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- **HAN, Yi**  
Kunming, Yunnan 650231 (CN)
- **ZHANG, Xia**  
Kunming, Yunnan 650231 (CN)
- **GONG, Xiaowei**  
Kunming, Yunnan 650231 (CN)
- **ZHAO, Wei**  
Kunming, Yunnan 650231 (CN)
- **HONG, Liu**  
Kunming, Yunnan 650231 (CN)
- **YANG, Qiang**  
Kunming, Yunnan 650231 (CN)
- **YOU, Junheng**  
Kunming, Yunnan 650231 (CN)
- **LIAO, Xiaoxiang**  
Kunming, Yunnan 650231 (CN)

(71) Applicant: **China Tobacco Yunnan Industrial Co., Ltd**  
Kunming, Yunnan 650231 (CN)

(74) Representative: **Gille Hrabal**  
Partnerschaftsgesellschaft mbB  
Patentanwälte  
Brucknerstraße 20  
40593 Düsseldorf (DE)

- (72) Inventors:
- **WU, Jun**  
Kunming, Yunnan 650231 (CN)
  - **ZHU, Donglai**  
Kunming, Yunnan 650231 (CN)
  - **LI, Tinghua**  
Kunming, Yunnan 650231 (CN)
  - **LI, Shoubo**  
Kunming, Yunnan 650231 (CN)

(54) **SMOKING APPARATUS FOR INDUCTION HEATING AT FRONT END OF CIGARETTE**

(57) The present disclosure relates to the field of novel cigarette smoking utensil, and in particular, to a smoke generating device with induction heating at the front end of the cigarette. The smoke generating device includes: a hollow heating cup (2), a heating element (5), and an induction coil (4); the hollow heating cup (2) includes an upper hollow structure, a lower hollow structure and a baffle between them, the heating element (5) is disposed in the lower hollow structure, and an induction coil (4) is on the periphery; the heating element (5) is made of a ferromagnetic metal, which has a structure that can pass through the air. The present disclosure designs for the first time a smoke generating device with induction heating at the front end of the cigarette. The inside and/or surface of the heating element has/forms a plurality of airflow channels, which can quickly and fully heat the air flowing through the surface, so as to effectively solve the problem of uneven heating of electric heating cigarettes, as well as flammable, uncontrollable charcoal-heated

cigarettes with insufficient aroma components and poor smoking sensation.

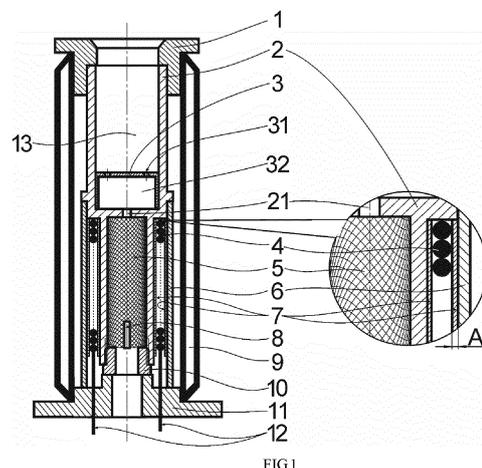


FIG.1

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## Description

### TECHNICAL FIELD

[0001] The present disclosure relates to the field of novel cigarette smoking utensil, and in particular, to a smoke generating device with induction heating at the front end of the cigarette.

### BACKGROUND

[0002] With the improvement of health awareness of the public, heat-not-burn cigarettes are gaining increasing popularity among smokers since they are less harmful than traditional burning cigarettes. At present, heating methods of heat-not-burn cigarettes include: contact electric heating, non-contact electric heating, charcoal heating, etc.

[0003] Contact electric heating refers to obtaining flue gas through direct contact heating of cigarettes, which uses electric heating pipes, needles or plates and other forms of heating devices to directly contact cigarettes or tobacco shreds, with direct contact and baking of cigarettes or tobacco at a temperature lower than the ignition point of the cigarette, so that the aroma and smoking components of the tobacco shreds are volatilized, to meet smoking requirements of smokers.

[0004] The problems with the above-mentioned methods of heating cigarettes or tobacco shreds are as follows:

1. The tobacco shreds in direct contact with the cigarette or tobacco can be fully baked, while the tobacco shreds at a distance from the heating element cannot be fully baked, thereby the baking effect has a certain degree of unevenness on the cross section of the circumference of the cigarette;
2. As the heating device itself has a small volume and its heat capacity is not high, smokers need to wait for a certain amount of heating time before smoking. As the heating element is in direct contact with the tobacco, in order to ensure the heating effect of the tobacco shreds away from the heating element, the surface of the heating element is usually increased by 10-20 degrees than the optimal heating temperature to ensure heating adequacy. Meanwhile, the problem is that, after the tobacco shreds in contact with the heating element are heated for several times, baked tobacco substances may stick to the heating element, bringing peculiar smell or heating difficulties to the subsequent smoking of the cigarette.

[0005] The existing charcoal-heated cigarettes are ignited by a carbon rod attached to the front end of the tobacco, so that the air flowing through the carbon rod is rapidly heated. When the hot air continues to flow through tobacco shreds at the end of the cigarette under negative

pressure during the smoker's suction, tobacco shreds are baked and heated to achieve non-combustion heating. Thus, tobacco aroma can be obtained, while harmful substances such as tar and nicotine produced in large quantities due to ignition can be avoided through such heating method. However, although such charcoal-heated cigarette has the characteristics of less harm than the existing ordinary cigarettes, as the front end of the cigarette is attached with a carbon rod, which increases the difficulty of cigarette manufacturing, thereby affecting production efficiency; there are also weaknesses, i.e., it takes a long time for consumers to ignite the carbon rod, and the carbon rod may have a certain peculiar smell in case of burning. Besides, the carbon rod is difficult to control after igniting, tobacco shreds are still burning when not smoking, and the end of the carbon rod is in direct contact with or relatively close to the tobacco; thus, at the end of the burning carbon rod, there may be direct baking or critical baking of a small amount of residual tobacco shreds.

[0006] The existing non-contact electric heating method uses a smoking utensil that electrically heats the input air, a ring-shaped metal heater, a flat-layer metal heater, or a combined flat-layer metal heater is directly energized and heated, the air flowing through the surface is heated, which is introduced into the cigarette for omnidirectional heating.

[0007] However, the non-contact electric heating method mentioned above has the following problems:

1. Due to energizing of adjacent surfaces of the heating element, sufficient space is required for mutual insulation to prevent short circuits; thus, only the air flowing through the surface layer of the heating element can be sufficiently heated;
2. The problem of inconvenience in temperature measurement and control of the heating element: as the temperature sensor cannot be directly installed on the heating element, in addition to inconvenience of installation and wiring on the airflow channel, there are large temperature differences in the flowing and static status of the airflow when sucking or not, and that the airflow is not easy to control and determine.

[0008] In order to solve the above-mentioned problems, the present disclosure is proposed.

### SUMMARY

[0009] The present disclosure provides a smoke generating device with induction heating at the front end of the cigarette, the smoke generating device includes:

A hollow heating cup 2, a ferromagnetic heating element 5, and an induction coil 4;  
Wherein, the hollow heating cup 2 includes an upper hollow structure, a lower hollow structure and a baffle between them, the upper hollow structure includes

a cigarette accommodating cavity 13, and the lower hollow structure includes a heating body accommodating cavity, The baffle is provided with a heat collecting hole 21 connecting the cigarette accommodating cavity 13 and the heating body accommodating cavity;

The heating element 5 has a structure that the air can pass through, and the heating element 5 is disposed in the heating body accommodating cavity of the hollow heating cup 2;

**[0010]** The induction coil 4 surrounds the outer wall of the heating body accommodating cavity of the hollow heating cup 2 and is connected to a power source.

**[0011]** The heating element 5 is made of ferromagnetic metals including iron, cobalt, and nickel.

**[0012]** The heating element 5 with a structure through which air can pass means that the heating element 5 has/forms a plurality of airflow channels inside and/or on the surface.

**[0013]** Preferably, the hollow heating cup 2 has an integrated structure or a split structure; that is, the upper hollow structure, the lower hollow structure and the baffle between them have an integrated or a split structure. The upper hollow structure, the lower hollow structure, and the baffle can be divided into two split-connected structures.

**[0014]** Preferably, the upper part of the hollow heating cup 2 has a hollow tubular structure, and its lower part has a hollow tubular structure with a top plate 14, the top plate is used as the aforementioned baffle, the upper and lower parts of the hollow heating cup 2 are detachably connected, preferably snap-fitted;

**[0015]** More preferably, the upper hollow tubular structure is made of a metal material, which is convenient for heat conduction and processing, and the lower hollow tubular structure with a top plate 14 is made of a non-metal material, which is convenient for magnetic conduction.

**[0016]** Preferably, the heating element 5 includes ferromagnetic bundled metal fibers, or porous and foamed solid ferromagnetic metal blocks.

**[0017]** Wherein, the ferromagnetic bundled metal fibers refer to: metal fiber bundles that are composed of ferromagnetic materials with a plurality of fiber bundles (with monofilament diameter between 0.5-0.001mm) bunched together in accordance with any rule. Within metal fiber bundles, there are small airflow channels between adjacent metal fibers, which can ensure the full flow of gas between metal fibers. The heating element 5 containing a large number of bundled fibers with a large specific surface area, when it is heated by the high-efficiency induction coil 4, the air sucked from the outside and flowing over the surface can quickly and fully exchange the heat of each filament in the heating element 5 to the flowing air.

**[0018]** The porous and foamed ferromagnetic metal blocks refer to metal blocks with a porous honeycomb

structure formed by foaming metallic aggregates, e.g., foam metal blocks, etc. The porous and foamed solid ferromagnetic metal blocks have a large specific surface area and numerous airflow channels, with air-heating effect similar to that of bundled metal fibers.

**[0019]** Preferably, the heating body accommodating cavity is connected to the outside air.

**[0020]** Preferably, in case the upper hollow structure, the lower hollow structure and the baffle between them have an integrated structure, the hollow heating cup 2 is made of a non-metallic material; more preferably, the hollow heating cup 2 is made of high-temperature resistant, non-toxic and non-metallic materials such as glass-ceramics and ceramics, etc., which are processed by precision processing or molding.

**[0021]** Preferably, the heating element 5 is disposed in the heating body accommodating cavity, and the heat shielding ring 10 abuts against the lower end of the heating element 5 to limit its position.

**[0022]** Preferably, the cigarette accommodating cavity 13 and the heating body accommodating cavity are cylindrical.

**[0023]** Preferably, the bundled metal fibers are bunched together in such a manner that metal fibers are disposed parallel to the axis of the heating body accommodating cavity.

**[0024]** Preferably, the smoke generating device further includes: a shielding ring 6 disposed on the periphery of the induction coil 4.

**[0025]** The shielding ring 6 generates electromagnetic shielding effect on the induction coil 4 working in the middle- and high-frequency range, which is made of non-ferromagnetic, easy-to-process aluminum, copper and aluminum or copper alloys, etc. The shielding ring 6 is sleeved in a circular ring or wound on the outside of the induction coil 4 with a thin metal sheet, to ensure that the induced magnetic field generated by the induction coil 4 after being energized may not cause electromagnetic interference or induced heating to the ferromagnetic materials or other devices surrounding the smoke generating device of the present disclosure, thus, the changing magnetic field generated by the induction coil 4 can be concentrated on the ferromagnetic heating element 5 to the maximum to generate eddy current and heat. The inner wall of the shielding ring 6 is required to be at least 0.5mm away from the outermost circle of the induction coil 4, the length of the shielding ring 6 must be greater than the total axial length of the induction coil 4, and both ends of the shielding ring 6 are at least equal to or greater than the length of the induction coil 4 by 5mm.

**[0026]** Preferably, the smoke generating device further includes: two layers of heat insulation and insulation isolation layer 7, one layer is wrapped on the outer wall of the heating body accommodating cavity of the hollow heating cup 2 surrounded by the induction coil 4, the other wraps the outside of the induction coil 4, and the induction coil 4 is disposed between the two isolation layers 7. This not only ensures the electromagnetic performance of the

induction coil 4 when it is working, but also ensures that the induction coil 4 is positioned on the outer wall of the heating body accommodating cavity of the hollow heating cup 2.

**[0027]** The isolation layer 7 is a high-temperature tape, glass fibers or a heat-shrinkable polymer material wrapping layer characterized by high-temperature resistance, insulation and heat isolation. Among which high-temperature resistance refers to no deformation at 250 degrees Celsius under one-atmosphere.

**[0028]** Preferably, the upper hollow structure of the hollow heating cup 2 is provided with a hollow heat equalizer 3 with a top plate, and a plurality of heat equalizing holes 31 are disposed on the top plate, the hollow structure inside the hollow heat equalizer 3 is a heat equalizing cavity 32, and the hollow heat equalizer 3 is disposed at the lower part of the cigarette accommodating cavity 13, the heat equalizing cavity 32 is connected to the cigarette accommodating cavity 13 through the heat equalizing hole 31, and the heat equalizing cavity 32 is connected to the heating body accommodating cavity through the heat collecting hole 21.

**[0029]** The heat equalizer 3 is a hollow cylinder with an open lower end and a top plate at the upper end. The heat equalizer 3 is placed in the upper hollow structure of the hollow heating cup 2 through interference fit, which is made of thin-walled, non-ferromagnetic aluminum or copper, its outer cylindrical surface and the inner wall of the cigarette hole 13 in the upper part of the heating cavity are preferably transitionally-matched. The heating cup 2 is made of a non-metallic material, its expansion after being heated is less than that of the metal heat equalizer 3, as long as the heat equalizer 3 does not naturally slide inside the upper hollow structure of the heating cup 2 at room temperature. (Based on common sense, in case two non-moving parts are in interference fit, it is possible that the expansion of the internal heat equalizer 3 is greater than that of the heating cup 2; the heating cup 2 is a non-metallic thin-walled component, thus, it is easy to cause damage to the heating cup 2 and the heat equalizer 3 due to stress concentration at the mating part.)

**[0030]** Preferably, the smoke generating device further includes: a temperature sensor 8 disposed at the end of the heating element 5, which is implanted in the heating element 5 through perforating the end of the heating element 5, so as to detect the temperature of the heating element 5.

**[0031]** Preferably, the smoke generating device further includes:

A heat shielding ring 10, and a hollow base 11;

**[0032]** Wherein, the heat shielding ring 10 is disposed at the lower end of the heating element 5, its upper end abuts against the heating element 5, and its lower end abuts against the hollow base 11, The heat shielding ring 10 and the hollow structure inside the hollow base 11 are connected to the outside air and the heating body accommodating cavity. The heat shielding ring 10 and the lower part of the hollow heating cup 2 are matched and

connected by means of a threaded mouth, a bayonet, a pin or a self-locking taper.

**[0033]** Preferably, the smoke generating device further includes: a vacuum insulation pipe 9 disposed on the periphery of the non-metallic hollow heating cup 2 and surrounds the shielding ring 6.

**[0034]** Preferably, the longitudinal section of the non-metal hollow heating cup 2 is H-shaped, which is made of glass or ceramic.

**[0035]** Preferably, the shielding ring 6 is made of a non-ferromagnetic material, including aluminum, copper, and alloys containing aluminum or copper.

**[0036]** Preferably, the heat equalizer 3 is made of a non-ferromagnetic material, including aluminum, copper, and alloys containing aluminum or copper.

**[0037]** Preferably, the heat equalizing holes 31 are evenly distributed in the circumferential direction on the top plate of the heat equalizer 3, and the heating element 5 has an axial airflow channel inside.

**[0038]** The heating process of the smoke generating device is as follows:

As shown in FIG.1, a cigarette is inserted into the cigarette accommodating cavity 13 (not shown in the Figures). After turning on the smoke generating device, the induction coil is energized, and the heating element 5 starts to generate heat. When smoking, the outside air is sucked in from the lower part of the heating cup 2 and is rapidly and fully heated by the heating element 5 to obtain high-temperature gas. When high-temperature air is sucked into the heat equalizing cavity 32 with a larger diameter formed by the cylindrical inner wall of the heat equalizer 3 from the heat collecting hole 21 with a smaller diameter, the air velocity at the front end of the heat collecting hole 21 is fast, with low pressure and high temperature; whereas the area relatively far away from the heat collecting hole 21 as well as the aperture or axial direction, the air temperature is low, with slow velocity and high pressure. When the hot high-speed airflow enters the heat equalizing cavity 32, under the action of pressure difference, the heat equalizing cavity 32 generates multi-regional and micro-flows to homogenize the heat and pressure difference, as the pressure and temperature of the gas reaching the heat equalizing hole 31 are homogenized, the temperature is slightly lower, the high-temperature gas is sucked into the cigarette inserted into the cigarette accommodating cavity 13 after receiving negative pressure in smoking. The homogenized high-temperature gas bakes and heats the tobacco shreds in the cigarette. Besides, the heat equalizing holes 31 are evenly distributed on the circumference of the top plate of the heat equalizer 3, which ensures that the smoke generating device of the present disclosure can bake tobacco shreds more evenly and fully compared with direct contact heating.

**[0039]** Meanwhile, in the process of heat exchange and pressure difference homogenization inside the heat equalizing cavity 32, the heat of input hot gas and the homogenized gas is also conducted to the heat equalizer

3 and finally to the upper part of the heating cup 2. Another source of heat of the heating cup 2 is that: the heating element 5 is heated through induction in the heating body accommodating cavity and the heat is transferred to the lower part of the heating cup 2 through radiation and air conduction, the lower part of the heating cup 2 directly conducts heat to the upper part of the heating cup 2. The heat conducted to the upper part of the heating cup 2 may also bake and heat the cigarettes inserted into the cigarette accommodating cavity 13. Thus, the design of the heating cup 2 of the present disclosure can make full use of heat.

**[0040]** Therefore, the cigarettes inserted into the cigarette accommodating cavity 13 are not only heated by the uniform high-temperature airflow from the plurality of heat equalizing holes 31, but also evenly baked and heated by the heat from the upper part of the heating cup 2 on the outer circumference of the cigarette accommodating cavity 13, so as to achieve even and sufficient baking and heating of tobacco shreds of the cigarette, thereby demonstrating the advantages of peripheral heating, sheet-shaped or pin-shaped central heating compared with direct contact heating. Besides, after the cigarette is smoked, there are no problems such as adhesion of centrally-heated tobacco substances and retention of tobacco shreds in the smoking utensil, which simplifies the process of taking out cigarettes from the smoking utensil without the need to design a structure dedicated to taking out cigarettes.

**[0041]** The above technical solutions can be freely combined under the premise of no contradiction.

**[0042]** The present disclosure has the following beneficial effects:

1. The present disclosure designs for the first time an electric heating smoke generating device that performs instantaneous induction heating of air that is sucked in and passed through, the heating principle is induction heating, as a plurality of airflow channels inside and/or on the surface of the heating element can quickly and fully heat the air flowing through the surface and inside of the heating element, thus effectively solving the problems of uneven heating of electric-heated cigarettes, and flammable, uncontrollable charcoal-heated cigarettes with insufficient aroma components and poor smoking sensation.

2. Among the preferred technical solutions, the heating element is ferromagnetic bundled metal fibers with a large specific surface area or ferromagnetic porous and foamed solid ferromagnetic metal blocks. Compared with ring-shaped, flat-layer or combined flat-layer metal heating elements, the heating element of the present disclosure has a large amount of small airflow channels inside, which are easier to disperse airflow, which can quickly and fully heat the air flowing through its surface and inside.

3. Among the preferred technical solutions, the heat equalizer 3 is disposed between the heating element

5 and the cigarette accommodating cavity 13 in the present disclosure for the first time, under the action of pressure difference, the heat equalizing cavity 32 inside produces multi-regional, micro-flow and homogenized heat and pressure difference to the heat equalizing holes 31, after receiving the negative pressure generated by smokers' suction, the relatively homogenized gas with a certain temperature drop is sucked into the cigarette inserted in the cigarette accommodating cavity 13, the homogenized high-temperature gas is used to bake and heat tobacco shreds in the cigarette.

4. Among the more preferred technical solutions, as the heat equalizing holes 31 are uniformly distributed on the circumference of the top plate of the heat equalizer 3, high-temperature gas has a high degree of dispersion. Compared with the existing contact electric heating, non-contact electric heating, and charcoal heating methods, the smoke generating device of the present disclosure can bake the tobacco more evenly and fully, while avoiding problems such as adhesion of tobacco substances after baking and retention of tobacco section in the smoking utensil of contact electric heating.

5. In addition, the heating cup 2 of the present disclosure can accommodate cigarettes in the upper part and heating elements in the lower part. While the heating element mainly provides air heating, the remaining heat is transferred to the lower part of the heating cup 2 through radiation and air conduction, then heat is directly transferred from the lower part to the upper part of the heating cup 2, which also has a baking effect on cigarettes. Thus, the design of the heating cup 2 of the present disclosure can make full use of heat.

## BRIEF DESCRIPTION OF THE DRAWINGS

### **[0043]**

FIG.1 is a longitudinal cross-sectional view of a smoke generating device with induction heating at the front end of the cigarette of Embodiment 1, and a partial enlarged view on the right.

FIG.2 is a schematic perspective view of the parts of the hollow heat equalizer 3 of the smoke generating device of Embodiment 1.

FIG.3 is a longitudinal cross-sectional view of a smoke generating device with induction heating at the front end of the cigarette of Embodiment 2, and a partial enlarged view on the right.

### **[0044]** List of signs in the drawings:

1. Plug socket, 2. Heating cup, 21, Heat collecting hole, 3. Heat equalizer, 31, Heat equalizing hole, 32, Heat equalizing cavity, 4. Induction coil, 5. Heating element, 6, Shielding ring, 7. Isolation layer, 8. Temperature sensor, 9. Vacuum insulation pipe, 10, Heat shielding ring,

11, Hollow base, 12, Coil lead, 13, Cigarette accommodating cavity, 14. Hollow tubular structure with integrated top plate, 141. Top plate through hole.

#### DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0045]** The present disclosure will be further explained below through specific embodiments.

#### Embodiment 1

**[0046]** As shown in FIG.1-2, Embodiment 1 provides a smoke generating device with induction heating at the front end of the cigarette, the smoke generating device includes:

A plug socket 1, a non-metal hollow heating cup 2, a hollow heat equalizer 3, an induction coil 4, a heating element 5, a shielding ring 6, a heat insulation and insulation isolation layer 7, a temperature sensor 8, a vacuum insulation pipe 9, a heat shielding ring 10, and a hollow base 11;

Wherein, the longitudinal section of the heating cup 2 is H-shaped, which is made of high-temperature resistant material, non-toxic, non-metallic materials such as glass-ceramics and ceramics with increased processing accuracy. The heating cup 2 has an integrated structure, including an upper hollow structure, a lower hollow structure and a baffle between them, the upper hollow structure includes a cigarette accommodating cavity 13, and the lower hollow structure includes a heating body accommodating cavity, The baffle is provided with a heat collecting hole 21 connecting the cigarette accommodating cavity 13 and the heating body accommodating cavity;

The heating element 5 includes ferromagnetic bundled metal fibers, or porous and foamed solid ferromagnetic metal blocks, the heating element 5 is disposed in the heating body accommodating cavity of the heating cup 2, the heating body accommodating cavity is connected to the outside air, and the heating element 5 has an axial airflow channel inside;

**[0047]** The induction coil 4 surrounds the outer wall of the heating body accommodating cavity of the heating cup 2 and is connected to a power source through the coil lead 12. The induction coil 4 is manually controlled when it is initially started. During the whole process of suction, the smoke generating device automatically adjusts the electrical parameters of the induction coil 4 in a timely manner according to the temperature detected by the temperature sensor 8, so as to meet the heat requirements of smoking.

**[0048]** Wherein, the ferromagnetic bundled metal fibers of Embodiment 1 refer to: metal fiber bundles that multi-fiber (with monofilament diameter between 0.5-0.001mm) made of ferromagnetic materials is

bunched together in a manner that metal fiber filaments are disposed in parallel with the axis of the heating body accommodating cavity. The porous and foamed solid ferromagnetic metal blocks also have a large specific surface area and numerous airflow channels, so that its air heating effect is similar to that of bundled metal fibers.

**[0049]** The heating element 5 is disposed in the heating body accommodating cavity, and is limited and fixed by the heat shielding ring 10 at the lower end.

**[0050]** The cigarette accommodating cavity 13 and the heating body accommodating cavity are cylindrical.

**[0051]** The shielding ring 6 is made of a non-ferromagnetic material, including aluminum, copper, and alloys containing aluminum or copper, which is disposed on the periphery of the induction coil 4. The shielding ring 6 generates electromagnetic shielding effect on the induction coil 4 working in the middle- and high-frequency range, the induction coil is made of non-ferromagnetic, easy-to-process aluminum, copper and aluminum or copper alloys, etc. The shielding ring 6 is sleeved in a circular ring or wound on the outside of the induction coil 4 with a thin metal sheet, to ensure that the induced magnetic field generated by the induction coil 4 after being energized may not cause electromagnetic interference or induced heating to the ferromagnetic materials or other device surrounding the smoke generating device of the present disclosure; thus, the changing magnetic field generated by the induction coil 4 can be concentrated on the ferromagnetic heating element 5 to the maximum to generate eddy current and heat. The inner wall of the shielding ring 6 is required to be at least 0.5mm away from the outermost circle of the induction coil 4, the length of the shielding ring 6 must be greater than the total axial length of the induction coil 4, and both ends of the shielding ring 6 are at least equal to or greater than the length of the induction coil 4 by 5mm.

**[0052]** The smoke generating device includes two layers of heat insulation and insulation isolation layer 7, one layer is wrapped on the outer wall of the heating body accommodating cavity of the hollow heating cup 2 surrounded by the induction coil 4, the other wraps the outside of the induction coil 4, and the induction coil 4 is disposed between the two isolation layers 7. This not only ensures electromagnetic performance of the induction coil 4 when it is working, but also ensures that the induction coil 4 is positioned on the outer wall of the heating body accommodating cavity of the hollow heating cup 2. The isolation layer 7 is a high-temperature tape, glass fibers or a heat-shrinkable polymer material wrapping layer characterized by high-temperature resistance, insulation and heat isolation.

**[0053]** The upper hollow structure of the hollow heating cup 2 is provided with a hollow heat equalizer 3 with a top plate; the plurality of heat equalizing holes 31 uniformly distributed in the circumferential direction are disposed on the top plate, the hollow structure inside the hollow heat equalizer 3 is a heat equalizing cavity 32, and the hollow heat equalizer 3 is disposed in the lower

part of the cigarette accommodating cavity 13, the heat equalizing cavity 32 is connected to the cigarette accommodating cavity 13 through the heat equalizing hole 31, and the heat equalizing cavity 32 is connected to the heating body accommodating cavity through the heat collecting hole 21. The diameter of the heat equalizing hole 31 is 0.3-1 mm.

**[0054]** The heat equalizer 3 is a hollow cylinder with an open lower end and a top plate at the upper end. The heat equalizer 3 is disposed in the upper hollow structure of the hollow heating cup 2 through interference fit, which is made of thin-walled, non-ferromagnetic aluminum or copper, and its outer cylindrical surface and the inner wall of the cigarette accommodating cavity 13 in the upper part of the heating cavity are preferably transitionally-matched. The heating cup 2 is made of a non-metallic material, its expansion after being heated is less than that of the metal heat equalizer 3, as long as the heat equalizer 3 does not naturally slide inside the upper hollow structure of the heating cup 2 at room temperature.

**[0055]** The temperature sensor 8 is disposed at the lower end of the heating element 5, and implanted in the heating element 5 through perforating the lower end of the heating element 5 to detect the temperature of the heating element 5.

**[0056]** The heat shielding ring 10 is disposed at the lower end of the heating element 5, the upper end of the heat shielding ring abuts against the heating element 5, and its lower end abuts against the hollow base 11, The heat shielding ring 10 and the hollow structure inside the hollow base 11 are connected to the outside air and the heating body accommodating cavity. The heat shielding ring 10 is threadedly connected with the inner hollow structure of the lower part of the hollow heating cup 2.

**[0057]** The heat shielding ring 10 is made of high-temperature resistant ceramic or quartz glass.

**[0058]** The vacuum insulation pipe 9 is disposed on the periphery of the hollow heating cup 2 and surrounds the shielding ring 6. Heat preservation and insulation materials outside the vacuum insulation pipe 9 can be further wrapped or the vacuum insulation pipe 9, which can be replaced with other heat preservation and insulation materials without affecting the appearance or using conditions, so as to reduce the heat generated internally to the periphery as much as possible, thereby improving heat efficiency; while avoiding causing damage to the devices and circuits, etc. near the heating cavity, or increasing users' bad experience. Of course, the use of the vacuum insulation pipe 9 is only an optimal method, rather than the only method that limits the present disclosure.

**[0059]** The plug socket 1 is disposed at the upper end of the non-metallic hollow heating cup 2 to fix the positions of the heating cup 2 and the insulation pipe 9. The plug socket 1 has a central through hole for inserting cigarettes.

## Embodiment 2

**[0060]** As shown in FIG.3, Embodiment 2 provides a smoke generating device with induction heating at the front end of the cigarette, its difference from Embodiment 1 is as follows: the hollow heating cup 2 has a split structure. The upper part of the hollow heating cup 2 has a hollow tubular structure, and the lower part has a hollow tubular structure with an integrated top plate 14, the top plate serves as the aforementioned baffle, and the top plate through hole 141 on the top plate serves as the heat collecting hole 21 of Embodiment 1. The upper part and the lower part of the hollow heating cup 2 are snap-fitted.

**[0061]** The upper hollow tubular structure is made of a metal material, which is convenient for heat conduction and processing, and the lower hollow tubular structure with a top plate 14 is made of a non-metal material, which is convenient for magnetic conduction.

**[0062]** The above are only specific embodiments of the present disclosure, the protection scope of the present disclosure is not limited thereto, any person skilled in the art can easily think of changes or substitutions within the technical scope disclosed by the present disclosure, and they shall be covered by the protection scope of the present disclosure. Thus, the protection scope of the present disclosure shall be subject to the protection scope of the claims.

## Claims

1. A smoke generating device with induction heating at the front end of a cigarette, comprising: a hollow heating cup (2), a ferromagnetic heating element (5), and an induction coil (4);

The hollow heating cup (2) comprises an upper hollow structure, a lower hollow structure and a baffle between them, the upper hollow structure comprises a cigarette accommodating cavity (13), and the lower hollow structure comprises a heating body accommodating cavity, the baffle is provided with a heat collecting hole (21) connecting the cigarette accommodating cavity (13) and the heating body accommodating cavity; The heating body (5) has a structure that the air can pass through, the heating body (5) is disposed in the heating body accommodating cavity of the hollow heating cup (2);

The induction coil (4) surrounds the outer wall of the heating body accommodating cavity of the hollow heating cup (2) and is connected to a power source, the heating body accommodating cavity is connected to the outside air.

2. The smoke generating device of claim 1, wherein the hollow heating cup (2) has an integrated or a split

structure.

3. The smoke generating device of claim 1, wherein the upper part of the hollow heating cup (2) has a hollow tubular structure, and the lower part has a hollow tubular structure with a top plate (14), and the top plate serves as the baffle of claim 1, the upper part and the lower part of the hollow heating cup (2) are detachably connected. 5
4. The smoke generating device of claim 1, wherein the smoke generating device further comprises: a shielding ring (6) disposed on the periphery of the induction coil (4);  
The heating element (5) comprises ferromagnetic bundled metal fibers or porous and foamed solid ferromagnetic metal blocks. 15
5. The smoke generating device of claim 1, wherein the smoke generating device further comprises: two layers of heat insulation and insulation isolation layer (7), one layer (7) is wrapped on the outer wall of the heating body accommodating cavity of the hollow heating cup (2) surrounded by the induction coil (4), the other layer (7) wraps the outside of the induction coil (4), and the induction coil (4) is located between the two isolation layers (7). 20 25
6. The smoke generating device of claim 1, wherein the upper hollow structure of the hollow heating cup (2) is provided with a hollow heat equalizer (3) with a top plate, and a plurality of heat equalizing holes (31) are provided on the top plate, the hollow structure inside the hollow heat equalizer (3) is a heat equalizing cavity (32), and the hollow heat equalizer (3) is disposed at the lower part of the cigarette accommodating cavity (13), the heat equalizing cavity (32) is connected to the cigarette accommodating cavity (13) through the heat equalizing hole (31), and the heat equalizing cavity (32) is connected to the heating body accommodating cavity through the heat collecting hole (21). 30 35 40
7. The smoke generating device of claim 1, wherein the smoke generating device further comprises: a temperature sensor (8) implanted in the heating element (5). 45
8. The smoke generating device of claim 1, wherein the smoke generating device further comprises: a heat shielding ring (10), and a hollow base (11);  
Wherein, the heat shielding ring (10) is disposed at the lower end of the heating body (5), the upper end of the heat shielding ring abuts against the heating body (5), and its lower end abuts against the hollow base (11), the heat shielding ring (10) and the hollow structure inside the hollow base (11) are connected to the outside air and the heating body accommo- 50 55

dating cavity.

9. The smoke generating device of claim 1, wherein the heating element (5) has an axial airflow channel inside. 5
10. The smoke generating device of claim 6, wherein the heat equalizing holes (31) are evenly distributed in the circumferential direction on the top plate of the heat equalizer (3). 10

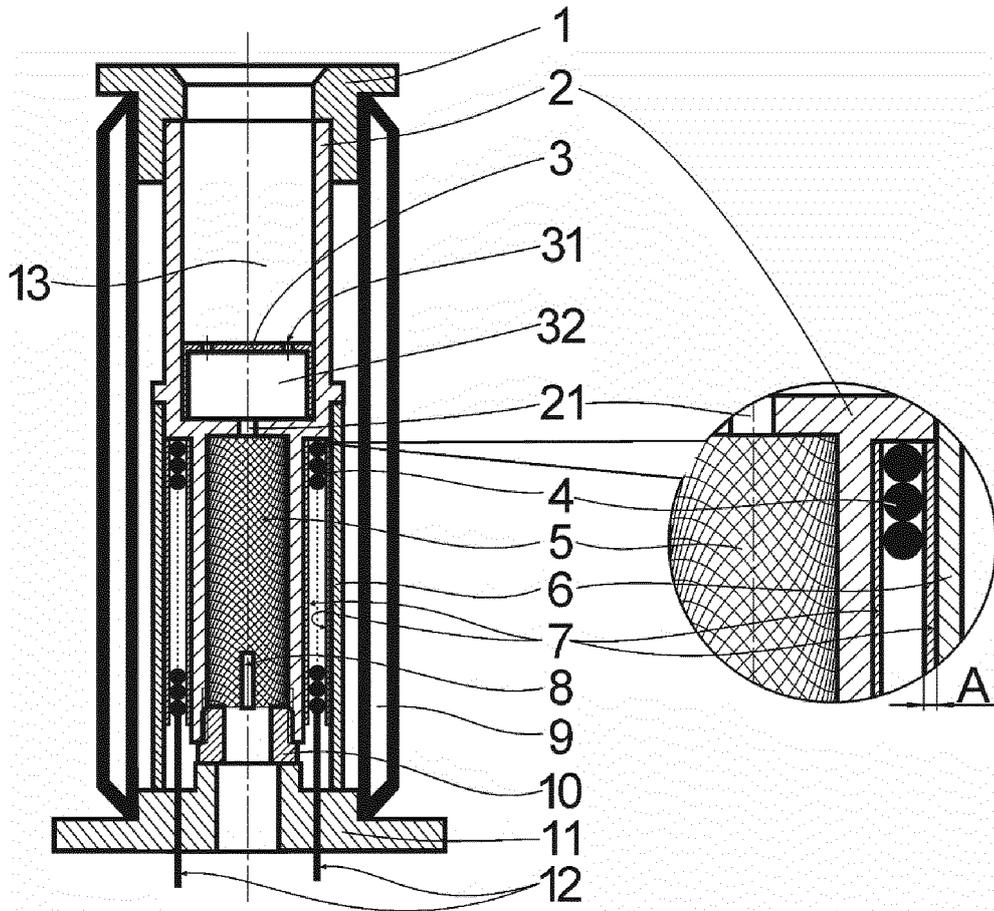


FIG.1

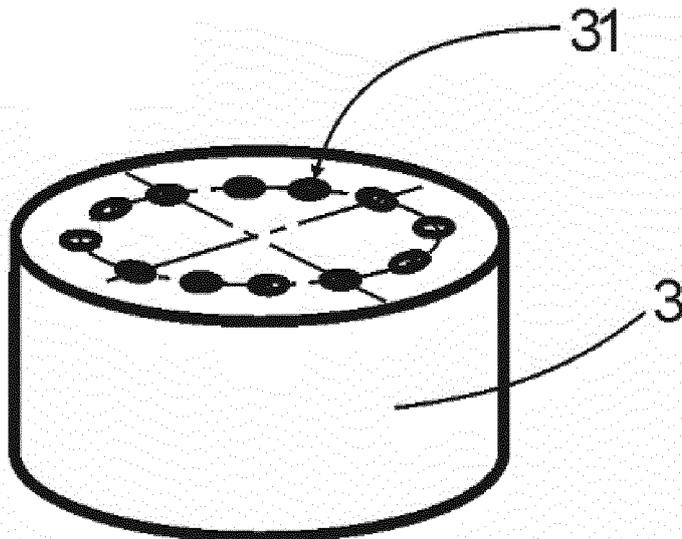


FIG.2



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/118486

5	<b>A. CLASSIFICATION OF SUBJECT MATTER</b> A24F 47/00(2020.01)j  According to International Patent Classification (IPC) or to both national classification and IPC		
10	<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) A24F47/-  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNPAT, CNKI, WPI, EPODOC: 云南中烟工业, 张霞, 朱东来, 吴俊, 李廷华, 巩效伟, 李寿波, 韩熠, 电子烟, 线圈, 铁磁, 磁铁, 磁性, 发热体, 发热本体, 加热体, 加热本体, 腔, 杯, 筒, 容纳, 收纳, 分体, 拆分, 拆卸, 发泡, 纤维丝, 管, 绝缘, 隔热, 屏蔽, 温度, 传感器, 感温, 均热, 匀热, 均匀, 周向, 圆周, 压差, electronic+, cigarette, winding??. magnetic+, heat+, chamber, temperature, sensor		
20	<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	
		Relevant to claim No.	
25	X	CN 207754539 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 24 August 2018 (2018-08-24) description, paragraphs [0023]-[0028], and figure 2	1-5, 8-9
30	Y	CN 207754539 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 24 August 2018 (2018-08-24) description, paragraphs [0023]-[0028], and figure 2	7
35	Y	CN 111264910 A (HUIZHOU PEIGESI TECHNOLOGY CO., LTD.) 12 June 2020 (2020-06-12) description, paragraphs [0074]-[0082], and figures 5-6	7
	X	CN 111264911 A (CHINA TOBACCO YUNNAN INDUSTRIAL CO., LTD.) 12 June 2020 (2020-06-12) description, paragraphs [0024]-[0029], and figure 1	1
	A	CN 111278183 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 12 June 2020 (2020-06-12) entire document	1-10
	<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
40	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
45	Date of the actual completion of the international search <b>01 June 2021</b>	Date of mailing of the international search report <b>25 June 2021</b>	
50	Name and mailing address of the ISA/CN <b>China National Intellectual Property Administration (ISA/ CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088 China</b>	Authorized officer	
55	Facsimile No. (86-10)62019451	Telephone No.	

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/118486

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 110604342 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 24 December 2019 (2019-12-24) entire document	1-10
A	CN 108552601 A (CHINA TOBACCO YUNNAN INDUSTRIAL LLC.) 21 September 2018 (2018-09-21) entire document	1-10
A	CN 104095295 A (CHINA TOBACCO YUNNAN INDUSTRIAL LLC.) 15 October 2014 (2014-10-15) entire document	1-10
A	EP 3711511 A1 (NERUDIA LIMITED) 23 September 2020 (2020-09-23) entire document	1-10

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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.  
**PCT/CN2020/118486**

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	207754539	U	24 August 2018	None			
CN	111264910	A	12 June 2020	None			
CN	111264911	A	12 June 2020	CN	212520790	U	12 February 2021
CN	111278183	A	12 June 2020	CN	211860585	U	03 November 2020
CN	110604342	A	24 December 2019	CN	211020992	U	17 July 2020
CN	108552601	A	21 September 2018	CN	208480614	U	12 February 2019
CN	104095295	A	15 October 2014	None			
EP	3711511	A1	23 September 2020	None			