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(54) **SNOW THROWER**

(57) Provided is a snow thrower. The snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for

supporting the snow collection device and the snow throwing device; a walking assembly including walking wheels driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. A working current of the first electric motor is less than or equal to 40 A when the snow collection element works with no load. The snow thrower has relatively high work efficiency.

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Description

TECHNICAL FIELD

[0001] The present application relates to a garden tool and, in particular, to a snow thrower.

BACKGROUND

[0002] A snow thrower in the related art typically includes a snow collection device and a snow throwing device. In the process where the snow thrower works, the snow collection device collects snow on the ground, and then the snow throwing device throws the snow to a specified position. Typically, it is inconvenient to adjust rotational speeds of the snow collection device and the snow throwing device of the snow thrower, which tends to cause a waste of energy and reduce the work efficiency. Nevertheless, rotational speeds of a snow collection device and a snow throwing device of each of some snow throwers are adjustable. However, when a rotational speed of the snow collection device needs to be adjusted, a rotational speed of the snow throwing device also varies accordingly. In this manner, the snow thrower cannot control a snow throwing distance and is more likely to stall.

[0003] This part provides background information related to the present application, and the background information is not necessarily the existing art.

SUMMARY

[0004] An object of the present application is to solve or at least alleviate part or all of the preceding problems. Therefore, an object of the present application is to provide a snow thrower with lower costs and higher energy efficiency.

[0005] To achieve the preceding object, the present application adopts the technical solutions below.

[0006] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. A working current of the first electric motor is less than or equal to 40 A when the snow collection element works with no load.

[0007] In an example, a working current of the second electric motor is less than or equal to 40 A when the snow collection element works with no load.

[0008] In an example, a sum of the working current of the first electric motor and a working current of the second electric motor is less than or equal to 80 A when the snow collection element works with no load.

[0009] In an example, the power supply device includes a battery pack configured to power the first electric motor and/or the second electric motor, and a nominal voltage of the battery pack is higher than or equal to 24 V.

[0010] In an example, the nominal voltage of the battery pack is higher than or equal to 40 V.

[0011] In an example, the snow thrower according further includes a control device configured to adjust a rotational speed of the first electric motor in response to a variation in a load.

[0012] In an example, when the control device adjusts the rotational speed of the first electric motor in response to the variation in the load, a rotational speed of the second electric motor remains constant.

[0013] In an example, when the control device adjusts the rotational speed of the first electric motor in response to the variation in the load, a rotational speed of the second electric motor is kept at a value of a rotational speed corresponding to a set snow throwing distance.

[0014] In an example, the snow collection device further includes a first transmission assembly connected to the first electric motor and the snow collection element.

[0015] In an example, the snow collection device further includes a second transmission assembly connected to the second electric motor and the snow throwing element.

[0016] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. The snow collection device further includes a first transmission assembly disposed between the first electric motor and the snow collection element to transmit power between the first electric motor and the snow collection element. A rotational speed of the first electric motor is higher than or equal to 5000 rpm and lower than or equal to 20000 rpm, and a reduction ratio of the first transmission assembly is higher than or equal to 40 and lower than or equal to 200.

[0017] In an example, a rotational speed of the second electric motor is higher than or equal to 5000 rpm and lower than or equal to 14000 rpm.

[0018] In an example, the snow throwing device further includes a second transmission assembly disposed between the second electric motor and the snow throwing

element to transmit power between the second electric motor and the snow throwing element, and a reduction ratio of the second transmission assembly is higher than or equal to 4 and lower than or equal to 20.

[0019] In an example, the first transmission assembly includes a first gear rotating about a first axis, and a second gear meshing with the first gear and rotating about a second axis.

[0020] In an example, the first axis and the second axis are parallel to each other.

[0021] In an example, the second axis is oblique or perpendicular to the first axis.

[0022] In an example, a diameter of the first electric motor is greater than or equal to 30 mm and less than or equal to 110 mm.

[0023] In an example, a diameter of the second electric motor is greater than or equal to 60 mm and less than or equal to 135 mm.

[0024] In an example, the reduction ratio of the first transmission assembly is higher than or equal to 80 and lower than or equal to 120.

[0025] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. The snow collection device further includes a first transmission assembly disposed between the first electric motor and the snow collection element to transmit power between the first electric motor and the snow collection element. A reduction ratio of the first transmission assembly is higher than or equal to 60 and lower than or equal to 180.

[0026] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; and a walking assembly driving the snow thrower to walk on the ground. When the snow collection element works with no load, a ratio of no-load output power of the second electric motor to no-load output power of the first electric motor is higher than or equal to 0.5 and lower than or equal to 1.5, and the snow thrower further includes a power supply device configured to power the first electric motor and the

second electric motor.

[0027] In an example, the no-load output power of the first electric motor is greater than or equal to 600 W and less than or equal to 2000 W

[0028] In an example, the no-load output power of the second electric motor is greater than or equal to 600 W and less than or equal to 2000 W

[0029] In an example, a sum of the no-load output power of the first electric motor and the no-load output power of the second electric motor is greater than or equal to 1200 W and less than or equal to 4000 W

[0030] In an example, maximum load power of the second electric motor is greater than or equal to 4000 W.

[0031] In an example, the snow thrower further includes: a control device configured to adjust a ratio of load output power of the second electric motor to load output power of the first electric motor according to a load.

[0032] In an example, a ratio of load output power of the second electric motor to load output power of the first electric motor is different from the ratio of the no-load output power of the second electric motor to the no-load output power of the first electric motor.

[0033] In an example, a ratio of load output power of the second electric motor to load output power of the first electric motor is higher than the ratio of the no-load output power of the second electric motor to the no-load output power of the first electric motor.

[0034] In an example, a diameter of the first electric motor is greater than or equal to 30 mm and less than or equal to 110 mm.

[0035] In an example, a diameter of the second electric motor is greater than or equal to 60 mm and less than or equal to 135 mm.

[0036] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. The snow throwing device further includes: a discharge chute for guiding a snow throwing direction; and a snow throwing cap connected to the discharge chute to guide a snow throwing height. A distance between a position where the snow is guided by the snow throwing device to fall on the ground and a central axis of the discharge chute is defined as a snow throwing distance, and a maximum snow throwing distance that the snow thrower is capable of reaching is greater than or equal to 10 m and less than or equal to 21 m.

[0037] In an example, the snow thrower further includes a control device configured to adjust a rotational speed of the first electric motor according to a load.

[0038] In an example, when the control device adjusts the rotational speed of the first electric motor according to a variation in the load, a rotational speed of the second electric motor does not vary with a variation in the rotational speed of the first electric motor.

[0039] In an example, when the control device adjusts the rotational speed of the first electric motor according to a variation in the load, a rotational speed of the second electric motor is kept at a value of a rotational speed corresponding to a set snow throwing distance.

[0040] In an example, the snow thrower further includes: an operation member operated by a user to adjust a rotational speed of the second electric motor to adjust the snow throwing distance.

[0041] In an example, the snow throwing device further includes a transmission assembly disposed between the second electric motor and the snow throwing element to transmit power between the second electric motor and the snow throwing element.

[0042] In an example, a maximum rotational speed of the snow throwing element is higher than or equal to 500 rpm and lower than or equal to 2000 rpm.

[0043] In an example, when the snow collection element works with no load, a ratio of no-load output power of the second electric motor to no-load output power of the first electric motor is higher than or equal to 0.5 and lower than or equal to 1.5.

[0044] In an example, a ratio of load output power of the second electric motor to load output power of the first electric motor is different from a ratio of no-load output power of the second electric motor to no-load output power of the first electric motor.

[0045] In an example, a ratio of load output power of the second electric motor to load output power of the first electric motor is higher than a ratio of no-load output power of the second electric motor to no-load output power of the first electric motor.

[0046] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a main housing for supporting the snow collection device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor. The snow collection element rotates about a rotation axis, a coordinate system using a point on the rotation axis of the snow collection element as an origin, a front and rear direction as an X-axis, and an up and down direction as a Y-axis is established, a forward direction is a positive direction of the X-axis, an upward direction is a positive direction of the Y-axis, a projection of the first electric motor on a plane where the coordinate system is located is within an angular region using the origin as a vertex and located in the plane where the coordinate system is located, a first side of the angular region is within a first quadrant of the coordinate system and an included angle between the first side of the angular region and the positive direction of the Y-axis is less than or

equal to 60 degrees, and a second side of the angular region is within a second quadrant of the coordinate system and an included angle between the second side of the angular region and the positive direction of the Y-axis is less than or equal to 80 degrees.

[0047] In an example, the projection of the first electric motor on the plane where the coordinate system is located is within a circular region using the origin as a center of a circle and located in the plane where the coordinate system is located, and a radius of the circular region is less than or equal to 0.7 m.

[0048] In an example, the first side of the angular region is within the first quadrant of the coordinate system and the included angle between the first side of the angular region and the positive direction of the Y-axis is less than or equal to 30 degrees, and the second side of the angular region is within the second quadrant of the coordinate system and the included angle between the second side of the angular region and the positive direction of the Y-axis is less than or equal to 60 degrees.

[0049] In an example, the first electric motor is disposed on an upper side of the snow collection element.

[0050] In an example, the first electric motor is disposed above the rotation axis of the snow collection element.

[0051] In an example, the main housing includes a snow collection cover for mounting the snow collection element, wherein the snow collection cover includes a top wall and two sidewalls disposed on two sides of the top wall one to one, and a projection of the first electric motor on a plane perpendicular to the front and rear direction is between projections of the two sidewalls on the plane perpendicular to the front and rear direction.

[0052] In an example, the main housing includes a snow collection cover for mounting the snow collection element, wherein the snow collection cover includes a top wall and two sidewalls disposed on two sides of the top wall one to one, and the first electric motor is at least partially disposed on an upper side of the top wall.

[0053] In an example, the main housing further includes a first electric motor housing formed with a first accommodation space for accommodating the first electric motor, and the first electric motor housing is mounted on the upper side of the top wall.

[0054] In an example, the snow thrower further includes a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate. The first electric motor is disposed on a front side of the second electric motor in the front and rear direction.

[0055] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device,

a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; and a power supply device configured to power the first electric motor and the second electric motor. The main housing includes a snow collection cover for mounting the snow collection element, wherein the snow collection cover includes a top wall and two sidewalls disposed on two sides of the top wall one to one, and the first electric motor is at least partially disposed on an upper side of the top wall.

[0056] In an example, a snow thrower includes a snow collection device including a snow collection element for collecting snow; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device; a main housing used for supporting the snow collection device and the snow throwing device and further including a snow collection cover for mounting the snow collection element; a walking assembly driving the snow thrower to walk on the ground; and a detection device including a first detection assembly configured to detect a state of snow on a left side of the snow collection cover and a second detection assembly configured to detect a state of snow on a right side of the snow collection cover.

[0057] In an example, the first detection assembly includes a first detection element that is capable of being driven by snow in front of the snow thrower or snow on a left side of the snow thrower to be displaced.

[0058] In an example, the first detection element is configured to be rotatable relative to the main housing, and a size of a rotation angle of the first detection element varies with a variation in a thickness of the snow.

[0059] In an example, the first detection assembly further includes a first sensor detecting the displacement of the first detection element.

[0060] In an example, the first detection assembly is at least partially disposed on an outer side of the main housing.

[0061] In an example, the snow collection cover includes a top wall and a first sidewall and a second sidewall that are disposed on two sides of the top wall, respectively, and the first detection assembly is mounted to the first sidewall.

[0062] In an example, the first detection assembly is at least partially disposed on an outer side of the first sidewall to detect a thickness of snow on the outer side of the first sidewall.

[0063] In an example, the second detection assembly is disposed on the second sidewall.

[0064] In an example, the detection device further includes a control device configured to adjust a movement state of the snow thrower according to a state of snow detected by the detection device, and the control device acquires a current state parameter of the snow according to a state parameter of the left-side snow detected by the

first detection assembly and a state parameter of the right-side snow detected by the second detection assembly.

[0065] In an example, a snow blower includes: a snow collection device including a snow collection element for collecting snow; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; a detection device including a first detection assembly configured to detect a state of snow and a second detection assembly configured to detect a state of snow; and a control device configured to acquire a current state parameter of the snow according to a state parameter of the snow detected by the first detection assembly and/or a state parameter of the snow detected by the second detection assembly and control a movement state of the snow thrower according to the current state parameter of the snow.

[0066] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; a power supply device configured to power the first electric motor and the second electric motor; and a control device configured to control a rotational speed of the first electric motor according to at least a state of the snow and a walking speed of the walking assembly.

[0067] In an example, when the state of the snow remains constant, a higher walking speed of the walking assembly indicates a higher rotational speed of the first electric motor.

[0068] In an example, the state of the snow includes a thickness of the snow and/or a density of the snow, and when the walking speed of the walking assembly remains constant, a greater thickness of the snow and/or a higher density of the snow indicates a higher rotational speed of the first electric motor.

[0069] In an example, the state of the snow includes a thickness of the snow and/or a density of the snow.

[0070] In an example, the snow thrower further includes: a memory storing a mapping relationship among the state of the snow, the walking speed of the walking assembly, and the rotational speed of the first electric motor. After acquiring the state of the snow and the walking speed, the control device acquires the rotational speed of the first electric motor according to the mapping relationship.

[0071] In an example, the mapping relationship includes a relationship table and/or a relationship function.

[0072] In an example, when the control device controls the rotational speed of the first electric motor, a rotational speed of the second electric motor does not vary with a variation in the rotational speed of the first electric motor.

[0073] In an example, when the control device controls the rotational speed of the first electric motor to vary, the control device controls a rotational speed of the second electric motor to remain constant.

[0074] In an example, the snow thrower further includes a detection device configured to detect the state of the snow.

[0075] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; a power supply device configured to power the first electric motor and the second electric motor; and a control device configured to control a rotational speed of the first electric motor according to at least a walking speed of the walking assembly.

[0076] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; a power supply device configured to power the first electric motor and the second electric motor; and a control device configured to control a walking speed of the walking assembly and a rotational speed of the first electric motor according to at least a state of the snow.

[0077] In an example, the snow thrower further includes a memory storing a mapping relationship among the state of the snow, the walking speed of the walking assembly, and the rotational speed of the first electric motor. After acquiring the state of the snow, the control device acquires the walking speed of the walking assembly and the rotational speed of the first electric motor according to the mapping relationship.

[0078] In an example, the mapping relationship includes a relationship table and/or a relationship function.

[0079] In an example, when the control device controls the rotational speed of the first electric motor, a rotational speed of the second electric motor does not vary with a variation in the rotational speed of the first electric motor.

[0080] In an example, when the control device controls

the rotational speed of the first electric motor to vary, the control device controls a rotational speed of the second electric motor to remain constant.

[0081] In an example, the snow thrower further includes a detection device configured to detect the state of the snow.

[0082] In an example, the control device is configured to adjust the rotational speed of the first electric motor according to the state of the snow and then control the walking speed of the walking assembly according to the state of the snow and the rotational speed of the first electric motor.

[0083] In an example, when a state parameter of the snow is greater than a first preset value, the rotational speed of the first electric motor is kept at a first constant rotational speed value.

[0084] In an example, when the state parameter of the snow is less than the first preset value, the rotational speed of the first electric motor is lower than the first constant rotational speed value.

[0085] In an example, when the state parameter of the snow is greater than the first preset value, the walking speed of the walking assembly remains decreasing gradually as the state parameter of the snow increases.

[0086] In an example, when the state parameter of the snow is less than the first preset value, the walking speed of the walking assembly is kept at a second constant rotational speed value.

[0087] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground; a power supply device configured to power the first electric motor and the second electric motor; and a control device configured to control a walking speed of the walking assembly according to at least a state of the snow. When a state parameter of the snow is less than a preset value, the walking speed of the walking assembly is kept at a constant rotational speed value, and when the state parameter of the snow is greater than the preset value, the walking speed of the walking assembly is lower than the constant rotational speed value.

[0088] In an example, a snow thrower includes: a snow collection device including a snow collection element for collecting snow and a first electric motor configured to drive the snow collection element to rotate; a snow throwing device including a snow throwing element for throwing out the snow collected by the snow collection device, a discharge chute guiding a snow throwing direction, and a second electric motor driving the snow throwing element to rotate; a main housing for supporting the snow

collection device and the snow throwing device; a walking assembly driving the snow thrower to walk on the ground and further including a walking electric motor; a mode setting member configured to be operated by a user to set a working mode of the snow thrower; and a control device connected to the mode setting member. The mode setting member is at least capable of causing the snow thrower to enter a first working mode and a second working mode, wherein when the snow thrower is in the first working mode, the control device controls the walking electric motor to run at a first preset rotational speed and controls the first electric motor to run at a second preset rotational speed, and when the snow thrower is in the second working mode, the control device controls the walking electric motor to run at a third preset rotational speed and controls the first electric motor to run at a fourth preset rotational speed. The third preset rotational speed is different from the first preset rotational speed, or the fourth preset rotational speed is different from the second preset rotational speed.

[0089] In an example, the third preset rotational speed is different from the first preset rotational speed, and the fourth preset rotational speed is different from the second preset rotational speed.

[0090] In an example, the mode setting member is further configured to be capable of causing the snow thrower to enter a third working mode, wherein when the snow thrower is in the third working mode, the control device controls the walking electric motor to run at a fifth preset rotational speed and controls the first electric motor to run at a sixth preset rotational speed.

[0091] In an example, when the control device controls a rotational speed of the first electric motor, a rotational speed of the second electric motor does not vary with a variation in the rotational speed of the first electric motor.

[0092] In an example, when the control device controls a rotational speed of the first electric motor to vary, the control device controls a rotational speed of the second electric motor to remain constant.

[0093] In an example, a first mark corresponding to the first working mode is further provided on the main housing.

[0094] In an example, the first mark is configured to be used by the user to observe whether a thickness of the snow reaches a position of the first mark so as to operate the mode setting member to switch the snow thrower to the first working mode.

[0095] In an example, the main housing further includes a snow collection cover, and the first mark is provided on the snow collection cover at a first height from the ground.

[0096] In an example, a second mark corresponding to the second working mode is further provided on a snow collection cover.

[0097] In an example, a snow thrower includes: a snow removal device configured to clear snow on the ground; and a main housing for supporting the snow removal device. The snow thrower further includes: a power unit

configured to drive the snow removal device to move and including at least one electric motor; a power supply device configured to power the at least one electric motor and including at least one battery pack; a first-stage snow removal assembly including a first snow removal blade and a first mounting shaft for mounting the first snow removal blade; a second-stage snow removal assembly including a second snow removal blade and a second mounting shaft for mounting the second snow removal blade; and a third-stage snow removal assembly including a third snow removal blade and a third mounting shaft for mounting the third snow removal blade. The main housing includes a battery compartment, the at least one battery pack is detachably disposed in the battery compartment, and a ratio of total energy of the at least one battery pack to a number of stages of snow removal assemblies in the snow removal device is higher than or equal to 45 Wh and lower than or equal to 1000 Wh.

[0098] In an example, the power supply device includes a plurality of battery packs, and a ratio of a number of the plurality of battery packs to the number of stages of the snow removal assemblies in the snow removal device is higher than or equal to 1:3 and lower than or equal to 6:3.

[0099] In an example, the total energy of the at least one battery pack is greater than or equal to 140 Wh.

[0100] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly and a third electric motor driving the third-stage snow removal assembly.

[0101] In an example, the first electric motor is further configured to drive the second-stage snow removal assembly.

[0102] In an example, the third electric motor is further configured to drive the second-stage snow removal assembly.

[0103] In an example, the at least one electric motor includes a third electric motor driving the third-stage snow removal assembly and the first-stage snow removal assembly and a second electric motor driving the second-stage snow removal assembly.

[0104] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly, a second electric motor driving the second-stage snow removal assembly, and a third electric motor driving the third-stage snow removal assembly.

[0105] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly and/or the second-stage snow removal assembly and a third electric motor driving the third-stage snow removal assembly, wherein load output power of the third electric motor is greater than load output power of the first electric motor.

[0106] In an example, the first mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the first snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0107] In an example, the second mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the second snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0108] In an example, a snow thrower includes: a snow removal device configured to clear snow on the ground; and a main housing for supporting the snow removal device. The snow thrower further includes: a power unit configured to drive the snow removal device to move and including at least one electric motor; and a power supply device configured to power the at least one electric motor and including at least one battery pack. The snow removal device includes: a first-stage snow removal assembly including a first snow removal blade and a first mounting shaft for mounting the first snow removal blade; a second-stage snow removal assembly including a second snow removal blade and a second mounting shaft for mounting the second snow removal blade; and a third-stage snow removal assembly including a third snow removal blade and a third mounting shaft for mounting the third snow removal blade. The main housing includes a battery compartment, the at least one battery pack is detachably disposed in the battery compartment, the main housing further includes a snow collection cover formed with an opening that opens forwards, the snow collection cover includes a left sidewall and a right sidewall, and a ratio of total energy of the at least one battery pack to a distance between the left sidewall and the right sidewall is higher than or equal to 175 Wh/m and lower than or equal to 5500 Wh/m.

[0109] In an example, the distance between the left sidewall and the right sidewall is greater than or equal to 550 mm.

[0110] In an example, the at least one electric motor includes a first electric motor driving at least one stage of a snow removal assembly in the snow removal device and a second electric motor driving at least another stage of a snow removal assembly in the snow removal device.

[0111] In an example, the at least one electric motor includes a first electric motor driving two stages of snow removal assemblies in the snow removal device and a second electric motor driving another stage of a snow removal assembly in the snow removal device.

[0112] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly, a second electric motor driving the second-stage snow removal assembly, and a third electric motor driving the third-stage snow removal assembly.

[0113] In an example, battery lifetime of the snow thrower bearing no load is longer than or equal to 10 min.

[0114] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly and/or the second-stage snow removal assembly and a third electric motor driving the third-stage snow removal assembly, wherein load output power of the third electric motor is greater than load output power of the first electric motor.

[0115] In an example, the first mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the first snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0116] In an example, the second mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the second snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0117] In an example, the at least one battery pack includes two battery packs, and the two battery packs are disposed in the battery compartment in a pluggable manner.

[0118] In an example, a snow thrower includes: a snow removal device configured to clear snow on the ground; and a main housing for supporting the snow removal device. The snow thrower further includes: a power unit configured to drive the snow removal device to move and including at least one electric motor; a power supply device configured to power the at least one electric motor and including at least one battery pack; and a discharge chute assembly mounted to the main housing and used for guiding a snow throwing direction. The snow removal device includes: a first-stage snow removal assembly including a first snow removal blade and a first mounting shaft for mounting the first snow removal blade; a second-stage snow removal assembly including a second snow removal blade and a second mounting shaft for mounting the second snow removal blade; and a third-stage snow removal assembly including a third snow removal blade and a third mounting shaft for mounting the third snow removal blade. The main housing includes a battery compartment, the at least one battery pack is detachably disposed in the battery compartment, a distance between a position where the snow is guided by the discharge chute assembly to fall on the ground and a central axis of the discharge chute assembly is defined as a snow throwing distance, and a maximum snow throwing distance that the snow thrower is capable of reaching is greater than or equal to 8 m and less than or equal to 20 m.

[0119] In an example, total energy of the at least one battery pack is greater than or equal to 140 Wh.

[0120] In an example, a nominal voltage of the at least one battery pack is higher than or equal to 24 V.

[0121] In an example, a ratio of the maximum snow throwing distance to a number of electric motors configured to drive the snow removal device is higher than or equal to 2.5 m and lower than or equal to 10 m.

[0122] In an example, the at least one electric motor includes a first electric motor driving at least one stage of a snow removal assembly in the snow removal device and a second electric motor driving at least another stage of a snow removal assembly in the snow removal device.

[0123] In an example, the at least one electric motor includes a first electric motor driving two stages of snow removal assemblies in the snow removal device and a

second electric motor driving another stage of a snow removal assembly in the snow removal device.

[0124] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly, a second electric motor driving the second-stage snow removal assembly, and a third electric motor driving the third-stage snow removal assembly.

[0125] In an example, the at least one electric motor includes a first electric motor driving the first-stage snow removal assembly and/or the second-stage snow removal assembly and a third electric motor driving the third-stage snow removal assembly, wherein load output power of the third electric motor is greater than load output power of the first electric motor.

[0126] In an example, the first mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the first snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0127] In an example, the second mounting shaft extends along a left and right direction, and a ratio of a rotational speed of the third snow removal blade to a rotational speed of the second snow removal blade is higher than or equal to 6 and lower than or equal to 18.

[0128] In an example, a snow thrower includes: a snow removal device configured to clear snow on the ground; and a main housing for supporting the snow removal device. The snow thrower further includes: a power unit configured to drive the snow removal device to move; and a power supply device configured to power the power unit. The snow removal device includes: a first-stage snow removal assembly including a first snow removal blade and a first mounting shaft for mounting the first snow removal blade; a second-stage snow removal assembly including a second snow removal blade and a second mounting shaft for mounting the second snow removal blade; and a third-stage snow removal assembly including a third snow removal blade and a third mounting shaft for mounting the third snow removal blade. The power unit includes: a first electric motor configured to drive at least one of the first-stage snow removal assembly, the second-stage snow removal assembly, and the third-stage snow removal assembly; and a second electric motor configured to drive at least another one of the first-stage snow removal assembly, the second-stage snow removal assembly, and the third-stage snow removal assembly.

[0129] In an example, the power supply device includes at least one battery pack configured to power the first electric motor and the second electric motor.

[0130] In an example, the first electric motor drives the first-stage snow removal assembly, and the second electric motor drives the second-stage snow removal assembly and the third-stage snow removal assembly.

[0131] In an example, the first mounting shaft extends along a left and right direction, and the snow thrower further includes a first reduction assembly connected to the first electric motor and the first mounting shaft.

[0132] In an example, a reduction ratio of the first reduction assembly is higher than or equal to 80 and lower than or equal to 120.

[0133] In an example, the second mounting shaft is coaxial with the third mounting shaft.

[0134] In an example, the third mounting shaft extends along a front and rear direction, and the snow thrower further includes a second reduction assembly connected to the second electric motor and the third mounting shaft.

[0135] In an example, a reduction ratio of the second reduction assembly is higher than or equal to 4 and lower than or equal to 20.

[0136] In an example, the first electric motor drives the first-stage snow removal assembly and the second-stage snow removal assembly, and the second electric motor drives the third-stage snow removal assembly.

[0137] In an example, the first electric motor is disposed on an upper side of the first-stage snow removal assembly.

[0138] In an example, the snow thrower further includes a first reduction assembly for transmitting power between the first electric motor and the first-stage snow removal assembly.

[0139] In an example, the first mounting shaft extends along a front and rear direction, the second mounting shaft extends along a left and right direction, the first-stage snow removal assembly includes two first snow removal blades, one of the two first snow removal blades is disposed on a front side of the second mounting shaft, and another one of the two first snow removal blades is disposed on a rear side of the second mounting shaft.

[0140] In an example, the first electric motor drives the first-stage snow removal assembly, the second electric motor drives the second-stage snow removal assembly, and the snow thrower further includes a third electric motor driving the third-stage snow removal assembly.

[0141] The present application has the following benefits: the snow thrower has higher work efficiency, a lower energy loss, and the lower costs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0142]

FIG. 1 is a perspective view of a snow thrower in an example of the present application;

FIG. 2 is a plan view of the snow thrower in FIG. 1;

FIG. 3 is a front view of the snow thrower in FIG. 1;

FIG. 4 is a perspective view of the snow thrower in FIG. 1 with a main housing removed;

FIG. 5 is a top view of the structure shown in FIG. 4;

FIG. 6 is a plan view of a walking assembly, a snow collection device, and a snow throwing device of the

snow thrower in FIG. 1;

FIG. 7 is a perspective view of the structure shown in FIG. 6;

FIG. 8 is a perspective view of a snow collection device, a snow throwing device, and part of a main housing of the snow thrower in FIG. 1;

FIG. 9 is a perspective view of the structure shown in FIG. 8 from another viewing angle;

FIG. 10 is a plan view of the structure shown in FIG. 8;

FIG. 11 is a schematic diagram showing the connection among some modules of the snow thrower in FIG. 1;

FIG. 12 is a graph showing variations in bus currents of a first electric motor and a second electric motor of the snow thrower in FIG. 1;

FIGS. 13A and 13B are example tables showing rotational speeds of rotary elements of the snow thrower in FIG. 1 at different thicknesses of snow;

FIG. 14 is a control flowchart of the snow thrower in FIG. 1;

FIG. 15 is another example table showing rotational speeds of rotary elements of the snow thrower in FIG. 1 at different thicknesses of snow;

FIGS. 16A to 16C are graphs showing the relationships between a working condition of the snow thrower in FIG. 1 and the thickness of snow, a walking speed, a snow intake during a walk, and the amount of collected snow of a snow collection element;

FIG. 17 is another control flowchart of the snow thrower in FIG. 1;

FIG. 18 is a plan view of the snow thrower in FIG. 1 with a detection element rotating by a certain angle;

FIG. 19 is a plan view of a snow thrower in another example of the present application;

FIG. 20 is a plan view of a snow thrower in another example of the present application;

FIG. 21 is a schematic diagram showing the connection among some modules of the snow thrower in FIG. 20;

FIG. 22 is an example table showing the relationship between a working condition of the snow thrower in

FIG. 20 and the thickness of snow, a walking speed, and the like;

FIG. 23 is a perspective view of a snow thrower in an example of the present application;

FIG. 24 is a plan view of a power unit, a snow removal device, and a walking assembly of the snow thrower in FIG. 23;

FIG. 25 is a perspective view of a snow removal device and part of a main housing in FIG. 23;

FIG. 26 is a module control diagram of the snow thrower in FIG. 23;

FIG. 27 is another module control diagram of the snow thrower in FIG. 23;

FIG. 28 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 29 is a plan view of the structure shown in FIG. 28;

FIG. 30 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 31 is a plan view of the structure shown in FIG. 30;

FIG. 32 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 33 is a plan view of the structure shown in FIG. 32;

FIG. 34 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 35 is a plan view of the structure shown in FIG. 34;

FIG. 36 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 37 is a plan view of the structure shown in FIG. 36;

FIG. 38 is a perspective view of a power unit, a snow removal device, and part of a main housing in a snow thrower in another example;

FIG. 39 is a perspective view of the structure shown in FIG. 38 from another viewing angle;

FIG. 40 is a perspective view of the power unit and the snow removal device in FIG. 38;

FIG. 41 is a plan view of the structure shown in FIG. 40;

FIG. 42 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 43 is a plan view of the structure shown in FIG. 42;

FIG. 44 is a perspective view of a power unit and a snow removal device in a snow thrower in another example;

FIG. 45 is a plan view of the structure shown in FIG. 44.

DETAILED DESCRIPTION

[0143] Before any examples of this application are explained in detail, it is to be understood that this application is not limited to its application to the structural details and the arrangement of components set forth in the following description or illustrated in the above drawings.

[0144] In this application, the terms "comprising", "including", "having" or any other variation thereof are intended to cover an inclusive inclusion such that a process, method, article or device comprising a series of elements includes not only those series of elements, but also other elements not expressly listed, or elements inherent in the process, method, article, or device. Without further limitations, an element defined by the phrase "comprising a ..." does not preclude the presence of additional identical elements in the process, method, article, or device comprising that element.

[0145] In this application, the term "and/or" is a kind of association relationship describing the relationship between associated objects, which means that there can be three kinds of relationships. For example, A and/or B can indicate that A exists alone, A and B exist simultaneously, and B exists alone. In addition, the character "/" in this application generally indicates that the contextual associated objects belong to an "and/or" relationship.

[0146] In this application, the terms "connection", "combination", "coupling" and "installation" may be direct connection, combination, coupling or installation, and may also be indirect connection, combination, coupling or installation. Among them, for example, direct connection means that two members or assemblies are connected together without intermediaries, and indirect connection means that two members or assemblies are respectively connected with at least one intermediate

members and the two members or assemblies are connected by the at least one intermediate members. In addition, "connection" and "coupling" are not limited to physical or mechanical connections or couplings, and may include electrical connections or couplings.

[0147] In this application, it is to be understood by those skilled in the art that a relative term (such as "about", "approximately", and "substantially") used in conjunction with quantity or condition includes a stated value and has a meaning dictated by the context. For example, the relative term includes at least a degree of error associated with the measurement of a particular value, a tolerance caused by manufacturing, assembly, and use associated with the particular value, and the like. Such relative term should also be considered as disclosing the range defined by the absolute values of the two end-points. The relative term may refer to plus or minus of a certain percentage (such as 1%, 5%, 10%, or more) of an indicated value. A value that did not use the relative term should also be disclosed as a particular value with a tolerance. In addition, "substantially" when expressing a relative angular position relationship (for example, substantially parallel, substantially perpendicular), may refer to adding or subtracting a certain degree (such as 1 degree, 5 degrees, 10 degrees or more) to the indicated angle.

[0148] In this application, those skilled in the art will understand that a function performed by an assembly may be performed by one assembly, multiple assemblies, one member, or multiple members. Likewise, a function performed by a member may be performed by one member, an assembly, or a combination of members.

[0149] In this application, the terms "up", "down", "left", "right", "front", and "rear" and other directional words are described based on the orientation or positional relationship shown in the drawings, and should not be understood as limitations to the examples of this application. In addition, in this context, it also needs to be understood that when it is mentioned that an element is connected "above" or "under" another element, it can not only be directly connected "above" or "under" the other element, but can also be indirectly connected "above" or "under" the other element through an intermediate element. It should also be understood that orientation words such as upper side, lower side, left side, right side, front side, and rear side do not only represent perfect orientations, but can also be understood as lateral orientations. For example, lower side may include directly below, bottom left, bottom right, front bottom, and rear bottom.

[0150] In this application, the terms "controller", "processor", "central processor", "CPU" and "MCU" are interchangeable. Where a unit "controller", "processor", "central processing", "CPU", or "MCU" is used to perform a specific function, the specific function may be implemented by a single aforementioned unit or a plurality of the aforementioned unit.

[0151] In this application, the term "device", "module" or "unit" may be implemented in the form of hardware or

software to achieve specific functions.

[0152] In this application, the terms "computing", "judging", "controlling", "determining", "recognizing" and the like refer to the operations and processes of a computer system or similar electronic computing device (e.g., controller, processor, etc.).

[0153] As shown in FIG. 1, a snow thrower 100 in an example is used by a user to clear snow on the ground, for example, snow on a road, snow in a courtyard, or snow in a garden. In this example, a walk-behind snow thrower 100 is used as an example of the snow thrower 100. When working, the user holds the walk-behind snow thrower 100 to push the walk-behind snow thrower 100 behind the walk-behind snow thrower 100 to walk on the ground or follow the walk-behind snow thrower 100 to walk on the ground. In some examples, the snow thrower 100 may be a smart snow thrower 100. The smart snow thrower 100 can move on the ground by itself without being followed by the user to clear the snow on the ground. Alternatively, in some examples, the snow thrower 100 may be a manned snow thrower 100. The user can be supported by the manned snow thrower 100 to walk along with the manned snow thrower 100. It is to be understood that a specific structural form of the snow thrower 100 is not limited by the relationship between the snow thrower 100 and the user. As long as the snow thrower 100 includes at least part of solutions of the present application described below, the snow thrower 100 falls within the scope of the present application.

[0154] To facilitate the description of technical solutions of the present application, up, down, front, rear, left, and right are defined, as shown by arrows in FIG. 1. Of course, directions in this example are not limited thereto.

[0155] As shown in FIG. 1, the snow thrower 100 includes a body 10 and a handle device 20. The handle device 20 is connected to the rear end of the body 10 to be gripped and operated by the user. The body 10 includes a main housing 11, a walking assembly 12, a snow collection device 13, and a snow throwing device 14. As the main frame of the snow thrower 100, the main housing 11 is used for supporting the snow collection device 13 and the snow throwing device 14. The walking assembly 12 is used for supporting the main housing 11 to drive the snow thrower 100 to walk on the ground. The snow collection device 13 is used for stirring the snow on the ground to collect the snow into the main housing 11. The snow throwing device 14 is used for throwing out the snow collected by the snow collection device 13 to a preset position beyond the snow thrower 100. In this manner, the snow thrower 100 can clear the snow on the ground to throw the snow to places where pedestrians do not often go or collect the snow together.

[0156] As shown in FIGS. 1 to 3, the handle device 20 is connected to the rear end of the main housing 11. When pushing or following the snow thrower 100 to walk along with the snow thrower 100, the user is behind the snow thrower 100 and holds the handle device 20 with hands. The handle device 20 includes connecting rods, an op-

eration assembly 22, and gripping handles 23. The connecting rods connect the operation assembly 22 to the body 10. The gripping handles 23 are disposed at the ends of the connecting rods far away from the body 10. The gripping handles 23 include a left handle and a right handle. The left handle and the right handle are gripped by the two hands of the user, respectively. The operation assembly 22 includes an operation bench and multiple operation members. The operation bench is connected to the two connecting rods. Multiple operation switches are mounted to the operation bench. The operation members are operated by the user to control assemblies, devices, and the like of the snow thrower 100, for example, the walking assembly 12, the snow collection device 13, and the snow throwing device 14. The multiple operation switches are further disposed in the operation bench and are electrically connected to the multiple operation members. The handle device 20 further includes a connection cable configured to electrically connect the multiple operation switches to the body 10. In some examples, the operation assembly 22 may also include a remote control configured to control the body 10. The remote control may be disposed separately from the body 10. The remote control may be detached from the snow thrower 100 or disposed independently of the snow thrower 100 so that the user controls the snow thrower 100.

[0157] The main housing 11 is connected to the ends of the connecting rods far away from the operation assembly 22. The main housing 11 further includes a snow collection cover 111 and a snow throwing housing 114. The snow collection cover 111 is used for mounting at least part of the snow collection device 13. The snow throwing housing 114 is used for mounting at least part of the snow throwing device 14. In this example, the body 10 further includes a power supply device 15 configured to provide an energy source for the snow thrower 100. The power supply device 15 is mounted to the main housing 11 and configured to power the walking assembly 12, the snow collection device 13, and the snow throwing device 14. In this example, the power supply device 15 includes a battery pack 151 for energy storage. The battery pack 151 is detachably mounted to the main housing 11. In this example, two battery packs 151 are provided so that the power supply device 15 can provide sufficient electrical energy to prolong the battery lifetime of the snow thrower 100. The main housing 11 further includes a battery compartment 113 for accommodating the power supply device 15. The battery packs 151 are detachably mounted in the battery compartment 113. It is to be understood that the power supply device 15 may be a power supply cable in another example. The power supply cable may be connected to utility power or another energy storage device.

[0158] As shown in FIGS. 4 to 7, the walking assembly 12 includes walking wheels 121 for driving the snow thrower 100 to walk on the ground and further includes a walking electric motor 122 configured to drive the

walking wheels 121 to rotate. The walking electric motor 122 drives the walking wheels 121 to rotate about a walking axis 101. The walking wheels 121 include a left walking wheel and a right walking wheel. The left walking wheel and the right walking wheel support the main housing 11 and are disposed on two sides of the main housing 11, respectively. The power supply device 15 may power the walking electric motor 122. In a left and right direction, the power supply device 15 is disposed between the left walking wheel and the right walking wheel. In an up and down direction, the power supply device 15 is at least partially disposed on the upper side of the left walking wheel and the right walking wheel. The walking electric motor 122 is disposed under the power supply device 15 and connected to the left walking wheel and the right walking wheel through a reduction assembly. In this example, one walking electric motor 122 is provided. The reduction assembly may include a clutch so that a speed difference may exist between the left walking wheel and the right walking wheel, thereby steering the snow thrower 100. It is to be understood that in some examples, the walking assembly 12 may include two walking electric motors 122 driving the left walking wheel and the right walking wheel respectively so that a speed difference may exist between the left walking wheel and the right walking wheel, thereby steering the snow thrower 100. In this example, the walking electric motor 122 is an outrunner. The outrunner is disposed outside the walking wheels 121 and drives the walking wheels 121 through the reduction assembly. It is to be understood that in some examples, the walking electric motor 122 may be a hub motor. The hub motor is at least partially disposed in one of the walking wheels 121 to drive the walking wheels 121 to rotate. In some examples, the walking electric motor 122 may be a wheel-side motor. The wheel-side motor is configured to be adjacent to one of the walking wheels 121 to drive the walking wheels 121 to rotate.

[0159] The snow collection device 13 includes a snow collection element 131 and a first electric motor 132 configured to drive the snow collection element 131 to rotate. The snow collection element 131 is an auger rotatable about a first rotation axis 102. The snow collection element 131 is mounted on a snow collection shaft 133 rotatably mounted to the snow collection cover 111. The first rotation axis is used as the central axis of the snow collection shaft 133. The snow collection element 131 may include two augers both mounted to the snow collection shaft 133. The snow collection element 131 is at least partially disposed in the snow collection cover 111. The snow collection cover 111 includes an opening 112 that opens forwards. When the snow collection element 131 rotates about the first rotation axis 102, the snow on the ground is stirred by the augers so that the snow on the ground enters the snow collection cover 111 through the opening 112. The two augers can also gather the snow to the middle of the opening 112 to improve snow collection efficiency.

[0160] The first electric motor 132 is configured to drive the snow collection element 131 to rotate about the first rotation axis 102. A certain distance exists between the first electric motor 132 and the snow collection element 131. Then, a first transmission assembly 134 transmits power outputted by the first electric motor 132 to the snow collection element 131 so that the snow collection element 131 is driven to rotate.

[0161] The snow throwing device 14 includes a snow throwing element 141 and a second electric motor 142 configured to drive the snow throwing element 141 to rotate. The snow throwing element 141 is an impeller mounted to a snow throwing shaft. The impeller is disposed on the rear side of the snow collection element 131. The snow collection element 131 can guide the snow to move towards the impeller. The snow throwing device 14 further includes a discharge chute 143 guiding a snow throwing direction. The discharge chute 143 is disposed at a position in the circumferential direction of the impeller. When the impeller rotates at a high speed, the snow is stirred by the impeller to rotate along the circumferential direction to the position of the discharge chute 143 and move along the discharge chute 143 to the outside of the snow thrower 100, so as to be thrown to the preset position.

[0162] In this example, the first electric motor 132 and the second electric motor 142 are disposed independently of each other. That is, the first electric motor 132 drives the snow collection element 131 to rotate, and the second electric motor 142 drives the snow throwing element 141 to rotate. In this manner, the rotation of the snow collection element 131 and the rotation of the snow throwing element 141 can be independently controlled. In this manner, compared with the solution that both the snow collection element 131 and the snow throwing element 141 are driven by one electric motor in the existing art, the technical solutions of the present application make snow collection more efficient and reduce an energy loss. In the existing art, the electric motor is connected to both a snow collection element 131 and the snow throwing element 141. Therefore, when the rotational speed of the snow collection element 131 varies, a rotational speed of the snow throwing element 141 also varies. For example, when the rotational speed of the snow collection element 131 increases, the rotational speed of the snow throwing element 141 also increases, and when the rotational speed of the snow collection element 131 decreases, the rotational speed of the snow throwing element 141 also decreases. Therefore, the matching relationship between the rotational speed of the snow throwing element 141 and the rotational speed of the snow collection element 131 cannot reach the most effective state. In other words, a relatively high energy loss is caused, or when the rotational speed of the snow collection element 131 decreases, the rotational speed of the snow throwing element 141 also decreases, which reduces a snow throwing distance. However, in the present application, the snow thrower

100 includes the two electric motors driving the snow collection element 131 and the snow throwing element 141, respectively. Specifically, the first electric motor 132 drives the snow collection element 131, and the second electric motor 142 drives the snow throwing element 141. In this manner, the rotational speed of the snow collection element 131 and the rotational speed of the snow throwing element 141 may be independently adjusted in different states. For example, when the rotational speed of the snow collection element 131 needs to be increased, the first electric motor 132 driving the snow collection element 131 can be independently controlled to increase the rotational speed while the rotational speed of the second electric motor 142 driving the snow throwing element 141 is kept constant, thereby effectively improving a snow clearing capability without affecting the snow throwing distance. Alternatively, when the rotational speed of the snow collection element 131 needs to be reduced, the first electric motor 132 driving the snow collection element 131 can be independently controlled to reduce the rotational speed while the rotational speed of the second electric motor 142 driving the snow throwing element 141 is kept constant, thereby reducing the energy loss of the snow thrower 100 without affecting the snow throwing distance.

[0163] In this example, the power supply device 15 further powers the first electric motor 132 and the second electric motor 142. After being mounted in the battery compartment 113, the battery packs 151 can power the first electric motor 132 and the second electric motor 142. The nominal voltage of each battery pack 151 of the two battery packs 151 is higher than or equal to 24 V. In this manner, the power supply device 15 is enabled to power a more powerful electric motor, and the load capacity of the snow thrower 100 is improved.

[0164] In some examples, the nominal voltage of the battery pack 151 is higher than or equal to 24 V. In some examples, the nominal voltage of the battery pack 151 is higher than or equal to 40 V. In some examples, the nominal voltage of the battery pack 151 is higher than or equal to 80 V. In some examples, the nominal voltage of the battery pack 151 may be, for example, 24 V, 36 V, 40 V, 56 V, or 80 V.

[0165] It is to be understood that in some examples, the nominal voltage of the battery pack may be 4 V to 24 V. Then, multiple battery packs are connected in series so that a power supply device with a higher output voltage is obtained.

[0166] In some examples, the battery pack 151 may be fixedly connected to the main housing 11. The battery pack 151 may be a built-in battery pack 151 disposed in the main housing 11.

[0167] In some examples, the battery pack 151 is detachably connected to the main housing 11. The battery pack 151 can power handheld power tools, riding power tools, and all-terrain vehicles like a platform.

[0168] In some examples, the battery pack 151 may be a lithium battery pack 151 or a lithium iron phosphate

battery pack 151.

[0169] When the snow collection element 131 works with no load, a working current of the first electric motor 132 is less than or equal to 40 A. In this manner, the maximum working current that flows through a current loop of the first electric motor 132 can be significantly reduced so that the maximum current that an electronic component on the current loop of the first electric motor 132 needs to carry can be reduced. Thus, an electronic component with a lower current-carrying capacity can be selected as the electronic component on the current loop of the first electric motor 132. In this manner, the costs of the electronic component can be reduced, thereby reducing the costs of the snow thrower 100. Alternatively, in the case where electronic components having basically the same current-carrying capacities as electronic components in the existing snow thrower 100 are selected, compared with the existing art, this solution can cause working currents of the electronic components in this example to be less than the current-carrying capacities thereof. Thus, the service lives of the electronic components can be prolonged. In another aspect, when the working current of the first electric motor 132 is reduced, the energy output of the power supply device 15 can also be reduced so that the battery lifetime of the power supply device 15 can be prolonged. In another aspect, when the working current of the first electric motor 132 is reduced, heat generated by the electronic component on the current loop of the first electric motor 132 can also be reduced, thereby reducing the energy loss.

[0170] In this example, when the snow collection element 131 works with no load, the working current of the first electric motor 132 is relatively small. In fact, when the snow collection element 131 works with a load, the working current of the first electric motor 132 is also reduced. In this manner, the work efficiency of the snow thrower 100 with the load can be improved, the battery lifetime of the snow thrower 100 is prolonged, the energy loss of the snow thrower 100 in a working process is reduced, and the utilization rate of electrical energy can be improved.

[0171] In some examples, when the snow collection element 131 works with no load, the working current of the first electric motor 132 is further less than or equal to 30 A. Thus, the energy utilization rate of the electric snow thrower 100 can be further improved. In some examples, the working current of the first electric motor 132 is further less than or equal to 20 A. In some examples, the working current of the first electric motor 132 is further less than or equal to 15 A.

[0172] In some examples, when the snow collection element 131 works with no load, a working current of the second electric motor 142 is less than or equal to 40 A. In this manner, the maximum working current that flows through a current loop of the second electric motor 142 can be significantly reduced so that the maximum current that an electronic component on the current loop of the second electric motor 142 needs to carry can be reduced. Thus, an electronic component with a lower current-

carrying capacity can be selected as the electronic component on the current loop of the second electric motor 142. In this manner, the costs of the electronic component can be reduced, thereby reducing the costs of the snow thrower 100. Alternatively, in the case where electronic components having basically the same current-carrying capacities as electronic components in the existing snow thrower 100 are selected, compared with the existing art, this solution can cause working currents of the electronic components in this example to be less than the current-carrying capacities thereof. Thus, the service lives of the electronic components can be prolonged. In another aspect, when the working current of the second electric motor 142 is reduced, the energy output of the power supply device 15 can also be reduced so that the battery lifetime of the power supply device 15 can be prolonged. In another aspect, when the working current of the second electric motor 142 is reduced, heat generated by the electronic component on the current loop of the second electric motor 142 can also be reduced, thereby reducing the energy loss. In some examples, the working current of the second electric motor 142 is less than or equal to 30 A. In some examples, the working current of the second electric motor 142 is further less than or equal to 20 A. In some examples, the working current of the second electric motor 142 is further less than or equal to 15 A.

[0173] In this example, when the snow collection element 131 works with no load, the working current of the second electric motor 142 is relatively small. In fact, when the snow collection element 131 works with the load, the working current of the second electric motor 142 is also reduced. In this manner, the work efficiency of the snow thrower 100 with the load can be improved, the battery lifetime of the snow thrower 100 is prolonged, the energy loss of the snow thrower 100 in the working process is reduced, and the utilization rate of the electrical energy can be improved.

[0174] In some examples, when the snow collection element 131 works with no load, the working current of the second electric motor 142 is further less than or equal to 40 A. Thus, the energy utilization rate of the electric snow thrower 100 can be further improved.

[0175] In some examples, when the snow collection element 131 works with no load, the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is less than or equal to 80 A. In this manner, a relatively small current flows through the bus shared by the first electric motor 132 and the second electric motor 142. Thus, a component with a lower current-carrying capacity can be selected as an electronic component on the bus. The costs of the electronic component can be reduced. Alternatively, in the case where electronic components having basically the same current-carrying capacities as electronic components in the existing snow thrower 100 are selected as electronic components on the bus, this solution can cause working currents of the electronic components in this example to be less than the current-carrying

capacities thereof. Thus, the service lives of the electronic components can be prolonged. In another aspect, when the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is reduced, the energy output of the power supply device 15 can also be reduced so that the battery lifetime of the power supply device 15 can be prolonged. In another aspect, when the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is reduced, heat generated by the electronic component on the bus can also be reduced, thereby reducing the energy loss.

[0176] In some examples, when the snow collection element 131 works with no load, the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is less than or equal to 50 A. In some examples, when the snow collection element 131 works with no load, the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is less than or equal to 35 A.

[0177] In this example, when the snow collection element 131 works with no load, the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is relatively small. In fact, when the snow collection element 131 works with the load, the sum of the working current of the first electric motor 132 and the working current of the second electric motor 142 is also reduced. In this manner, the work efficiency of the snow thrower 100 with the load can be improved, the battery lifetime of the snow thrower 100 is prolonged, the energy loss of the snow thrower 100 in the working process is reduced, and the utilization rate of the electrical energy can be improved.

[0178] As shown in FIGS. 4 and 11, the snow thrower 100 further includes a control device 30 configured to control the first electric motor 132 and the second electric motor 142. In this example, the control device 30 can control an electrical parameter of the first electric motor 132 to vary and can further control the electrical parameter of the first electric motor 132 to vary independently of the second electric motor 142. Likewise, the control device 30 can control an electrical parameter of the second electric motor 142 to vary and can further control the electrical parameter of the second electric motor 142 to vary independently of the first electric motor 132. In this manner, when the electrical parameter of the first electric motor 132 varies, the electrical parameter of the second electric motor 142 may not vary with the variation of the first electric motor 132. Likewise, when the electrical parameter of the second electric motor 142 varies, the electrical parameter of the first electric motor 132 may not vary with the variation of the second electric motor 142.

[0179] In this example, the control device 30 is further configured to adjust a rotational speed of the first electric motor 132 in response to a variation in a load. For example, the control device 30 can adjust the rotational speed of the first electric motor 132 according to a varia-

tion in the thickness of the snow to be cleared by the snow thrower 100 so that the rotational speed of the snow collection element 131 varies with the variation in the thickness of the snow. In this manner, the snow collection element 131 can clear the snow more efficiently according to the thickness of the snow so that the snow thrower 100 can automatically adapt to the variation in the thickness of the snow to be cleared by the snow thrower 100. Thus, the clearing efficiency of the snow thrower 100 can be improved.

[0180] Load information received by the control device 30 may be the thickness of the snow. In another example, the load information may be the density of the snow. In this manner, the control device 30 can identify, according to the density of the snow, that the snow is loose, wet, or mixed with ice, to better control the rotational speed of the first electric motor 132.

[0181] In this example, the snow throwing element 141 is driven by the second electric motor 142 instead of sharing an electric motor with the snow collection element 131. In this manner, in this example, when the control device 30 adjusts the rotational speed of the first electric motor 132 in response to the variation in the load, the rotational speed of the second electric motor 142 may remain constant. In this manner, when the snow thrower 100 clears snow of different thicknesses, the rotational speed of the snow collection element 131 can be automatically adjusted so that the snow throwing distance of the snow thrower 100 is not affected when the snow collection element 131 gathers the snow efficiently. That is to say, when the thicknesses of the snow are different, the rotational speed of the snow collection element 131 of the snow thrower 100 varies, but the rotational speed of the snow throwing element 141 may remain constant. Thus, the snow throwing distance of the snow throwing element 141 does not vary. In the existing art, when the rotational speed of the snow collection element 131 is increased because the snow becomes thicker, the rotational speed of the snow throwing element 141 is also increased so that the snow throwing distance is increased, which causes the snow to fail to be thrown to a preset position as expected. Alternatively, when the rotational speed of the snow collection element 131 is reduced because the snow becomes thinner, the rotational speed of the snow throwing element 141 is also reduced so that the snow throwing distance is reduced, which causes the snow to fail to be thrown to a preset position as expected.

[0182] In this example, the control device 30 is further configured to, when the rotational speed of the first electric motor 132 is adjusted in response to the variation in the load, cause the rotational speed of the second electric motor 142 to remain at a value of a rotational speed corresponding to a set snow throwing distance. Specifically, an operation device may include a first operation member 221. The first operation member 221 is operated by the user to adjust and set the snow throwing distance of the snow thrower 100. The control device 30

controls, according to the set snow throwing distance, the rotational speed of the second electric motor 142 to be kept at the value of the rotational speed corresponding to the set snow throwing distance. More specifically, the first operation member 221 is operated by the user to adjust the rotational speed of the second electric motor 142 to adjust the snow throwing distance. In this manner, even if the rotational speed of the first electric motor 132 varies with the load, the rotational speed of the second electric motor 142 is also kept at the value of the rotational speed corresponding to the set snow throwing distance. Thus, the rotational speed of the snow throwing element 141 remains constant, and further, the snow throwing distance of the snow thrower 100 remains constant.

[0183] As shown in FIGS. 3 to 7, the snow collection device 13 includes the first transmission assembly 134. The first transmission assembly 134 is connected to the first electric motor 132 and the snow collection element 131 and used for transmitting the power between the first electric motor 132 and the snow collection element 131. The first transmission assembly 134 can reduce a high rotational speed outputted from the first electric motor 132 to transmit the reduced rotational speed to the snow collection element 131 so that the snow collection element 131 is driven to rotate at a low speed. In this example, the rotational speed of the first electric motor 132 is higher than or equal to 5000 rpm and lower than or equal to 20000 rpm. In this manner, the first electric motor 132 can output a relatively high rotational speed, thereby improving the work efficiency of the snow thrower 100. The first transmission assembly 134 is used for implementing a speed reduction function between the first electric motor 132 and the snow collection element 131. Specifically, the reduction ratio of the first transmission assembly 134 is higher than or equal to 40 and lower than or equal to 200. In this manner, the snow collection element 131 can have higher output torque and drive thicker and heavier snow, thereby improving the load capacity of the snow thrower 100. In another aspect, the rotational speed of the first electric motor 132 is higher than or equal to 5000 rpm and lower than or equal to 20000 rpm so that the first electric motor 132 is lighter, smaller, and less costly. Thus, the weight of the whole snow thrower 100 can be reduced, the arrangement of the whole snow thrower 100 is more compact, and the snow thrower 100 is less costly. In some examples, the reduction ratio of the first transmission assembly 134 is higher than or equal to 80 and lower than or equal to 120. In some examples, the reduction ratio of the first transmission assembly 134 is higher than or equal to 60 and lower than or equal to 180.

[0184] In some examples, the rotational speed of the first electric motor 132 is higher than or equal to 10000 rpm and lower than or equal to 14000 rpm, and the reduction ratio of the first transmission assembly 134 is higher than or equal to 80 and lower than or equal to 120. In this manner, the rotational speed of the first electric motor 132, the reduction ratio of the first transmission

assembly 134, and the relationship between the rotational speed of the first electric motor 132 and the reduction ratio of the first transmission assembly 134 can be optimized so that the snow collection device 13 works with relatively high efficiency.

[0185] The rotational speed of the second electric motor 142 is higher than or equal to 5000 rpm and lower than or equal to 14000 rpm so that the second electric motor 142 is lighter, smaller, and less costly. Thus, the weight of the whole snow thrower 100 can be reduced, the arrangement of the whole snow thrower 100 is more compact, and the snow thrower 100 is less costly.

[0186] As shown in FIGS. 3 to 7, the snow throwing device 14 includes a second transmission assembly 144. The second transmission assembly 144 is connected to the second electric motor 142 and the snow throwing element 141 and used for transmitting power between the second electric motor 142 and the snow throwing element 141. The second transmission assembly 144 can reduce a high rotational speed outputted from the second electric motor 142 to transmit the reduced rotational speed to the snow throwing element 141 so that the snow throwing element 141 is driven to rotate at a low speed. The second transmission assembly 144 is used for implementing a speed reduction function between the second electric motor 142 and the snow throwing element 141. Thus, the rotational speed of the second electric motor 142 can be higher. The second electric motor 142 outputs a relatively high rotational speed so that the work efficiency of the snow thrower 100 can be improved. The reduction ratio of the second transmission assembly 144 is higher than or equal to 4 and lower than or equal to 20. In this manner, the snow throwing element 141 can have higher output torque and drive thicker and heavier snow, thereby improving the load capacity of the snow thrower 100. In another aspect, the rotational speed of the second electric motor 142 is higher than or equal to 5000 rpm and lower than or equal to 14000 rpm so that the second electric motor 142 is lighter, smaller, and less costly. Thus, the weight of the whole snow thrower 100 can be reduced, the arrangement of the whole snow thrower 100 is more compact, and the snow thrower 100 is less costly.

[0187] It is to be understood that in another example, the second transmission assembly 144 may not be disposed between the second electric motor 142 and the snow throwing element 141. Instead, the snow throwing element 141 is directly mounted on the second electric motor 142, and the second electric motor 142 directly drives the snow throwing element 141 to rotate.

[0188] Specifically, the first transmission assembly 134 is a gear transmission assembly. The gear transmission assembly includes a gear set with gears mutually meshing with each other. For example, the gear transmission assembly may be a planetary gear assembly, a worm gear assembly, or a bevel gear assembly. The gear set with the gears mutually meshing with each other may include a first gear 134a and a second gear 134b mesh-

ing with the first gear 134a. The first gear 134a is rotatable about a first axis 103, and the second gear 134b rotates about a second axis 104. In this example, the first gear 134a and the second gear 134b are perpendicular to or obliquely intersect with each other. The gear set may further include a third gear 134c meshing with the second gear 134b. The third gear 134c rotates about a third axis 105. The third axis 105 and the second axis 104 are parallel to each other. It is to be understood that in another example, the first axis 103 and the second axis 104 may be parallel to each other.

[0189] The second transmission assembly 144 may be a gear transmission assembly. The gear transmission assembly includes a gear set with gears mutually meshing with each other. For example, the gear transmission assembly may be a planetary gear assembly, a worm gear assembly, or a bevel gear assembly. The second transmission assembly 144 may include multiple gears that mutually mesh with each other. The rotation axes of part of the multiple gears may be parallel to each other.

[0190] It is to be understood that in another example, the first transmission assembly 134 may be a belt transmission assembly, and the second transmission assembly 144 may be a belt transmission assembly.

[0191] In this example, the first electric motor 132 may be an outrunner. The diameter of the first electric motor 132 is greater than or equal to 30 mm and less than or equal to 110 mm. Thus, the first electric motor 132 is relatively small so that the first electric motor 132 can be arranged at a proper position of the main housing 11 without occupying too much space. The stack length of the stator of the first electric motor 132 is greater than or equal to 10 mm and less than or equal to 50 mm. The weight of the first electric motor 132 is greater than or equal to 0.4 kg and less than or equal to 2.5 kg. In some examples, the diameter of the first electric motor 132 is greater than or equal to 35 mm and less than or equal to 95 mm.

[0192] The second electric motor 142 may be an outrunner. The diameter of the second electric motor 142 is greater than or equal to 60 mm and less than or equal to 135 mm. Thus, the second electric motor 142 is relatively small so that the second electric motor 142 can be arranged at a proper position of the main housing 11 without occupying too much space. The stack length of the stator of the second electric motor 142 is greater than or equal to 10 mm and less than or equal to 60 mm. The weight of the second electric motor 142 is greater than or equal to 1 kg and less than or equal to 6 kg. In some examples, the diameter of the second electric motor 142 is greater than or equal to 85 mm and less than or equal to 135 mm.

[0193] When the snow collection element 131 works with no load, the ratio of no-load output power of the second electric motor 142 to no-load output power of the first electric motor 132 is higher than or equal to 0.5 and lower than or equal to 1.5. In this manner, in the case where the power supply device 15 outputs certain power, the ratio of the no-load output power of the second

electric motor 142 to the no-load output power of the first electric motor 132 is within a reasonable range. Thus, both the first electric motor 132 and the second electric motor 142 are caused to work near the maximum efficiency point as far as possible, thereby improving the work efficiency of the snow thrower 100. In addition, output power of the snow collection element 131 and output power of the snow throwing element 141 are distributed more reasonably. Thus, when working with the load, the snow thrower 100 can collect the snow at reasonable power and throw the snow at reasonable power.

[0194] The no-load output power of the first electric motor 132 is greater than or equal to 600 W and less than or equal to 2000 W. Thus, the first electric motor 132 can work near the maximum efficiency point. The no-load output power of the second electric motor 142 is greater than or equal to 600 W and less than or equal to 2000 W. Thus, the second electric motor 142 can work near the maximum efficiency point. In some examples, the no-load output power of the first electric motor 132 is greater than or equal to 900 W and less than or equal to 1500 W, and the no-load output power of the second electric motor 142 is greater than or equal to 900 W and less than or equal to 1500 W.

[0195] In some examples, the sum of the no-load output power of the first electric motor 132 and the no-load output power of the second electric motor 142 is greater than or equal to 1200 W and less than or equal to 4000 W. Thus, when the snow thrower 100 runs with no load, the total output power of the first electric motor 132 and the second electric motor 142 can be relatively low so that the energy loss can be reduced.

[0196] It is to be noted that no-load parameters of the first electric motor 132 and the second electric motor 142 each refer to parameters at the time when the snow collection element 131 does not clear the snow and rotates normally to a stable state.

[0197] When the snow collection element 131 runs with the load, that is, the snow thrower 100 clears the snow, the maximum load power of the second electric motor 142 is greater than or equal to 4000 W. Thus, the load power of the second electric motor 142 can be greater than the load power of the first electric motor 132, energy can be distributed reasonably, and it is ensured that the snow throwing distance of the snow thrower 100 is not affected.

[0198] The control device 30 is electrically connected to the first electric motor 132 and the second electric motor 142. The control device 30 can adjust, according to the variation in the load, the load power of the second electric motor 142 and the load power of the first electric motor 132 to vary. In this manner, when the load varies, the rotational speed of the first electric motor 132 can vary with the load and the power of the first electric motor 132 varies with the variation in the load so that the snow clearing efficiency is ensured. Likewise, when the load varies, the power of the second electric motor 142 can

vary with the variation in the load so that the snow throwing distance of the snow thrower 100 is ensured.

[0199] The ratio of the load power of the second electric motor 142 to the load power of the first electric motor 132 is different from the ratio of the no-load output power of the second electric motor 142 to the no-load output power of the first electric motor 132. Specifically, the ratio of the load power of the second electric motor 142 to the load power of the first electric motor 132 is higher than the ratio of the no-load output power of the second electric motor 142 to the no-load output power of the first electric motor 132. In this manner, when no load is borne, the no-load output power of the second electric motor 142 is as low as possible, thereby reducing the energy loss. When the load is borne, the load power of the second electric motor 142 is as high as possible, and the ratio of the load power of the second electric motor 142 to the total output power is also as high as possible, thereby improving the load capacity of the snow thrower 100.

[0200] FIG. 12 is a graph showing current variations of the snow thrower 100 in the working process. Curve a shows a current variation of the first electric motor 132, and curve b shows a current variation of the second electric motor 142. In a no-load stage, the current of the first electric motor 132 is basically the same as the current of the second electric motor 142. In a load stage, the current of the second electric motor 142 is much greater than the current of the first electric motor 132. The current of the first electric motor 132 basically remains constant in the no-load stage and the load stage. The current of the second electric motor 142 increases significantly from the no-load stage to the load stage. At point P1 of curve a, the first electric motor 132 has the maximum current. In this case, the first electric motor 132 has the maximum load power. At point P2 of curve b, the second electric motor 142 has the maximum current. In this case, the second electric motor 142 has the maximum load power.

[0201] As shown in FIG. 1 and FIGS. 8 to 10, the discharge chute 143 is rotatably connected to the main housing 11. The user may operate the operation assembly 22 to drive the discharge chute 143 to rotate about a first snow throwing axis 106 relative to the main housing 11 so that the discharge chute 143 opens in different directions, thereby adjusting the snow throwing direction of the snow thrower 100. The first snow throwing axis 106 basically extends along the up and down direction. In a front and rear direction, the discharge chute 143 is disposed between the power supply device 15 and the snow collection cover 111. The main housing 11 further includes the snow throwing housing 114 disposed on the rear side of the snow collection cover 111. The snow throwing housing 114 is used for accommodating the snow throwing element 141. The snow throwing housing 114 has a basically cylindrical surface. The discharge chute 143 is connected to the cylindrical surface and communicates with the inner space of the snow throwing housing 114. In this manner, the snow throwing element

141 can throw the snow into the discharge chute 143 and throw the snow out through the discharge chute 143.

[0202] The snow throwing device 14 further includes a snow throwing cap 145 connected to the discharge chute 143. The snow throwing cap 145 is rotatably connected to the side of the discharge chute 143 far away from the main housing 11. The snow throwing cap 145 is rotatable about a second snow throwing axis 107 relative to the discharge chute 143. The second snow throwing axis 107 is basically perpendicular to the first snow throwing axis 106. When rotating relative to the discharge chute 143, the snow throwing cap 145 can change the angle of a movement direction of the snow after coming out from the snow throwing cap 145 relative to the ground, thereby guiding a snow throwing height and changing the snow throwing distance.

[0203] The distance between a position where the snow is guided by the snow throwing device 14 to fall on the ground and the central axis (the first snow throwing axis 106) of the discharge chute 143 is defined as the snow throwing distance L. For example, as shown in FIG. 2, the distance between the central axis of the discharge chute 143 and an approximate center of a snowbank is regarded as the snow throwing distance L. In this example, the maximum snow throwing distance that the snow thrower 100 can reach is greater than or equal to 10 m and less than or equal to 21 m. In this example, each of the snow collection element 131 and the snow throwing element 141 is driven by an independent electric motor. In this manner, the snow throwing element 141 can rotate at a higher rotational speed. The snow thrower 100 may be configured to cause the snow throwing element 141 to rotate at the higher rotational speed so that the maximum snow throwing distance that the snow thrower 100 can reach is great enough, thereby meeting more requirements of the user. In some examples, the maximum snow throwing distance that the snow thrower 100 can reach is greater than or equal to 12 m and less than or equal to 21 m. In some examples, the maximum snow throwing distance that the snow thrower 100 can reach is greater than or equal to 15 m and less than or equal to 21 m.

[0204] As described above, the user can operate the first operation member 221 to adjust the rotational speed of the second electric motor 142 to adjust the snow throwing distance. Compared with the existing art in which the snow throwing distance cannot be changed or is changed little through the change of a snow throwing angle, this solution allows the user to be capable of setting the snow throwing distance more flexibly.

[0205] In this example, the maximum rotational speed of the snow throwing element 141 is higher than or equal to 500 rpm and lower than or equal to 2000 rpm so that it can be ensured that the snow thrower 100 has a relatively great snow throwing distance.

[0206] The snow collection cover 111 is used for mounting the snow collection element 131. The snow collection cover 111 includes a top wall, a first sidewall 111b, a second sidewall 111c, and a rear wall 111d, which

surround and form the inner space of the snow collection cover 111. The snow collection element 131 is disposed in the inner space. The front end edges of the top wall, the first sidewall 111b, the second sidewall 111c, and the rear wall 111d surround and form the preceding opening 112. The top wall is disposed on the upper side of the snow collection element 131. The first sidewall 111b and the second sidewall 111c are disposed on the left and right sides of the top wall, respectively. The first sidewall 111b extends downwards from the left end of the top wall. The second sidewall 111c extends downwards from the right end of the top wall. Two ends of a first rotation shaft are rotatably mounted to the first sidewall 111b and the second sidewall 111c, respectively. The snow collection shaft 133 is rotatable about the first rotation axis 102 relative to the first sidewall 111b and the second sidewall 111c so that the snow collection element 131 connected to the first rotation shaft is rotatable relative to the snow collection cover 111. In this example, a projection of the front edge of the first sidewall 111b on a plane perpendicular to the front and rear direction extends basically along the up and down direction, and a projection of the front edge of the second sidewall 111c on the plane perpendicular to the front and rear direction extends basically along the up and down direction. The rear wall 111d is connected to the top wall, the first sidewall 111b, and the second sidewall 111c. The rear wall 111d is at least partially arc-shaped. The rear wall 111d is formed with a snow inlet. The snow inlet is basically provided in the middle of the rear wall 111d in the left and right direction. In this manner, the snow collection element 131 can gather the snow towards the middle and guide the snow rearwards so that most of the snow can move towards the snow inlet, thereby improving the snow clearing efficiency.

[0207] As shown in FIG. 6, a coordinate system using a point on the first rotation axis 102 of the snow collection element 131 as an origin O, the front and rear direction as an X-axis, and the up and down direction as a Y-axis is established. A forward direction is the positive direction of the X-axis. An upward direction is the positive direction of the Y-axis. The coordinate system has a first quadrant, a second quadrant, a third quadrant, and a fourth quadrant. As shown in FIG. 6, a projection of the first electric motor 132 on the plane where the coordinate system is located is within an angular region A using the origin O as a vertex and located in the plane where the coordinate system is located. A first side S1 of the angular region A is within the first quadrant of the coordinate system, and the included angle A1 between the first side S1 of the angular region A and the positive direction of the Y-axis is less than or equal to 60 degrees. A second side S2 of the angular region A is within the second quadrant of the coordinate system, and the included angle A2 between the second side S2 of the angular region A and the positive direction of the Y-axis is less than or equal to 80 degrees. In this manner, the position of the first electric motor 132 and the position of the first transmission assembly 134 connected

to the first electric motor 132 and the snow collection element 131 can be arranged conveniently. It can be reliably implemented with low costs that the snow collection element 131 is driven by the first electric motor 132 independent of the second electric motor 142. In addition, the first electric motor 132 is disposed in the angular region A so that the second electric motor 142 can be conveniently disposed on the rear side of the snow throwing element 141. The first electric motor 132 is disposed in the angular region A so that the first transmission assembly 134 can more easily transmit the power between the first electric motor 132 and the snow collection element 131.

[0208] The projection of the first electric motor 132 on the plane where the coordinate system is located is within a circular region using the origin O as the center of a circle and located in the plane where the coordinate system is located. The radius of the circular region is less than or equal to 0.7 m. In this manner, the distance between the first electric motor 132 and the snow collection element 131 can be reduced so that more stable transmission is implemented. In some examples, the radius of the circular region is less than or equal to 0.4 m.

[0209] The first side S1 of the angular region A is within the first quadrant of the coordinate system, and the included angle between the first side S1 of the angular region A and the positive direction of the Y-axis is less than or equal to 30 degrees. The second side S2 of the angular region A is within the second quadrant of the coordinate system, and the included angle between the second side S2 of the angular region A and the positive direction of the Y-axis is less than or equal to 60 degrees. More specifically, the first electric motor 132 is disposed above the first rotation axis 102. In some examples, the first electric motor 132 is disposed on the upper side of the snow collection element 131. In this manner, the space on the upper side of the snow collection element 131 can be fully utilized, thereby reducing the dimension of the snow thrower 100 in the front and rear direction.

[0210] A projection of the first electric motor 132 on the plane perpendicular to the front and rear direction is between a projection of the first sidewall 111b and a projection of the second sidewall 111c on the plane perpendicular to the front and rear direction. It is to be noted that as shown in FIG. 10, the first electric motor 132 is not beyond the first sidewall 111b and the second sidewall 111c in the left and right direction. That is, it is considered that the first electric motor 132 is located between the first sidewall 111b and the second sidewall 111c in the left and right direction. In this manner, the problem is avoided that the first electric motor 132 is beyond the first sidewall 111b and the second sidewall 111c in the left and right direction, increasing the load of the snow thrower 100. Thus, in the process where the snow thrower 100 clears the snow, snow on the left and right sides is not in contact with the first electric motor 132.

[0211] In this example, the main housing 11 further includes a first electric motor housing 115 mounted on

the outer side of the top wall. The first electric motor housing 115 forms a first accommodation space for accommodating the first electric motor 132 so that the first electric motor 132 is disposed on the upper side of the top wall. In this manner, on the one hand, the first electric motor 132 is relatively high and cannot be touched by the snow so that the load of the snow thrower 100 is not affected. On the other hand, the first electric motor 132 is disposed on the upper side of the top wall so that transmission assemblies can be conveniently disposed. Specifically, the first transmission assembly 134 includes a long shaft 134d passing through the top wall. A first reduction assembly is connected to the end of the long shaft 134d adjacent to the electric motor, and a second reduction assembly is connected to the end of the long shaft 134d far away from the electric motor. The first reduction assembly is connected to the first electric motor 132 and the long shaft 134d, and the second reduction assembly is connected to the long shaft 134d and the snow collection shaft 133. The extension direction of the long shaft 134d is perpendicular to the first rotation axis 102. Alternatively, in another example, the extension direction of the long shaft 134d may be oblique to the first rotation axis 102.

[0212] In this manner, both the first electric motor 132 and the first transmission assembly 134 are disposed on the front side of the second electric motor 142 and further disposed on the front side of the snow throwing element 141. Thus, the whole snow thrower 100 is arranged reasonably, and the transmission structure is simple and easier to implement.

[0213] As shown in FIGS. 1 and 4, the snow thrower 100 further includes a wire 31 used by the first electric motor 132. At least part of the wire 31 extends on the outer side of the snow collection cover 111. The wire 31 is connected to the power supply device 15 and/or the control device 30 so that the power supply device 15 and the control device 30 are electrically connected to the first electric motor 132. In this manner, the first electric motor 132 is disposed on the upper side of the top wall of the snow collection cover 111, which further facilitates the arrangement of the wire 31.

[0214] As shown in FIG. 11, the control device 30 is electrically connected to the first electric motor 132 and the second electric motor 142. The control device 30 can control the rotational speed of the first electric motor 132 according to the state of the snow and a walking speed of the walking assembly 12. In this manner, when the state of the snow changes or the walking speed of the walking assembly 12 varies, the control device 30 can automatically control the rotational speed of the first electric motor 132 so that the rotational speed of the snow collection element 131 automatically adapts to the change of the state of the snow and the variation in the walking speed. In this manner, the rotational speed of the snow collection element 131 can vary with not only the variation in the load but also the variation in the walking speed of the walking assembly 12. This solution is smar-

ter than the method of adjusting the speed of the snow collection element 131 according to only the change of the state of the snow in the existing art. In the case where the snow changes from one state to another, if the walking speed of the snow thrower 100 varies, the load of the snow collection element 131 varies. Therefore, in this case, if the snow collection element 131 adapts to the state of the snow to remain its rotational speed, the walking speed of the snow thrower 100 varies, which may result in that the snow collection element 131 fails to clear the snow completely or causes the energy loss.

[0215] The state of the snow may include the thickness of the snow and/or the density of the snow. In this example, the thickness of the snow is used as an example.

[0216] As shown in FIGS. 13A and 13B, corresponding rotational speeds of the snow collection element 131 are set according to different thicknesses of the snow and different walking speeds. It is to be understood that the control device 30 directly controls the rotational speed of the first electric motor 132 and finally controls the rotational speed of the snow collection element 131. In other words, the control device 30 can calculate the corresponding rotational speed of the first electric motor 132 according to the rotational speed of the snow collection element 131 and the reduction ratio of the first transmission assembly 134 and control the first electric motor 132.

[0217] Specifically, FIG. 13A shows that the snow collection element 131 has different rotational speeds corresponding to different walking speeds when the thickness of the snow is 0.1 m. In this example, when the rotational speed of the snow collection element 131 varies, the rotational speed of the snow throwing element 141 remains constant. During design, a snow intake during a walk corresponding to the walking speed may be made to be less than the amount of collected snow of the snow collection element 131, and the amount of collected snow of the snow collection element 131 may be made to be less than the amount of thrown snow of the snow throwing element 141. In this manner, almost all of the snow (the snow intake during the walk) passed by the snow thrower 100 during the walk can be collected by the snow collection element 131, and almost all of the snow collected by the snow collection element 131 can also be thrown out by the snow throwing element 141. Thus, the case is avoided where the snow is not cleared completely.

[0218] It is to be understood that the snow intake during the walk refers to the amount of snow covered by the snow thrower 100 during the walk per unit of time. The snow intake during the walk is related to the thickness of the snow and the walking speed. The greater the thickness, the greater the snow intake during the walk. The higher the walking speed, the greater the snow intake during the walk. The amount of collected snow refers to the amount of snow that can be collected by the snow collection element 131. The amount of collected snow is related to the rotational speed of the snow collection element 131. The higher the rotational speed, the greater

the amount of collected snow. The amount of thrown snow refers to the amount of snow that can be thrown out by the snow throwing element 141. The amount of thrown snow of the snow throwing element 141 is related to the rotational speed of the snow throwing element 141. The higher the rotational speed, the greater the amount of thrown snow.

[0219] Referring to FIGS. 13A and 13B, for example, when the walking speed is kept at 0.05 m/s and the thickness of the snow varies from 0.1 m to 0.2 m, the rotational speed of the snow collection element 131 also varies.

[0220] It may be known from the preceding description that in this example, when the state of the snow remains constant, the higher the walking speed of the walking assembly 12, the higher the rotational speed of the first electric motor 132. That is to say, when the state of the snow remains constant, the snow intake during the walk of the walking assembly 12 increases if the walking speed of the walking assembly 12 becomes higher. In this case, the snow collection element 131 is required to be matched with a greater amount of collected snow to clear the snow completely.

[0221] Moreover, when the walking speed of the walking assembly 12 remains constant, the greater the thickness of the snow and/or the higher the density of the snow, the higher the rotational speed of the first electric motor 132. That is to say, when the walking speed of the walking assembly 12 remains constant, the snow intake during the walk of the walking assembly 12 increases if the snow becomes thicker. In this case, the snow collection element 131 is also required to be matched with a greater amount of collected snow to clear the snow completely.

[0222] As shown in FIGS. 13A and 13B, when the walking speed and the rotational speed of the snow collection element 131 vary, the rotational speed of the snow throwing element 141 may remain constant. In this manner, it can be ensured that the snow throwing distance remains constant so that the snow thrower 100 throws the snow to the preset position. That is to say, when the control device 30 controls the rotational speed of the first electric motor 132, the rotational speed of the second electric motor 142 may not vary with the variation in the rotational speed of the first electric motor 132. Alternatively, when controlling the rotational speed of the first electric motor 132 to vary, the control device 30 controls the rotational speed of the second electric motor 142 to remain constant. Of course, it is to be understood that in fact, the control device 30 may adjust the rotational speed of the second electric motor 142 according to the variation in the load and/or the variation in the walking speed and/or the variation in the rotational speed of the first electric motor 132 to control the snow thrower 100 more smartly.

[0223] The snow thrower 100 may further include a memory 32. The mapping relationship among the state of the snow, the walking speed of the walking assembly 12,

and the rotational speed of the first electric motor 132 may be stored in the memory 32 in advance. The rotational speed of the first electric motor 132 may be understood as the rotational speed of the snow collection element 131 because the rotational speed of the first electric motor 132 can be calculated through the rotational speed of the snow collection element 131 and the reduction ratio of the first transmission assembly 134. If the rotational speed of the snow collection element 131 is stored, it may still be considered in this case that the mapping relationship among the state of the snow, the walking speed of the walking assembly 12, and the rotational speed of the first electric motor 132 is stored because there is a correspondence between the rotational speed of the snow collection element 131 and the rotational speed of the first electric motor 132.

[0224] The control device 30 is connected to the memory 32. In this manner, after acquiring the state of the snow and the walking speed, the control device 30 may acquire the rotational speed of the first electric motor 132 according to the mapping relationship and then control the first electric motor 132 according to the obtained value. Thus, the snow thrower 100 clears the snow more smartly and efficiently, thereby improving the work efficiency and reducing the energy loss.

[0225] The mapping relationship may include relationship tables shown in FIG. 13A and FIG. 13B. When the mapping relationship is a relationship table, data in FIG. 13B may be used if the thickness of the snow is between 0.1 and 0.2. Likewise, a calculation may be performed with a similar method if the walking speed is between two speeds.

[0226] Alternatively, in another example, the mapping relationship may be a relationship function. An input parameter of the relationship function may be the walking speed and the thickness of the snow, and an output parameter of the relationship function may be the rotational speed of the first electric motor 132.

[0227] It is to be understood that in some examples, the control device 30 may control the rotational speed of the first electric motor 132 according to the walking speed. In some examples, the control device 30 may control the rotational speed of the first electric motor 132 according to only the variation in the walking speed instead of the change of the state of the snow. In this manner, when the walking speed increases, the control device 30 controls the rotational speed of the first electric motor 132 to increase, and when the walking speed decreases, the control device 30 controls the rotational speed of the first electric motor 132 to decrease. In this manner, to some extent, the snow thrower 100 can be smartly controlled, the work efficiency is improved, and the energy loss is reduced.

[0228] As shown in FIGS. 1 and 11, the snow thrower 100 further includes a detection device 40 configured to detect the state of the snow. The control device 30 is communicatively or electrically connected to the detection device 40. The control device 30 acquires a state

parameter of the snow through the detection device 40 to adjust the rotational speed of the first electric motor 132. The snow thrower 100 further includes a speed detection device 50. The speed detection device 50 may be electrically or communicatively connected to the control device 30. The speed detection device 50 is configured to detect the walking speed. The control device 30 acquires the walking speed through the speed detection device 50 to control the rotational speed of the first electric motor 132.

[0229] In an example of the present application, a control method of the snow thrower 100 is further provided. FIG. 14 is a control flowchart of an example of the snow thrower 100. In conjunction with FIGS. 1 and 14, the control method includes the steps described below.

[0230] In S101, the snow thrower is started. The start of the snow thrower 100 may refer to that the snow thrower 100 is powered on and the walking electric motor 122 is started to cause the snow thrower 100 to walk on the ground. Alternatively, the start of the snow thrower 100 may refer to that the first electric motor 132 and/or the second electric motor 142 of the snow thrower 100 are also started.

[0231] In S102, the state parameter of the snow and the walking speed are acquired. The state parameter of the snow may be detected through the detection device 40. The state parameter of the snow may be the thickness of the snow or the density of the snow. The walking speed may be detected through the speed detection device 50. The control device 30 acquires the state parameter of the snow and the walking speed of the walking assembly 12.

[0232] In S103, the rotational speed of the first electric motor 132 is acquired according to the state parameter of the snow and the walking speed. The control device 30 acquires the rotational speed of the first electric motor 132 according to the state parameter of the snow, the walking speed, and the mapping relationship stored in the memory 32.

[0233] In S104, the first electric motor is controlled according to the acquired rotational speed of the first electric motor. The duty cycle of a pulse-width modulation (PWM) signal of the first electric motor 132 is controlled according to the acquired rotational speed of the first electric motor 132 so that an output rotational speed of the first electric motor 132 is controlled.

[0234] In some examples, the control device 30 is further configured to control the walking speed of the walking assembly 12 and the rotational speed of the first electric motor 132 according to the state of the snow. That is to say, the input parameter is the state parameter of the snow and the output parameter is the walking speed of the walking assembly 12 and the rotational speed of the first electric motor 132 so that fully smart control of the snow thrower 100 can be implemented. The user does not need to control the walking speed of the snow thrower 100 according to the change of the state of the snow. Instead, the control device 30 automatically controls the walking speed of the snow thrower 100 and controls the

matching relationship between the first electric motor 132 and the walking speed. In this manner, the snow thrower 100 can walk at a better walking speed and a better rotational speed of the first electric motor 132 according to the change of the state of the snow, thereby improving the work efficiency of the snow thrower 100.

[0235] In this example, the mapping relationship among the state of the snow, the walking speed of the walking assembly 12, and the rotational speed of the first electric motor 132 may be stored in the memory 32. In this manner, after acquiring the state parameter of the snow, the control device 30 may acquire, according to the mapping relationship, a walking speed and a rotational speed of the first electric motor 132 that are matched with the state parameter of the snow. Then, the control device 30 controls the walking electric motor 122 and the first electric motor 132. In this manner, the snow thrower 100 is controlled in a simpler manner. The snow thrower 100 only needs to identify the state parameter of the snow and automatically match the walking speed with the rotational speed of the first electric motor 132 so that the snow thrower 100 is controlled more smartly.

[0236] Likewise, the mapping relationship may include the relationship table or the relationship function. When the mapping relationship is a relationship table illustrated in FIG. 15, data corresponding to a thickness of the snow of 0.04 m may be used if the thickness of the snow is between 0.02 m and 0.04 m.

[0237] Alternatively, in another example, the mapping relationship may be the relationship function. The input parameter of the relationship function may be the thickness of the snow, and the output parameter of the relationship function may be the walking speed of the walking electric motor 122 and the rotational speed of the first electric motor 132.

[0238] As shown in FIG. 16, the mapping relationship may be the relationship function. FIG. 16A shows the correspondence between the thickness of the snow and a working condition, FIG. 16B shows the correspondence between the walking speed and the working condition, and FIG. 16C shows the correspondence between the rotational speed of the first electric motor 132 and the working condition. After acquiring the parameter of the thickness of the snow, the control device 30 may correspondingly acquire the working condition of the snow thrower 100 in this case and then correspondingly acquire the walking speed of the walking assembly 12 and the rotational speed of the first electric motor 132 according to the working condition. As shown in FIG. 16A, the working condition includes a light load working condition and a heavy load working condition. The light load working condition may correspond to a working condition 0 to a working condition 4. The heavy load working condition may correspond to working conditions after the working condition 4. In the light load working condition, the power outputted by the power supply device 15 is sufficient to support the running of the walking electric motor 122, the first electric motor 132, and the second electric motor

142. Therefore, in the light load working condition, the walking speed is relatively high. As shown in FIG. 16B, the walking speed may be kept constant at 0.7 m/s instead of increasing with the increase in the thickness of the snow. In this case, the rotational speed of the first electric motor 132 may vary with the variation in the thickness of the snow. In the light load working condition, as the snow becomes thicker, the amount of snow (the snow intake during the walk) covered by the snow thrower 100 during the walk gradually increases. Therefore, the rotational speed of the first electric motor 132 is required to gradually increase so that covered snow can be collected as much as possible. As shown in FIG. 16C, as the snow thrower 100 runs in the heavy load working condition, if the snow thrower 100 still remains the relatively high walking speed in this case, the rotational speed of the first electric motor 132 needs to increase in this case. Apparently, in this manner, the total power of the first electric motor 132, the walking electric motor 122, and the second electric motor 142 is caused to exceed the power outputted by the power supply device 15. Therefore, in this case, the walking speed of the walking device needs to be reduced so that it is ensured that the power outputted by the power supply device 15 is sufficient to support the running of the snow thrower 100, the snow thrower 100 is prevented from stalling, and the energy loss can be reduced. Specifically, in a heavy load condition, the rotational speed of the first electric motor 132 is set to a preset rotational speed so that it is ensured that the first electric motor 132 works near the maximum efficiency point. In this case, the amount of snow that can be collected by the snow collection element 131 is fixed. However, as the snow becomes thicker, it is necessary to ensure that the amount of snow (the snow intake during the walk) covered by the snow thrower 100 during the walk is less than or equal to the amount of snow that can be collected by the snow collection element 131. Therefore, it is necessary to reduce the walking speed of the walking assembly 12 as the thickness of the snow varies.

[0239] In this example, when the control device 30 controls the rotational speed of the first electric motor 132, the rotational speed of the second electric motor 142 may not vary with the variation in the rotational speed of the first electric motor 132 so that the rotational speed of the second electric motor 142 remains constant.

[0240] In some examples, the control device 30 is further configured to adjust the rotational speed of the first electric motor 132 according to the state of the snow and then control the walking speed of the walking assembly 12 according to the state of the snow and the rotational speed of the first electric motor 132 so that the snow thrower 100 clears the snow at a relatively reasonable speed, thereby improving the work efficiency.

[0241] When the snow thrower 100 is in the heavy load working condition, that is, the state parameter of the snow is greater than a first preset value, the rotational speed of the first electric motor 132 is kept at a first constant rotational speed value. Thus, when the snow thrower

100 is in the heavy load working condition, the first electric motor 132 works near the maximum efficiency point as far as possible. In this case, the walking speed of the walking assembly 12 gradually decreases as the state parameter of the snow increases. Thus, it can be ensured that the snow thrower 100 is less likely to stall. In addition, it can be ensured that the snow intake during the walk of the walking assembly 12 is less than or equal to the amount of collected snow of the snow collection element 131.

[0242] When the snow thrower 100 is in the light load working condition, that is, the state parameter of the snow is less than the first preset value, the rotational speed of the first electric motor 132 is lower than the first constant rotational speed value, and the rotational speed of the first electric motor 132 further increases with the increase in the state parameter of the snow. In this case, the walking speed of the walking assembly 12 is kept at a second constant rotational speed value. In this case, the snow thrower 100 can clear the snow at a relatively high speed, thereby improving the work efficiency. When the state parameter of the snow is greater than the first preset value, the walking speed is further less than a second constant rotational speed.

[0243] In an example of the present application, another control method of the snow thrower 100 is further provided. FIG. 17 is a control flowchart of an example of the snow thrower 100. In conjunction with FIGS. 1 and 17, the control method includes the steps described below.

[0244] In S201, the snow thrower 100 is started. The start of the snow thrower 100 may refer to that the snow thrower 100 is powered on and the walking electric motor 122 is started to cause the snow thrower 100 to walk on the ground. Alternatively, the start of the snow thrower 100 may refer to that the first electric motor 132 and/or the second electric motor 142 of the snow thrower 100 are also started.

[0245] In S202, the state parameter of the snow is acquired. The state parameter of the snow may be detected through the detection device 40. The state parameter of the snow may be the thickness of the snow or the density of the snow.

[0246] In S203, the walking speed and the rotational speed of the first electric motor 132 are acquired according to the state parameter of the snow. The control device 30 acquires the walking speed and the rotational speed of the first electric motor 132 according to the state parameter of the snow and the mapping relationship stored in the memory 32.

[0247] In S204, the walking electric motor 122 and the first electric motor 132 are controlled according to the acquired walking speed and the acquired rotational speed of the first electric motor 132. The duty cycle of the walking electric motor 122 and the duty cycle of the first electric motor 132 are controlled according to the acquired walking speed and the acquired rotational speed of the first electric motor 132 so that an output rotational speed of the walking electric motor 122 and the

output rotational speed of the first electric motor 132 are controlled.

[0248] As shown in FIGS. 1 to 3, the detection device 40 includes a first detection assembly 41 and a second detection assembly 42. The first detection assembly 41 is configured to detect snow on the left side of the snow collection cover 111, and the second detection assembly 42 is configured to detect snow on the right side of the snow collection cover 111. In this manner, when the snow thrower 100 clears the snow on the left side, the state parameter of the snow may be detected through the first detection assembly 41, and when the snow thrower 100 clears the snow on the right side, the state parameter of the snow may be detected through the second detection assembly 42. Thus, the snow thrower 100 can be suitable for more working conditions and meet different usage habits of the user. In addition, the first detection assembly 41 and the second detection assembly 42 can make detection results more accurate.

[0249] As shown in FIG. 2, FIG. 11, and FIG. 18, the first detection assembly 41 may be mounted on the first sidewall 111b of the snow collection cover 111 so that the first detection assembly 41 is located on the outer side of the main housing 11, and the second detection assembly 42 may be mounted on the second sidewall 111c so that the second detection assembly 42 is located on the outer side of the main housing 11. The detection device 40 is mounted to the side surfaces of the snow collection cover 111 so that the snow collected in the process where the snow thrower 100 clears the snow can be prevented from affecting the accuracy of the detection results.

[0250] The first detection assembly 41 includes a first detection element 411 and a first sensor 412. In this example, the first detection element 411 may be configured to detect the thickness of the snow. Specifically, the first detection element 411 can be driven by snow in front of the snow thrower 100 or snow on the left side of the snow thrower 100 to be displaced. The first detection element 411 is mounted on the first sidewall 111b and rotatable relative to the snow collection cover 111. As shown in FIG. 18, when snow of a certain thickness is in contact with the first detection element 411, the first detection element 411 is driven to rotate. The size of a rotation angle of the first detection element 411 varies with the variation in the thickness of the snow. The thicker the snow, the larger the rotation angle of the first detection element 411. The thinner the snow, the smaller the rotation angle of the first detection element 411. The first sensor 412 is configured to detect the displacement of the first detection element 411. For example, the first sensor 412 may be a position sensor, an angle sensor, or the like.

[0251] The second detection assembly 42 has a corresponding second detection element 421 and a corresponding second sensor 422.

[0252] The first detection assembly 41 is mounted on the outer side of the first sidewall 111b to detect the thickness of snow on the outer side of the first sidewall 111b, and the second detection assembly 42 is mounted

on the outer side of the second sidewall 111c to detect the thickness of snow on the outer side of the second sidewall 111c.

[0253] The control device 30 is connected to the first detection assembly 41 and the second detection assembly 42 to acquire detection data of the first detection assembly 41 and detection data of the second detection assembly 42. The control device 30 may acquire a current state parameter of the snow according to the state parameter of the left-side snow detected by the first detection assembly 41 and/or the state parameter of the right-side snow detected by the second detection assembly 42. When the snow thrower 100 clears the snow on the left side, the first detection device 40 detects the state parameter of the snow on the left side, the second detection assembly 42 detects no data, and the control device 30 may control the snow thrower 100 according to only the data detected by the first detection assembly 41. When the snow thrower 100 clears the snow on the right side, the second detection device 40 detects the state parameter of the snow on the right side, the first detection assembly 41 detects no data, and the control device 30 may control the snow thrower 100 according to only the data detected by the second detection assembly 42.

[0254] In some examples, the first detection assembly 41 may detect first data, and the second detection assembly 42 may detect second data. The control device 30 may add the first data and the second data together to obtain the average value of the first data and the second data and use the average value as the current state parameter of the snow. Alternatively, after obtaining the first data and the second data, the control device 30 may use a greater one of the first data and the second data as the current state parameter of the snow.

[0255] In some examples, the detection device may be a sensor configured to detect a current. The detection device may detect the current that flows through the first electric motor, and the control device adjusts the walking speed of the walking assembly according to the current that flows through the first electric motor. It is known that the current of the first electric motor varies with the state of the snow. Therefore, the current of the first electric motor can also reflect the change of the state of the snow. Therefore, the control device can determine the load of the snow thrower by acquiring the current of the first electric motor, that is, the thickness of the snow. In this case, the control device controls the walking speed to vary, so as to adapt to the variation in the thickness of the snow.

[0256] Alternatively, the detection device may detect the current that flows through the second electric motor, and the control device adjusts the walking speed of the walking assembly according to the current that flows through the second electric motor.

[0257] FIG. 19 shows a snow thrower 200 in another example. The snow thrower 200 is basically the same as the snow thrower 100 in FIG. 1, and a main difference

between the snow thrower 200 and the snow thrower 100 lies in a different detection device 201. All structures of the snow thrower 100 in FIG. 1 that can be suitable for the snow thrower 200 in FIG. 19 are applicable in this example. The details are not repeated.

[0258] In this example, the detection device 201 is mounted on the top wall 202a of a snow collection cover 202. For example, the detection device 201 may be mounted on the upper side of the top wall 202a and is electrically connected to the control device. A cable in the detection device 201 may pass through a first electric motor housing 203 and then extend to the control device on the outer wall of the snow collection cover 202. The detection device 201 may be an ultrasonic sensor, an infrared sensor, or the like.

[0259] As shown in FIGS. 1 and 19, the snow thrower 100 and the snow thrower 200 are two-stage snow throwers, that is to say, a snow collection element 131 and a snow throwing element 141 are used in a snow guide process. In fact, in another type of snow throwers, a transmission element disposed between the snow collection element and the snow throwing element may also be used in the snow guide process. The transmission element is rotatable relative to the main housing. The transmission element can transmit, by rotating at a high speed, the snow collected by the snow collection element to the snow throwing element. Then, the snow throwing element guides the snow to the discharge chute. The transmission element may be driven by a third electric motor. In this manner, the control device can control the rotational speed of the first electric motor and/or the rotational speed of the second electric motor and/or a rotational speed of the third electric motor, thereby improving the work efficiency of the snow thrower.

[0260] As shown in FIGS. 20 and 21, a snow thrower 300 has a snow collection device, a snow throwing device, and a walking device that are basically the same as those in the first example. The main difference between the snow thrower 300 and the snow thrower 100 lies in that the operation assembly further includes a mode setting member 301. The mode setting member 301 is operated by the user to select a working mode. The mode setting member 301 may enable the snow thrower 300 to be in at least a first working mode and a second working mode. In the first working mode, a control device 304 can control a walking electric motor 302 to run at a first preset rotational speed and can control a first electric motor 303 to run at a second preset rotational speed. In the second working mode, the control device 304 can control the walking electric motor 302 to run at a third preset rotational speed and can control the first electric motor 303 to run at a fourth preset rotational speed. The third preset rotational speed is different from the first preset rotational speed, or the fourth preset rotational speed is different from the second preset rotational speed. In this manner, the user may select the first working mode or the second working mode by himself or herself by observing the state of the snow, and it is unnecessary to provide the detection

assembly for detecting the state of the snow. Thus, the snow thrower 300 is controlled more accurately, and the case can be avoided where the detection device may obtain an inaccurate detection result in a complex working condition. Alternatively, the user may set the working mode of the snow thrower 300 according to a work requirement. Walking speeds and rotational speeds of the snow collection element that correspond to different working modes may be stored in the memory 305. The control device 304 may calculate, according to the corresponding walking speeds and the corresponding rotational speeds of the snow collection element, rotational speeds of the walking electric motor 302 and rotational speeds of the first electric motor 303 that correspond to the different working modes.

[0261] The first working mode may be a light load mode. As shown in FIG. 22, the first working mode may correspond to working conditions at a light load level that are suitable for clearing snow whose thickness is less than 0.05 m. The user observes that the snow to be cleared is excessively thin and the thickness of the snow may be less than 0.05 m. In this case, the user may set the snow thrower 300 to the first working mode through the mode setting member 301. The second working mode may be an intermediate load mode, which may specifically correspond to a working condition at an intermediate load level 1 in FIG. 22. The working condition at the intermediate load level 1 is suitable for clearing snow whose thickness is 0.05 m to 0.1 m.

[0262] In some examples, the mode setting member 301 may be further configured to be capable of causing the snow thrower 300 to enter a third working mode. When the snow thrower 300 is in the third working mode, the control device 304 controls the walking electric motor 302 to run at a fifth preset rotational speed and controls the first electric motor 303 to run at a sixth preset rotational speed. As shown in FIG. 22, the third working mode may correspond to a working condition at an intermediate load level 2. The working condition at the intermediate load level 1 is suitable for clearing snow whose thickness is 0.1 m to 0.2 m.

[0263] In some examples, the mode setting member 301 may be further configured to cause the snow thrower 300 to enter a fourth working mode and a fifth working mode. As shown in FIG. 21, the fourth working mode may correspond to a working condition at an intermediate load level 3, and the fifth working mode may correspond to the heavy load working condition. The number of working modes is not limited thereto.

[0264] In this example, the snow collection element and the snow throwing element, like those of the snow thrower 100 in FIG. 1, are driven by the first electric motor 303 and the second electric motor 306, respectively. The details are not repeated. When the control device 304 controls a rotational speed of the first electric motor 303, a rotational speed of the second electric motor 306 does not vary with a variation in the rotational speed of the first electric motor 303. If the snow throwing distance is set,

the rotational speed of the second electric motor 306 may remain constant in this case.

[0265] It is known that the user needs some experience to determine, by observing the thickness of the snow, which working mode the snow thrower 300 should be set to, which may cause a mode mismatch. Therefore, in this example, a first mark 308 corresponding to the first working mode and a second mark 309 corresponding to the second working mode are further provided on a snow collection cover 307. The first mark 308 may be a first mark line at a first height from the ground. The first mark line may intuitively indicate the thickness of the snow. The first mark 308 may be a first mark line at a second height from the ground. When the thickness of the snow is below the first mark line, the user may cause, through the mode setting member 301, the snow thrower 300 to enter the first working mode. When the thickness of the snow is between the first mark line and a second mark line, the user may cause, through the mode setting member 301, the snow thrower 300 to enter the second working mode.

[0266] In some examples, a third mark line corresponding to the third working mode, a fourth mark line corresponding to the fourth working mode, and a fifth mark line corresponding to the fifth working mode may further be provided on the snow collection cover 307.

[0267] Specifically, as shown in FIG. 21, the first mark line may be provided on the snow collection cover 307 at a height of 0.05 m from the ground, the second mark line may be provided on the snow collection cover 307 at a height of 0.1 m from the ground, the third mark line may be provided on the snow collection cover 307 at a height of 0.2 m from the ground, the fourth mark line may be provided on the snow collection cover 307 at a height of 0.3 m from the ground, and the fifth mark line may be provided on the snow collection cover 307 at a height of 0.4 m from the ground.

[0268] As shown in FIG. 23, a walk-behind power tool in an example is specifically a snow thrower 500 and is used by the user to clear snow on the ground, for example, snow on a road, snow in a courtyard, or snow in a garden. In this example, a walk-behind snow thrower is used as an example of the snow thrower 500. When working, the user holds the walk-behind snow thrower to push the walk-behind snow thrower behind the walk-behind snow thrower to walk on the ground or follow the walk-behind snow thrower to walk on the ground. In some examples, the snow thrower 500 may be a smart snow thrower. The smart snow thrower can move on the ground by itself without being followed by the user to clear the snow on the ground. Alternatively, in some examples, the snow thrower 500 may be a manned snow thrower. The user can be supported by the manned snow thrower to walk along with the manned snow thrower 500. It is to be understood that a specific structural form of the snow thrower 500 is not limited by the relationship between the snow thrower 500 and the user. As long as the snow thrower 500 includes at least part of solutions of the present application described below, the snow thrower

500 falls within the scope of the present application.

[0269] To facilitate the description of technical solutions of the present application, up, down, front, rear, left, and right are defined, as shown by arrows in FIG. 23. Of course, directions in this example are not limited thereto.

[0270] As shown in FIGS. 23 and 24, the snow thrower 500 includes a body 510 and a handle device 520. The handle device 520 is connected to the rear end of the body 510 to be gripped and operated by the user. The body 510 includes a main housing 530, a walking assembly 540, a snow removal device 550, a power unit 560, and a power supply device 570. As the main frame of the snow thrower 500, the main housing 530 is used for supporting the snow removal device 550 and the power supply device 570. The walking assembly 540 is used for supporting the main housing 530 to drive the snow thrower 500 to walk on the ground. The snow removal device 550 is used for clearing the snow on the ground to throw the snow to a preset position. In this manner, the snow thrower 500 can clear the snow on the ground to throw the snow to places where pedestrians do not often go or collect the snow together. The power unit 560 is configured to drive the snow removal device 550 to move. The power supply device 570 is configured to power the walking assembly 540 and the power unit 560.

[0271] As shown in FIGS. 23 and 24, the handle device 520 is connected to the rear end of the main housing 530. When pushing or following the snow thrower 500 to walk along with the snow thrower 500, the user is behind the snow thrower 500 and holds the handle device 520 with hands. The handle device 520 includes connecting rods 521, an operation assembly 522, and gripping handles 523. The connecting rods 521 connect the operation assembly 522 to the body 510. The gripping handles 523 are disposed at the ends of the connecting rods 521 far away from the body 510. The gripping handles 523 include a left handle and a right handle. The left handle and the right handle are gripped by the two hands of the user, respectively. The operation assembly 522 includes an operation bench and multiple operation members. The operation bench is connected to the two connecting rods 521. Multiple operation switches are mounted to the operation bench. The operation members are operated by the user to control assemblies, devices, and the like of the snow thrower 500, for example, the walking assembly 540 and the snow removal device 550. The multiple operation switches are further disposed in the operation bench and are electrically connected to the multiple operation members. The handle device 520 further includes a connection cable configured to electrically connect the multiple operation switches to the body 510. In some examples, the operation assembly 522 may also include a remote control configured to control the body 510. The remote control may be disposed separately from the body 510. The remote control may be detached from the snow thrower 500 or disposed independently of the snow thrower 500 so that the user controls the snow thrower 500.

[0272] The main housing 530 is connected to the ends of the connecting rods 521 far away from the operation assembly 522. As shown in FIGS. 23 and 25, the main housing 530 further includes a snow collection cover 531 and a snow throwing housing 532. The snow collection cover 531 is disposed on the front side of the snow throwing housing 532 and formed with an opening 533 that opens forwards. The snow throwing housing 532 is disposed on the rear side of the snow collection cover 531 and communicates with the snow collection cover 531. The snow thrower 500 further includes a discharge chute assembly 580 mounted to the main housing 530 and used for guiding the snow throwing direction. The discharge chute assembly 580 is connected to the snow throwing housing 532. In the process where the snow thrower 500 clears the snow, the snow sequentially passes through the opening 533, the snow collection cover 531, the snow throwing housing 532, and the discharge chute assembly 580, and then, the snow is thrown to the preset position. The snow collection cover 531 includes a top wall 5311, a first sidewall 5312, a second sidewall 5313, and a rear wall 5314 which surround and form the inner space of the snow collection cover 531. The first sidewall 5312 and the second sidewall 5313 may be a left sidewall and a right sidewall, respectively.

[0273] The power supply device 570 is mounted to the main housing 530. The power supply device 570 includes at least one battery pack 571 for energy storage, and the battery pack 571 is detachably mounted to the main housing 530. In this example, the power supply device 570 includes at least two battery packs 571 so that the power supply device 570 can provide sufficient electrical energy to prolong the battery lifetime of the snow thrower 500. The main housing 530 further includes a battery compartment 534 for accommodating the power supply device 570. The two battery packs 571 are disposed in the battery compartment 534 in a pluggable manner. It is to be understood that the power supply device 570 may be a power supply cable in another example. The cable may be connected to utility power or another energy storage device. The main housing 530 further includes a compartment cover 535 for covering the battery compartment 534. The compartment cover 535 is rotatably connected to the battery compartment 534. The rotation axis of the compartment cover 535 may extend along the left and right direction so that the compartment cover 535 is opened from front to back or from back to front. The rotation axis of the compartment cover 535 may extend along the front and rear direction so that the compartment cover 535 is opened from left to right or from right to left. Thus, the user may not have to twist an arm to trigger the latch on the compartment cover 535.

[0274] The walking assembly 540 includes walking wheels 541 for driving the snow thrower 500 to walk on the ground and further includes a walking electric motor 542 configured to drive the walking wheels 541 to rotate. The walking electric motor 542 drives the walking wheels

541 to rotate about a walking axis. The walking wheels 541 include a left walking wheel and a right walking wheel. The left walking wheel and the right walking wheel support the main housing 530 and are disposed on two sides of the main housing 530, respectively. The power supply device 570 may power the walking electric motor 542. In the left and right direction, the power supply device 570 is disposed between the left walking wheel and the right walking wheel. In the up and down direction, the power supply device 570 is at least partially disposed on the upper side of the left walking wheel and the right walking wheel. The walking electric motor 542 is disposed under the power supply device 570 and connected to the left walking wheel and the right walking wheel through a reduction assembly. In this example, one walking electric motor 542 is provided. The reduction assembly may include a clutch so that a speed difference may exist between the left walking wheel and the right walking wheel, thereby steering the snow thrower 500. It is to be understood that in some examples, the walking assembly 540 may include two walking electric motors 542 driving the left walking wheel and the right walking wheel respectively so that a speed difference may exist between the left walking wheel and the right walking wheel, thereby steering the snow thrower 500. In this example, the walking electric motor 542 is an outrunner. The outrunner is disposed outside the walking wheels 541 and drives the walking wheels 541 through the reduction assembly. It is to be understood that in some examples, the walking electric motor 542 may be a hub motor. The hub motor is at least partially disposed in one of the walking wheels 541 to drive the walking wheels 541 to rotate. In some examples, the walking electric motor 542 may be a wheel-side motor. The wheel-side motor is configured to be adjacent to one of the walking wheels 541 to drive the walking wheels 541 to rotate.

[0275] In this example, the power supply device 570 powers at least the walking electric motor 542. The nominal voltage of the battery pack 571 is higher than or equal to 24 V. In this manner, the power supply device 570 is enabled to power a more powerful electric motor, and the load capacity of the snow thrower 500 is improved.

[0276] In some examples, the nominal voltage of the battery pack 571 is higher than or equal to 24 V. In some examples, the nominal voltage of the battery pack 571 is higher than or equal to 40 V. In some examples, the nominal voltage of the battery pack 571 is higher than or equal to 48 V. In some examples, the nominal voltage of the battery pack 571 may be, for example, 24 V, 36 V, 40 V, 56 V, or 80 V.

[0277] It is to be understood that in some examples, the nominal voltage of the battery pack 571 may be 4 V to 24 V. Then, multiple battery packs 571 are connected in series so that a power supply device 570 with a higher output voltage is obtained.

[0278] In some examples, the battery pack 571 may be fixedly connected to the main housing 530. The battery

pack 571 may be a built-in battery pack disposed in the main housing 530.

[0279] In some examples, the battery pack 571 is detachably connected to the main housing 530. The battery pack 571 can power handheld power tools, riding power tools, and all-terrain vehicles like a platform.

[0280] In some examples, the battery pack 571 may be a lithium battery pack, a lithium iron phosphate battery pack, a supercapacitor battery pack, a solid-state battery pack, a semi-solid-state battery pack, a pouch battery pack, a sodium-ion battery pack, a silicon-carbon battery pack, or a full-tab battery pack.

[0281] As shown in FIGS. 23 to 25, the snow removal device 550 includes a first-stage snow removal assembly 551, a second-stage snow removal assembly 552, and a third-stage snow removal assembly 553. When the snow thrower 500 clears the snow, the first-stage snow removal assembly 551 is typically in contact with the snow first and throws the snow to the second-stage snow removal assembly 552, and then the second-stage snow removal assembly 552 throws the snow to the third-stage snow removal assembly 553. The sequence of snow removal assemblies is basically the same as the sequence in which the snow passes through the snow removal assemblies. The first-stage snow removal assembly 551 includes a first snow removal blade 5511 and a first mounting shaft 5512 for mounting the first snow removal blade 5511. The second-stage snow removal assembly 552 includes a second snow removal blade 5521 and a second mounting shaft 5522 for mounting the second snow removal blade 5521. The third-stage snow removal assembly 553 includes a third snow removal blade 5531 and a third mounting shaft 5532 for mounting the third snow removal blade 5531. In this example, the ratio of a rotational speed of the third snow removal blade 5531 to a rotational speed of the first snow removal blade 5511 is higher than or equal to 6 and lower than or equal to 18.

[0282] In this example, the ratio of the total energy of all the battery packs 571 included in the power supply device 570 to the number of stages of the snow removal assemblies in the snow removal device 550 is higher than or equal to 45 Wh and lower than or equal to 1000 Wh. For example, in this example, the snow removal device 550 includes the first-stage snow removal assembly 551, the second-stage snow removal assembly 552, and the third-stage snow removal assembly 553. Then, the number of stages of the snow removal assemblies in the snow removal device 550 is three. It is to be understood that in another example, the snow removal device 550 may further include a fourth-stage snow removal assembly. In this manner, the number of stages of the snow removal assemblies in the snow removal device 550 is four. In some examples, the total energy of all the battery packs 571 included in the power supply device 570 is greater than or equal to 140 Wh and less than or equal to 3000 Wh.

[0283] In this example, the ratio of the total energy of all

the battery packs 571 included in the power supply device 570 to the distance L1 between the left sidewall and the right sidewall is higher than or equal to 175 Wh/m and lower than or equal to 5500 Wh/m. In this manner, for the snow thrower 500 with a relatively large dimension, the number of stages of the snow removal device 550 is large enough so that snow covered by the snow thrower 500 in a width direction can be cleared. The total energy of the power supply device 570 is relatively great so that the battery lifetime of the snow thrower with a relatively large number of stages and the relatively large dimension is prolonged. Thus, the snow thrower 500 with higher efficiency, better performance, and longer battery lifetime is provided. Specifically, the distance L1 between the left sidewall and the right sidewall is greater than or equal to 550 mm. The battery lifetime of the snow thrower 500 bearing no load is longer than or equal to 10 min.

[0284] In this example, the first mounting shaft 5512 of the first-stage snow removal assembly 551 extends along the left and right direction, and the first snow removal blade 5511 is rotatable about a first axis 501 along with the first mounting shaft 5512. When the snow thrower 500 runs, the first snow removal blade 5511 can rapidly rotate to collect the snow on the ground so that the snow enters the snow collection cover 531 from the opening 533. In this manner, the first-stage snow removal assembly 551 may be considered to belong to the snow collection device.

[0285] The second-stage snow removal assembly 552 is disposed on the rear side of the first-stage snow removal assembly 551 and used for receiving the snow collected by the first-stage snow removal assembly 551. The second mounting shaft 5522 of the second-stage snow removal assembly 552 extends along the front and rear direction. The second mounting shaft 5522 is basically perpendicular to the first mounting shaft 5512. The second snow removal blade 5521 is mounted on the second mounting shaft 5522 and rotates about a second axis 502 along with the second mounting shaft 5522. The second-stage snow removal device 550 is used for receiving the snow thrown by the first-stage snow removal device 550 and then continues to transmit the snow to the third-stage snow removal assembly 553.

[0286] The third mounting shaft 5532 of the third-stage snow removal assembly 553 also extends along the front and rear direction, and the third snow removal blade 5531 is mounted on the third mounting shaft 5532. The third snow removal blade 5531 rotates about a third axis 503 along with the third mounting shaft 5532. The third mounting shaft 5532 is perpendicular to the first mounting shaft 5512. In this example, the third mounting shaft 5532 is coaxial with the second mounting shaft 5522. For example, the third mounting shaft 5532 and the second mounting shaft 5522 are integrally formed with each other, that is, the third mounting shaft 5532 and the second mounting shaft 5522 are the same shaft. Alternatively, the third mounting shaft 5532 and the first mounting shaft 5512 are formed separately and then fixedly connected to each

other. In other examples, the third mounting shaft 5532 and the first mounting shaft 5512 may be parallel to each other instead of being coaxial with each other. In this manner, a transmission assembly may be disposed between the third mounting shaft 5532 and the first mounting shaft 5512.

[0287] In some examples, the ratio of the number of battery packs 571 to the number of stages of the snow removal assemblies in the snow removal device 550 is higher than or equal to 1:3 and lower than or equal to 6:3. In some examples, the ratio of the number of battery packs 571 to the number of stages of the snow removal assemblies in the snow removal device 550 is higher than or equal to 2:3 and lower than or equal to 4:3. In this manner, the battery pack 571 can meet the requirement of the snow thrower 500 on the battery lifetime and prolong the snow clearing duration of the snow thrower 500.

[0288] As shown in FIG. 24, the power unit 560 includes at least one electric motor, and the power supply device 570 is configured to power the electric motor. In this example, the at least one electric motor includes two electric motors. One of the two electric motors drives at least one stage of a snow removal member in the snow removal device 550, and the other one of the two electric motors drives at least another stage of a snow removal assembly in the snow removal device 550. The power supply device 570 is configured to power the two electric motors. For example, in this example, the at least one electric motor includes a first electric motor 561 and a third electric motor 562. The first electric motor 561 is configured to drive the first-stage snow removal assembly 551, and the third electric motor 562 is configured to drive the third-stage snow removal assembly 553. In this example, the third electric motor 562 further drives the second-stage snow removal assembly 552.

[0289] A first reduction assembly 563 is further disposed between the first electric motor 561 and the first-stage snow removal assembly 551. The reduction ratio of the first reduction assembly 563 is higher than or equal to 40 and lower than or equal to 200. In this manner, the first-stage snow removal assembly 551 can have higher output torque and drive thicker and heavier snow, thereby improving the load capacity of the snow thrower 500. An output rotational speed of the first electric motor 561 is higher than or equal to 5000 rpm and lower than or equal to 20000 rpm. In this manner, the first electric motor 561 can output a relatively high rotational speed, thereby improving the work efficiency of the snow thrower 500. In some examples, the reduction ratio of the first reduction assembly 563 is higher than or equal to 80 and lower than or equal to 120. In some examples, the reduction ratio of the first reduction assembly 563 is higher than or equal to 60 and lower than or equal to 180. In some examples, the rotational speed of the first electric motor 561 is higher than or equal to 10000 rpm and lower than or equal to 14000 rpm.

[0290] In this example, the first electric motor 561 may be an outrunner. The diameter of the first electric motor

561 is greater than or equal to 30 mm and less than or equal to 110 mm. Thus, the first electric motor 561 is relatively small so that the first electric motor 561 can be arranged at a proper position of the main housing 530 without occupying too much space. The stack length of the stator of the first electric motor 561 is greater than or equal to 10 mm and less than or equal to 50 mm. The weight of the first electric motor 561 is greater than or equal to 0.4 kg and less than or equal to 2.5 kg. In some examples, the diameter of the first electric motor 561 is greater than or equal to 35 mm and less than or equal to 95 mm.

[0291] A second reduction assembly 564 is further disposed between the third electric motor 562 and the third snow removal assembly 553. The second reduction assembly 564 is connected to the third electric motor 562 and the third mounting shaft 5532. The reduction ratio of the second reduction assembly 564 is higher than or equal to 4 and lower than or equal to 20.

[0292] The third electric motor 562 may be an out-runner. The diameter of the third electric motor 562 is greater than or equal to 60 mm and less than or equal to 135 mm. Thus, the third electric motor 562 is relatively small so that the third electric motor 562 can be arranged at a proper position of the main housing 530 without occupying too much space. The stack length of the stator of the third electric motor 562 is greater than or equal to 10 mm and less than or equal to 60 mm. The weight of the third electric motor 562 is greater than or equal to 1 kg and less than or equal to 6 kg. In some examples, the diameter of the third electric motor 562 is greater than or equal to 85 mm and less than or equal to 135 mm.

[0293] In this example, load output power of the electric motor driving the third-stage snow removal assembly 553 is greater than load output power of the electric motor driving the first-stage snow removal assembly 551. For example, in this example, load output power of the third electric motor 562 is greater than load output power of the first electric motor 561. When the snow thrower 500 includes the first electric motor 561, the second electric motor, and the third electric motor 562, the load output power of the third electric motor 562 is greater than the load output power of the first electric motor 561 and is further greater than load output power of the second electric motor.

[0294] It is to be understood that in this example, the third electric motor 562 is configured to drive not only the third-stage snow removal assembly 553 but also the second-stage snow removal assembly 552. Therefore, the third electric motor 562 may also be referred to as the second electric motor. Alternatively, in another example, the first electric motor 561 drives the first-stage snow removal assembly 551 and the second-stage snow removal assembly 552, and the third electric motor 562 drives the third-stage snow removal assembly 553. In this case, the third electric motor 562 may also be referred to as the second electric motor.

[0295] As shown in FIG. 26, the snow thrower 500

further includes a control device 590 configured to control the power unit 560 and the walking assembly 540. The control device 590 is configured to control the first electric motor 561 and the third electric motor 562. The first electric motor 561 and the third electric motor 562 drive the first-stage snow removal assembly 551 and the third-stage snow removal assembly 553, respectively, thereby implementing decoupling control of the first-stage snow removal assembly 551 and the second-stage snow removal assembly 552. In this manner, the control device 590 may control the rotational speed of the first electric motor 561 according to an actual situation of the snow without varying the rotational speed of the third-stage snow removal assembly 553. In addition, the control device 590 may further control the rotational speed of the third electric motor 562 according to the snow throwing distance. The third electric motor 562 drives the third-stage snow removal assembly 553 to rotate, and the rotational speed of the third-stage snow removal assembly 553 is related to the snow throwing distance of the snow thrower 500. When the speed of the third-stage snow removal assembly 553 is increased, the snow throwing distance of the snow thrower 500 is also increased. When the speed of the third-stage snow removal assembly 553 is reduced, the snow throwing distance of the snow thrower 500 is also reduced. As shown in FIG. 26, the snow thrower 500 further includes a detection device 591. The detection device 591 is configured to detect a current of the electric motor driving the third-stage snow removal assembly 553, for example, a current of the third electric motor 562. When the detection device 591 detects that the current is greater than a preset value, the control device 590 controls a current flowing through the first electric motor 561 to decrease.

[0296] The distance between a position where the snow is guided by the discharge chute assembly 580 to fall on the ground and the central axis of the discharge chute assembly 580 is defined as the snow throwing distance. The maximum snow throwing distance that the snow thrower 500 can reach is greater than or equal to 8 m and less than or equal to 20 m. In this manner, the control device 590 controls the first electric motor 561 and the third electric motor 562 separately so that the maximum snow throwing distance of the snow thrower 500 can be increased. In addition, since the second-stage snow removal assembly 552 is further disposed, the maximum snow throwing distance of snow thrower 500 can be further increased. In this example, the ratio of the maximum snow throwing distance to the number of electric motors configured to drive the snow removal device 550 is higher than or equal to 2.5 m and lower than or equal to 10 m.

[0297] As shown in FIGS. 23 and 24, the first electric motor 561 is disposed on the upper side of the first-stage snow removal assembly 551. The first electric motor 561 is further disposed on the outer side of the top wall 5311 of the snow collection cover 531.

[0298] The multiple operation switches include at least

one start switch 592. In this example, a start switch 593 is configured to control the start and stop of the first electric motor 561 and the start and stop of the third electric motor 562.

[0299] In some examples, the power unit 560 includes the first electric motor 561 driving the first-stage snow removal assembly 551, the second electric motor driving the second-stage snow removal assembly 552, and the third electric motor 562 driving the third-stage snow removal assembly 553. In this case, the snow thrower 500 may include two start switches. One of the first electric motor 561, the second electric motor, and the third electric motor 562 is controlled by one start switch (the first start switch 593), and the other two of the first electric motor 561, the second electric motor, and the third electric motor 562 are controlled by the other start switch (the second start switch 594). For example, the first start switch 593 controls the start or stop of the first electric motor 561, and the second start switch 594 controls the start or stop of the second electric motor and the start or stop of the third electric motor 562. Alternatively, in some examples, the start or stop of the first electric motor 561, the start or stop of the second electric motor, and the start or stop of the third electric motor 562 may be controlled by one start switch.

[0300] As shown in FIG. 24, the second mounting shaft 5522 and the second snow removal blade 5521 are disposed on the rear side of the first snow removal blade 5511. The second-stage snow removal assembly 552 and the first-stage snow removal assembly 551 do not overlap each other in the front and rear direction. In this manner, the second snow removal blade 5521 and the first snow removal blade 5511 are spaced in the front and rear direction. Thus, snow scraped by the first-stage snow removal assembly 551 can be more smoothly transmitted to the second-stage snow removal assembly 552, thereby reducing falling snow.

[0301] FIG. 28 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 28 and 29, this example has basically the same structures as the snow thrower 500 in the example shown in FIG. 23. All solutions of the snow thrower 500 shown in FIGS. 23 to 27 that are suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the snow thrower 500 in FIG. 23, and the identical parts thereof are not repeatedly described. In this example, a second-stage snow removal assembly 552a and a first-stage snow removal assembly 551a overlap each other in the front and rear direction. Specifically, the first-stage snow removal assembly 551a includes two first snow removal blades 5511a. The two first snow removal blades 5511a are spaced apart by a certain distance so that a second snow removal blade 5521a is disposed between the two first snow removal blades 5511a. In this manner, the distance between the second snow removal blade 5521a and a first mounting shaft 5512a can be reduced so that the space occupied

by a snow removal device 550a in the front and rear direction is reduced.

[0302] FIG. 30 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 30 and 31, this example has basically the same structures as the snow thrower 500 in the example shown in FIG. 23. All solutions of the snow thrower 500 shown in FIGS. 23 to 27 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 23, and the identical parts thereof are not repeatedly described. In this example, a first electric motor 561b drives a first-stage snow removal assembly 551b, a third electric motor 562b drives a third-stage snow removal assembly 553b, and the power source of a second-stage snow removal assembly 552b is the first electric motor 561b, that is, the first electric motor 561b further drives the second-stage snow removal assembly 552b. Specifically, the first electric motor 561b drives the first-stage snow removal assembly 551b through the first reduction assembly, and the first electric motor 561b further drives the second-stage snow removal assembly 552b through the second reduction assembly. The first reduction assembly and the second reduction assembly may be disposed in a first reduction housing. Both a first mounting shaft 5512b and a second mounting shaft 5522b extend into the first reduction housing. The second mounting shaft 5522b is detached from a third mounting shaft 5532b.

[0303] FIG. 32 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 32 and 33, this example has basically the same structures as the snow thrower in the example shown in FIG. 30. All solutions of the snow thrower shown in FIGS. 30 and 31 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example in FIG. 30, and the identical parts thereof are not repeatedly described. In this example, a first mounting shaft 5512c of a first-stage snow removal assembly 551c extends along the front and rear direction, a second-stage snow removal assembly 552c includes two second snow removal blades 5521c, a second mounting shaft 5522c extends along the left and right direction, and a first snow removal blade 5511c is disposed on the front side of the second mounting shaft 5522c. In this example, the second mounting shaft 5522c extends along the left and right direction, and the ratio of a rotational speed of a third snow removal blade 5531c to a rotational speed of each of the two second snow removal blades 5521c is higher than or equal to 6 and lower than or equal to 18.

[0304] FIG. 34 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 34 and 35, the snow thrower in this example has basically the same structures as the snow thrower in the example shown in FIG. 32. All solutions of the snow thrower shown in FIGS. 32 and 33 that can be suitable

for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 32, and the identical parts thereof are not repeatedly described. In this example, a first-stage snow removal assembly 551d includes two first snow removal blades 5511d. The two first snow removal blades 5511d are disposed on the front side and rear side of a second snow removal blade 5521d, respectively. One part of a first mounting shaft 5512d is located on the front side of a second mounting shaft 5522d to be used for mounting one of the two first snow removal blades 5511d. The other part of the first mounting shaft 5512d is located on the rear side of the second mounting shaft 5522d to be used for mounting the other one of the two first snow removal blades 5511d. In this example, when the snow thrower works, the first snow removal blade 5511d located on the front side of the second mounting shaft 5522d is used for scraping the snow on the ground, that is, collecting the snow. The first snow removal blade 5511d located on the rear side of the second mounting shaft 5522d is used for transmitting the snow stirred by the second snow removal blade 5521d to a third snow removal blade 5531d, that is, throwing the snow.

[0305] FIG. 36 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 36 and 37, the snow thrower in this example has basically the same structures as the snow thrower 500 in the example shown in FIG. 23. All solutions of the snow thrower 500 shown in FIGS. 23 to 27 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 23, and the identical parts thereof are not repeatedly described. In this example, a power unit 560e includes a second electric motor 565e and a third electric motor 562e. The second electric motor 565e drives a second-stage snow removal assembly 552e, and the third electric motor 562e drives a first-stage snow removal assembly 551e and a third-stage snow removal assembly 553e. A second mounting shaft 5522e extends along the left and right direction, a first mounting shaft 5512e extends along the front and rear direction, and a third mounting shaft 5532e extends along the front and rear direction. The first mounting shaft 5512e is coaxial with the third mounting shaft 5532e. In another example, the first mounting shaft and the third mounting shaft may be spaced apart and parallel to each other instead of being coaxial with each other. In this example, the first mounting shaft 5512e and the third mounting shaft 5532e are integrally formed with each other. One part of the whole constituted by the first mounting shaft 5512e and the third mounting shaft 5532e is located on the front side of the second mounting shaft 5522e to be used for mounting a first snow removal blade 5511e, and the other part of the whole is located on the rear side of the second mounting shaft 5522e to be used for mounting a third snow removal blade 5531e. In another example, the first mounting shaft and the second

mounting shaft may be disposed separately and then fixedly connected to each other.

[0306] FIG. 38 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 38 to 41, the snow thrower in this example has basically the same structures as the snow thrower in the example shown in FIG. 23. All solutions of the snow thrower shown in FIGS. 23 to 27 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 23, and the identical parts thereof are not repeatedly described. As shown in FIGS. 38 to 41, a power unit 560f includes a first electric motor 561f, a second electric motor 565f, and a third electric motor 562f. The first electric motor 561f is configured to drive a first-stage snow removal assembly 551f, the second electric motor 565f is configured to drive a second-stage snow removal assembly 552f, and the third electric motor 562f is configured to drive a third-stage snow removal assembly 553f. The three electric motors included in the power unit 560f drive the first-stage snow removal assembly 551f, the second-stage snow removal assembly 552f, and the third-stage snow removal assembly 553f, respectively. In this manner, the control device can control the three electric motors separately so that the snow removal device can more efficiently remove the snow. In this example, a first mounting shaft 5512f extends along the left and right direction. The first electric motor 561f is disposed on the inner side of a snow collection cover 531f and drives, through a first reduction assembly 563f, the first mounting shaft 5512f to rotate. The first reduction assembly 563f is disposed on the outer side of the snow collection cover 531f. For example, the first reduction assembly 563f may be disposed on the outer surface of the left sidewall or right sidewall of the snow collection cover 531f. The first reduction assembly 563f may be a belt transmission assembly. A second mounting shaft 5522f extends along the front and rear direction. A second snow removal blade 5521f is disposed on the rear side of a first snow removal blade 5511f. The second electric motor 565f drives, through the second reduction assembly, the second mounting shaft 5522f to rotate and is disposed on the upper side of the top wall of the snow collection cover 531f. A third mounting shaft 5532f extends along the front and rear direction. The third electric motor 562f is disposed on the rear side of the third-stage snow removal assembly 553f to drive the third mounting shaft 5532f to rotate. The third electric motor 562f may drive, through a third reduction assembly, the third mounting shaft 5532f to rotate. In another example, the third electric motor 562f may directly drive the third mounting shaft 5532f to rotate.

[0307] FIG. 42 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 42 and 43, the snow thrower in this example has basically the same structures as the snow thrower in the example shown in FIG. 38. All solutions of the snow

thrower shown in FIGS. 38 to 41 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 23, and the identical parts thereof are not repeatedly described. In this example, a first mounting shaft 5512g extends along the front and rear direction. A first electric motor 561g driving the first mounting shaft 5512g to rotate is disposed on the outer side of the top wall of the snow collection cover. A second mounting shaft 5522g extends along the left and right direction. A second electric motor 565g is disposed on the inner side of the snow collection cover. A second reduction assembly 564g for transmitting power between the second electric motor 565g and the second mounting shaft 5522g is disposed on the outer surface of the left sidewall or right sidewall of the snow collection cover.

[0308] FIG. 44 is a perspective view showing part of devices of a snow thrower in another example. As shown in FIGS. 44 and 45, the snow thrower in this example has basically the same structures as the snow thrower in the example shown in FIG. 42. All solutions of the snow thrower shown in FIGS. 42 and 43 that can be suitable for the snow thrower in this example are applicable in this example. The following mainly introduces the different parts between this example and the example shown in FIG. 42, and the identical parts thereof are not repeatedly described. In this example, a first-stage snow removal assembly 551h includes two first snow removal blades 5511h. One of the two first snow removal blades 5511h is disposed on the front side of a second mounting shaft 5522h, and the other one of the two first snow removal blades 5511h is disposed on the rear side of the second mounting shaft 5522h.

[0309] The basic principles, main features, and advantages of this application are shown and described above. It is to be understood by those skilled in the art that the aforementioned examples do not limit the present application in any form, and all technical solutions obtained through equivalent substitutions or equivalent transformations fall within the scope of the present application.

Claims

1. A snow thrower (100, 200, 300, 500), comprising:

a snow collection device (13) comprising a snow collection element (131) for collecting snow and a first electric motor (132) configured to drive the snow collection element to rotate;

a snow throwing device (14) comprising a snow throwing element (141) for throwing out the snow collected by the snow collection device, a discharge chute (143) guiding the snow along a snow throwing direction, and a second electric motor (142) driving the snow throwing element to rotate;

a main housing (11) for supporting the snow collection device and the snow throwing device; a walking assembly (12) driving the snow thrower to walk on the ground; and a power supply device (15) configured to power the first electric motor and the second electric motor; wherein the snow collection device further comprises:

a first transmission assembly (134) disposed between the first electric motor and the snow collection element to transmit power between the first electric motor and the snow collection element; wherein a rotational speed of the first electric motor is higher than or equal to 5000 rpm and lower than or equal to 20000 rpm, and a reduction ratio of the first transmission assembly is higher than or equal to 40 and lower than or equal to 200.

2. The snow thrower according to claim 1, wherein a rotational speed of the second electric motor is higher than or equal to 5000 rpm and lower than or equal to 14000 rpm.
3. The snow thrower according to claim 2, wherein the snow throwing device further comprises a second transmission assembly (144) disposed between the second electric motor and the snow throwing element to transmit power between the second electric motor and the snow throwing element, and a reduction ratio of the second transmission assembly is higher than or equal to 4 and lower than or equal to 20.
4. The snow thrower according to claim 1, wherein the first transmission assembly comprises a first gear (134a) rotating about a first axis (103), and a second gear (134b) meshing with the first gear and rotating about a second axis (104).
5. The snow thrower according to claim 4, wherein the first axis and the second axis are parallel to each other.
6. The snow thrower according to claim 4, wherein the second axis is oblique or perpendicular to the first axis.
7. The snow thrower according to claim 1, wherein a diameter of the first electric motor is greater than or equal to 30 mm and less than or equal to 110 mm.
8. The snow thrower according to claim 1, wherein a diameter of the second electric motor is greater than or equal to 60 mm and less than or equal to 135 mm.

9. The snow thrower according to claim 1, wherein the reduction ratio of the first transmission assembly is higher than or equal to 80 and lower than or equal to 120. 5
10. The snow thrower according to claim 1, wherein a working current of the first electric motor is less than or equal to 40 A when the snow collection element works with no load. 10
11. The snow thrower according to claim 1, wherein a working current of the second electric motor is less than or equal to 40 A when the snow collection element works with no load. 15
12. The snow thrower according to claim 1, further comprising a control device (30) configured to adjust a rotational speed of the first electric motor in response to a variation in a load, wherein a rotational speed of the second electric motor is kept at a value of a rotational speed corresponding to a set snow throwing distance when the rotational speed of the first electric motor varies. 20
13. The snow thrower according to claim 1, wherein the snow collection element rotates about a rotation axis (102), a coordinate system using a point on the rotation axis of the snow collection element as an origin, a front and rear direction as an X-axis, and an up and down direction as a Y-axis is established, a forward direction is a positive direction of the X-axis, an upward direction is a positive direction of the Y-axis, a projection of the first electric motor on a plane where the coordinate system is located is within an angular region using the origin as a vertex and located in the plane where the coordinate system is located, a first side of the angular region is within a first quadrant of the coordinate system and an included angle between the first side of the angular region and the positive direction of the Y-axis is less than or equal to 60 degrees, and a second side of the angular region is within a second quadrant of the coordinate system and an included angle between the second side of the angular region and the positive direction of the Y-axis is less than or equal to 80 degrees. 25 30 35 40 45
14. The snow thrower according to claim 1, further comprising a control device (30) configured to control a rotational speed of the first electric motor according to at least a state of the snow and a walking speed of the walking assembly. 50
15. The snow thrower according to claim 1, further comprising a control device (30) configured to control a walking speed of the walking assembly and a rotational speed of the first electric motor according to at least a state of the snow 55

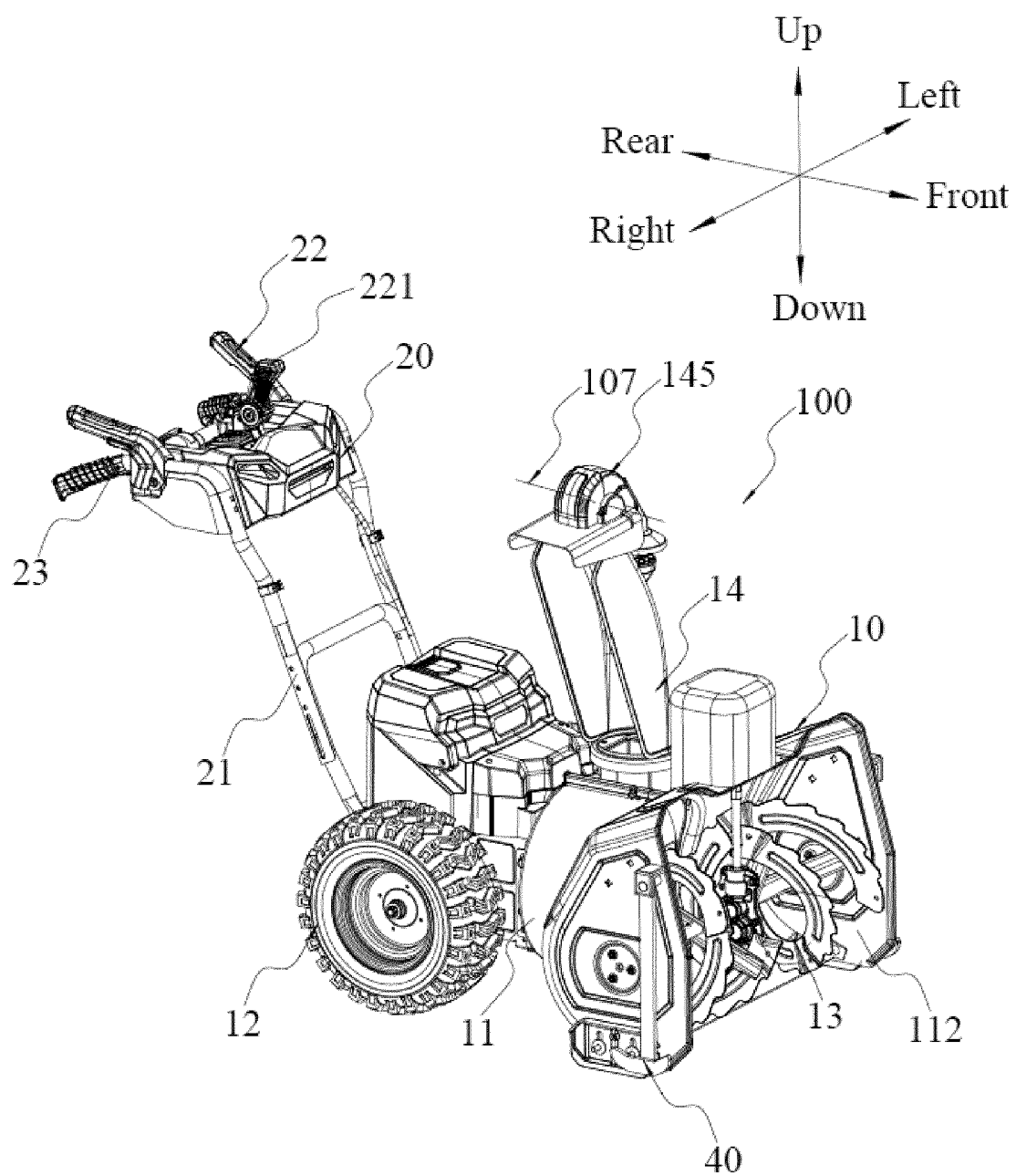


FIG. 1

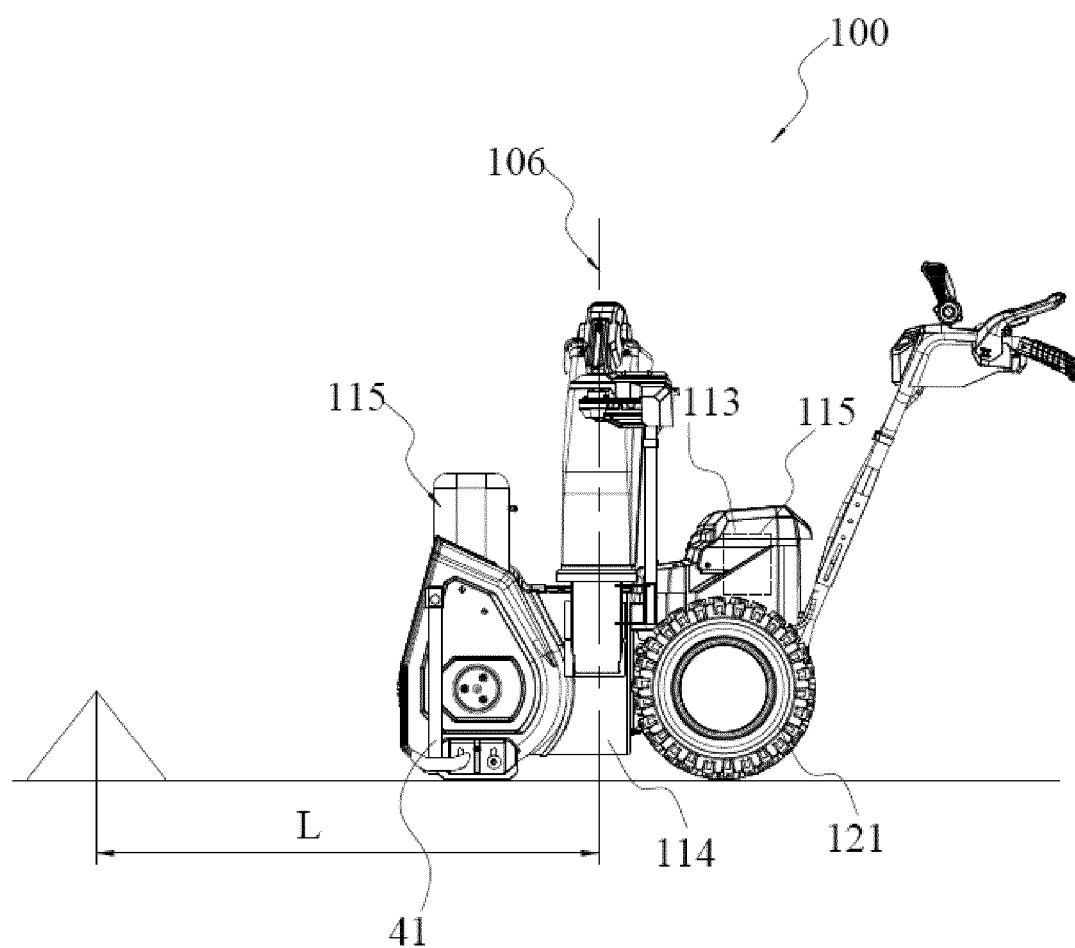


FIG. 2

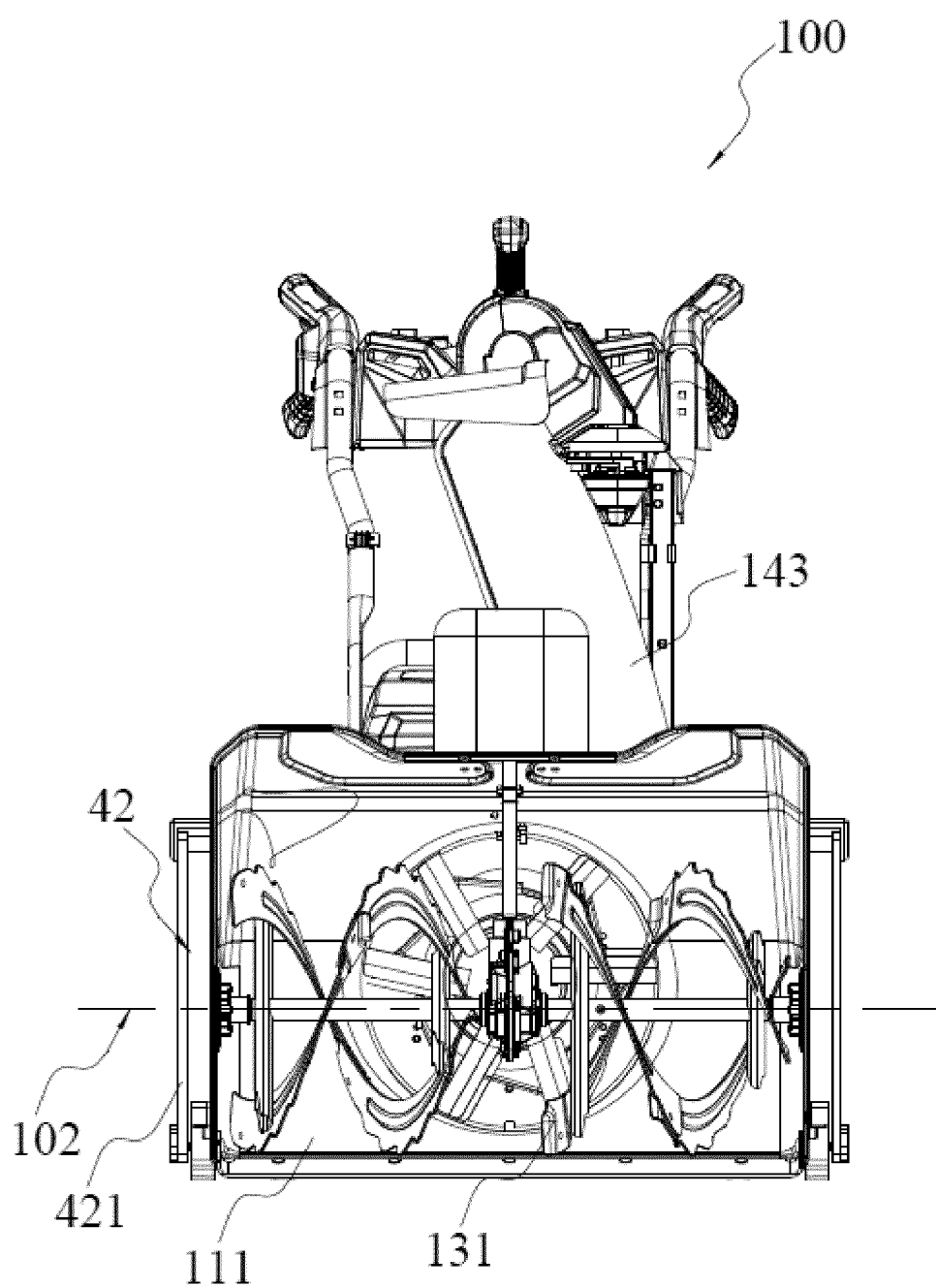


FIG. 3

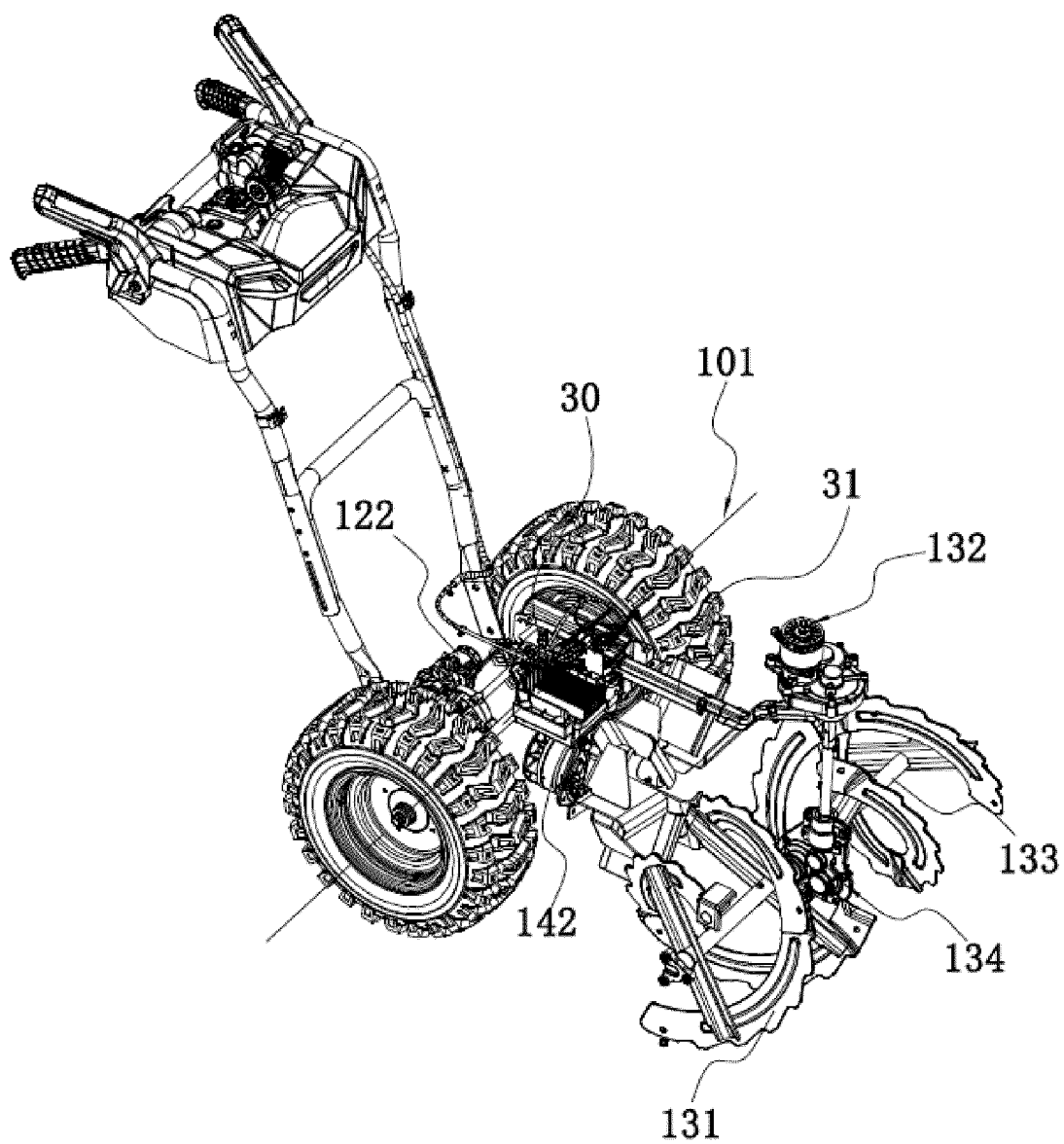


FIG. 4

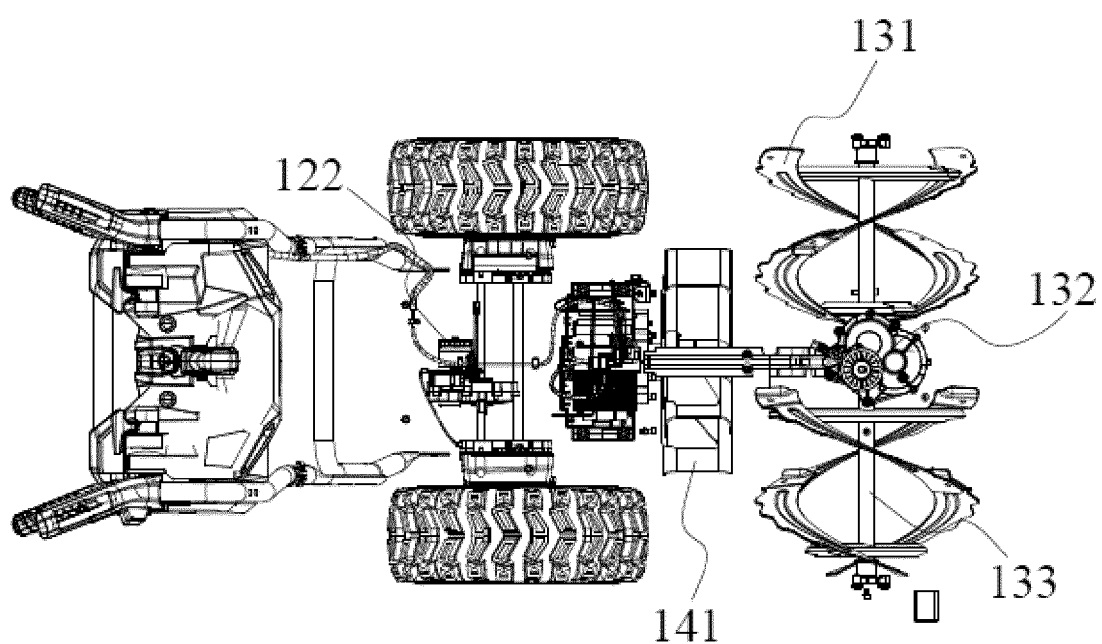


FIG. 5

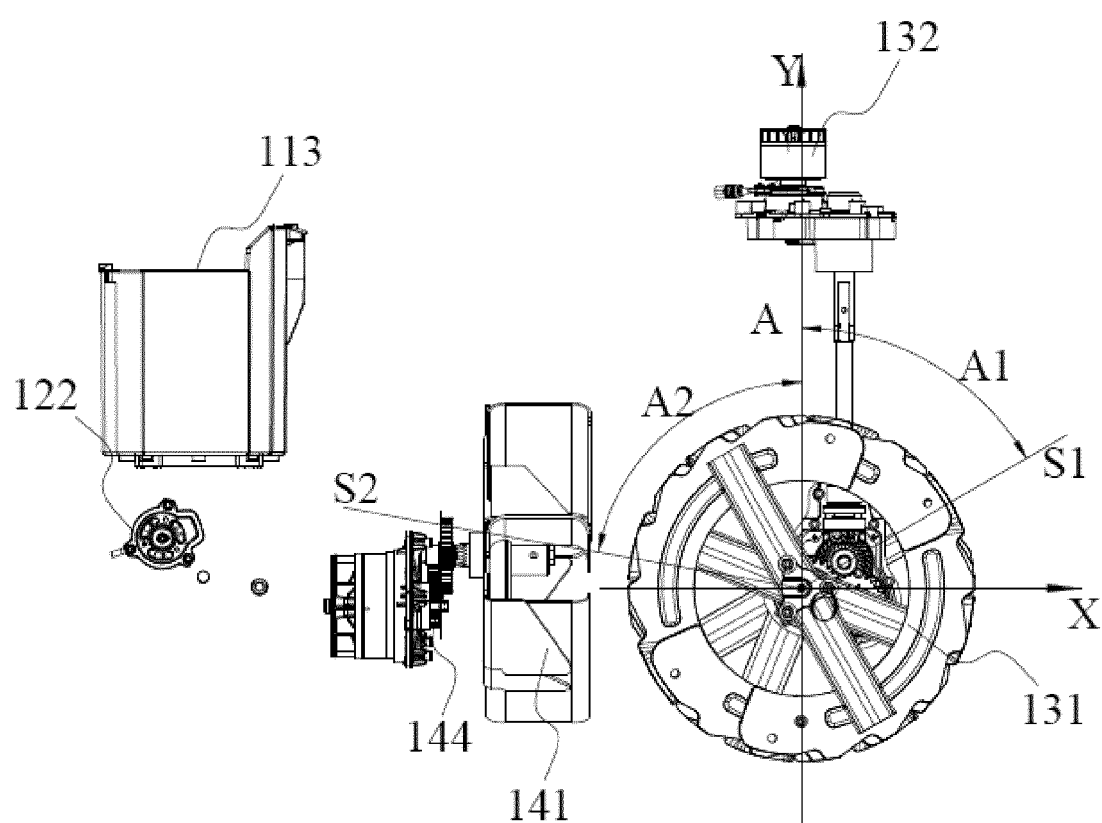


FIG. 6

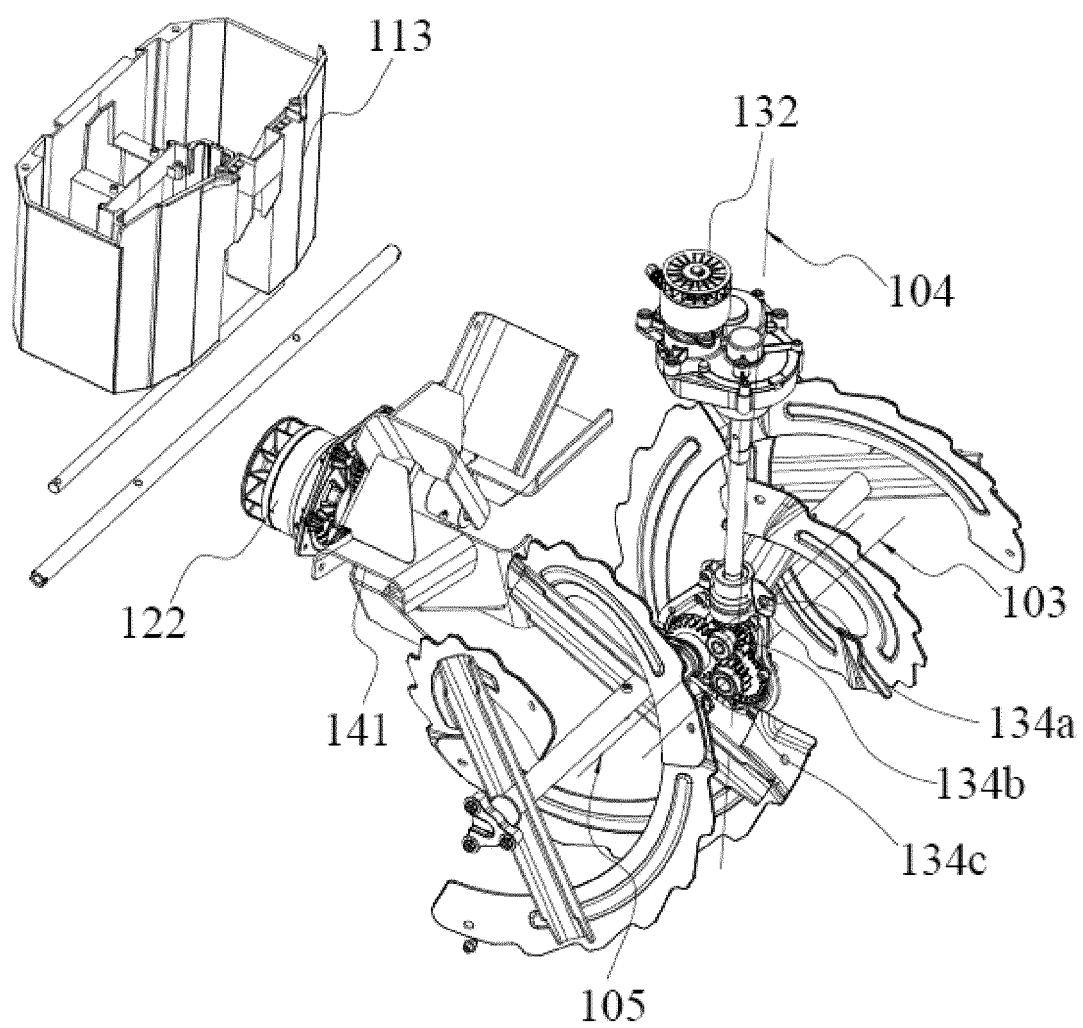


FIG. 7

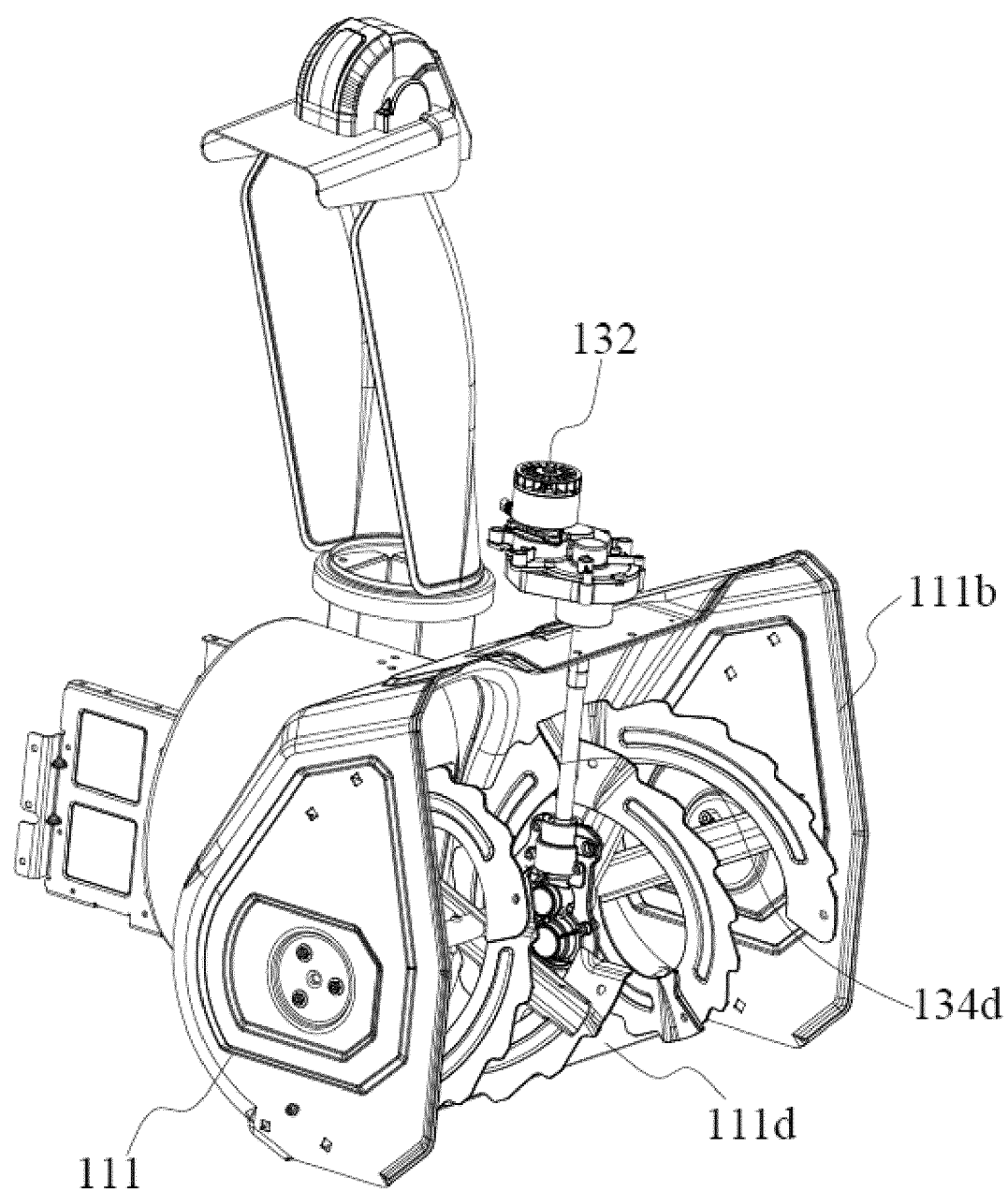


FIG. 8

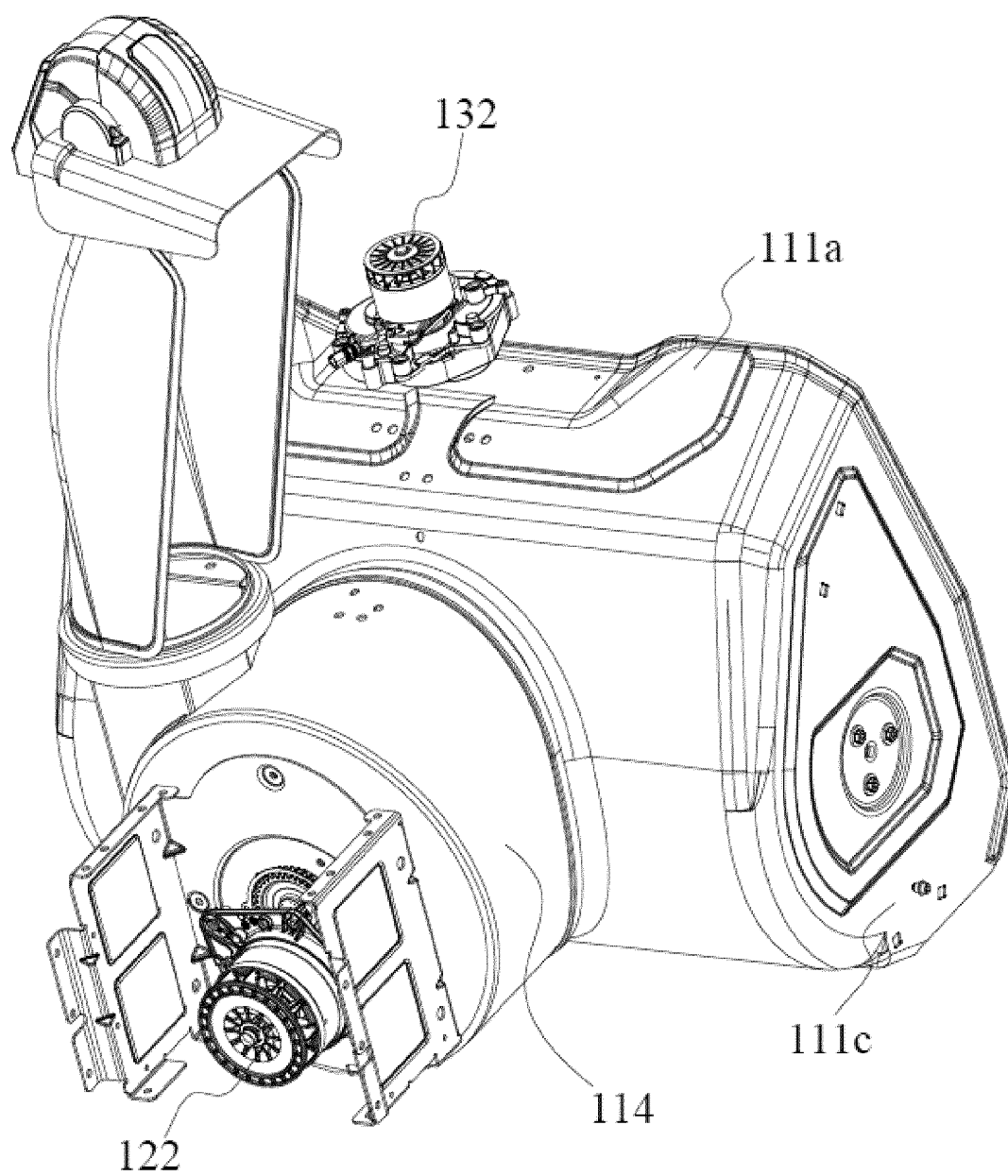


FIG. 9

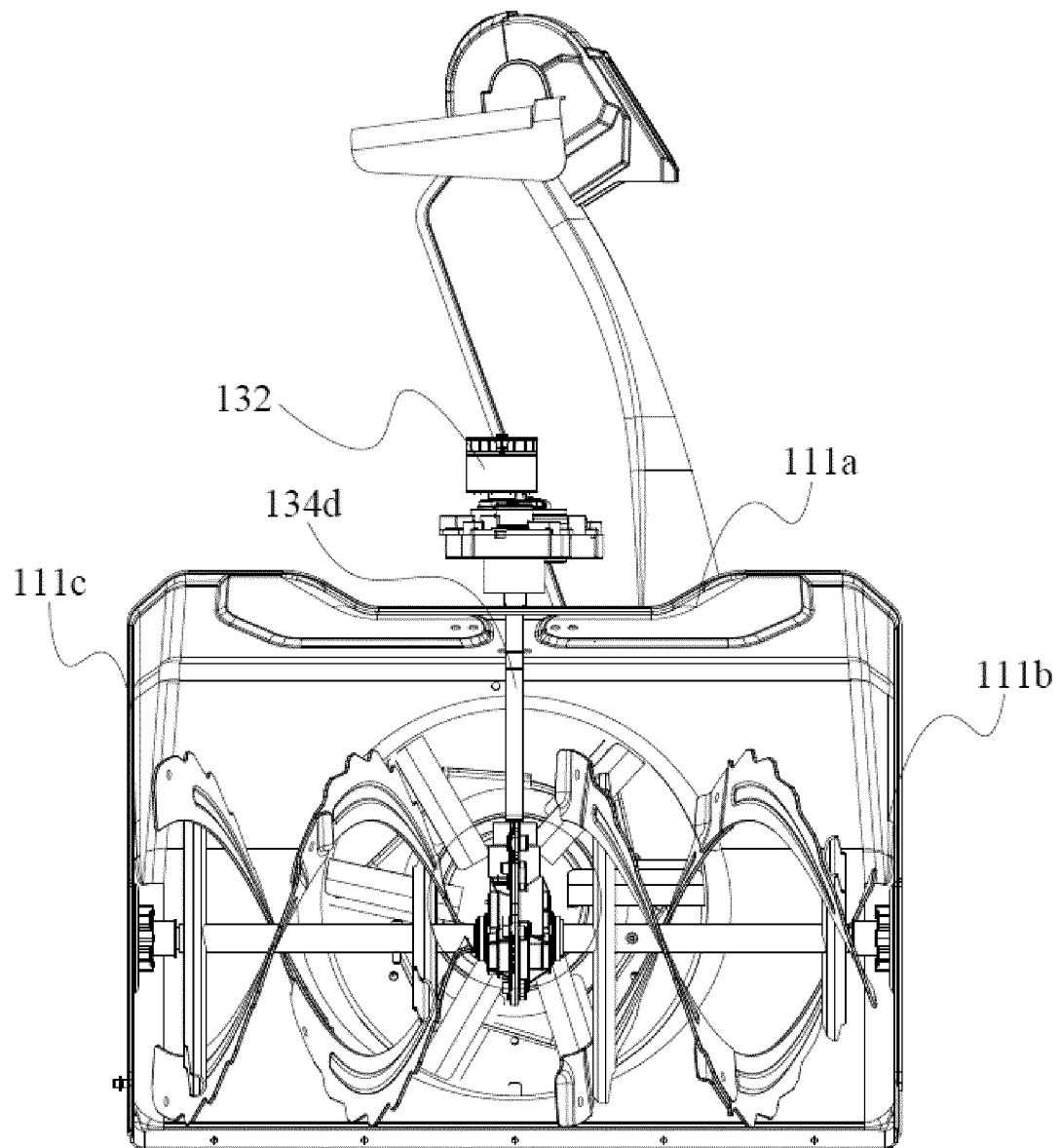


FIG. 10

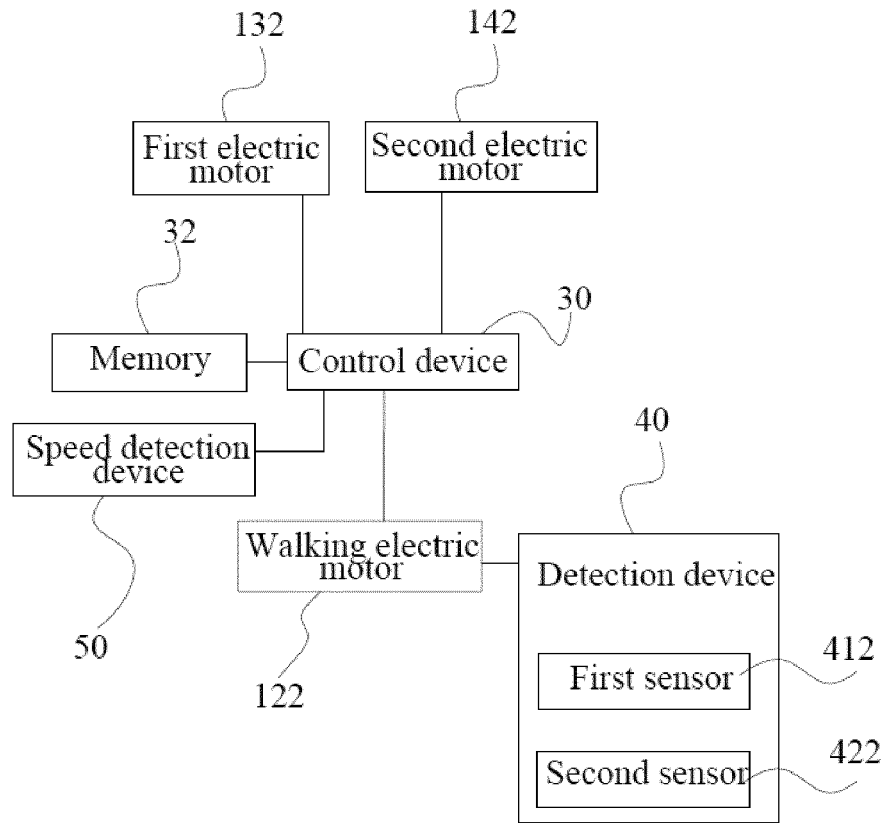


FIG. 11

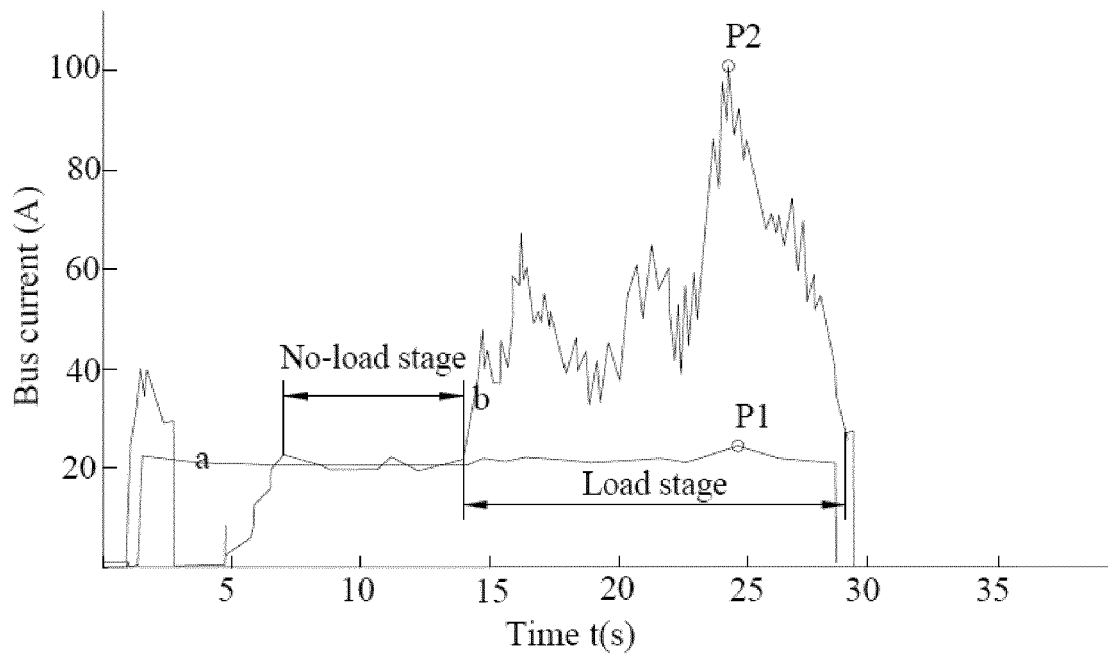


FIG. 12

Thickness of Snow 0.1m					
Walking Speed	Snow Intake During a Walk	Rotational Speed of a Snow Collection Element	Amount of Collected Snow of the Snow Collection Element	Rotational Speed of a Snow Throwing Element	Amount of Thrown Snow of the Snow Throwing Element
(m/s)	(m ³ /s)	(rpm)	(m ³ /s)	(rpm)	(m ³ /s)
0	0	0	0	1143	0.088
0.05	0.003	11	0.00345	1143	0.088
0.1	0.006	23	0.0069	1143	0.088
0.15	0.009	34	0.01035	1143	0.088
0.2	0.012	46	0.0138	1143	0.088
0.25	0.015	57	0.01725	1143	0.088
0.3	0.018	69	0.0207	1143	0.088
0.35	0.021	80	0.02415	1143	0.088
0.4	0.024	92	0.0276	1143	0.088

FIG. 13A

Thickness of Snow 0.2m					
Walking Speed (m/s)	Snow Intake During a Walk (m ³ /s)	Rotational Speed of a Snow Collection Element (rpm)	Amount of Collected Snow of the Snow Collection Element (m ³ /s)	Rotational Speed of a Snow Throwing Element (rpm)	Amount of Thrown Snow of the Snow Throwing Element (m ³ /s)
0	0	0	0	1143	0.088
0.05	0.006	23	0.0069	1143	0.088
0.1	0.012	46	0.0138	1143	0.088
0.15	0.018	69	0.0207	1143	0.088
0.2	0.024	92	0.0276	1143	0.088
0.25	0.03	115	0.0345	1143	0.088
0.3	0.036	130	0.0414	1143	0.088
0.35	0.042	156	0.0483	1143	0.088
0.4	0.048	182	0.0552	1143	0.088

FIG. 13B

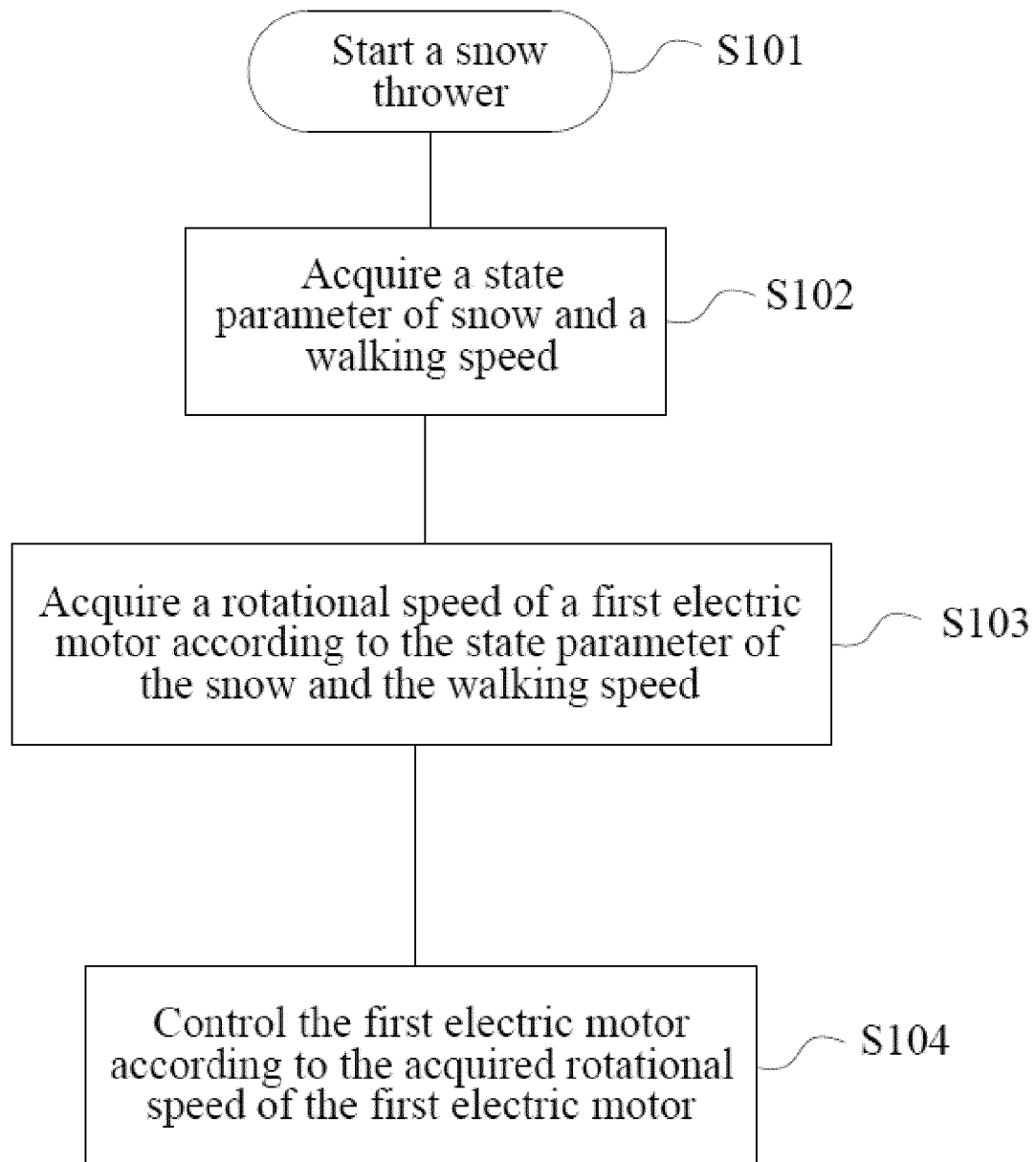


FIG. 14

Thickness of snow	Walking speed	Snow Intake During a Walk	Rotational Speed of a Snow Collection Element	Amount of Collected Snow of the Snow Collection Element	Rotational Speed of a Snow Throwing Element	Amount of Thrown Snow of the Snow Throwing Element
(m)	(m/s)	(m ³ /s)	(rpm)	(m ³ /s)	(rpm)	(m ³ /s)
0.02	0.7	0.0084	32.2	0.00966	1143	0.088
0.04	0.7	0.0168	64.4	0.01932	1143	0.088
0.06	0.7	0.0252	96.6	0.02898	1143	0.088
0.08	0.7	0.0336	128.8	0.03864	1143	0.088
0.1	0.56	0.0336	128.8	0.03864	1143	0.088
0.12	0.47	0.0336	128.8	0.03864	1143	0.088
0.14	0.4	0.0336	128.8	0.03864	1143	0.088
0.16	0.35	0.0336	128.8	0.03864	1143	0.088
0.18	0.31	0.0336	128.8	0.03864	1143	0.088
0.2	0.28	0.0336	128.8	0.03864	1143	0.088
0.22	0.25	0.0336	128.8	0.03864	1143	0.088
0.24	0.23	0.0336	128.8	0.03864	1143	0.088
0.26	0.22	0.0336	128.8	0.03864	1143	0.088
0.28	0.2	0.0336	128.8	0.03864	1143	0.088
0.3	0.19	0.0336	128.8	0.03864	1143	0.088
0.32	0.18	0.0336	128.8	0.03864	1143	0.088
0.34	0.16	0.0336	128.8	0.03864	1143	0.088
0.36	0.16	0.0336	128.8	0.03864	1143	0.088
0.38	0.15	0.0336	128.8	0.03864	1143	0.088
0.4	0.14	0.0336	128.8	0.03864	1143	0.088

FIG. 15

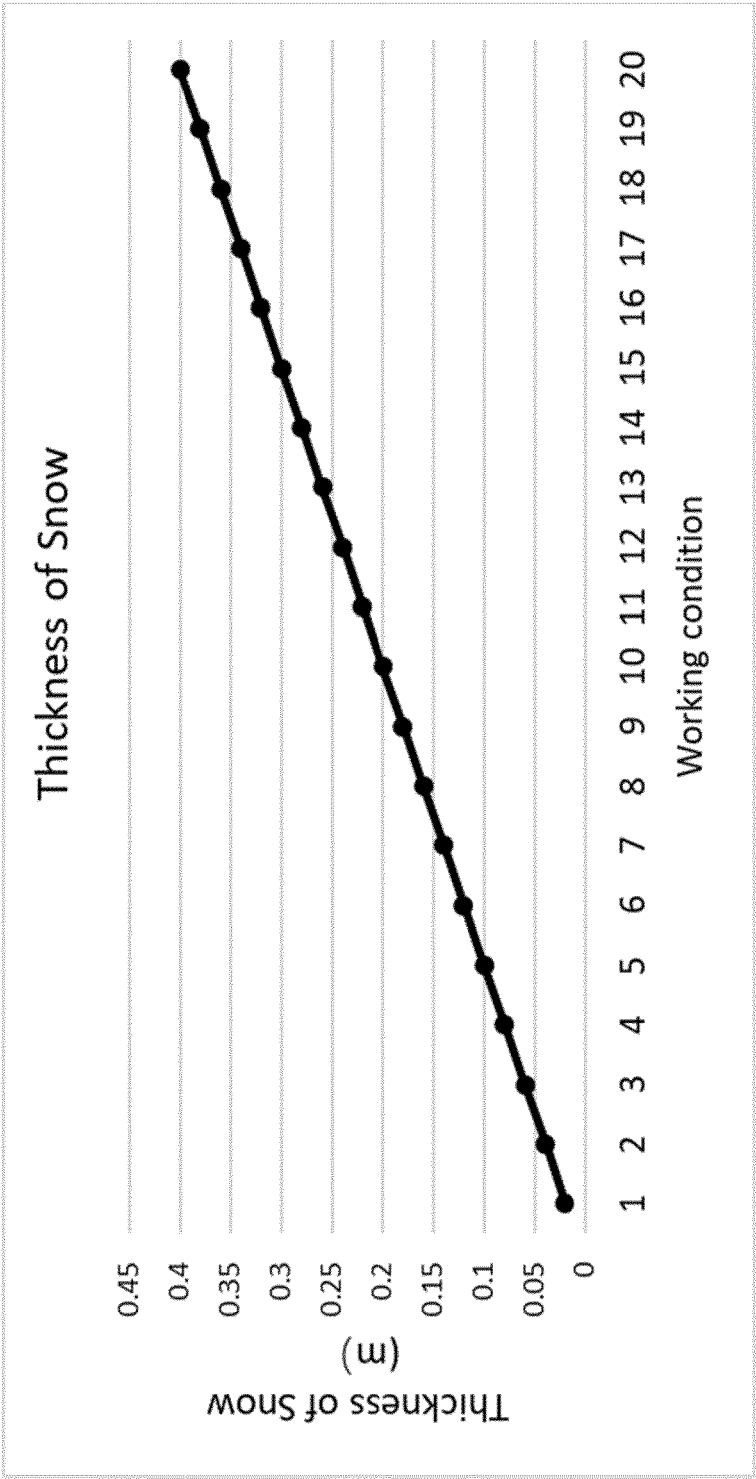


FIG. 16A

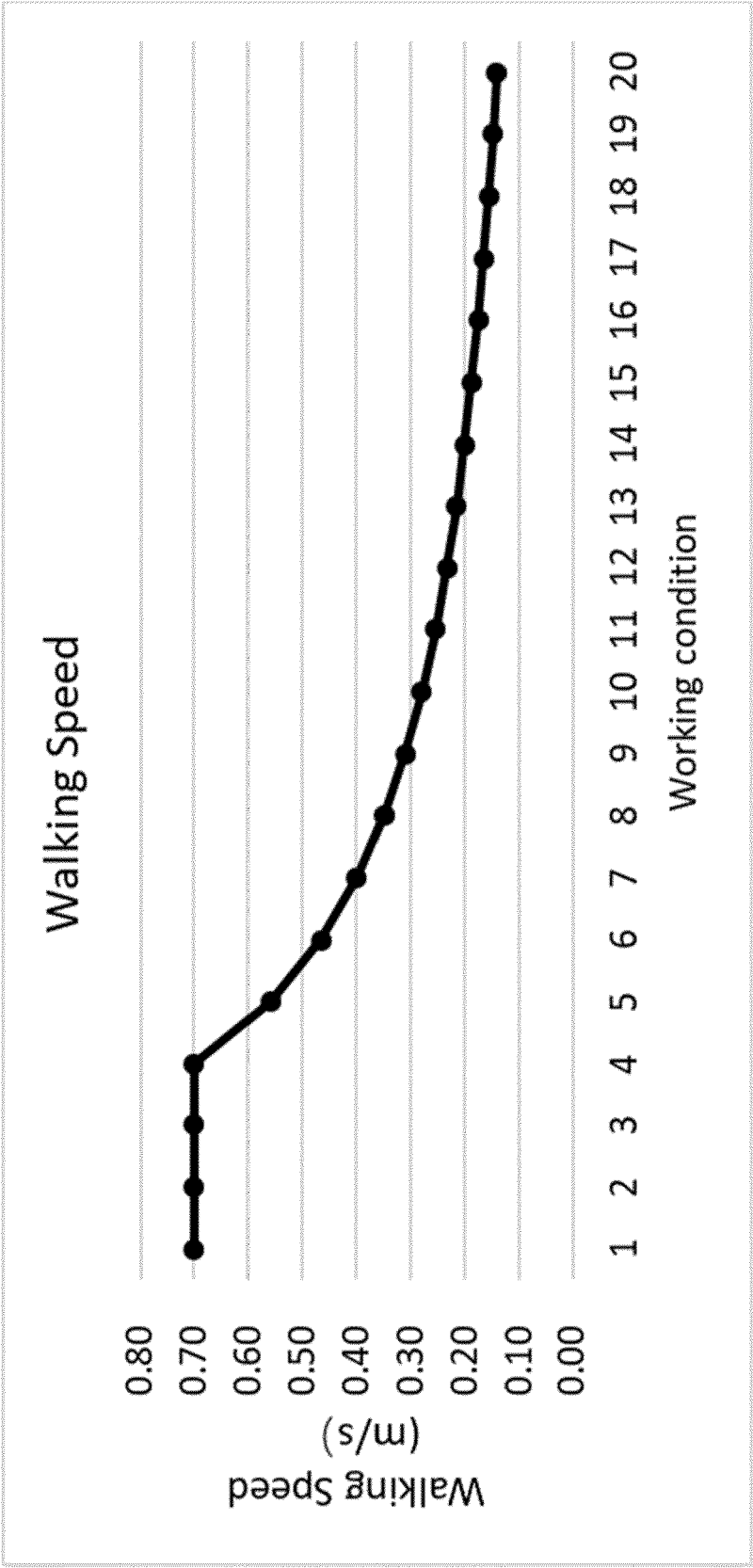


FIG. 16B

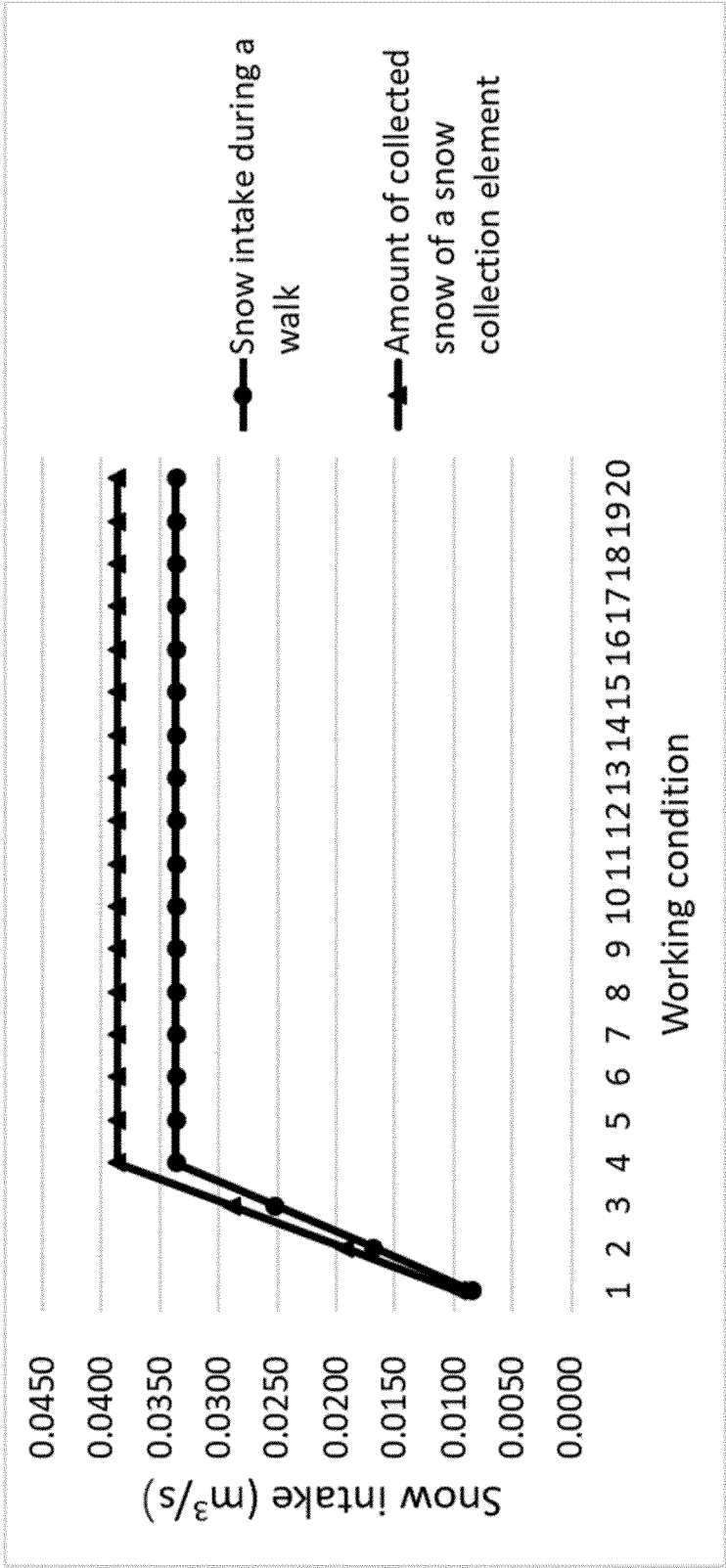


FIG. 16C

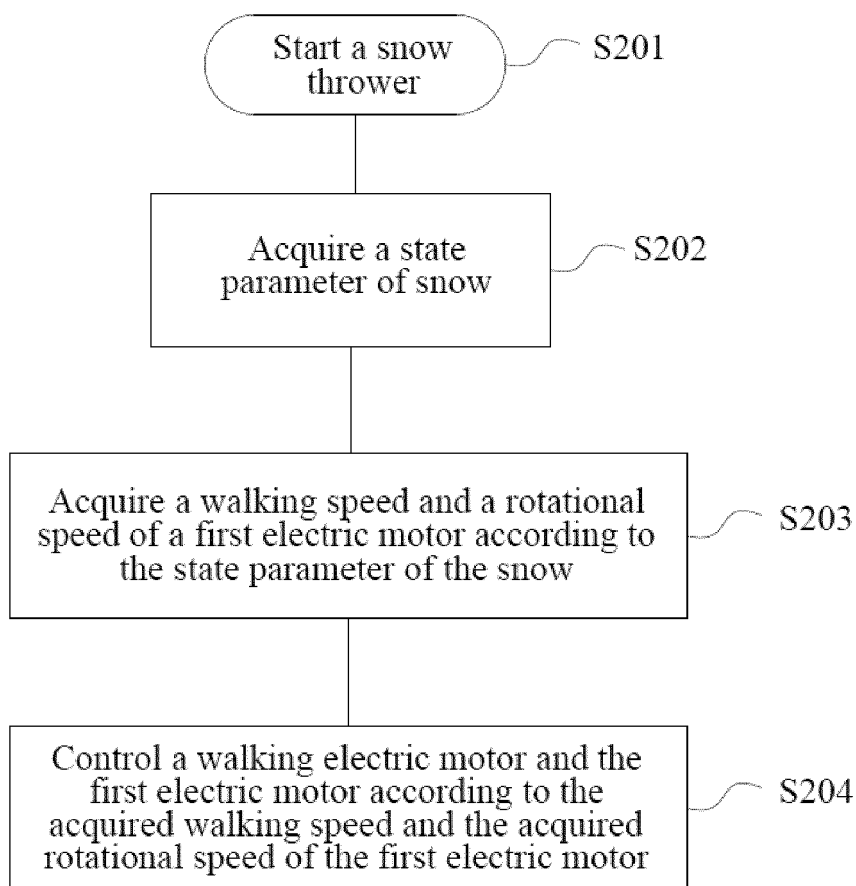


FIG. 17

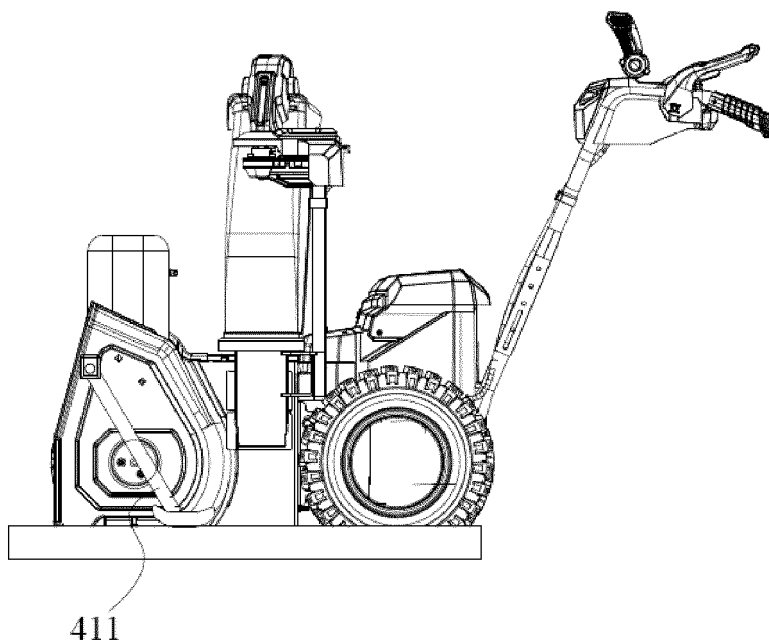


FIG. 18

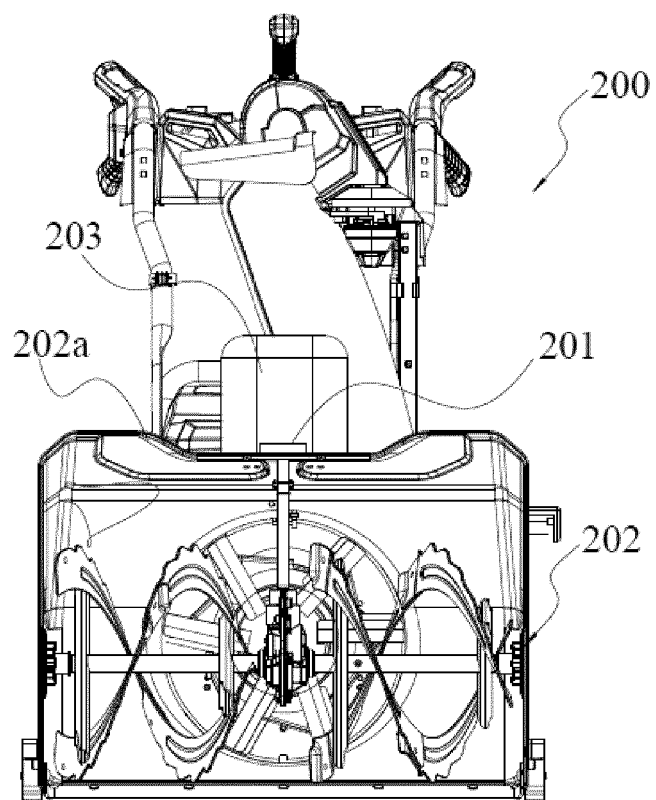


FIG. 19

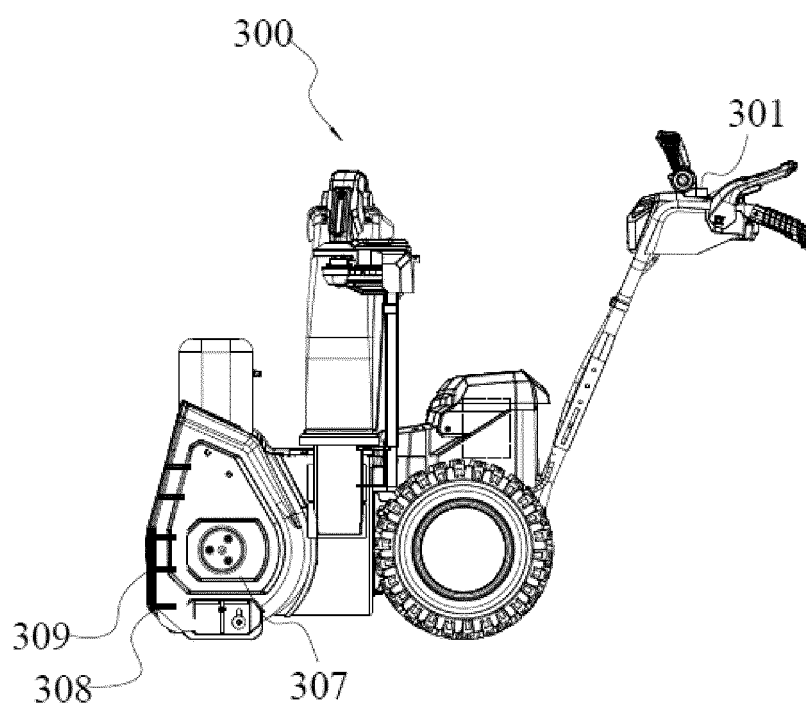


FIG. 20

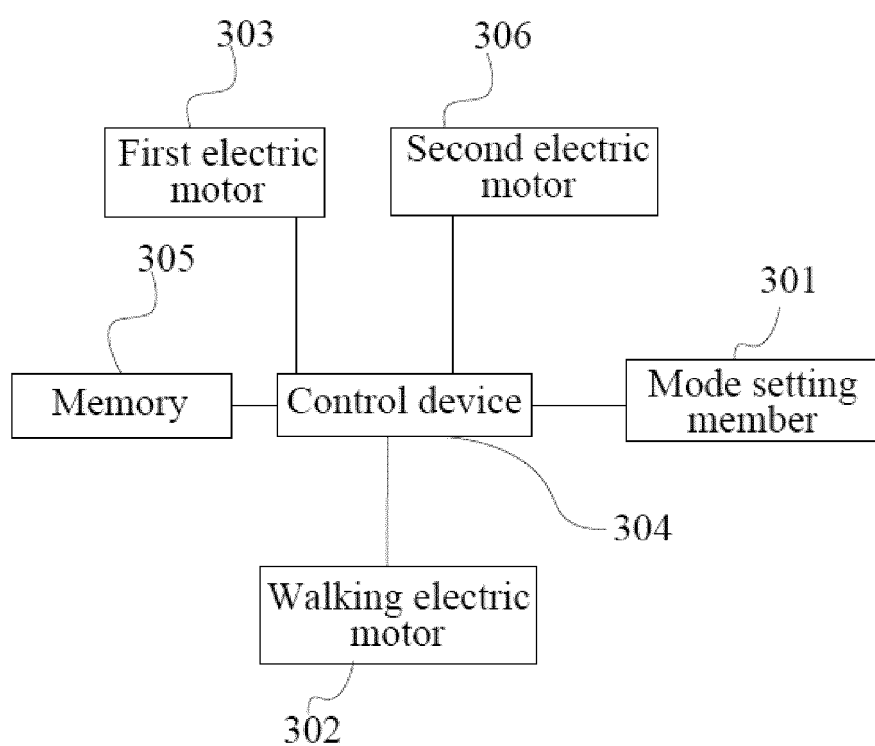


FIG. 21

Working Condition	Thickness of Snow	Walking Speed (m/s)	Snow Intake During a Walk (m ³ /s)	Rotational Speed of a Snow Collection Element (rpm)	Amount of Collected Snow of the Snow Collection Element (m ³ /s)	Rotational Speed of a Snow Throwing Element (rpm)	Amount of Thrown Snow of the Snow Throwing Element (m ³)
	(m)						
Light load level	0.0~0.05	0.7	0.0252	96.6	0.02898	1143	0.088
Intermediate load level 1	0.05~0.1	0.56	0.0336	128.8	0.03864	1143	0.088
Intermediate load level 2	0.1~0.2	0.28	0.0336	128.8	0.03864	1143	0.088
Intermediate load level 3	0.2~0.3	0.19	0.0336	128.8	0.03864	1143	0.088
Heavy level	0.3~0.4	0.14	0.0336	128.8	0.03864	1143	0.088

FIG. 22

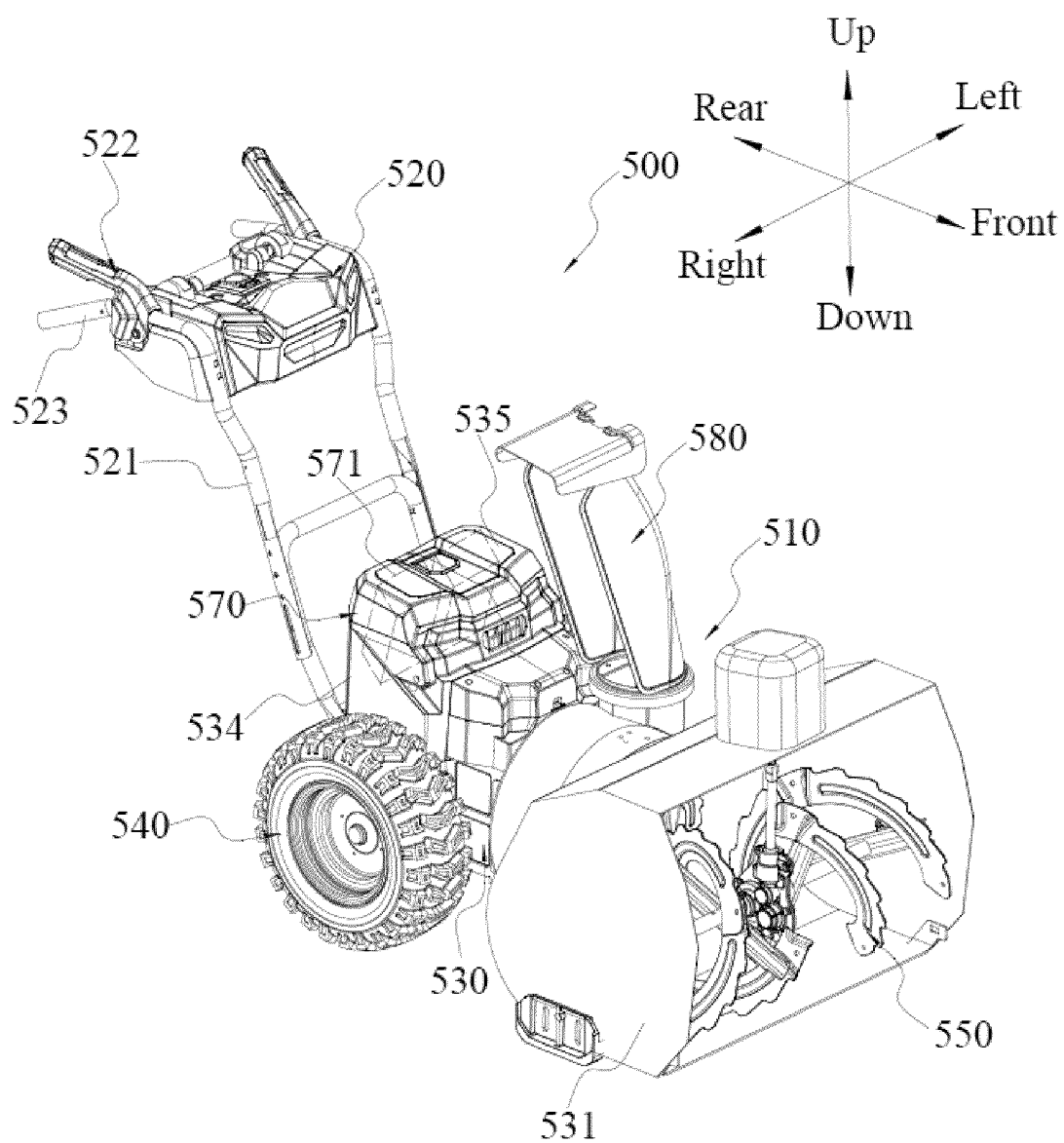


FIG. 23

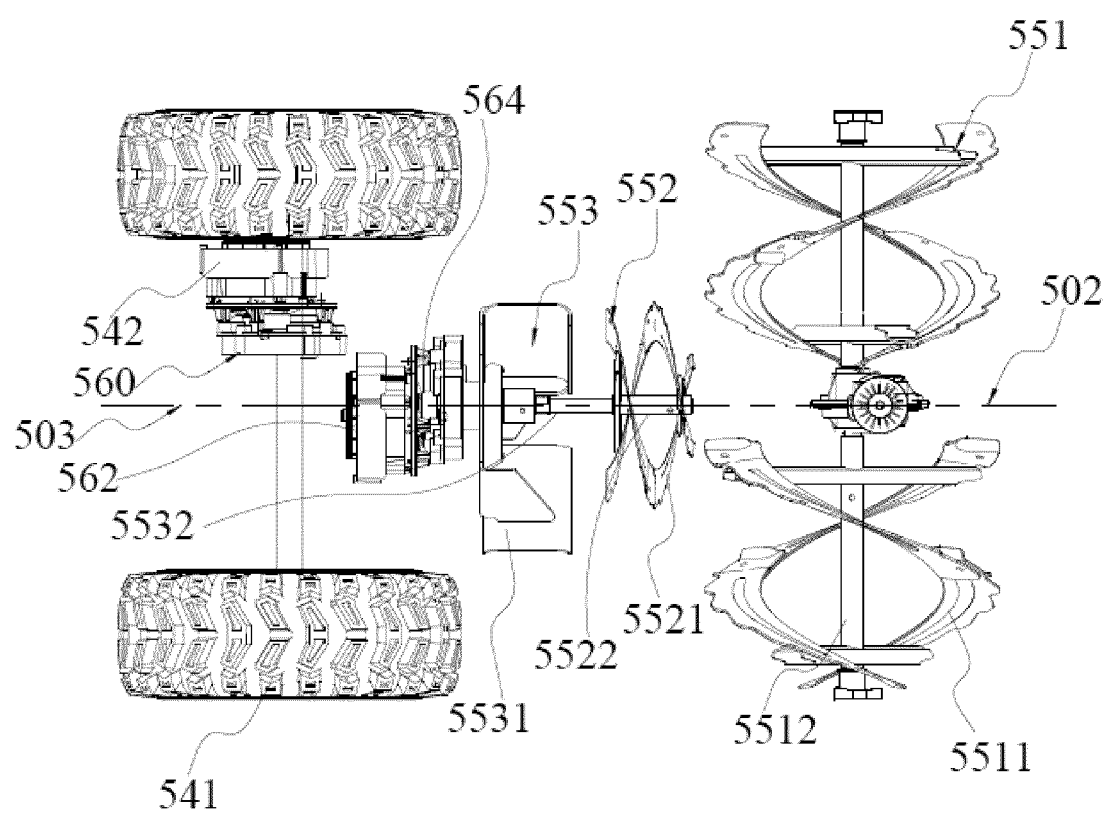


FIG. 24

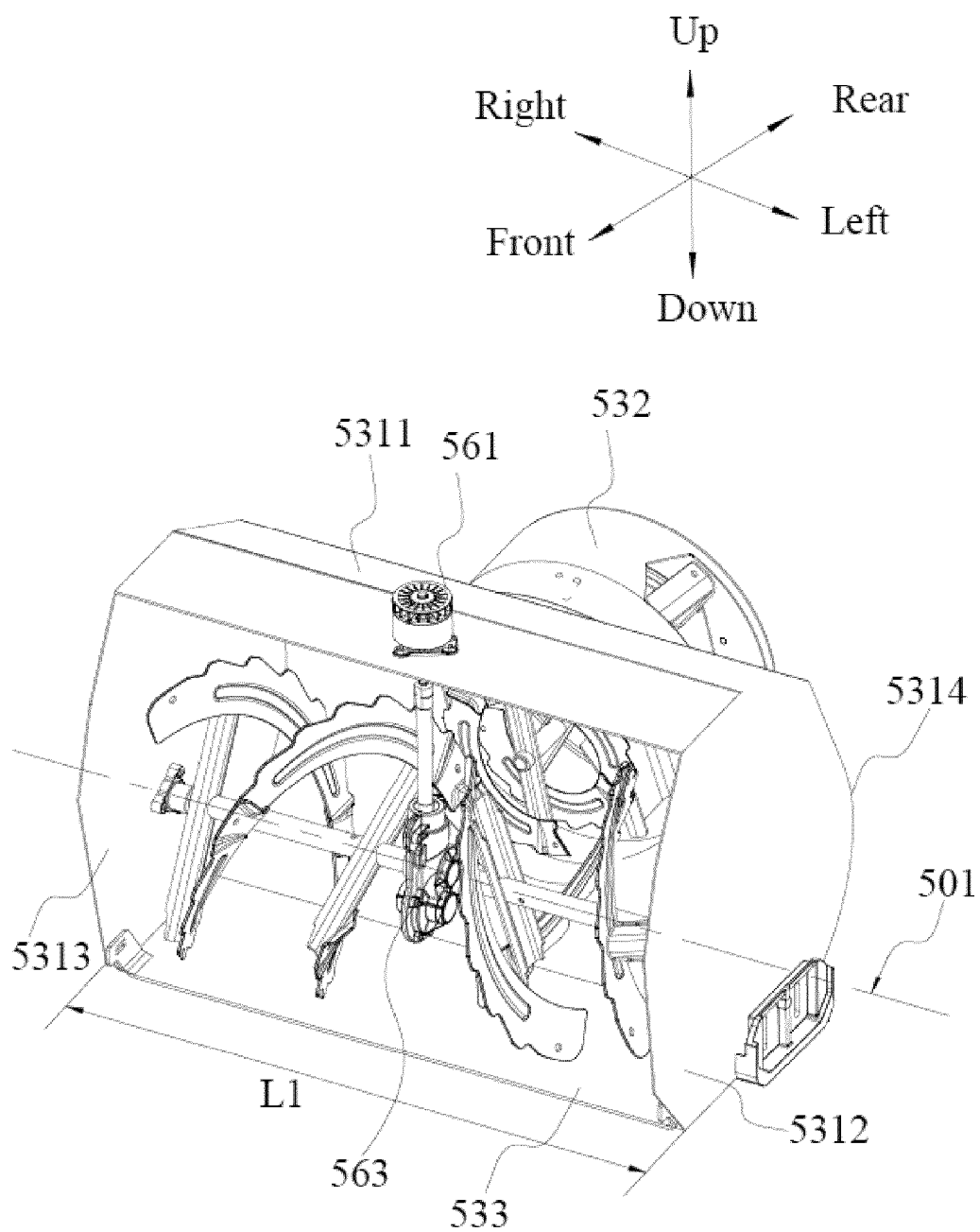


FIG. 25

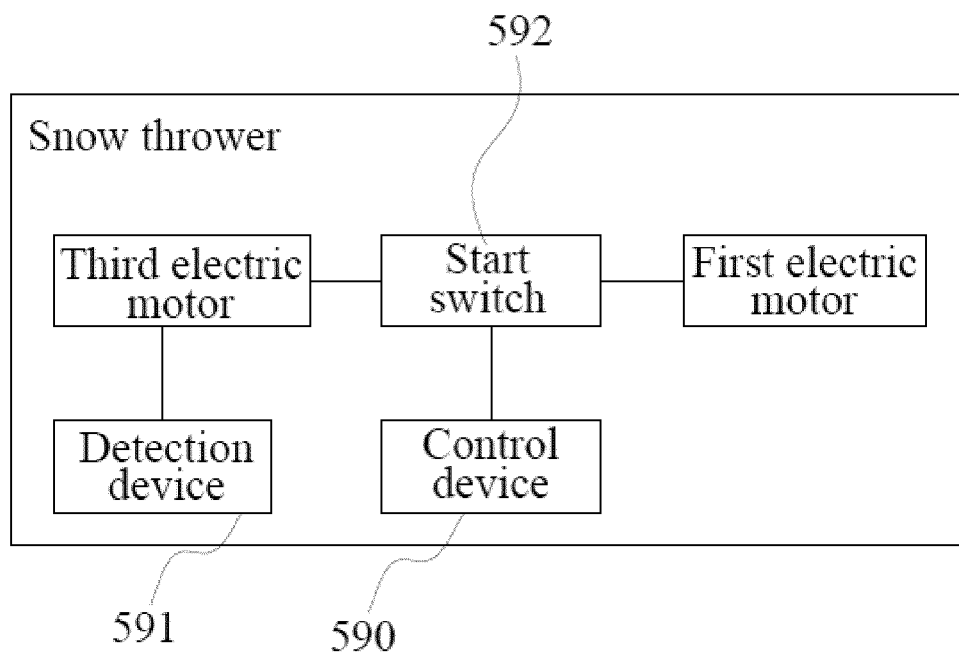


FIG. 26

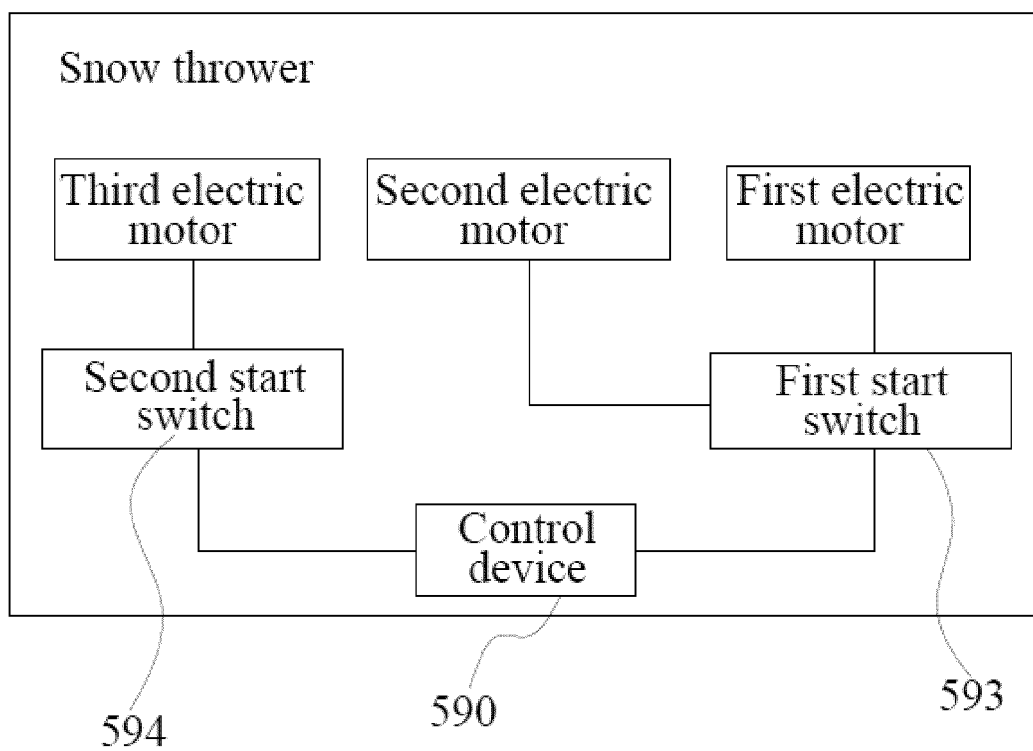


FIG. 27

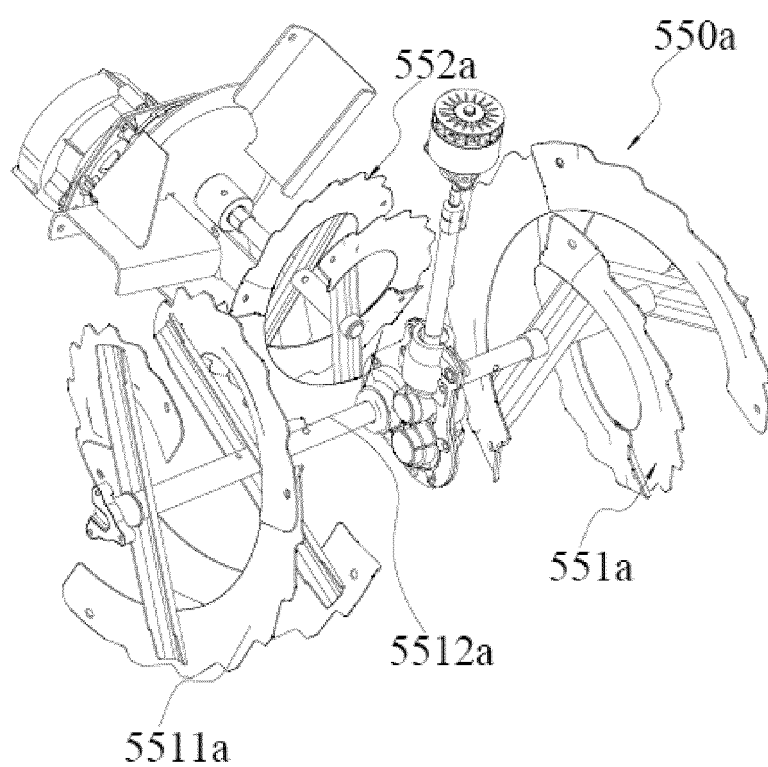


FIG. 28

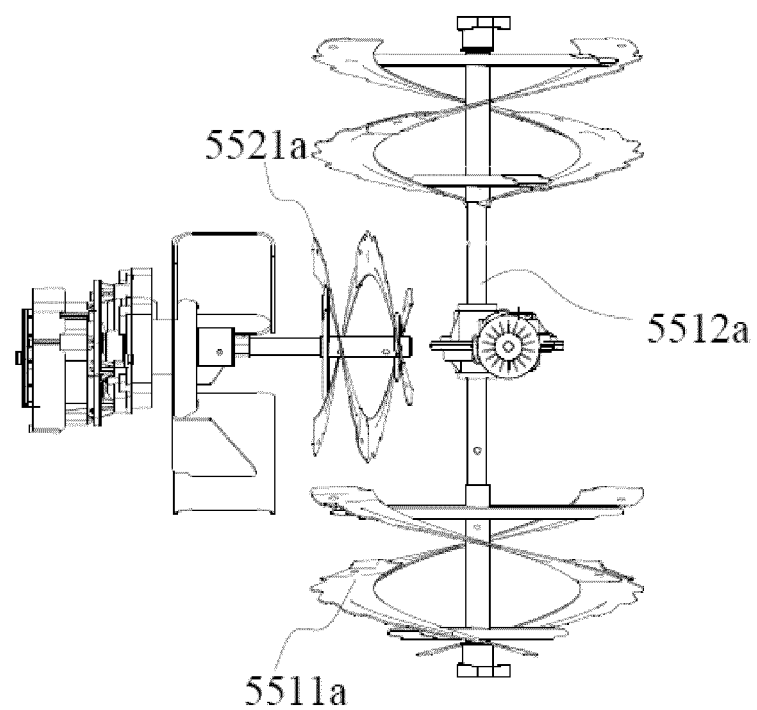


FIG. 29

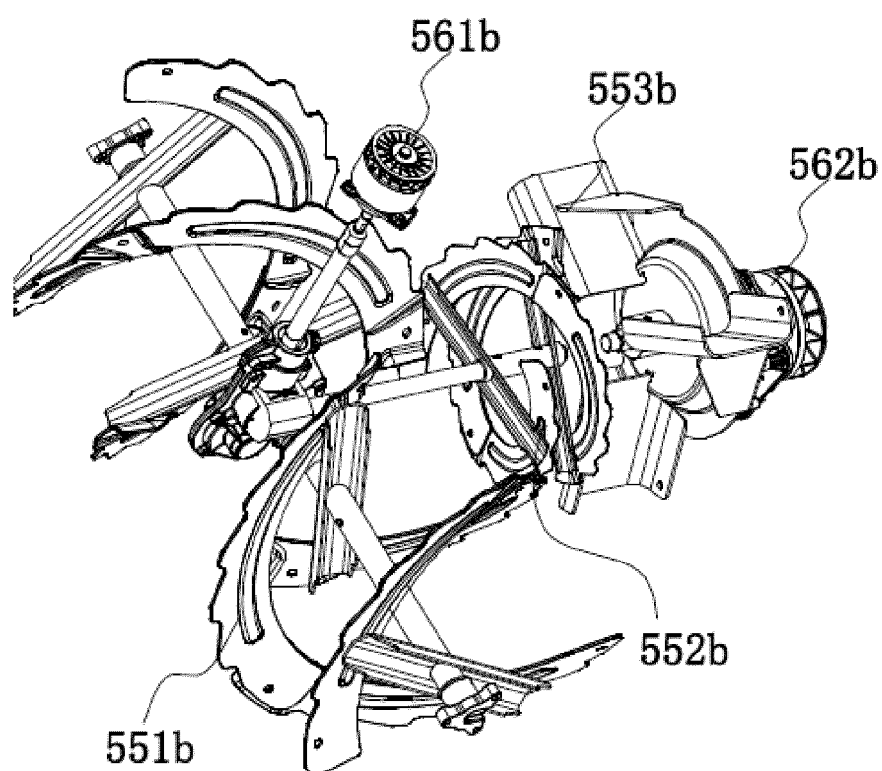


FIG. 30

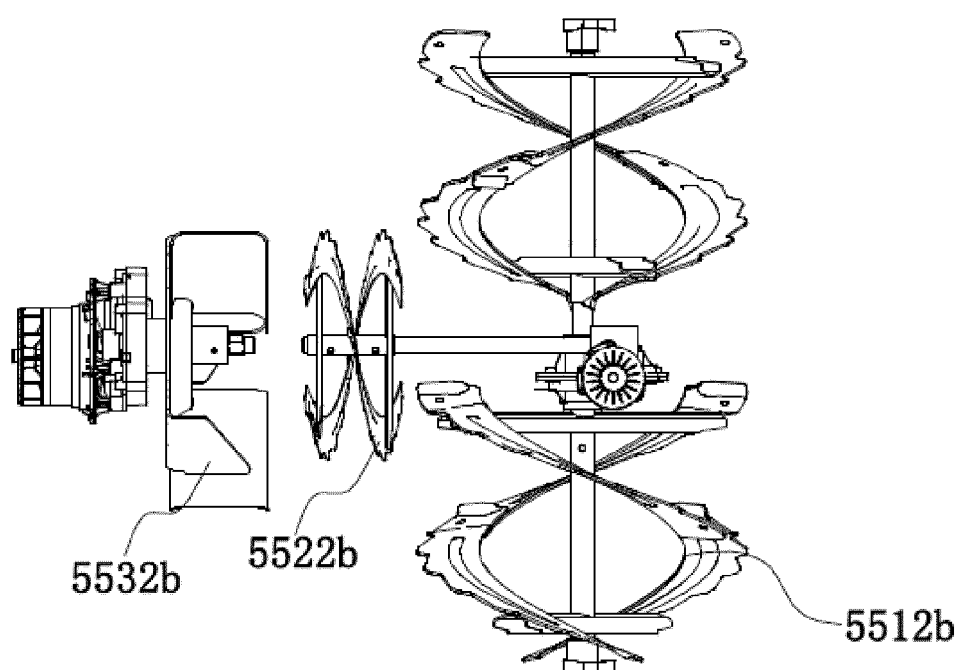


FIG. 31

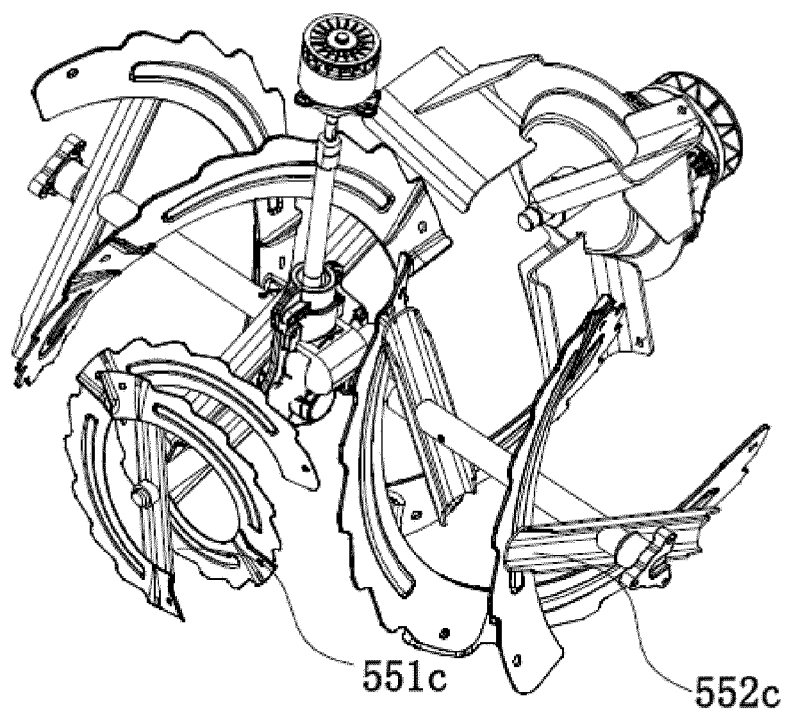


FIG. 32

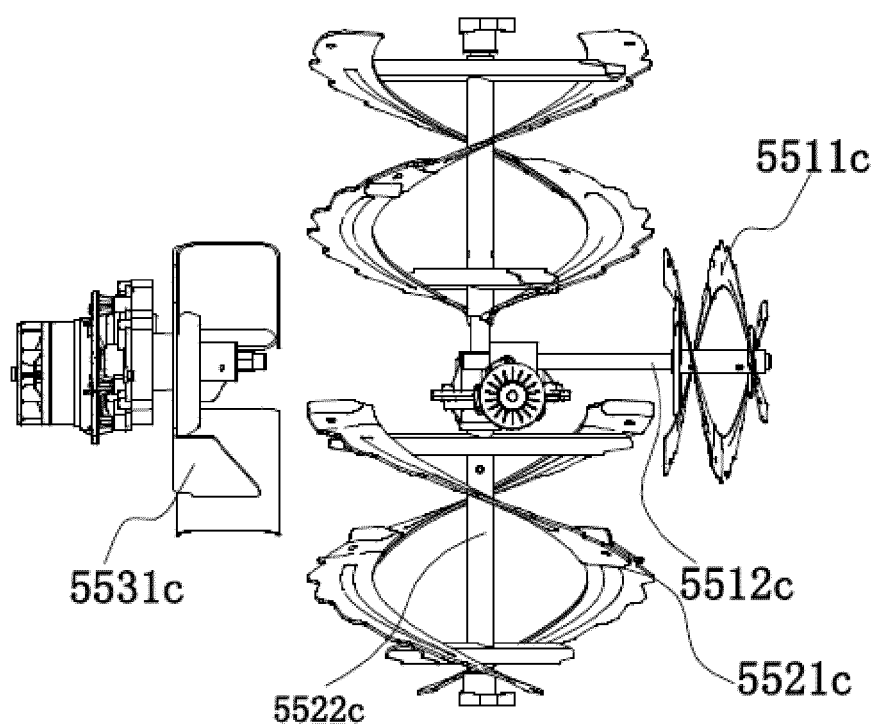


FIG. 33

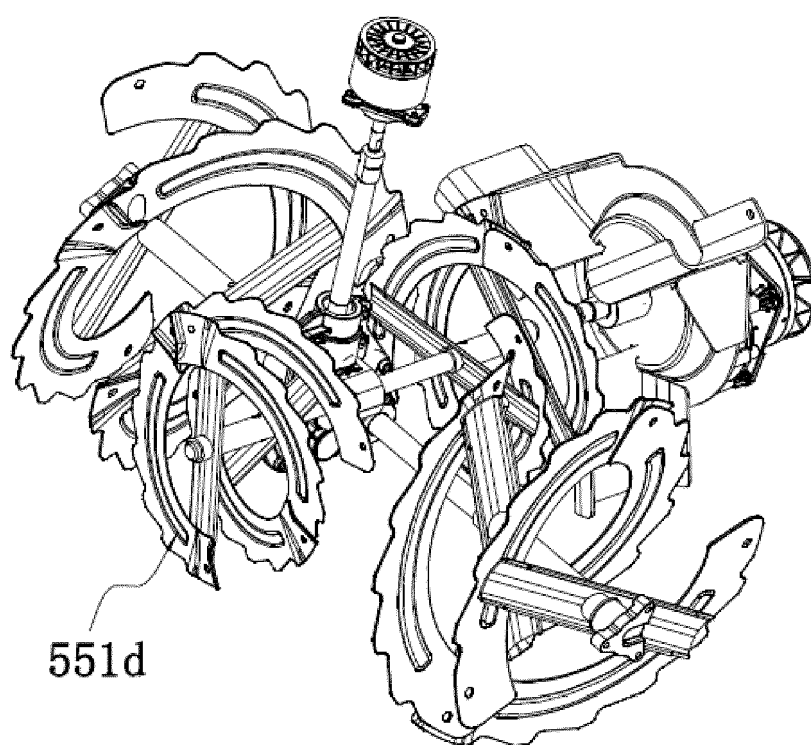


FIG. 34

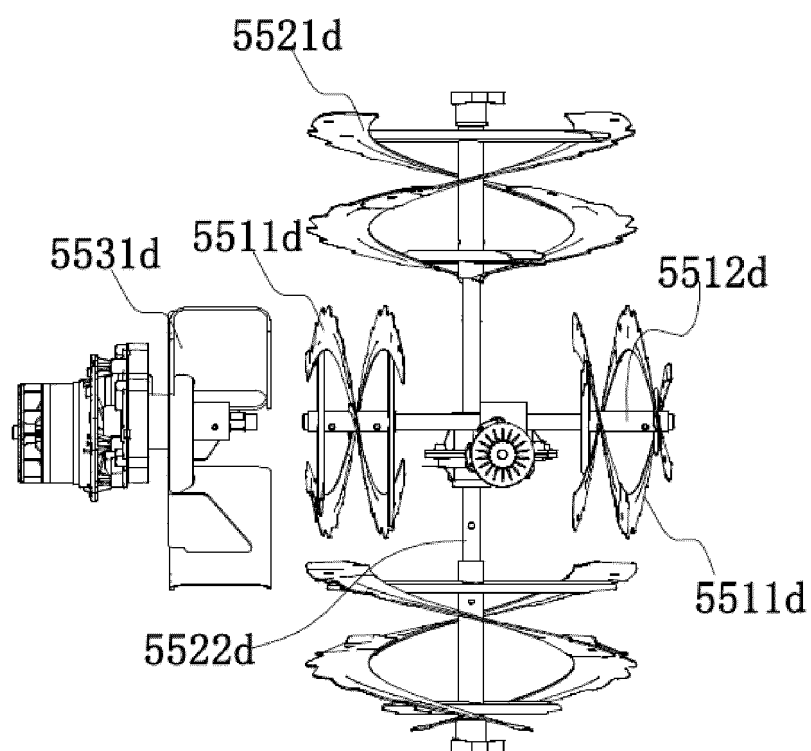


FIG. 35

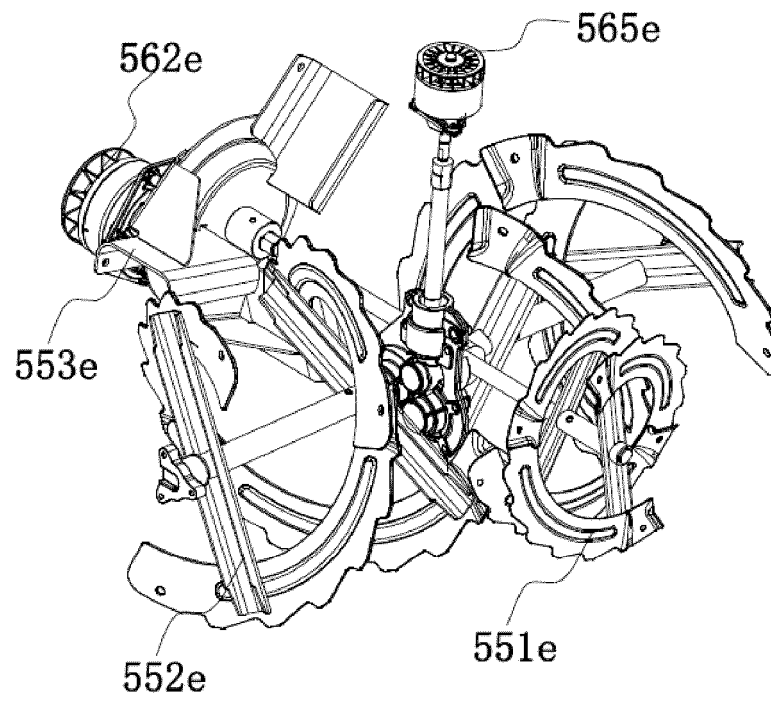


FIG. 36

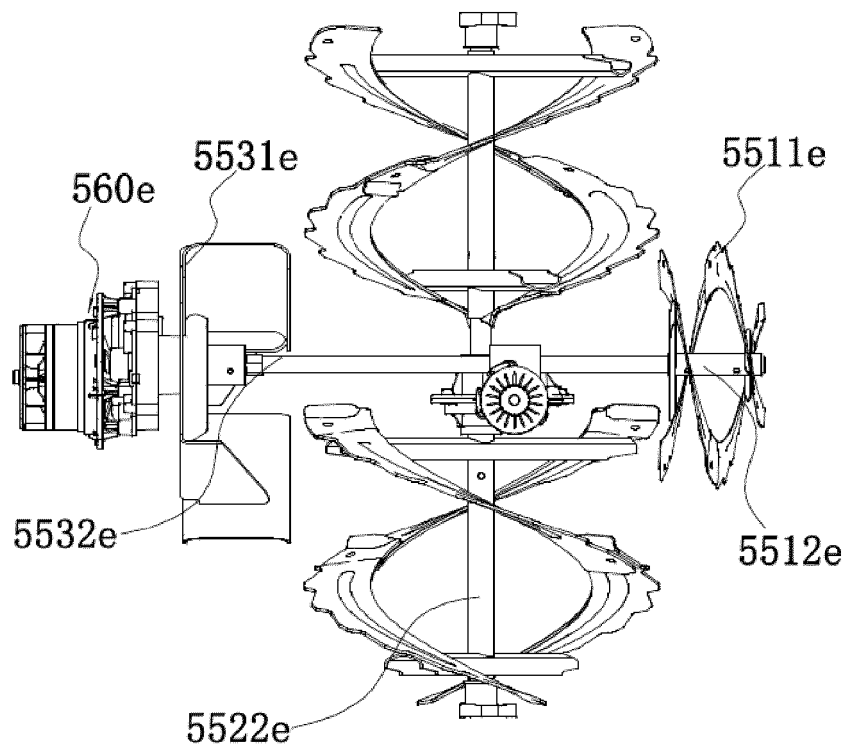


FIG. 37

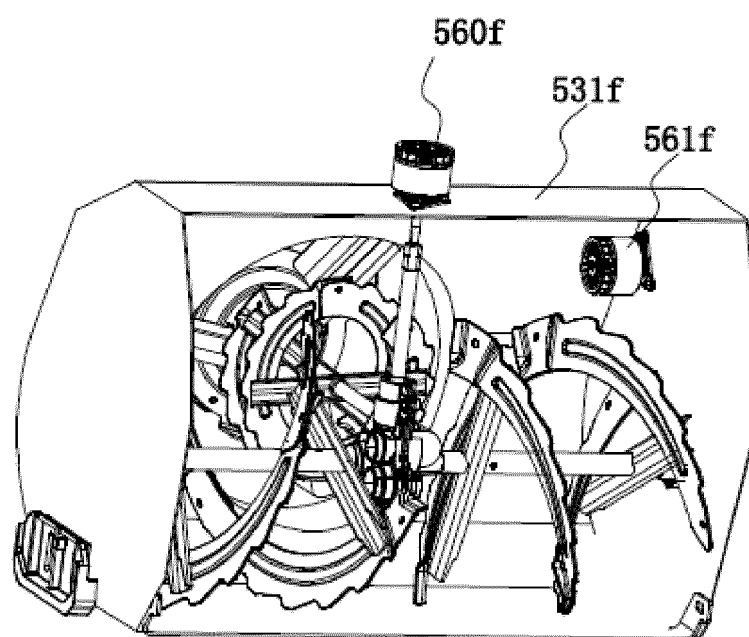


FIG. 38

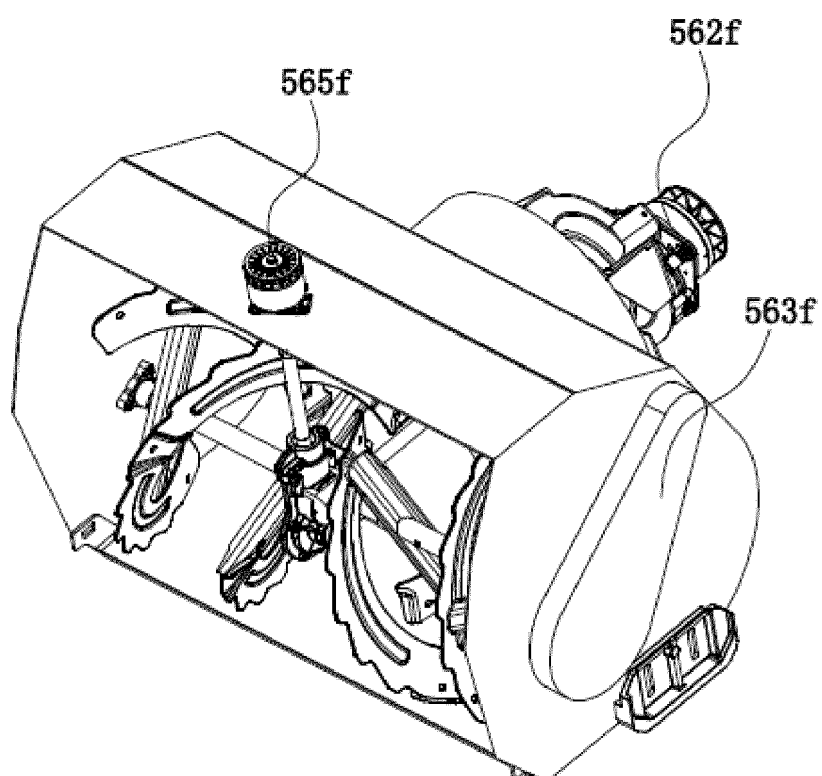


FIG. 39

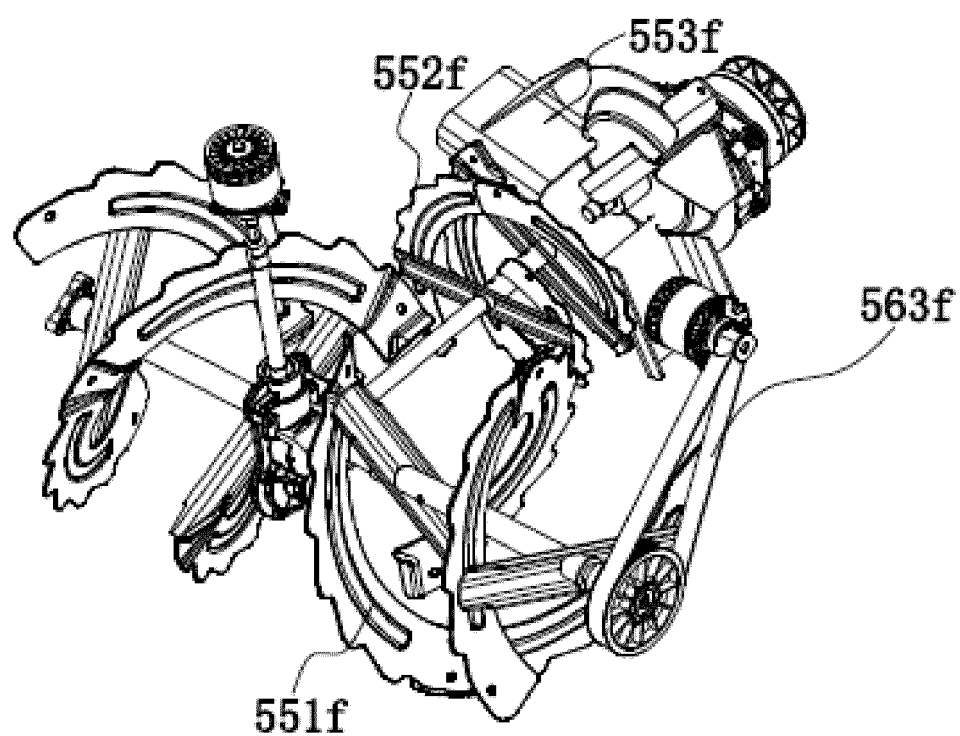


FIG. 40

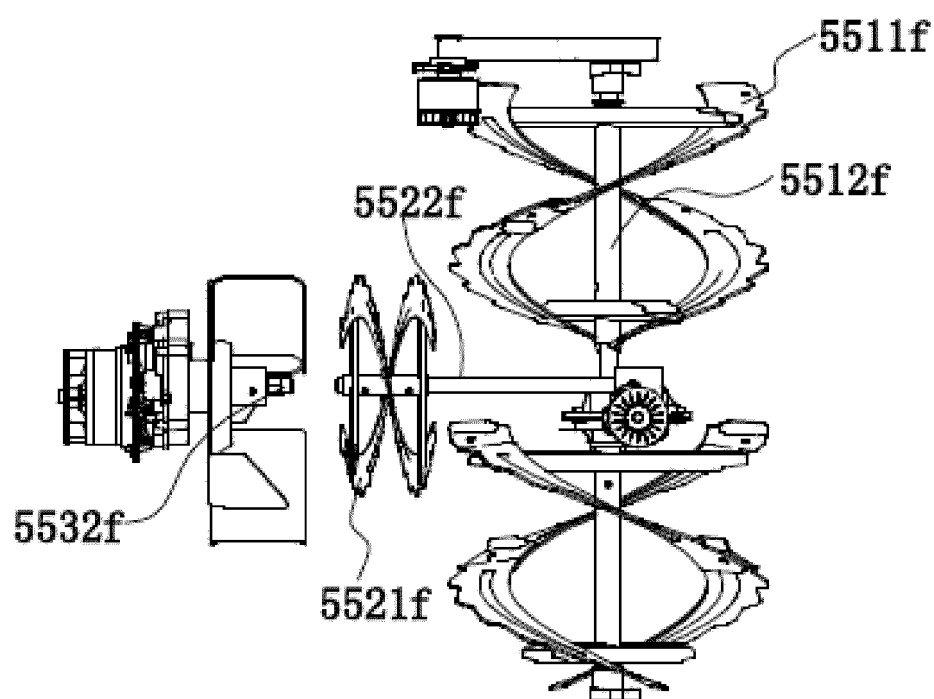


FIG. 41

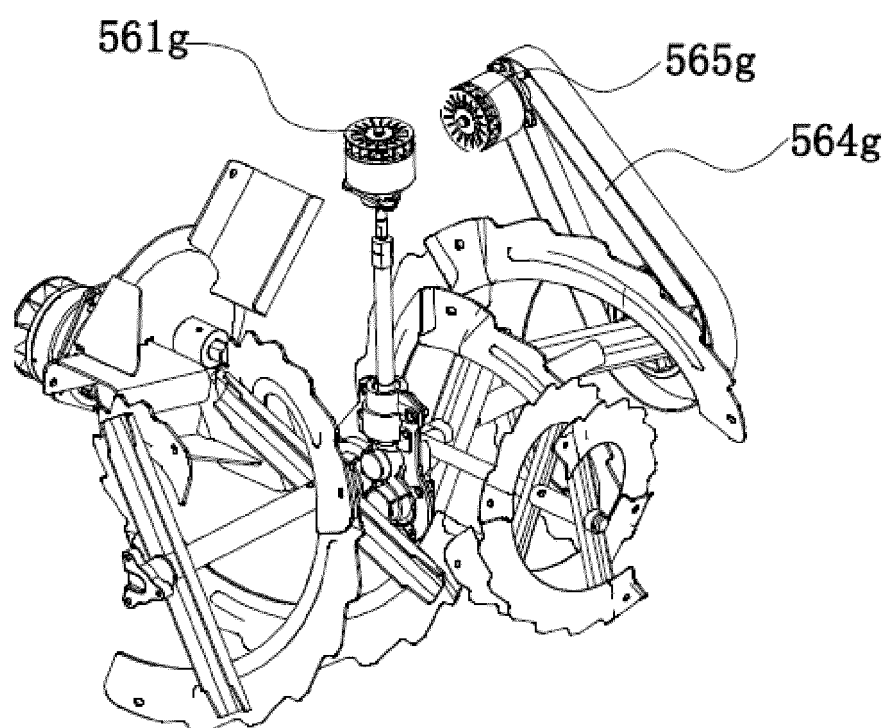


FIG. 42

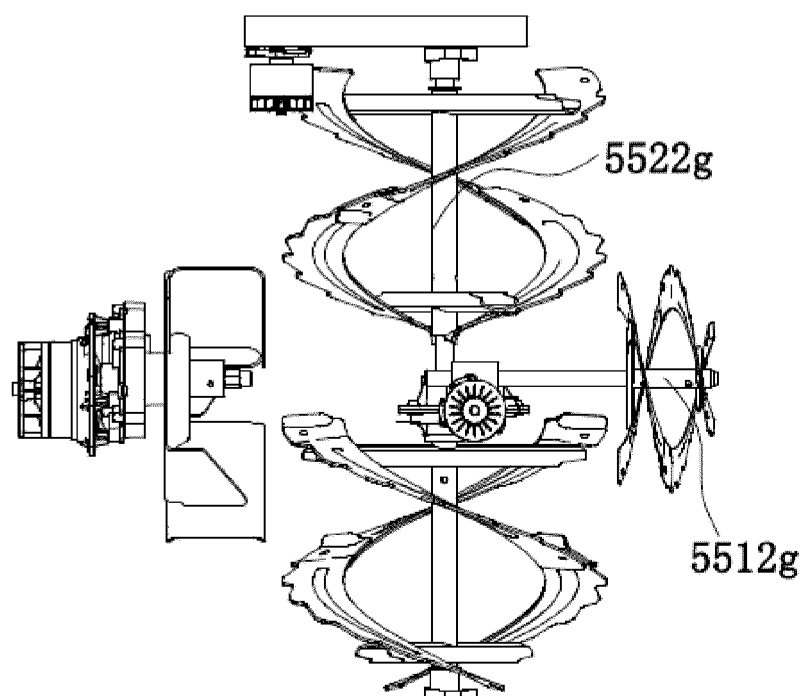


FIG. 43

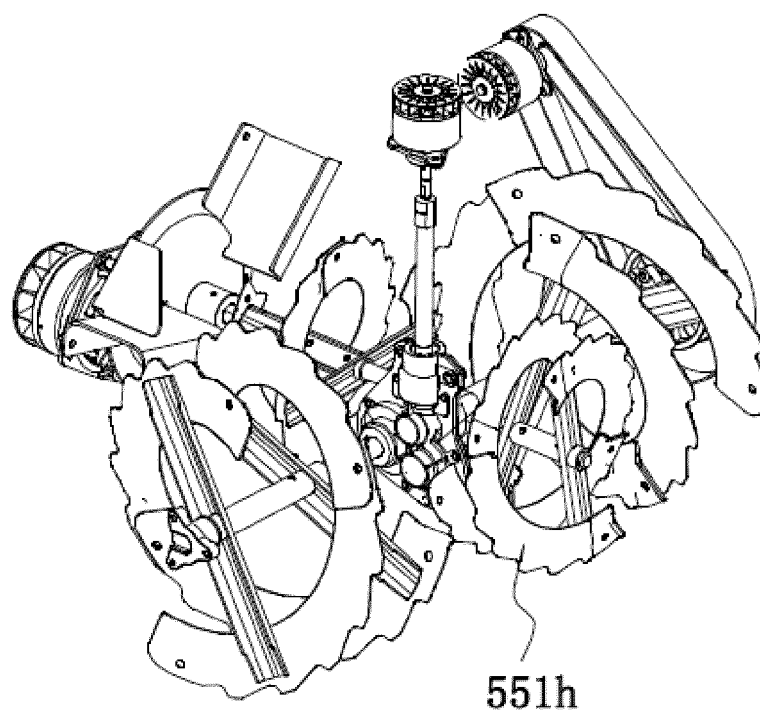


FIG. 44

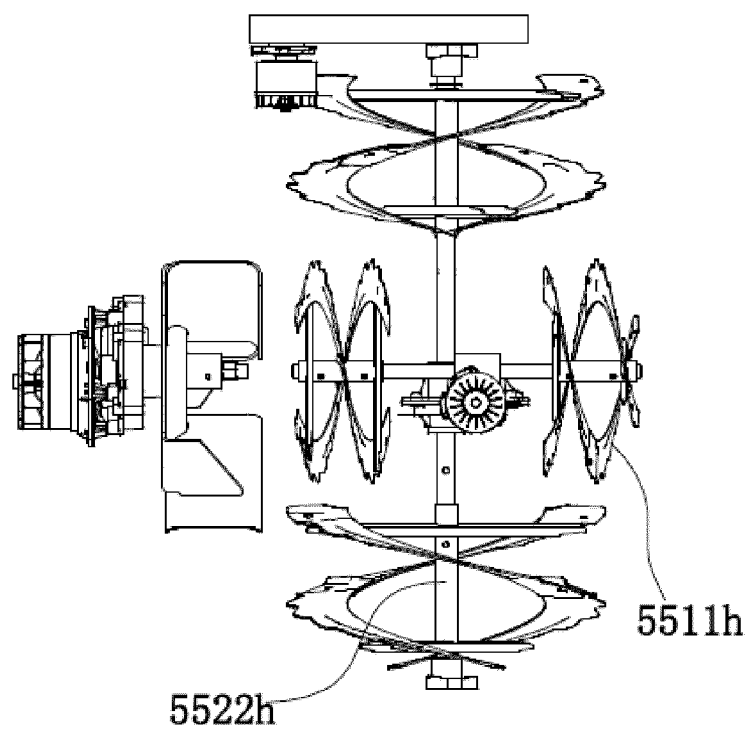


FIG. 45



EUROPEAN SEARCH REPORT

Application Number

EP 24 19 8047

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 106 702 941 A (ZHEJIANG YAT ELECTRIC APPLIANCE CO LTD) 24 May 2017 (2017-05-24)	1-5, 7-15	INV.
Y	* the whole document *	4, 6, 12, 15	E01H5/04 E01H5/09
A	CN 216 739 438 U (GRALIBO JIANGSU STOCK LTD COMPANY) 14 June 2022 (2022-06-14) * the whole document *	1-15	
Y	CN 115 288 068 A (UNIV SOUTHWEST) 4 November 2022 (2022-11-04) * figures 1, 6 *	4, 6	
Y	CN 110 894 711 B (POSITEC POWER TOOLS SUZHOU CO LTD) 22 March 2022 (2022-03-22) * the whole document *	12	
Y	US 4 391 052 A (GUY JR BURLIN A [US]) 5 July 1983 (1983-07-05) * column 3, lines 39-45 *	15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		14 February 2025	Kerouach, May
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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 19 8047

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14 - 02 - 2025

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82