right-hand side. More specifically, the user may hold the grip 4 in his or her right hand and hold the auxiliary handle 7 in his or her left hand, for example. The user brings the tip tool T1 closer toward the object 100. At this time, the user adjusts, using the first level body 51, the orientation of the electric power tool 1 such that the rotational axis A1 of the tip tool T1 is aligned with the horizontal axis (corresponding to the first directional axis). That is to say, the user adjusts the orientation of the electric power tool 1 such that the center C1 of the air bubble 513 of the first level body 51 is located at the center of the region F1. When the center C1 of the air bubble 513 is located at the center of the region F1, the rotational axis A1 of the tip tool T1 is aligned with the horizontal axis. In this state, the user operates the operating unit Op1 manually to turn the tip tool T1.

[0060] Even while drilling the hole 110 in the object 100, the user may also adjust, by checking the first level body 51 as appropriate, the orientation of the electric power tool 1 such that the rotational axis A1 is aligned with the horizontal axis.

[0061] When the depth of the hole 110 reaches the depth specified with the depth gauge 65, the tip 650 of the depth gauge 65 comes into contact with the object 100. In this manner, the depth gauge 65 prevents the hole 110 from becoming deeper than the specified depth by coming into contact with the object 100 when the depth of the hole 110 drilled by the tip tool T1 reaches the specified depth. At this point in time, the user stops operating the operating member Op1 manually.

[0062] As can be seen, adjusting the orientation of the electric power tool 1 using the first level body 51 allows the user to drill the hole 110 in the object 100 such that the depth axis of the hole 110 is aligned with the horizontal axis.

[0063] Next, exemplary work of drilling a hole in an object, which may be a floor material, such that the depth axis of the hole is aligned with the vertical axis will be described. In the following description, only differences from the situation where the object 100 is the wall material will be described.

[0064] For this work, the second level body 52 is used, out of the first and second level bodies 51 and 52 (see FIG. 6). The second level body 52 is still able to detect, even when it has rotated in the rotational direction R1 or in the opposite direction (see FIG. 7), the horizontal state accurately enough. That is why the level 5 may be moved to any position while being turned in the rotational direction R1, or in the opposite direction, with respect to the depth gauge 65.

[0065] The user may hold the grip 4 in his or her right hand and hold the auxiliary handle 7 in his or her left hand, for example. The user brings the tip tool T1 toward the object 100. At this time, the user adjusts, using the second level body 52 (see FIG. 6), the orientation of the electric power tool 1 such that the rotational axis A1 of the tip tool T1 is aligned with the vertical axis (corresponding to the second directional axis). That is to say, the user adjusts the orientation of the electric power tool 1 such that the air bubble of the second level body 52 is located inside the reference circle 524 (see FIG. 6) when viewed along the rotational axis A1. When the air bubble is located inside the reference circle 524 when viewed along the rotational axis A1, the rotational axis A1 of the tip tool T1 is aligned with the vertical axis. In this state, the user operates the operating unit Op1 manually to turn the tip tool T1.

[0066] Even while drilling the hole in the object, the user may also adjust, by checking the second level body 52 as appropriate, the orientation of the electric power tool 1 such that the rotational axis A1 is aligned with the vertical axis.

[0067] As can be seen, adjusting the orientation of the electric power tool 1 using the second level body 52 allows the user to drill a hole in the object such that the depth axis of the hole is aligned with the vertical axis.

(Variations)

[0068] Next, variations of the exemplary embodiment will be described. Any of the variations to be described below may be used in combination as appropriate.

[0069] The electric power tool 1 according to the exemplary embodiment described above is a hammer drill. However, this is only an example and should not be construed as limiting. The electric power tool 1 may also be a driver such as an impact driver. That is to say, the tip tool T1 may also be a driver bit, for example, and the electric power tool 1 may also be used to tighten a screw or any other fastening member. In this case, using the level 5 allows the screw to be tightened such that the shank of the screw is aligned with the horizontal or vertical axis. Furthermore, the electric power tool 1 does not have to be a hammer drill for applying striking force to the object 100, but may also be a drill for applying only rotational force to the object 100.

[0070] In the exemplary embodiment described above, the level 5 turns in a plane perpendicular to the rotational axis A1. This means that the level 5 turns around the rotational axis A1 and that the level 5 turning is translatable in the plane perpendicular to the rotational axis A1. In the exemplary embodiment, the level 5 may just turn in the rotational direction R1, or in the opposite direction, around the rotational axis A1 without translating in such a plane perpendicular to the rotational axis A1.

[0071] The level 5 not only turns in the rotational direction R1, or in the opposite direction, around the rotational axis A1 but may also translate in a plane perpendicular to the rotational axis A1 and/or translate along the rotational axis A1. Alternatively, the level 5 may also translate in a plane perpendicular to the rotational axis A1 while turning around the rotational axis A1. Still alternatively, the level 5 may turn around the rotational axis A1 and translate in a plane perpendicular to the rotational axis A1 at different timings. In short, a predetermined angle (of 90 degrees in the exemplary embodiment described above) may be maintained, throughout the turn, between the direction defined by the level 5 by itself independently of the barrel 3 (such as the axis of the first spirit level vial 511) and the plane perpendicular to the rotational axis A1. In other words, a predetermined angle (of, e.g., 60 degrees) may be maintained, throughout the turn, between a line connecting one point of the level 5 (e.g., a center point of the second spirit level vial 521) to another point (e.g., the center point of the insertion port 530) and the plane perpendicular to the rotational axis A1. Furthermore, the angle does not have to be exactly the predetermined angle. Alternatively, the level 5 may turn with the angle formed between the direction defined by the level 5 by itself independently of the barrel 3 and the plane perpendicular to the rotational axis A1 allowed to vary within a range of ± 5 degrees, for example, with respect to the predetermined angle.

[0072] Also, the level 5 may be able to turn either equal to, or less than, 360 degrees in the rotational direction R1, or in the opposite direction, with respect to the depth gauge 65 of the fixing member 6. Furthermore, the level 5 may be able to turn either equal to, or less than, 360 degrees in the rotational direction R1, or in the opposite direction, around the barrel 3. Likewise, the auxiliary handle block B1 may also be able to turn either equal to, or less than, 360 degrees in the rotational direction R1, or in the opposite direction, around the barrel 3.

[0073] Furthermore, the level 5 may also be able to turn in the rotational direction R1, or in the opposite direction, around the barrel 3 independently of the auxiliary handle 7. That is to say, the level 5 and the auxiliary handle 7 do not always turn in the rotational direction R1, or in the opposite direction, around the barrel 3 in synch with each other.

[0074] Optionally, the level 5 may include only one of the first and second level bodies 51 and 52. Alternatively, the level 5 may include an additional level body besides the first and second level bodies 51 and 52.

[0075] Furthermore, a level body having the same shape as the second level body 52 may be provided as the first level body 51 such that the axis of the level body is aligned with an axis perpendicular to the rotational axis A1.

[0076] Alternatively, a level body having the same shape as the first level body 51 may be provided as the second level body 52 such that the axis of the level body is aligned with an axis perpendicular to the rotational axis A1. Still alternatively, two level bodies, each having the same shape as the first level body 51, may be provided as the second level body 52 such that the respective axes of the two level bodies intersect with each other and are aligned with a plane perpendicular to the rotational axis A1.

[0077] Furthermore, the level 5 does not have to be a bubble tube level with a spirit level vial. Alternatively, the level 5 may also be a pointer level including a pointer with a weight and designed to detect, as the vertical axis, a direction pointed to by the pointer in accordance with the earth's gravitational force. Still alternatively, the level 5 may also be a level including a single or a plurality of acceleration sensors and designed to detect the horizontal axis by having the single or plurality of acceleration sensors detect the direction of the earth's gravitational force. Still alternatively, the level 5 may also be a digital level.

[0078] Furthermore, the level 5 does not have to determine whether or not the rotational axis A1 is aligned with the horizontal axis or whether or not the rotational axis A1 is aligned with the vertical axis. Alternatively, the first level body 51 may be fixed to the fixing member 6 such that the axis of the first spirit level vial 511 according to the embodiment defines a predetermined angle (of, e.g., 60 degrees) with respect to a plane perpendicular to the rotational axis A1. In that case, adjusting the orientation of the electric power tool 1 such that the center C1 of the air bubble 513 of the first level body 51 is located at the center of the region F1 makes the rotational axis A1 define the predetermined angle with respect to the horizontal plane. This allows the user to drill, using the electric power tool 1, a hole in the object 100 such that the depth axis of the hole defines the predetermined angle with respect to the horizontal plane.

[0079] In short, the first level body 51 may determine whether or not the rotational axis A1 is aligned with a first directional axis different from the horizontal axis. Also, in that case, the second level body 52 suitably determines whether or not the rotational axis A1 is aligned with a second directional axis that intersects with the first directional axis. The second directional axis may or may not be the vertical axis.

[0080] Optionally, a configuration for stopping the turn of the level 5 around the depth gauge 65 may be provided. For example, a member in the shape of a C-clamp may be provided for the housing 53 of the level 5. Screwing the clamp-shaped member, for example, squeezes the depth gauge 65. That is to say, in that case, squeezing

the depth gauge 65 with a portion of the housing 53 stops the turn of the level 5 around the depth gauge 65.

[0081] In the exemplary embodiment described above, a lithium-ion battery is used as a power supply for the electric power tool 1. However, this is only an example and should not be construed as limiting. Alternatively, the battery may also be a primary battery or a secondary rechargeable battery other than a lithium ion battery. Optionally, an external power supply such as a utility power supply may also be used as a power supply for the electric power tool 1.

(Resume)

[0082] As can be seen from the foregoing description, an electric power tool 1 according to a first aspect includes a holder H1, a barrel 3, a grip 4, a level 5, and a fixing member 6. The holder HI fixes a tip tool T1 thereon so as to allow the tip tool T1 to rotate in a rotational direction R1 around a rotational axis A1. The holder HI is fixed to the barrel 3. The grip 4 protrudes from the barrel 3. The fixing member 6 is attached onto the barrel 3 and fixes the level 5 on the fixing member. The fixing member 6 is able to turn, along with the level 5, around the barrel 3, in a plane perpendicular to the rotational axis A1 and in the rotational direction R1 of the tip tool T1 or in an opposite direction thereof.

[0083] This configuration allows the user to adjust, using the level 5, the orientation of the electric power tool 1 such that the rotational axis A1 of the tip tool T1 is aligned with a predetermined directional axis (such a horizontal axis or a vertical axis). In addition, the level 5 is able to turn, along with the fixing member 6, around the barrel 3, in a plane perpendicular to the rotational axis A1 and in the rotational direction R1 of the tip tool T1, or in the opposite direction thereof. This allows the user to turn the level 5 to such an angle that allows him or her to keep sight of the level 5 easily. For example, the user may turn the level 5 to such an angle that allows him or her to align the sights easily without letting the tip tool T1 block his or her view of the level 5.

[0084] An electric power tool 1 according to a second aspect, which may be implemented in conjunction with the first aspect, further includes an auxiliary handle 7. The auxiliary handle 7 is coupled to the fixing member 6. The auxiliary handle 7 is able to turn, along with the fixing member 6 and the level 5, in the rotational direction R1, or in the opposite direction, around the barrel 3.

[0085] This configuration allows the user to turn the level 5 around the barrel 3 simply by turning the auxiliary handle 7 around the barrel 3.

[0086] In an electric power tool 1 according to a third aspect, which may be implemented in conjunction with the second aspect, the auxiliary handle 7 includes a bar 70. The bar 70 is coupled to the fixing member 6. The bar 70 faces the barrel 3 in a longitudinal direction defined by a longitudinal axis of the bar 70. The fixing member 6 fixes the level 5 such that the barrel 3 is located between the bar 70 and the level 5 in the longitudinal direction.

[0087] This configuration reduces the chances of the tip tool T1 and the level 5 overlapping with each other when viewed from the front of the bar 70.

[0088] In an electric power tool 1 according to a fourth aspect, which may be implemented in conjunction with the third aspect, the fixing member 6 fixes the level 5 at a position shifted in the rotational direction R1, or in an opposite direction, around the barrel 3 with respect to an extension of the longitudinal axis of the bar 70.

[0089] Providing the level 5 on the extension of the longitudinal axis of the bar 70 could let the barrel 3 block a view of the level 5 when viewed along the longitudinal axis of the bar 70. In contrast, according to this configuration, the level 5 is fixed at a position shifted with respect to the extension of the longitudinal axis of the bar 70. This reduces the chances of letting the barrel 3 block a view of the level 5 and allows the user to keep sight of the level 5 more easily.

[0090] An electric power tool 1 according to a fifth aspect, which may be implemented in conjunction with any one of the first to fourth aspects, further includes an operating member Op1. The operating member Op1 accepts an operation of rotating the tip tool T1. The operating member Op1 is mounted on the grip 4. The fixing member 6 fixes the level 5 such that the level 5 is adjacent to a portion P1, located between the grip 4 and the holder HI in one direction aligned with the rotational axis A1, of the barrel 3.

[0091] This configuration allows the level 5 to be adjacent to a portion PI, located between the grip 4 and the holder H1 in the one direction, of the barrel 3. That is to say, the level 5 is located closer to the tip tool T1 compared to a situation where the level 5 is adjacent to a portion P2 (see FIG. 2), located at the same position as the grip 4 in the one direction, of the barrel 3. This allows the user to keep sight of both the tip tool T1 and the level 5 easily.

[0092] In an electric power tool 1 according to a sixth aspect, which may be implemented in conjunction with any one of the first to fifth aspects, the fixing member 6 includes a depth gauge 65 in a rod shape. In a situation where the tip tool T1 is a drill bit configured to drill a hole 110 in an object 100, the depth gauge 65 is configured to come into contact with the object 100 when a depth of the hole 110 drilled reaches a specified depth in order to reduce chances of the hole 110 becoming deeper than the specified depth. The level 5 has an insertion port 530. The depth gauge 65 is inserted into the insertion port 530. The level 5 is fixed onto the depth gauge 65 by inserting the depth gauge 65 into the insertion port 530.

[0093] According to this configuration, the fixing member 6 includes the depth gauge 65 and the level 5 is fixed to the depth gauge 65. This reduces the number of parts to provide, compared to a situation where the fixing member 6 and the depth gauge 65 are provided separately from each other.

[0094] An electric power tool 1 according to a seventh

aspect, which may be implemented in conjunction with any one of the first to sixth aspects, further includes a locking mechanism 8. The locking mechanism 8 is configured to lock and unlock the level 5 onto/from the barrel 3 so as to prevent and allow a turn of the level 5 in the rotational direction R1, or in the opposite direction, around the barrel 3.

[0095] According to this configuration, having the level 5 locked, and prevented from turning, by the locking mechanism 8 allows the user to detect the horizontal state with good stability by using the level 5.

[0096] In an electric power tool 1 according to an eighth aspect, which may be implemented in conjunction with any one of the first to seventh aspects, the level 5 is able to turn in the rotational direction R1, or in the opposite direction, with respect to the fixing member 6.

[0097] This configuration allows the level 5 to turn, along with the fixing member 6, around the barrel 3 and to turn with respect to the fixing member 6. This allows the user to adjust the position of the level 5 more finely than in a situation where the level 5 is only allowed to turn around the barrel 3.

[0098] In an electric power tool 1 according to a ninth aspect, which may be implemented in conjunction with any one of the first to eighth aspects, the level 5 is attachable to, and detachable from, the fixing member 6.

This configuration makes the level 5 replaceable.

[0099] In an electric power tool 1 according to a tenth aspect, which may be implemented in conjunction with any one of the first to ninth aspects, the level 5 includes a first level body 51 and a second level body 52. The first level body 51 determines whether or not the rotational axis A1 is aligned with a first directional axis. The second level body 52 determines whether or not the rotational axis A1 is aligned with a second directional axis intersecting with the first directional axis.

[0100] This configuration allows the user to adjust the orientation of the electric power tool 1 with the first level body 51 such that the rotational axis A1 of the tip tool T1 is aligned with the first directional axis and also allows him or her to adjust the orientation of the electric power tool 1 with the second level body 52 such that the rotational axis A1 of the tip tool T1 is aligned with the second directional axis.

[0101] In an electric power tool 1 according to an eleventh aspect, which may be implemented in conjunction with the tenth aspect, the first directional axis is a horizontal axis. The second directional axis is a vertical axis.

[0102] A level 5 according to a twelfth aspect is provided for the electric power tool 1 according to any one of the first to eleventh aspects.

[0103] This configuration allows the user to adjust, using the level 5, the orientation of the electric power tool 1 such that the rotational axis A1 of the tip tool T1 is aligned with a predetermined directional axis (such a horizontal axis or a vertical axis). In addition, the user may also turn the level 5 around the barrel 3 to such an angle that allows him or her to keep sight of the level 5 easily.

[0104] An auxiliary handle block B1 according to a thirteenth aspect is for use in an electric power tool 1 including a holder H1, a barrel 3, a grip 4, a level 5, a fixing member 6, and an auxiliary handle 7. The auxiliary handle block B1 includes the level 5, the fixing member 6, and the auxiliary handle 7 of the electric power tool 1. The holder HI fixes a tip tool T1 thereon so as to allow the tip tool T1 to rotate in a rotational direction R1 around a rotational axis A1. The holder HI is fixed to the barrel 3. The grip 4 protrudes from the barrel 3. The fixing member 6 is attached onto the barrel 3 to fix the level 5 thereon. The auxiliary handle 7 is coupled to the fixing member 6. The fixing member 6 is able to turn, along with the level 5, around the barrel 3, in a plane perpendicular to the rotational axis A1 and in the rotational direction R1 of the tip tool T1, or in an opposite direction thereof. The auxiliary handle 7 is able to turn, along with the fixing member 6 and the level 5, in the rotational direction R1, or in the opposite direction, around the barrel 3.

[0105] This configuration allows the user to adjust, using the level 5, the orientation of the electric power tool 1 such that the rotational axis A1 of the tip tool T1 is aligned with a predetermined directional axis (such a horizontal axis or a vertical axis). In addition, the user may also turn the level 5 around the barrel 3 to such an angle that allows him or her to keep sight of the level 5 easily. Furthermore, this also allows the user to turn the level 5 around the barrel 3 simply by turning the auxiliary handle 7 around the barrel 3.

[0106] Note that the configurations according to the second to eleventh aspects are not essential constituent elements of the electric power tool 1 but may be omitted as appropriate.

Reference Signs List

[0107]

1	Electric Power Tool
HI	Holder
3	Barrel
4	Grip
5	Level
6	Fixing Member
T1	Tip Tool
A1	Rotational Axis
R1	Rotational Direction
7	Auxiliary Handle
70	Bar
Op1	Operating Member
P1	Portion
65	Depth Gauge
100	Object
110	Hole
530	Insertion Port
8	Locking Mechanism

B1 Auxiliary Handle Block
51 First Level Body
52 Second Level Body

Claims

1. An electric power tool (1) comprising:

a holder (HI) configured to fix a tip tool (T1) thereon so as to allow the tip tool (T1) to rotate in a rotational direction (R1) around a rotational axis (A1);
a barrel (3) to which the holder (HI) is fixed;
a grip (4) protruding from the barrel (3);
a level (5); and
a fixing member (6) configured to be attached onto the barrel (3) and fix the level (5) on the fixing member (6),
the fixing member (6) being able to turn, along with the level (5), around the barrel (3), in a plane perpendicular to the rotational axis (A1) and in the rotational direction (R1) of the tip tool (T1) or in an opposite direction thereof.

2. The electric power tool (1) of claim 1, further comprising an auxiliary handle (7) coupled to the fixing member (6), wherein
the auxiliary handle (7) is able to turn, along with the fixing member (6) and the level (5), in the rotational direction (R1), or in the opposite direction, around the barrel (3).

3. The electric power tool (1) of claim 2, wherein
the auxiliary handle (7) includes a bar (70) coupled to the fixing member (6),
the bar (70) faces the barrel (3) in a longitudinal direction defined by a longitudinal axis of the bar (70), and
the fixing member (6) fixes the level (5) such that the barrel (3) is located between the bar (70) and the level (5) in the longitudinal direction.

4. The electric power tool (1) of claim 3, wherein
the fixing member (6) fixes the level (5) at a position shifted in the rotational direction (R1), or in the opposite direction, around the barrel (3) with respect to an extension of the longitudinal axis of the bar (70).

5. The electric power tool (1) of any one of claims 1 to 4, further comprising an operating member (Op1) configured to accept an operation of rotating the tip tool (T1), wherein
the operating member (Op1) is mounted on the grip (4), and
the fixing member (6) fixes the level (5) such that the level (5) is adjacent to a portion (PI), located between the grip (4) and the holder (H1) in one direction aligned with the rotational axis (A1), of the barrel (3).

6. The electric power tool (1) of any one of claims 1 to 5, wherein
the fixing member (6) includes a depth gauge (65) in a rod shape,
in a situation where the tip tool (T1) is a drill bit configured to drill a hole (110) in an object (100), the depth gauge (65) is configured to come into contact with the object (100) when a depth of the hole (110) drilled reaches a specified depth in order to reduce chances of the hole (110) becoming deeper than the specified depth,
the level (5) has an insertion port (530) to which the depth gauge (65) is inserted, and
the level (5) is fixed onto the depth gauge (65) by inserting the depth gauge (65) into the insertion port (530).

7. The electric power tool (1) of any one of claims 1 to 6, further comprising a locking mechanism (8) configured to lock and unlock the level (5) onto/from the barrel (3) so as to prevent and allow a turn of the level (5) in the rotational direction (R1), or in the opposite direction, around the barrel (3).

8. The electric power tool (1) of any one of claims 1 to 7, wherein
the level (5) is able to turn in the rotational direction (R1), or in the opposite direction, with respect to the fixing member (6).

9. The electric power tool (1) of any one of claims 1 to 8, wherein
the level (5) is attachable to, and detachable from, the fixing member (6).

10. The electric power tool (1) of any one of claims 1 to 9, wherein
the level (5) includes:

a first level body (51) configured to determine whether or not the rotational axis (A1) is aligned with a first directional axis; and
a second level body (52) configured to determine whether or not the rotational axis (A1) is aligned with a second directional axis intersecting with the first directional axis.

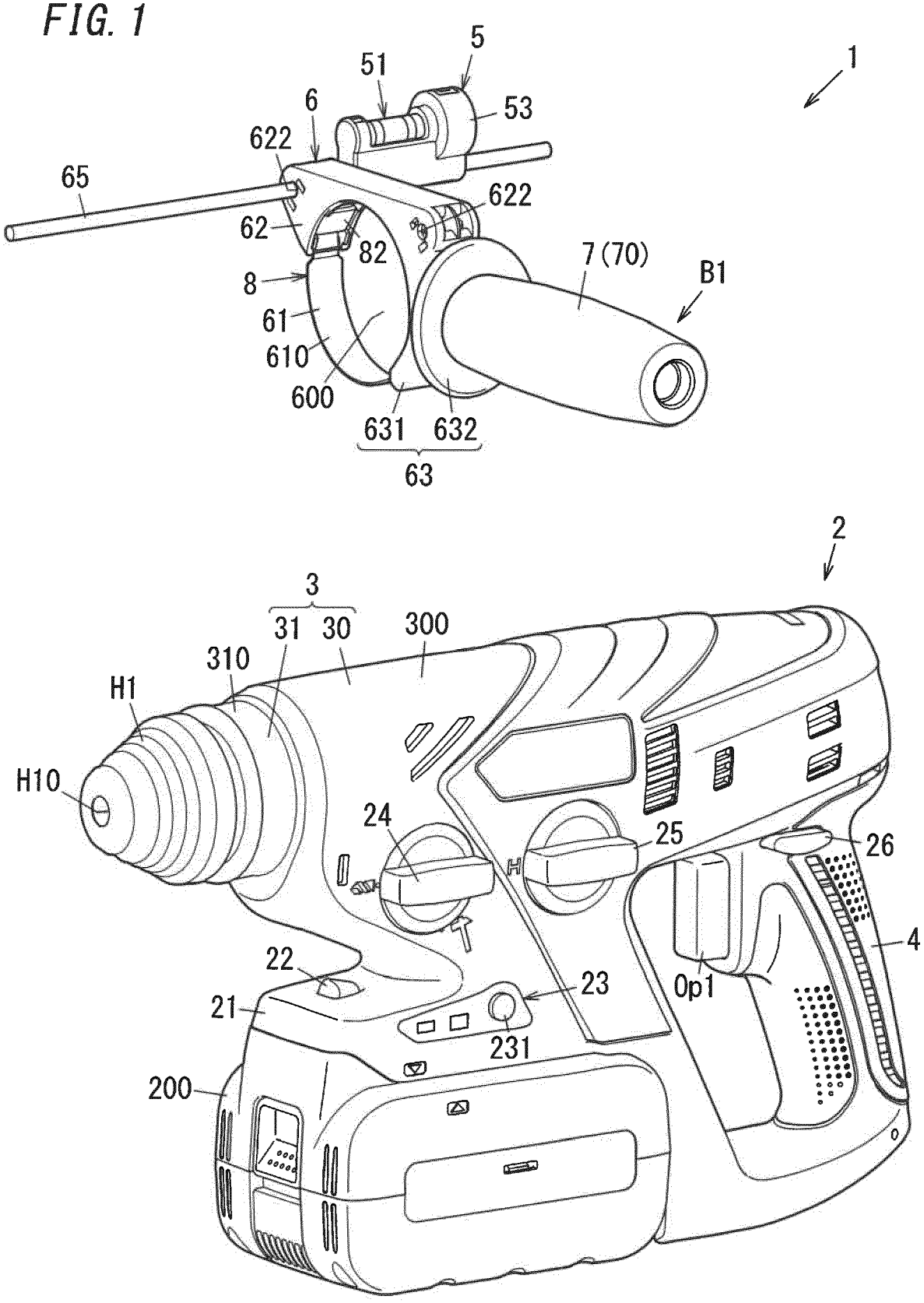
11. The electric power tool (1) of claim 10, wherein
the first directional axis is a horizontal axis, and
the second directional axis is a vertical axis.

12. A level (5) provided for the electric power tool (1) of any one of claims 1 to 11.

13. An auxiliary handle block (B1) for use in an electric power tool (1), the electric power tool (1) comprising:

a holder (HI) configured to fix a tip tool (T1) thereon so as to allow the tip tool (T1) to rotate in a rotational direction (R1) around a rotational axis (A1);
a barrel (3) to which the holder (H1) is fixed;
a grip (4) protruding from the barrel (3);
a level (5);
a fixing member (6) configured to be attached onto the barrel (3) to fix the level (5) thereon, and
an auxiliary handle (7) coupled to the fixing member (6),
the auxiliary handle block (B1) including the level (5), the fixing member (6), and the auxiliary handle (7) of the electric power tool (1),
the fixing member (6) being able to turn, along with the level (5), around the barrel (3), in a plane perpendicular to the rotational axis (A1) and in the rotational direction (R1) of the tip tool (T1) or in an opposite direction thereof,
the auxiliary handle (7) being able to turn, along with the fixing member (6) and the level (5), in the rotational direction (R1), or in the opposite direction, around the barrel (3).

FIG. 1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5
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6
622
65
622
62
82
8
7 (70)
B1
61
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631
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3
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30
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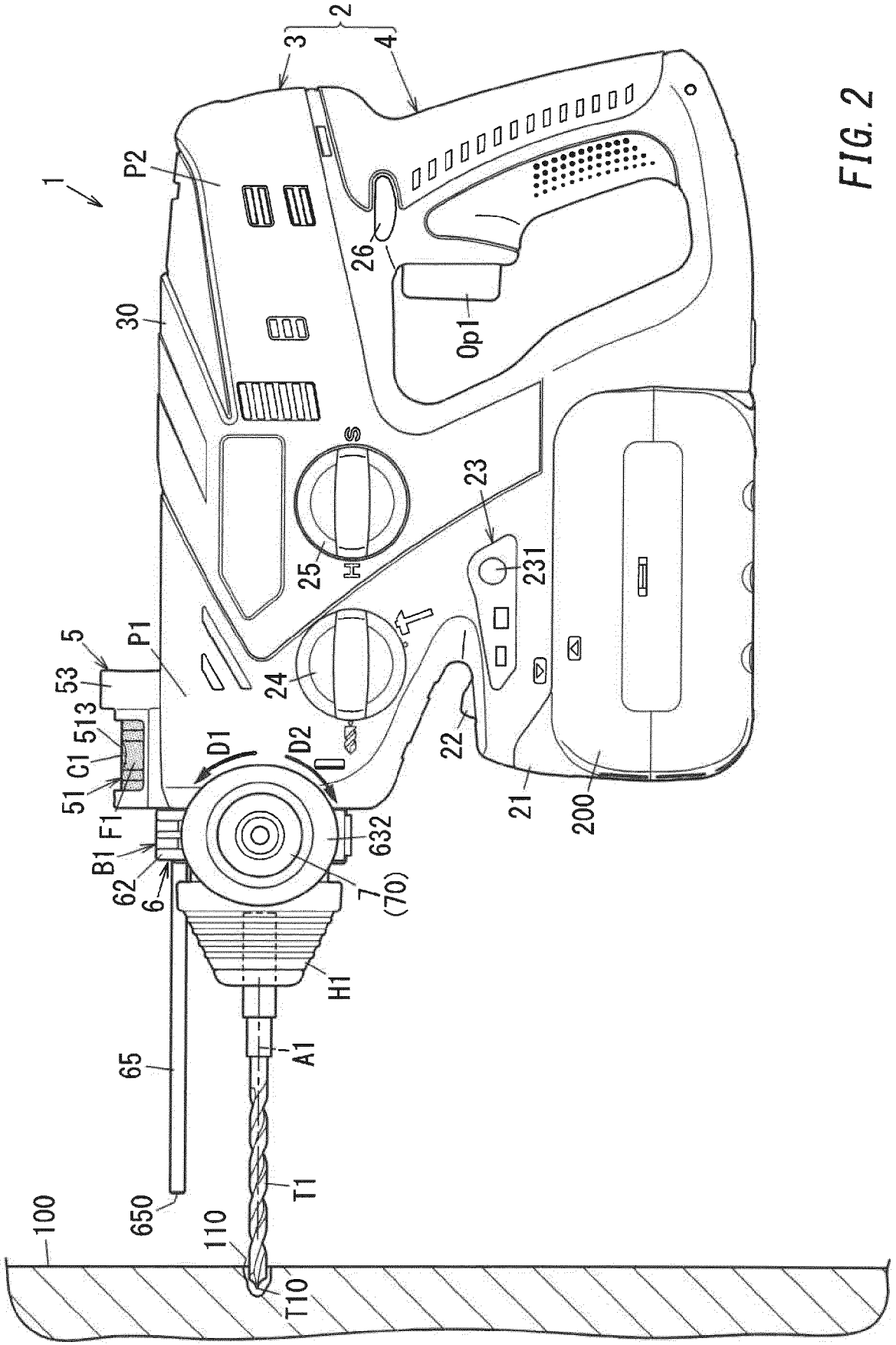
H1
H10
24
25
26
4
22
23
21
231
Op1
200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C1
D1
D2
22
21
200
F1
B1
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632
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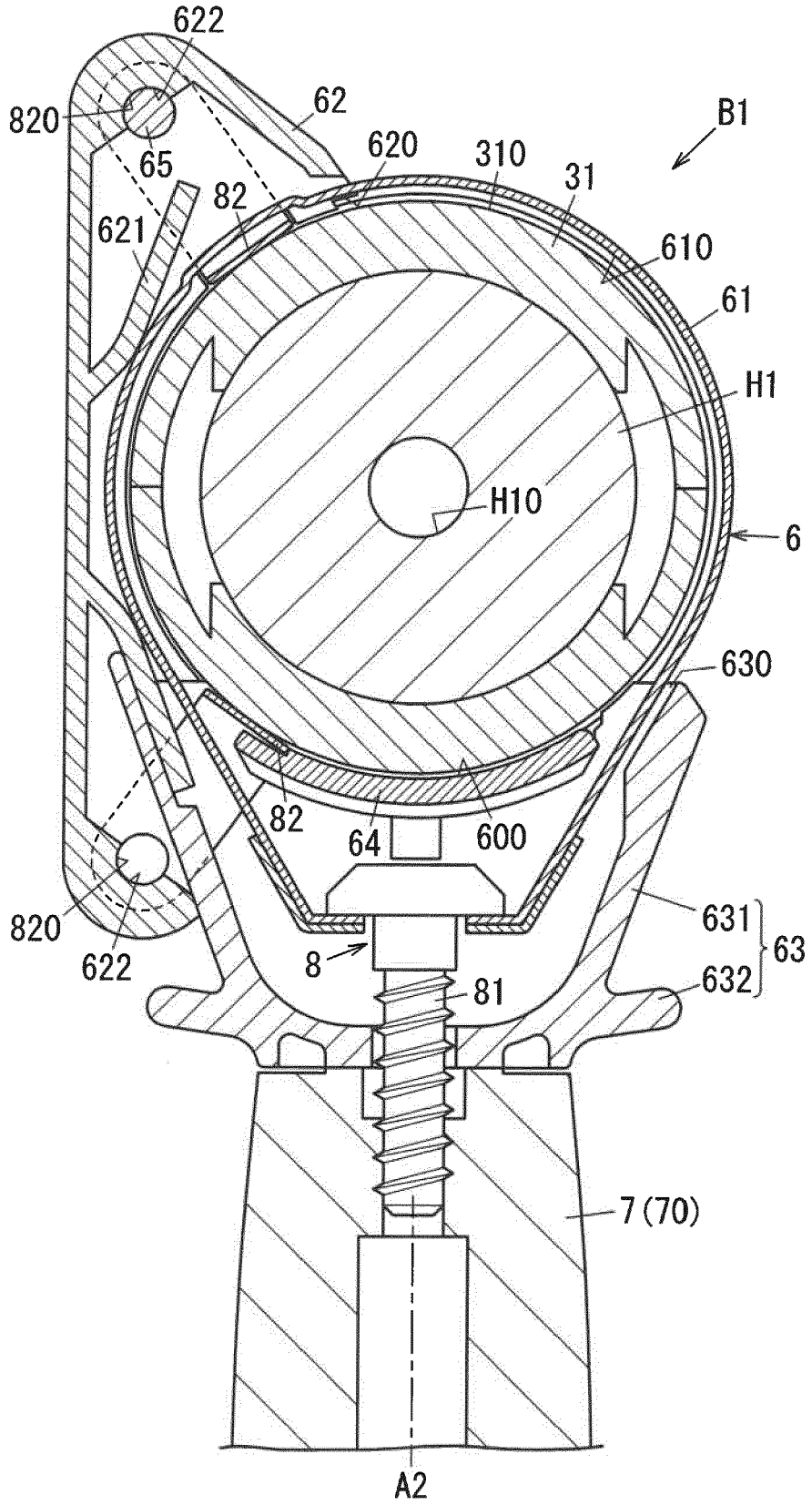
(70)
H1
65
A1
T1
650
110
100
T10

FIG. 2

FIG. 3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632
7 (70)
A2

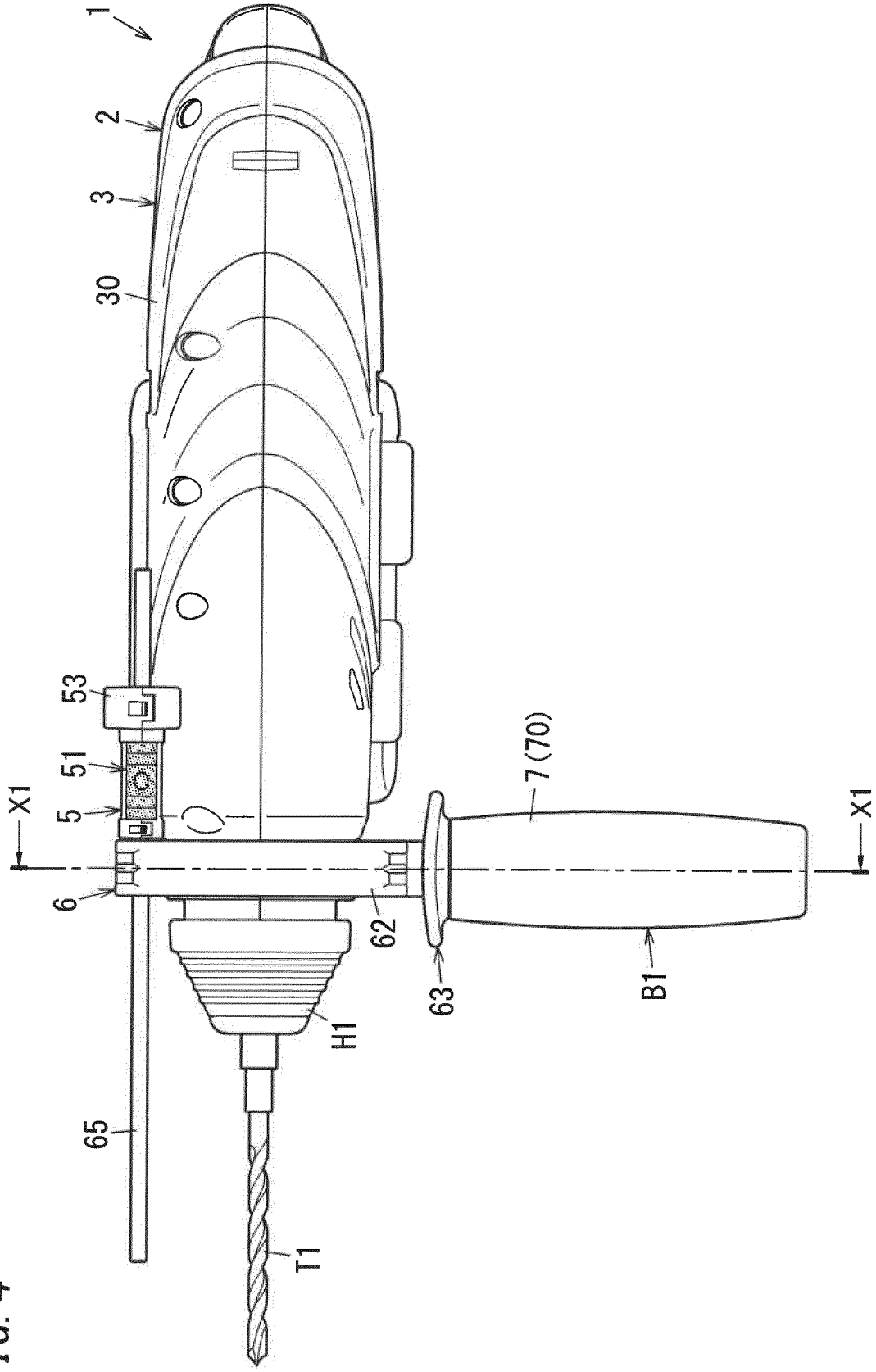


FIG. 4

FIG. 5

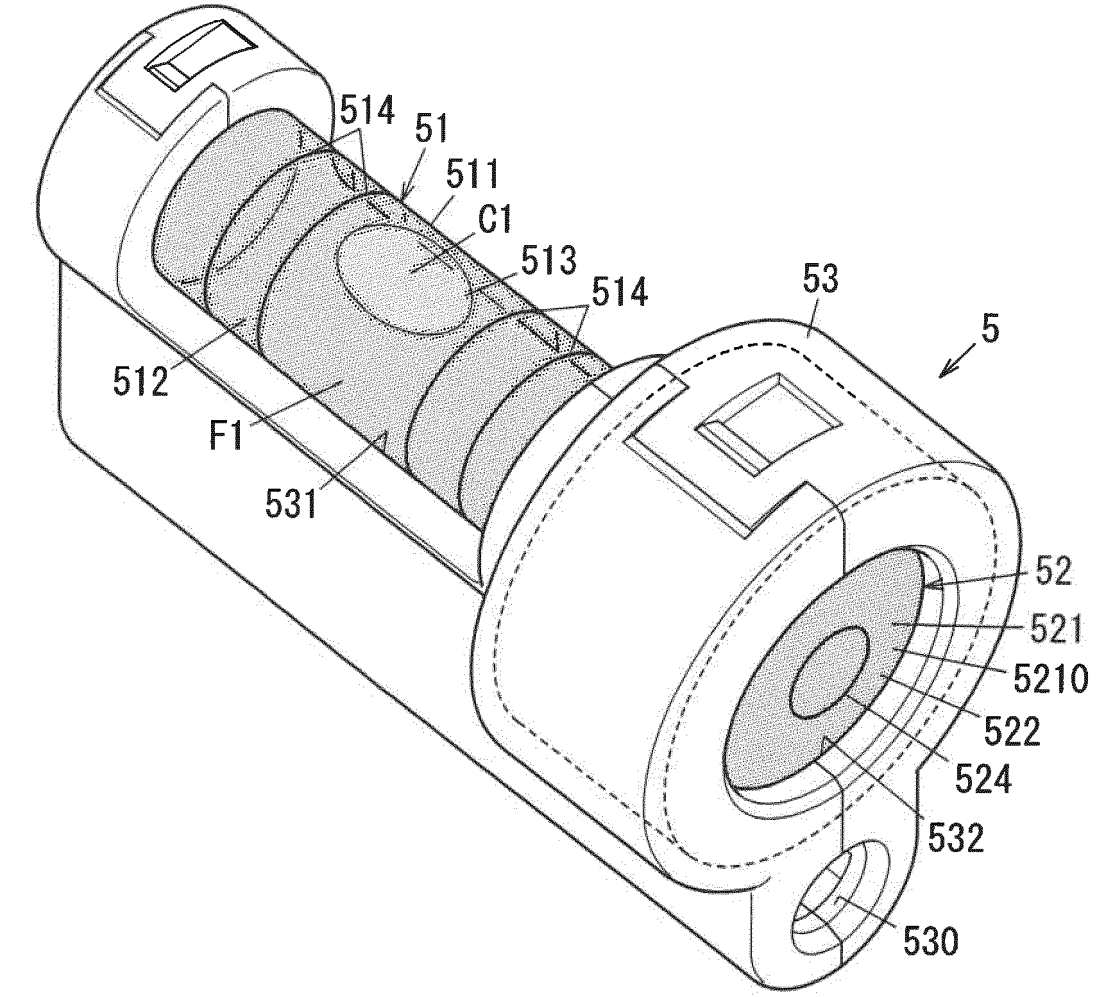


FIG. 6

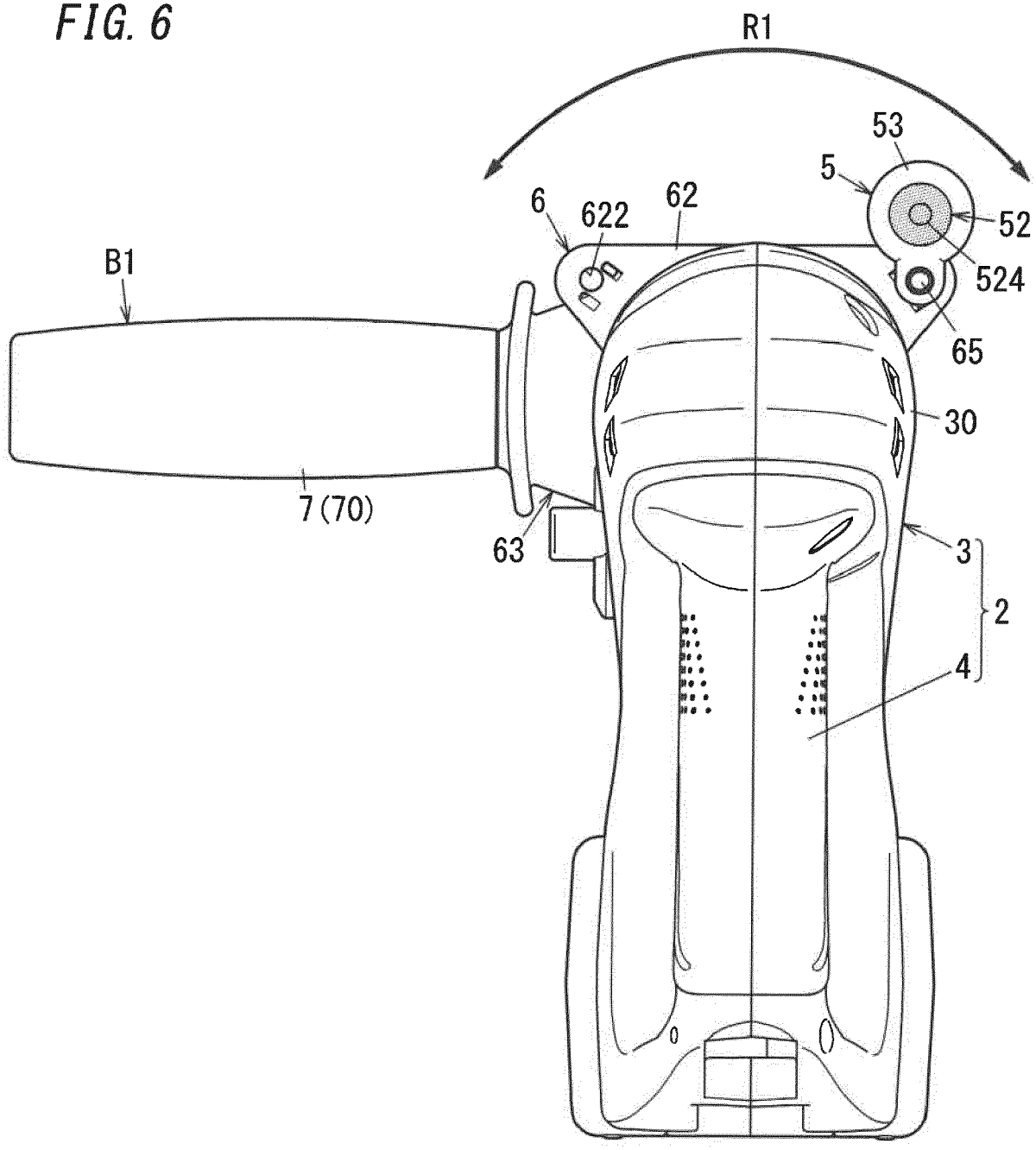
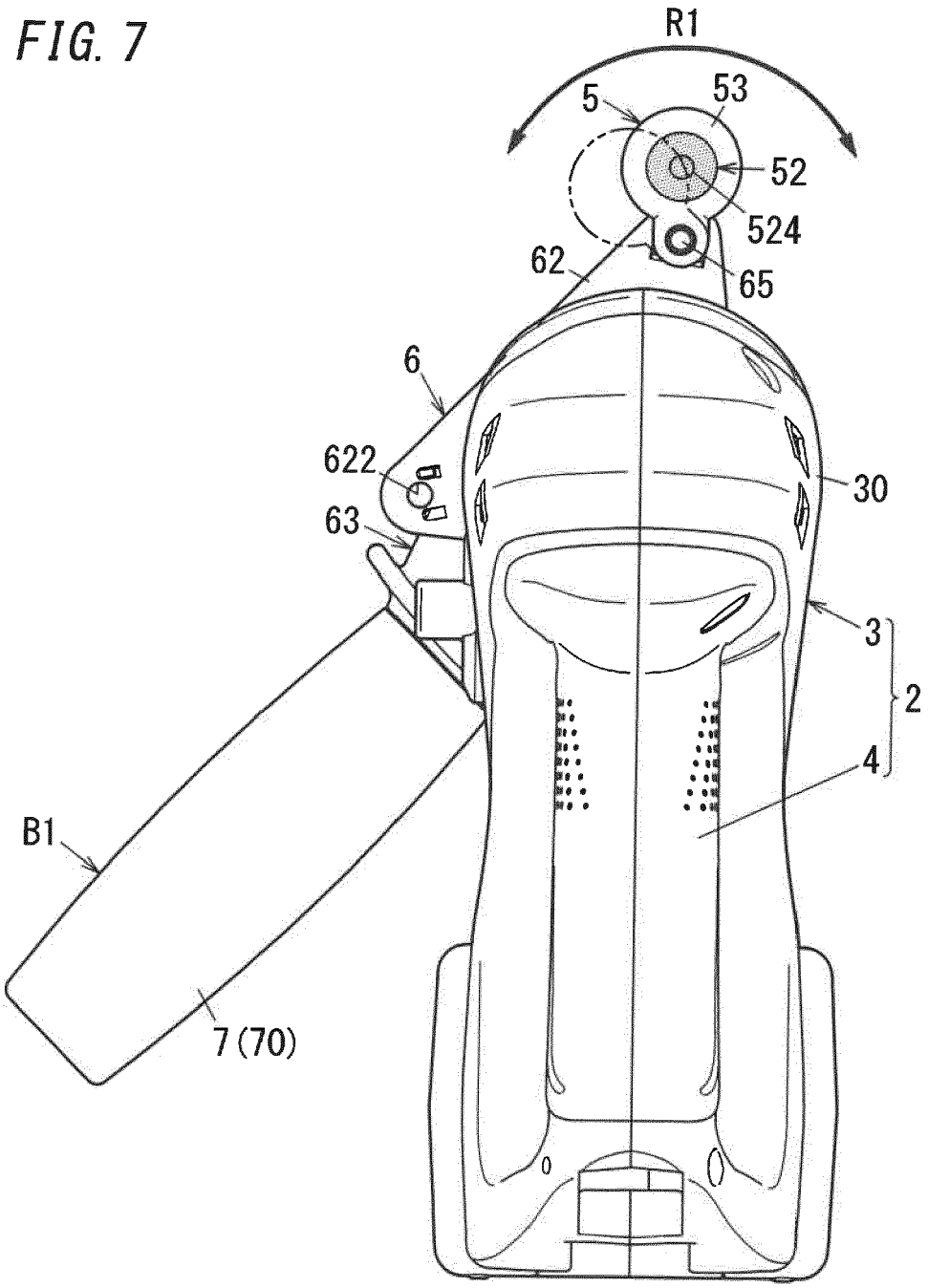


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 3598

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X Y	FR 3 026 327 A1 (MAZZONE LIBERO [FR]) 1 April 2016 (2016-04-01) * page 4, line 8 - page 6, line 9 * * page 7, line 16 - page 8, line 22 * -----	1-8,10, 12,13 9	INV. B25F5/02
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 June 2019	Gerard, Olivier

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18-06-2019

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