## CLAIMS

**What is claimed is:**

1. A portable fan, comprising a fan and a power supply drive assembly electrically connected to the fan; wherein the power supply drive assembly comprises a battery and a fan drive circuit electrically connected to the battery; the fan drive circuit comprises:

a master control circuit;

a three-phase drive circuit, comprising at least three signal input ends and three drive signal output ends; wherein each of the at least three signal input ends is electrically connected to the master control circuit to receive control signals; each of the three drive signal output ends is electrically connect to a respective one of three signal ends of a direct-current (DC) brushless fan motor to respectively output a three-phase drive signal to drive the DC brushless fan motor to rotate; and

a battery voltage conversion circuit and a direct current conversion circuit;

wherein the battery is a lithium ion battery and is configured to supply power to the fan drive circuit; the battery voltage conversion circuit is configured to convert a battery voltage into a drive voltage; the direct current conversion circuit is configured to convert the drive voltage into an operating voltage, which is within a range of 3.3V to 5V, for the DC brushless fan motor.

2. The portable fan according to claim 1, further comprising: an inverted-phase electric potential detection circuit, wherein the inverted-phase electric potential detection circuit comprises three detection branches; wherein each of the three detection branches comprises a detection end and a detection output end electrically connected to the detection end; three detection ends of the three detection branches are respectively electrically connected to the three drive signal output ends; three detection output ends of the three detection branches are electrically connected to the master control circuit to respectively output a first detection signal, a second detection signal, and a third detection signal; the master control circuit is informed of a phase of the three-phase drive signal based on the first detection signal, the second detection signal, and the third detection signal to adjust the control signals.

3. The portable fan according to claim 2, wherein, the detection branch comprises a first detection resistor, a second detection resistor, and a third detection resistor; the first detection resistor and the second detection resistor are connected to each other in series; an end of the

first detection resistor away from the second detection resistor is the detection end, and an end of the second detection resistor away from the first detection resistor is grounded; a node between the first detection resistor and the second detection resistor is the detection output end.

4. The portable fan according to claim 2 or 3, wherein, the three-phase drive circuit comprises a first transistor, a second transistor, a third transistor, a fourth transistor, a fifth transistor, a sixth transistor, a seventh transistor, an eighth transistor, and a ninth transistor; a first conductive end of the first transistor, a first conductive end of the second transistor, and a first conductive end of the third transistor are connected to a power supply end; a first conductive end of the fourth transistor is connected to the power supply end; a first conductive end of the fifth transistor is connected to the power supply end; a first conduction end of the sixth transistor is connected to the power supply end; a control end of the fourth transistor, a control end of the fifth transistor, and a control end of the sixth transistor are electrically connected to the master control circuit, a control end of the seventh transistor is electrically connected to the control end of the fourth transistor, a control end of the eighth transistor is electrically connected to the control end of the fifth transistor, and a control end of the ninth transistor is electrically connected to the control end of the sixth transistor, so as to receive the control signals; second conduction ends of the fourth transistor, the fifth transistor, and the sixth transistor are grounded; a first conductive end of the seventh transistor is connected to a second conductive end of the first transistor; a second conductive end of the seventh transistor is grounded; a first conductive end of the eighth transistor is connected to a second conductive end of the second transistor; a second conductive end of the eighth transistor is grounded; a first conductive end of the ninth transistor is connected to the second conductive end of the third transistor; a second conductive end of the ninth transistor is grounded; a node between the first conductive of the seventh transistor and the second conductive of the first transistor, a node between the first conductive of the eighth transistor and the second conductive of the second transistor, and a node between the first conductive of the ninth transistor and the second conductive of the third transistor respectively serve as the three drive signal output ends.

5. The portable fan according to claim 4, wherein,

the at least three signal input ends are three PWM signal input ends; the control signals comprise three PWM signals; and the fan drive circuit further comprises a current detection circuit; the second conductive ends of the seventh transistor, the eighth transistor, and the ninth transistor are all grounded via the current detection circuit; the current detection circuit is

electrically connected to the master control circuit; the current detection circuit comprises a sense resistor and a sense capacitor; the second conductive ends of the seventh transistor, the eighth transistor, and the ninth transistor are grounded via the sense resistor and the sense capacitor sequentially; a node between the sense resistor and the sense capacitor is electrically connected to the master control circuit.

6. The portable fan according to any one of claims 2 to 5, wherein, the three-phase drive circuit comprises a first transistor, a second transistor, a third transistor, a fourth transistor, a fifth transistor, and a sixth transistor; a first conductive end of the first transistor, a first conductive end of the second transistor, and a first conductive end of the third transistor are connected to a power supply end; a first conductive end of the fourth transistor is connected to a second conductive end of the first transistor, a first conductive end of the fifth transistor is connected to a second conductive end of the second transistor, a first conduction end of the sixth transistor is connected to a second conductive end of the third transistor; a node between the first conductive of the fourth transistor and the second conductive of the first transistor, a node between the first conductive of the fifth transistor and the second conductive of the second transistor, and a node between the first conductive of the sixth transistor and the second conductive of the third transistor respectively serve as the three drive signal output ends; control ends of the first transistor, the second transistor, the third transistor, the fourth transistor, the fifth transistor, and the sixth transistor are electrically connected to the master control circuit to receive the control signals; and the control signals comprise six PWM signals.

7. The portable fan according to any one of claims 2 to 6, wherein, the battery is a lithium-ion battery; the portable fan further comprises:

a control main board, configured to control the portable fan;

a battery protection device, arranged on the control main board and electrically connected to the control main board;

wherein, the battery protection device is electrically connected to the control main board, and pins B+ and B- of the battery protection device are respectively connected to a positive electrode and a negative electrode of the lithium-ion battery.

8. The portable fan according to claim 7, wherein, the battery protection device is integrally arranged with the control main board.

9. The portable fan according to claim 7 or 8, wherein the battery protection device comprises an intelligent processor, a current collection module and a voltage collection module; the intelligent processor is connected to the current collection module and the voltage collection module; the current collection module and the voltage collection module are connected to a power supply module; and/or

the power supply module is provided in the control main board, and the pins P+ and P- of the battery protection device are respectively connected to pins of the power supply module.

10. The portable fan according to any one of claims 1 to 9, wherein, the portable fan is configured to be worn to a neck of a user;

wherein the portable fan comprises two arms configured to be disposed at two sides of the neck respectively; at least one of the two arms receives the lithium ion battery.

11. The portable fan according to any one of claims 1 to 9, comprising a handheld portion and an airflow portion connected to the handheld portion; wherein the handheld portion is configured to be held by a hand of a user; and the power supply drive assembly, which comprises the three-phase DC brushless fan motor, and the fan are arranged inside the airflow portion; the battery is arranged inside the handheld portion.

12. The portable fan according to any one of claims 1 to 11, wherein, the fan drive circuit further comprises a current detection circuit, the second conductive end of the sixth transistor is grounded via the current detection circuit, the current detection circuit is electrically connected to the master control circuit; the current detection circuit comprises a sense resistor and a sense capacitor; the second conductive end of the sixth transistor is grounded via the sense resistor; the sense capacitor is connected in parallel with the sense resistor; a node between the sense resistor and the second conduction end of the sixth transistor is electrically connected to the master control circuit; the current detection circuit further comprises a first series resistor, a second series resistor, a parallel resistor; the parallel resistor is connected in parallel with the sense resistor; the first series resistance is connected between an end of the sense capacitor and an end of the sense resistor; the second series resistance is connected between the other end of the sense capacitor and the other end of the sense resistor.

13. The portable fan according to any one of claims 1 to 12, wherein, the master control circuit comprises a master control chip and three three-phase control chips, each of the three three-phase control chips is electrically connected to the master control chip and the three-phase

drive circuit; the fan drive circuit further comprises a voltage conversion circuit; the voltage conversion circuit is configured to receive a battery voltage, convert the battery voltage into a drive voltage, and provide the drive voltage to power supply ends of the three three-phase control chips; the master control chip is configured to output a master control signal to the three three-phase control chips to enable each of the three three-phase control chips to output the respective control signal to the three-phase drive circuit; the fan drive circuit further comprises a switch control circuit; the switch control circuit is electrically connected to the battery, the voltage conversion circuit, and the master control circuit to control operation of the voltage conversion circuit; the switch control circuit comprises a keypad, a first switch transistor, a second switch transistor, and a third switch transistor; two conductive ends of the first switch transistor are respectively connected to the positive electrode of the battery and the input end of the voltage conversion circuit; a control end of the first switch transistor is grounded via two conductive ends of the third switch transistor; a positive electrode of the battery is connected to the control end of the third switch transistor via the two conductive ends of the first switch transistor and a one-way diode; a control end of the second switch transistor is grounded via the keypad; a control end of the third switch transistor is electrically connected to the master control circuit; a node between the second switch transistor and the one-way diode is further electrically connected to the master control circuit; the fan drive circuit further comprises a direct current (DC) conversion circuit, the DC conversion circuit is configured to receive the drive voltage and convert the drive voltage to a DC operating voltage.

14. The portable fan according to any one of claims 1 to 13, wherein, the fan drive circuit further comprises a battery voltage detection circuit, the battery voltage detection circuit comprises a second voltage divider resistor and a third voltage divider resistor that is connected in series to the second voltage divider resistor; a node between the second voltage divider resistor and the third voltage divider resistor is electrically connected to the master control circuit; or the battery voltage detection circuit comprises a filter capacitor and a sampling resistor connected in series to the filter capacitor; the sampling resistor is connected between the filter capacitor and the ground; a node between the filter capacitor and the sampling resistor is electrically connected to the master control circuit; the fan drive circuit further comprises a signal amplification circuit; the node between the filter capacitor and the sampling resistor is connected to the master control circuit via the signal amplification circuit; the signal amplification circuit is configured to amplify a signal sampled by the sampling resistor and provide the amplified signal to the master control circuit.

15. The portable fan according to any one of claims 1 to 14, wherein,

the fan drive circuit further comprises a Hall detection circuit; the Hall detection circuit is electrically connected to the master control circuit to detect a magnetic field generated by the DC brushless fan motor and to output a Hall detection signal to the master control circuit; the master control circuit is informed, based on the Hall detection signal, of a position of a rotor of the DC brushless fan motor; the Hall detection circuit further comprises a motor temperature detection element connected between a Hall element of the Hall detection circuit and the master control circuit; the fan drive circuit further comprises a transistor temperature detection circuit; the transistor temperature detection circuit comprises a voltage regulated capacitor connected in parallel with the thermistor; the thermistor is configured to sense a temperature of each transistor of the three-phase drive circuit; a node between the first voltage divider resistor and the thermistor is electrically connected to the master control circuit and is configured to output a temperature signal, enabling the master control circuit to control, based on the temperature signal, the fan drive circuit to enter or not enter a temperature protection state; the thermistor is connected between the first voltage divider resistor and the ground; the transistor temperature detection circuit further comprises a voltage regulated capacitor connected in parallel with the thermistor.

16. The portable fan according to any one of claims 1 to 15, wherein,

the master control circuit comprises a master control chip and an auxiliary chip; two three-phase drive circuits, two inverted-phase electric potential detection circuits, and two DC brushless fan motors are arranged in one-to-one correspondence to each other; the master control circuit is electrically connected to one of the two three-phase drive circuits to output the control signals to one of the two three-phase drive circuits to drive the respective one of the two brushless DC fan motors; the inverted-phase electric potential detection circuit is electrically connected to the respective one three-phase drive circuit and outputs the first detection signal, the second detection signal, and the third detection signal to the master control chip to enable the master control chip to be informed of the phase of the three-phase drive signal of the respective one three-phase drive circuit to adjust the control signals output to the respective one three-phase drive circuit; the auxiliary chip is electrically connected to the other one of the two three-phase drive circuits to output the control signal to the other one of the two three-phase drive circuits to drive the other one of the two DC brushless fan motors; the other one of the two inverted-phase electric potential detection circuits is electrically connected to the respective

three-phase drive circuit and outputs a corresponding first detection signal, a corresponding second detection signal and a corresponding third detection signal to the auxiliary chip to enable the auxiliary chip to be informed of the phase of the three-phase drive signal of the other one of the two three-phase drive circuits to adjust the control signals output to the other one of the two three-phase drive circuits.

17. A fan, comprising:

a neck housing, defining a neck space, wherein the neck housing is configured to be worn to a neck of a user, and the neck is configured to be received in the neck space;

an airflow portion, arranged inside the neck housing and configured to blow an airflow towards the neck space; wherein the airflow portion comprises rotation air blades and a three-phase motor drive assembly driveably connected to the rotation air blades to drive the rotation air blades to rotate to generate the airflow; wherein the three-phase motor drive assembly comprises the three-phase drive circuit according to any one of claims 1 to 16.

18. The fan according to claim 17, wherein,

the airflow portion further comprises a positioning protruding post;

the three-phase motor drive assembly comprises a stator and a rotor sleeving an outside of the stator; the rotor is fixedly mounted on the rotation air blades and is coaxially arranged with the rotation air blades; the stator fixedly sleeves the positioning protruding post.

19. The fan according to claim 18, wherein the neck housing comprises a connection section and two neck side sections respectively connected to two sides of the connection section; each of the connection section and/or at least one of the two neck side sections is arranged with one respective airflow portion.

20. The fan according to claim 19, wherein the connection section is arranged with the respective one airflow portion; the connection section defines a first air guiding cavity therein; the connection section defines a first air outlet communicated with the first air guiding cavity; the first air outlet faces towards the neck space; the positioning protruding post is received in the first air guiding cavity; the rotation air blades are rotatably received in the first air guiding cavity and configured to blow the airflow to the first air outlet.