(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 256 992 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.10.2023 Bulletin 2023/41

(21) Application number: **22791065.0**

(22) Date of filing: **20.04.2022**

(51) International Patent Classification (IPC):
A24F 40/70 *(2020.01)* ***A24D 3/02*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A24D 3/02; A24F 40/40; A24F 40/70

(86) International application number:
PCT/CN2022/087918

(87) International publication number:
WO 2022/222959 (27.10.2022 Gazette 2022/43)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **21.04.2021 CN 202110430185**

(71) Applicant: **Hunan Jishou Minzu Materials Co., Ltd.**
Hunan 416000 (CN)

(72) Inventors:
- **YAO, Jianwen**
  Hunan 416000 (CN)
- **TANG, Hu**
  Hunan 416000 (CN)
- **WU, Shaofeng**
  Hunan 416000 (CN)

(74) Representative: **LEITZINGER OY**
c/o Spaces
Mannerheiminaukio 1A
00100 Helsinki (FI)

(54) PROCESSING DEVICE AND MANUFACTURING METHOD FOR COOLING ELEMENT, AND CIGARETTE PROCESSING SYSTEM

(57) A processing device and a manufacturing method for a cooling element, and a cigarette processing system are provided. The processing device for a cooling element includes a cooling material pretreatment unit (1) and a composite molding unit (2); the cooling material pretreatment unit (1) is configured for pretreating cooling materials; and the composite molding unit (2) is configured for compositing tows into layered cooling materials and molding the layer cooling materials. The cigarette processing system includes the processing device for a cooling element. The manufacturing method for a cooling element includes: respectively pretreating at least one group of cellulose acetate fiber tows and at least one group of polylactic acid fiber tows, then performing splicing, extrusion, and molding to form layered cooling materials including at least one cellulose acetate layer and at least one polylactic acid fiber layer, and then rolling the layered cooling materials into a columnar shape to obtain the cooling element. By means of the processing device and manufacturing method for a cooling element, a manufactured cooling element is stable in structure and good in cooling effect.

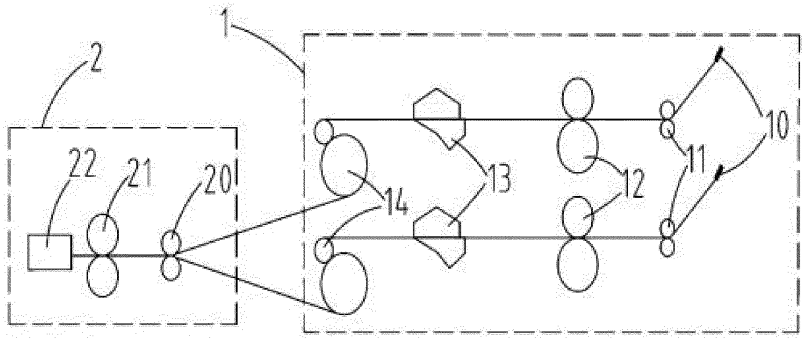

FIG. 2

EP 4 256 992 A1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of China Patent Application No. 202110430185.X, filed on April 21, 2021 in China National Intellectual Property Administration and entitled "PROCESSING DEVICE AND MANUFACTURING METHOD FOR COOLING ELEMENT, AND CIGARETTE PROCESSING SYSTEM", the content of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of heat-not-burn cigarettes, and in particular, to a processing device and a manufacturing method for a cooling element, and a cigarette processing system.

BACKGROUND

[0003] Heat-not-burn cigarettes are one of emerging tobacco products, at least generally composed of an aerosol generation element and a filtering element. If smoke generated by heating of the aerosol generation element only passes through the filtering element, a temperature drop of the smoke is limited. After the smoke reaches the mouth of a user, the user will have a burning experience, leading to a decrease in the suction experience of the user. Therefore, generally, a cooling element would be generally added in a cigarette structure of a heat-not-burn cigarette.

[0004] In the related technologies, shapes, materials, processing methods, and arrangement positions in cigarettes of cooling elements are different. For example, commonly used cooling elements are usually formed by molding compression. Although a processing technique of this method is simple, the simple structure of the cooling element results in a poor cooling effect. As a result, the user has a burning sensation during suction, and the suction experience is poor.

SUMMARY

[0005] The present disclosure provides a processing device and a manufacturing method for a cooling element, and a cigarette processing system, thereby at least solving the above problems.

[0006] Some embodiments of the present disclosure provide a processing device for a cooling element. The processing device at least achieves the objective mentioned above.

[0007] In some implementations, the processing device can include a cooling material pretreatment unit and a composite molding unit, wherein the cooling material pretreatment unit can be configured for pretreating filamentous cooling materials; the composite molding unit can be configured for compositing the pretreated filamentous cooling materials into layered cooling materials and molding the layered cooling materials;

the composite molding unit can include splicing rollers, extrusion rollers, and a molding pipe which are arranged in sequence; the splicing rollers can be configured for splicing a plurality of groups of filamentous cooling materials into the layered cooling materials; the extrusion rollers can be configured for extruding and compositing the layered cooling materials; and the molding pipe can be configured for molding the extruded and composited layered cooling materials to obtain the cooling element. The air blower can be configured for blowing the filamentous cooling materials to be loosened; the prestretching rollers can be configured for stretching the loosened filamentous cooling materials; the threaded rollers can be configured for opening the stretched filamentous cooling materials; the plasticizer spray adding boxes can be configured for adding a plasticizer to the opened filamentous cooling materials; and the conveying rollers can be configured for conveying the filamentous cooling materials with the plasticizer into the composite molding unit.

[0008] Optionally, the filamentous cooling materials may include polylactic acid fiber tows and cellulose acetate fiber tows.

[0009] Optionally, the prestretching rollers, the threaded rollers, the plasticizer spray adding boxes, and the conveying rollers in each of the at least two groups can be arranged in pairs respectively.

[0010] Optionally, the conveying rollers can comprise a plurality of metal rollers arranged in parallel and cooperating with each other.

[0011] Optionally, the threaded rollers of each of the at least two groups comprise can include a first threaded roller and a second threaded roller which are arranged in sequence; and the splicing rollers and the extrusion rollers can be arranged in parallel in pairs respectively.

[0012] Optionally, a width limiting assembly can be arranged between the cooling material pretreatment unit and the splicing rollers.

[0013] Optionally, the width limiting assembly can be a group of stainless steel metal rollers which are slidable for limiting widths of tows.

[0014] Optionally, a high-pressure tow catcher can be arranged between the extrusion rollers and the molding pipe; and the high-pressure tow catcher can be configured for catching the layered cooling materials and conveying the layered cooling materials into the molding pipe.

[0015] Some other embodiments of the present disclosure further provide a manufacturing method for a cooling element, which can include:

[0016] respectively pretreating at least one group of cellulose acetate fiber tows and at least one group of polylactic acid fiber tows, then performing splicing, extrusion, and molding to form layered cooling materials comprising at least one cellulose acetate layer and at least one polylactic acid fiber layer, and then rolling the layered cooling materials into a columnar shape to obtain the cooling element.

[0017] Optionally, a running speed of the cellulose acetate fiber tows and the polylactic acid fiber tows can be 60 m/min to 80 m/min; and a ratio of a running speed of the molding pipe to a linear speed of the extrusion rollers can be 1: 1 to 1: 1.1.

[0018] Optionally, a pressure of the extrusion rollers is 0.05 MPa to 0.35 MPa.

[0019] Optionally, a steam pressure of the molding pipe is 0.3 MPa to 0.6 MPa.

[0020] Optionally, the cooling material pretreatment unit can include conveying rollers; and a ratio of a linear speed of the extrusion rollers to a linear speed of the conveying rollers is 1: 1.1 to 1: 1.3.

[0021] Some other embodiments of the present disclosure further provide a cigarette processing system, which can include the processing device for a cooling element.

[0022] Compared with the prior art, the present disclosure can at least include the beneficial effects below: According to the processing device for a cooling element and the cigarette processing system of the present disclosure, the filamentous cooling materials treated by the cooling material pretreatment unit are spliced and extruded together by means of the splicing rollers and the extrusion rollers to form basic layered cooling materials and are then molded in the molding pipe, thereby obtaining the cooling element with the layered cooling materials for cigarettes. The device has a simple structure, and the obtained cooling element with the layered cooling materials has a stable structure and a good cooling effect, thereby greatly reducing the burning sensation of a user during suction of a cigarettes and achieving a relatively good user experience.

[0023] According to the manufacturing method for a cooling element of the present disclosure, the at least one group of cellulose acetate fiber tows and the at least one group of polylactic acid fiber tows are respectively pretreated, are composited under the splicing action and the extrusion action, and are rolled into a columnar shape to finally obtain the cooling element. The cooling element has a stable structure, does not need an additional supporting element, and has a good cooling effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] In order to provide a clearer explanation of the technical solutions of the embodiments of the present disclosure, a brief introduction will be given to the accompanying drawings required in the embodiments. It should be understood that the following drawings only illustrate certain embodiments of the present disclosure, and therefore should not be regarded as limiting the scope of the present disclosure.

FIG. 1 is a cross section schematic diagram of a cooling element processed according to an embodiment of the present disclosure;
FIG. 2 is a schematic diagram of a processing device for a cooling element according to Embodiment 1;
FIG. 3 is a schematic diagram of a processing device for a cooling element according to Embodiment 2;
FIG. 4 is a schematic diagram of a processing device for a cooling element according to Embodiment 3;
FIG. 5 is a schematic diagram of a non-closure state of an inner layer of a disqualified cooling element;
FIG. 6 is a schematic diagram of a non-closure state of an outer layer of a disqualified cooling element; and
FIG. 7 is a schematic diagram of a non-uniform distribution state of a material density of a disqualified cooling element.

Reference numerals in the drawings:

[0025]

1 - cooling material pretreatment unit;
10 - air blower; 11- prestretching roller; 12 - threaded roller; 13 - plasticizer spray adding box; 14 - conveying roller;
2 - composite molding unit;
20 - splicing roller; 21 - extrusion roller; 22 - molding pipe; 23 - width limiting assembly; and 24 - high-pressure tow catcher.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0026] As used herein:
"Prepared from" is synonymous with "include". The terms "comprise", "include", "has", "contain" or any other variations thereof used herein are intended to cover non-exclusive inclusion. For example, a composition, step, method, product, or device that includes the listed elements does not need to be limited to those elements, but can include other elements that are not explicitly listed or inherent in such composition, step, method, product, or device.

[0027] A conjunction "composed of" excludes any unspecified element, step or component. If configured in claims, this phrase will make the claims closed and exclude materials other than those described, except for conventional impurities related to them. When the phrase "composed of" appears in the clause of the claim subject rather than immediately following the subject, it only limits the elements described in that clause, other elements are not excluded from the claims as a whole.

[0028] When equivalents, concentrations, or other values or parameters are expressed in terms of ranges, preferred ranges, or ranges defined by a series of upper and lower preferred values, it should be understood that all ranges formed by any matching of any upper range or preferred value with any lower range or preferred value are specifically disclosed, regardless of whether the range is separately disclosed. For example, when the range "1-5" is disclosed, the described range should be interpreted as including ranges "1-4", "1-3", "1-2", "1-2 and 4-5", "1-3 and 5", and the like. When a numerical range is described herein, unless otherwise specified, it is intended to include its end values and all integers and fractions within the range.

[0029] In these embodiments, unless otherwise specified, the portions and percentages are calculated by mass.

[0030] "Mass portion" refers to a basic unit of measurement that represents a mass proportion relationship of multiple components. One portion can represent any unit mass, such as 1 g or 2.689 g. If it is assumed that the mass portion of a component A is a, and the mass portion of a component B is b, it represents a ratio of a mass of the component A to a mass of the component B is a: b. In another case, it indicates that a mass of the component A is aK, and a mass of the component B is bK (K is any number, representing a multiplier factor). It cannot be misunderstood that unlike the mass portion, the sum of the mass portions of all the components is not limited to 100.

[0031] "And/or" is used to indicate that one or both of situations described may occur, for example, A and/or B include (A and B) and (A or B).

[0032] A processing device for a cooling element includes a cooling material pretreatment unit and a composite molding unit, wherein the cooling material pretreatment unit is configured for pretreating filamentous cooling materials; the composite molding unit is configured for compositing the pretreated filamentous cooling materials into layered cooling materials and molding the layered cooling materials;

[0033] the composite molding unit includes splicing rollers, extrusion rollers, and a molding pipe which are arranged in sequence; the splicing rollers are configured for splicing a plurality of groups of filamentous cooling materials into layered cooling materials; the extrusion rollers are configured for extruding and compositing the layered cooling materials; and the molding pipe is configured for molding the pressurized and composited layered cooling materials to obtain the cooling element.

[0034] In an optional implementation, the cooling material pretreatment unit includes at least two groups, each of the at least two groups includes an air blower, prestretching rollers, threaded rollers, plasticizer spray adding boxes, and conveying rollers which are arranged in sequence; the air blower is configured for blowing the filamentous cooling materials to be loosened; the prestretching roller is configured for stretching the loosened filamentous cooling materials; the threaded roller is configured for opening the stretched filamentous cooling materials; the plasticizer spray adding box is configured for adding a plasticizer to the opened filamentous cooling materials; and the conveying roller is configured for conveying the filamentous cooling materials with the plasticizer into the composite molding unit.

[0035] In an optional implementation, the threaded rollers includes a first threaded roller and a second threaded roller which are arranged in sequence.

[0036] In an optional implementation, a width limiting assembly is arranged between the cooling material pretreatment unit and the splicing rollers.

[0037] In an optional implementation, the splicing rollers and the extrusion rollers are separately independently arranged in parallel in pairs.

[0038] In an optional implementation, a high-pressure tow catcher is arranged between the extrusion rollers and the molding pipe; and the high-pressure tow catcher is configured for catching the layered cooling materials and conveying the layered cooling materials into the molding pipe.

[0039] The present disclosure further provides a cigarette processing system, including the processing device for a cooling element.

[0040] The present disclosure further provides a manufacturing method for a cooling element, which performs manufacturing by means of the processing device for a cooling element. The manufacturing method includes:

respectively pretreating at least one group of cellulose acetate fiber tows and at least one group of polylactic acid fiber tows by the cooling material pretreatment unit, and putting pretreated same into the composite molding unit; performing splicing by the splicing rollers, performing extruding and compositing by the extrusion rollers to form layered cooling materials including at least one cellulose acetate layer and at least one polylactic acid fiber layer, and then molding the layered cooling materials in the molding pipe to obtain the cooling element.

[0041] In an optional implementation, a running speed of the tows is 60 m/min to 80 m/min.

[0042] In an optional implementation, a pressure of the extrusion rollers is 0.05 MPa to 0.35 MPa.

[0043] In an optional implementation, a stream pressure of the molding pipe is 0.3 MPa to 0.6 MPa.

[0044] In an optional implementation, a ratio of a running speed of the molding pipe to a linear speed of the extrusion rollers is 1: 1 to 1: 1.1.

[0045] Optionally, the running speed of the tows can be 60 m/min, 70 m/min, 80 m/min, and any value between 60 m/min and 80 m/min; the pressure of the extrusion rollers can be 0.05 MPa, 0.10 MPa, 0.15 MPa, 0.20 MPa, 0.25 MPa, 0.30 MPa, 0.35 MPa, and any value between 0.05 MPa and 0.35 MPa; the stream pressure of the molding pipe can be 0.3 MPa, 0.4 MPa, 0.5 MPa, 0.6 MPa, and any value between 0.3 MPa and 0.6 MPa; and a ratio of the running speed of the molding pipe to the linear speed of the extrusion rollers can be 1: 1, 1: 1.05, 1: 1, and any value between 1: 1 and 1: 1.1.

[0046] In an optional implementation, the cooling material pretreatment unit includes conveying rollers; and a ratio of the linear speed of the extrusion rollers to a linear speed of the conveying rollers is 1: 1.1 to 1: 1.3.

[0047] Optionally, the ratio of the linear speed of the extrusion rollers to the linear speed of the conveying rollers can be 1: 1.1, 1: 1.2, 1: 1.3, and any value between 1: 1.1 and 1: 1.3.

[0048] The following will provide a detailed description of the implementations of the present disclosure in conjunction with specific embodiments. However, those skilled in the art will understand that the following embodiments are only used to illustrate the present disclosure and should not be considered as limiting the scope of the present disclosure. If specific conditions are not specified in the implementations, the conventional conditions or conditions recommended by manufacturers shall be followed. Reagents or instruments used without specifying a manufacturer are all conventional products that can be commercially purchased.

[0049] Firstly, a target processing object of the processing device provided in the present disclosure is explained: The cooling element is overall hollow cylindrical, and the cylindrical body adopts a two-layer or multilayer structure. A two-layer structure is taken as an example: one layer is a cellulose acetate fiber layer and the other layer is a polylactic acid layer (as shown in FIG. 1).

Embodiment 1

[0050] As shown in FIG. 2, this embodiment provides a processing device for a cooling element. The processing device includes a cooling material pretreatment unit 1 and a composite molding unit 2 which are arranged in sequence according to the processing process.

[0051] The cooling material pretreatment unit 1 is configured for respectively pretreating polylactic acid fiber tows and cellulose acetate fiber tows. The composite molding unit 2 is configured for compositing and molding the pretreated pretreating polylactic acid fiber tows and the pretreated cellulose acetate fiber tows to obtain a cooling element prepared from layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer.

[0052] In a preferred implementation, the cooling material pretreatment unit 1 includes a plurality of groups, each of the plurality of groups includes an air blower 10, prestretching rollers 11, threaded rollers 12, plasticizer spray adding boxes 13, and conveying rollers 14 which are arranged in sequence. Quantities of groups of the various components in the cooling material pretreatment unit 1 are related to a quantity of layers of the cooling element. In each group, the prestretching rollers 11, the threaded rollers 12, the plasticizer spray adding boxes 13, and the conveying rollers 14 are separately arranged in pairs. The composite molding unit 2 includes splicing rollers 20, extrusion rollers 21, and a molding pipe 22 which are arranged in sequence.

[0053] This embodiment further provides a manufacturing method for a cooling element, including the following steps: the cellulose acetate fiber tows and the polylactic acid fiber tows passed through corresponding air blowers 10 at a speed of 60 m/min and then entered corresponding prestretching rollers 11 for stretching, and were guided into corresponding threaded rollers 12 for opening; after being opened, the cellulose acetate fiber tows and the polylactic acid fiber tows entered corresponding plasticizer spray adding boxes 13 and were sprayed with a plasticizer (such as glycerinum and a water-based adhesive); then the cellulose acetate fiber tows and the polylactic acid fiber tows were stacked and composited under continuous actions of splicing rollers 20 and extrusion rollers 21 after passing through corresponding conveying rollers 14 to form layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer; finally, the layered cooling materials entered a molding pipe 22 and was molded under a steam action of a tow rolling core model. A pressure of the extrusion rollers 21 was 0.05 MPa; a steam pressure of the molding pipe 22 was 0.3 MPa; a ratio of a running speed of the molding pipe 22 to a linear speed of the extrusion rollers 21 was 1: 1;

and a ratio of the linear speed of the extrusion rollers 21 to a linear speed of the conveying rollers 14 was 1: 1.1.

Embodiment 2

[0054] As shown in FIG. 3, this embodiment provides a processing device for a cooling element. The processing device includes a cooling material pretreatment unit 1 and a composite molding unit 2 which are arranged in sequence according to the processing process.

[0055] The cooling material pretreatment unit 1 is configured for respectively pretreating polylactic acid fiber tows and cellulose acetate fiber tows. The composite molding unit 2 is configured for compositing and molding the pretreated pretreating polylactic acid fiber tows and the pretreated cellulose acetate fiber tows to obtain a cooling element prepared from layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer.

[0056] In a preferred implementation, the cooling material pretreatment unit 1 includes a plurality of groups, each of the plurality of groups includes an air blower 10, prestretching rollers 11, threaded rollers 12, plasticizer spray adding boxes 13, and conveying rollers 14 which are arranged in sequence. Quantities of groups of the various components in the cooling material pretreatment unit 1 are related to a quantity of layers of the cooling element. In each group, the prestretching rollers 11, the threaded rollers 12, the plasticizer spray adding boxes 13, and the conveying rollers 14 are separately arranged in pairs. The conveying rollers 14 can be provided in parallel with a plurality of metal rollers cooperating with each other. In order to ensure an opening effect, in a preferred implementation, there are two pairs of threaded rollers 12 arranged in sequence.

[0057] The composite molding unit 2 includes a width limiting assembly 23, splicing rollers 20, extrusion rollers 21, and a molding pipe 22 which are arranged in sequence. The width limiting assembly 23 is a group of stainless steel metal rollers for limiting widths of twos which are slidable.

[0058] This embodiment further provides a manufacturing method for a cooling element, including the following steps: the cellulose acetate fiber tows and the polylactic acid fiber tows passed through corresponding air blowers 10 at a speed of 80 m/min and then entered corresponding prestretching rollers 11 for stretching, and were guided into corresponding threaded rollers 12 for opening; after being opened, the cellulose acetate fiber tows and the polylactic acid fiber tows entered corresponding plasticizer spray adding boxes 13 and were sprayed with a plasticizer; the cellulose acetate fiber tows and the polylactic acid fiber tows were stacked and composited under continuous actions of splicing rollers 20 and extrusion rollers 21 after passing through corresponding conveying rollers 14 to form layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer; finally, the layered cooling materials entered a molding pipe 22 and was molded under a steam action of a tow rolling core model. A pressure of the extrusion rollers 21 was 0.35 MPa; a steam pressure of the molding pipe 22 was 0.6 MPa; a ratio of a running speed of the molding pipe 22 to a linear speed of the extrusion rollers 21 was 1: 1.1; and a ratio of the linear speed of the extrusion rollers 21 to a linear speed of the conveying rollers 14 was 1: 1.3.

Embodiment 3

[0059] As shown in FIG. 4, this embodiment provides a processing device for a cooling element. The processing device includes a cooling material pretreatment unit 1 and a composite molding unit 2 which are arranged in sequence according to the processing process.

[0060] The cooling material pretreatment unit 1 is configured for respectively pretreating polylactic acid fiber tows and cellulose acetate fiber tows. The composite molding unit 2 is configured for compositing and molding the pretreated pretreating polylactic acid fiber tows and the pretreated cellulose acetate fiber tows to obtain a cooling element prepared from layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer.

[0061] In a preferred implementation, the cooling material pretreatment unit 1 includes a plurality of groups, each of the plurality of groups includes an air blower 10, prestretching rollers 11, threaded rollers 12, plasticizer spray adding boxes 13, and conveying rollers 14 which are arranged in sequence. Quantities of groups of the various components in the cooling material pretreatment unit 1 are related to a quantity of layers of the cooling element. In each group, the prestretching rollers 11, the threaded rollers 12, the plasticizer spray adding boxes 13, and the conveying rollers 14 are separately arranged in pairs. The conveying rollers 14 can be provided in parallel with a plurality of metal rollers cooperating with each other. In order to ensure an opening effect, in a preferred implementation, there are two pairs of threaded rollers 12 arranged in sequence.

[0062] The composite molding unit 2 includes a width limiting assembly 23, splicing rollers 20, extrusion rollers 21, and a molding pipe 22 which are arranged in sequence. The width limiting assembly 23 is a group of stainless steel metal rollers for limiting widths of twos in a sliding manner which are slidable.

[0063] In order to make the composited tow materials better and more stably enter the molding pipe 22 to ensure smooth running of the whole device, a high-pressure tow catcher 24 is arranged between the extrusion rollers 21 and the molding pipe 22.

[0064] This embodiment further provides a manufacturing method for a cooling element, including the following steps: the cellulose acetate fiber tows and the polylactic acid fiber tows passed through corresponding air blowers 10 at a speed of 70 m/min and then entered corresponding prestretching rollers 11 for stretching, and were guided into corresponding threaded rollers 12 for opening; after being opened, the cellulose acetate fiber tows and the polylactic acid fiber tows entered corresponding plasticizer spray adding boxes 13 and were sprayed with a plasticizer; the cellulose acetate fiber tows and the polylactic acid fiber tows were stacked and composited under continuous actions of splicing rollers 20 and extrusion rollers 21 after passing through corresponding conveying rollers 14 to form layered cooling materials with a cellulose acetate fiber layer and a polylactic acid fiber layer; finally, the layered cooling material entered a molding pipe 22 and was molded under a steam action of a tow rolling core model. A pressure of the extrusion rollers 21 was 0.15 MPa; a steam pressure of the molding pipe 22 was 0.4 MPa; a ratio of a running speed of the molding pipe 22 to a linear speed of the extrusion rollers 21 was 1: 1.05; and a ratio of the linear speed of the extrusion rollers 21 to a linear speed of the conveying rollers 14 was 1: 1.2.

[0065] It should be noted that after molding, the manufacturing method further includes splitting and other post-treatment steps.

[0066] Based on the above processing device for a cooling element, the present disclosure further provides a heat-not-burn cigarette processing system. The processing device for a cooling element is integrated with processing devices for other components (for example, aerosol generation element processing equipment, filtering element processing equipment, and cigarette assembling equipment) to obtain a complete automatic processing system, so as to improve the processing efficiency and reduce the production cost.

Comparative example 1

[0067] Pure cellulose acetate fibers (CA) were used as cooling materials to prepare a cooling element with the same thickness and pore size as that in Embodiment 1.

Comparative example 2

[0068] Pure polylactic acid fibers (PLA) were used as cooling materials to prepare a cooling element with the same thickness and pore size as that in Embodiment 1.

[0069] The cooling elements obtained in Embodiment 1 and the comparative examples 1 to 2 were processed into heat-not-burn cigarettes respectively, and then a lip temperature test and a collapse deformation test were performed on each of the cooling elements .

[0070] In the lip temperature test, suction was simulated according to a cigarette suction model specified in the national standard GB/T19609-2004, and the health canada intense (HCI) suction mode was used. Suction parameters were: a suction capacity: 55 mL, a suction frequency: 30s, and a suction duration: 2 s. A thermocouple temperature detector was used to detect a temperature value of smoke when a cigarette sample was sucked for the sixth time, namely, a temperature value of a position of a mouth that was 0 mm away from a center of a cigarette holder rod.

[0071] Results of the lip temperature test are shown in Table 1:

Table 1 Results of the lip temperature test

Test object	Suction temperature at the lip/°C					
	First time of suction	Second time of suction	Third time of suction	Fourth time of suction	Fifth time of suction	Sixth time of suction
Comparative example 1	62.5	68.6	64.4	61.8	60.9	60.2
Comparative example 2	47.3	49.6	51.9	50.4	50.1	49.8
Embodiment 1	48.3	49.8	52.0	49.3	49.6	50.6

[0072] Circumference variations of a suction process were measured: "-" represents that the circumference becomes small. Results are as shown in Table 2:

Table 2 Results of the collapse deformation test

Test object	Deformation or collapse (circumference variation mm)					
	First time of suction	Second time of suction	Third time of suction	Fourth time of suction	Fifth time of suction	Sixth time of suction
Comparative example 1	-0.04	-0.12	-0.10	-0.09	-0.08	-0.04
Comparative example 2	-0.26	-0.34	-0.21	-0.17	-0.16	-0.10
Embodiment 1	-0.08	-0.12	-0.11	-0.10	-0.09	-0.04

[0073] According to Table 1 and Table 2 above, it could be seen that the heat-not-burn cigarette prepared from the cooling element provided in Embodiment 1 of the present disclosure not only achieved a good cooling effect (low lip temperature), but also achieved good stability (small deformation). This was because the PLA had higher heat absorption performance than that of the CA. The CA had a glass transition temperature of 185°C and a melting point of 310°C; and the PLA had a glass transition temperature of 60°C and a melting point of 160°C. However, a thermal deformation of the PLA was greater than that of the CA. Therefore, it was difficult to achieve a balance between the cooling effect and the stability by using any material alone.

Comparative example 3

[0074] Compared with Embodiment 2, a difference was that the width limiting assembly 23 was not used, and other equipment and process were all the same.

Comparative example 4

[0075] Compared with Embodiment 2, a difference was that the extrusion roller 21 was not used, and other equipment and process were all the same.

[0076] According to the statistics of the yield of Embodiment 2 and the yields of the comparative example 3 and comparative example 4, it could be seen that an average yield of Embodiment 2 was 80%, while the yield of the comparative example 3 was only 35% and the yield of the comparative example 4 was only 30%. The process stability was poor in the comparative example 3 and comparative example 4.

[0077] A specific reason was that the width limiting assembly 23 was not used. Due to left and right oscillation and amplitude fluctuation of the tows in a production process, a finished product would not have a stable layered structure as there was not the width limiting assembly 23. Without the extrusion rollers 21, the two strands of tows did not abut against. After the tows entered the molding pipe, the changes in the two strands of tows under the extrusion action of the molding pipe 22 were inconsistent, making it difficult to obtain a stable layered structure.

[0078] The cross-sectional diagrams of disqualified products in the comparative example 3 and the comparative example 4 are as shown in FIG. 5, FIG. 6, and FIG. 7. FIG. 5 shows a non-closure state of an inner layer of a disqualified cooling element; FIG. 6 shows a non-closure state of an outer layer of a disqualified cooling element; and FIG. 7 shows a non-uniform distribution state of a material density of a disqualified cooling element.

[0079] It should be finally noted that the various above embodiments are only used to describe the technical solutions of the present application, and not intended to limit the present application. Although the present application has been described in detail with reference to the foregoing embodiments, those ordinarily skilled in the art should understand that they can still modify the technical solutions described in all the foregoing embodiments, or equivalently replace some or all of the technical features, and these modifications or replacements do not depart the essences of the corresponding technical solutions from the spirit and scope of the technical solutions of all the embodiments of the present application.

[0080] In addition, those skilled in the art can understand that although some embodiments herein include certain features included in other embodiments rather than other features, combination of features of different embodiments means that they fall within the scope of the present disclosure and form different embodiments. For example, in the above claims, any one of the claimed embodiments can be used in any combination. The disclosure of information in this Background section is only for enhancement of understanding of the general background of the present disclosure and should not necessarily be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to those skilled in the art.

Industrial practicability

[0081] The present disclosure provides a processing device and a manufacturing method for a cooling element, and a cigarette processing system. The processing device for a cooling element includes a cooling material pretreatment unit and a composite molding unit; the cooling material pretreatment unit is configured for pretreating cooling materials; and the composite molding unit is configured for compositing tows into layered cooling materials and molding the layered cooling materials. The cigarette processing system includes the processing device for a cooling element. The manufacturing method for a cooling element includes: respectively pretreating at least one group of cellulose acetate fiber tows and at least one group of polylactic acid fiber tows, then performing splicing, extrusion, and compositing to form layered cooling materials including at least one cellulose acetate layer and at least one polylactic acid fiber layer, and then rolling the layered cooling materials into a columnar shape to obtain a cooling element. According to the processing device and the manufacturing method for a cooling element of the present disclosure, the manufactured cooling element is stable in structure and good in cooling effect.

[0082] In addition, it can be understood that the processing device and the manufacturing method for a cooling element, and the cigarette processing system of the present disclosure can be reproduced and can be used in various industrial applications. For example, the processing device and the manufacturing method for a cooling element, and the cigarette processing system of the present disclosure can be used in the technical field of heat-not-burn cigarettes.

Claims

1. A processing device for a cooling element, **characterized in that** the processing device comprises a cooling material pretreatment unit and a composite molding unit, wherein the cooling material pretreatment unit is configured for pretreating filamentous cooling materials; the composite molding unit is configured for compositing the pretreated filamentous cooling materials into layered cooling materials and molding the layered cooling materials;
the composite molding unit comprises splicing rollers, extrusion rollers, and a molding pipe which are arranged in sequence; the splicing rollers are configured for splicing a plurality of groups of filamentous cooling materials into the layered cooling materials; the extrusion rollers are configured for extruding and compositing the layered cooling materials; and the molding pipe is configured for molding the extruded and composited layered cooling materials to obtain the cooling element.

2. The processing device according to claim 1, wherein the filamentous cooling materials comprise polylactic acid fiber tows and cellulose acetate fiber tows.

3. The processing device according to claim 1 or 2, wherein the cooling material pretreatment unit comprises at least two groups each comprising an air blower, prestretching rollers, threaded rollers, plasticizer spray adding boxes, and conveying rollers which are arranged in sequence; the air blower is configured for blowing the filamentous cooling materials to be loosened; the prestretching rollers are configured for stretching the loosened filamentous cooling materials; the threaded rollers are configured for opening the stretched filamentous cooling materials; the plasticizer spray adding boxes are configured for adding a plasticizer to the opened filamentous cooling materials; and the conveying rollers are configured for conveying the filamentous cooling materials with the plasticizer into the composite molding unit.

4. The processing device according to claim 3, wherein the prestretching rollers, the threaded rollers, the plasticizer spray adding boxes, and the conveying rollers in each of the at least two groups are arranged in pairs respectively.

5. The processing device according to claim 3 or 4, wherein the conveying rollers comprises a plurality of metal rollers arranged in parallel and cooperating with each other.

6. The processing device according to any one of claims 3 to 5, wherein the threaded rollers of each of the at least two groups comprise a first threaded roller and a second threaded roller which are arranged in sequence; and the splicing rollers and the extrusion rollers are arranged in parallel in pairs respectively.

7. The processing device according to any one of claims 1 to 6, wherein a width limiting assembly is arranged between the cooling material pretreatment unit and the splicing rollers.

8. The processing device according to claim 7, wherein the width limiting assembly is a group of stainless steel metal rollers which are slidable for limiting widths of tows.

9. The processing device according to any one of claims 1 to 8, wherein a high-pressure tow catcher is arranged between the extrusion rollers and the molding pipe; and the high-pressure tow catcher is configured for catching the layered cooling materials and conveying the layered cooling materials into the molding pipe.

10. A manufacturing method for a cooling element, **characterized in that**, the manufacturing method comprises: respectively pretreating at least one group of cellulose acetate fiber tows and at least one group of polylactic acid fiber tows, then performing splicing, extrusion, and molding to form layered cooling materials comprising at least one cellulose acetate layer and at least one polylactic acid fiber layer, and then rolling the layered cooling materials into a columnar shape to obtain the cooling element.

11. The manufacturing method according to claim 10, wherein a running speed of tows is 60 m/min to 80 m/min; and a ratio of a running speed of the molding pipe to a linear speed of the extrusion rollers is 1: 1 to 1: 1.1.

12. The manufacturing method according to claim 10 or 11, wherein a pressure of the extrusion rollers is 0.05 MPa to 0.35 MPa; and
a steam pressure of the molding pipe is 0.3 MPa to 0.6 MPa.

13. The manufacturing method according to any one of claims 10 to 12, wherein the cooling material pretreatment unit comprises conveying rollers; and a ratio of a linear speed of the extrusion rollers to a linear speed of the conveying rollers is 1: 1.1 to 1: 1.3.

14. A cigarette processing system, comprising the processing device for a cooling element according to any one of claims 1 to 9.

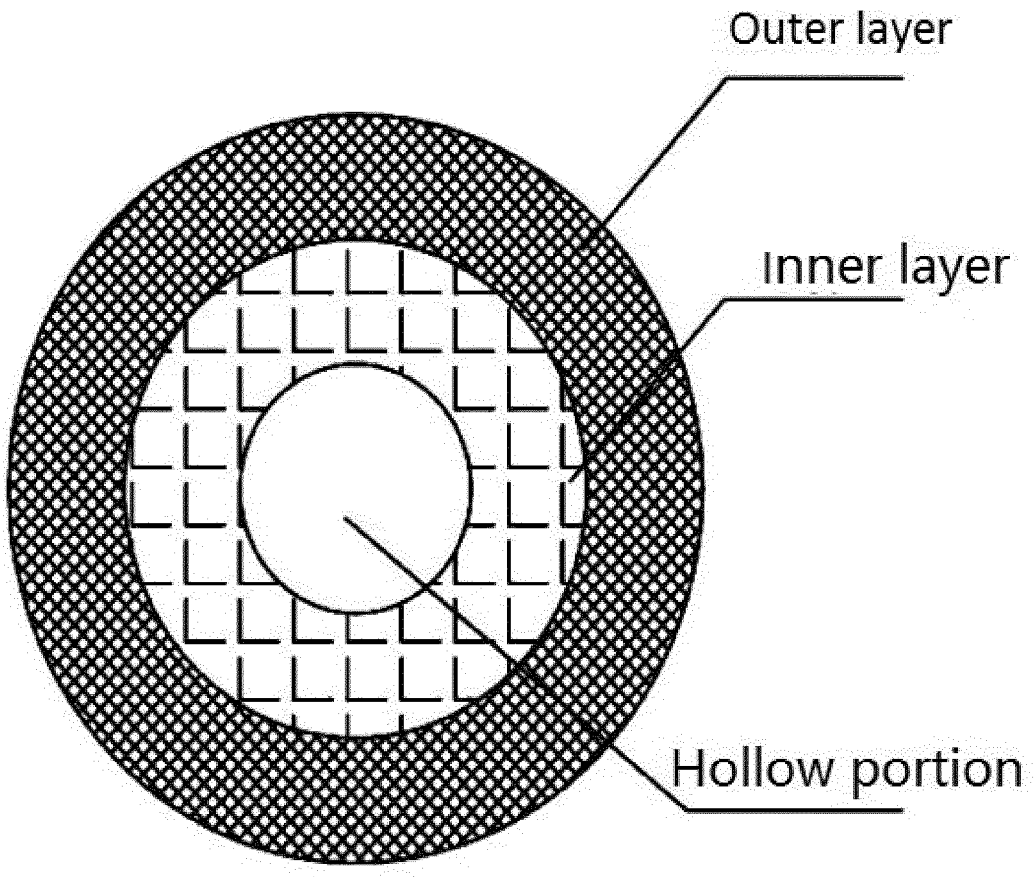
Outer layer
Inner layer
Hollow portion

FIG. 1

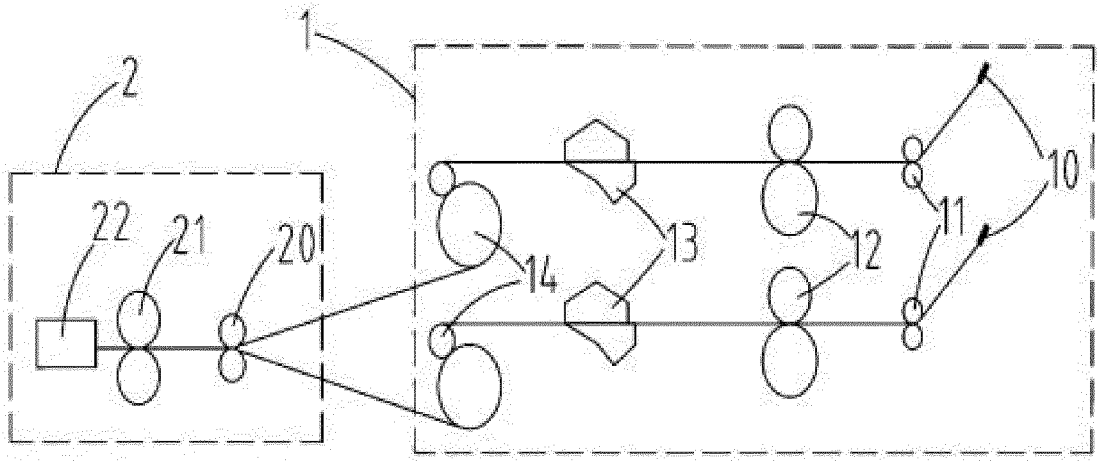
1
2
22
21
20
14
13
12
11
10

FIG. 2

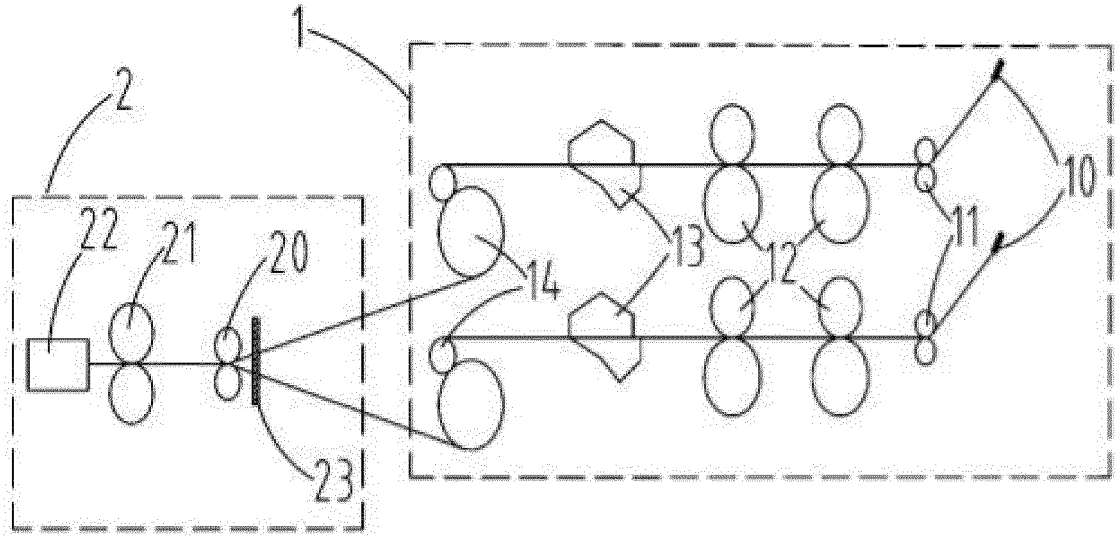

FIG. 3

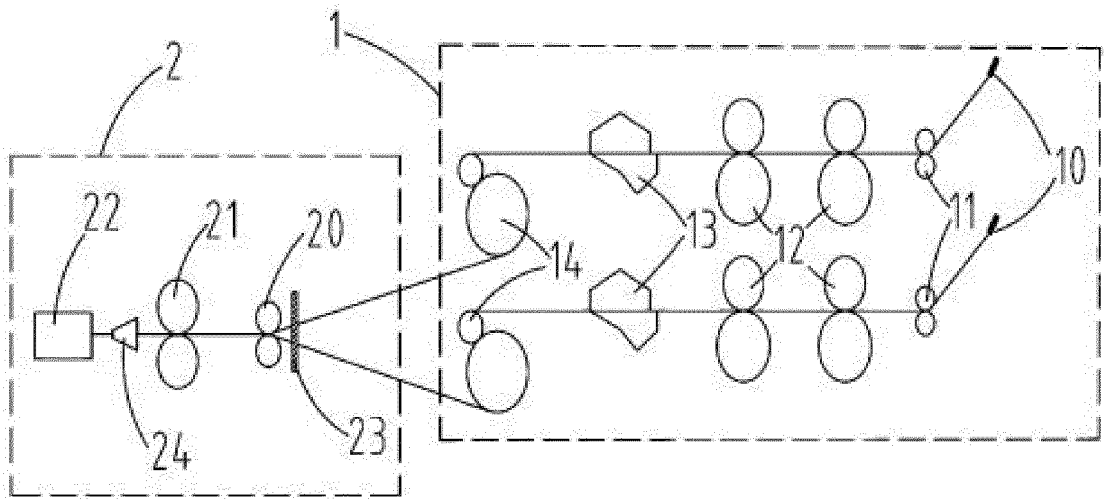

FIG. 4

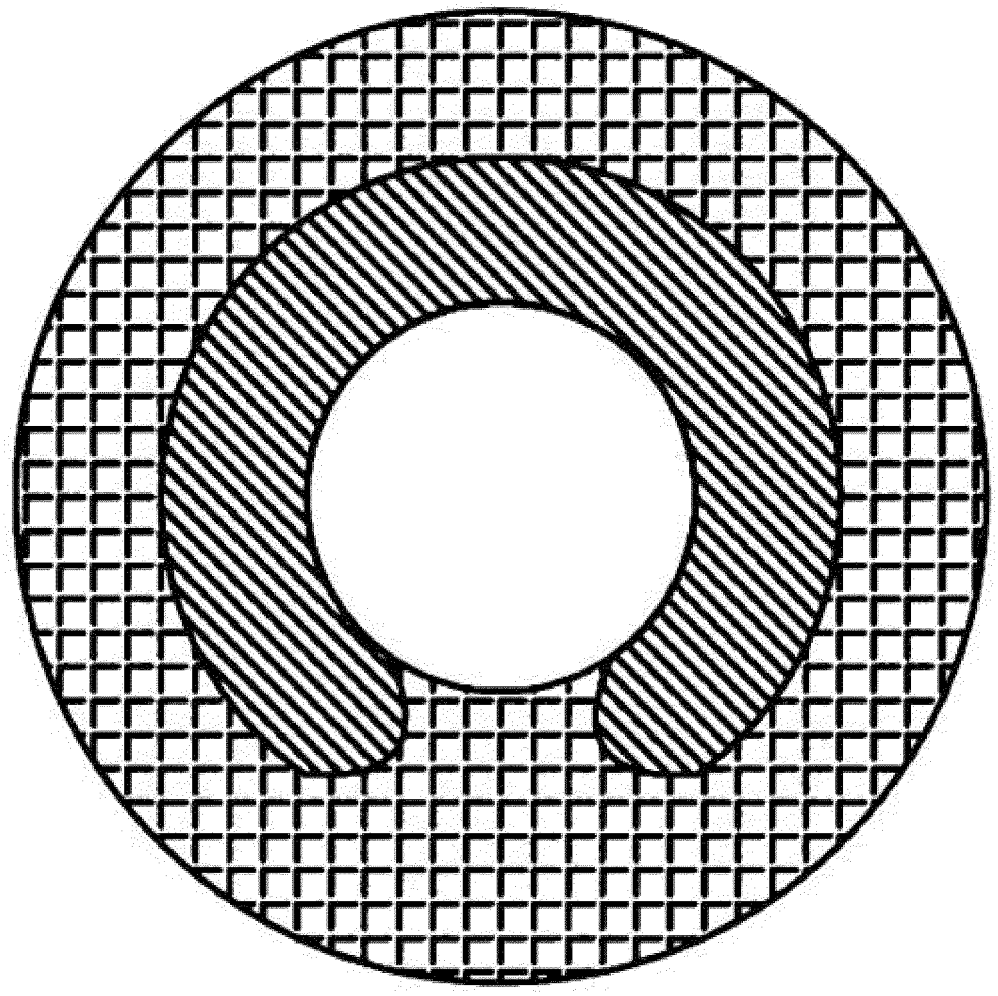

FIG. 5

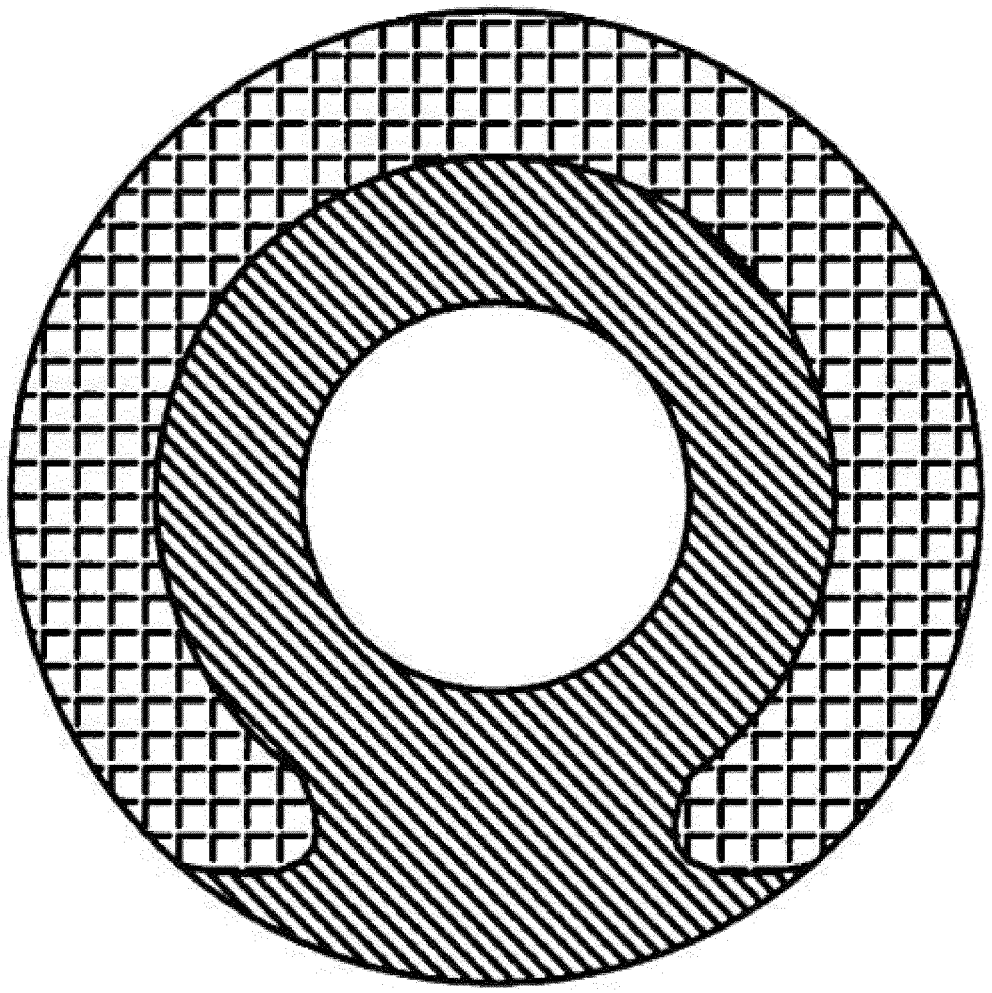

FIG. 6

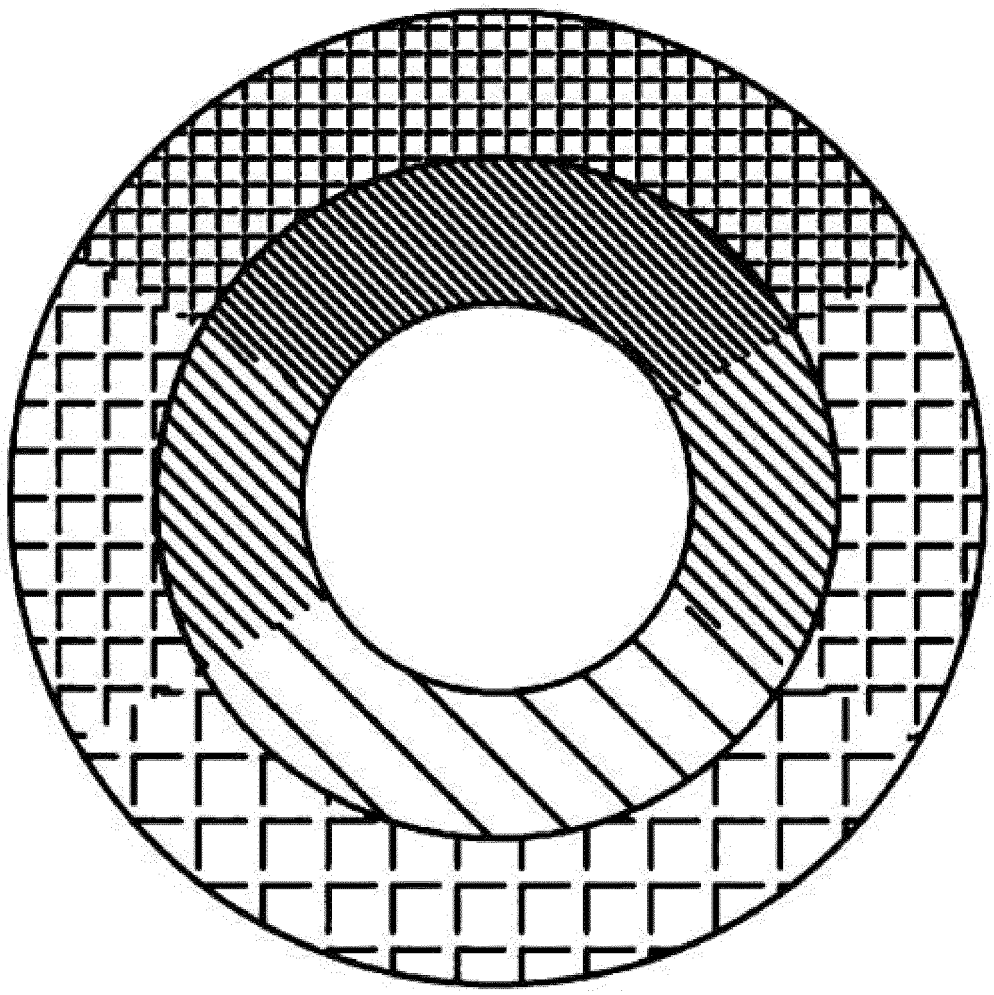

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/087918

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/70(2020.01)i; A24D 3/02(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24D, A24F, A24B, A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPABS, CNTXT; ENTXT, VEN, CNKI, ISI Web of Knowledge, Elsevier Science: 烟, 冷, 降温, 过滤, 隔热, 开松, 解纤, 打松, 扯松, 开纤, 复合, 层, 叠, 聚乳酸, 聚(乳酸), 聚交酯, PLA, 醋酸纤维, 乙酰化纤维, 乙酸纤维, 醋纤维, 醋酸酯纤维, 乙酰基纤维, 醋纤, CA, smok+, tobacco?, fum+, cigarette?, cigar?, cool+, tem., filter+, open+, loos+, splic+, extru+, layer?, composit +, polylactic acid, fiber?, cellulose, acetate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 110881685 A (SHANDONG JIANGJUN TOBACCO NEW MATERIAL TECHNOLOGY CO., LTD.) 17 March 2020 (2020-03-17) description, paragraphs 5-65, and figures 1-4	1-14
Y	CN 109730356 A (YUNNAN BAGU BIOTECHNOLOGY CO., LTD.) 10 May 2019 (2019-05-10) description, paragraphs 19-20, and figure 1	1-14
Y	CN 104489921 A (HONGTA TOBACCO (GROUP) CO., LTD.) 08 April 2015 (2015-04-08) description, paragraphs 4-21, and figures 1-3	1-14
Y	CN 204292186 U (HONGTA TOBACCO (GROUP) CO., LTD.) 29 April 2015 (2015-04-29) description, paragraphs 4-22, and figures 1-3	1-14
Y	CN 211832796 U (HUBEI CHINA TOBACCO INDUSTRY CO., LTD. et al.) 03 November 2020 (2020-11-03) description, paragraphs 4-14, and figure 1	1-14
Y	CN 102488327 A (HONGTA TOBACCO (GROUP) CO., LTD.) 13 June 2012 (2012-06-13) description, paragraphs 5-62, and figures 1-5	1-14

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

* 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

Date of the actual completion of the international search	Date of mailing of the international search report
18 July 2022	**25 July 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/087918

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 103169154 A (MAANSHAN TONGJIELIANG BIOLOGICAL MATERIAL CO., LTD.) 26 June 2013 (2013-06-26) entire document	1-14
A	CN 108477673 A (NANTONG CIGARETTE FILTER CO., LTD.) 04 September 2018 (2018-09-04) entire document	1-14
A	CN 209219246 U (HUBEI CHINA TOBACCO INDUSTRY CO., LTD. et al.) 09 August 2019 (2019-08-09) entire document	1-14
A	CN 108703412 A (SHANGHAI TONGXUN ENVIRONMENTAL PROTECTION TECHNOLOGY CO., LTD.) 26 October 2018 (2018-10-26) entire document	1-14
A	CN 211703520 U (YUXI XINTE MATERIAL CO., LTD.) 20 October 2020 (2020-10-20) entire document	1-14
A	CN 101816456 A (YUNNAN FUJI BIOLOGICAL MATERIAL TECHNOLOGY CO., LTD.) 01 September 2010 (2010-09-01) entire document	1-14
A	CN 208837087 U (HUBEI CHINA TOBACCO INDUSTRY CO., LTD. et al.) 10 May 2019 (2019-05-10) entire document	1-14
A	CN 109463797 A (JIANGSU DARE FILTER TIP MATERIALS COMPANY) 15 March 2019 (2019-03-15) entire document	1-14
A	CN 207574506 U (UNIVERSITY OF SCIENCE AND TECHNOLOGY BEIJING) 06 July 2018 (2018-07-06) entire document	1-14
A	JP S53130500 A (DAICEL LTD.) 14 November 1978 (1978-11-14) entire document	1-14
A	US 2012000480 A1 (SEBASTIAN, A. D. et al.) 05 January 2012 (2012-01-05) entire document	1-14
A	CN 109171015 A (HUBEI CHINA TOBACCO INDUSTRY CO., LTD.) 11 January 2019 (2019-01-11) entire document	1-14

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/087918

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	110881685	A	17 March 2020	None			
CN	109730356	A	10 May 2019	None			
CN	104489921	A	08 April 2015	None			
CN	204292186	U	29 April 2015	None			
CN	211832796	U	03 November 2020	None			
CN	102488327	A	13 June 2012	None			
CN	103169154	A	26 June 2013	None			
CN	108477673	A	04 September 2018	None			
CN	209219246	U	09 August 2019	None			
CN	108703412	A	26 October 2018	None			
CN	211703520	U	20 October 2020	None			
CN	101816456	A	01 September 2010	None			
CN	208837087	U	10 May 2019	None			
CN	109463797	A	15 March 2019	None			
CN	207574506	U	06 July 2018	None			
JP	S53130500	A	14 November 1978	JP	S5913181	B2	28 March 1984
US	2012000480	A1	05 January 2012	US	2018338525	A1	29 November 2018
				US	2015272208	A1	01 October 2015
CN	109171015	A	11 January 2019	None			

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 202110430185X **[0001]**