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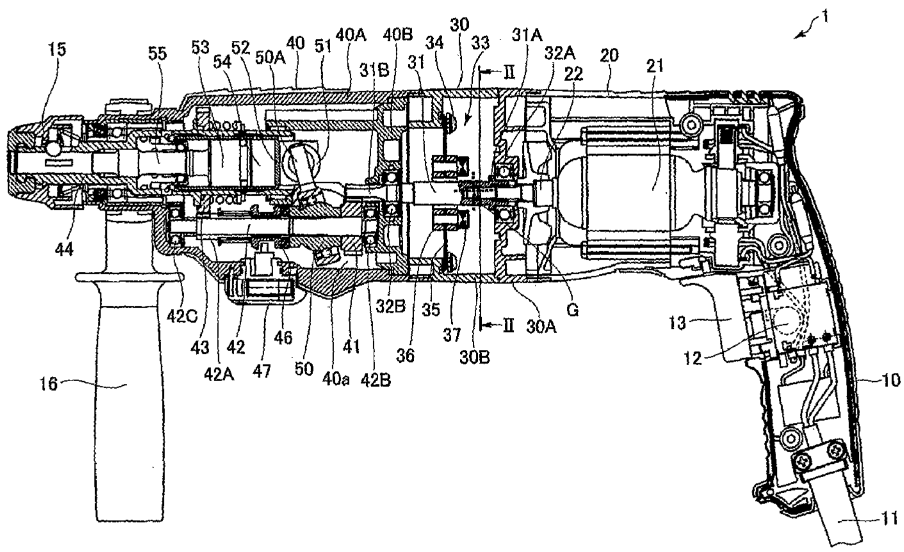
(54) Title: ELECTRICALLY-DRIVEN POWER TOOL



(57) Abstract: An improved electrically-driven power tool (1) reduces vibration resulting from a striking member and improves ease of operation. A weight casing (30) is provided between a motor casing (20) and a gear casing (40) . The weight casing includes a first weight casing (30A) connected to the motor casing and a second weight casing (30B) formed cylindrically and connected to the gear casing. A counterweight mechanism (33) is provided in the first weight casing. The counterweight mechanism is equipped with a pair of connecting members (34) , a pair of weight support members (35) , a counterweight (36) , and a bolt (37) . A first intermediate shaft (31) is inserted through the counterweight. A center of gravity G of an impact tool is positioned in the weight casing.

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DESCRIPTION

ELECTRICALLY-DRIVEN POWER TOOL

Technical Field

The present invention relates to an electrically-driven power tool, and more specifically to such a power tool having a vibration control mechanism.

Background Art

Conventionally, electrically-driven power tools such as an impact tool having vibration control mechanisms have been proposed. Japanese Patent Application Publication No. 2005-040880 discloses an impact tool having a casing composed of a handle, a motor housing, and a gear housing connected with one another. An electrical motor is accommodated in the motor housing. The gear housing accommodates a motion conversion mechanism for converting a rotation motion of the electrical motor to a reciprocation motion reciprocally moving in directions in parallel to the direction in which the motor shaft extends. A cylinder extending in a direction perpendicular to the motor shaft is provided in an impact housing in part of the gear housing. A tool support portion is provided on the front side of the cylinder, and a bit or a working tool can be attached to or detached from the tool support portion.

A piston is provided in the cylinder to be slidably movable along the inner periphery of the cylinder. The output of the motion conversion mechanism reciprocates the piston along the inner periphery of the cylinder. A striking member is provided in the front section of the cylinder and is slidably movable along the inner periphery of the cylinder. An air chamber is formed in the cylinder between the piston and the striking member. An intermediate member is provided in the front side of the striking member to be slidable with forward and backward movements within the cylinder. The working tool mentioned above is positioned at the front side of the intermediate member.

In operation, rotational driving force of the motor is transmitted to the motion conversion mechanism, and the latter reciprocates the piston within the cylinder. The reciprocation motion of the piston repeatedly increases and decreases the pressure of the air confined in the air chamber, thereby imparting an impact force upon the striking member. The striking member moves forward and collides against the rear face of the intermediate member, so that the impact force is imparted upon the working tool. The workpiece is fractured by the impact force imparted upon the working tool.

Disclosure of Invention

The impact tool described above generates vibrations attendant to collision of the striking member against the intermediate member. The vibration is the cause to degrade operational ease of the impact tool.

In view of the foregoing, it is an object of the invention to provide an electrically-driven power tool with improved ease of operation in which vibrations resulting from the drive of the striking member are reduced.

In order to achieve the above and other objects, the present invention provides an electrically-driven power tool that includes: a motor having an output shaft and generating rotational force; a rotation shaft extending in a direction; a gear section that operatively couples the output shaft of the motor to the rotation shaft to transmit the rotational force to the rotation shaft; a moving member; a motion converting mechanism operatively coupled to the rotation shaft and configured to convert the rotational force to reciprocally moving force, the reciprocally moving force being imparted upon the moving member to reciprocally move in the direction in which the rotation shaft extends; a motor casing that accommodates the motor; a gear casing that accommodates the gear section and the motion converting mechanism; a dynamic vibration absorber that includes a weight movable in the direction in which the rotation shaft extends, the dynamic vibration absorber absorbing vibrations generated attendant to the reciprocally moving force with the movement of the weight; and an absorber casing that supports the dynamic vibration absorber, the absorber casing being disposed between the motor casing and the gear casing.

It is preferable that the motor casing, the absorber casing, and the gear casing be arranged in the stated order along the direction in which the rotation shaft extends, and the weight be accommodated in the absorber casing.

It is further preferable that the weight is formed with a hole in alignment with the rotation shaft.

It is preferable that the dynamic vibration absorber further include a weight support connected to the absorber casing, and a plurality of connectors positioned at rotationally symmetrical positions around a center of gravity of the weight. The weight support is connected to the absorber casing with the plurality of connectors.

It is also preferable that a center of gravity of the electrically-driven power tool and the center of gravity of the weight be positioned in the absorber casing.

It is preferable that the absorber casing include: a first absorber casing that supports a bearing for rotatably supporting the output shaft of the motor; and a second absorber casing held between the absorber casing and the gear casing. The gear casing includes: a first gear casing having a cylindrical shape and connected to the second absorber casing; and a second gear casing disposed in the firs gear casing at a side adjacent to the second absorbing casing, the second gear casing partitioning a space defined by the second absorbing casing and a space defined by the first gear casing. In the second absorber casing, there is provided a rotation transmitting member extending in a direction in which the output shaft of the motor extends. The rotation transmitting member has a first end operatively coupled to the output shaft of the motor and a second end meshingly engaged with the gear section provided in the first gear casing. The second gear casing includes a bearing for rotatably supporting the rotation transmitting member.

The dynamic vibration absorber may be disposed at an outer periphery of the absorber casing. In this case, the dynamic vibration absorber includes a connector for connecting to the absorber casing. The amplitude of the vibration of the weight is larger than the width of the absorber casing along the direction in which the output shaft of the motor extends. It is preferable that the absorber casing be formed with a groove that extends in the direction in which the output shaft extends and that engages the connector. When the absorber casing is held between the motor casing and the gear casing, the connector is also supported between the motor casing and the gear casing.

It is also preferable that the electrically-driven power tool further include: a cylinder that is accommodated in the motor casing and extends in the direction in which the output shaft of the motor extends; a holder provided at one end of the cylinder for supporting a bit; and a piston driven by the reciprocally moving force from the motion converting mechanism and slidably movably disposed within the cylinder. The weight of the dynamic vibration absorber reciprocally moves back and forth in synchronous relation with the reciprocating motion of the piston. The direction of the reciprocal movement of the dynamic vibration absorber is in coincidence with that of the reciprocating motion of the piston.

Brief Description of Drawings

Fig. 1 is a cross-sectional view showing an impact tool according to a first embodiment of the present invention;

Fig. 2 is a cross-sectional view taken along the II-II line in Fig. 1;

Fig. 3 is a cross-sectional view showing an impact tool according to a second embodiment of the present invention;

Fig. 4 is a cross-sectional view taken along the IV-IV line of Fig. 3;

Fig. 5 is a cross-sectional view showing an impact tool according to a third embodiment of the present invention; and

Fig. 6 is a cross-sectional view showing a weight casing and a counterweight mechanism employed in the third embodiment.

Best Mode for Carrying Out the Invention

Referring to Figs. 1 and 2, an impact tool 1 according to a first embodiment will be described. It should be noted that the impact tool is one example of an electrically-driven power tool. In Fig. 1, the left side will be described as the front end of the impact tool 1 and the right side as the back end of the impact tool 1. The impact tool 1 is equipped with a casing in which are connected a handle 10, a motor casing 20, a weight casing 30, and a gear casing 40.

A power supply cable 11 is attached to the handle 10 and a switch mechanism 12 is mounted internally in the handle 10. A trigger 13 that can be manipulated by the user is connected to the switch mechanism 12. The power supply cable 11 connects the switch mechanism 12 to an external power supply (not shown in the figure). By operating the trigger 13, the switch mechanism 12 can be connected to and disconnected from the external power supply.

The motor casing 20 is provided above the handle 10. The handle 10 and the motor casing 20 are formed integrally from plastic. The electrical motor 21 is housed in the motor casing 20. The motor 21 is equipped with an output shaft 22 and outputs rotational drive force.

The weight casing 30 is formed as a shaped resin product positioned in front of the motor casing 20. The weight casing 30 includes a first weight casing 30A connected with the motor casing 20 and a second weight casing 30B formed cylindrically and connected to the gear casing 40. A bearing 32A is provided on the first weight casing 30A. In the second weight casing 30B, the first intermediate shaft 31 is positioned co-axially with the output shaft 22 and is rotatably supported by the bearing 32A and a bearing 32B that will be described later. A rear end 31A of the first intermediate shaft 31 engages the output shaft 22, and the rotation of the output shaft 22 is transmitted to the first intermediate shaft 31 by way of the rear end 31A. The front end of the first intermediate shaft 31 is positioned inside the gear casing 40 and a first gear 31B is provided thereon. Also, the output shaft 22 is rotatably supported by the bearing 32A by way of the rear end 31A.

A counterweight mechanism 33 is provided in the second weight casing 30B. As shown in Fig. 2, which is a cross-sectional view taken along the II-II line in Fig. 1, the counterweight mechanism 33 is equipped with a pair of connecting members 34, a pair of weight support members 35, a counterweight 36, and a bolt 37. The connecting members 34 are provided at the upper and lower ends of the second weight housing 60B. More specifically, the connecting members 34 are positioned at rotationally symmetrical positions with respect to the center of gravity of the counterweight 36. The pair of weight support members 35 is formed from leaf springs. The upper and lower ends of the weight support members 35 are connected to the second weight casing 30B by way of the connecting members 34.

The counterweight 36 is formed with a roughly circular cross-section with a shaft insertion hole 36a formed at the center. The counterweight 36 is secured to the weight support members 35 by bolts 37. Thus, the counterweight 36 is supported on both ends by the pair of weight support members 35. Also, the first intermediate shaft 31 is inserted through the shaft insertion hole 36a. Thus, the shaft insertion hole 36a faces the output shaft 22. Also, the center of gravity G of the impact tool 1 is positioned inside the weight casing 30.

The gear casing 40 is formed as a shaped resin product positioned in front of the second weight casing 30B. In the gear casing 40, there is a first gear casing 40A formed cylindrically and connected to the second weight casing 30B, and a second gear casing 40B forming a partition between the first gear casing 40A and the second weight casing 30B. The bearing 32B mentioned above is provided in the second gear casing 40B. The first gear casing 40A and the second gear casing 40B define a reduction chamber 40a, which is a mechanism chamber holding a rotation transmitting mechanism described later. In the gear housing 40A, the second intermediate shaft 42 is supported in parallel to the output shaft 22 so that it can rotate around its axial center by the first gear casing 40A and the second gear casing 40B by way of a bearing 42B and a bearing 42C. A side handle 16 is provided near a tool support 15, described later, of the first gear housing 40A.

A second gear 41 that meshingly engages the first gear 31B is secured co-axially to the second intermediate shaft 42 on the side of the motor 21. A gear 42A is formed at the end of the second intermediate shaft 42 to meshingly engage a third gear 43. A cylinder 44 is provided in the first gear housing 40A above the second intermediate shaft 42. The cylinder 44 extends in parallel to the second intermediate shaft 42 and is rotatably supported by the second gear casing 40B. The third gear 43 is secured to the outer periphery of the cylinder 44 and meshingly engages the gear 42A described above so that the cylinder 44 can rotate around its axial center.

The tool support 15 is provided at the end of the cylinder 44, and a bit (not shown in the figure) can be attached to and removed from the tool support 15. A clutch 46 biased by a spring toward the motor 21 forms a spline engagement with an intermediate section of the second intermediate shaft 42. The clutch 46 can be switched by way of a change lever 47 positioned below a first gear housing 40A between a hammer drill mode (the position shown in the figure) and a drill mode (with the clutch 46 moved toward the front). On the motor 21 side of the clutch 46, a motion converter 50 that converts rotational motion to reciprocating motion is rotatably mounted to the outside of the second intermediate shaft 42. An arm 50A of the motion converter 50 can make a reciprocating motion to the front and back of the impact tool 1 as a result of the rotation of the second intermediate shaft 42.

When the clutch 46 is switched to hammer drill mode using the change lever 47, the clutch 46 engages the second intermediate shaft 42 with the motion converter 50. The motion converter 50 is, by way of a piston pin 51, connected to and moves in tandem with a piston 52 provided in the cylinder 44. The piston 52 is slidably mounted in the cylinder 44 so that it can make a reciprocating motion in parallel to the second intermediate shaft 42. A striking member 53 is mounted in the piston 52, and an air chamber 54 is defined in the cylinder 44 between the piston 52 and the striking member 53. An intermediate element 55, supported in the cylinder 44 at a position opposite from the air chamber side of the striking member 53, is able to slide in the direction of the motion of the piston 52. A bit is positioned opposite from the striking member side of the intermediate element 55. Thus, the striking member 53 strikes the bit by way of the intermediate element 55.

Rotational output from a motor is transmitted to the second intermediate shaft 42 by way of the first intermediate shaft 31, the first gear 31B, and the second gear 41. The rotation of the second intermediate shaft 42 is transmitted to the cylinder 44 by way of the meshing engagement between the gear 42A and the third gear 43 mounted to the outside of the cylinder 44. When the clutch 46 is moved to hammer drill mode as a result of operating the change lever 47, the clutch 46 connects to the motion converter 50 and the rotational drive of the second intermediate shaft 42 is transmitted to the motion converter 50. At the motion converter 50, the rotational drive is converted to the reciprocating motion of the piston 52 by way of a piston pin 51. The reciprocating motion of the piston 52 causes the pressure of the air inside the air chamber 54 formed between the striking member 53 and the piston 52 to repeatedly increase and decrease, resulting in the application of impact force to the striking member 53. When the striking member 53 moves forward and collides against the back face of the intermediate element 55, the impact force is imparted by way of the intermediate element 55 upon the bit. In this manner, rotational force and impact force are simultaneously imparted upon the bit in hammer drill mode.

If the clutch 46 is in drill mode, the clutch 46 disengages the connection between the second intermediate shaft 42 and the motion converter 50, and only the rotational drive of the second intermediate shaft 42 is transmitted to the cylinder 44 by way of the gear 42A and the third gear 43. Thus, only rotational force is applied to the tool tip not shown in the figure.

In the operation of the impact tool 1 according to this embodiment, vibration is generated as a result of the reciprocating motion of the striking member 53. This vibration is transmitted to the connecting members 34 by way of the second weight casing 30B. The vibration transmitted to the connecting members 34 is in turn transmitted to the weight support members 35 and the counterweight 36, resulting in the counterweight 36 vibrating in the same direction as the reciprocating motion of the piston 52. This vibration makes it possible to reduce the vibration of the impact tool 1 resulting from the reciprocating motion of the striking member 53, thus improving the ease of operation of the impact tool 1.

Also, as described above, the weight casing 30 is provided between the motor casing 20 and the gear casing 40, and the counterweight mechanism 33 is provided in the weight casing 30. Thus, the impact tool 1 can be provided using a motor casing and a gear casing identical to those of a conventional impact tool that does not include the counterweight mechanism 33. This makes it possible to provide the impact tool 1 with the counterweight mechanism 33 at a low cost. Also, since the counterweight mechanism 33 is positioned in the second weight casing 30B, the diameter of the cylindrical second weight casing 30B can be kept small. More specifically, when the weight casing 30 is provided outside the counterweight mechanism 33, operations near walls and the like become difficult, the weight casing 30 becomes difficult to grasp, and ease of operation is reduced. This embodiment solves these problems.

Also, the counterweight 36 includes the shaft insertion hole 36a and the first intermediate shaft 31 is inserted through the shaft insertion hole 36a. Thus, the space in the weight casing 30 can be used efficiently, preventing the longitudinal dimension of the impact tool 1 from becoming too large and making it possible to provide the counterweight 36 at an appropriate mass. As described above, the counterweight mechanism 33 is formed from the connecting members 34, the weight support members 35, and the counterweight 36. Since no substantial friction is generated between the weight casing 30, the counterweight 36, and the weight support members 35, formed as leaf springs, the weight support members 35 and the counterweight 36 can vibrate smoothly in the same direction as the reciprocating motion of the piston 52. Thus, the vibration of the impact tool 1 resulting from the reciprocating motion of the piston 52 can be efficiently reduced and the ease of operation of the impact tool 1 can be improved. Furthermore, the pair of the connecting members 34 are positioned in rotational symmetry centered around the center of gravity of the counterweight 36. Thus, the counterweight 36 can be moved in a reciprocating manner in parallel to the direction of the reciprocating motion of the piston 52. As a result, the vibration of the impact tool 1 generated by the reciprocating movement of the piston 52 can be efficiently reduced and the ease of operation of the impact tool 1 can be improved.

Also, the first intermediate shaft 31 is provided in the weight casing 30, and the first intermediate shaft 31 is rotatably supported by the bearing 32A provided on the first weight casing 30A and the bearing 32B provided on the second gear casing 40B. In conventional impact tools with no weight casing 30 or counterweight mechanism 33, the end of the output shaft 22 is rotatably supported by the bearing 32B. In this embodiment, the use of the weight casing 30 increases the distance between the motor 21 and the second gear 41. If the end of the output shaft 22 is rotatably supported by the bearing 32B as in the conventional technology, the length of the output shaft 22 is greater and the strength of the output shaft 22 is reduced, leading to a shorter service life. Furthermore, with the increased length of the output shaft 22, the output shaft 22 is more easily flexed, leading to increased vibration resulting from rotational imbalance in the motor 21. In this embodiment, the placement of the first intermediate shaft 31 in the weight casing 30 makes it possible for the impact tool 1 to have a long service life and reduced vibrations.

The position of the center of gravity G of the impact tool 1 and the position of the center of gravity of the counterweight 36 are set up to be in the weight casing 30. Thus, the distance between the position of the center of gravity G of the impact tool 1 and the position of the center of gravity of the counterweight 36 is decreased. This reduces the moment generated during the reciprocating vibration of the counterweight 36, thus providing ease of operation in the impact tool 1.

Next, referring to Figs. 3 and 4, an impact tool 101 according to a second embodiment will be described. Members that are the same as those from the first embodiment will be denoted by like numerals. Duplicate descriptions will be omitted and only different aspects will be described.

A counterweight mechanism 133 is equipped with a support member 134, two springs 135, and a counterweight 136. The support member 134 forms a cylindrical shape and extends in the direction of the axis of the output shaft 22. The ends of the support member 134 are supported by the second gear casing 40B and the first weight casing 30A. The first intermediate shaft 31 is positioned in the hollow section of the support member 134. The counterweight 136 is positioned around the outer periphery of the support member 134 and can slide relative to the support member 134. A support insertion hole 136a is formed on the counterweight

136 and the support member 134 is inserted through the support insertion hole 136a. Of the two springs 135, one of the springs 135 is positioned at the back end of the counterweight 136 and is interposed between the counterweight 136 and the first weight casing 30A. The other spring 135 is at the front end of the counterweight 136 and interposed between the counterweight 136 and the second gear casing 40B.

In the impact tool 101 according to this embodiment, the vibration generated by the reciprocating motion of the striking member 53 is transmitted to the springs 135 and the counterweight 136 by way of the first weight casing 30A and the second gear casing 40B, and the counterweight 136 vibrates in the same direction as the reciprocating motion of the piston 52. This vibration makes it possible to reduce the vibration of the impact tool 101 resulting from the reciprocating motion of the striking member 53, thus improving the ease of operation of the impact tool 101. Other advantages of the impact tool 101 are similar to the advantages of the impact tool 1 according to the first embodiment.

Referring to Figs. 5 and 6, an impact tool 201 according to a third embodiment will be described. Members that are the same as those from the first embodiment will be denoted by like numerals. Duplicate descriptions will be omitted and only different aspects will be described.

As shown in Fig. 6, grooves 30c are formed on the sides of the weight casing 30 from one axial end of the weight casing 30 to the other end, extending in parallel to the direction of the axis of the first intermediate shaft 31. Also, two counterweight mechanisms 233 are positioned on the sides of the weight casing 30. The counterweight mechanism 233 includes a housing 233A. Two springs 235 (only one is shown in the figure) and a counterweight 236 are positioned in the housing 233A. At the front and back ends of the counterweight 236 are two springs 235. The counterweight 236 is provided in the housing 233A and can vibrate due to the bias from the springs 235. The amplitude of the vibration is set to be larger than the axial width of the output shaft 22 of the weight casing 30.

The housing 233A includes a connector 237, and the connector 237 fits into the groove 30c. When the weight casing 30 is supported between the motor casing 20 and the gear casing 40, the connector 237 is also supported between the motor casing 20 and the gear casing 40. As a result, the housing 233A is aligned and the counterweight mechanism 233 is also aligned.

In the impact tool 201 according to this embodiment, the vibration generated by the reciprocating motion of the striking member 53 is transmitted to the springs 235 and the counterweights 236 by way of the weight casing 30 and the housings 233A, and the counterweights 236 vibrates in the same direction as the reciprocating motion of the piston 52. This vibration makes it possible to reduce the vibration of the impact tool 201 resulting from the reciprocating motion of the striking member 53, thus improving the ease of operation of the impact tool 201. Also, by positioning the counterweight mechanisms 233 at the sides of the weight casing 30, it is possible to prevent the longitudinal dimension of the impact tool 201 from becoming too large.

Also, by fitting the connector 237 to the groove 30c and supporting the weight casing 30 between the motor casing 20 and the gear casing 40 as described above, the counterweight mechanisms 233 is aligned. This improves the ease of assembling the impact tool 201. Furthermore, if the weight casing 30 and the counterweight mechanisms 233 (the counterweight housings 233A) are formed integrally, it is possible for the connector to be weak, resulting in breakage. However, since the weight casing 30 and the counterweight mechanisms 233 (the weight housings 233A) are formed separately, the connector 237 can be placed in contact with the end surface of the gear casing 40 and the motor casing 20, thus improving the longitudinal strength of the impact tool 201 at the connector 237. Furthermore, if there is breakage or the like, the counterweight mechanisms 233 can be easily replaced. Other advantages of the impact tool 201 are similar to the advantages of the impact tool 1 according to the first embodiment.

Although the present invention has been described with respect to specific embodiments, it will be appreciated by one skilled in the art that a variety of changes may be made without departing from the scope of the invention. For example, in the impact tool 1 according to the first embodiment, two connecting members 34 are provided at the top and bottom ends of the second weight casing 30B, but it would also be possible to provide three or more connecting members in rotationally symmetrical positions. In this case, the number of the weight support members 35 would match the number of the connecting members 34. Also, in the embodiments described above, an impact tool has been taken as an example of an electrically-driven power tool, but it would also be possible to implement the present invention to a saber saw.

CLAIMS

1. An electrically-driven power tool comprising:

a motor having an output shaft and generating rotational force;

a rotation shaft extending in a direction;

a gear section that operatively couples the output shaft of the motor to the rotation shaft to transmit the rotational force to the rotation shaft;

a moving member;

a motion converting mechanism operatively coupled to the rotation shaft and configured to convert the rotational force to reciprocally moving force, the reciprocally moving force being imparted upon the moving member to reciprocally move in the direction in which the rotation shaft extends;

a motor casing that accommodates the motor;

a gear casing that accommodates the gear section and the motion converting mechanism;

a dynamic vibration absorber that includes a weight movable in the direction in which the rotation shaft extends, the dynamic vibration absorber absorbing vibrations generated attendant to the reciprocally moving force with the movement of the weight; and

an absorber casing that supports the dynamic vibration absorber and is disposed between the motor casing and the gear casing.

2. The electrically-driven power tool according to claim 1, wherein the motor casing, the absorber casing, and the gear casing are arranged in the stated order along the direction in which the rotation shaft extends, and the weight is accommodated in the absorber casing.

3. The electrically-driven power tool according to claim 2, wherein the weight is formed with a hole in alignment with the rotation shaft.

4. The electrically-driven power tool according to claim 3, wherein the dynamic vibration absorber further comprises a weight support connected to the absorber casing, and a plurality of connectors positioned at rotationally symmetrical positions around a center of gravity of the weight, wherein the weight support is connected to the absorber casing with the plurality of connectors.

5. The electrically-driven power tool according to any one of claims 1 through 4, wherein a center of gravity of the electrically-driven power tool and the center of gravity of the weight are positioned in the absorber casing.

6. The electrically-driven power tool according to any one of claims 1 through 4, wherein the absorber casing comprises: a first absorber casing that supports a bearing for rotatably supporting the output shaft of the motor; and a second absorber casing held between the absorber casing and the gear casing,

wherein the gear casing comprises: a first gear casing having a cylindrical shape and connected to the second absorber casing; and a second gear casing disposed in the firs gear casing at a side adjacent to the second absorbing casing, the second gear casing partitioning a space defined by the second absorbing casing and a space defined by the first gear casing, and

wherein a rotation transmitting member is provided in the second absorber casing, the rotation transmitting member extending in a direction in which the output shaft of the motor extends and having a first end operatively coupled to the output shaft of the motor and a second end meshingly engaged with the gear section provided in the first gear casing, the second gear casing including a bearing for rotatably supporting the rotation transmitting member.

7. The electrically-driven power tool according to claim 1, wherein the dynamic vibration absorber is disposed at an outer periphery of the absorber casing, and comprises a connector for connecting the dynamic vibration absorber to the absorber casing, wherein an amplitude of vibration of the weight is larger than a width of the absorber casing along the direction in which the output shaft of the motor extends.

8. The electrically-driven power tool according to claim 7, wherein the absorber casing is formed with a groove that extends in the direction in which the output shaft extends and that engages the connector, wherein holding the absorber casing between the motor casing and the gear casing supports the connector between the motor casing and the gear casing.

9. The electrically-driven power tool according to any one of claims 1 through 4, further comprising:

a cylinder that is accommodated in the motor casing and extends in the direction in which the output shaft of the motor extends;

a holder provided at one end of the cylinder for supporting a bit; and

a piston driven by the reciprocally moving force from the motion converting mechanism and slidably movably disposed within the cylinder,

wherein the weight of the dynamic vibration absorber reciprocally moves back and forth in synchronous relation with the reciprocating motion of the piston, the direction of the reciprocal movement of the dynamic vibration absorber being in coincidence with that of the reciprocating motion of the piston.

Fig. 1

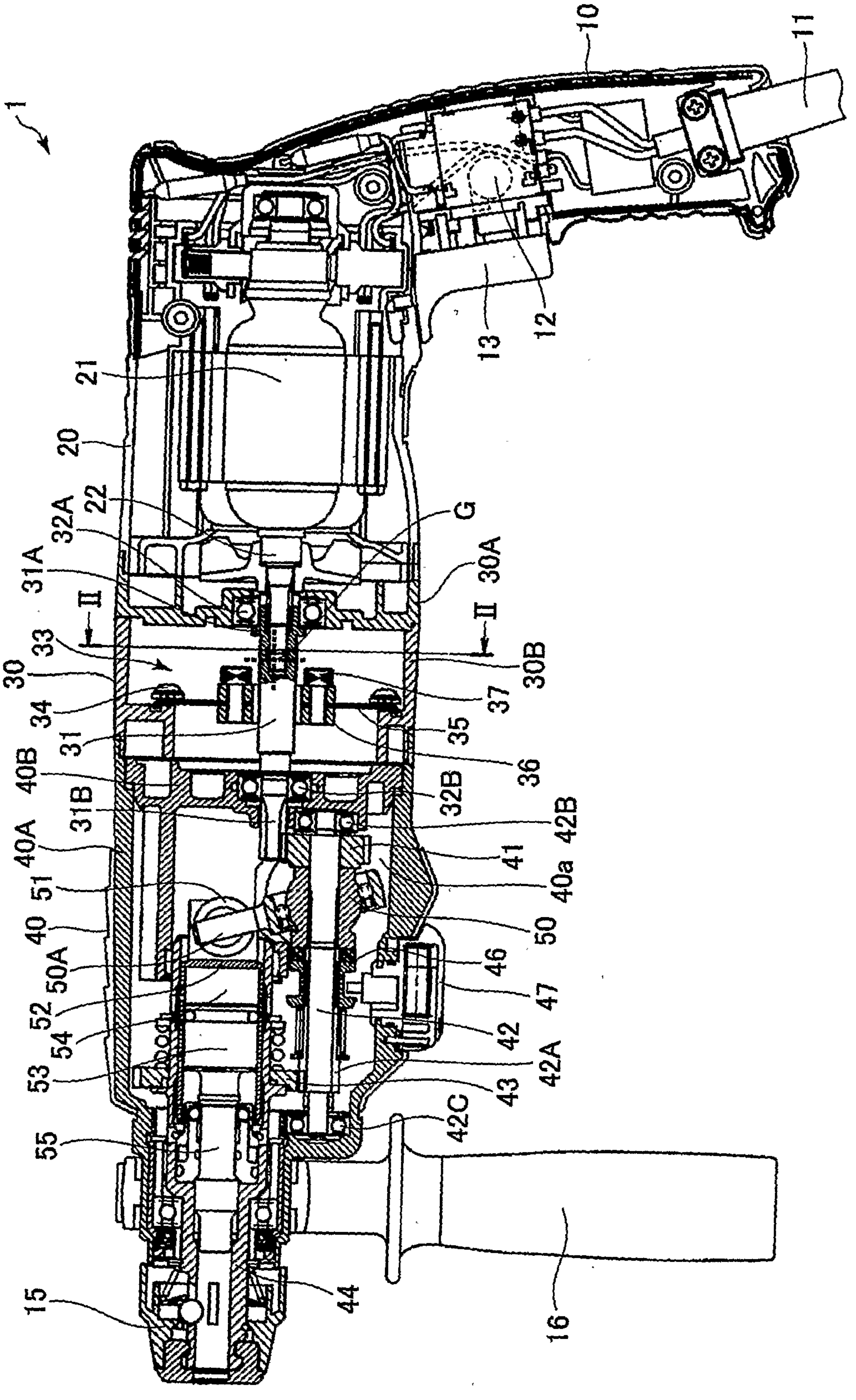
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Fig. 2

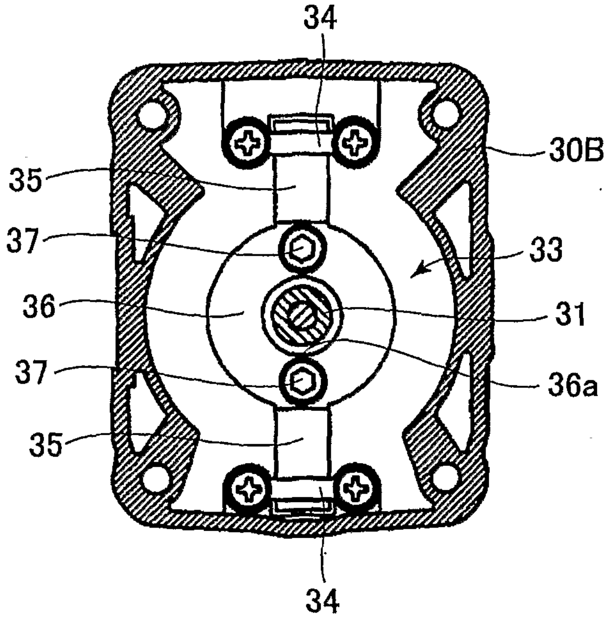

Fig. 3

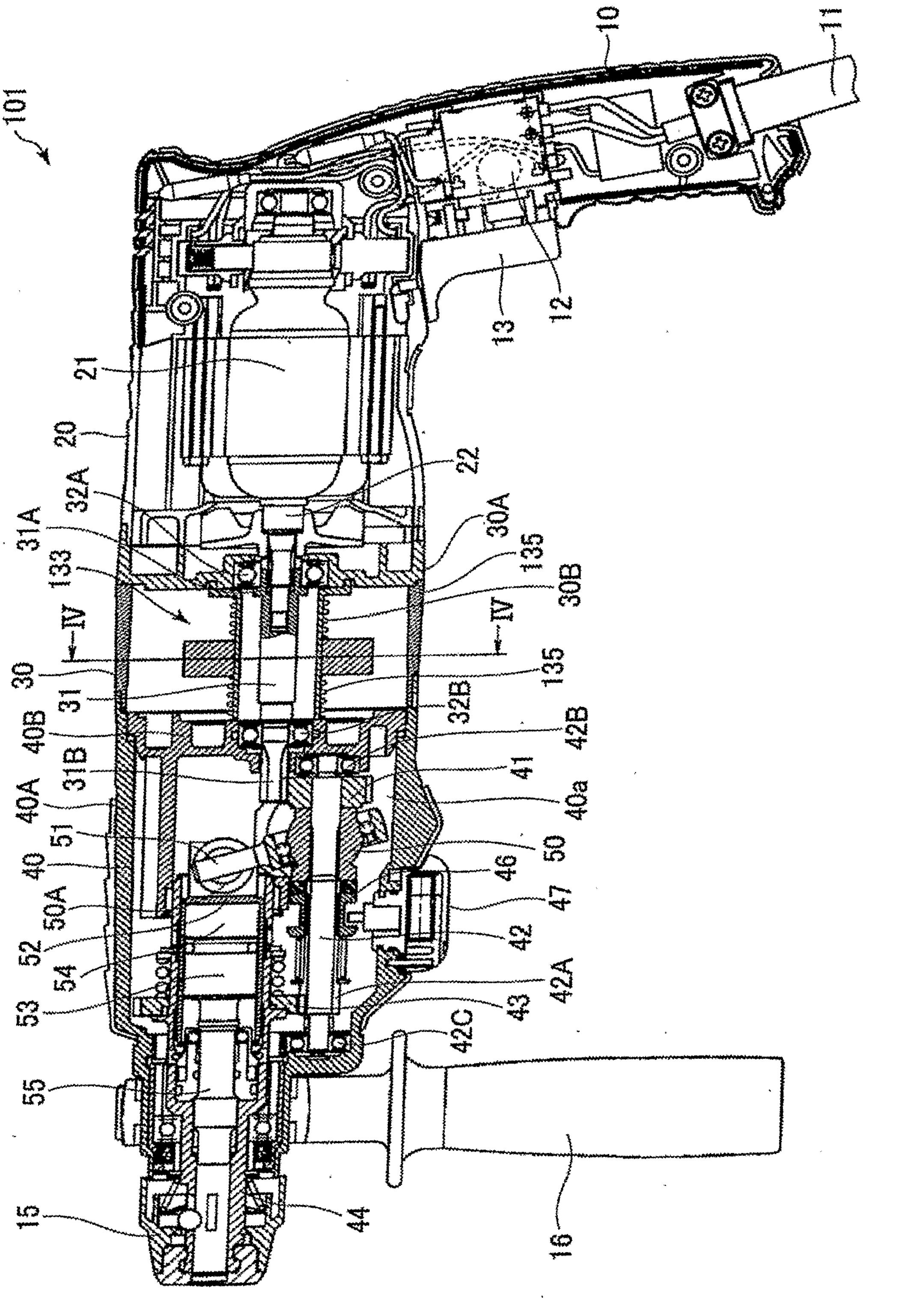
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Fig. 4

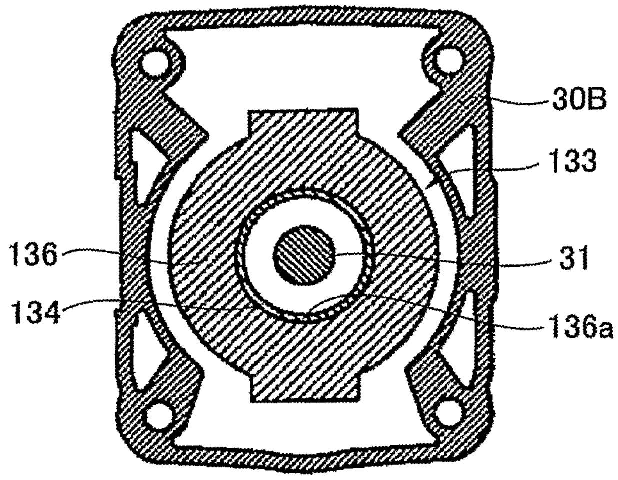


Fig. 5

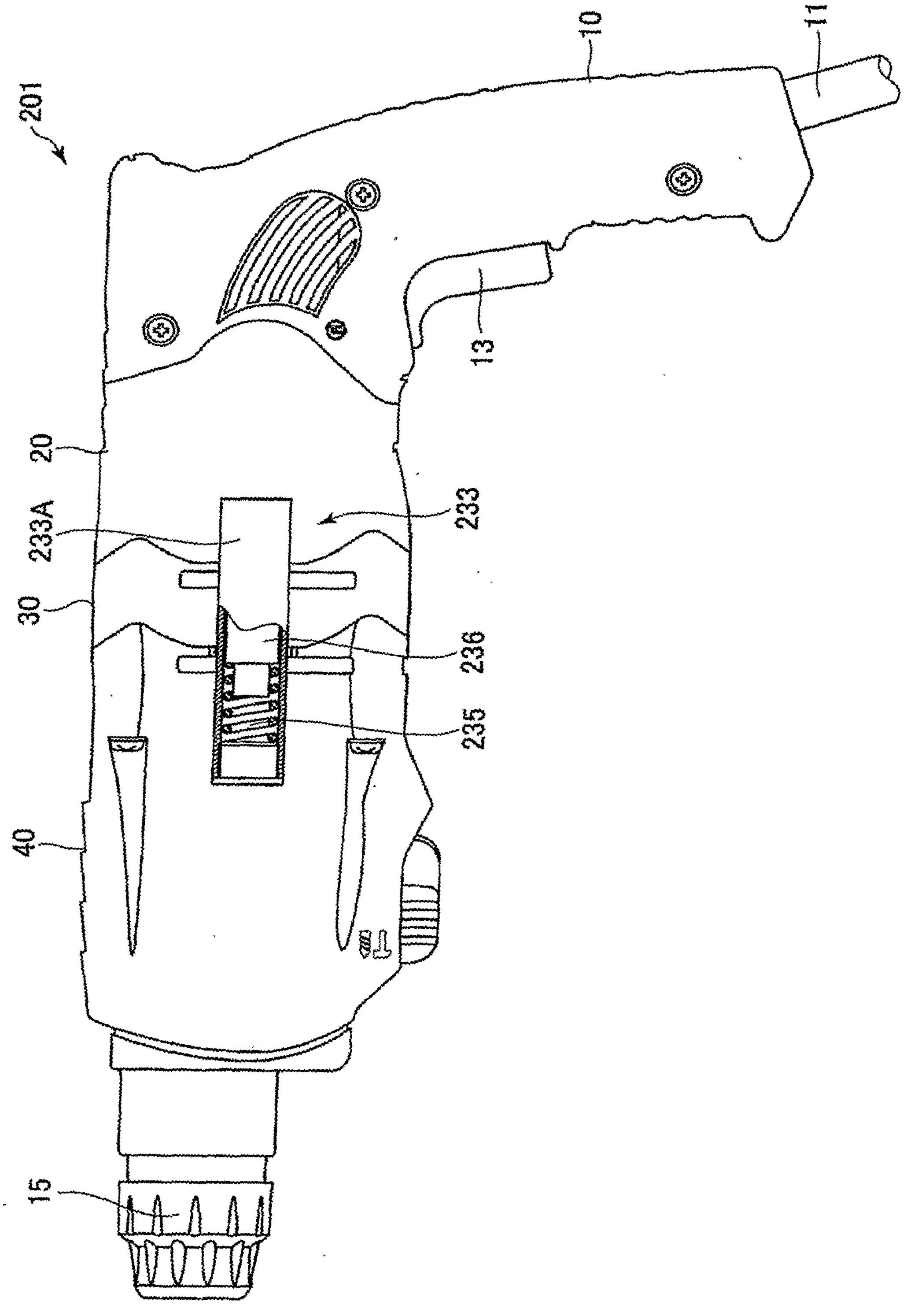
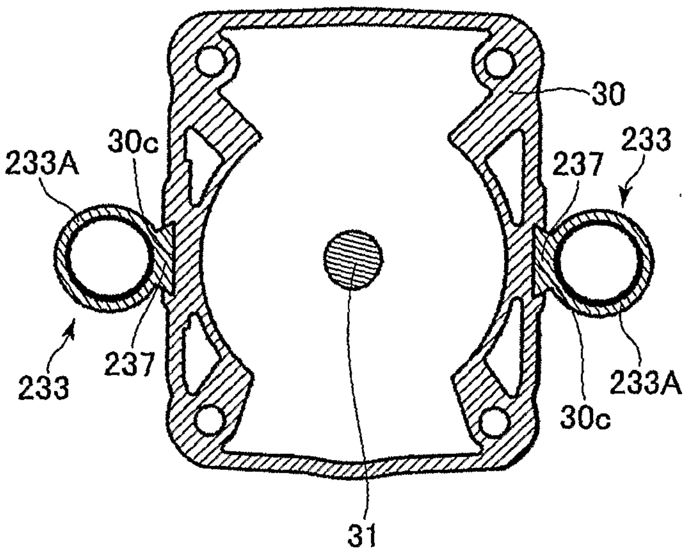


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2007/055012

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25F5/00 B25D17/24

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 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 practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 1 415 768 A (ATLAS COPCO ELECTRIC TOOLS [DE]) 6 May 2004 (2004-05-06) figure 1	1,2
X	EP 1 618 999 A (A & M ELECTRIC TOOLS GMBH [DE]) 25 January 2006 (2006-01-25) abstract; figures 1,2	1
A	US 5 566 458 A (PALM BERNHARD [US]) 22 October 1996 (1996-10-22) column 3, lines 15-22; figure 1	1-3
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-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 June 2007	06/07/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Popma, Ronald

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2007/055012

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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