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(54) **INTELLIGENT-IDENTIFICATION QUICK-CHARGE HEATING CONTROL DEVICE FOR ELECTRIC HEATING PRODUCTS**

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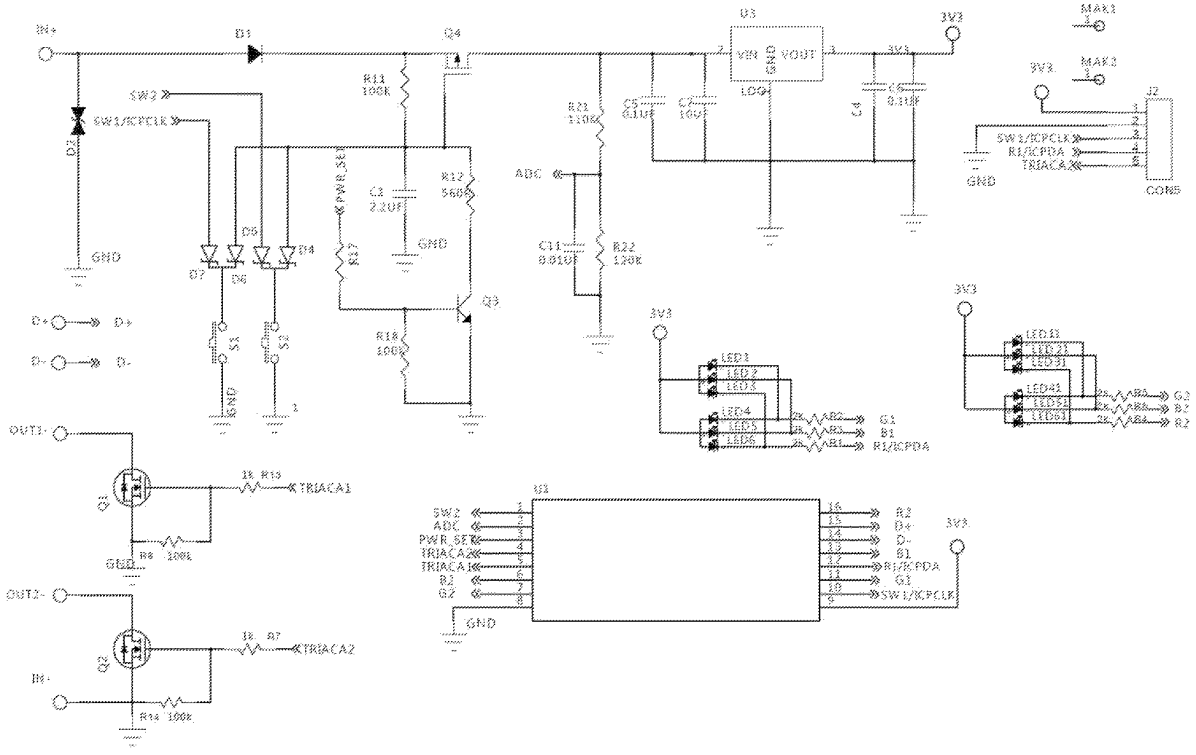
(57) **ABSTRACT**

An intelligent-identification quick-charge heating control device for electric heating products includes a button wake-up circuit, a power supply circuit, an output control circuit, a main control circuit that supports a quick charge (QC) protocol and a Type-C interface used for a paired connection with a quick charge source, so that the quick charge source can charge a heating load quickly after obtaining a successful handshake communication, so as to achieve the effects of reducing the heating time and improving the heating efficiency.

10 Claims, 2 Drawing Sheets



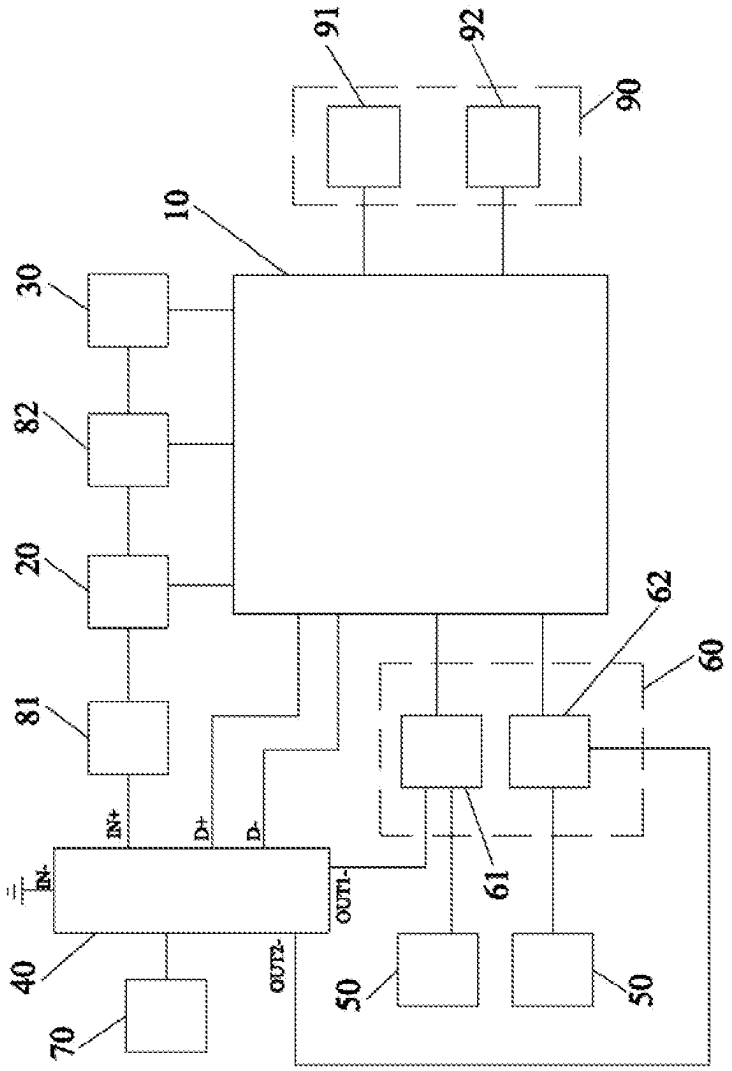


FIG. 1

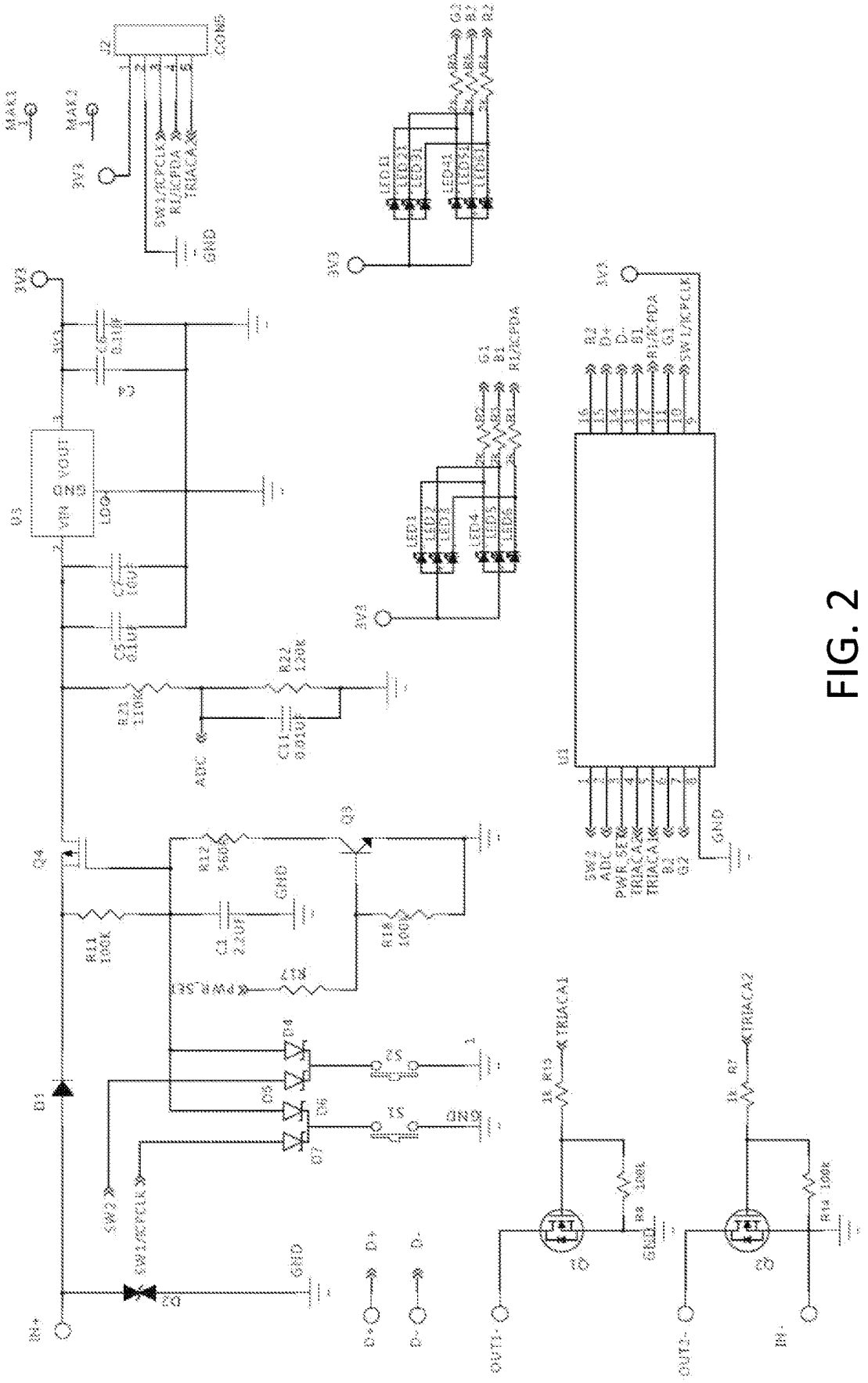


FIG. 2

INTELLIGENT-IDENTIFICATION QUICK-CHARGE HEATING CONTROL DEVICE FOR ELECTRIC HEATING PRODUCTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of heating control devices, and more particularly to an intelligent-identification quick-charge heating control device for electric heating products.

2. Description of the Prior Art

Electric heating products (such as electric heating quilts, electric blankets, hot compresses, etc.) are essential items for cold winters. At present, it is difficult for a controller of the electric heating products on the market to quickly identify a quick charge source in order to charge a heating load more quickly (with a higher DC voltage), and thus resulting in long heating time and low heating efficiency. In addition, the conventional quick charge source will enter into a sleep mode and result in no output current after having been working for a period of time.

In view of the aforementioned problems of the prior art, the inventor of the present invention based on years of experience in the related industry to conduct extensive research and experiment, and finally developed an intelligent-identification quick-charge heating control device for electric heating products in accordance with the present invention to overcome the problems of the prior art.

SUMMARY OF THE INVENTION

Therefore, it is a primary objective of the present invention to provide an intelligent-identification quick-charge heating control device for electric heating products, so that after a successful handshake, a quick charge source can charge a heating load quickly to reduce the heating time and improve the heating efficiency, and users may operate a button to wake up the quick charge source to continue working, so as to avoid the quick charge source from entering into the sleep mode and wake up the operation flexibly.

To achieve the aforementioned and other objectives, the present invention discloses an intelligent-identification quick-charge heating control device for electric heating products comprising a button wake-up circuit for waking up a quick charge source by a button, a main control circuit that supports a quick charge (QC) protocol, a power supply circuit for supplying power to the main control circuit, a Type-C interface for pairing and coupling the quick charge source, and an output control circuit coupled to a heating load, and the main control circuit being coupled to the output control circuit and the button wake-up circuit; wherein, the Type-C interface comprises a pin IN+, a pin IN−, a pin D+, a pin D− and a pin OUT1−, the pin IN+ is coupled to the power supply circuit through the button wake-up circuit, the pin IN− is grounded, the pin D+ and pin D− are coupled to the main control circuit and completes a handshake communication of a quick charge (QC) protocol with the quick charge source, the pin OUT1− is coupled to the output control circuit to quickly charge the heating load under the condition of the handshake communication.

Compared with the prior art, the present invention has the following advantages and effects: The invention mainly uses the main control circuit that supports the quick charge (QC) protocol and the quick charge source to complete a handshake communication of the quick charge (QC) protocol and achieve the effects of quickly charging the heating load by the quick charge source after obtaining a successful handshake communication with the quick charge source, so as to reduce the heating time and improve the heating efficiency. Primarily, the invention uses the button wake-up circuit to automatically operate the button to wake up the quick charge source to continue working, so as to avoid the quick charge source from entering into the sleep mode, and the wakeup process is automatic and flexible.

Secondly, the invention uses the overvoltage detection circuit and the anti-surge circuit to improve the safety and reliability of the product.

Thirdly, the invention uses the status indicating light circuit to timely show the operating status of the product and the overall circuit structure is designed skillfully and reasonably to ensure the stability and reliability of the product during use.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram showing the control principle of a preferred embodiment of the present invention; and

FIG. **2** is a schematic circuit diagram showing a circuit in accordance with a preferred embodiment of the present invention (without showing a quick charge source and a heating load).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIGS. **1** and **2** for an intelligent-identification quick-charge heating control device for electric heating products, the device comprises a button wake-up circuit **20** for waking up a quick charge source **70**, a main control circuit **10** that supports a quick charge (QC) protocol, a power supply circuit **30** for supplying power to the main control circuit **10**, a Type-C interface **40** provided for pairing and coupling the quick charge source **70**, and an output control circuit **60** coupled to a heating load **50**, and the main control circuit **10** is coupled to the output control circuit **60** and the button wake-up circuit **20**.

In this embodiment, the quick charge source **70** is a power bank or a charger that supports the quick charge (QC) protocol. Of course, the quick charge source **70** can also be other Type-C quick charge source **70** and is not limited by this embodiment. The heating load **50** can be a heating wire. Of course, the heating load **50** can be other heating loads **50** and is not limited by this embodiment.

The Type-C interface **40** comprises a pin IN+, a pin IN−, a pin D+, a pin D− and a pin OUT1−, and a pin OUT2−. The pin IN+ is coupled to the power supply circuit **30** through the button wake-up circuit **20**, the pin IN− is grounded, the pin D+ and pin D− are coupled to the main control circuit and completes a handshake communication of a quick charge (QC) protocol with the quick charge source **70**. In this embodiment, there are two heating loads **50**, and the pin OUT1− and the pin OUT2− are coupled to the output control circuit **60** for outputting a 20 VDC voltage to the corresponding heating load **50** to complete a quick charge of the corresponding heating load **50** under the handshake communication condition.

In this embodiment, the main control circuit **10** comprises a main control chip U**1** that supports a QC quick charge protocol (such as QC2.0 protocol, QC3.0 protocol and QC4.0 protocol), and the main control chip U**1** has a plurality of main control pins **1** to **16**.

The main control pin **4** and the main control pin **5** are coupled to the output control circuit separately, the main control pin **9** is coupled to the power supply circuit **30**, the main control pin **14** is coupled to the pin D− of the Type-C interface **40**, and the main control pin **15** is coupled to the pin D+ of the Type-C interface.

In this embodiment, the output control circuit **60** comprises a first output control circuit **61** and a second output control circuit **62**.

The first output control circuit **61** comprises a resistor R**13**, a resistor R**8** and a MOS tube Q**1**, and the main control pin **4** of the main control circuit **10** is coupled to a gate of the MOS tube Q**1** through the resistor R**13**, the gate of the MOS tube Q**1** is coupled to a source of the MOS tube Q**1** through the resistor R**8**, the source of the MOS tube Q**1** is grounded, and a drain of the MOS tube Q**1** is coupled to the pin OUT1−.

The second output control circuit **62** comprises a resistor R**7**, a resistor R**14** and a MOS tube Q**2**, the main control pin **5** of the main control circuit **10** is coupled to a gate of the MOS tube Q**2** through the resistor R**7**, the gate of the MOS tube Q**2** is coupled to a source of the MOS tube Q**2** through the resistor R**14**, and the source of the MOS tube Q**2** is grounded, and a drain of the MOS tube Q**2** is coupled to the pin OUT2−.

In this embodiment, the button wake-up circuit **20** comprises a button S**1**, a diode D**6**, a diode D**7**, a resistor R**11**, a resistor R**12**, a resistor R**17**, a resistor R**18**, a capacitor C**1**, a MOS tube Q**4** and a triode Q**3**, a cathode of the diode D**7** and a cathode of the diode D**6** are jointly grounded by the button S**1**, the main control pin **10** of the main control circuit **10** is coupled to an anode of the diode D**7**, an anode of the diode D**6** is coupled to a collector of the triode Q**3** through the resistor R**12**, and the anode of the diode D**6** is coupled to a gate of the MOS tube Q**4**.

The gate of the MOS tube Q**4** is grounded by the capacitor C**1**, the pin IN+ is coupled to a source of the MOS tube Q**4**, the source of the MOS tube Q**4** and the gate of the MOS tube Q**4** are coupled to each other through the resistor R**11**, and a drain of the MOS tube Q**4** is coupled to a voltage regulation pin **2** of the power supply circuit **30**; the main control pin **3** of the main control circuit **10** is coupled to a base of triode Q**3** through the resistor R**17**, an emitter of the triode Q**3** is grounded, and the base and emitter of the triode Q**3** are coupled to each other through the resistor R**18**.

In this embodiment, in order to wake up the button conveniently, the button wake-up circuit **20** further comprise a button S**2**, a diode D**4** and a diode D**5**; a cathode of the diode D**4** and a cathode of the diode D**5** are jointly grounded by the button S**2**, the main control pin **1** of the main control circuit **10** is coupled to an anode of the diode D**5**, and an anode of the diode D**4** is coupled to the anode of the diode D**6**.

Since the Type-C interface **40** is plugged in the power bank and situated at a standby mode for a long time, the power bank will be in a sleep mode without outputting power. In this embodiment, regardless of pressing the button S**1** or button S**2**, we can plug in the Type-C interface **40** to wake up the power bank by analogy. For example, pressing the button S**1** is used here to illustrate the working principle in this embodiment.

After the button S**1** is pressed, the button S**1** is grounded instantly, and the MOS tube Q**4** is conducted instantly, and the main control chip U**1** is started immediately to continue sending a signal to trigger the MOS tube Q**4** and maintain the conduction of the MOS tube Q**4**, so that the main control chip U**1** has the power continuously and keeps on conducting the MOS tube Q**1** and the MOS tube Q**2** to charge the heating load **50** quickly.

The power supply circuit **30** comprises a three-terminal voltage regulator U**3**, a capacitor C**4**, a capacitor C**5**, a capacitor C**6**, a capacitor C**7** and a diode D**1**.

The three-terminal voltage regulator U**3** comprises a plurality of voltage regulation pins **1** to **3**, the voltage regulation pin **1** is grounded, the pin IN+ is coupled to a positive electrode of the diode D**1**, a negative electrode of the diode D**1** is coupled to the voltage regulation pin **2**, the voltage regulation pin **2** is coupled to the voltage regulation pin **1** through the capacitor C**5**, the capacitor C**7** is coupled in parallel with both terminals of the capacitor C**5**; the voltage regulation pin **3** outputs a 3.3 VDC voltage to the main control pin **9** of the main control circuit **10**, the voltage regulation pin **3** is coupled to the voltage regulation pin **1** through the capacitor C**6**, and the capacitor C**4** is coupled in parallel with both terminals of the capacitor C**6**.

The present invention further comprises an anti-surge circuit **81**, a status indicating light circuit **90**, and an over-voltage detection circuit **82** for detecting a voltage between the pin IN+ and the pin IN−.

The pin IN+ is coupled to the voltage regulation pin **2** of the power supply circuit **30** through the anti-surge circuit **81**. Preferably, the anti-surge circuit **81** comprises a diode D**2** having a terminal coupled to the pin IN+ and the other terminal grounded.

Wherein, a transient voltage suppressor (TVS) diode is a general high-efficiency circuit protection device with an extreme quick response time (sub-nanoscale) and a very high surge absorption capacity. When both terminals of the TVS diode undergo an instant impact of high energy, the TVS diode can change the impedance between the two terminals from high impedance to low impedance and absorb a large instantaneous current and clamp the voltage at both terminals to a predetermined value to protect the subsequent circuits and components from being impacted by the transient high-voltage peak pulse power.

The power supply circuit **30** is electrically coupled to the status indicating light circuit **90**, and the status indicating light circuit **90** is coupled to the main control circuit **10**.

The status indicating light circuit **90** comprises a first status indicating light circuit **91**, and the status indicating light circuit **90** comprises a first status indicating light LED**1**, a status indicating light LED**2**, a status indicating light LED**3**, a status indicating light LED**4**, a status indicating light LED**5**, a status indicating light LED**6**, a resistor R**4**, a resistor R**5** and a resistor R**6**.

Both negative electrodes of the status indicating light LED**1** and the status indicating light LED**4** are coupled to the main control pin **7** of the main control circuit **10** through the resistor R**5**; both negative electrodes of the status indicating light LED**2** and the status indicating light LED**5** are coupled to the main control pin **6** of the main control circuit **10** of the through the resistor R**6**; both negative electrodes of the status indicating light LED**3** and the status indicating light LED**6** are coupled to the main control pin **16** of the main control circuit **10** through the resistor R**4**; six positive electrodes of the status indicating lights LED**1** to LED**6** are coupled to the power supply circuit **30**. It is noteworthy that there are two heating loads **50** in this embodiment, and thus

the status indicating light circuit **90** further comprises a second status indicating light circuit **92**, the first status indicating light circuit **91** and the second status indicating light circuit **92** are provided for showing the working status of the corresponding heating loads **50**, and the second status indicating light circuit **92** and the first status indicating light circuit **91** have the same circuit structure. The circuit structure of the second status indicating light circuit **92** is illustrated in FIG. **2**.

The overvoltage detection circuit **82** comprises a resistor R**21**, a resistor R**22** and a capacitor C**11**, and the pin IN+ is coupled to the main control pin **2** of the main control circuit **10** through the resistor R**21**, and the main control pin **2** of the main control circuit **10** is grounded by the resistor R**22**, and both terminals of the resistor R**22** are coupled in parallel with the capacitor C**11**. In this embodiment, the overvoltage detection circuit **82** is disposed between the button wake-up circuit **20** and the power supply circuit **30**.

Next, the principle of identifying the quick charge source **70** and charging the electric heating products quickly will be elaborated below:

After the Type-C interface **40** is plugged and connected to the quick charge source **70**, the quick charge source **70** outputs a standard 5 VDC voltage, and the power supply circuit **30** converts the standard 5 VDC voltage into a 3.3V working voltage which is supplied to the main control chip U**1** and the status indicating light circuit **90**.

After the main control chip U**1** is electrically conducted, the main control pin **14** and the main control pin **15** send a handshake signal to the corresponding pin D− and pin D+ of the Type-C interface **40**. Once the handshake communication succeeds, the pin OUT1− of the Type-C interface **40** outputs a 20V voltage to the drain of the MOS tube Q**1**. In the meantime, the pin OUT2− also outputs a 20V voltage to the drain of the MOS tube Q**2**, so that both MOS tube Q**1** and MOS tube Q**2** are electrically conducted, and the Type-C interface **40** outputs a 20V voltage to the corresponding heating load **50** for a quick charge and the heating load **50** can be heated quickly.

What is claimed is:

1. An intelligent-identification quick-charge heating control device for electric heating products, comprising: a button wake-up circuit for waking up a quick charge source a main control circuit that supports a quick charge (QC) protocol, a power supply circuit for supplying power to the main control circuit, a Type-C interface for pairing and coupling the quick charge source, and an output control circuit coupled to a heating load, and the main control circuit being coupled to the output control circuit and the button wake-up circuit; wherein, the Type-C interface includes a pin IN+, a pin IN−, a pin D+, a pin D− and a pin OUT1−, the pin IN+ is coupled to the power supply circuit through the button wake-up circuit, the pin IN− is grounded, the pin D+ and pin D− are coupled to the main control circuit and completes a handshake communication of a quick charge (QC) protocol with the quick charge source, the pin OUT1− is coupled to the output control circuit to quickly charge the heating load under the condition of the handshake communication.

2. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, wherein the main control circuit comprises a main control chip U**1** having a plurality of main control pins **1** to **16**, the main control pin **4** and the main control pin **5** are coupled to the output control circuit separately, the main control pin **9** is coupled to the power supply circuit, the main control pin **14** is coupled to the pin D− of the Type-C interface, and the main control pin **15** is coupled to the pin D+ of the Type-C interface.

3. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, wherein the output control circuit comprises a resistor R**13**, a resistor R**8** and a MOS tube Q**1**, and the main control circuit is coupled to a gate of the MOS tube Q**1** through the resistor R**13**, the gate of the MOS tube Q**1** is coupled to a source of the MOS tube Q**1** through the resistor R**8**, the source of the MOS tube Q**1** is grounded, and a drain of the MOS tube Q**1** is coupled to the pin OUT1−.

4. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, wherein the Type-C interface further comprises a pin OUT2−; the output control circuit further comprises a resistor R**7**, a resistor R**14** and a MOS tube Q**2**; the main control circuit is coupled to a gate of the MOS tube Q**2** through the resistor R**7**, the gate of the MOS tube Q**2** is coupled to a source of the MOS tube Q**2** through the resistor R**14**, the source of the MOS tube Q**2** is grounded, and a drain of the MOS tube Q**2** is coupled to the pin OUT2−.

5. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, wherein the button wake-up circuit comprises a button S**1**, a diode D**6**, a diode D**7**, a resistor R**11**, a resistor R**12**, a resistor R**17**, a resistor R**18**, a capacitor C**1**, a MOS tube Q**4** and a triode Q**3**, a cathode of the diode D**7** and a cathode of the diode D**6** are jointly grounded by the button S**1**, the main control circuit is coupled to an anode of the diode D**7**, an anode of the diode D**6** is coupled to a collector of the triode Q**3** through the resistor R**12**, and the anode of the diode D**6** is coupled to a gate of the MOS tube Q**4**; the gate of the MOS tube Q**4** is grounded by the capacitor C**1**, the pin IN+ is coupled to a source of the MOS tube Q**4**, the source of the MOS tube Q**4** and the gate of the MOS tube Q**4** are coupled to each other through the resistor R**11**, and a drain of the MOS tube Q**4** is coupled to the power supply circuit; the main control circuit is coupled to a base of triode Q**3** through the resistor R**17**, an emitter of the triode Q**3** is grounded, and the base and emitter of the triode Q**3** are coupled to each other through the resistor R**18**.

6. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, further comprising an overvoltage detection circuit for detecting a voltage between the pin IN+ and the pin IN−, wherein, the overvoltage detection circuit comprises a resistor R**21**, a resistor R**22** and a capacitor C**11**, the pin IN+ is coupled to the main control circuit through the resistor R**21**, the main control circuit is grounded by the resistor R**22**, and both terminals of the resistor R**22** are coupled in parallel with the capacitor C**11**.

7. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, further comprising an anti-surge circuit, and the pin IN+ being coupled to the power supply circuit through the anti-surge circuit.

8. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **1**, further comprising a status indicating light circuit, and the power supply circuit being electrically coupled to the status indicating light circuit, and the status indicating light circuit being coupled to the main control circuit.

9. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim **8**, wherein the status indicating light circuit comprises a status indicating light LED**1**, a status indicating light LED**2**,

a status indicating light LED3, a status indicating light LED4, a status indicating light LED5, a status indicating light LED6, a resistor R4, a resistor R5 and a resistor R6; both negative electrodes of the status indicating light LED1 and the status indicating light LED4 are coupled to the main control circuit through the resistor R5; both negative electrodes of the status indicating light LED2 and the status indicating light LED5 are coupled to the main control circuit through the resistor R6; both negative electrodes of the status indicating light LED3 and the status indicating light LED6 are coupled to the main control circuit through the resistor R4; and six positive electrodes of the status indicating lights LED1 to LED6 are coupled to the power supply circuit.

10. The intelligent-identification quick-charge heating control device for electric heating products as claimed in claim 1, wherein the power supply circuit comprises a three-terminal voltage regulator U3, a capacitor C4, a capacitor C5, a capacitor C6, a capacitor C7 and a diode D1; the three-terminal voltage regulator U3 comprises a plurality of voltage regulation pins 1 to 3, the voltage regulation pin 1 is grounded, the pin IN+ is coupled to a positive electrode of the diode D1, a negative electrode of the diode D1 is coupled to the voltage regulation pin 2, the voltage regulation pin 2 is coupled to the voltage regulation pin 1 through the capacitor C5, the capacitor C7 is coupled in parallel with both terminals of the capacitor C5; the voltage regulation pin 3 outputs a 3.3 VDC voltage to the main control circuit, the voltage regulation pin 3 is coupled to the voltage regulation pin 1 through the capacitor C6, and the capacitor C4 is coupled in parallel with both terminals of the capacitor C6.

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