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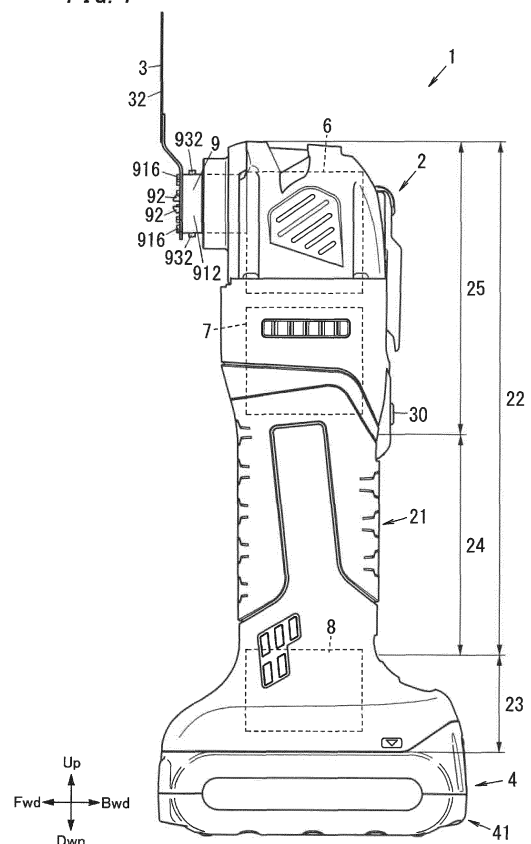
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(54) **TOOL AND TOOL SYSTEM**

(57) An object of the present disclosure is to eliminate the need to attach and remove an additional member, separately provided from a bit (3), onto/from a tool (1) when having the bit (3) held by the tool (1). A tool (1) according to an embodiment includes: a holder (9) for holding a bit (3); and an oscillating rotary mechanism (6) for imparting an oscillating rotary motion to the holder (9). The holder (9) includes a holding surface (911), a securing portion (922), and an elastic mechanism (920). In a holding state where the bit (3) is held by the holder (9), the bit (3) is placed on top of the holding surface (911), and the securing portion (922) is engaged with an attachment portion (35) forming part of the bit (3). In addition, in the holding state, the elastic mechanism (920) applies elastic force to the securing portion (922), and the securing portion (922) applies force, resultant from the elastic force and directed toward the holding surface (911), to the attachment portion (35).

FIG. 1



Description

Technical Field

[0001] The present disclosure generally relates to a tool and a tool system, and more particularly relates to a tool with the ability to impart an oscillating rotary motion to a bit and a tool system including the bit and the tool.

Background Art

[0002] An electric power tool as disclosed in JP 2017-127943 A is an exemplary electric power tool for imparting an oscillating rotary motion to a bit. According to JP 2017-127943 A, after a cutting edge is temporarily attached onto the electric power tool, a pin is inserted into respective holes of the cutting edge and a tip of the electric power tool such that the cutting edge is clamped between the pin and the tip of the electric power tool. This allows the cutting edge to be secured onto the electric power tool.

[0003] The electric power tool of JP 2017-127943 A uses the pin to have the bit held by the electric power tool, thus requiring troublesome jobs of inserting and removing the pin into/from the electric power tool. In addition, once the pin has been lost, the bit is no longer attachable to the electric power tool.

[0004] It is therefore an object of the present disclosure to provide a tool and tool system that eliminates the need to attach and remove an additional member, separately provided from a bit, onto/from the tool when having the bit held by the tool.

Summary

[0005] A tool according to an aspect of the present disclosure includes: a holder for holding a bit; and an oscillating rotary mechanism for imparting an oscillating rotary motion to the holder. The holder includes a holding surface, a securing portion, and an elastic mechanism. In a holding state where the bit is held by the holder, the bit is placed on top of the holding surface, and the securing portion is engaged with an attachment portion forming part of the bit. In addition, in the holding state, the elastic mechanism applies elastic force to the securing portion, and the securing portion applies force, resultant from the elastic force and directed toward the holding surface, to the attachment portion.

[0006] A tool system according to another aspect of the present disclosure includes: the tool described above; and the bit.

Brief Description of Drawings

[0007]

FIG. 1 is a side view of a tool and tool system according to an exemplary embodiment of the present

disclosure;

FIG. 2 is a rear view of the tool and tool system;

FIG. 3 is a cross-sectional view illustrating an upper portion of the tool and tool system;

FIGS. 4A, 4B, and 4C are schematic cross-sectional views illustrating how to attach a bit to the tool;

FIGS. 5A, 5B, and 5C are schematic cross-sectional views illustrating how to remove the bit from the tool; and

FIG. 6 is a schematic cross-sectional view illustrating an alternative attachment portion for the tool.

Description of Embodiments

[0008] An overview of a tool 1 and tool system 10 according to the present disclosure will be described. A tool 1 includes: a holder 9 with the ability to hold a bit 3; and an oscillating rotary mechanism 6 for imparting an oscillating rotary motion to the holder 9. The holder 9 includes a holding surface 911, a securing portion 922, and an elastic mechanism 920. In a holding state where the bit 3 is held by the holder 9, the bit 3 is placed on top of the holding surface 911, and the securing portion 922 is engaged with an attachment portion 35 forming part of the bit 3. In addition, in the holding state, the elastic mechanism 920 applies elastic force to the securing portion 922, and the securing portion 922 applies force, resultant from the elastic force and directed toward the holding surface 911, to the attachment portion 35. The tool system 10 includes the tool 1 and the bit 3.

[0009] Thus, the present disclosure allows the bit 3 to be held by the holder 9 with the force applied from the securing portion 922 of the holder 9 of the tool 1 to the attachment portion 35 of the bit 3. This eliminates the need to attach and remove an additional member, separately provided from the bit 3, onto/from the tool 1 when having the bit 3 held by the tool 1.

[0010] Next, a more specific embodiment of the present disclosure will be described with reference to FIGS. 1-5C. Note that the exemplary embodiment to be described below is only one of various embodiments of the present disclosure and should not be construed as limiting. Rather, the embodiment may be readily modified in various manners, depending on a design choice or any other factor, without departing from a true spirit and scope of the present disclosure. In addition, various directions, including a forward/backward direction, a rightward/leftward direction, and an upward/downward direction to be referred to in the following description, are mentioned just for the sake of convenience and are insubstantial ones. That is to say, those directions should not be construed as defining in what directions the tool 1 according to the exemplary embodiment should be used.

[0011] As shown in FIGS. 1 and 2, a tool system 10 according to this embodiment is implemented as a hand-held multi-purpose tool including a tool 1 and a bit 3. As used herein, the "multi-purpose tool" refers to a tool 1 which has the ability to impart an oscillating rotary motion

to the bit 3 around an axis of rotation X and of which the bit 3 is replaceable. Note that the axis of rotation X is a virtual axis and the "oscillating rotary motion" refers herein to an axial rotation, of which the rotational direction inverts sequentially.

[0012] The tool 1 includes a holder 9, a tool body 2, and a battery pack 4. The tool body 2 is a part for imparting an oscillating rotary motion to the holder 9 with power supplied from the battery pack 4, i.e., a part for imparting an oscillating rotary motion to the bit 3 held by the holder 9. The tool body 2 is formed in the shape of a bar, which is thick enough for the user to grip the tool 1. That is to say, the tool body 2 may serve as a grip for the user. The tool body 2 includes a housing 21 for housing various constituent members of a mechanism for imparting an oscillating rotary motion to the holder 9 and the bit 3. The constituent members include an oscillating rotary mechanism 6 and a drive source 7.

[0013] The oscillating rotary mechanism 6 is a mechanism for imparting an oscillating rotary motion to the holder 9 around the axis of rotation X. The drive source 7 is an electric motor for driving the oscillating rotary mechanism 6. The oscillating rotary mechanism 6 is housed in an upper internal part of the housing 21. The drive source 7 is housed under the oscillating rotary mechanism 6 inside of the housing 21, and a control circuit 8 is housed under the drive source 7 inside of the housing 21.

[0014] The housing 21 has a generally cylindrical shape, and may have a generally circular or rectangular cross section when taken on a plane perpendicular to the axis (upward/downward direction) of the housing 21. The housing 21 includes a barrel 22 and a pedestal 23.

[0015] The barrel 22 has the shape of a cylinder with a generally circular cross section and extends in the upward/downward direction. A roughly lower half of the barrel 22 serves as a grip 24 allowing the user to hold the tool 1 with his or her hand. The grip 24 is formed to be somewhat thinner than an upper part 25, which is roughly an upper half of the barrel 22.

[0016] The pedestal 23 is provided at the lower end along the length (upward/downward direction) of the barrel 22 and protrudes outward from the outer peripheral portion of the barrel 22. More specifically, the pedestal 23 is formed in the shape of a rectangular parallelepiped elongated in the forward/backward direction. The front and rear side surfaces of the pedestal 23 protrude outward in the forward/backward direction with respect to the front and rear side surfaces of the upper part 25 of the barrel 22 (see FIG. 1). The right and left side surfaces of the pedestal 23 protrude outward in the rightward/leftward direction with respect to the right and left side surfaces of the grip 24 of the barrel 22 and protrude approximately to the same degree as the right and left side surfaces of the upper part 25 of the barrel 22 (see FIG. 2).

[0017] The battery pack 4 is attached removably to a lower surface 231 of the pedestal 23. Attaching the battery pack 4 onto the lower surface 231 of the pedestal

23 connects the battery pack 4 to the pedestal 23 (and therefore, to the tool body 2) both mechanically and electrically.

[0018] The holder 9 is arranged on a front surface of the upper part 25 of the housing 21. More specifically, inside of the upper part 25 of the housing 21, housed in the forward/backward direction is a rotary shaft member 61 for imparting an oscillating rotary motion to the holder 9. The tip (i.e., the front end) of the rotary shaft member 61 protrudes forward from the front surface of the upper part 25 of the housing 21. The holder 9 is arranged at the tip of the rotary shaft member 61 so as to be ready to hold the bit 3.

[0019] On the outer peripheral surface of the housing 21, provided are a power switch 30 and a shift dial 40.

[0020] The power switch 30 is a switch for switching the operation mode of the tool 1 from a driving state to a non-driving state, and vice versa. The power switch 30 is a sliding switch, which may be turned both upward and downward. The power switch 30 is provided, for example, over the grip 24 on the outer peripheral surface of the housing 21 (e.g., at a position on which the user putting his or her hand on the grip 24 is able to put his or her thumb). The shift dial 40 is a dial switch for use to adjust the rotational frequency of the bit 3 in oscillating motion. The rotational frequency in oscillating motion may be adjusted by turning this shift dial 40. The shift dial 40 may be provided, for example, under the grip 24 on the outer peripheral surface of the housing 21.

[0021] The battery pack 4 is a part for supplying power to the tool body 2. The battery pack 4 includes a plurality of batteries and a battery case 41.

[0022] The batteries may be lithium-ion batteries, for example. Those batteries are electrically connected together. The battery case 41 forms the shell of the battery pack 4 and houses the plurality of batteries therein. The battery pack 4 is able to change the performance of the batteries (such as the rated output voltage and capacity of the batteries) according to the number of the batteries connected together and the type of electrical connection (i.e., series or parallel) between the batteries. For example, a battery pack with a rated output voltage of 14.4 V and a battery pack with a rated output voltage of 18 V may be provided as the battery packs 4.

[0023] The tool 1 with such a configuration is activated or deactivated by the turn of the power switch 30. Turning the shift dial 40 while the tool 1 is up and running allows the rotational frequency of the bit 3 in oscillating motion to be changed. For example, the user may strip a tile easily just by holding the tool 1 on the grip 24 and inserting the tip of the bit 3 in oscillating motion into the gap between the tile and the underlying material (such as a wall). Changing the bits 3 according to the type of the machining to do allows this tool 1 to be used in various types of machining.

[0024] Next, the oscillating rotary mechanism 6 will be described with reference to FIG. 3.

[0025] The oscillating rotary mechanism 6 is arranged

in the upper internal part of the housing 21. Under the oscillating rotary mechanism 6 (i.e., over the grip 24), housed is the drive source 7. The drive source 7 is arranged along the length of the housing 21. The shaft 71 of the drive source 7 extends upward (i.e., toward the upper part of the housing 21). The shaft 71 outputs the rotative power of the drive source 7. The shaft 71 starts to rotate around an axis of rotation extending in the upward/downward direction when the drive source 7 starts running.

[0026] The oscillating rotary mechanism 6 includes the rotary shaft member 61, an actuating arm 63, and a coupling shaft member 64. Part of the rotary shaft member 61, the actuating arm 63, and the coupling shaft member 64 are housed in the housing 21.

[0027] The rotary shaft member 61 supports the holder 9 and imparts an oscillating rotary motion to the holder 9. The rotary shaft member 61 is arranged in an upper internal part of the housing 21. The rotary shaft member 61 is rotatable around the axis of rotation X extending in the forward/backward direction (i.e., perpendicularly to the shaft 71). The tip of the rotary shaft member 61 protrudes forward from the front surface of the housing 21.

[0028] The holder 9 is fixed to one end (front end) in the direction aligned with the axis of rotation X (i.e., the forward/backward direction) of the rotary shaft member 61. Optionally, the holder 9, provided separately from the tool 1, may be attached to the rotary shaft member 61. Alternatively, the rotary shaft member 61 and the holder 9 may form respective integral parts of the same member.

[0029] The actuating arm 63 includes an actuating portion 631 fixed to an outer peripheral surface of the rotary shaft member 61 and an arm portion 632 extending perpendicularly to the axis of rotation X from the actuating portion 631 toward the shaft 71 (i.e., downward). The arm portion 632 has a U-shape with right and left branch portions.

[0030] The coupling shaft member 64 is coupled to the tip (upper end) of the shaft 71. The coupling shaft member 64 includes a coaxial portion 64a and an eccentric portion 64b located over the coaxial portion 64a (i.e., located opposite from the shaft 71 with respect to the coaxial portion 64b). The coaxial portion 64a is coupled to the shaft 71. The center axis of the eccentric portion 64b is parallel to, but does not agree with, the axis of rotation of the shaft 71. That is to say, the center axis of the eccentric portion 64b is eccentric with respect to the axis of rotation of the shaft 71. The eccentric portion 64b is surrounded with the U-arm portion 632 of the actuating arm 63. A bearing 65 is fitted onto the eccentric portion 64b so as to surround the outer periphery of the eccentric portion 64b. The outer peripheral surface of the bearing 65 is in contact with, and clamped between, the legs of the U-arm portion 632. That is to say, the arm portion 632 of the actuating arm 63 clamps the bearing 65 and the eccentric portion 64b is fitted into the center hole of the bearing 65.

[0031] In this oscillating rotary mechanism 6, when the

shaft 71 starts to be driven in rotation by the drive source 7, the coupling shaft member 64 also starts to rotate. The eccentric portion 64b of the coupling shaft member 64 rotates around an axis that is offset with respect to its own center axis. As the eccentric portion 64b rotates, the bearing 65 also sets up a rotary motion such that the center of the bearing 65 moves around the axis of rotation of the shaft 71. This makes the bearing 65 swing, to the right and to the left, the arm portion 632 of the actuating arm 63 in contact with the bearing 65, thus making the actuating portion 631 of the actuating arm 63 impart an oscillating rotary motion to the rotary shaft member 61 around the axis of rotation X aligned with the forward/backward direction. This oscillating rotary motion of the rotary shaft member 61 in turn imparts an oscillating rotary motion to the holder 9, fixed to the rotary shaft member 61, around the axis of rotation X.

[0032] Next, the holder 9 will be described in detail with reference to FIGS. 4A-5C. In this embodiment, the holder 9 includes a holder body 91, a securing member 92, and a releasing member 93.

[0033] The holder body 91 is fixed to the front end of the rotary shaft member 61. The holder body 91 may be made of a metallic material, for example. The holder body 91 may have the shape of a cylinder, of which the center axis is aligned with the axis of rotation X. The holder body 91 has, at its front end, a holding surface 911 facing forward. Thus, in this embodiment, the axis of rotation X is perpendicular to the holding surface 911. The holder body 91 also has an outer peripheral surface 912.

[0034] The outer peripheral surface 912 surrounds, and faces away from, the axis of rotation X. The holder body 91 further has a supporting recess 913, which has an opening on the holding surface 911.

[0035] The securing member 92 may be made of a metallic material, for example. The securing member 92 is fitted into the supporting recess 913 of the holder body 91. The securing member 92 includes a supporting portion 921 and securing portions 922. The supporting portion 921 includes a base 923 and supporting pieces 924 extending from the base 923. The base 923 is fixed onto the bottom of the supporting recess 913. The supporting pieces 924 extend from the base 923 toward the opening of the supporting recess 913 (i.e., forward), and the tip (front end) of the supporting pieces 924 protrudes into an external space through the opening of the supporting recess 913. The supporting portion 921 may include two supporting pieces 924, which are arranged side by side with a gap left between them and perpendicularly to the axis of rotation X. In this embodiment, the holder 9 includes two securing portions 922, which are located in front of the holding surface 911. That is to say, the securing portions 922 are arranged so as to face toward the holding surface 911. The two securing portions 922 protrude from the respective tips of the two supporting pieces 924 perpendicular to, and away from, the axis of rotation X.

[0036] In this embodiment, the supporting portion 921

constitutes an elastic mechanism 920. That is to say, the elastic mechanism 920 includes the supporting portion 921 leading to the securing portions 922. The elastic mechanism 920 produces, when elastically deformed at least partially, elastic force and applies the elastic force to the securing portions 922. The elastic force applied by the elastic mechanism 920 to the securing portions 922 is produced by the elasticity of the supporting portion 921.

[0037] The securing portions 922 are movable along the holding surface 911. Specifically, the elastic deformation of the supporting portion 921 allows each of the securing portions 922 to move, within the elastically deformable range of the supporting portion 921, along the holding surface 911 in the direction in which the securing portion 922 protrudes and in the opposite direction thereof. That is to say, the directions in which each of the securing portions 922 is movable include the protruding direction of the securing portion 922 and the opposite direction thereof.

[0038] When no external force is applied from outside of the holder 9 to the securing members 92, the supporting pieces 924 are suitably pressed against the inner peripheral surface of the supporting recess 913 due to the elasticity of the supporting portion 921. In that case, when external force is applied to any of the securing portions 922 in a direction opposite from the protruding direction of the securing portion 922, the securing portion 922 moves in the direction opposite from its own protruding direction, while elastic force is applied from the supporting portion 921 to the securing portion 922 in the protruding direction of the securing portion 922. In this case, when the force applied externally to the securing member 92 decreases or goes zero, the securing portion 922 moves in its own protruding direction and returns to its home position.

[0039] Each securing portion 922 has a securing surface 925 facing toward, and sloping away from, the holding surface 911. The securing surface 925 is sloped away from the holding surface 911 such that the gap between the securing surface 925 and the holding surface 911 increases toward the tip of the protruding portion of the securing portion 922. The securing surface 925 may have a planar surface, for example. Note that the securing surface 925 may be sloped as a whole toward the holding surface 911. Each securing portion 922 also has a guide surface 926 facing away from, and sloping toward, the holding surface 911. The guide surface 926 is sloped in the opposite direction from the securing surface 925. That is to say, the guide surface 926 is sloped toward the tip of the protruding portion of the securing portion 922 such that the distance from the guide surface 926 to the holding surface 911 decreases toward the tip of the protruding portion of the securing portion 922.

[0040] The releasing member 93 includes a pressing portion 931 and a release button 932 coupled to the pressing portion 931. The holder body 91 has an arrangement space 914, in which the pressing portion 931 is arranged. The arrangement space 914 has an opening

on the inner peripheral surface of the supporting recess 913 such that the opening faces the supporting pieces 924. Thus, the pressing portion 931 faces the supporting pieces 924. The pressing portion 931 is movable from the arrangement space 914 toward the supporting recess 913. The holder body 91 also has a through hole 915 extending in the opposite direction from the arrangement space 914 with respect to the supporting recess 913, and opening on the outer peripheral surface 912 of the holder body 91. The release button 932 is inserted into the through hole 915 and protrudes into the external space from the outer peripheral surface 912. If the securing member 92 has a plurality of supporting pieces 924, the holder 9 suitably includes a plurality of releasing members 93 respectively associated with the plurality of supporting pieces 924. In this embodiment, the securing member 92 includes two supporting pieces 924. Thus, the holder 9 includes two releasing members 93 respectively associated with the two supporting pieces 924 and the holder body 91 has two sets of arrangement spaces 914 and through holes 915 respectively associated with the two releasing members 93. The two release buttons 932 are arranged on the outer peripheral surface 912 of the holder 9 to be symmetric to each other with respect to the center axis of the holder 9.

[0041] In addition, the holding surface 911 further includes a plurality of projections 916, which are arranged at predetermined intervals along the circumference of a circle surrounding the securing member 92 (i.e., to surround the opening of the supporting recess 913) so as to project in the direction in which the holding surface 911 faces.

[0042] An example of the bit 3 will be described. The bit 3 may be made of a metallic material, for example. The bit 3 may have a thin plate shape, for example, and has its thickness aligned, in the holding state, with the axis of rotation X. The bit 3 includes a base end portion 31 and a machining part 32 extending from the base end portion 31 in one direction perpendicular to the axis of rotation X. The bit 3 has a portion to be placed on top of the holding surface 911. In this embodiment, that portion is the base end portion 31. The machining part 32 is located forward of the base end portion 31 (i.e., more distant from the tool 1 than the base end portion 31 is). One end, connected to the machining part 32, of the base end portion 31 is bent toward the machining part 32. Thus, the bit 3 is formed in a step shape. The other end, located opposite from the base end portion 31, of the machining part 32 is a cutting edge for machining. The base end portion 31 has a hole running through the base end portion 31 (attachment hole 33) and a plurality of holes 34 arranged to surround the attachment hole 33. The plurality of holes 34 correspond one to one to the plurality of projections 916 on the holding surface 911. That portion, placed on top of the holding surface 911, of the bit 3 includes attaching portions 35. In this embodiment, parts of an edge of the attachment hole 33 in the base end portion 31 constitute the attaching portions 35. In

other words, the attaching portions 35 are parts of the edge of the attachment hole 33 to be engaged with the securing portions 922.

[0043] Note that the machining part 32 does not have to have the shape described above, but may also have any other appropriate shape according to the type of machining to be performed using the bit 3. For example, the machining part 32 may also be implemented as a grinder.

[0044] Next, it will be described with reference to FIGS. 4A-4C how to attach the bit 3 onto the holder 9. In this embodiment, the holder 9 realizes the holding state by forcing the securing portions 922 into the bit 3, which is not held by the holder 9 yet. Specifically, first, when the bit 3 is not held by the holder 9 yet, the base end portion 31 is placed in position to face the holding surface 911 as shown in FIG. 4A. In this state, the attachment hole 33 of the base end portion 31 is aligned with the securing portions 922 of the holder 9 and the plurality of holes 34 of the base end portion 31 are aligned with the plurality of projections 916 on the holding surface 911 of the holder 9. In such a state, the securing portions 922 are forced into the bit 3 as shown in FIG. 4B. Then, the guide surface 926 of each securing portion 922 comes into contact with an associated attachment portion 35 forming part of the edge of the attachment hole 33. As the securing portions 922 are forced deeper into the bit 3, force is applied from the attachment portions 35 to the guide surfaces 926. This causes the supporting portion 921 to be deformed elastically to make the securing portions 922 move along the holding surface 911 in the direction opposite from the protruding direction thereof. As the securing portions 922 are forced even deeper into the bit 3, the guide surfaces 926 go out of contact with the attachment portions 35 and the securing surfaces 925 come into contact with the attachment portions 35 instead. Thus, the elastic force applied by the supporting portion 921 causes the securing portions 922 to move along the holding surface 911 in the protruding direction thereof. As the securing portions 922 are forced even deeper into the bit 3, finally, the plurality of projections 916 are fitted into the plurality of holes 34 and the base end portion 31 comes into contact with the holding surface 911 with the securing surfaces 925 kept in contact with the attachment portions 35. Consequently, the holding state shown in FIG. 4C is realized.

[0045] In the holding state, the bit 3 is placed on top of the holding surface 911. In addition, in the holding state, the securing portions 922 are engaged with the attachment portions 35, the elastic mechanism 920 applies elastic force to the securing portions 922, and the securing portions 922 apply force, resultant from the elastic force and directed toward the holding surface 911, to the attachment portion 35. Specifically, in the holding state, with the securing surfaces 925 of the securing portions 922 kept in contact with the attachment portions 35, elastic force is applied from the supporting portion 921, serving as the elastic mechanism 920, to the securing portions 922 in the direction parallel to the holding surface

911 and aligned with the protruding direction of the securing portions 922. That is to say, the direction of the elastic force applied by the elastic mechanism 920 to the securing portions 922 agrees with the direction in which the securing portions 922 move toward the attachment portions 35, out of the two directions in which the securing portions 922 are movable along the holding surface 911. Consequently, the securing portions 922 are pressed against, and engaged with, the attachment portions 35. In this embodiment, elastic forces are applied to the two securing portions 922 in two opposite directions along the holding surface 911, thus pressing the two securing portions 922 against the attachment portions 35. This balances the forces applied from the securing portions 922 to the bit 3 along the holding surface 911, thus preventing, in the holding state, the bit 3 from moving along the holding surface 911. In addition, pressing the securing portions 922 against the attachment portions 35 in this manner allows the securing portions 922 to apply the force, resultant from the elastic force applied by the supporting portion 921, to the attachment portions 35. That is to say, each of the securing portions 922 has the securing surface 925 facing toward, and sloping away from, the holding surface 911, and is in contact with the attachment portion 35 on the securing surface 925 in the holding state. This brings the securing portions 922 into engagement with the attachment portions 35. In addition, each of the securing portions 922 applies force, directed toward the holding surface 911, from the securing surface 925 to the attachment portion 35. The reason is that since the securing surfaces 925 are sloped as described above, the force applied from the securing portions 922 to the attachment portions 35 includes a component of force directed toward the holding surface 911. This force directed toward the holding surface 911 presses the base end portion 31 of the bit 3 against the holding surface 911. This prevents the bit 3 from being released from the holding surface 911 in the holding state. Consequently, the bit 3 is firmly held by the holder 9.

[0046] The user may put, in the holding state, his or her hand on the grip 24 of the tool 1 and insert the tip of the bit 3 that is in oscillating motion into the gap between a tile and the underlying material such as a wall, for example. This allows the user to strip the tile easily. Alternatively, the user may also drill a hole through a given member such as plasterboard by pressing the tip of the bit 3 in oscillating motion against the surface of the member. Still alternatively, the user may also use this tool 1 for multiple types of machining by changing the bits 3 according to the type of the machining to do.

[0047] Next, it will be described with reference to FIGS. 5A-5C how to remove the bit 3 from the holder 9. To remove the bit 3 from the holder 9, the releasing member 93 may be used. When pressed in the holding state, the releasing member 93 performs a releasing operation of bringing the securing portions 922 out of engagement with the attachment portions 35. In this embodiment, the releasing member 93 includes the release buttons 932

protruding from the outer peripheral surface 912 of the holder 9 as described above. When any of the release buttons 932 is pressed in the holding state, the releasing member 93 performs the releasing operation. Specifically, as shown in FIG. 5A, pressing any of the release buttons 932 of the releasing member 93 toward an associated one of the supporting pieces 924 of the supporting portion 921 causes the releasing member 93 to move toward the supporting piece 924 of the supporting portion 921. Then, the pressing portion 931 of the releasing member 93 presses the supporting piece 924 to have the supporting piece 924 deformed. This causes each of the securing portions 922 to move along the holding surface 911 in the direction opposite from the protruding direction thereof. This brings the securing portions 922 out of engagement with the attachment portions 35. Pulling the bit 3 away from the holding surface 911 in such a state as shown in FIG. 5B allows the bit 3 to be removed from the holder 9 as shown in FIG. 5C.

[0048] Note that the exemplary embodiment described above is only an example of the present disclosure and should not be construed as limiting. Rather, the exemplary embodiment may be readily modified in various manners in terms of specifics. Some of those numerous variations of the exemplary embodiment will be enumerated one after another.

[0049] For example, in the exemplary embodiment described above, the holder 9 includes two securing portions 922 and the two securing portions 922 apply forces to the two attachment portions 35, respectively, in the holding state. Those forces are applied along the holding surface 911 in mutually opposite directions and are balanced with each other. However, this is only an example and should not be construed as limiting. Alternatively, the holder 9 may include three or more securing portions 922 as well. That is to say, the holder 9 suitably includes a plurality of securing portions 922 and the bit 3 suitably includes a plurality of attachment portions 35. In the holding state, the plurality of securing portions 922 are suitably engaged with their associated attachment portions 35, respectively. In addition, the force applied along the holding surface 911 from the plurality of securing portions 922 to their associated attachment portions 35 are suitably balanced with each other in the holding state. This allows the holder 9 to firmly hold the bit 3 so as to prevent the bit 3 from moving along the holding surface 911.

[0050] Also, in the exemplary embodiment described above, the securing portions 922 applies forces, directed away from the axis of rotation X, along the holding surface 911 to the attachment portions 35. However, the forces do not always have to be applied in such directions. Alternatively, depending on the configurations of the attachment hole 33 and the attachment portions 35, the securing portions 922 may also apply forces, directed toward the axis of rotation X, along the holding surface 911 to the attachment portions 35. Furthermore, in the embodiment described above, the two securing portions 922 apply outward force with antiparallel vectors to the

attachment portions 35. However, this is only an example and should not be construed as limiting. Alternatively, depending on the configuration of the attachment hole 33 and the attachment portions 35, the two securing portions 922 may also apply inward force with antiparallel vectors to the attachment portions 35 as well.

[0051] As already described for the exemplary embodiment, each of the securing portions 922 suitably has the securing surface 925 facing toward, and sloping away from, the holding surface 911. In that case, however, the securing surface 925 does not have to be a plane. That is to say, the securing surface 925 may be a curved surface, a raised surface, or a depressed surface as well, as long as the securing surface 925 is sloped as a whole with respect to the holding surface 911. Optionally, when each securing portion 922 has the securing surface 925, its associated attachment portion 35 may also have a supporting surface 36, which is sloped with respect to the holding surface 911 and which faces, and comes into contact with, the securing surface 925 in the holding state. In that case, the securing portions 922 are allowed to come into contact with the attachment portions 35 with more stability.

[0052] The attachment portions 35 of the bit 3 and the securing portions 922 of the holder 9 do not have to have the structures described above for the exemplary embodiment as long as the bit 3 is able to be held by the holder 9 by bringing the securing portions 922 into engagement with the attachment portions 35. Alternatively, a surface, designed to face the holding surface 911 in the holding state, of the bit 3 may have a recess and a depression to be engaged with the securing portion 922 may be provided as an alternative attachment portion 35 on the inner peripheral surface of the recess. Optionally, the bit 3 may have a plurality of attachment holes 33 and the holder 9 may have multiple pairs of securing portions 922 corresponding to the respective attachment holes 33.

[0053] Furthermore, in the embodiment described above, the elastic mechanism 920 is implemented as the supporting portion 921 of the securing member 92, and configured to apply elastic force, resultant from the elasticity of the supporting portion 921, to the securing portions 922. However, the elastic mechanism 920 does not have to have such a structure. Alternatively, the elastic mechanism 920 may include not only the supporting portion 921 described above but also an additional elastic member such as a spring or a rubber member interposed between the two supporting pieces 924. This allows the elastic mechanism 920 to apply the elastic force, resultant from the elasticity of the elastic member, to the securing portions 922 via the supporting pieces 924.

[0054] Furthermore, in the embodiment described above, the elastic mechanism 920 applies elastic force, directed along the holding surface 911, to the securing portions 922, and the securing portions 922 come into contact with the attachment portions 35 on the sloped securing surface 925. This brings the securing portions

922 into engagement with the attachment portions 35 and causes the securing portions 922 to apply force directed toward the holding surface 911 to the attachment portions 35. However, this is only an example and should not be construed as limiting. Alternatively, the securing portions 922 may also apply force to the attachment portions 35 in any other way. For example, the securing portions 922 may apply force directed toward the holding surface 911 to the attachment portions 35 by having the elastic mechanism 920 apply elastic force directed toward the holding surface 911 to the securing portions 922 engaged with the attachment portions 35.

[0055] Furthermore, in the embodiment described above, in the holding state, the plurality of projections 916 on the holding surface 911 are fitted into the respective holes 34 of the bit 3, thus preventing the bit 3 from rotating with respect to the holder 9. However, this is only an example and should not be construed as limiting. Alternatively, the rotation of the bit 3 with respect to the holder 9 may also be prevented by providing any other mutually fitting structure for the holder 9 and the bit 3, not just the combination of the projections 916 and the holes 34. For example, contrary to the embodiment described above, the holding surface 911 may have a plurality of holes and the bit 3 may have a plurality of projections to be fitted into those holes in the holding state. Speaking more generally, the rotation of the bit 3 with respect to the holder 9 may be prevented by forming the bit 3 and the holder 9 in any other pair of concavo-convex shapes to make them fit into each other in the holding state.

[0056] Optionally, the holder 9 may be designed to be attachable and removable to/from the tool body 2. Optionally, the tool 1 according to the present disclosure may also be implemented by attaching the holder 9 to a tool with no holders 9.

[0057] Furthermore, in the embodiment described above, the tool 1 is implemented as an electric power tool (electric tool) including an electric motor as its drive source 7. However, the tool 1 does not have to be such an electric power tool. That is to say, the tool 1 may also be a hydraulic power tool or an air power tool as well.

[0058] Note that embodiments and their variations described above are only examples of the present disclosure and should not be construed as limiting. Rather, those embodiments and variations may be readily combined in various manners depending on a design choice or any other factor without departing from a true spirit and scope of the present disclosure.

[0059] As can be seen from the foregoing description of embodiments and variations, a tool (1) according to a first aspect of the present disclosure includes: a holder (9) with the ability to hold a bit (3); and an oscillating rotary mechanism (6) for imparting an oscillating rotary motion to the holder (9). The holder (9) includes a holding surface (911), a securing portion (922), and an elastic mechanism (920). In a holding state where the bit (3) is held by the holder (9), the bit (3) is placed on top of the holding

surface (911), and the securing portion (922) is engaged with an attachment portion (35) forming part of the bit (3). In addition, in the holding state, the elastic mechanism (920) applies elastic force to the securing portion (922), and the securing portion (922) applies force, resultant from the elastic force and directed toward the holding surface (911), to the attachment portion (35).

[0060] Thus, the first aspect eliminates the need to attach and remove an additional member, separately provided from the bit (3), onto/from the tool (1) when having the bit (3) held by the tool (1).

[0061] In a tool (1) according to a second aspect, which may be implemented in conjunction with the first aspect, the holder (9) includes a plurality of the securing portions (922). The bit (3) includes a plurality of the attachment portions (35). In the holding state, the plurality of the securing portions (922) are each engaged with an associated one of the plurality of the attachment portions (35), the plurality of the securing portions (922) apply forces, resultant from the elastic force, to the plurality of the attachment portions (35) in directions aligned with the holding surface (911), and the forces in the directions aligned with the holding surface (911) are balanced.

[0062] The second aspect allows the securing portions (922) to prevent, in the holding state, the bit (3) from moving along the holding surface (911).

[0063] In a tool (1) according to a third aspect, which may be implemented in conjunction with the first or second aspect, the holder (9) realizes the holding state by forcing the securing portion (922) into the bit (3) which is not held by the holder (9).

[0064] The third aspect realizes the holding state in a simple way.

[0065] In a tool (1) according to a fourth aspect, which may be implemented in conjunction with any one of the first to third aspects, the bit (3) has an attachment hole (33), and the attachment portion (35) forms at least part of an edge of the attachment hole (33).

[0066] The fourth aspect allows the bit (3) to be positioned easily with respect to the holder (9) by aligning the attachment hole (33) with the securing portion (922) and realizes the holding state easily by forcing the securing portion (922) into the attachment hole (33).

[0067] In a tool (1) according to a fifth aspect, which may be implemented in conjunction with any one of the first to fourth aspects, the holder (9) further includes a releasing member (93). When pressed in the holding state, the releasing member (93) performs a releasing operation of bringing the securing portion (922) out of engagement with the attachment portion (35).

[0068] The fifth aspect allows the bit (3) to be removed easily from the holder (9) using the releasing member (93) just by performing a simple operation to cancel the holding state.

[0069] In a tool (1) according to a sixth aspect, which may be implemented in conjunction with the fifth aspect, the holder (9) has an outer peripheral surface (912). The releasing member (93) includes a release button (932)

protruding from the outer peripheral surface (912). The releasing member (93) performs the releasing operation when the release button (932) is pressed in the holding state.

[0070] The sixth aspect allows the bit (3) to be removed from the holder (9) simply by pressing the release button (932).

[0071] In a tool (1) according to a seventh aspect, which may be implemented in conjunction with any one of the first to sixth aspects, the securing portion (922) is movable in a direction aligned with the holding surface (911), and a direction in which the elastic force is applied in the holding state agrees with a component, directed toward the attachment portion (35), of the direction.

[0072] The seventh aspect allows the securing portion (922) to be engaged with the attachment portion (35) with stability by pressing the securing portion (922) against the attachment portion (35) with the elastic force applied by the elastic mechanism (920).

[0073] In a tool (1) according to an eighth aspect, which may be implemented in conjunction with the seventh aspect, the securing portion (922) has a securing surface (925) facing toward, and sloping away from, the holding surface (911). In the holding state, the securing portion (922) is engaged with the attachment portion (35) by bringing the securing surface (925) into contact with the attachment portion (35) and applies the force directed toward the holding surface (911) from the securing surface (925) to the attachment portion (35).

[0074] The eighth aspect allows the bit (3) to be firmly held by the holder (9) by making the securing portion (922) press the bit (3) against the holding surface (911) in the holding state.

[0075] In a tool (1) according to a ninth aspect, which may be implemented in conjunction with any one of the first to eighth aspects, the elastic mechanism (920) includes a supporting portion (921) leading to the securing portion (922), and the elastic force is produced by elasticity of the supporting portion (921).

[0076] The ninth aspect allows the supporting portion (921) to apply elastic force, resultant from its own elasticity, directly to the securing portion (922), thus simplifying the configuration of the elastic mechanism (920).

[0077] A tool system (10) according to a tenth aspect includes: the tool (1) according to any one of the first to ninth aspects; and the bit (3).

[0078] Thus, the tenth aspect eliminates the need to attach and remove an additional member, separately provided from the bit (3), onto/from the tool (1) when having the bit (3) held by the tool (1).

Reference Signs List

[0079]

1	Tool
3	Bit
33	Attachment Hole

35	Attachment Portion
6	Reciprocating Rotary Mechanism
9	Holder
911	Holding Surface
5 912	Outer Peripheral Surface
92	Securing Member
920	Elastic Mechanism
921	Supporting Portion
922	Securing Portion
10 925	Securing Surface
93	Releasing Member
10	Tool System

15 Claims

1. A tool (1) comprising:

a holder (9) configured to hold a bit (3); and
an oscillating rotary mechanism (6) configured to impart an oscillating rotary motion to the holder (9),
the holder (9) including a holding surface (911), a securing portion (922), and an elastic mechanism (920),
in a holding state where the bit (3) is held by the holder (9),
the bit (3) being placed on top of the holding surface (911),
the securing portion (922) being engaged with an attachment portion (35) that forms part of the bit (3),
the elastic mechanism (920) applying elastic force to the securing portion (922), and
the securing portion (922) applying force, resultant from the elastic force and directed toward the holding surface (911), to the attachment portion (35).

2. The tool (1) of claim 1, wherein
the holder (9) includes a plurality of the securing portions (922),
the bit (3) includes a plurality of the attachment portions (35),
in the holding state, the plurality of the securing portions (922) are each engaged with an associated one of the plurality of the attachment portions (35), the plurality of the securing portions (922) apply forces, resultant from the elastic force, to the plurality of the attachment portions (35) in directions aligned with the holding surface (911), and the forces in the directions aligned with the holding surface (911) are balanced.

3. The tool (1) of claim 1 or 2, wherein
the holder (9) is configured to realize the holding state by forcing the securing portion (922) into the bit (3) which is not held by the holder (9).

4. The tool (1) of any one of claims 1 to 3, wherein the bit (3) has an attachment hole (33), and the attachment portion (35) forms at least part of an edge of the attachment hole (33). 5
5. The tool (1) of any one of claims 1 to 4, wherein the holder (9) further includes a releasing member (93), and the releasing member (93) is configured to, when pressed in the holding state, perform a releasing operation of bringing the securing portion (922) out of engagement with the attachment portion (35). 10
6. The tool (1) of claim 5, wherein the holder (9) has an outer peripheral surface (912), the releasing member (93) includes a release button (932) protruding from the outer peripheral surface (912), and the releasing member (93) is configured to, when the release button (932) is pressed in the holding state, perform the releasing operation. 15 20
7. The tool (1) of any one of claims 1 to 6, wherein the securing portion (922) is movable in a direction aligned with the holding surface (911), and a direction in which the elastic force is applied in the holding state agrees with a component, directed toward the attachment portion (35), of the direction. 25
8. The tool (1) of claim 7, wherein the securing portion (922) has a securing surface (925) facing toward, and sloping away from, the holding surface (911), and in the holding state, the securing portion (922) is engaged with the attachment portion (35) by bringing the securing surface (925) into contact with the attachment portion (35) and applies the force directed toward the holding surface (911) from the securing surface (925) to the attachment portion (35). 30 35 40
9. The tool (1) of any one of claims 1 to 8, wherein the elastic mechanism (920) includes a supporting portion (921) leading to the securing portion (922), and the elastic force is produced by elasticity of the supporting portion (921). 45
10. A tool system (10) comprising:
 - the tool (1) of any one of claims 1 to 9; and 50
 - the bit (3).

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FIG. 1

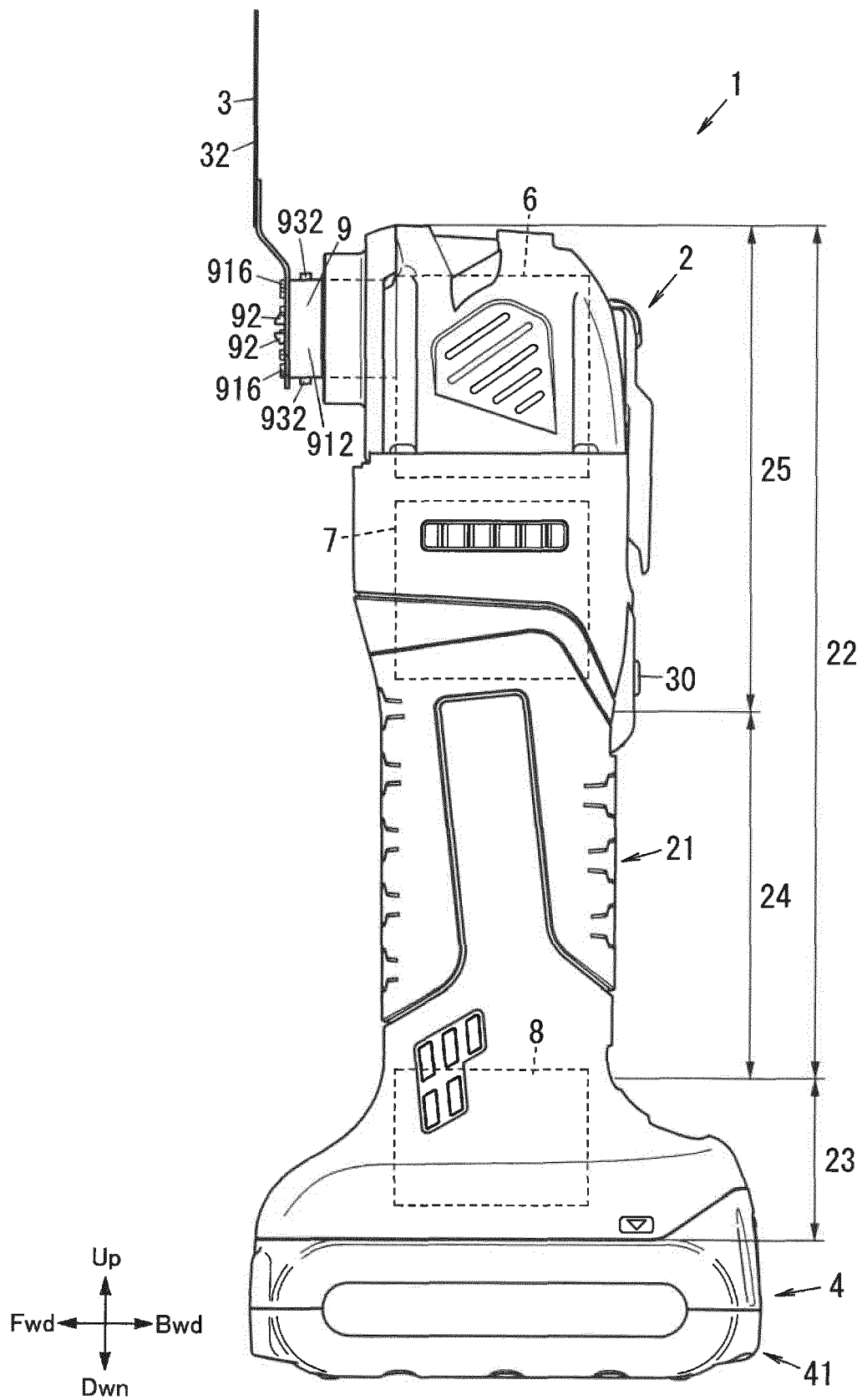


FIG. 2

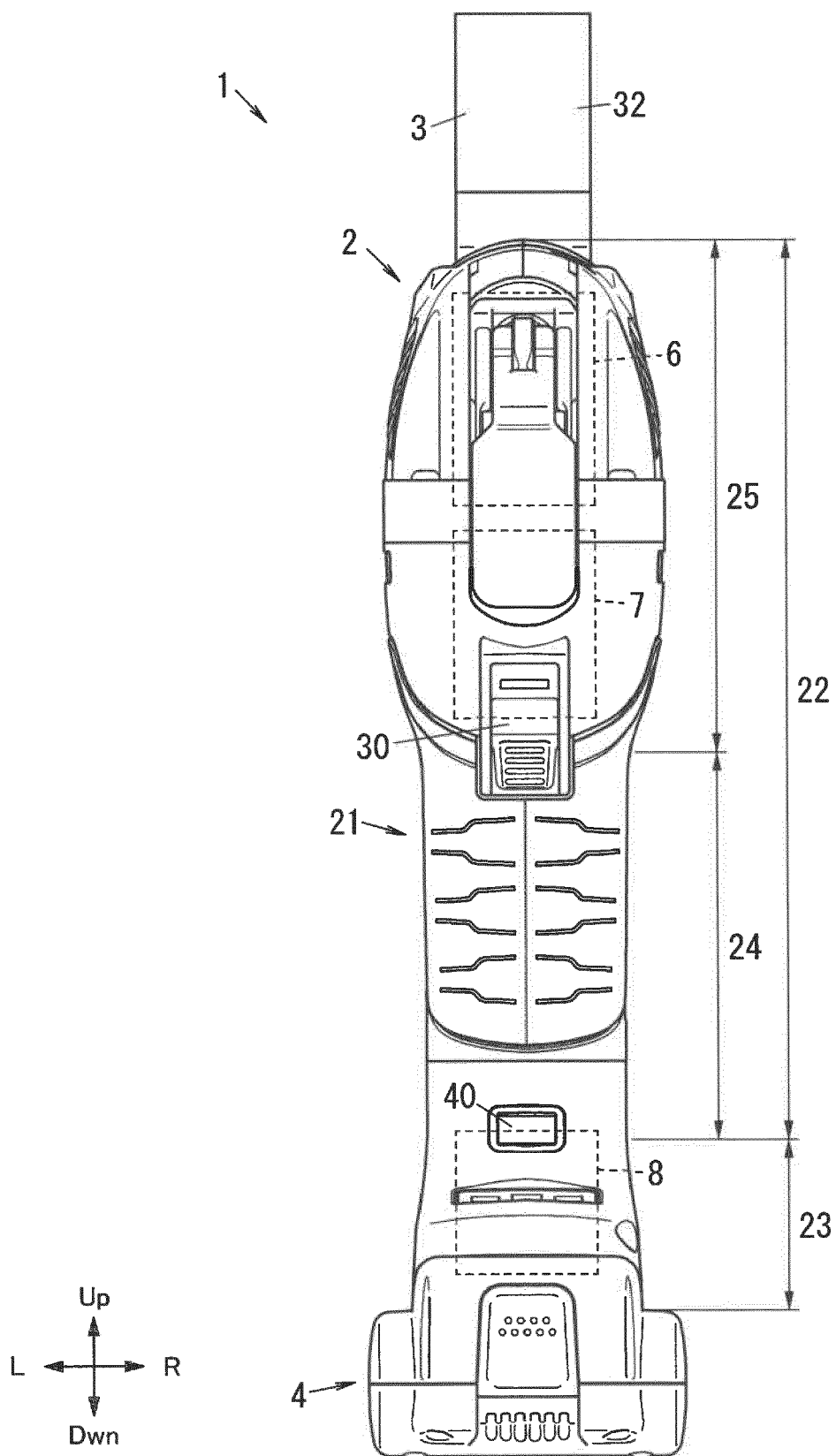


FIG. 3

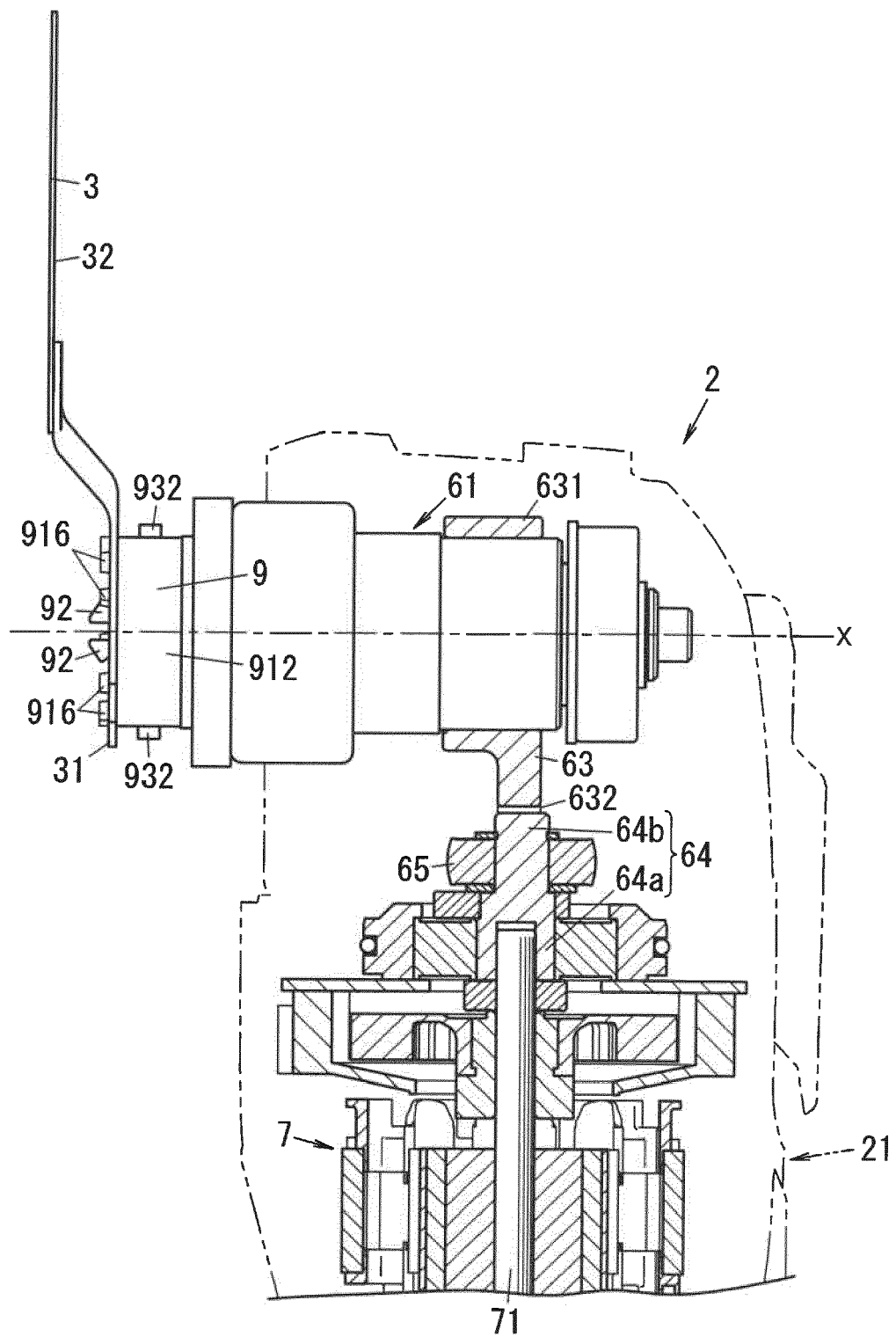


FIG. 4A

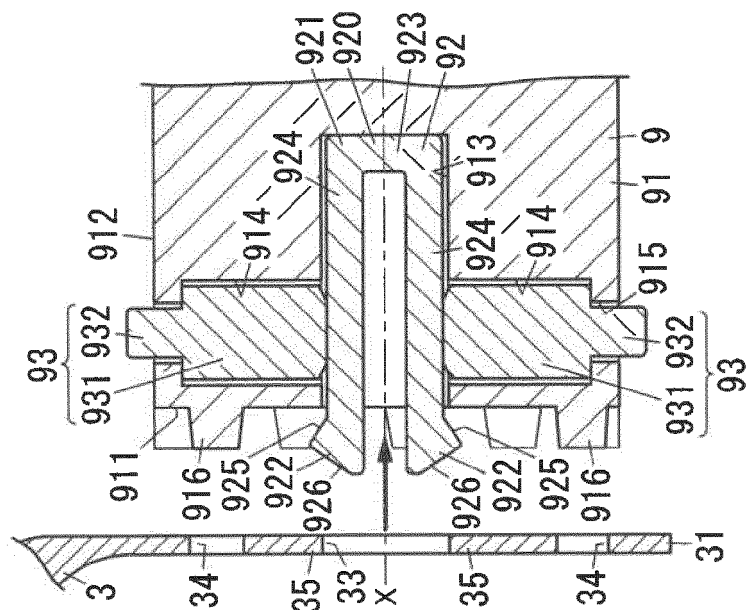


FIG. 4B

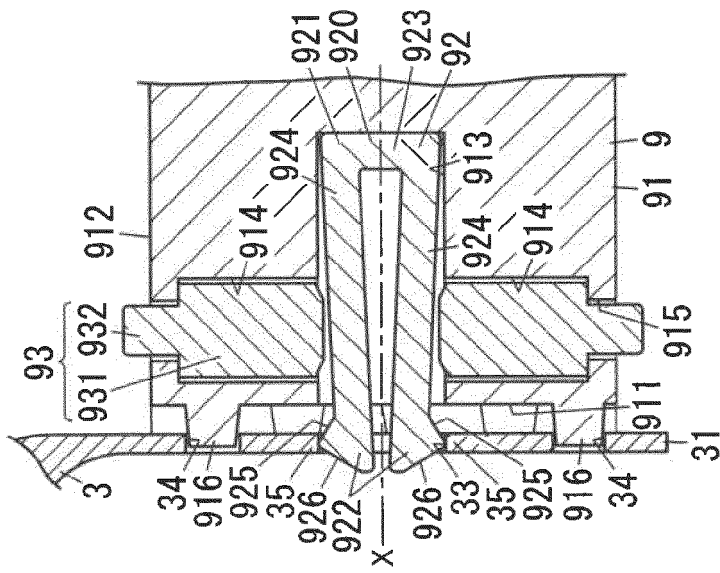
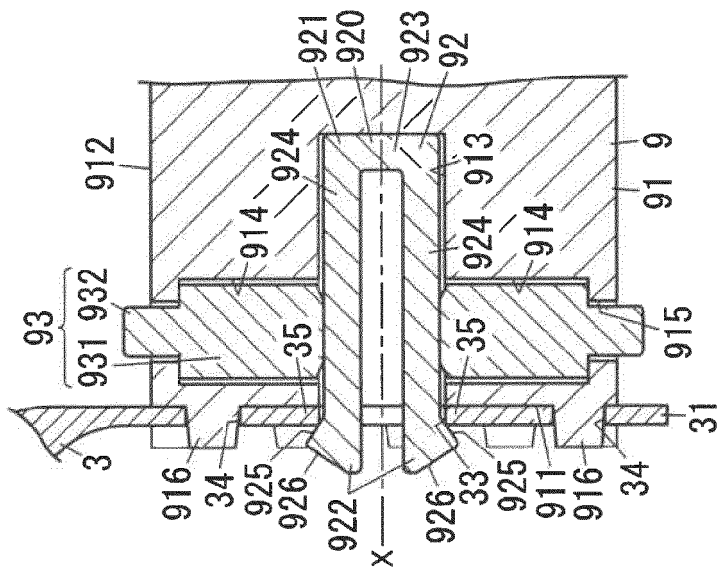


FIG. 4C



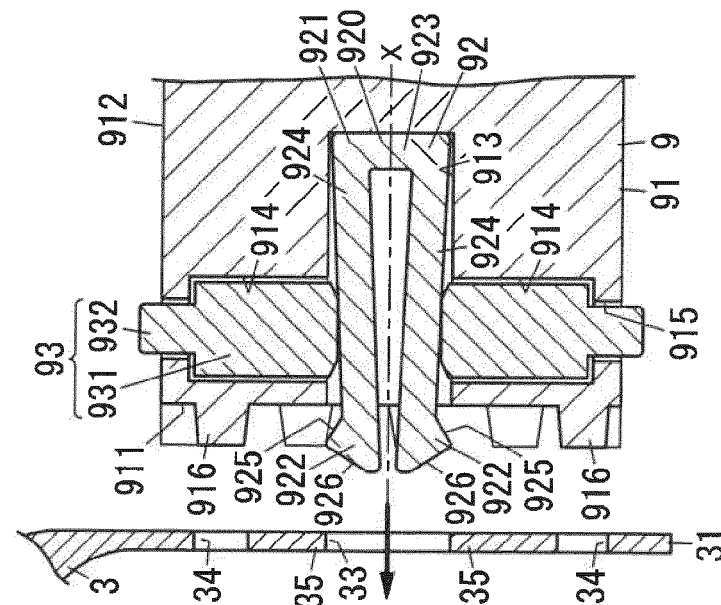
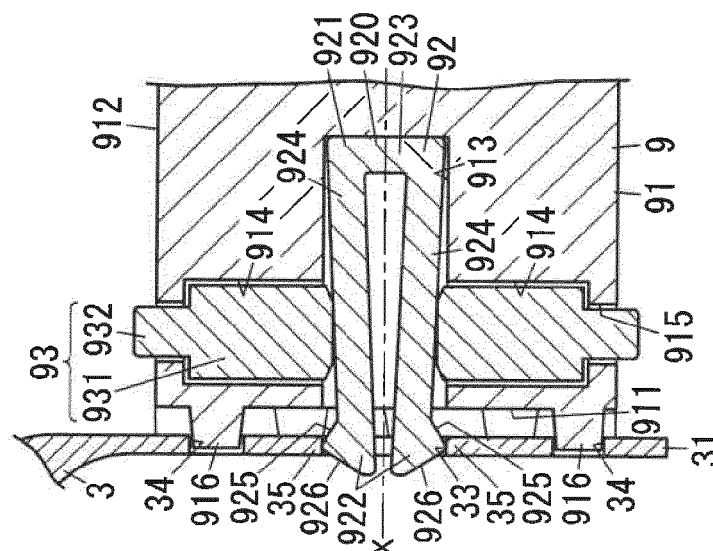
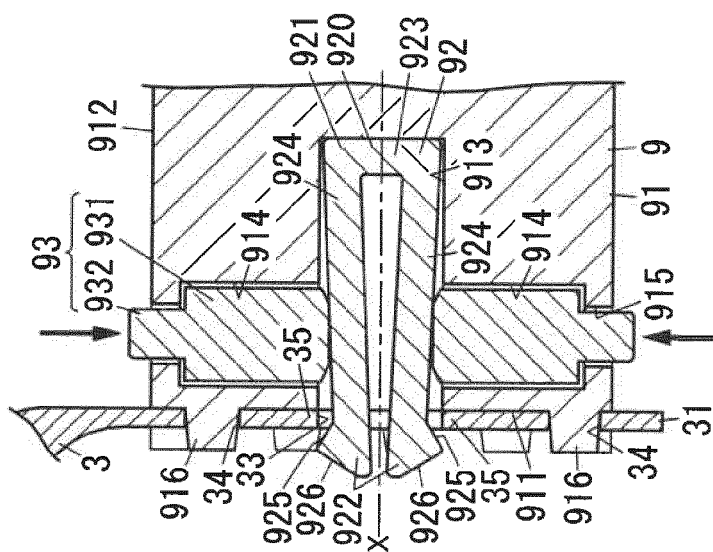
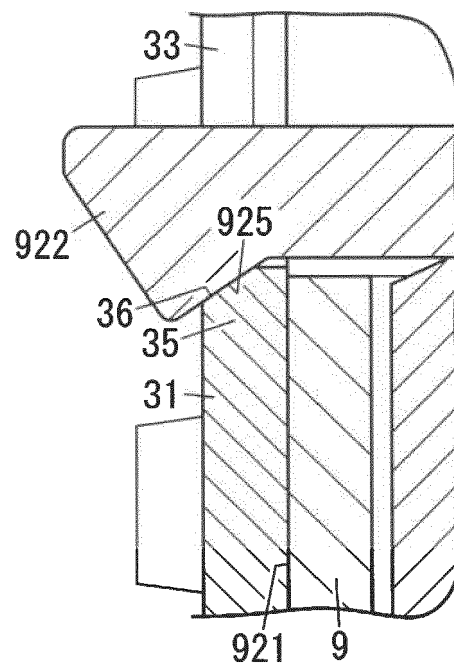


FIG. 6





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