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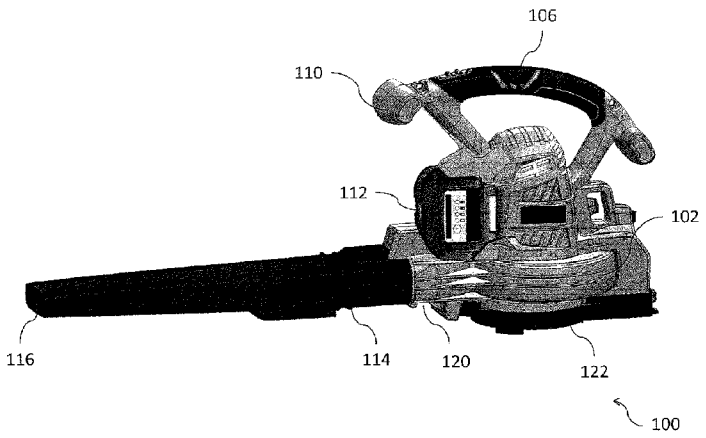


FIGURE 1

(57) Abstract: A power tool comprises a main body (102) having an operation unit arranged to deliver a blowing or suction force to an operation opening (116), wherein the operation unit is powered by a battery assembly (112) arranged to be combined with the main body (102) such that a center of gravity of the combined main body (102) and the battery assembly (112), when in use, is arranged to urge the operation opening (116) towards an operating surface.

POWER TOOL

TECHNICAL FIELD

The present invention relates to a power tool and particularly, although not exclusively, to a cordless blower vacuum power tool.

BACKGROUND

In order to clean a large area of ground surface withdebris such as leaves, soils or general waste, gardeners and keepers generally use power tools such as a blower vacuum to shorten the cleaning duration. However, it is not uncommon that the gardeners have to work very long hours at locations such as a large park to complete a full service. Therefore, it is inevitable that the gardeners will have to use a blower vacuum for a very long period of time.

Although a blower or vacuum tool will reduce the effort for workers, the size and driving mechanism of a blower or vacuum tool will have considerable weight which must be carried by the workers. In turn, workers who use these tools will have to carry and manipulate the tool to complete their work, including the pointing or directing of the blower or vacuuming portions of the tool into a cleaning area. Over time, a user may suffer from fatigue or work related injuries from the constant manipulation and carrying of the tool.

SUMMARY OF THE INVENTION

In accordance with a first aspect of the present invention, there is provided a power tool comprising a main body having an operation unit arranged to deliver a blowing or suction force to an operation opening; wherein the operation unit is powered by a battery assembly arranged to be combined with the main body such that a center of gravity of the combined main body and the battery assembly, when in use, is arranged to urge the operation opening towards an operating surface.

In an embodiment of the first aspect, the blowing or suction force is delivered to the operation opening via an operation conduit.

In an embodiment of the first aspect, the battery assembly when combined with the main body urges the operation conduit in a direction towards the operation surface.

In an embodiment of the first aspect, the battery assembly is combined with the main body in a position adjacent to the operation unit.

In an embodiment of the first aspect, the main body further comprises a handle at a position substantially above the operation unit.

In an embodiment of the first aspect, the handle is arranged to be grasped by a user of the power tool such that the combined main body and the battery assembly is arranged to urge the operation conduit towards the operating surface.

In an embodiment of the first aspect, the main body further comprises an auxiliary grip adjacent to the handle.

In an embodiment of the first aspect, the auxiliary grip is positioned substantially above the battery assembly.

In an embodiment of the first aspect, the handle and the auxiliary grip are arranged to allow a dual-hand operation of the power tool.

In an embodiment of the first aspect, the auxiliary grip is arranged to be grasped by the user to direct the operation conduit to the operating surface.

In an embodiment of the first aspect, the operation unit includes a motor arranged to drive a fan.

In an embodiment of the first aspect, the battery assembly is arranged to be mounted to the main body at a position adjacent to the motor.

In an embodiment of the first aspect, the motor is arranged to operate with a rotational axis substantially perpendicular to a central axis of the operation opening.

In an embodiment of the first aspect, the motor is arranged to operate with a rotational axis substantially parallel to a central axis of the operation opening.

In an embodiment of the first aspect, the battery assembly is arranged to be removably mounted to the main body.

In an embodiment of the first aspect, the main body further comprises a battery locking mechanism arranged to secure the battery assembly to the main body.

In an embodiment of the first aspect, the power tool is arranged to operate in at least one of a vacuum mode and a blower mode with the operation conduit operating as a vacuum tube or a blower tube respectively.

In an embodiment of the first aspect, when the power tool is configured to operate in a blower mode, the center of gravity of the combined main body and the battery assembly is adjacent to a connecting position for connecting the blower tube to the main body.

In an embodiment of the first aspect, the battery assembly is arranged to be mounted to the main body adjacent to the blower tube.

In an embodiment of the first aspect, when the power tool is configured to operate in a vacuum mode, the center of gravity of the combined main body and the battery assembly is adjacent to a joining position for joining a debris container to the main body.

In an embodiment of the first aspect, the battery assembly is arranged to be mounted to the main body adjacent to the debris container.

In an embodiment of the first aspect, the operating surface is below the center of gravity of the combined main body and the battery assembly.

In accordance with a second aspect of the present invention, there is provided a power tool comprising a main body having an operation unit arranged to deliver a blowing or suction force to an operation opening; wherein the operation unit is powered by a battery assembly arranged to be combined with the main body such that when the main body is grasped by a user of the power tool, the power tool is arrange to rest in an equilibrium position about the user's grasp such that in the equilibrium position, the operation opening is substantially near an operation position.

In an embodiment of the second aspect, the battery assembly is arranged to be mounted to the main body in a position so as to minimize a force required to maintain the power tool in the equilibrium position.

In an embodiment of the second aspect, the battery assembly is arranged to be mounted to the main body in a position so as to minimize a force required to adjust the power tool from the equilibrium position to the operation position.

In an embodiment of the second aspect, the blowing or suction force is delivered to the operation opening via an operation conduit.

In an embodiment of the second aspect, the battery assembly is combined with the main body in a position adjacent to the operation unit.

In an embodiment of the second aspect, further comprising a handle fixed to the main body at a position substantially above the operation unit, wherein the handle is arranged to be grasped by a user of the power tool.

In an embodiment of the second aspect, the main body further comprises an auxiliary grip adjacent to the handle.

In an embodiment of the second aspect, the auxiliary grip is positioned substantially above the battery assembly.

In an embodiment of the second aspect, the handle and the auxiliary grip are arranged to allow a dual-hand operation of the power tool.

In an embodiment of the second aspect, the auxiliary grip is arranged to be grasped by the user to direct the power tool to the operation position.

In an embodiment of the first or the second aspect, the operation opening is below a center of gravity of the combined main body and the battery assembly.

In an embodiment of the first or the second aspect, the power tool is at least one of a blower, a vacuum cleaner, and a dual mode vacuum-blower apparatus.

These embodiments are advantageous in that the battery assembly of the power tool is mounted to the main body of the power tool in a position that the equilibrium position or orientation of the power tool is optimized, such that the operation opening is in a position which is substantially near an operation position, when it is held by a user of the power tool. The center of gravity of the combined main body and the battery assembly is optimized to direct the power tool to an optimized direction when the power tool is naturally held by a user. Such configuration allows the user to exert a minimized force required to maintain the power tool in the equilibrium position, or to adjust the power tool to the operation position near the equilibrium position. For example, a nozzle of a cleaning apparatus (such as a blower or a vacuum cleaner) in such configuration may be urged to a ground surface when the cleaning apparatus is naturally or ergonomically held by a user due to the optimized position of center of gravity of the combined main body and the battery assembly of the cleaning apparatus. The user may conveniently clean the ground surface using such cleaning apparatus by exerting a minimized force to hold the power tool without applying additional forces to urge the nozzle of the cleaning apparatus towards the ground surface during a cleaning operation.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a side view of a first operating mode of a power tool in accordance with one embodiment of the present invention;

Figure 2 is a side view of a second operating mode of the power tool of Figure 1;

Figure 3 is a side view of the first operating mode in a first usage position of the power tool of Figure 1;

Figure 4 is a side view of the first operating mode in a second usage position of the power tool of Figure 1;

Figure 5 is a side view of the second operating mode in a first usage position of the power tool of Figure 1;

Figure 6 is a side view of a first operating mode of a power tool in accordance with a second embodiment of the present invention;

Figure7 is a side view of a second operating mode of the power tool of Figure 6;

Figure 8is a side view of the first operating mode in a first usage position of the power tool of Figure 6;

Figure9is a side view of the first operating mode in a second usage position of the power tool of Figure 6;

Figure 10is a side view of the second operating mode in a first usage position of the power tool of Figure 7;

Figure 11a is a generalized load distribution diagram of the power tool in blower mode in accordance with Figure 3;

Figure 11b is a generalized load distribution diagram of a conventional power tool design in blower mode;

Figure 12a is a generalized load distribution diagram of the power tool in vacuum mode in accordance with Figure 5; and

Figure 12b is a generalized load distribution diagram of a convention power tool design in vacuum mode.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is given by way of example only to illustrate preferred embodiments of the invention. In particular, the language and terminology used herein is for descriptive purposes only and is not intended to limit the scope or functionality of the invention. The invention may be employed in various combinations or embodiments utilizing various elements and means not explicitly described herein, but within the knowledge and skill of one ordinarily skilled in the art.

With reference to Figures 1 and 2, there is provided a power tool comprising a main body having an operation unit arranged to deliver a blowing or suction force to an operation opening, wherein the operation unit is powered by a battery assembly arranged to be combined with the main body such that a center of gravity of the combined main body and the battery assembly, when in use, is arranged to urge the operation opening towards an operating surface.

In accordance with the embodiment as shown in Figure 1, there is illustrated a power tool that is arranged to operate as a blower vacuumor known also as a blower vac 100. In this embodiment, the blower vacuum 100 includes a main body 102 that includes an operation unit (not shown) which may include a motor and a fan or impeller unit arranged to generate a blowing or suction force.The fan may also be connected to the motor via a transmission system that connects the motor's mechanical output to thefan. The operation unit are housed (or partially housed) by a housing of the main body 102.

In this embodiment, the power tool is arranged to provide a blower functionality in which the motor is arranged to operate with a rotational axis that is substantially perpendicular to a central axis of the operation opening as shown in Figure 1. The motor that is used for driving the fan can be of a brushless type or a brushed type. In order to energize the motor, or the operation unit as a whole, a removable battery assembly 112 is mounted with the main body 102 for providing electrical energy required for the operation unit to operate.

In this embodiment of the blower vac 100, the main body 102 also includes ahandle 106 that may be formed above the operation unit. In this example, the handle 106 has at least one auxiliary grip 110 adjacent the handle 106 which in this embodiment, is arranged for a dual-handed operation of the blower vac 100. The handle 106 may be formed integrally with the main body 102 and connects to the main body 102 through two

leg-sections as shown in Figure 1. As shown on the handle 106, there may also be a center portion covered with a layer of anti-slip material for enhancing the grip of the handle by a user.Such alayer of anti-slip material can be a layer of soft rubber or a texturized surface.

In this example, the center portion of the handle is elongated and consists of different sections of different radii. This may be advantageous in that an inconsistency in the radius of the center portion may provide anoptimizedprofiled for maximum grip when the handle 106 is being held in different positions and orientations by the user.

Between the handle 106 and the main body 102 near a forward end 120of the main body 102, there may alsobe a battery port, such as a cavity formedfor mounting a battery assembly 112. Once the battery assembly 112 is mounted with the main body 102, a battery locking mechanism (not shown) such as a latch matched with a groove on the battery assembly will activate and securely attach to the battery assembly 112 so as to prevent the battery assembly 112 from being accidentally removed from the main body 102.

In this embodiment, the battery assembly 112 may be of a considerable amount of the blower vac's total weight and is mounted near the forward end 120 of the main body 102.In turn, the blower vac 102's aggregated center of gravity is now shifted to be located in a position that urges an operation conduit 114, which in this embodiment is a blower tube,downwards and towards an operating surface. This results in the operation opening 116 to be urged towards an operating surface, which may include a ground surface or a surface that receives a blowing force and is below the center of gravity of the combined main body and the battery assembly. The auxiliary handle 110 in this embodiment may also be designed in a way that the auxiliary handle 110 is substantially above the battery assembly 112 when the blower vac 100 is being operated. This is advantageous in that the auxiliary handle provides a secondary gripping position for when delicate maneuvering of the blower vac 100 is necessary.

As previously mentioned, a blowing force will be generated by the operation unit in the embodiment as shown in Figure 1. Once the blowing force is generated, the blowing force will be delivered to an operation opening 116 on an operation conduit 114 of the blower vac 100. The operation conduit 114 may be removablymounted with a front portion of the main body 102 and the operation conduit 114 can be simply detached or replaced with other parts so that the blower vac can be easily stowed or for other functions that will be further described.

In accordance with the embodiment as shown in Figure 2, the blower vac 100 is configured to be used for vacuuming purpose. The blower vac 100 in vacuum mode requires an operation unit (not shown) which includes a motor, a transmission that connects the motor's mechanical output to a fan and the fan for generating a suction force. For suction functionality, the motor may be arranged to operate with a rotational axis that is substantially parallel to a central axis of an operation opening 206, which in this case is a vacuum opening 206 of a vacuum tube 200.

Preferably, as shown in Figures 1 and 2, the main body 102 is the same or substantially similar as the main body 102 may be implemented to operate in both a blower and vacuum mode. To facilitate these two functions, an air inlet may be attached to a vacuum tube whilst a blower tube arranged to deliver a blowing force is replaced with a vacuum bag or a debris collector so as to catch debris sucked by the vacuum tube.

The suction force generated by the operation unit (not shown) will be delivered by the fan to avacuum opening 206 of a vacuum tube 200, which is detachably mounted with a fan cover 202 that is positioned between a bottom portion 122 of the blower vac and a mounting end of the vacuum tube 200.In order to store the collected waste properly, the blower vac in Figure 2 is designed to be capable of mounting a storage member such as a debris container 204 in the vicinity of the battery assembly 112. The debris container 204 can be a reusable container bag or a rubbish bag with a form fitting mounting portion and may preferably have a plurality of openings, so as to avoid suction air to escape whilst capturing debris which may be sucked in.

With reference to Figures 3 to 5, the blower vac of the present embodiment is illustrated with regard to the two available operating modes. The first operating mode of the blower vac can be used to generate a

blowing force for moving a large amount of debris such as leaves to a desired location. In order to use the first operating mode, a user 300 will have to firstly configure the blower vac for blowing usage. To do so, a user 300 will attach the operation conduit, which is in the form of a blower tube 114 in this embodiment, to the front end 120 of the main body 102. Once the blower tube 114 is mounted, the user 300 will insert the battery assembly 112 into the cavity adjacent the main body 102 and below the handle 106 so as to provide an electrical energy source to the operation unit. After the above components are assembled, the user may grasp the handle 106 as shown in Figure 3, while operating the power switch 302 to switch on the motor for driving the fan.

As the battery assembly 112 may contribute a rather large percentage of the overall weight of the blower vac, such a forward mounting position of the battery assembly (disregarding the operation conduit) is advantageous to the user. Typically, a blower vac is used for blowing debris on a ground surface and as such, a user will experience discomfort to a certain degree as the user is generally required to carry the blower vac with a twisted wrist to urge the nozzle to the operation surface. However, the blower vac in this embodiment takes advantage of the weight of the battery assembly and provides a much more ergonomically superior design. The weight of the battery assembly may be positioned considerably more forward and thus causing the blower vac's aggregated center of gravity to be noticeably away from the gripping point of the user. Such a design results in an urging force due to gravity to be induced to the front end 120 of the blower vac and thus the user may not need to rotate and maneuver the blower vac through their wrists during usage. This feature is very advantageous to a user as more than often any typical gardening work requiring a blower vac would involve a prolonged period of holding the device. By reducing the amount of loaded movement of a user's wrist, the user is now significantly less prone to any wrist-related injuries from using the blower vac in the embodiment.

Should a user finds the need to direct the blower tube to a raised location, the user may choose to operate blower vac 100 as illustrated in Figure 4. In this example, the user 300 does not only grasp the handle 106 for operating the blower vac in vacuum mode but may also grasps the auxiliary handle 110 with a second hand 304 for additional lifting power. The auxiliary handle 110 is configured to be adjacent to the handle 106 and above the battery assembly 112. In this embodiment, the user can effortlessly adjust the direction of the conduit opening 116 in either vertical or horizontal direction that is deemed required.

Generally, once a user has used a blower vac to move debris such as leaves into a more condensed location, the user may also use the vacuuming function of the blower vac to vacuum the debris and shred them along the process of vacuum. In order to operate the vacuummode of the blower vac, a user may attach a different set of components to the device. Firstly a user will attach an operation conduit in the form of a vacuum tube 200 to the fan cover 202 or alternative open the fan cover 202 and then attach the operation conduit to the main body 102. After attaching the vacuum tube 200, the user will attach the debris container to the blower vac for storage of debris obtained from cleaning a surface. Lastly, the user can mount the battery assembly 112 with the main body 102 of the blower vac for energising the operation unit in order to generate a vacuum force. Once the debris is sucked into the main body 102 through the vacuum tube 200, the fan of the operation unit may shred the debris to greatly reduce the volume of the debris for improving storage efficiency of the debris container. Although in some examples, the fan may not necessarily be arranged to shred the debris.

With regard to both operating modes of the blower vac in this embodiment, due to the novel placement of the battery assembly 112, the blower vac is arranged to rest in an equilibrium position about a user's grasp such that in the equilibrium position, the operation opening may be below a center of gravity of the combined main body and the battery assembly.(i.e. vacuum opening 206 and blower tube opening 116). The equilibrium position may be defined as a position where the blower vac is stable and does not subject to any unbalanced force.

In turn, in this position the blower vac 100 may be substantially near a respective operation position for the two modes.Such a design is advantageous as a user does not need to constantly asserting a force to the blower vac in order to maintain a suitable operation position of the device.The operation position of the blower mode may include holding the blower vac in a way that the operation conduit (i.e. a blower tube) is pointing at an operation surface or a ground surface at an angle. The other operation position for using the vacuum mode

may includeholding the blower vac in a way that the operation conduit (i.e. vacuum tube) is pointing at an operation surface or a ground surface at an angle.

In another embodiment that is shown in Figures 6 to 7,the power tool that is arranged to operate as a blower vac 600 have a slight difference in comparison to the first embodiment that has been described previously. The blower vac600 includes, among a list of common features with the first embodiment, a differently designed handle 606 and a different battery assembly mounting method.

The handle 606 in this embodiment is also integrally formed with the main body 612 and connects to the main body 612 through two legs. However, the front leg of the handle 612 is also a bracket 611 that can hold a battery assembly 612 in a vertical orientation. This bracket 611 may include an opening 613 for a battery assembly 612 to be inserted through and the opening 613 is in the vicinity of the switch 610. This design is indeed advantageous to enhance the life cycle of the battery assembly. Even though it is shown in these Figures that the bracket has large cutouts, a person skilled in the art would appreciate that it is possible to not formall of these cutouts and therefore the battery assembly will be more protected from the elements.

In addition to newly designed bracket for mounting a battery assembly in vertical orientation, the handle 606 also includes a differently designed auxiliary handle 608.The auxiliary handle 608 is integrally formed at the front end 120 of the handle 606 and this handle 608 may also be a part of the bracket opening 613 for the battery assembly 612 to be inserted through.However, even though the form of the handle 606 and auxiliary handle 608 is different to the ones in the other embodiment, their locations on the main body 602 remain unchanged. Therefore, the handle 606 is still substantially above the main body 602.

With reference to Figure 7, there is shown the blower vac of this embodiment in vacuum mode. The handle 606 in this embodiment functions almost exactly the same as the handle in the other embodiment. As the rear auxiliary handle 609 remains unchanged from the other embodiment. Therefore, the operation of the device is not noticeably affected.

As shown in Figures 8 to 10, the two different operation modes of the blower vac in this embodiment are being illustrated.Regarding Figures 8 and 9, the blower vac is depicted to be in blower mode and is held by a user 800. The method to assemble and use the blower vac in vacuum mode is very similar to the previous embodiment.However, one difference between the previous embodiment and this embodiment are that the mounting method of the battery assembly is different as shown in the Figureswhilst the gripping method for two-handed use is different. With regard to the gripping method, with reference to Figure 9, it can be seen that the auxiliary handle 608 does not provide as much gripping area for the user to grasp so as to direct the blower vac to the operation position. However, as previously described, the operating position of the blower vac is designed to be easily obtainable as the battery assembly is arranged to be mounted to the main body in a position so as to minimize a force required to maintain the blower vac in the equilibrium position. Regarding the embodiment as shown in figure 10, the design of the handle 606 and the auxiliary handle 608 has no noticeable impact to the operation of the blower vac in vacuum mode.

In embodiments that are not shown, these embodiments may include battery assemblies, handles auxiliary handles and brackets of different designs and/or dimensions. For example, a cylindrical battery assembly may be used instead of a polygonal-shaped battery assembly. In order to mount such a cylindrical battery assembly, the bracket may need to be redesigned and therefore possibly affecting the designs of the handle and the auxiliary handle.

In order to elaborate the effect of the battery assembly positioning in relation to one example of the handling characteristics of a power tool, Figures 11a to 12b are presented. Figures 11a and 11b are related to the blower mode of a power tool in this invention whereas Figures 12a to 12b are related to the vacuum mode of the same power tool.

With reference to Figure 11a and 11b, there is shown an example of a generalized load distribution diagram for two different designs of a power tool. Figure 11a relates to a power tool having a battery configured forward the handle 1100A being grasped by a user of the power tool whereas Figure 11b relates to

another power tool having a battery configured behind the handle 1100B being grasped by a user of the power tool. Figure 11a shows that the cantilever beam 1110A, which represents the direction of an operation conduit is tilted due to the weight of the power tool and the battery. Figure 11b shows that, to tilt the cantilever beam 1110B, extra effort has to be made by the user in order to offset the loading of the battery, which is configured behind the handle. For example, the user will have to exert an extra tilting force to tilt orientation of the power tool, or to apply an extra force downwardly to force such tilting of the orientation of the power tool.

With reference to Figures 12a and 12b, there is illustrated another example of a generalized load distribution diagram for two different designs of a power tool in vacuum mode. Figure 12a relates to a power tool having a battery configured forward the handle 1200A being grasped by a user of the power tool whereas Figure 12b relates to another power tool having a battery configured behind the handle 1200B being grasped by a user of the power tool. Figure 12a shows that the cantilever beam 1210A, which represents the direction of an operation conduit is tilted due to a combination of the weight the battery and a user's effort which is larger than the weight of the power tool. Figure 12b shows that, to tilt the cantilever beam 1110B, extra effort has to be made by the user in order to offset the loading of the battery, which is configured behind the handle. Similarly, the user will have to exert an extra tilting force to tilt orientation of the power tool, or to apply an extra force downwardly to force such tilting of the orientation of the power tool.

In comparing these two illustrations, it can be concluded that the battery's weight can also be taken advantage of for reducing a user's effort to tilt the direction of an operation conduit downward and thus, by positioning the battery in accordance with the embodiments of the invention, the embodiments are advantageous in that the weight distribution of the power tool is optimized to direct the power tool to an optimized direction when the power tool is naturally or ergonomically held by a user. The user will only have to exert a minimum force required to hold and tilt the power tool for different operations.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

Any reference to prior art contained herein is not to be taken as an admission that the information is common general knowledge, unless otherwise indicated.

CLAIMS

1. A power tool comprising a main body having an operation unit arranged to deliver a blowing or suction force to an operation opening; wherein the operation unit is powered by a battery assembly arranged to be combined with the main body such that a center of gravity of the combined main body and the battery assembly, when in use, is arranged to urge the operation opening towards an operating surface.

2. A power tool in accordance with claim 1, wherein the blowing or suction force is delivered to the operation opening via an operation conduit.

3. A power tool in accordance with claim 2, wherein the battery assembly when combined with the main body urges the operation conduit in a direction towards the operation surface.

4. A power tool in accordance with any one of the preceding claims, wherein the battery assembly is combined with the main body in a position adjacent to the operation unit.

5. A power tool in accordance with any one of claims 2 to 4, wherein the main body further comprises a handle at a position substantially above the operation unit.

6. A power tool in accordance with claim 5, wherein the handle is arranged to be grasped by a user of the power tool such that the combined main body and the battery assembly is arranged to urge the operation conduit towards the operating surface.

7. A power tool in accordance with claims 5 or 6, wherein the main body further comprises an auxiliary grip adjacent to the handle.

8. A power tool in accordance with claim 7, wherein the auxiliary grip is positioned substantially above the battery assembly.

9. A power tool in accordance with claims 7 or 8, wherein the handle and the auxiliary grip are arranged to allow a dual-hand operation of the power tool.

10. A power tool in accordance with claim 9, wherein the auxiliary grip is arranged to be grasped by the user to direct the operation conduit to the operating surface.

11. A power tool in accordance with any one of the preceding claims, wherein the operation unit includes a motor arranged to drive a fan.

12. A power tool in accordance with claim 10, wherein the battery assembly is arranged to be mounted to the main body at a position adjacent to the motor.

13. A power tool in accordance with claims 11 or 12, wherein the motor is arranged to operate with a rotational axis substantially perpendicular to a central axis of the operation opening.

14. A power tool in accordance with claims 11 or 12, wherein the motor is arranged to operate with a rotational axis substantially parallel to a central axis of the operation opening.

15. A power tool in accordance with any one of the preceding claims, wherein the battery assembly is arranged to be removably mounted to the main body.

16. A power tool in accordance with claim 15, wherein the main body further comprises a battery locking mechanism arranged to secure the battery assembly to the main body.

17. A power tool in accordance with any one of claims 2 to 16, wherein the power tool is arranged to operate in at least one of a vacuum mode and a blower mode with the operation conduit operating as a vacuum tube or a blower tube respectively.

18. A power tool in accordance with claim 17, when the power tool is configured to operate in a blower mode, the center of gravity of the combined main body and the battery assembly is adjacent to a connecting position for connecting the blower tube to the main body.

19. A power tool in accordance with claim 18, wherein the battery assembly is arranged to be mounted to the main body adjacent to the blower tube.

20. A power tool in accordance with claim 17, when the power tool is configured to operate in a vacuum mode, the center of gravity of the combined main body and the battery assembly is adjacent to a joining position for joining a debris container to the main body.

21. A power tool in accordance with claim 20, wherein the battery assembly is arranged to be mounted to the main body adjacent to the debris container.

22. A power tool in accordance with any one of the preceding claims, wherein the operating surface is below the center of gravity of the combined main body and the battery assembly.

23. A power tool comprising a main body having an operation unit arranged to deliver a blowing or suction force to an operation opening; wherein the operation unit is powered by a battery assembly arranged to be combined with the main body such that when the main body is grasped by a user of the power tool, the power tool is arrange to rest in an equilibrium position about the user's grasp such that in the equilibrium position, the operation opening is substantially near an operation position.

24. A power tool in accordance with claim 23, wherein the battery assembly is arranged to be mounted to the main body in a position so as to minimize a force required to maintain the power tool in the equilibrium position.

25. A power tool in accordance with claims 23 or 24, wherein the battery assembly is arranged to be mounted to the main body in a position so as to minimize a force required to adjust the power tool from the equilibrium position to the operation position.

26. A power tool in accordance with any one of claims 23 to 25, wherein the blowing or suction force is delivered to the operation opening via an operation conduit.

27. A power tool in accordance with any one of claims 23 to 26, wherein the battery assembly is combined with the main body in a position adjacent to the operation unit.

28. A power tool in accordance with any one of claims 23 to 27, further comprising a handle fixed to the main body at a position substantially above the operation unit, wherein the handle is arranged to be grasped by a user of the power tool.

29. A power tool in accordance with claims 28, wherein the main body further comprises an auxiliary grip adjacent to the handle.

30. A power tool in accordance with claim 29, wherein the auxiliary grip is positioned substantially above the battery assembly.

31. A power tool in accordance with claims 29 or 30, wherein the handle and the auxiliary grip are arranged to allow a dual-hand operation of the power tool.

32. A power tool in accordance with claim 31, wherein the auxiliary grip is arranged to be grasped by the user to direct the power tool to the operation position.

33. A power tool in accordance with any one of the preceding claims, wherein the operation opening is below a center of gravity of the combined main body and the battery assembly.

34. A power tool in accordance with any one of the preceding claims, wherein the power tool is at least one of a blower, a vacuum cleaner, and a dual mode vacuum-blower apparatus.

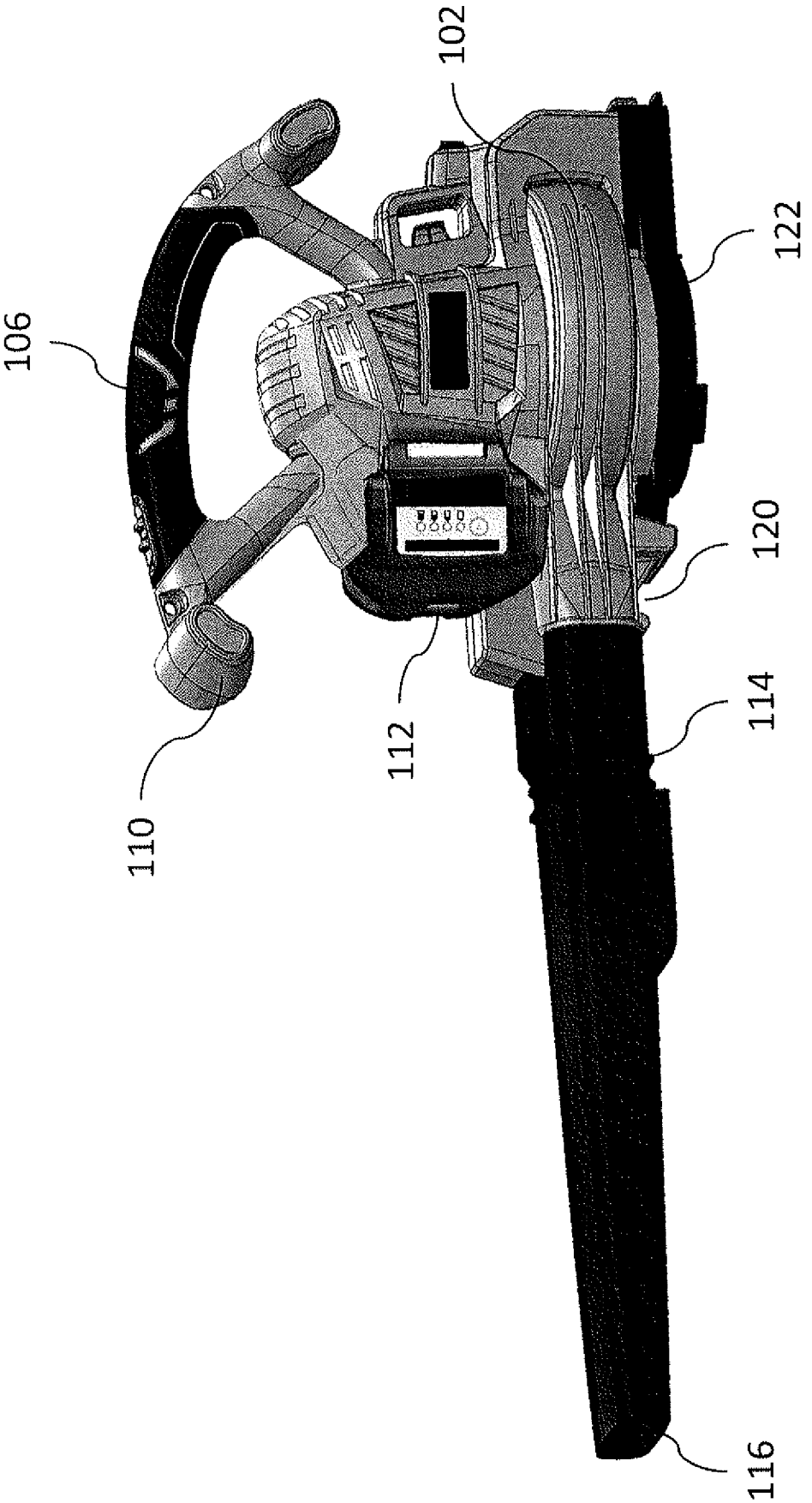


FIGURE 1

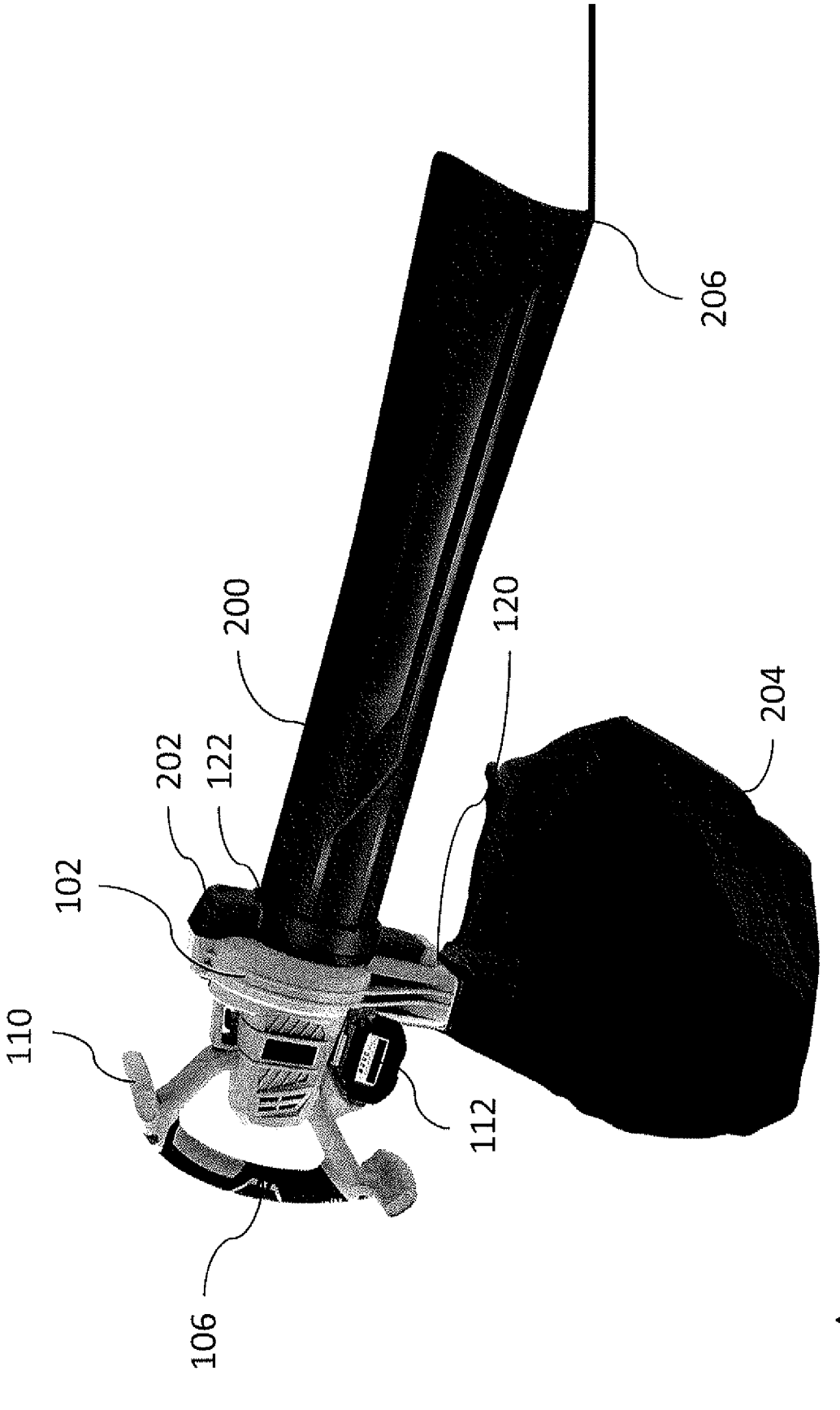


FIGURE 2

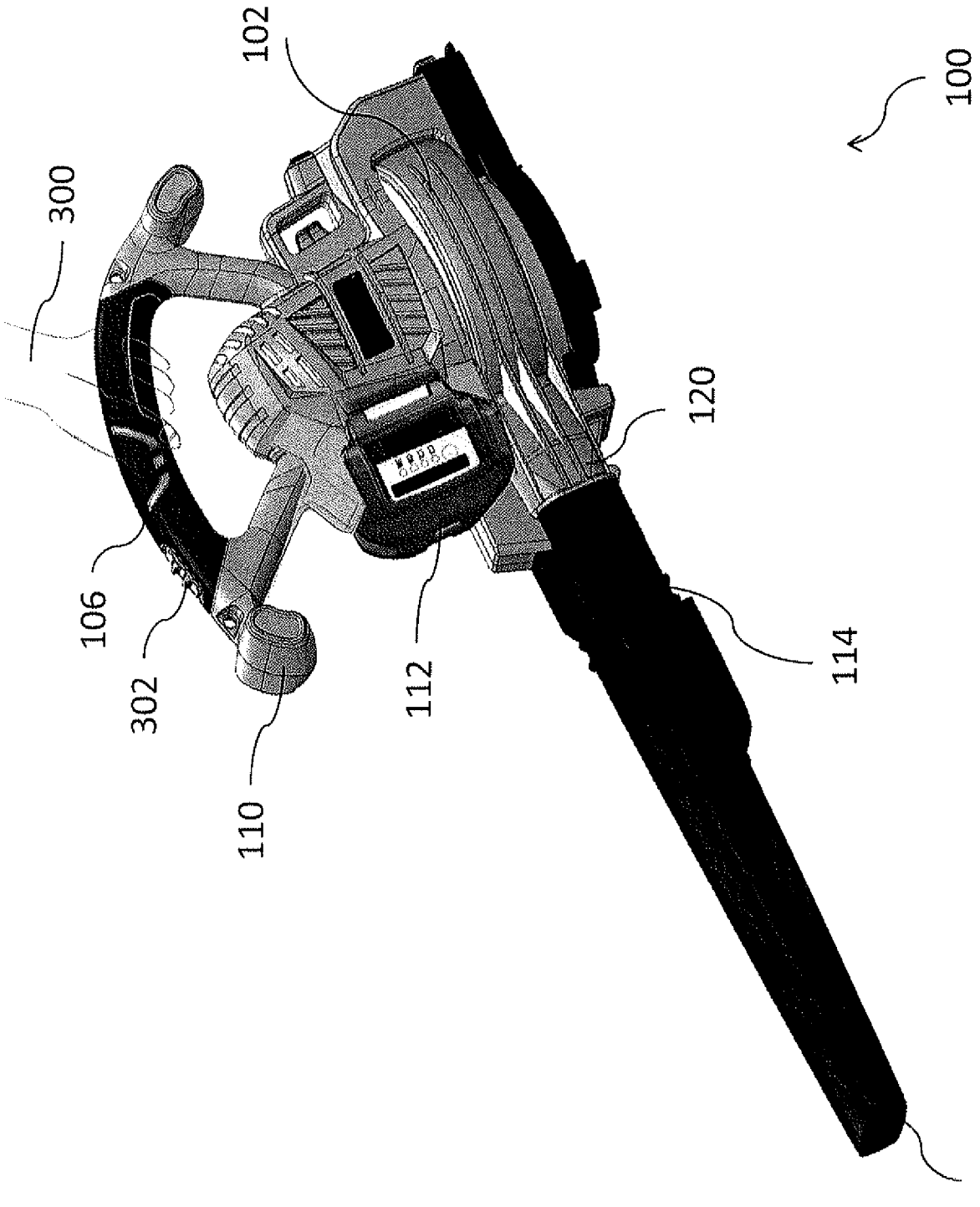


FIGURE 3

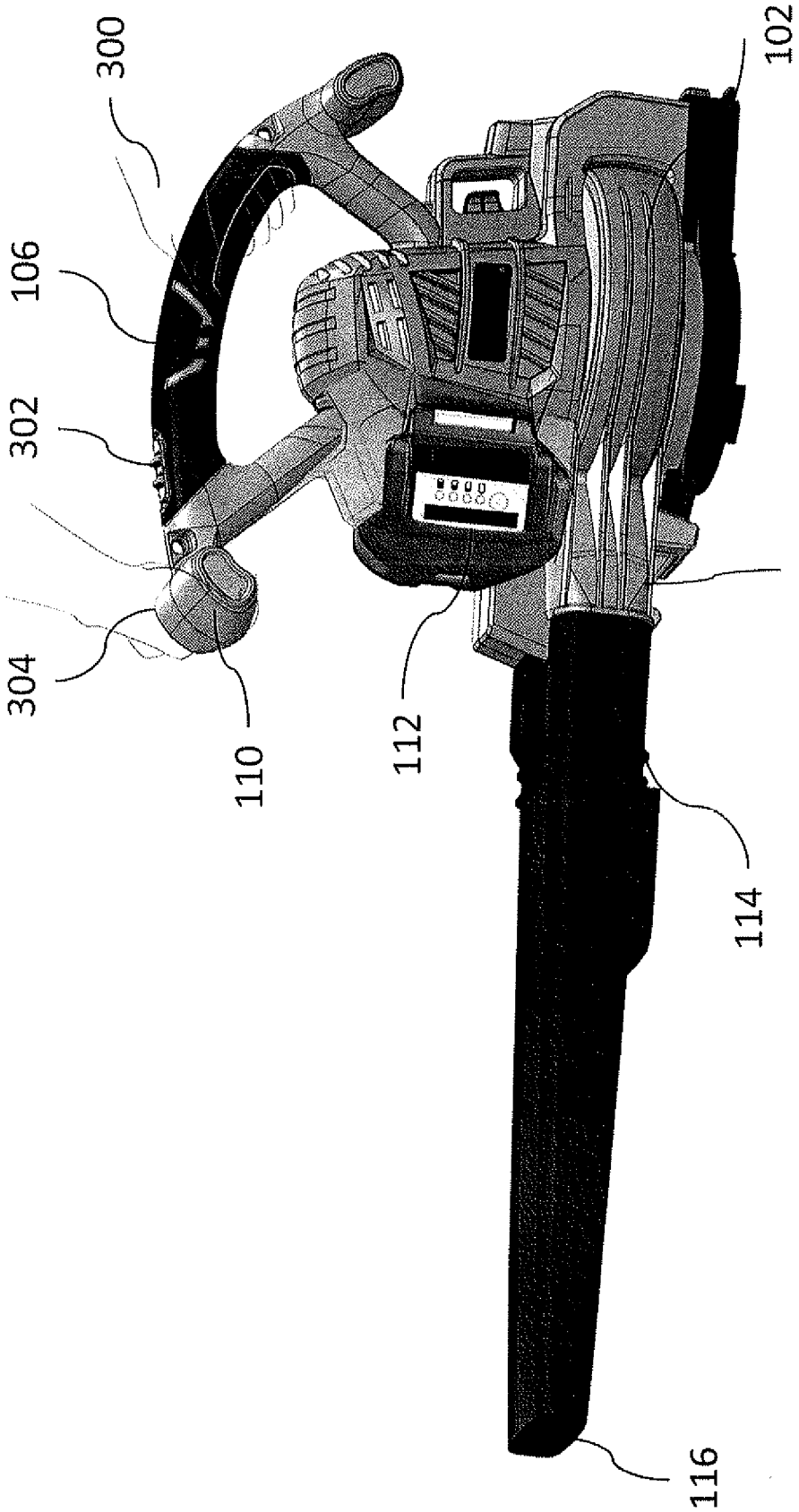


FIGURE 4

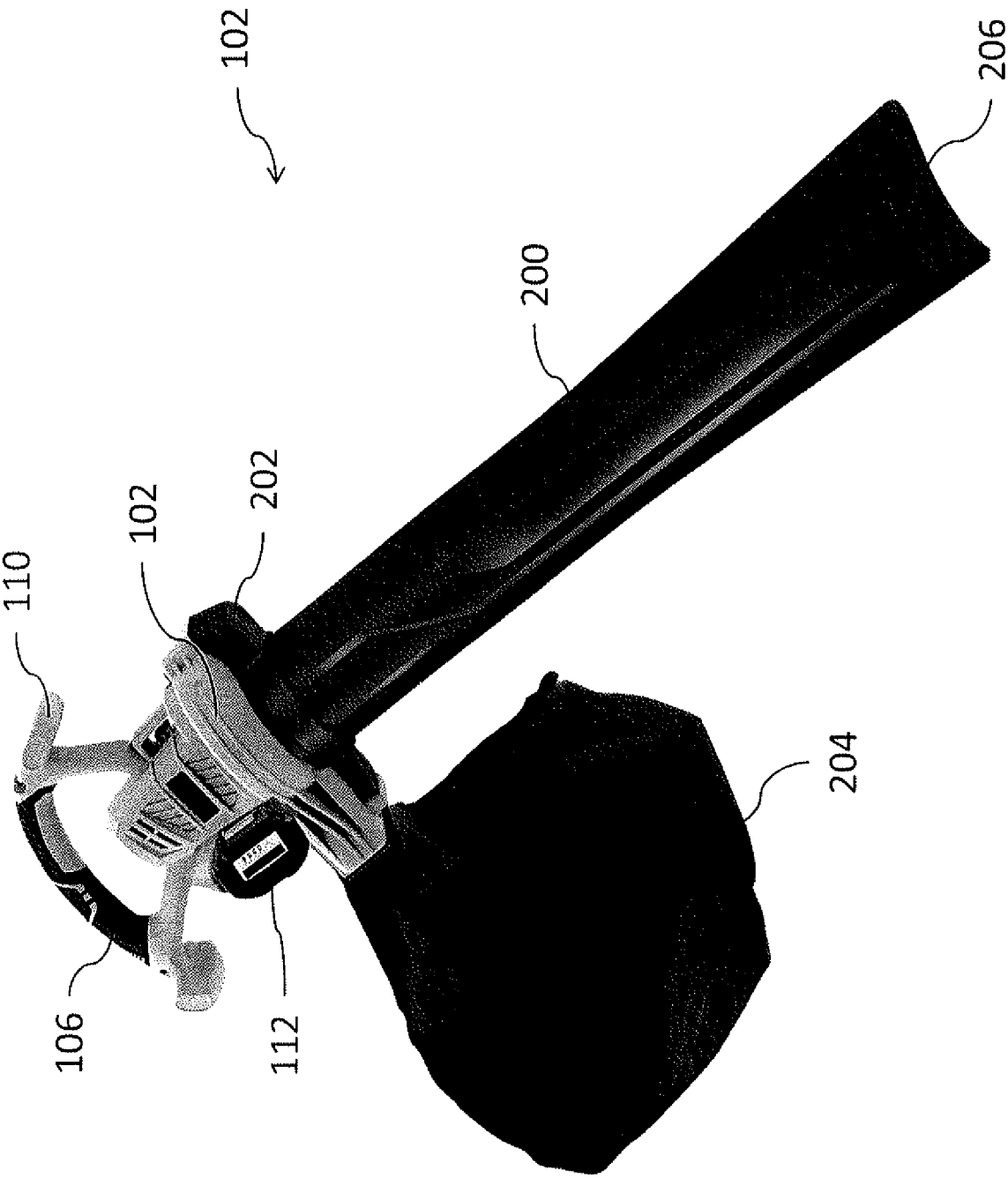


FIGURE 5

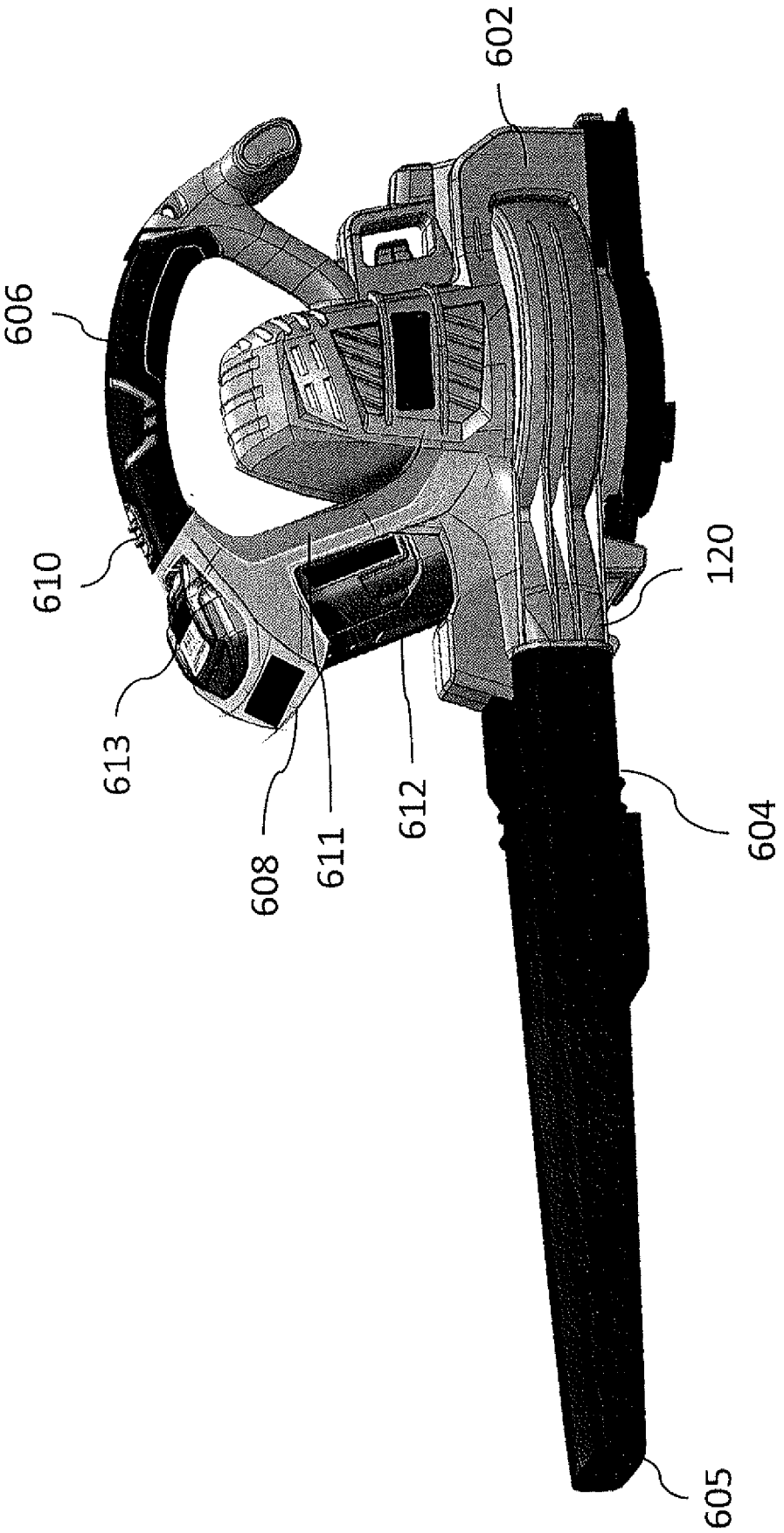


FIGURE 6

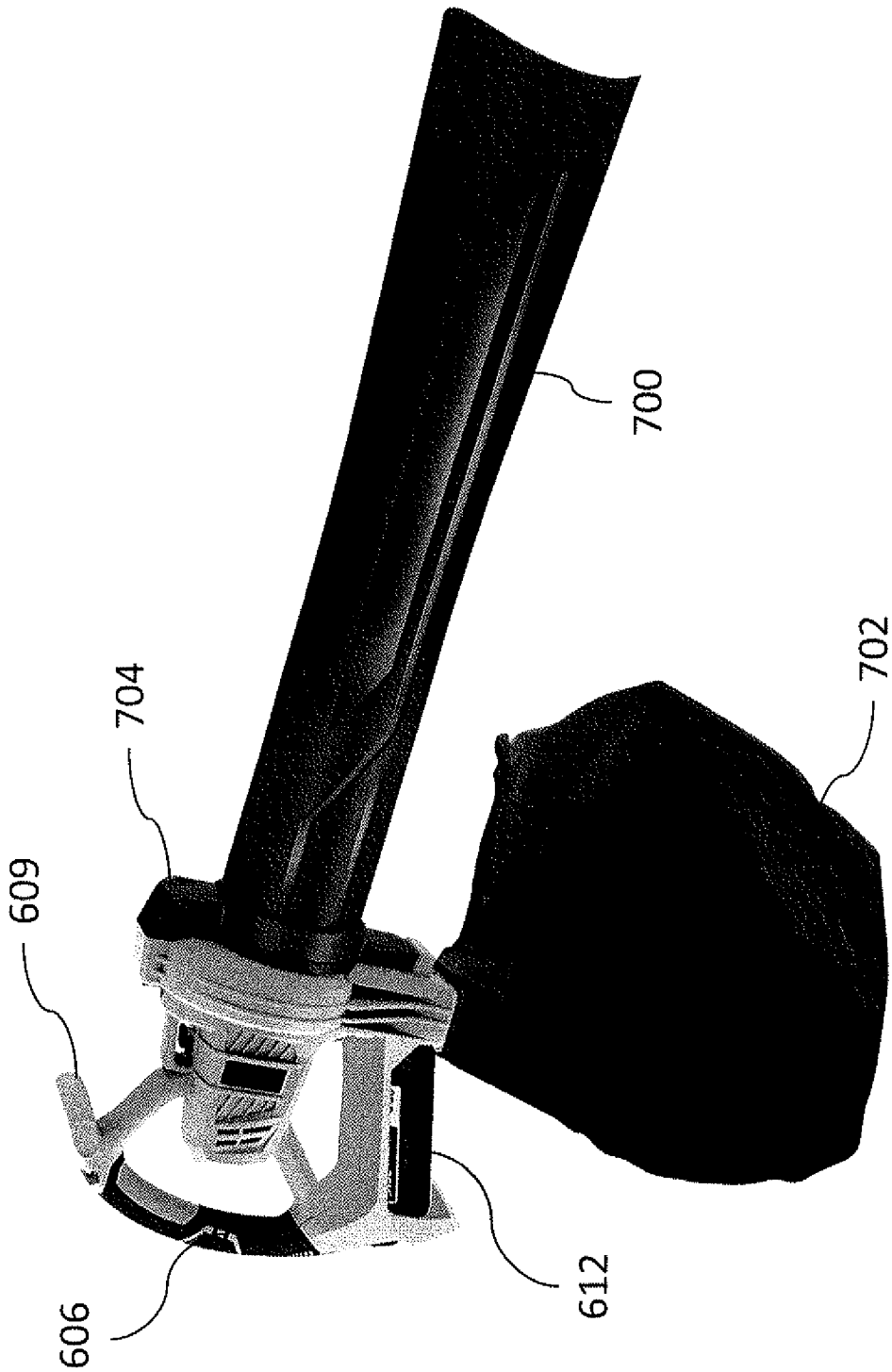


FIGURE 7

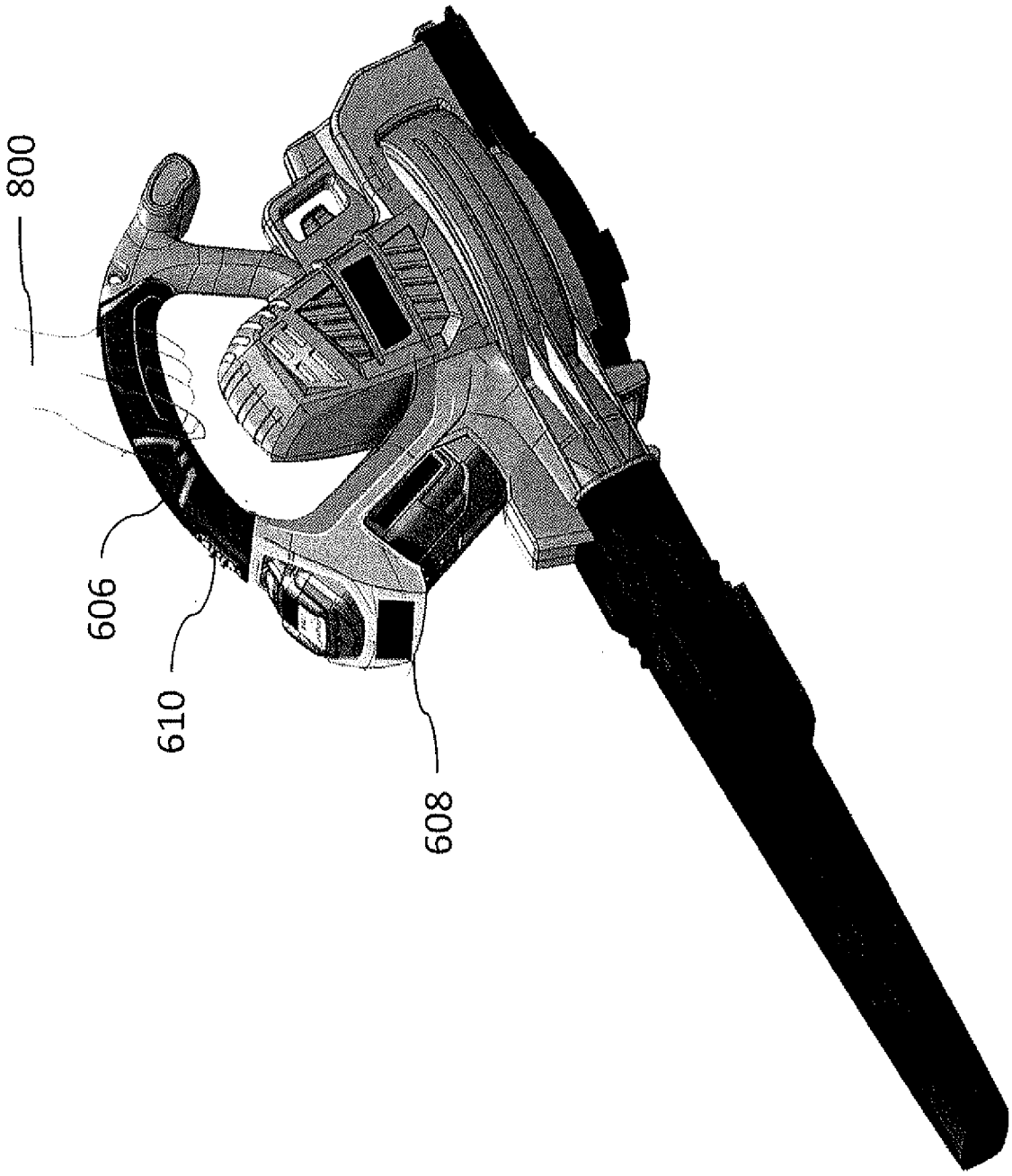


FIGURE 8

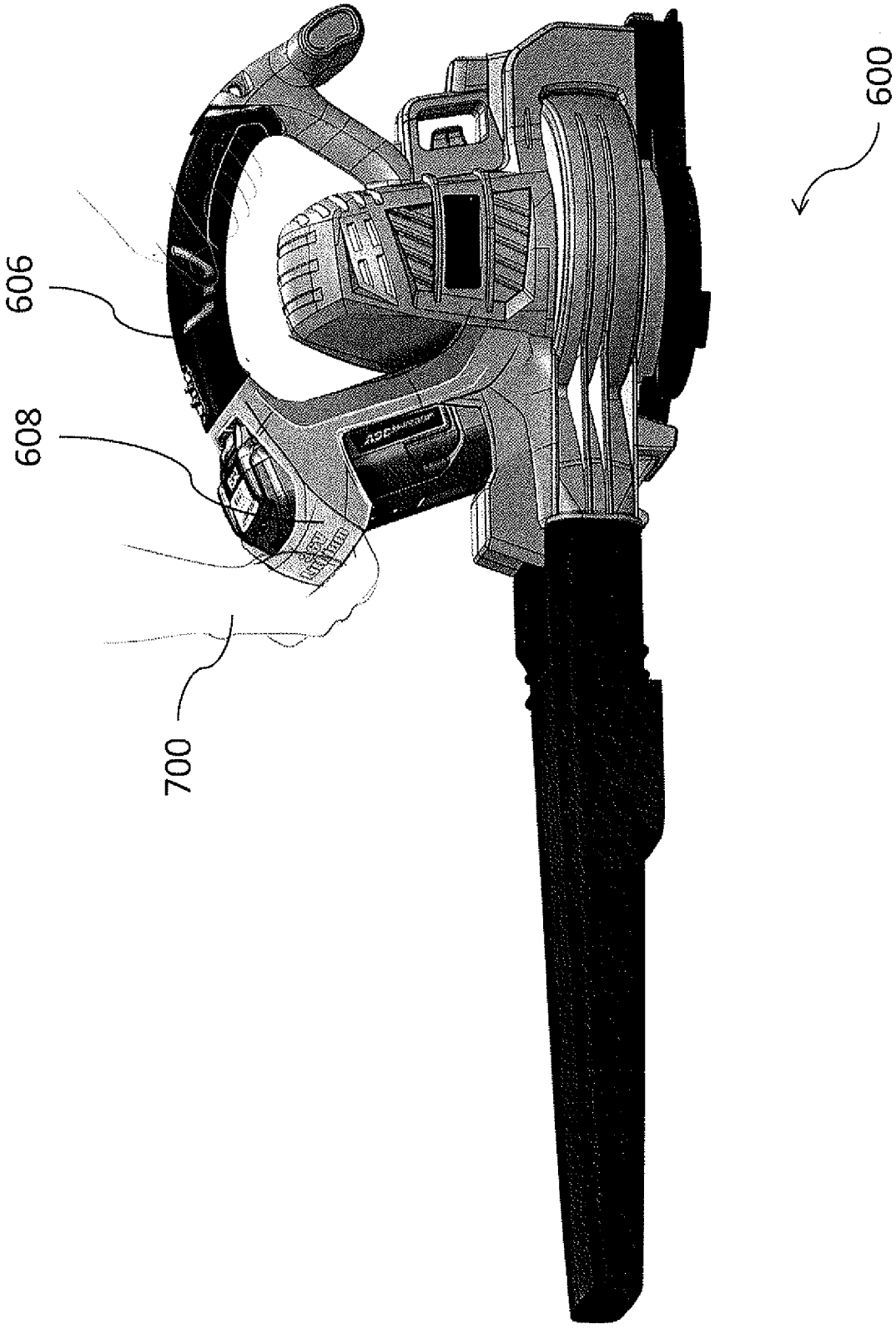


FIGURE 9



FIGURE 10

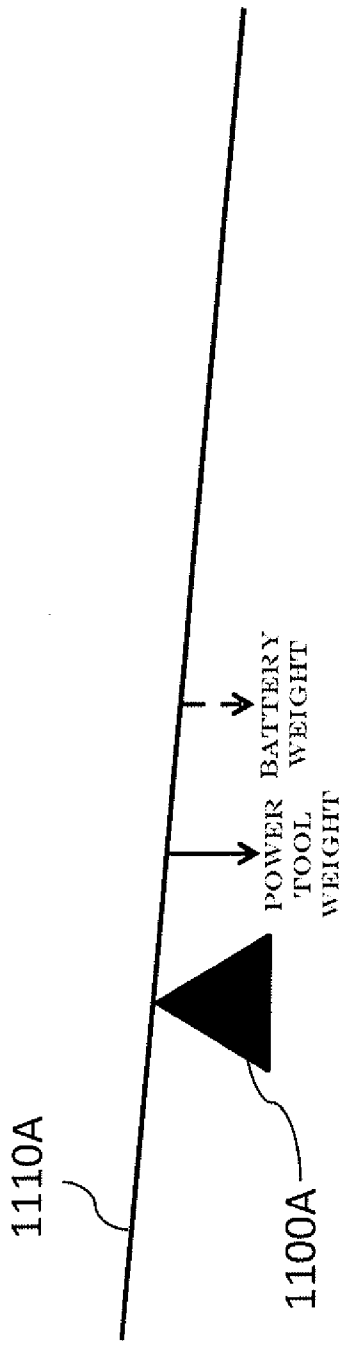


FIGURE 11A

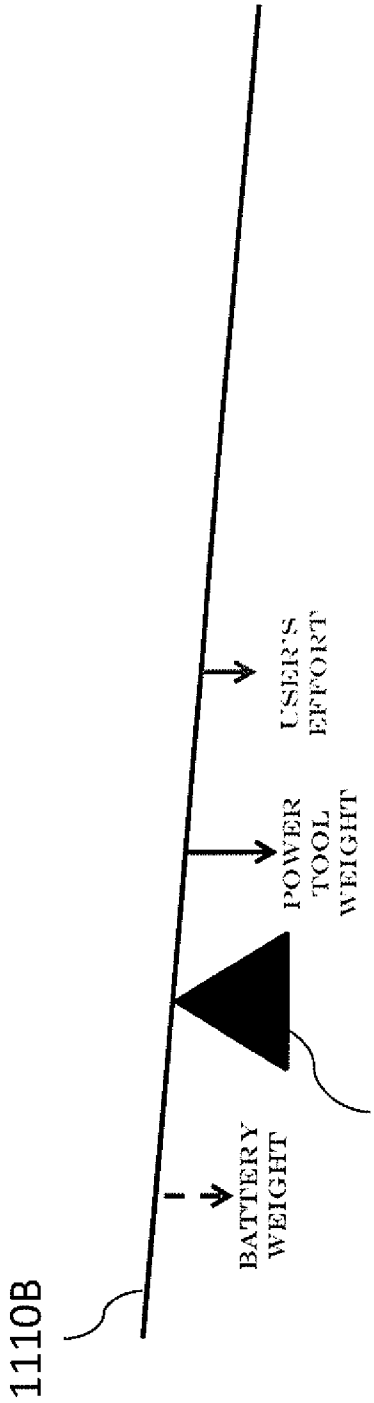


FIGURE 11B

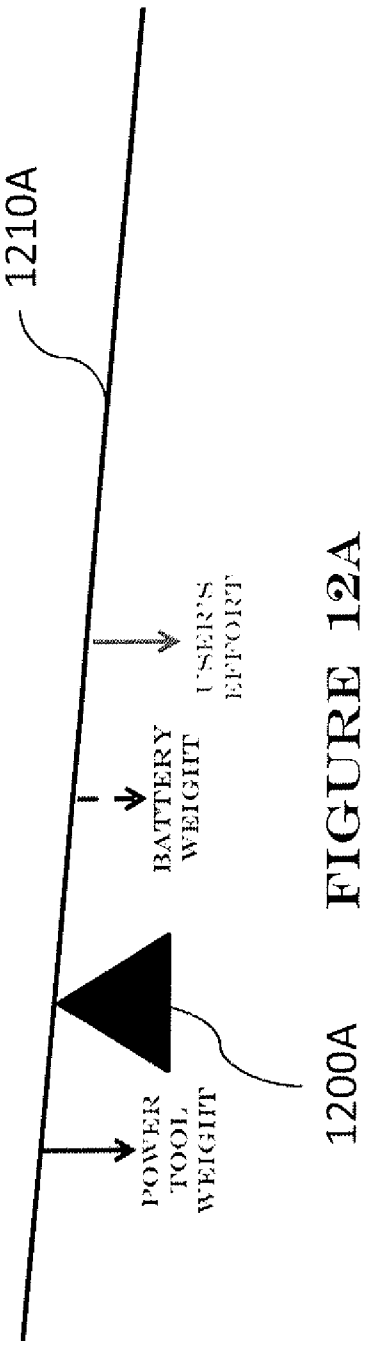


FIGURE 12A

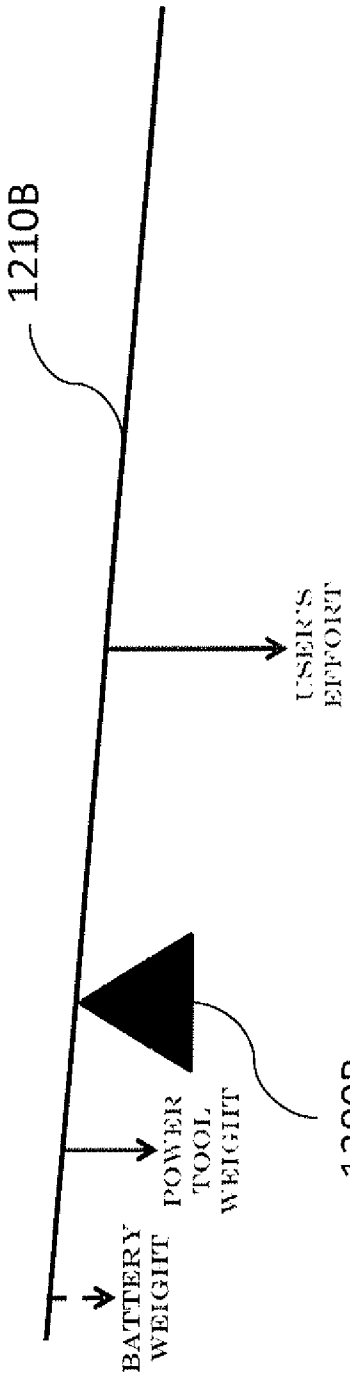


FIGURE 12B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/091958

A. CLASSIFICATION OF SUBJECT MATTER

A47L 5/14(2006.01)i; F04D 25/08(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)

A47L,F04D

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)

EPODOC, WPI, CNPAT, CNKI:cleaner, blower, battery, gravity

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 104154008 A (TECHTRONIC OUTDOOR PROD TECH) 19 November 2014 (2014-11-19) see description, paragraphs [0027] to [0031] and figure 1	1-34
Y	EP 2581011 A1 (BLACK & DECKER INC) 17 April 2013 (2013-04-17) see description, paragraphs [0131] to [0133] and figure 32	1-34
E	CN 204327537 U (TECHTRONIC OUTDOOR PROD TECH) 13 May 2015 (2015-05-13) see embodiment of description and figure 1	1-6, 15-17
A	JP 2004041760 A (MATSUSHITA ELECTRIC IND CO LTD) 12 February 2004 (2004-02-12) see the whole document	1-34

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2015	**29 July 2015**

Name and mailing address of the ISA/CN	Authorized officer
STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China**	**SHU,Hongning**
Facsimile No. **(86-10)62019451**	Telephone No. **(86-10)62085247**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2014/091958

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	104154008	A	19 November 2014	US	2014331444	A1	13 November 2014
				EP	2803260	A1	19 November 2014
				AU	2014202503	A1	27 November 2014
EP	2581011	A1	17 April 2013	CN	103040406	A	17 April 2013
				CA	2791720	A1	12 April 2013
				US	2013091655	A1	18 April 2013
				AU	2012238314	A1	02 May 2013
				US	8595895	B2	03 December 2013
CN	204327537	U	13 May 2015	None			
JP	2004041760	A	12 February 2004	None			