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(54) **MOUHPICE FILTER AND CIGARETTE HAVING VARIABLE VENTILATION**

(57) The invention discloses a variable-ventilation filter tip and a cigarette. The above filter tip includes a filter element and a coating layer, wherein the coating layer wraps the filter element; the filter element includes a smoke inlet end and a smoke release end; a phase-change ventilation area and a non-phase-change ventilation area are arranged on the coating layer, a plurality of first ventilation holes are arranged in the phase-change ventilation area, and a plurality of second ventilation holes are arranged in the non-phase-change ventilation area; outside air penetrates through the coating layer through the first ventilation holes and the second

ventilation holes to enter a part of the filter element; a part in the filter element close to the smoke inlet end is provided with a starch tube; and a phase-change material is filled in the first ventilation hole; and a phase-change temperature of the phase-change material ranges from 45°C to 60°C. The invention further discloses the cigarette applying the above filter tip. According to the invention, the cigarette may be smoked in an ignition manner or a non-ignition heating manner.

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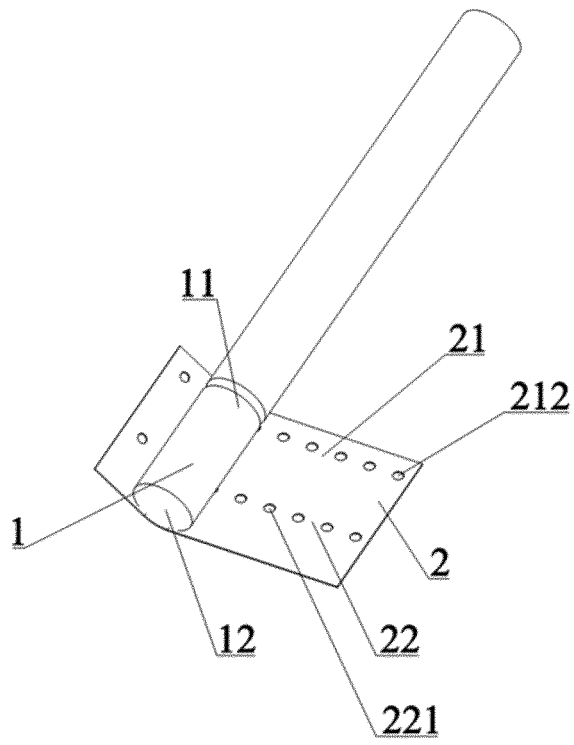


FIG. 1

## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to the field of cigarette filter tip designing and processing, and more particularly, to a variable-ventilation filter tip and a cigarette.

### BACKGROUND

**[0002]** A cigarette may be sucked by burning cut tobaccos with open flame or baking the cut tobaccos without burning to release smoke. No matter which manner is used to release the smoke, it is necessary to filter the smoke through a filter tip, and then the smoke enters a human body.

**[0003]** At present, the design of the filter tip is often considered to only meet a single condition, for example, only a condition of sucking by ignition is met, or only a condition of sucking without burning is met. However, a user not only needs to suck the smoke by ignition, but also needs to suck the smoke without burning. In this case, the design of a traditional filter tip cannot meet the needs of the user, thus bringing inconvenience to the user.

**[0004]** Improvement of the filter tip in the prior art is still limited to a single sucking manner, for example, in the Chinese patent application No. 201721766369.9, a ventilation rate is automatically changed by arranging a piece of high permeability paper between a filter stick and a piece of tipping paper and coating a phase-change material on the high permeability paper. However, such structural design can only meet automatic adjustment of sucking the smoke by ignition. For the increasing demands of consumers, there is still a lack of a filter tip which can not only meet the sucking manner by ignition, but also meet the heat-not burn sucking manner.

### SUMMARY

**[0005]** A technical problem to be mainly solved by the present invention is to aim at the prior art that lacks of a cigarette which can not only meet a sucking manner by ignition, but also meet a sucking manner of non-ignition heating, to provide a variable-ventilation filter tip.

**[0006]** Another technical problem to be solved by the present invention is to provide a cigarette applying the variable-ventilation filter tip.

**[0007]** In order to solve the above technical problems, specific technical solutions adopted by the present invention are as follows.

**[0008]** A variable-ventilation filter tip includes a filter element and a coating layer, the coating layer wraps the filter element; the filter element includes a smoke inlet end and a smoke release end; a phase-change ventilation area and a non-phase-change ventilation area are arranged on the coating layer, a plurality of first ventilation holes are arranged in the phase-change ventilation area,

and a plurality of second ventilation holes are arranged in the non-phase-change ventilation area; outside air passes through the coating layer through the first ventilation holes and the second ventilation holes respectively to penetrate into a part of the filter element; a phase-change material is filled in the first ventilation hole; a part in the filter element close to the smoke inlet end is provided with a starch tube; and a phase-change temperature of the phase-change material ranges from 45°C to 60°C.

**[0009]** According to the present invention, the phase-change ventilation area and the non-phase-change ventilation area are arranged at the coating layer, and the first ventilation holes and the second ventilation holes are respectively arranged in the phase-change ventilation area and the non-phase-change ventilation area, the phase-change material is filled in the first ventilation hole, the phase-change ventilation area serves as a selective ventilation area which can be automatically opened as the temperature changes, and the non-phase-change ventilation area is a constant ventilation area. When the sucking manner of non-ignition heating is used, the temperature of the smoke release end is very high, which will melt the phase-change material. At this time, the first ventilation holes are automatically opened to increase a ventilation volume and reduce the temperature of the smoke sucked out. When the sucking manner by ignition is used, the temperature of the smoke release end is low, which will not affect sucking.

**[0010]** On one hand, the starch tube in the present invention has a good cooling effect, and on the other hand, the starch tube has a certain supporting effect, and is convenient for inserting the cigarette especially when the sucking manner of non-ignition heating is used.

**[0011]** As a preferable solution of the present invention, the phase-change ventilation area is close to the smoke inlet end, or the non-phase-change ventilation area is close to the smoke inlet end.

**[0012]** As a preferred technical solution, the phase-change ventilation area is close to the smoke inlet end, or the non-phase-change ventilation area is close to the smoke inlet end. When the phase-change ventilation area is close to the smoke inlet end, the phase-change ventilation area first senses a temperature change, which is beneficial to control the ventilation volume and has a good cooling effect. When the non-phase change ventilation area is close to the smoke inlet end, such structure is convenient for processing and manufacturing. However, no matter which one of the above two ventilation area arrangements is employed, the objective of "one smoke and two sucking manners" can be achieved, but each arrangement has its own preference, either for cooling effect, or for processing and manufacturing.

**[0013]** As a preferred solution of the present invention, a distance between the phase-change ventilation area and the smoke inlet end is no less than a distance between the phase-change ventilation area and the non-phase-change ventilation area; or, a distance between

the non-phase-change ventilation area and the smoke inlet end is no less than the distance between the phase-change ventilation area and the non-phase-change ventilation area.

**[0014]** According to the present invention, a distance between the phase-change ventilation area and another position is measured by taking a central line of the phase-change ventilation area as a starting point and taking the another position as an end point, and this distance is the distance between the two. Similarly, the distance measurement of the non-phase-change ventilation area is consistent with that of the phase-change ventilation area.

**[0015]** The purpose of doing this is that in the sucking manner of non-ignition heating, because a part of a cooling section is inserted into a heating device and contacts with the high-temperature smoke, limitation of the distance can make better use of the cooling section for cooling.

**[0016]** As a preferred solution of the present invention, a phase-change temperature of the phase-change material ranges from 55°C to 60°C, or 45°C to 55°C. In order to ensure that a temperature of smoke entering a body of a user is not too high and avoid burning a mouth, the phase-change material needs to undergo phase change under a certain condition in the temperature range of 45°C to 60°C, a phase-change state may either be melting or shrinking, and all phase-change forms which can meet the needs of opening the ventilation area and increasing the ventilation volume are suitable. The phase-change temperature of the phase-change material determines a sensation temperature of the smoke entering the user, and the needs of the user can be satisfied only when the phase-change material is melted in a suitable temperature range for ventilating and cooling. Therefore, when the phase-change material is close to the smoke inlet end, the phase-change temperature of the phase-change material is high, and it is more suitable to use the phase-change material with the phase-change temperature ranging from 55°C to 60°C. When the phase-change material is far away from the smoke inlet end, the phase-change temperature of the phase-change material is low, so it is more suitable to use the phase-change material with the phase-change temperature ranging from 45°C to 55°C.

**[0017]** As a preferred solution of the present invention, the phase-change material includes the following constituents in parts by weight: 7 to 10 parts of a starch, 0.1 to 1.5 parts of a polylactic acid, and 0.1 to 1.5 parts of a polyol.

**[0018]** As a preferred solution of the present invention, the starch is selected from one or more of a corn starch, a potato starch, a purple potato starch, and a lily starch, wherein grain sizes of the corn starch, the potato starch, the purple potato starch and the lily starch are all in a range of 10 μm to 100 μm.

**[0019]** As a preferred solution of the present invention, a molecular weight of the polylactic acid is 20,000 to 80,000.

**[0020]** The phase-change material is composed of fully degradable biological materials, which has a high environmental protection value. The addition of the polyol softens the material and improves fluidity, thus being more convenient to open the phase-change ventilation area. The ventilation of the phase-change ventilation area depends on the opening of the first ventilation holes. A specific opening mode of the first ventilation holes is that: the phase-change material contacts the high-temperature smoke and undergoes phase change; meanwhile, due to a high sucking pressure at a center of the phase-change material, the state of the phase-change material changes from being closed to gradually opening from the center to both sides, thus realizing a process of increasing the ventilation volume of the phase-change ventilation area with the increase of temperature.

**[0021]** Here, a specific weight ratio of the phase-change material used in the present invention is given as follows: 7.0 to 10.0 parts of the starch, 0.1 to 1.5 parts of the phase-change material, and 0.1 to 1.5 parts of the polyol. The starch may be selected from one or more of the corn starch, the potato starch, the purple potato starch, and the lily starch, with the grain size in the range of 10 μm to 100 μm. The polyol is selected from one or two of propylene glycol or glycerol. In order to change the ventilation volume of the phase-change material in time with the change of temperature, a thickness of the phase-change material depends on a temperature resistance of the material, and different materials have different temperature resistance. Generally speaking, when the phase-change material is too thick, more heat is needed to open the holes. Therefore, the thickness of the phase-change material is preferably in a range of 50 μm to 500 μm.

**[0022]** As a preferred solution of the present invention, when only the second ventilation holes are used for ventilation, a total ventilation rate of the cigarette is in a range of 30% to 60%. When the first ventilation holes and the second ventilation holes are ventilated at the same time, the total ventilation rate of the cigarette is no lower than 70%. In this way, the proper ventilation rate and good sucking experience of the cigarette can be ensured in the case that the cigarette is ignited and sucked, and the ventilation can be increased in the case of heat-not-burn sucking, so that a temperature of hot smoke and a temperature on a surface of the filter tip can be effectively reduced. If the first ventilation holes and the second ventilation holes are of ventilation hole structures and evenly distributed on the coating layer, quantities, aperture sizes and arrangements of these ventilation holes may be adjusted according to actual needs to meet the ventilation rate requirements of the cigarette. However, it is found through experimental studies that the ventilation rate may be consistent when the cigarette is close to the smoke release end at different distances, but the cooling effect is also related to the design of a cigarette structure, a material and a supporting heater. Therefore, the cooling effect can also be achieved by reasonably setting posi-

tions of the ventilation holes and combining the design of the cigarette and the supporting heater. It is worth noting that with the burning of the cigarette, a temperature at the filter end also gradually increases. When the cigarette is ignited and sucked to a rear end, the first ventilation holes may be opened, which may lead to more airflow entering the filter tip to dilute the smoke and reduce the temperature of the smoke during sucking, thus being capable of ensuring the consistency of a sucking taste. As a further preferred technical solution, the distance between the phase-change ventilation area and the smoke inlet end is less than the distance between the phase-change ventilation area and the non-phase-change ventilation area, and such arrangement is beneficial to improving the taste of the smoke.

**[0023]** In order to realize the application of the filter tip, especially in the ever-changing tobacco revolution times, the present invention further provides:

a cigarette including the above-mentioned filter tip, which may be used in a traditional sucking manner by ignition, or used in a sucking manner of non-ignition heating.

**[0024]** In the present invention, the cigarette further includes a tobacco section, and the filter tip is connected with the tobacco section.

**[0025]** Compared with the prior art, the present invention has the following beneficial effects.

**[0026]** According to the present invention, the phase-change ventilation area and the non-phase-change ventilation area are arranged at the coating layer, and the first ventilation holes and the second ventilation holes are respectively arranged in the phase-change ventilation area and the non-phase-change ventilation area, the phase-change material is filled in the first ventilation hole, the phase-change ventilation area serves as a selective ventilation area which can be automatically opened as the temperature changes, and the non-phase-change ventilation area is a constant ventilation area. When the sucking manner of non-ignition heating is used, the temperature of the smoke release end is very high, which will melt the phase-change material. At this time, the first ventilation holes are automatically opened to increase the ventilation volume and reduce the temperature of the smoke sucked out. When the sucking manner by ignition is used, the temperature of the smoke release end is low, which will not affect sucking.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### [0027]

FIG. 1 is a schematic diagram of a three-dimensional structure of the present invention.

FIG. 2 is a schematic diagram of a front view structure of the present invention.

FIG. 3 is a structural schematic diagram of the present invention in a use state.

FIG. 4 is a structural schematic diagram of the present invention in another use state.

FIG. 5 is a structural schematic diagram of a cooling section of the present invention.

**[0028]** In the drawings: 1 refers to filter element; 11 refers to smoke inlet end; 12 refers to smoke release end; 14 refers to starch tube; 15 refers to hollow cavity; 2 refers to coating layer; 21 refers to phase-change ventilation area; 22 refers to non-phase-change ventilation area; 211 refers to phase-change material; 212 refers to first ventilation hole; and 221 refers to second ventilation hole.

#### DETAILED DESCRIPTION

**[0029]** The present invention will be further described below with reference to specific implementations.

##### Embodiment 1

**[0030]** As shown in FIG. 1 to FIG. 5, this embodiment provides a variable-ventilation filter tip, which includes a filter element 1 and a coating layer 2. The coating layer 2 wraps the filter element 1. The filter element 1 includes a smoke inlet end 11 and a smoke release end 12. A phase-change ventilation area 21 and a non-phase-change ventilation area 22 are arranged on the coating layer 2, a plurality of first ventilation holes 212 are arranged in the phase-change ventilation area, and a plurality of second ventilation holes 221 are arranged in the non-phase-change ventilation area 22. Outside air penetrates through the coating layer 2 through the first ventilation holes 212 and the second ventilation holes 221 to enter a part of the filter element 13. A phase-change material 211 is filled in the first ventilation hole 212. A starch tube 14 is arranged in a part of the filter element close to the smoke inlet end, and the starch tube 14 is provided with a hollow cavity 15. A phase-change temperature of the phase-change material 211 ranges from 45°C to 60°C.

**[0031]** A specific opening manner of the first ventilation holes 212 is that: the phase-change material 211 contacts high-temperature smoke and undergoes phase change; meanwhile, because a pressure at a center of the phase-change material 211 is high due to a sucking force, a state of the phase-change material 211 changes from being closed to gradually opening from the center to both sides, thus realizing a process of increasing the ventilation volume of the phase-change ventilation area with the increase of temperature.

**[0032]** When the phase-change ventilation area 21 is close to the smoke inlet end 11, the phase-change ventilation area 21 first senses a temperature change, which is beneficial to control the ventilation volume and has a good cooling effect. At this time, the phase-change temperature of the phase-change material 211 is in a range of 55°C to 60°C. When the non-phase-change ventilation area 221 is close to the smoke inlet end, the phase-change temperature of the phase-change material 211

is in a range of 45°C to 55°C, which is relatively low, and such structure is convenient for processing and manufacturing. However, no matter which one of the above two ventilation area arrangements is employed, the objective of "one smoke and two sucking manners" can be achieved, but each arrangement has its own preference, either for cooling effect, or for processing and manufacturing. In this embodiment, a distance between the phase-change ventilation area 21 and the smoke inlet end 11 is no less than a distance between the phase-change ventilation area 21 and the non-phase-change ventilation area 22, and such arrangement is conducive to improving a taste of the smoke. In this case, the phase-change material 211 undergoes phase change at 55°C to increase the ventilation volume, and a ventilation rate is 80%.

**[0033]** The coating layer 2 is provided with the phase-change ventilation area 21 and the non-phase-change ventilation area 22. The phase-change material 211 is arranged on the phase-change ventilation area 21. In this embodiment, the plurality of first ventilation holes 212 are arranged in the phase-change ventilation area 21, and the phase-change material 211 is filled in the first ventilation hole 212. A structure of the ventilation hole is easy to process. On one hand, filling the phase-change material 211 in the hole will not increase a thickness of the coating layer 2, which makes the filter natural and beautiful; and on the other hand, the phase-change material 211 has a high degree of binding in the hole and is not easy to fall off. The second ventilation holes 221 are evenly arranged in the non-phase-change ventilation area 22.

**[0034]** The phase-change material 211 can undergo phase change at a temperature condition ranging from 45°C to 60°C. The phase-change temperature of the phase-change material 211 determines a sensation temperature of the smoke entering a user, and needs of the user may be satisfied only when the phase-change material is melted in a suitable temperature range for ventilating and cooling. Therefore, it is more suitable to use the phase-change material with the phase-change temperature ranging from 50°C to 55°C. In this embodiment, the phase-change temperature ranges from 50°C to 55°C, and the employed phase-change material includes constituents of a starch, a polylactic acid, and a polyol, which has the advantages of convenient combination and easy circulation. In order to meet the requirement that the ventilation volume of the phase-change material changes in time with the change of temperature, a thickness of the phase-change material cannot be too thick. In this embodiment, the thickness of the phase-change material ranges from 50 μm to 500 μm. Specifically in this embodiment, the thickness of the phase-change material is 300 μm. In addition, when only the non-phase-change ventilation area 22 is ventilated, a total ventilation rate of a cigarette is in a range of 30% to 60%. When the phase-change ventilation area 21 and the non-phase-change ventilation area 22 are ventilated at the same

time, the ventilation rate of the filter tip is no lower than 70%, and such structure can provide a better and more stable taste of smoke. If the phase-change ventilation area 21 and the non-phase-change ventilation area 22 are of ventilation hole structures and evenly distributed on the coating layer 2, quantities, aperture sizes and arrangements of these ventilation holes may be adjusted according to actual needs to meet the ventilation rate requirements of the cigarette. An effect of reducing the temperature of the smoke can also be achieved by adjusting positions of the first ventilation holes.

**[0035]** A cigarette applying the above-mentioned filter may be used in a traditional sucking manner by ignition, and may also be applied to a sucking manner of non-ignition heating.

**[0036]** In the present invention, the cigarette further includes a tobacco section, and the filter tip is connected with the tobacco section.

**[0037]** A working principle of the present invention is as follows.

**[0038]** When the cigarette is sucked in the ignition manner, the phase-change ventilation area 21 is kept in a closed state. The non-phase-change ventilation area 22 increases a certain ventilation volume, which is enough to reduce the temperature at which cut tobaccos are released into a human body. When the cigarette is sucked in the heat-not-burn manner, the temperature of the smoke entering the filter tip is higher than that when smoking in the ignition manner. At this time, the phase-change material 211 in the phase-change ventilation area 21 undergoes phase change. The phase-change ventilation area 21 is opened to increase the ventilation volume. At this time, the total ventilation rate of the cigarette can reach more than 70%.

#### Embodiment 2

**[0039]** As shown in FIG. 4, this embodiment is a second embodiment of the present invention, which is basically the same as Embodiment 1, except that the non-phase-change ventilation area 22 is close to the smoke inlet end 11, and the distance between the non-phase-change ventilation area 22 and the smoke inlet end 11 is no less than the distance between the phase-change ventilation area 21 and the non-phase-change ventilation area 22. At this moment, the phase-change material 211 undergoes phase change at 50°C to increase the ventilation volume, and the total ventilation rate of the cigarette is 75%.

**[0040]** Obviously, the above-mentioned embodiments of the present invention are merely examples for clearly illustrating the present invention, but are not intended to limit the implementations of the present invention. For those of ordinary skills in the art, other different forms of changes or variations can be made on the basis of the above description. It is not necessary or possible to exhaust all the implementations here. Any modifications, equivalent substitutions, and improvements made within

the spirit and principle of the present invention shall all fall within the scope of protection claimed by the present invention.

### Claims

1. A variable-ventilation filter tip, **characterized in that**, the variable-ventilation filter tip comprises a filter element and a coating layer, the coating layer wraps the filter element; and the filter element comprises a smoke inlet end and a smoke release end; a phase-change ventilation area and a non-phase-change ventilation area are arranged on the coating layer, a plurality of first ventilation holes are arranged in the phase-change ventilation area, and a plurality of second ventilation holes are arranged in the non-phase-change ventilation area; outside air passes through the coating layer through the first ventilation holes and the second ventilation holes respectively to penetrate into a part of the filter element; a phase-change material is filled in the first ventilation hole; a part in the filter element close to the smoke inlet end is provided with a starch tube; and a phase-change temperature of the phase-change material ranges from 45°C to 60°C. 5
2. The variable-ventilation filter tip according to claim 1, **characterized in that**, the phase-change ventilation area is close to the smoke inlet end. 10
3. The variable-ventilation filter tip according to claim 2, **characterized in that**, a distance between the phase-change ventilation area and the smoke inlet end is no less than a distance between the phase-change ventilation area and the non-phase-change ventilation area. 15
4. The variable-ventilation filter tip according to claim 3, **characterized in that**, the phase-change temperature of the phase-change material ranges from 55°C to 60°C. 20
5. The variable-ventilation filter tip according to claim 1, **characterized in that**, the non-phase-change ventilation area is close to the smoke inlet end. 25
6. The variable-ventilation filter tip according to claim 5, **characterized in that**, a distance between the non-phase-change ventilation area and the smoke inlet end is no less than a distance between the phase-change ventilation area and the non-phase-change ventilation area. 30
7. The variable-ventilation filter tip according to claim 6, **characterized in that**, the phase-change temper- 35
8. The variable-ventilation filter tip according to any one of claims 2 to 4, **characterized in that**, the phase-change ventilation area is located on the starch tube. 40
9. The variable-ventilation filter tip according to any one of claims 1 to 8, **characterized in that**, when only the second ventilation holes are ventilated, a total ventilation rate of a cigarette ranges from 40% to 60%; and when the first ventilation holes and the second ventilation holes are ventilated at the same time, the total ventilation rate of the cigarette is no lower than 70%. 45
10. A cigarette, **characterized in that**, the cigarette comprises the filter tip according to any one of claims 1 to 9. 50

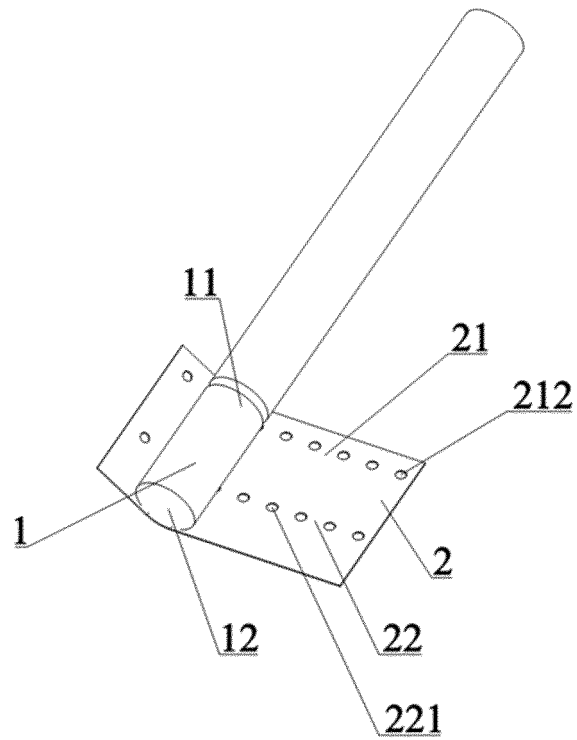


FIG. 1

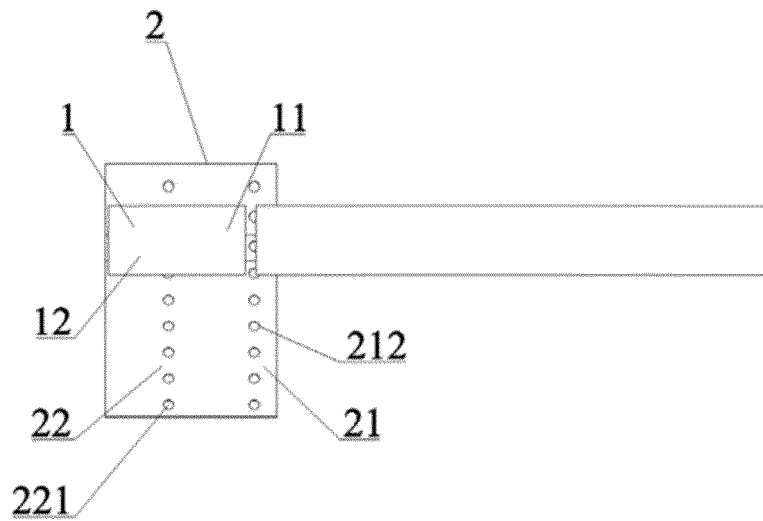


FIG. 2

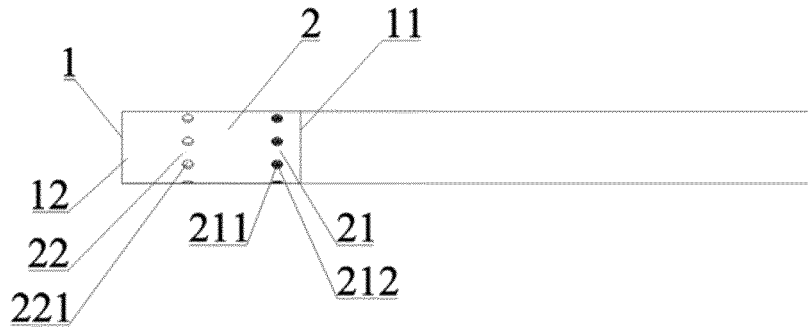


FIG. 3

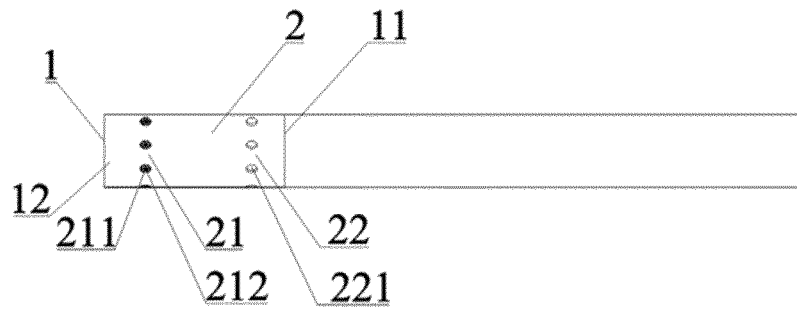


FIG. 4

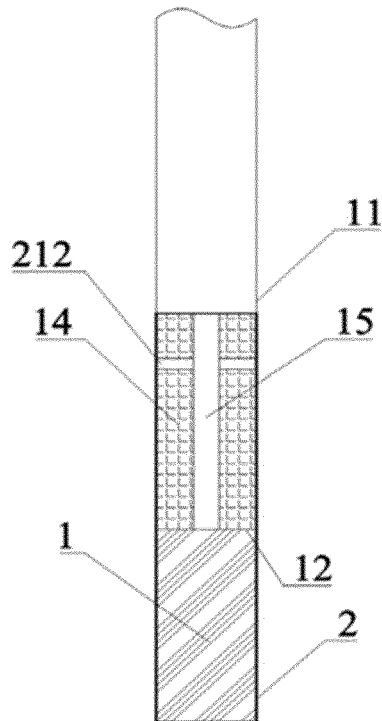


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/102662

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**A. CLASSIFICATION OF SUBJECT MATTER**

A24D 3/04(2006.01)i; A24D 3/14(2006.01)i; A24D 1/04(2006.01)n

According to International Patent Classification (IPC) or to both national classification and IPC

10

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A24D

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)

CNABS, CNKI, CNTXT, VEN: 滤嘴, 包覆, 相变, 通风, 孔, 广东中烟, filter, ventilation, hole?, phase, change

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

20

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 109924542 A (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 25 June 2019 (2019-06-25) description, paragraphs [0004]-[0060], figures 1-4	1-10
Y	CN 101442917 A (PHILIP MORRIS PRODUCTS S.A.) 27 May 2009 (2009-05-27) description, page 3, paragraph 3 to page 4, paragraph 6, figure 2	1-10
Y	CN 109924539 A (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 25 June 2019 (2019-06-25) description, paragraphs [0004]-[0062], figures 1-4	1-10
Y	CN 103462216 A (HAUNI MASCHINENBAU AG) 25 December 2013 (2013-12-25) description, paragraphs [0013]-[0082]	1-10
Y	CN 207653551 U (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 27 July 2018 (2018-07-27) description, paragraphs [0004]-[0055]	1-10
Y	CN 207653554 U (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 27 July 2018 (2018-07-27) description, paragraphs [0004]-[0050]	1-10

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 Further documents are listed in the continuation of Box C.
  See patent family annex.

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* Special categories of cited documents:	"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
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Date of the actual completion of the international search

16 April 2020

Date of mailing of the international search report

26 April 2020

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Name and mailing address of the ISA/CN

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/CN2019/102662**

5  
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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.
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