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(54) **AN ELECTRONIC HEATING DEVICE AND HEATING METHOD THEREOF**

(57) An electronic heating device and a heating method. The device comprises a control unit U1, multiple heating modules and multiple measuring modules, a control unit U1 for outputting a control signal for driving a heating module to work or shut down, and a heating module for the tobacco is heated; the measuring module is used for collecting the voltage and current information of the heating module, converting the voltage and current into resistance information and transmitting it to the con-

trol unit U1 for the control unit U1 to adjust the control signal to drive the heating module to work. The voltage and current are kept within the allowable range of the control unit U1. The heating module and the measuring module are set up, and the control unit controls the heating temperature of the heating module as the target temperature according to the data transmitted by the measuring module.

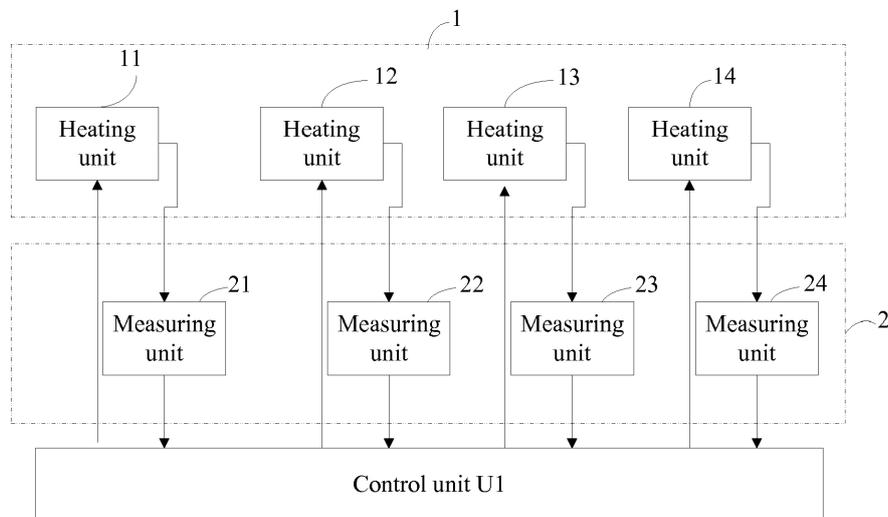


Fig. 1

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Description

Technical Field

[0001] The invention relates to the electronic cigarette field, especially for an electronic heating device and heating method.

Background Art

[0002] With the improvement of the people's living, peoples gradually realize the harm of smoking on the human body, and thus created electronic cigarettes. Listed on the foreign market is an IQOS mode electronic cigarette smoking device, the electronic cigarette smoking device requires the purchase of special cigarette, the cigarette is only about a quarter of the length of domestic common cigarette, the special cigarette is placed into the IQOS smoking device, start heating, the cigarette heated to more than 300 degrees, so that the special cigarette smoke release for smokers to smoke. The electronic cigarette device will heat the cigarette without burning, and does not generate harmful substances such as tar and carbon monoxide, and reduces physical harm to the smoker.

[0003] IQOS e-cigarette device can only be heated and baked on special cigarette, and the IQOS device heating chip is inserted into the center of the special cigarette, which is heated and baked from the center, and the special cigarette is strip-shaped, and is inserted in parallel with the heating plate. When the heating plate applies voltage, the heating plate generates heat, and the entire root when cigarette is baked, the temperature in the area surrounding the heating sheet is relatively high, and the temperature in the area away from the heating sheet is relatively low, and a higher temperature is required to bake the cigarette in the periphery of the heating sheet. The IQOS smoking sheet heats the cigarette There is a disadvantage that the center temperature is high and the peripheral temperature is low, and the cigarette parallel to the heating sheet gradually decreases from the center outward temperature, and the cigarette at the periphery of the heating sheet 90° cannot be baked sufficiently.

[0004] Therefore, it is necessary to design a new electronic cigarette device to achieve direct baking and heating of common cigarette. After cigarette baking, smoke is evenly released to the smoker to smoke, the baking is more complete, and the cigarette gas is released more evenly.

Summary of the Invention

[0005] The invention relates to an electronic heating device and a heating method. The device comprises a control unit U1, multiple heating modules and multiple measuring modules, a control unit U1 for outputting a control signal for driving a heating module to work or shut down, and a heating module for the tobacco is heated;

the measuring module is used for collecting the voltage and current information of the heating module, converting the voltage and current into resistance information and transmitting it to the control unit U1 for the control unit U1 to adjust the control signal to drive the heating module to work. The voltage and current are kept within the allowable range of the control unit U1. In the present invention, the heating module and the measuring module are set up, and the control unit controls the heating temperature of the heating module as the target temperature according to the data transmitted by the measuring module, thereby realizing the direct baking and heating of the ordinary tobacco to uniformly release the smoke. Several heating modules surround the heating module. The tobacco is arranged at intervals so that the baking is more complete, the tobacco cigarette gas is released more evenly, and the energy consumption is saved.

[0006] The purpose of the present invention is to overcome the drawbacks of the prior art and provide an electronic heating device and heating method.

[0007] An electronic heating device comprises a control unit U1, a heating module and a measuring module, wherein:

- 25 the control unit U1 is configured to output a control signal used to drive the heating module to turn on or off;
- the heating module is configured to heat tobacco; and
- 30 the measuring module is configured to collect the voltage and current signal of the heating module, and is further configured to convert the voltage and current signal to a resistance signal; and wherein,
- 35 the measuring module is configured to transmit the resistance signal to the control unit U1, and then the control unit U1 is configured to then output a control signal to drive the heating module.

[0008] Its further technical solution is that the heating module comprises four heating unit, and the four heating units surround the periphery of tobacco product in use.

[0009] Its further technical solution is that the measuring module comprises four measuring unit.

[0010] Its further technical solution is that each heating unit comprises a switching element and a heating conductor RT, and wherein heating or closing of the heating conductor RT depends on whether the control unit U1 drives the switching element to turn on or off.

[0011] Its further technical solution is that the switch element comprises a MOS transistor Q1.

[0012] Its further technical solution is that the heating unit further comprises a first bias resistor R1 and a second bias resistor R2.

[0013] Its further technical solution is that the heating unit also comprises a sampling resistor R3.

[0014] Its further technical solution is that each measuring units comprises a current amplifier.

[0015] Its further technical solution is that the control

unit U1 is STM32F030CBT6.

[0016] The invention also provides a heating method using the above electronic heating device, comprises:

starting the heating mode;
 the heating module controlling the heat;
 the measuring module measuring the resistance of the heating conductor RT;
 the control unit U1 estimating the temperature of the surface of the heating conductor RT;
 the control unit U1 determining whether the temperature of the surface of the heating conductor RT has reached the target temperature, wherein:

if not, returning to the heating module for further heating;
 if yes, the heating conductor RT keeps the target temperature for baking a tobacco product, and the control unit U1 adjusts the PWM output duty cycle;

after the heating conductor RT has maintained the target temperature for a while, the heating module turning off the heating mode.

[0017] The beneficial effect of the present invention, as the following:

An electronic heating device of the present invention is provided with a number of heating modules arranged around the tobacco compartment and several measuring modules for detecting current and voltage of the heating module. According to the data sent by the measuring module, the control unit controls the heating temperature of the heating module as the target temperature, and achieves direct baking heating of the ordinary tobacco. After the baking tobacco, the smoke is evenly released to the smoker, and several heating modules surround the heating module. The tobacco is arranged at intervals so that the baking is more complete, the tobacco cigarette gas is released more evenly, and the energy consumption is saved.

Description of Drawings

[0018]

FIG. 1 is the structural block diagram of the electronic heating device for an embodiment 1.

FIG. 2 is the circuit schematic of the electronic heating device for an embodiment 1.

FIG. 3 is the flow chart of the electronic heating method of the electronic heating device for an embodiment 1.

FIG. 4 is the curve diagram of the working time and target temperature of the heating module for an embodiment 1.

FIG. 5 is the structural block diagram of the electronic heating device for another embodiment 2.

Detailed Description of the Invention

[0019] As shown in Fig. 1 to Fig. 4, in an embodiment, An electronic heating device can directly bake heating to ordinary cigarette or tobacco, evenly release cigarette smoke after tobacco baking, smoke to the smoker, fully bake, release tobacco cigarette gas more evenly, and save energy. In the embodiment of the present invention, the tobacco product is the cigarette product, that is, the cigarette.

Embodiment 1

[0020] As shown Fig. 1, an electronic heating device comprises a control unit U1, a heating module 1 and a measuring unit 2, wherein:

the control unit U1 (i.e., MCU U1) is configured to output a control signal for driving the heating module 1 to work or shut off;
 the heating module 1 is configured to heat the tobacco product; and
 the measuring module 2 is configured to collect the voltage and current signal of the heating module 1, and is further to convert the voltage and current signal to a resistance signal; and wherein,
 the measuring module is configured to transmit the resistance signal to the control unit U1, and the control unit U1 is configured to then output a control signal to drive the heating module 1. The voltage and current used for driving the heating module to work are kept within the allowable range of the control unit U1.

[0021] The electronic heating device use the heating module 1 to heat and bake of the tobacco product and do not burn the tobacco, and releases the cigarette gas that is smoked by the smoker. The device reduces the damage to the human body caused by tar and harmful substances released by burning cigarette.

[0022] Further, as shown Fig. 1, the heating module 1 comprises four heating units (11, 12, 13, and 14), and the four heating units surround the periphery of tobacco. In other embodiment, the heating module 1 comprises multiple heating units, for example, two, three, or five, and so on.

[0023] Correspondingly, the measuring module 2 also comprises four measuring units (21, 22, 23, and 24), and each measuring units 2 collects the current and voltage of one heating units (11, 12, 13, and 14), so as to the control unit U1 can control each heating units individually, and ensures that the heating temperature of each heating units can reach the target temperature, and the same time, each heating units heat a certain area of tobacco, and the tobacco gas sustain release. If the whole branch of tobacco is baked at the same time, the tobacco gas will be released quickly.

[0024] The number of the above-mentioned measuring

units 2 may also be one, two, three, five, six, etc.

[0025] In other embodiment, the measuring module 2 comprises multiple measuring units, for example, two, three, or five, and so on.

[0026] Furthermore, the above-mentioned each heating units comprises a switch element and a heating conductor RT. Heating or closing of the heating conductor RT depends on whether the control unit U1 drives the switch element to turn on or off. The control unit U1 drive the heating module 1 through controlling the switch element to turn on or off.

[0027] When the control unit U1 controls opening or closing of each heating units, the control unit U1 also collect the voltage and current signal of each heating units through each measuring units corresponding to each heating units, and then the measuring units convert the voltage and current signal to a resistance signal.

[0028] The voltage and current signal collected by each measuring units in the heating conductor RT are kept within the allowable range of the control unit U1. Each heating units of the heating module 1 contains a positive temperature coefficient of the heating conductor RT. When the control unit U1 outputs an opening signal to a heating unit, a voltage is applied to the heating conductor RT. After the current flows through the heating conductor RT, it is converted into heat. This heat that is provided to the baking tobacco through the heating conductor RT of each heating unit of the heating module 1 are uniformly wrapped around the tobacco and can uniformly bake the tobacco. The control unit U1 controls each heating units separately so that the heat can be concentrated in a certain area of the tobacco for baking, and the tobacco gas can be continuously released. For example, if the whole batch of tobacco is baked at the same time, the smoke will be released quickly.

[0029] Further, as shown Fig.2, the above-mentioned switching element comprises an MOS transistor Q1, Specifically, the MOS transistor Q1 is a P-MOS transistor Q1, it can also be a PNP transistor or an NPN transistor.

[0030] Each heating units further comprises a first bias resistor R1, a second bias resistor R2 and a sampling resistor R3. One end of the first bias resistor R1 and the second bias resistor R2 are respectively connected to the control pin (i.e., G-pole) and the input pin (i.e., S-pole) of the MOS transistor Q1 of the switching element, and the other ends of the first bias resistor R1 and the second bias resistor R2 are connected to a connection point, which is connected to a control port 243 of the control unit U1. The output pin (i.e., D-pole) of the MOS transistor Q1 is connected to an end a sampling resistor R3, and the other end the sampling resistor R3 is grounded through the heating conductor RT.

[0031] According to the characteristics of the P-MOS transistor, when the voltage V_{gs} between the gate and the source of the MOS transistor is less than a certain value, that is 0.8v to 2.0v, the MOS transistor Q1 will be conduction, otherwise it will be cut off; as shown in Fig.2, the two bias resistors (R1, R2) and the control port 243

of the control unit U1 will provide an output level, which is used to provide the voltage V_{gs} between the gate and the source for MOS transistor Q1. The voltage V_{gs} between the gate and the source of the MOS transistor Q1 is 0V when the control unit U1 outputs the high level at the control port 243, the P-MOS transistor Q1 does not meet the conduction conditions, and the MOS transistor Q1 remains cut off. When the control unit U1 output at the control port 243 is low level, the voltage V_{gs} between the gate and source of the MOS transistor Q1 is a negative value. The high level or low level that is outputted through the control port 243 of the control unit U1 can make the voltage V_{gs} between the gate and the source of the MOS transistor Q1 to be less than a voltage range value from 0.8v to 2.0v, so that the P-MOS transistor Q1 enters a conducting state.

[0032] The MOS transistor Q1 acts as an electronic switch. The first bias resistor R1 and the second bias resistor R2 provide an appropriate configuration voltage for the MOS transistor Q1. The high level is provided through the control unit U1 at the control port 243 to make the MOS transistor Q1 to be turned off, when the control unit U1 passes a low level through the control port 243, the MOS transistor Q1 turns on.

[0033] In addition, the above-described each measuring units comprises a current amplifier.

[0034] The sampling resistor R3 is a current sampling resistor. The current flowing through the heating conductor RT is equal to the current flowing through the sampling resistor R3. The current flows through the sampling resistor R3 and generates a voltage across the sampling resistor R3. Since the resistance of the sampling resistor R3 is relatively small, therefore, the voltage across the sampling resistor R3 is also relatively small. After the current be amplified by the current amplifier several times, it is converted into a voltage V_I that is suitable AD sampling voltage, and the voltage V_I is sampled by the control unit U1 at the first sampling port 241. The current sampling resistor requires a small resistance R3 and an accuracy of 1%.

[0035] In the above-mentioned each measuring units, after the voltage on the heating conductor RT passes through the isolation resistor R4, it is sampled by the control unit U1 at the second sampling port 242, and another voltage V_T is sample at the second sampling port 242.

[0036] The heating conductor RT has a positive temperature coefficient characteristic, and the resistance value increases as the temperature increases. The resistance value of the heating conductor RT reflects the different temperature values.

[0037] Preferably, the control unit U1 is STM32F030CBT6, whose the control port 243 can output the PWM control signal, and the first sampling port 241 and the second sampling port 242 have a function that is the analog signal conversion function.

[0038] In this embodiment, the control unit U1 outputs four ways PWM control signal to respectively control four

heating units (11, 12, 13, and 14). The control unit U1 provides eight ways analog to digital conversion signals for four measuring units (21, 22, 23, and 24), and two ways analog to digital conversion signals are provided to each measuring unit.

[0039] Assuming that the voltage read by the control unit U1 at the first sampling port 241 is V_I and the voltage read at the second sampling port 242 is V_T , the resistance (R) of the heating conductor RT is the following:

$$R = K \cdot V_T / V_I,$$

wherein K is the current amplifier voltage conversion coefficient of the current amplifier.

[0040] As shown in Fig.4, The four-ways PWM provided by the above control unit U1 are as follows:

$t_0 \sim t_7$ is the heating unit 11 working time period;
 $t_2 \sim t_{13}$ is the heating unit 12 working time period;
 $t_8 \sim t_{19}$ is the heating unit 13 working time period; and
 $t_{14} \sim t_{20}$ is the heating unit 14 working time period.

[0041] Specific details as follows:

The stage 1

[0042] The heating unit 11 works in t_0 to t_7 time period. In t_0 to t_1 time period, the heating unit 11 maintains the conduction state of the MOS transistor Q1 from t_0 time point, and the heating unit 11 start to control the heating of the heating conductor RT, so that the temperature of the heating conductor RT reaches T_3 quickly.

[0043] In t_1 to t_7 time period, the interval of time measurement of the heating conductor RT resistance size together with the target temperature T_3 to start PID operation and to get the PWM duty cycle control. It is adjusting the control port 243 to output the PWM duty cycle size and to control MOS transistor Q1 cut on or cut off, keeping the temperature of the heating conductor RT at T_3 . After t_7 time point, the MOS transistor Q1 of the heating unit 11 remains cut off.

The stage 2

[0044] The heating unit 12 works in t_2 to t_3 time period.

[0045] In t_2 to t_3 time period, the MOS transistor Q1 of the heating unit 12 turns on, so that the temperature of the heating conductor RT rapidly rises to T_1 .

[0046] In t_3 to t_4 time period, the duty cycle of the PWM is adjusted to maintain the temperature of the heating unit 12 as T_1 .

[0047] In t_4 to t_5 time period, the MOS transistor of the heating unit 12 turns on, the temperature of the heating conductor RT rises rapidly to T_2 .

[0048] In t_5 to t_6 time period, the duty cycle of PWM is

adjusted to maintain the temperature of the heating unit 12 as T_2 .

[0049] In t_6 to t_7 time period, the MOS transistor Q1 of the heating unit 12 turns on, so that the temperature of the heating conductor RT rapidly rises to T_3 .

[0050] In t_7 to t_{13} time period, the duty cycle of PWM is adjusted to maintain the temperature of the heating unit 12 as T_3 , and the MOS transistor Q1 of the heating unit 12 after t_{13} maintains closed.

The stage 3

[0051] The heating unit 13 works in t_8 to t_{19} time period.

[0052] In $t_8 \sim t_9$ time period, the MOS transistor Q1 of the heating unit 13 turns on, so that the temperature rapidly rises to T_1 .

[0053] In t_9 to t_{10} time period, the duty cycle of PWM is adjusted to maintain the temperature of the heating unit 13 as T_1 .

[0054] In t_{10} to t_{11} time period, the MOS transistor Q1 of the heating unit 13 turns on, so that the temperature of the heating conductor RT rises quickly to T_2 .

[0055] In t_{11} to t_{12} time period, the PWM duty cycle is adjusted to maintain the temperature of the heating unit 13 as T_2 .

[0056] In t_{12} to t_{13} time period, the MOS transistor Q1 of the heating unit 13 turns on, so that the temperature of the heating conductor RT rapidly rises to T_3 .

[0057] In t_{13} to t_{19} time period, the duty cycle of PWM is adjusted control to maintain the temperature of the heating unit 13 as T_3 . After t_{19} time point, the MOS transistor Q1 of the heating unit 3 remains closed.

The stage 4

[0058] The heating unit 14 works in t_{14} to t_{20} time period.

[0059] In t_{14} to t_{15} time period, the MOS tube of the heating unit 14, so that the temperature of the heating conductor RT rises quickly to T_1 .

[0060] In t_{15} to t_{16} time period, the duty cycle of the PWM is adjusted to maintain the temperature of the heating unit 14 as T_1 .

[0061] In t_{16} to t_{17} time period, the MOS transistor Q1 of the heating unit 14 turns on, so that the temperature of the heating conductor RT rapidly rises to T_2 .

[0062] In t_{17} to t_{18} time period, the duty cycle of PWM is adjusted to maintain the temperature of the heating unit 14 as T_2 .

[0063] In t_{18} to t_{19} time period, the MOS transistor Q1 of the heating unit 14 turns on, so that the temperature of the heating conductor RT rises quickly to T_3 .

[0064] In t_{19} to t_{20} time period, the duty cycle of the PWM control is adjusted to maintain the temperature of the heating unit 14 as T_3 . After t_{20} time point, the MOS transistor Q1 of the heating unit 4 remains closed.

[0065] In t_{20} to t_{21} time period, this time period is a

natural cooling time. After all MOS transistors Q1 of the four heating module 1 are turned off, and the internal residual temperature of the heating conductor RT is still relatively high, and it is necessary to wait for a period of time that the temperature returns to normal temperature before allowing the next operation.

[0066] The heating conductor RT has a temperature sensing characteristic, and the electric heating device does not need to additionally add a temperature sensor, so that to reduce the space for mounting the temperature sensor, and does not need to consider the temperature inconsistency problem caused by the location where the temperature sensor is installed.

[0067] The heating method of the electronic heating device can effectively surround bake the tobacco, that is cigarette, and the heating temperature is accurately controlled. After the tobacco is to be baked, the tobacco gas is evenly released to the smoker for smoking. The four heating units are cooperated in divided time and the power is increased in divided time, so that the baking more uniform and save energy, and the tobacco will release more tobacco gas.

[0068] The tobacco is baked in an annular package, baked from the outside to the inside, and the tobacco is heated from the bottom up. The heating unit 11 performs high-power baking of the front tobacco to release the gas of the front tobacco and the heating unit 12 uses lower power. The adjacent portion of tobacco is preheated. After the front end tobacco baking is completed, the heating unit 12 is enabled to bake the adjacent portion of the tobacco with high power to ensure and sustained release of tobacco gas. The four heating units cooperatively iteratively heat the entire tobacco without causing the tobacco to be completely baked.

[0069] As shown in Fig.1, for the above-mentioned electronic heating device, by providing multiple heating units arranged around the tobacco compartment and multiple measuring units for detecting the current and the voltage of the heating unit, the control unit U1 can use the data transmitted by the measuring unit to The heating temperature of the heating unit is controlled as the target temperature to achieve direct baking heating of the ordinary tobacco. After the tobacco is to be baked, the smoke is uniformly released to the smoker. Several heating units are arranged around the tobacco compartment to make the baking more fully. The release of cigarette smoke is more even and saves energy.

[0070] As shown in Fig.3, The invention also provides a heating method using the above electronic heating device, including the following steps:

- S1; starting the heating mode;
- S2; the heating module controlling the heat;
- S3; the measuring module measuring the resistance of the heating conductor RT S4; and the control unit U1 estimating the temperature of the surface of the heating conductor RT;
- S5; the control unit U1 determining whether the tem-

perature of the surface of the heating conductor RT has reached a target temperature, wherein:

if not, returning to the heating module for further heating;

if yes, keep the target temperature for baking a tobacco and adjust a PWM output duty cycle of the control unit U1; wherein,

S6; after the heating conductor RT has maintained the target temperature for a while, the heating module turning off the heating mode.

[0071] After the heating of the heating conductor RT starts, the four heating unit operate at full speed. The temperature of the surface of the heating conductor RT can be estimated by detecting the resistance value of the heating conductor RT. When the temperature of the surface of the heating conductor RT reaches a preset target temperature, the target temperature is maintained for baking tobacco. In the temperature maintaining phase, the resistance value of the heating conductor RT is read in the interval cycle time, and the PID operation is performed between the RT resistance of the heating conductor and the target resistance value, and a control amount for controlling the duty cycle of a PWM can be obtained. By adjusting the duty cycle of the PWM of the control ports 243 of the control unit U1, the target temperature can be maintained. After the target temperature is baked for a certain time, the tobacco is fully baked and no smoke is released. At this time, the control unit turns off the heating unit.

Embodiment 2

[0072] In the embodiment, as shown Fig.5, the number of the measuring unit of the measuring module 2 is one that is the number both the measuring unit and the measuring module is also one. The measuring unit is equivalent to the measuring module 2. Four heating units (11, 12, 13, and 14) are connected with one measuring unit. The average temperature of four heating units (11, 12, 13, and 14) is measured by one measuring module 2, and the average temperature value comes from the average temperature of the heating element RT measured by the four heating units (11, 12, 13, 14).

[0073] The heating process of the heating conductor RT, the control process of the control unit U1, the design structure of the heating unit and the design structure of the measuring unit are the same with embodiment 1. These will not repeat here.

Claims

1. An electronic heating device comprising a control unit (U1), a heating module and a measuring module, wherein:

the control unit (U1) is configured to output a

- control signal used to drive the heating module to work or shut off;
the heating module is configured to heat tobacco; and
the measuring module is configured to collect the voltage and current signal of the heating module, and is further configured to convert the voltage and current signal to a resistance signal; and wherein,
the measuring module is configured to transmit the resistance signal to the control unit U1, and the control unit (U1) is configured to then output a control signal to drive the heating module. 5
2. The electronic heating device of claim 1, wherein the heating module comprises four heating units and the four heating units surround the periphery of tobacco product in use. 15
3. The electronic heating device of claim 2, wherein the measuring module comprises four measuring units. 20
4. The electronic heating device of any one of claims 2 or 3, wherein each heating unit comprises a switching element and a heating conductor (RT), and wherein heating or closing of the heating conductor (RT) depends on whether the control unit (U1) drives the switching element to turn on or off. 25
5. The electronic heating device of claim 4, wherein the switch element comprises a MOS transistor (Q1). 30
6. The electronic heating device of claim 5, wherein the heating unit further comprises a first bias resistor (R1) and a second bias resistor (R2). 35
7. The electronic heating device of claim 6, wherein the heating unit further comprises a sampling resistor (R3). 40
8. The electronic heating device of claim 3, wherein each measuring unit comprises a current amplifier. 45
9. The electronic heating device of any preceding claim, wherein the control unit (U1) is STM32F030CBT6. 45
10. A heating method using the electronic heating device of claim 4, wherein the method comprises: 50
- starting the heating mode;
the heating module controlling the heat;
the measuring module measuring the resistance of the heating conductor (RT);
the control unit (U1) estimating the temperature of the surface of the heating conductor (RT);
the control unit (U1) determining whether the temperature of the surface of the heating con- 55

ductor (RT) has reached a target temperature, wherein:

if not, returning to the heating module for further heating;
if yes, the heating conductor (RT) keeps the target temperature for baking a tobacco product, and the control unit (U1) adjusts a PWM output duty cycle; wherein

after the heating conductor (RT) has maintained the target temperature for a while, the heating module turning off the heating mode.

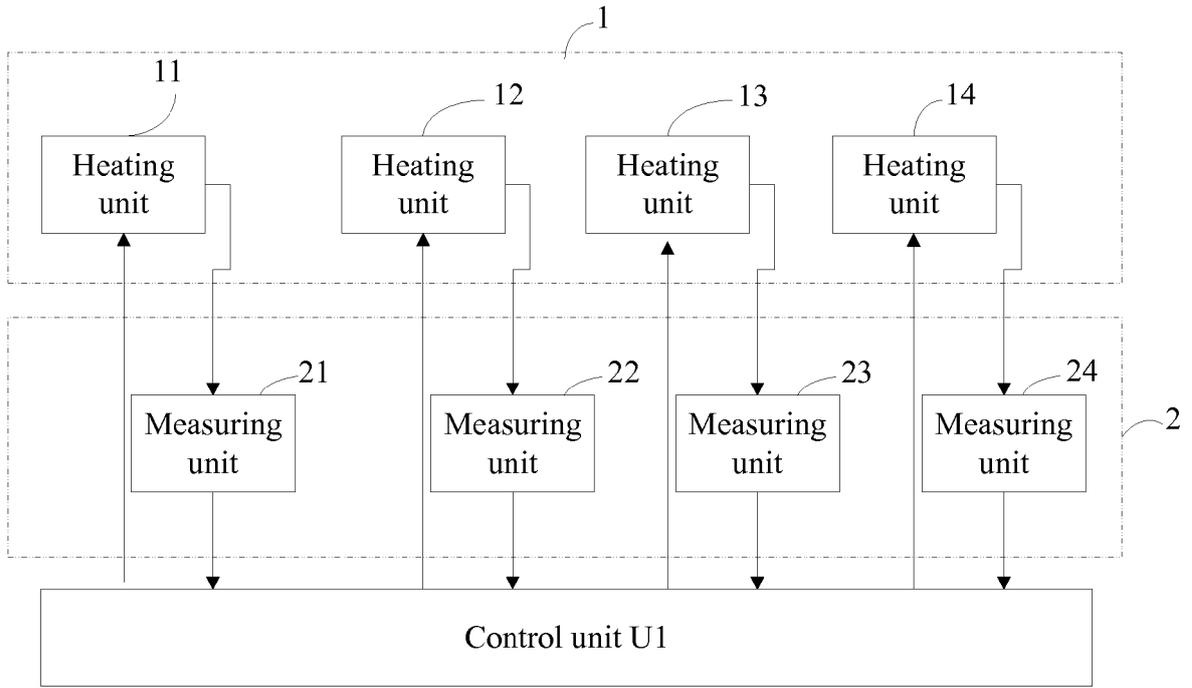


Fig. 1

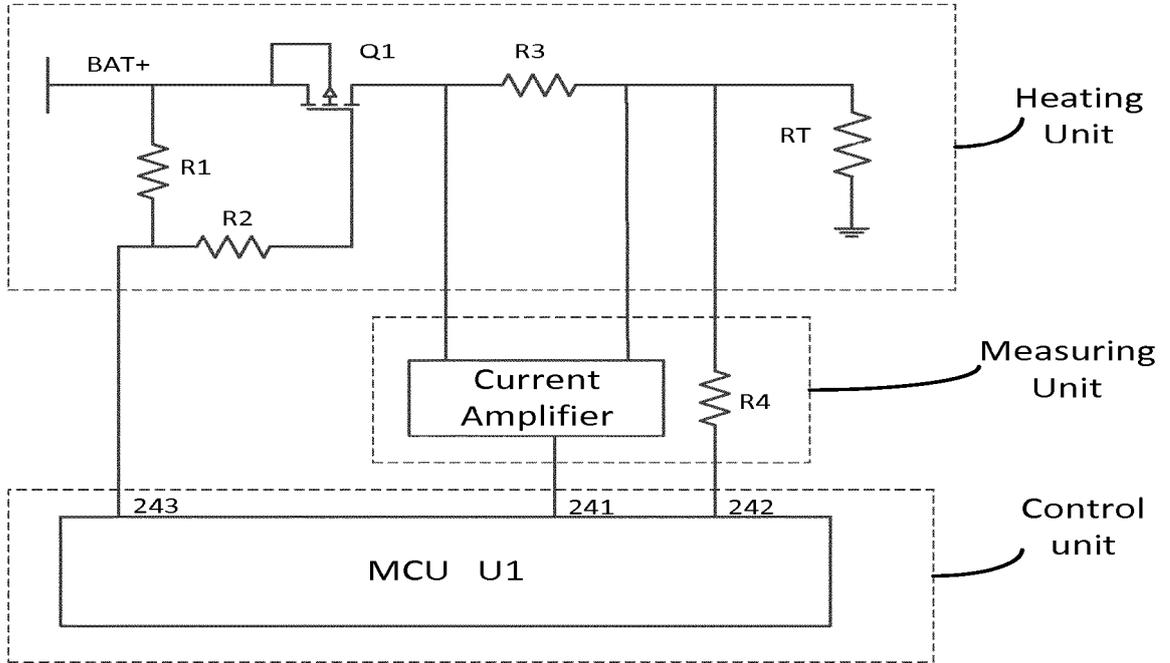


Fig. 2

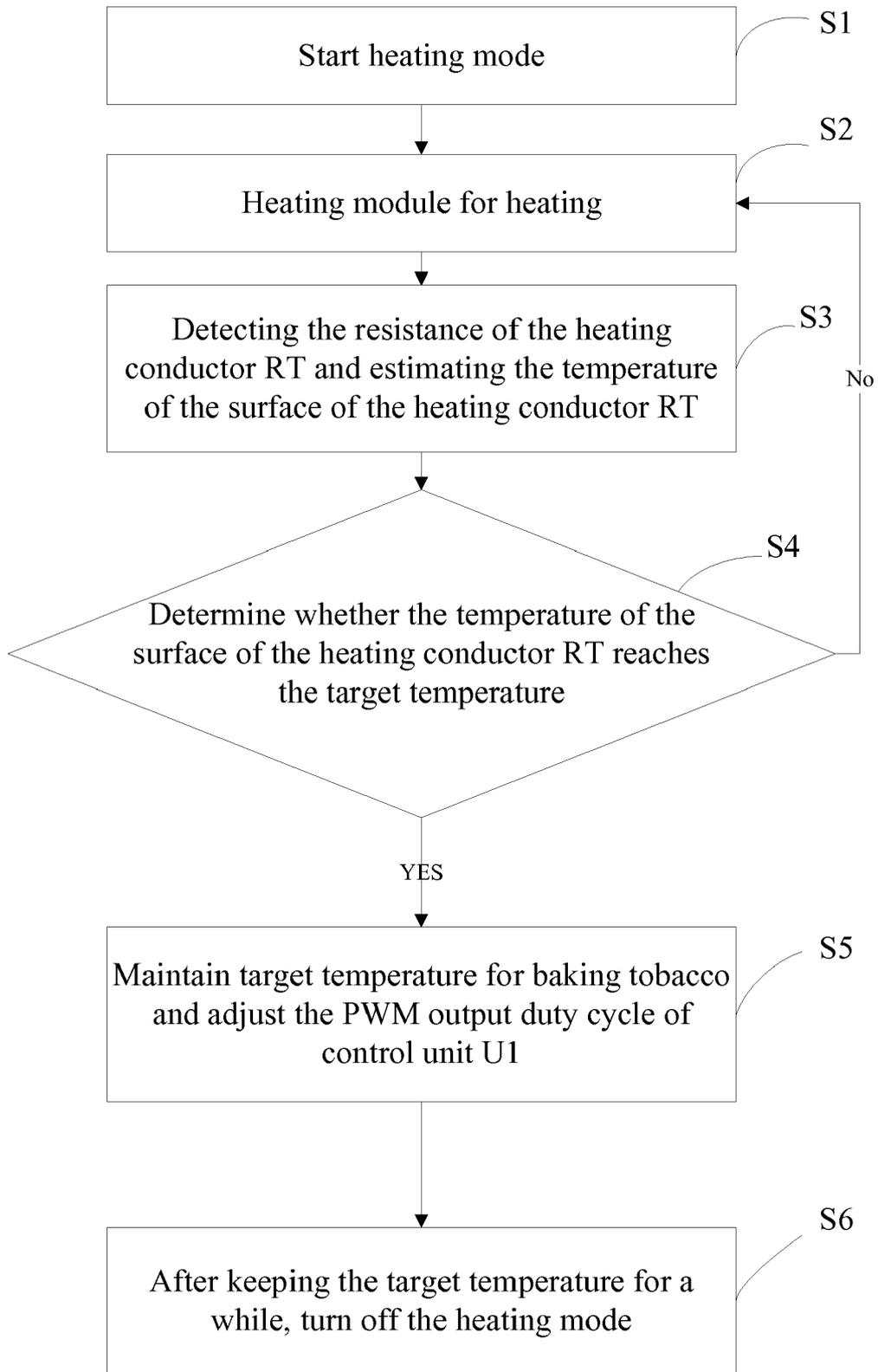


Fig. 3

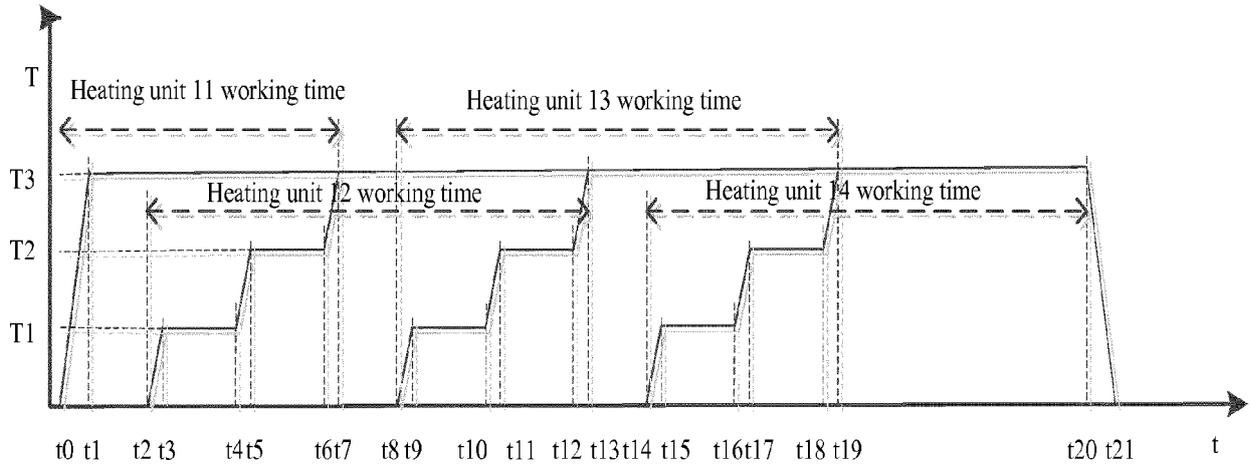


Fig. 4

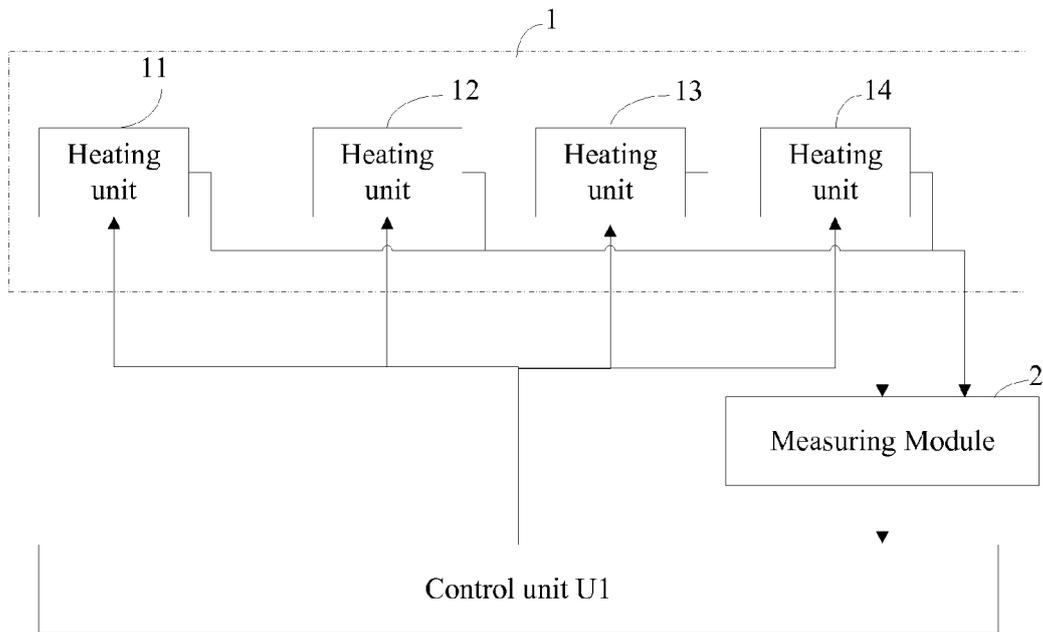


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 18 17 8112

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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 107 467 718 A (HUIZHOU NEW HONGWEI TECH CO LTD) 15 December 2017 (2017-12-15) * the whole document *	1-10	INV. H05B1/02 A24F47/00
X	US 2015/359263 A1 (BELLINGER JOHN [US]) 17 December 2015 (2015-12-17) * abstract * * paragraph [0007] - paragraph [0008] * * paragraph [0030] * * paragraph [0033] - paragraph [0039] * * paragraph [0043] - paragraph [0049] * * paragraph [0061] - paragraph [0062] * * figures 1-14 *	1-10	
X	US 2017/164658 A1 (LIN GUANGRONG [CN] ET AL) 15 June 2017 (2017-06-15) * abstract * * paragraph [0005] - paragraph [0013] * * paragraph [0047] - paragraph [0053] * * figures 1-9 *	1-10	
X	DE 20 2014 101126 U1 (EWWK UG HAFTUNGSBESCHRÄNKT [DE]) 1 April 2014 (2014-04-01) * abstract * * paragraph [0011] - paragraph [0014] * * paragraph [0019] - paragraph [0023] * * paragraph [0031] - paragraph [0037] * * paragraph [0041] * * figures 1,2 *	1-10	TECHNICAL FIELDS SEARCHED (IPC) H05B A24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 January 2019	Examiner Chelbosu, Liviu
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