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(54) **ELECTRIC SCREWDRIVER**

(57) Provided is an electric screwdriver. The electric screwdriver includes a housing; an electric motor including a motor shaft rotatable about a motor axis; an output assembly including an output shaft movable forward and backward along a direction of a first axis; and a transmission assembly configured to transmit the power outputted by the motor shaft to the output shaft. The electric screwdriver further includes a startup circuit configured to start the electric motor. The startup circuit includes a switch assembly controlling the on state of the startup circuit; and an activation assembly including a detection element electrically connected to the electric motor or connected to the electric motor through a signal and an activation element configured to activate the detection element. The output shaft is capable of driving the detection element to move. The detection element includes one activated state during movement. When the detection element is in the activated state and the switch assembly is on, the electric motor starts.

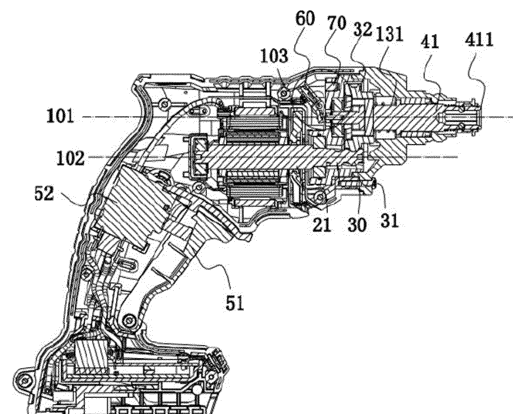


Fig. 3

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Description

[0001] This application claims priority to Chinese Patent Application No. 202110166289.4 filed with the China National Intellectual Property Administration (CNIPA) on Feb. 4, 2021, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present application relates to a power tool, for example, an electric screwdriver.

BACKGROUND

[0003] Due to the advantages of usage flexibility and convenience, an electric screwdriver is very popular on the market and widely used in the industry, household, and other occasions where screws need to be assembled and disassembled. However, a switch assembly is generally disposed in the current electric screwdriver on the market, and a user can drive an output shaft to rotate by operating the switch assembly; and when operating the electric screwdriver for long time nailing, the user needs to keep operating the switch assembly, which is not convenient for the user to operate, reducing the working efficiency.

SUMMARY

[0004] The present application provides an electric screwdriver that is easy to operate and has low power consumption.

[0005] The present application adopts the technical solutions described below. An electric screwdriver includes a housing; an electric motor at least partially disposed in the housing and including a motor shaft rotatable about a motor axis; and an output assembly configured to output power and including an output shaft movable forward and backward along a direction of a first axis. The electric screwdriver further includes a startup circuit configured to start the electric motor. The startup circuit includes a switch assembly controlling the on state of the startup circuit; and an activation assembly including a detection element connected to the electric motor electrically or through a signal, and an activation element configured to activate the detection element. The output shaft is capable of driving the detection element, and the detection element includes at least one activated state during movement. When the detection element is in one of the at least one activated state and the switch assembly is on, the electric motor starts.

[0006] In some examples, the activation element is fixedly disposed in the housing.

[0007] In some examples, the switch assembly includes a switch configured to control the on state of at least one of the detection element and the activation element.

[0008] In some examples, the activation element is disposed on a moving path of the detection element.

[0009] In some examples, the output shaft is capable of driving the detection element to rotate about a first axis of rotation, and the detection element is capable of being activated by the activation element during rotation.

[0010] In some examples, the output shaft includes an input end and an output end disposed opposite to each other along the first axis, where the input end is disposed away from the electric motor relative to the output end; and when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

[0011] In some examples, the electric screwdriver further includes a gearbox fixedly disposed in the housing, where the output shaft is at least partially disposed in the gearbox; and in a direction perpendicular to the first axis, the activation element is located above the output shaft and fixedly disposed on the gearbox.

[0012] In some examples, the activation assembly further includes a biasing member capable of providing a biasing force that keeps the detection element at an initial position when the detection element is not driven by an external force.

[0013] In some examples, the activation assembly further includes a rotary member to which the detection element is mounted, where the output end drives the rotary member to overcome the biasing force so that the detection element approaches the activation element.

[0014] In some examples, the activation element is a permanent magnet.

[0015] In some examples, the detection element is a Hall sensor.

[0016] An electric screwdriver includes a housing; an electric motor at least partially disposed in the housing and including a motor shaft rotatable about a motor axis; and an output assembly configured to output power and including an output shaft movable forward and backward along a direction of a first axis. The electric screwdriver further includes a startup circuit configured to start the electric motor. The startup circuit includes a switch assembly controlling the on state of the startup circuit; and an activation assembly including at least one activated state. When the activation assembly is in one of the at least one activated state and the switch assembly is on, the electric motor starts; and in a direction perpendicular to the first axis, the activation assembly is located above the output shaft.

[0017] In some examples, the activation assembly includes a detection element electrically connected to the electric motor or connected to the electric motor through a signal and an activation element configured to activate the detection element; and the output shaft is capable of driving the detection element, and the detection element includes at least one activated state during movement; where when the detection element is in one of the at least one activated state and the switch assembly is on, the

electric motor starts.

[0018] In some examples, the output shaft is capable of driving the detection element to rotate about a first axis of rotation, and the detection element is capable of being activated by the activation element during rotation.

[0019] In some examples, the output shaft includes an input end and an output end disposed opposite to each other along the first axis, where the input end is disposed away from the electric motor relative to the output end; and when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

[0020] In some examples, the electric screwdriver further includes a gearbox fixedly disposed in the housing, where the output shaft is at least partially disposed in the gearbox; and in the direction perpendicular to the first axis, the activation element is located above the output shaft and fixedly disposed on the gearbox.

[0021] In some examples, during movement, the detection element includes the at least one activated state in which the detection element is activated by the activation element to generate an activation signal and a sleep state in which the detection element is not activated by the activation element. When the detection element is in the sleep state, the distance between the detection element and the activation element is greater than or equal to 2 mm along the direction of the first axis.

[0022] An electric screwdriver includes a housing; an electric motor at least partially disposed in the housing and including a motor shaft rotatable about a motor axis; and an output assembly configured to output power and including an output shaft movable forward and backward along a direction of a first axis. The electric screwdriver further includes a startup circuit configured to start the electric motor. The startup circuit includes a switch assembly controlling the on state of the startup circuit; and an activation assembly including a detection element electrically connected to the electric motor or connected to the electric motor through a signal and an activation element configured to activate the detection element. The detection element is drivable by the output shaft. During movement, the detection element includes an activated state in which the detection element is activated by the activation element to generate an activation signal and a sleep state in which the detection element is not activated by the activation element. When the activation assembly is in the activated state and the switch assembly is on, the electric motor starts; and when the detection element is in the sleep state, the distance between the detection element and the activation element is greater than or equal to 2 mm along the direction of the first axis.

[0023] In some examples, the activation element is fixedly disposed in the housing.

[0024] In some examples, the activation element is disposed on a moving path of the detection element.

[0025] In some examples, the output shaft includes an input end and an output end disposed opposite to each

other along the first axis, where the input end is disposed away from the electric motor relative to the output end; and when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

[0026] The present application provides an electric screwdriver that is easy to operate and has low power consumption.

BRIEF DESCRIPTION OF DRAWINGS

[0027]

FIG. 1 is a perspective view of an electric screwdriver of the present application;

FIG. 2 is a perspective view of the electric screwdriver shown in FIG. 1 with a trigger in a closed state and an activation assembly at an initial position after part of a housing is removed;

FIG. 3 is a sectional view of the electric screwdriver shown in FIG. 2;

FIG. 4 is an enlarged view of the sectional view shown in FIG. 3;

FIG. 5 is a perspective view of the electric screwdriver shown in FIG. 1 with a trigger in an open state and an activation assembly in an activated state after part of a housing is removed;

FIG. 6 is a sectional view of the electric screwdriver shown in FIG. 5;

FIG. 7 is an enlarged view of the sectional view shown in FIG. 6; and

FIG. 8 is an analog circuit diagram of a startup circuit in the electric screwdriver shown in FIG. 1.

DETAILED DESCRIPTION

[0028] An electric screwdriver 100 shown in FIGS. 1 and 2 can be used to drive a fastener such as a screw into concrete or wood.

[0029] As shown in FIGS. 1 and 2, the electric screwdriver 100 includes a housing 10, an electric motor 20, a transmission assembly 30, an output assembly 40, a switch assembly 50, an activation assembly 60, and an energy source. The output assembly 40 includes an output shaft 41, and the output shaft 41 can rotate about a first axis 101 to output power. The output shaft 41 can move along the first axis 101 when a force is applied, and the output shaft 41 can be restored to an original position when the external force is withdrawn. For the electric screwdriver, the electric screwdriver 100 may fur-

ther include a functional element (not shown in the figure) connected to the output shaft 41 to drive the fastener such as the screw into the cement or wood. The functional element may be a bit.

[0030] To facilitate the description of the technical solutions of the present application, up, down, front, rear, left, and right as shown in FIG. 1 are further defined.

[0031] The housing 10 includes an accommodation portion 11 and a handle portion 12. The accommodation portion 11 is formed with an accommodation chamber 110. The electric motor 20, the transmission assembly 30, and the activation assembly 60 are all disposed in the accommodation chamber 110. The handle portion 12 is used for a user to hold. The handle portion 12 is connected to the accommodation portion 11, and the handle portion 12 extends obliquely downward from the accommodation portion 11.

[0032] The electric motor 20 is disposed in the accommodation chamber 110 formed by the accommodation portion 11. The electric motor 20 includes a motor shaft 21 for outputting power. The motor shaft 21 can rotate about a motor axis 102 relative to the housing 10. The motor axis 102 about which the motor shaft 21 rotates is basically parallel to the first axis 101 about which the output shaft 41 rotates. In this example, the motor axis 102 about which the motor shaft 21 rotates is parallel to and does not coincide with the first axis 101 about which the output shaft 41 rotates, and it is also to be understood that the output shaft 41 is disposed substantially on the upper side of the electric motor 20.

[0033] The transmission assembly 30 is used for transmitting power outputted by the motor shaft 21 to the output shaft 41. The transmission assembly 30 includes a first transmission member 31 and a second transmission member 32, where the first transmission member 31 is fixedly connected to or integrally formed with the motor shaft 21, the second transmission member 32 rotates synchronously with the output shaft 41, and the first transmission member 31 is always engaged with the second transmission member 32. The second transmission member 32 is always at least partially in contact with the output shaft 41 during the movement along the first axis 101 when a force is applied. The second transmission member 32 is formed with a sliding groove for the reciprocating movement of the output shaft 41. The output shaft 41 is fixedly connected to or integrally formed with an engagement portion. The engagement portion always mates with the sliding groove, thereby ensuring the synchronous rotation of the second transmission member 32 and the output shaft 41.

[0034] The output assembly 40 includes the output shaft 41, where the output shaft 41 can move along the direction of the first axis 101 when a force is applied. In this example, the output shaft 41 includes an input end 411 and an output end 412 disposed opposite to each other along the direction of the first axis 101, where the input end 411 is disposed away from the electric motor 20 relative to the output end 412, and the functional el-

ement is mounted at the input end 411 of the output shaft 41. The engagement portion is disposed near the output end 412 relative to the input end 411.

[0035] The energy source is used for providing a source of energy to the electric screwdriver 100. The energy source may be an alternating current or a direct current. In this example, the energy source is the direct current, that is, the energy source may be a battery pack. The battery pack may be inserted into the housing 10, or the battery pack may be separated from the housing 10, that is, the battery pack is not directly mounted on the surface of the housing 10. As long as a power source can be supplied, a specific mounting manner is not limited herein.

[0036] Referring to FIG. 8, the switch assembly 50, the activation assembly 60, and the electric motor 20 are defined herein as a startup circuit for ease of description of this solution. The startup circuit is used for controlling the stopping and operation of the electric motor 20.

[0037] The startup circuit includes the switch assembly 50 and the activation assembly 60, that is to say, the signals between the activation assembly 50 and the activation assembly 60 are connected in series. The switch assembly 50 is used for controlling the on state of the startup circuit and is at least partially disposed in the handle portion 12. In this manner, it is convenient for the user to operate the switch assembly 50 when the user holds the handle portion 12. The switch assembly 50 includes a trigger 51 for the user to operate and a switch 52 drivable by the trigger 51, where the switch 52 is coupled to the electric motor 20. It is to be noted that the coupling connection in the present application includes a signal connection, an electrical connection, and a mechanical connection. The trigger 51 is movable relative to the housing 10, and the trigger 51 can drive the switch 52 to change the state during movement, that is, it is to be understood that the trigger 51 includes an open state and a closed state during movement. When the trigger 51 is in the open state, the startup circuit is turned on, that is to say, at this time, the trigger 51 allows the motor shaft 21 to provide power to the output shaft 41. When the trigger 51 is in the closed state, the startup circuit is turned off, that is to say, the trigger 51 prohibits the motor shaft 21 from providing power to the output shaft 41.

[0038] The activation assembly 60 is disposed in the accommodation chamber 110 and includes a detection element 61 and an activation element 70. The detection element 61 is electrically connected to the electric motor 20 or connected to the electric motor 20 through a signal, and the activation element 70 is used for activating the detection element 61. The detection element 61 is driven by the output shaft 41 to move, and the activation element 70 is disposed on a moving path of the detection element 61. During movement, the detection element 61 includes an activated state in which the detection element 61 is activated by the activation element 70 to generate an activation signal and a sleep state in which the detection element 61 is not activated by the activation element 70.

[0039] In this example, when the detection element 61 is in the activated state and the switch assembly 50 is on, the electric motor 20 starts. That is, the electric motor 20 cannot start when either the detection element 61 is in the sleep state or the trigger 51 is in the closed state. In this manner, the noise of the electric motor 20 when the electric screwdriver 100 is not loaded can be reduced, thereby extending the working duration of the battery pack. It is to be noted here that the output shaft 41 drives the detection element 61 to move, which may be understood that the output shaft 41 directly drives the detection element 61 to translate, rotate, slide, or the like, or the output shaft 41 indirectly drives the detection element 61 to translate, rotate, slide, or the like. In this example, the output shaft 41 drives the detection element 61 to rotate about a first axis of rotation 103, and when rotating, the detection element 61 can be activated by the activation element 70 so that the detection element 61 is in the activated state.

[0040] As an example, while the switch 52 sends a signal to the electric motor 20, the switch 52 can also control the on state of the detection element 61. That is, it is to be understood that when the user operates the trigger 51 and drives the switch 52 to the open state, the switch 52 enables the detection element 61 to be powered on through an electrical connection or a signal connection, and in the same time unit, the user drives the shaft to move the detection element 61 so that the activation element 70 activates the detection element 61 and the electric motor 20 starts. That is, the user cannot start the electric motor 20 by either driving only the trigger 51 or driving only the output shaft 41 in the same time unit. That is to say, in this example, only after the trigger 51 is driven, the detection element 61 can be powered on and activated by the activation element 70. For example, the detection element 61 may be a Hall sensor and the activation element 70 may be a permanent magnet. Of course, the detection element 61 may also be other sensors, which is not limited, as long as the preceding conditions can be satisfied.

[0041] As another example, while the switch 52 sends a signal to the electric motor 20, the switch 52 can also enable the activation element 70 to be powered on so that the activation element 70 is turned on, and the detection element 61 is powered in other manners. That is, it is to be understood that when the user operates the trigger 51 and drives the switch 52 to the open state, the switch 52 enables the detection element 61 to be powered on through an electrical connection or a signal connection, and in the same time unit, the user drives the shaft to move the detection element 61 so that the activation element 70 activates the detection element 61 and the electric motor 20 starts. That is, it is to be understood that only after the trigger 51 is driven, the activation element 70 can be powered on and can activate the detection element 61. For example, the detection element 61 may be a light sensor and the activation element 70 may be a light-emitting element. Of course, the detection el-

ement 61 may be the Hall sensor and the activation element 70 may be an electromagnet. Of course, the detection element 61 may also be other types of sensors, which is not limited, as long as the preceding conditions can be satisfied.

[0042] As some other examples, while the switch 52 sends a signal to the electric motor 20, the switch 52 can also enable the activation element 70 and the detection element 61 to be powered on so that the activation element 70 and the detection element 61 are turned on. That is, it is to be understood that when the user operates the trigger 51 and drives the switch 52 to the open state, the switch 52 enables the detection element 61 and the activation element 70 to be powered on through an electrical connection or a signal connection, and in the same time unit, the user drives the shaft to move the detection element 61 so that the activation element 70 activates the detection element 61 and the electric motor 20 starts. That is, it is to be understood that only after the trigger 51 is driven, the activation element 70 and the detection element 61 can be powered on, and the activation element 70 can activate the detection element 61. For example, the detection element 61 may be the light sensor and the activation element 70 may be the light-emitting element. Of course, the detection element 61 may also be other types of sensors, which is not limited, as long as the preceding conditions can be satisfied.

[0043] As other examples, the activation assembly 60 may also be powered in other manners, that is, the activation assembly 60 is not affected by the switch 52, and the switch 52 is allowed to enable only the electric motor 20 to be powered. However, it is still satisfied that when the trigger 51 is in the open state and the detection element 61 is in the activated state, the electric motor 20 is started. It is to be understood that the open state of the trigger 51 does not refer to a single position, but may correspond to multiple positions, as long as the switch 52 can send the signal to the electric motor 20 when the trigger 51 is at a certain position. The same is true for the closed state of the trigger 51.

[0044] The activated state of the detection element 61 does not refer to a single position, but may correspond to multiple positions, as long as the detection element 61 can send the signal to the electric motor 20 when the detection element 61 is at a certain position. The same is true for the sleep state of the detection element 61. Meanwhile, it is to be noted that, considering the case where the switch 52 enables the detection element 61 or/and the activation element 70 to be powered on and the detection element 61 is not in the activated state no matter which position the detection element 61 is forced to move, to facilitate a clear description of the content of this solution, the position at which the detection element 61 not driven by an external force is located is defined as an initial position (as shown in FIG. 4), and when the detection element 61 is at the initial position, the detection element 61 is in the sleep state.

[0045] As shown in FIGS. 1 to 7, the electric screw-

driver 100 further includes a gearbox 13 at least partially disposed in the accommodation chamber 110 and an elastic member 131 disposed in the gearbox 13, where the gearbox 13 is fixedly connected to the housing 10. In this example, the output shaft 41 can penetrate through the gearbox 13 and drive the detection element 61 to rotate. For example, the input end 411 is subjected to a force to move along the direction of the first axis 101 so that when moving backward along the direction of the first axis 101, the output end 412 can drive the detection element 61 to rotate about the first axis of rotation 103. The elastic member 131 is used for restoring the elastic member 131 to an original position, the elastic member 131 is sleeved on the output shaft 41, an end of the elastic member 131 abuts against a protrusion formed by the output shaft 41, and the other end of the elastic member 131 abuts against the second transmission member 32. The output shaft 41 is subjected to a force to move backward so that the elastic member 131 has elastic deformation and generates a deformation force. When the external force is withdrawn, the output shaft 41 is restored to the original position due to the deformation force. In fact, it is easily found that the original position of the output shaft 41 is often not fixed due to installation or operation, which we do not care about, as long as the position at which the output shaft 41 not affected by any external force is located may be understood as the original position.

[0046] When the detection element 61 is in the sleep state, the distance D between the detection element 61 and the activation element 70 is greater than or equal to 2 mm along the direction of the first axis 101. In the present application, the detection element 61 is driven by the output shaft 41 to move to the activation element 70, that is to say, a certain distance exists between the detection element 61 and the activation element 70. The detection element 61 is configured to rotate about the first axis of rotation 103, the detection element 61 does not need to move a long distance to be activated by the activation element 70, and too much space due to the moving path of the detection element 61 does not need to be provided in the housing 10 so that the structure is optimized, too large a length of the electric screwdriver 100 along the direction of the first axis 101 can be avoided, and the miniaturization of the electric screwdriver 100 is achieved.

[0047] In the direction perpendicular to the first axis 101, the activation assembly 60 is disposed on the upper side of the motor shaft 21, where the activation element 70 is disposed on the upper side of the first axis 101, thereby facilitating the setting of other parts. Further, the first axis of rotation 103 is basically perpendicular to the first axis 101.

[0048] The activation element 70 is fixedly disposed in the housing 10, where the activation element 70 may be located on the moving path of the detection element 61 or in the vicinity of the moving path of the detection element 61, as long as when the detection element 61

moves to a certain position, the activation element 70 can activate the detection element 61 so that the activation element 70 transmits the activation signal to the electric motor 20. That is to say, the activation method between the detection element 61 and the activation element 70 does not necessarily mean that the detection element 61 is in contact with the activation element 70, but may also mean that a distance exists between the detection element 61 and the activation element 70. In this example, the activation element 70 is fixedly connected to the gearbox 13. For example, a groove is disposed on a side of the gearbox 13 adjacent to the electric motor 20, and the detection assembly 70 is disposed in the groove. On the premise that the trigger 51 is always in the open state, the output shaft 41 drives the detection element 61 to approach the gearbox 13 so that when the detection element 61 rotates from the sleep state to the activated state, the activation element 70 is at least partially in contact with the detection element 61.

[0049] The activation assembly 60 further includes a rotary member 62, a biasing member 63, and a connector 64. The rotary member 62 is rotatably connected to the gearbox 13 by the connector 64, and the rotary member 62 is used for mounting the detection element 61. It is also to be understood that the output shaft 41 drives the rotary member 62 to rotate about the first axis of rotation 103, thereby driving the detection element 61 to rotate. The biasing member 63 is mounted on the rotary member 62. For example, during installation, the biasing member 63 has a biasing force that keeps the rotary member 62 relatively fixed to the gearbox 13 when no external force exists. In this example, the rotary member 62 includes a connecting portion 622 and a mounting portion 621, where the mounting portion 621 is formed with an accommodation groove, and the detection element 61 is mounted in the accommodation groove and rotates synchronously with the rotary member 62. The connecting portion 622 is fixedly connected to or integrally formed with the mounting portion 621. For example, the connecting portion 622 is integrally formed with the mounting portion 621. The biasing member 63 can provide the biasing force that keeps the detection element 61 at the initial position without the driving of the external force, that is to say, the biasing member 63 keeps the detection element 61 at the initial position in the case where no external force drives the output shaft 41. On the premise that the trigger 51 is always in the open state, when the input end 411 is subjected to a force to move along the first axis 101 in a direction toward the motor shaft 21, the output end 412 can drive the detection element 61 to switch from the sleep state to the activated state, where the output end 412 is at least partially in contact with the connecting portion 622 when the detection element 61 is in the sleep state. That is to say, when the detection element 61 is in the activated state, the detection element 61 is at least partially in contact with the activation element 70. A connection assembly 80 is connected to the output shaft 41 and includes an intermediate piece 81

and a driver 82. An end of the intermediate piece 81 is fixedly connected to the output shaft 41, the other end of the intermediate piece 81 is fixedly connected to the driver 82, and the driver 82 may drive the connecting portion 622 and thus rotate the detection element 61. The driver 82 may be a bearing. In this manner, damage to the connecting portion 622 can be avoided when the electric motor 20 drives the output shaft 41 to operate at high speed, thereby extending the service life. In this example, the detection element 61 is the Hall sensor and the activation element 70 is the permanent magnet. It is to be noted that the output end 412 described above may also be formed by the driver 82.

Claims

1. An electric screwdriver, comprising:

a housing;
an electric motor at least partially disposed in the housing and comprising a motor shaft rotatable about a motor axis; and
an output assembly configured to output power and comprising an output shaft movable forward and backward along a direction of a first axis; wherein the electric screwdriver further comprises:

a startup circuit configured to start the electric motor;
wherein the startup circuit comprises:

a switch assembly controlling an on state of the startup circuit; and
an activation assembly comprising a detection element connected to the electric motor electrically or through a signal, and an activation element configured to activate the detection element;
wherein the output shaft is capable of driving the detection element, and the detection element comprises at least one activated state during movement; and
when the detection element is in one of the at least one activated state and the switch assembly is on, the electric motor starts.

2. The electric screwdriver of claim 1, wherein the activation element is fixedly disposed in the housing.

3. The electric screwdriver of claim 1, wherein the switch assembly comprises a switch configured to control an on state of at least one of the detection

element and the activation element.

4. The electric screwdriver of claim 1, wherein the activation element is disposed on a moving path of the detection element.

5. The electric screwdriver of claim 1, wherein the output shaft is capable of driving the detection element to rotate about a first axis of rotation, and the detection element is capable of being activated by the activation element during rotation.

6. The electric screwdriver of claim 5, wherein

the output shaft comprises an input end and an output end disposed opposite to each other along the first axis, wherein the input end is disposed away from the electric motor relative to the output end; and

when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

7. The electric screwdriver of claim 6, further comprising:

a gearbox fixedly disposed in the housing, wherein the output shaft is at least partially disposed in the gearbox; and
in a direction perpendicular to the first axis, the activation element is located above the output shaft and fixedly disposed on the gearbox.

8. The electric screwdriver of claim 6, wherein the activation assembly further comprises a biasing member capable of providing a biasing force that keeps the detection element at an initial position when the detection element is not driven by an external force.

9. The electric screwdriver of claim 8, wherein the activation assembly further comprises a rotary member to which the detection element is mounted, wherein the output end drives the rotary member to overcome the biasing force so that the detection element approaches the activation element.

10. The electric screwdriver of claim 1, wherein the activation element is a permanent magnet.

11. The electric screwdriver of claim 1, wherein the detection element is a Hall sensor.

12. An electric screwdriver, comprising:

a housing;

an electric motor at least partially disposed in the housing and comprising a motor shaft rotatable about a motor axis; and
 an output assembly configured to output power and comprising an output shaft movable forward and backward along a direction of a first axis; wherein the electric screwdriver further comprises:

a startup circuit configured to start the electric motor;
 wherein the startup circuit comprises:

a switch assembly controlling an on state of the startup circuit; and
 an activation assembly comprising at least one activated state;
 wherein when the activation assembly is in one of the at least one activated state and the switch assembly is on, the electric motor starts; and
 in a direction perpendicular to the first axis, the activation assembly is located above the output shaft.

13. The electric screwdriver of claim 12, wherein

the activation assembly comprises a detection element electrically connected to the electric motor or connected to the electric motor through a signal and an activation element configured to activate the detection element; and
 the output shaft is capable of driving the detection element, and the detection element comprises at least one activated state during movement;
 wherein when the detection element is in one of the at least one activated state and the switch assembly is on, the electric motor starts.

14. The electric screwdriver of claim 13, wherein the output shaft is capable of driving the detection element to rotate about a first axis of rotation, and the detection element is capable of being activated by the activation element during rotation.

15. The electric screwdriver of claim 14, wherein

the output shaft comprises an input end and an output end disposed opposite to each other along the first axis, wherein the input end is disposed away from the electric motor relative to the output end; and
 when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

16. The electric screwdriver of claim 15, further comprising:

a gearbox fixedly disposed in the housing, wherein the output shaft is at least partially disposed in the gearbox; and
 in the direction perpendicular to the first axis, the activation element is located above the output shaft and fixedly disposed on the gearbox.

17. The electric screwdriver of claim 13, wherein

during movement, the detection element comprises the at least one activated state in which the detection element is activated by the activation element to generate an activation signal and a sleep state in which the detection element is not activated by the activation element;
 wherein when the detection element is in the sleep state, a distance between the detection element and the activation element is greater than or equal to 2 mm along the direction of the first axis.

18. An electric screwdriver, comprising:

a housing;
 an electric motor at least partially disposed in the housing and comprising a motor shaft rotatable about a motor axis; and
 an output assembly configured to output power and comprising an output shaft movable forward and backward along a direction of a first axis; wherein the electric screwdriver further comprises:

a startup circuit configured to start the electric motor;
 wherein the startup circuit comprises:

a switch assembly controlling an on state of the startup circuit; and
 an activation assembly comprising a detection element electrically connected to the electric motor or connected to the electric motor through a signal and an activation element configured to activate the detection element, wherein the detection element is drivable by the output shaft;
 wherein during movement, the detection element comprises an activated state in which the detection element is activated by the activation element to generate an activation signal and a sleep state in which the detection element is not activated by the activation element;

wherein when the activation assembly is in the activated state and the switch assembly is on, the electric motor starts; and

when the detection element is in the sleep state, a distance between the detection element and the activation element is greater than or equal to 2 mm along the direction of the first axis.

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19. The electric screwdriver of claim 18, wherein the activation element is fixedly disposed in the housing.

20. The electric screwdriver of claim 18, wherein the activation element is disposed on a moving path of the detection element.

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21. The electric screwdriver of claim 18, wherein

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the output shaft comprises an input end and an output end disposed opposite to each other along the first axis, wherein the input end is disposed away from the electric motor relative to the output end; and

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when the input end is subjected to a force to move along the first axis in a direction toward the motor shaft, the output end is capable of driving the detection element to rotate toward the activation element.

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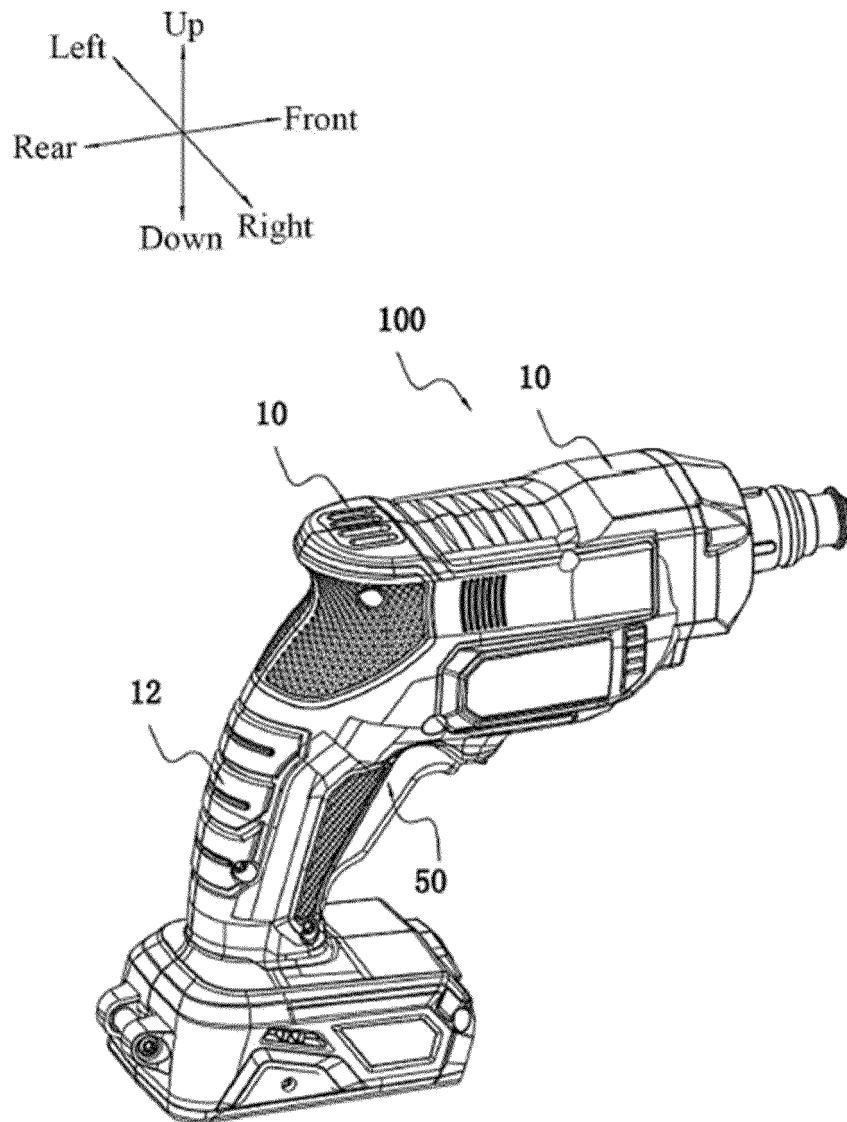


Fig.1

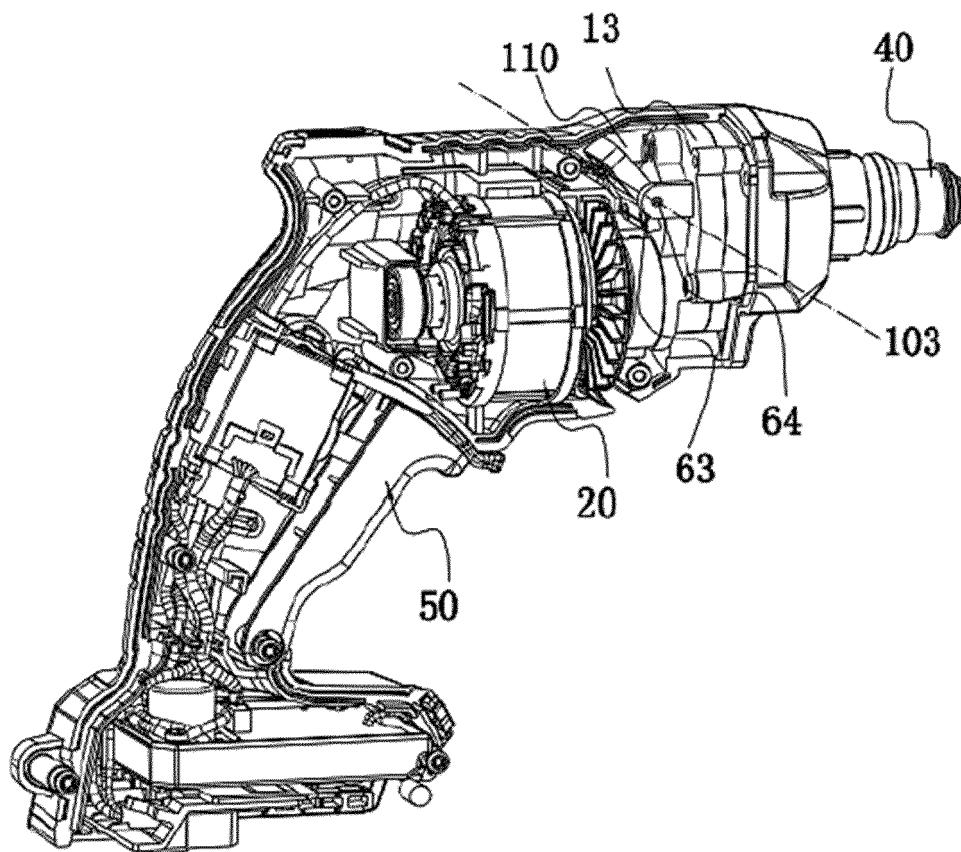


Fig.2

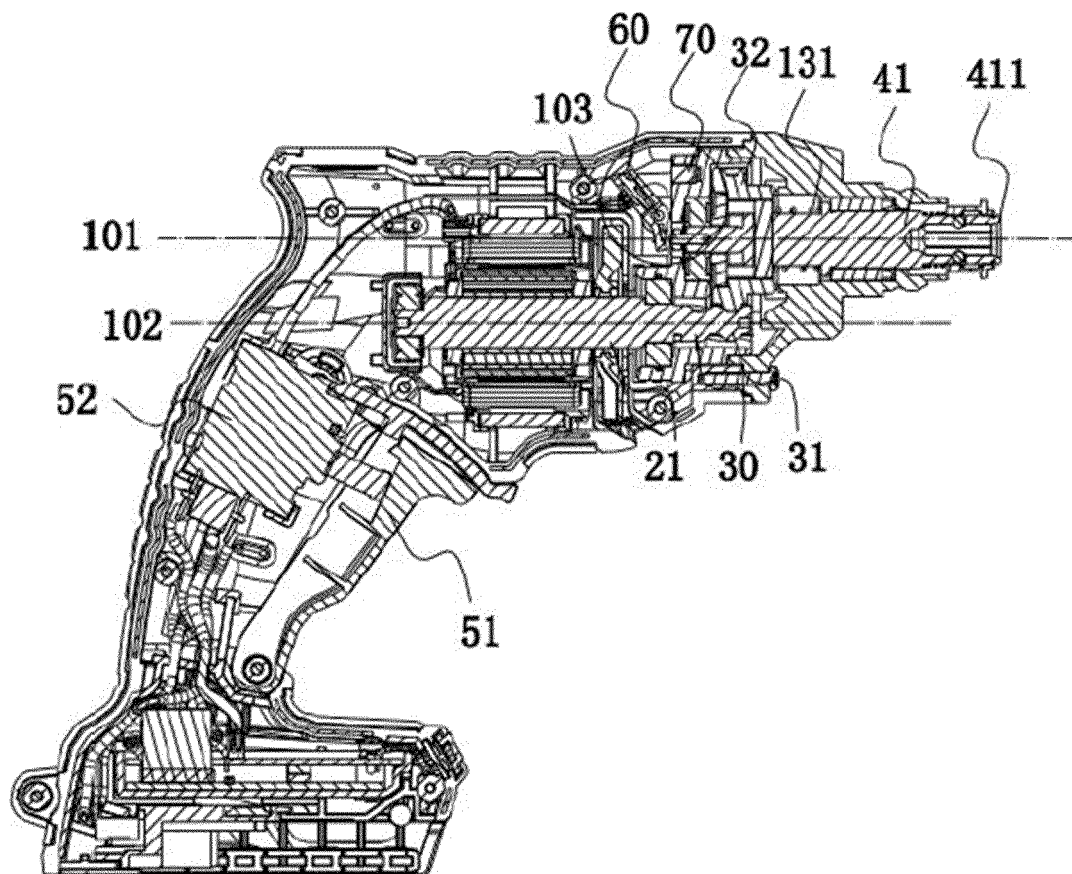


Fig.3

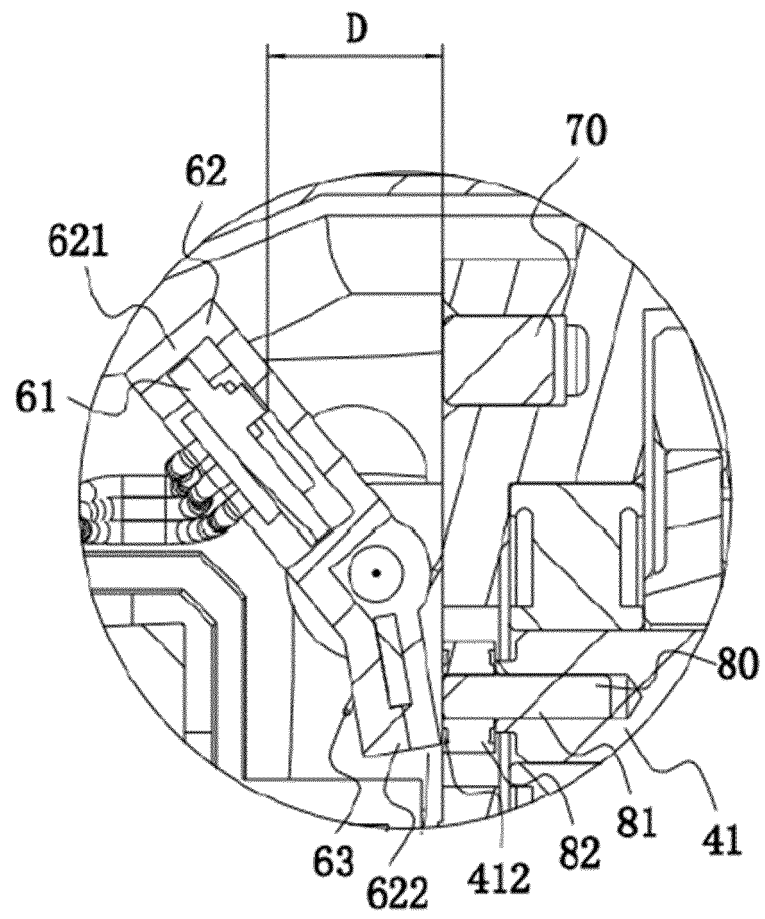


Fig.4

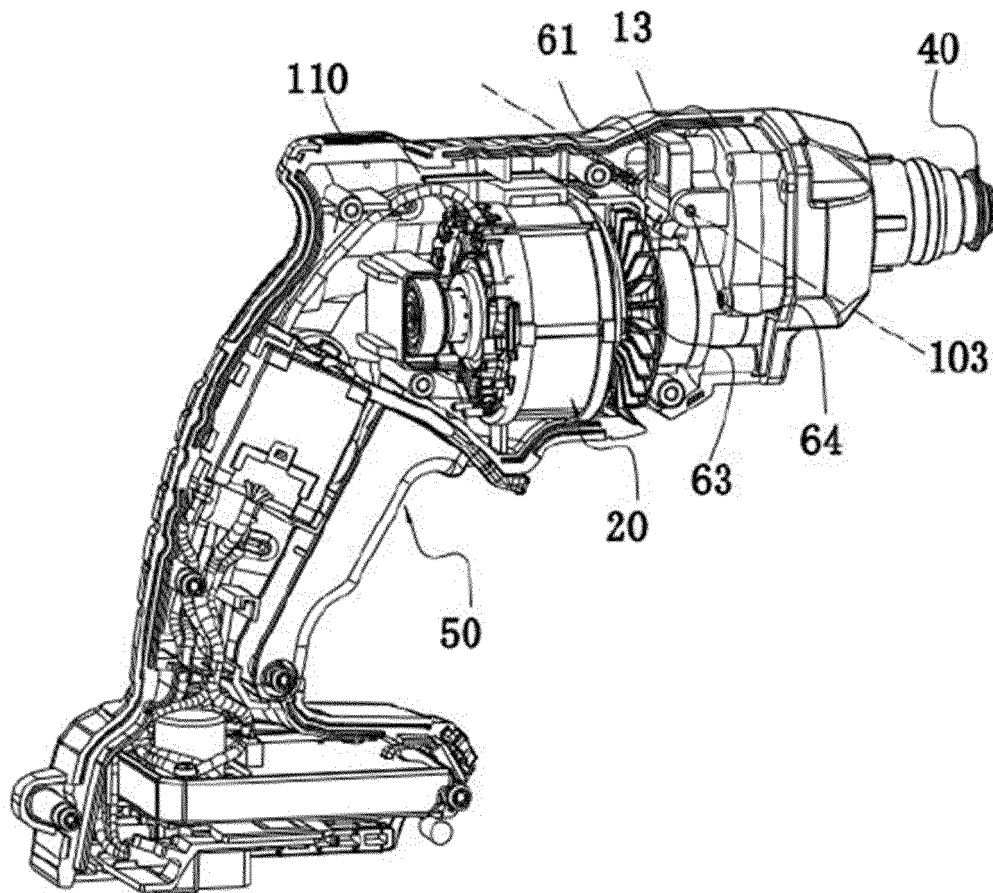


Fig.5

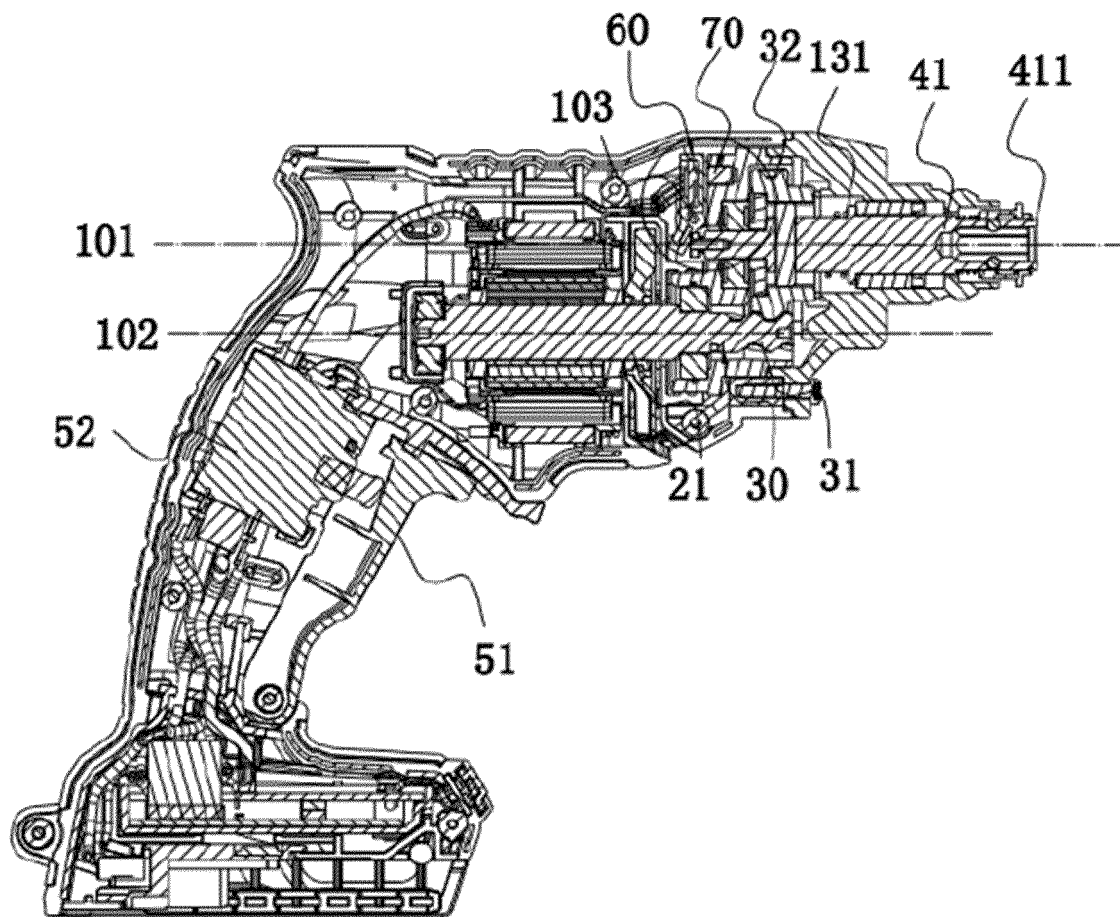


Fig.6

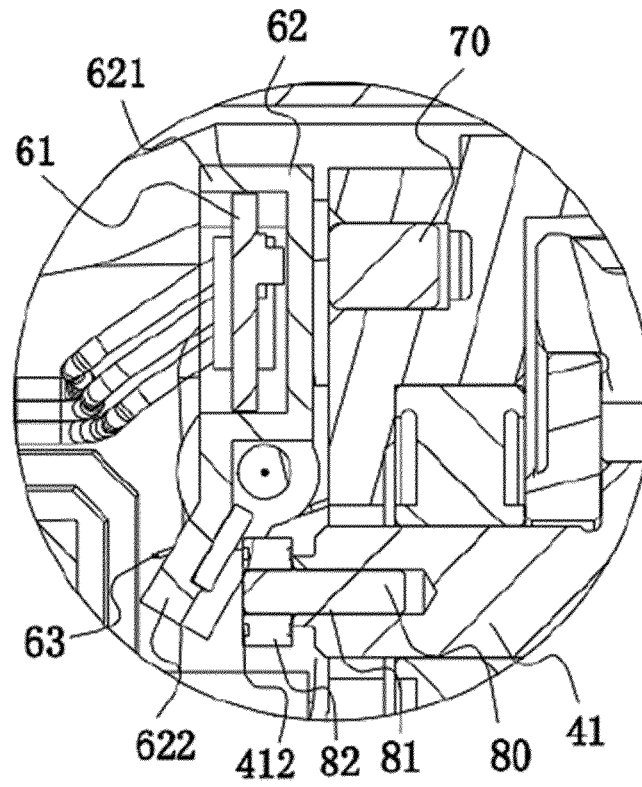


Fig.7

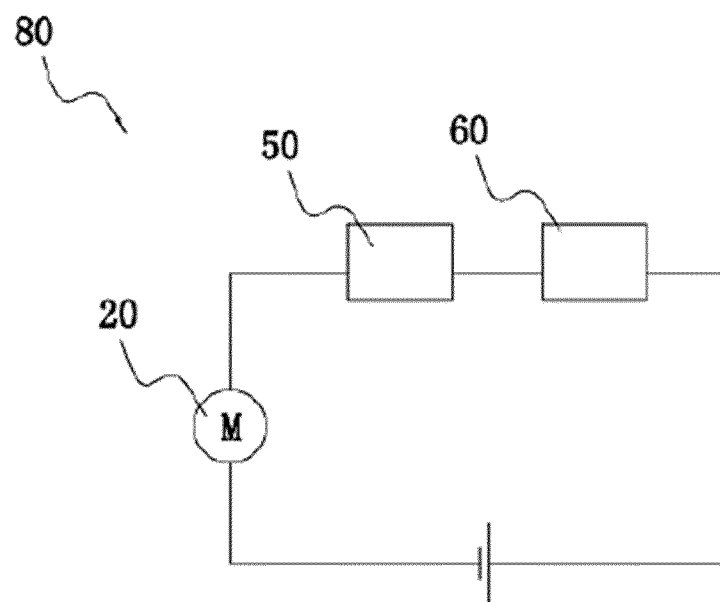


Fig.8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/074528

A. CLASSIFICATION OF SUBJECT MATTER B25B 19/00(2006.01)i; B25B 21/00(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B25F; B25B; B25D Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																					
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNPAT, CNKI, WPI, EPODOC: 南京泉峰, 姜小波, 张子华, 电动, 螺丝批, 螺丝刀, 电机, 输出轴, 轴线, 启动, 电路, 开关, 检测, 激活, 导通; auto, electric, drive, screw, screwdriver, motor, output, export, axis, start+, circuit, switch, test+, detect+, activat+, conduct+.																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CN 105619342 A (NANJING CHERVON INDUSTRY CO., LTD.) 01 June 2016 (2016-06-01) description, paragraphs [0017]-[0029] and figures 1-6</td> <td>1-21</td> </tr> <tr> <td>A</td> <td>CN 107225537 A (NANJING CHERVON INDUSTRY CO., LTD.) 03 October 2017 (2017-10-03) entire document</td> <td>1-21</td> </tr> <tr> <td>A</td> <td>CN 201664774 U (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 08 December 2010 (2010-12-08) entire document</td> <td>1-21</td> </tr> <tr> <td>A</td> <td>CN 103846852 A (ROBERT BOSCH CO., LTD.) 11 June 2014 (2014-06-11) entire document</td> <td>1-21</td> </tr> <tr> <td>A</td> <td>CN 107206581 A (HITACHI KOKI KK) 26 September 2017 (2017-09-26) entire document</td> <td>1-21</td> </tr> <tr> <td>A</td> <td>US 3650336 A (ROCKWELL MFG. CO.) 21 March 1972 (1972-03-21) entire document</td> <td>1-21</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	CN 105619342 A (NANJING CHERVON INDUSTRY CO., LTD.) 01 June 2016 (2016-06-01) description, paragraphs [0017]-[0029] and figures 1-6	1-21	A	CN 107225537 A (NANJING CHERVON INDUSTRY CO., LTD.) 03 October 2017 (2017-10-03) entire document	1-21	A	CN 201664774 U (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 08 December 2010 (2010-12-08) entire document	1-21	A	CN 103846852 A (ROBERT BOSCH CO., LTD.) 11 June 2014 (2014-06-11) entire document	1-21	A	CN 107206581 A (HITACHI KOKI KK) 26 September 2017 (2017-09-26) entire document	1-21	A	US 3650336 A (ROCKWELL MFG. CO.) 21 March 1972 (1972-03-21) entire document	1-21
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Date of the actual completion of the international search 06 April 2022	Date of mailing of the international search report 26 April 2022																				
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/074528

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