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(54) **DRY-METHOD RECONSTITUTED TOBACCO HAVING ADJUSTABLE AND CONTROLLABLE AIR PERMEABILITY AND TIGHTNESS, AND PREPARATION METHOD AND APPLICATION OF DRY-METHOD RECONSTITUTED TOBACCO**

(57) The invention relates to a dry-method reconstituted tobacco having adjustable and controllable air permeability and tightness, and a preparation method and an application thereof. Aiming at loose and porous structure and variable pore sizes of the base structure of a dry-method reconstituted tobacco, the particle size of solids (tobacco particles) in a coating liquid is changed to fill up the pores of different diameters, so that the first-level adjustment and control of air permeability and tightness is achieved; a section of roll coating, dip coating or curtain coating, slit coating or otherwise is applied after spray coating to achieve the second-level adjustment

and control of air permeability and tightness; and the surface finishing and thickness are adjusted for the reconstituted tobacco by adjusting the moisture and pressure during press polishing, so that the third-level adjustment and control of air permeability and tightness is achieved. The air permeability and tightness of the dry-method reconstituted tobacco according to the invention can be reasonably adjusted and controlled according to the requirements of a heated cigarette product for high, medium, and low sensory quality, thereby satisfying the quality requirements for smoke characteristics of the heated cigarette.

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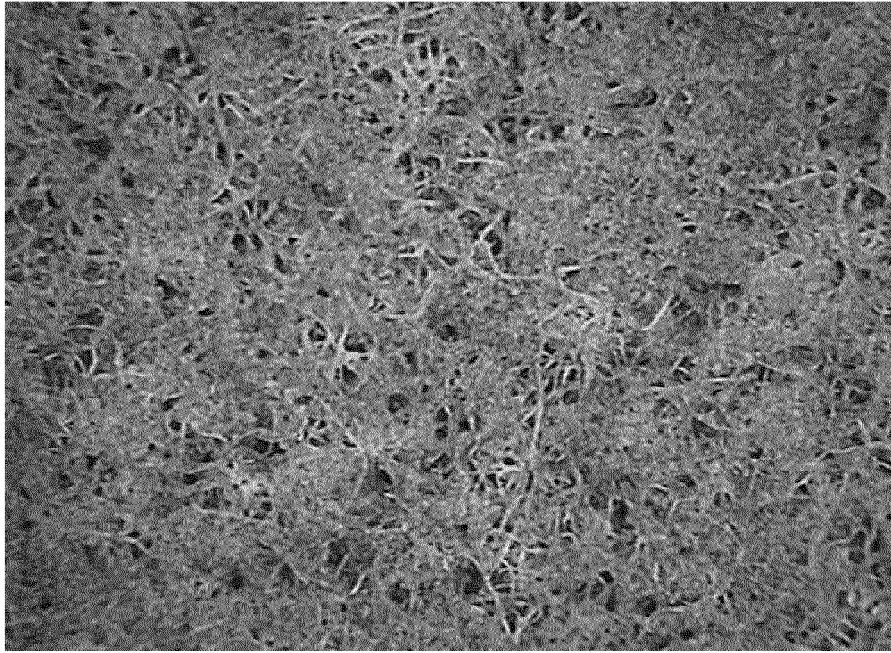


Fig. 2

Description**Field of the Invention**

5 **[0001]** The invention belongs to the technical field of reconstituted tobacco in the tobacco industry and in particular relates to a dry-method reconstituted tobacco having adjustable and controllable air permeability and tightness, and a preparation method and an application thereof. The dry-method reconstituted tobacco is applicable to filler materials used for the smoke producing section of heat-not-burn cigarette.

10 **Background of the Invention**

[0002] Reconstituted tobacco is also called tobacco sheet or recombined tobacco. Heated cigarette is one of the important forms of new tobacco products. Generally the tobacco materials are heated at a relatively low temperature (below 350°C) to release the endogenic and exogenous components in the tobacco to meet the sensory enjoyment and physiological satisfaction of the consumers to some extent. The burning cone of traditional cigarette can reach 900°C or above, and the heating temperature of heated cigarette is generally not higher than 350°C. Current preparation processes for reconstituted tobacco used for heated cigarette at home and abroad mainly include slurry process, rolling process, wet papermaking process and dry papermaking process.

[0003] The final product of dry-method reconstituted tobacco is obtained by applying the coating liquid containing tobacco particles, smoke agent and tobacco extract and other components to the surface of the coating base, i.e., the dry-method base prepared by air-laying process, for multiple times followed by multi-stage drying. The preparation method of reconstituted tobacco is a new technology and a new process, so there are not many relevant literatures yet. Moreover, existing patents mostly focus on investigation on the producing facilities for the dry-method reconstituted tobacco. For example, patent CN103431514B discloses a complete production line for reconstituted tobacco sheets by dry papermaking process, patent CN103798948A discloses a drying unit for production of reconstituted tobacco by dry papermaking process, patent CN103960766A discloses a base forming unit for production of reconstituted tobacco by dry papermaking process, patent CN105212257A discloses a base forming unit used for reconstituted tobacco produced by dry papermaking process, patent CN103783653A discloses a base forming unit for production of reconstituted tobacco by dry papermaking process, patent CN103960767A discloses a defiber unit for production of reconstituted tobacco by dry papermaking process, patent CN103960768A discloses a slurry coating unit for production of reconstituted tobacco by dry papermaking process, and patent CN103892440A discloses a unit for production of reconstituted tobacco by dry papermaking process (including a defiber unit, a base forming unit, a slurry coating unit and a drying unit connected in sequence).

[0004] Existing patents have made only a few investigations on the preparation method of dry-method reconstituted tobacco. Examples that are known to be related to such field are listed as follows: patent CN104824824B discloses a method of producing reconstituted tobacco bearing tobacco fragments by dry papermaking technology, in which the tobacco fragments are respectively added to the costing liquid slurry in the process of base forming and used for coating, thus simplifying the procedure and reducing falling or flying power due to excessive amount of the tobacco power; patent CN103315376A discloses a method for production of reconstituted tobacco base by dry papermaking; patent CN103222676A discloses a method for production of reconstituted tobacco base by dry papermaking; patent CN108451001A discloses a dry-method reconstituted tobacco used for heat-not-burn cigarette and a preparation method thereof, in which the dry-method reconstituted tobacco includes fiber sheet base, tobacco powder, adhesive, smoke agent, sugar and flavor. Although the aforesaid patents involve preparation methods, the investigations are mainly centered on the producing facilities for the dry-method reconstituted tobacco. In respect of the relationship between physical properties and sensory quality of the dry-method reconstituted tobacco, technical measures are insufficient to reasonably control the physical and chemical indicators. Compared with the reconstituted tobacco by slurry process, rolling process and papermaking process, the dry-method reconstituted tobacco has the features of high air permeability, high porosity, high bulk, and relatively low tightness and filling density. Such features are undoubtedly suitable for reconstituted tobacco used for traditional cigarette that requires high filling power and low filling density. However, for heated cigarette, they are not advantages but disadvantages. The sensory quality requirements of heated cigarette are important factors determining the preparation process and physical and chemical properties of reconstituted tobacco; thick and rich smoke, smooth and gentle taste, durability and stability are key sensory indicators that require dry-method reconstituted tobacco to be provided with reasonable air permeability and tightness.

55 **Summary of the Invention**

[0005] The technical problem to be solved by the invention is to provide a preparation method of a dry-method reconstituted tobacco having adjustable and controllable air permeability and tightness with regard to the relatively high air

permeability and low tightness of traditional dry-method reconstituted tobacco that influence the thickness, richness, smoothness and gentleness of smoke, as well as durability and stability.

[0006] To address above technical problem, the technical solution of the invention is a preparation method of a dry-method reconstituted tobacco, comprising the following steps:

step I, preparing dry-method base by air-laying process, with a fixed content of 10g/m^2 - 70g/m^2 ;

step II, preparing a coating liquid L, a coating liquid M and a coating liquid S; in parts by weight, wherein the composition of coating liquids L, M and S in parts by weight is as follows: 5-25 parts of tobacco particles, 2-12 parts of smoke agent, 2-8 parts of adhesive, 1-6 part(s) of tobacco extract, 1-3 part(s) of dispersing agent, 1-3 part(s) of stabilizing agent, 1-4 part(s) of tobacco flavor and 70-90 parts of water; the solid percentage of coating liquids L, M and S is 10%-20%, and the viscosity is $50\text{mPa}\cdot\text{s}$ - $3000\text{mPa}\cdot\text{s}$; tobacco particles in the coating liquid L are large, with a particle size of $250\mu\text{m}$ - $106\mu\text{m}$ (equivalent to 60-150 meshes), those in the coating liquid M are medium, with a particle size of $106\mu\text{m}$ - $48\mu\text{m}$ (equivalent to 150-300 meshes), and those in the coating liquid S are small, with a particle size of $48\mu\text{m}$ - $25\mu\text{m}$ (equivalent to 300-500 meshes);

step III, transferring at least two of the coating liquids L, M and S in step II to a front face of the dry-method base and at least two of the coating liquids L, M and S in step II to a back face of the dry-method base through multiple spray coating both in an order of coating liquid L, coating liquid M and then coating liquid S, with each coating followed by a hot air drying, thus obtaining a semi-finished product of the dry-method reconstituted tobacco;

step IV, preparing a coating liquid X without tobacco particles, wherein the composition of the coating liquid X in parts by weight is as follows: 20-70 parts of tobacco extractum, 5-20 parts of smoke agent, 0-6 part(s) of adhesive and 10-70 parts of water; the solid percentage of coating liquid X is 20%-70%, and the viscosity is $50\text{mPa}\cdot\text{s}$ - $3000\text{mPa}\cdot\text{s}$;

step V, transferring the coating liquid X prepared in step IV to the surface of the semi-finished product of the dry-method reconstituted tobacco obtained in step III by roll coating, dip coating, curtain coating or slit coating, and obtaining a semi-finished product of reconstituted tobacco after drying by hot air;

step VI, subjecting the semi-finished product of reconstituted tobacco obtained in step V to surface finishing and thickness adjustment (0.16mm - 0.30mm) by soft press polishing, and obtaining the final product of reconstituted tobacco with a fixed content of 100g/m^2 - 200g/m^2 , thickness of 0.16mm - 0.30mm , air permeability of 100CU - 10000CU , tightness of 0.333g/cm^3 - 1.250g/cm^3 , smoke agent content of 10%-20%, and water content of 8%-16%.

[0007] As for the preferred embodiment of the above coating method, the spray coating includes air coating, high-pressure airless coating or air-mixed coating; the roll coating is made on a single or both faces, the dip coating is made on both faces, the curtain coating includes single-or multiple-layer curtain coating, and the slit coating includes single-or multiple-layer slit coating; the spray coating has a spreading rate of 75%-85%, and the roll coating, dip coating, curtain coating and slit coating have a spreading rate of 2%-40%.

[0008] A further purpose of the invention is to provide a dry-method reconstituted tobacco having adjustable and controllable air permeability and tightness, whose key properties can be obtained by the above preparation method.

[0009] A further purpose of the invention is to provide a preferred application of the dry-method reconstituted tobacco to ensure a better quality of the obtained cigarette, with the specific solution detailed as follows: when the dry-method reconstituted tobacco is applied to production of heat-not-burn cigarette, a tobacco shred full-cutting technology rather than a half-cutting or mostly-cutting technology is used to cut the dry-method reconstituted tobacco into filamentous tobacco shreds that are fully cut and totally separated from each other without entanglement or adhesion, with each reconstituted tobacco shred having a width of 0.6mm - 1.2mm .

[0010] Further, the reconstituted tobacco shreds in a smoke producing section are arranged orderly or disorderly; wherein, the order arrangement means that all reconstituted tobacco shreds are parallel to axial direction of a cigarette, and the disorder arrangement means that some reconstituted tobacco shreds are not parallel to axial direction of a cigarette.

[0011] Further, the reconstituted tobacco shreds fill in the smoke producing section with a density of 300mg/cm^3 - 800mg/cm^3 .

[0012] Further, the smoke producing section formed by the reconstituted tobacco shreds and a supporting section formed by a paper tube generate a composite rod A by composition of a binary filter rod, and a cooling section formed by diaphragm paper composite materials and a filtering section formed by bundles of filamentous cellulose acetate fiber shreds generate a composite rod B by composition of a binary filter rod; the composite rods A and B are rolled in a cigarette making machine and connected by a tipping paper to produce a heat-not-burn cigarette, which is generated by combination of "2+2" double binary compositions and connection with tipping paper.

[0013] Further, when the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, a secondary flavoring technology such as flavor spraying or flavor injection through the filter rod is used to transfer the flavor components to inside the base rod of the smoke producing section; the flavor components

consist of one or more of tobacco flavor, tobacco liquid, tobacco extract and smoke agent; the dosage of the secondary flavoring is 1%-15% as calculated by the weight of the reconstituted tobacco.

[0014] Further, when the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, a kind of paper-based composite material with the functions of heat insulation or heat reflection and uniform heat transfer, such as an aluminum foil, a tin foil or a graphene-containing forming paper, is used to wrap the reconstituted tobacco shreds and form the base rod of the smoke producing section.

[0015] The invention has the following advantageous effects: aiming at loose and porous structure and variable pore sizes of the base structure of a dry-method reconstituted tobacco, the particle size of solids (tobacco particles) in a coating liquid is changed to fill up the pores of different diameters, so that the first-level adjustment and control of air permeability and tightness is achieved; a section of roll coating, dip coating or curtain coating, slit coating or otherwise is applied after spray coating to achieve the second-level adjustment and control of air permeability and tightness; and the surface finishing and thickness are adjusted for the reconstituted tobacco by adjusting the moisture and pressure during press polishing, so that the third-level adjustment and control of air permeability and tightness is achieved. The air permeability and tightness of the dry-method reconstituted tobacco according to the invention can be reasonably adjusted and controlled according to the requirements of a heated cigarette product for high, medium, and low sensory quality, thereby satisfying the quality requirements for smoke characteristics of the heated cigarette.

[0016] Compared with the prior art, the invention has the following advantages and benefits:

(1) The dry-method reconstituted tobacco prepared according to the invention has adjustable and controllable air permeability (100CU-10000CU) and tightness ($0.333\text{g}/\text{cm}^3$ - $1.250\text{g}/\text{cm}^3$), which solves the problems of overly high air permeability and low tightness of the existing dry-method reconstituted tobacco; the dry-method reconstituted tobacco with different air permeability and tightness can be selected based on the sensory quality requirements for the heated cigarette,

(2) Aiming at loose and porous structure and variable pore sizes of the dry-method base structure and the dry-method reconstituted tobacco, the invention uses tobacco particles with different particle sizes to fill up the pores of different diameters, adopts new coating methods combining spray coating with roll coating, dip coating, curtain coating or slit coating, and utilizes the polish pressing and polishing technologies to adjust the surface properties and thickness to achieve the third-level adjustment and control of air permeability and tightness of the dry-method reconstituted tobacco.

(3) When the dry-method reconstituted tobacco prepared according to the invention is used for heated cigarette, compared with the existing dry-method reconstituted tobacco, significant improvement will be seen in indicators such as thickness, richness, smoothness and gentleness of smoke, durability and stability, as well as sensory quality.

(4) The dry-method reconstituted tobacco prepared according to the invention can be applied to both a smoke producing section comprising orderly arranged reconstituted tobacco shreds and a smoke producing section comprising disorderly arranged reconstituted tobacco shreds, satisfying the requirements of internal heating and external heating modes for the filler materials and greatly increasing the adaptability.

Brief Description of the Drawings

[0017]

Fig. 1 is a surface microstructure diagram of the dry-method reconstituted tobacco of the control sample (40X).

Fig. 2 is a surface microstructure diagram of the dry-method reconstituted tobacco of the Embodiment 1 (40X).

Fig. 3 is a surface microstructure diagram of the dry-method reconstituted tobacco of the Embodiment 2 (40X).

Fig. 4 is a surface microstructure diagram of the dry-method reconstituted tobacco of the Embodiment 3 (40X).

Detailed Description of the Preferred Embodiments

[0018] The invention is further described in combination with the drawings and embodiments as follows.

[0019] The preparation method of the dry-method reconstituted tobacco according to the invention includes the following steps:

step I, preparing dry-method base by air-laying process, with a fixed content of $10\text{g}/\text{m}^2$ - $70\text{g}/\text{m}^2$;

step II, preparing a coating liquid L, a coating liquid M and a coating liquid S, wherein the composition of coating liquids L, M and S in parts by weight is as follows: 5-25 parts of tobacco particles, 2-12 parts of smoke agent, 2-8 parts of adhesive, 1-6 part(s) of tobacco extract, 1-3 part(s) of dispersing agent, 1-3 part(s) of stabilizing agent, 1-4 part(s) of tobacco flavor and 70-90 parts of water; the smoke agent, adhesive, dispersing agent and stabilizing agent are all food grade products; the solid percentage of coating liquids L, M and S is 10%-20%, and the viscosity is

50mPa·s-3000mPa·s; tobacco particles in the coating liquid L are large, with a particle size of 250 μ m-106 μ m (equivalent to 60-150 meshes), those in the coating liquid M are medium, with a particle size of 106 μ m-48 μ m (equivalent to 150-300 meshes), and those in the coating liquid S are small, with a particle size of 48 μ m-25 μ m (equivalent to 300-500 meshes);

step III, transferring at least two of the coating liquids L, M and S in step II to a front face of the dry-method base and at least two of the coating liquids L, M and S in step II to a back face of the dry-method base through multiple spray coating both in an order of coating liquid L, coating liquid M and then coating liquid S (for example, in case only coating liquid L and coating liquid M are applied to the front face of the dry-method base, the coating liquid L should be applied before the coating liquid M), with each coating followed by a hot air drying, thus obtaining a semi-finished product of the dry-method reconstituted tobacco;

step IV, preparing a coating liquid X without tobacco particles, wherein the composition of the coating liquid X in parts by weight is as follows: 20-70 parts of tobacco extractum, 5-20 parts of smoke agent, 0-6 part(s) of adhesive and 10-70 parts of water; the solid percentage of coating liquid X is 20%-70%, and the viscosity is 50mPa·s-3000mPa·s; the smoke agent and adhesive are both food grade products.

step V, transferring the coating liquid X prepared in step IV to the surface of the semi-finished product of the dry-method reconstituted tobacco obtained in step III by roll coating, dip coating, curtain coating or slit coating, and obtaining a semi-finished product of reconstituted tobacco after drying by hot air;

step VI, subjecting the semi-finished product of reconstituted tobacco obtained in step V to surface finishing and thickness adjustment (0.16mm-0.30mm) by soft press polishing, and obtaining the final product of reconstituted tobacco with a fixed content of 100g/m²-200g/m², thickness of 0.16mm-0.30mm, air permeability of 100CU-10000CU, tightness of 0.333g/cm³-1.250g/cm³, smoke agent content of 10%-20%, preferably 12%-18%, and water content of 8%-16%. Wherein, the smoke agent can be polyols, sugar alcohols, glycerides, such as glycerol, 1,2-propanediol, 1,3-butanediol, sorbitol, mannitol, glycerol acetate and fatty acid ester.

[0020] As for the preferred embodiment of the above coating method, the spray coating includes air coating, high-pressure airless coating or air-mixed coating; the roll coating is made on a single or both faces, the dip coating is made on both faces, the curtain coating includes single-or multiple-layer curtain coating, and the slit coating includes single-or multiple-layer slit coating; the spray coating has a spreading rate of 75%-85%, and the roll coating, dip coating, curtain coating and slit coating have a spreading rate of 2%-40%.

[0021] For specific application of the dry-method reconstituted tobacco, the preferred solution is as follows: when the dry-method reconstituted tobacco is applied to production of heat-not-burn cigarette, a tobacco shred full-cutting technology rather than a half-cutting or mostly-cutting technology is used to cut the dry-method reconstituted tobacco into filamentous tobacco shreds that are fully cut and totally separated from each other without entanglement or adhesion, with each reconstituted tobacco shred having a width of 0.6mm-1.2mm. Further preferably, the reconstituted tobacco shreds in a smoke producing section are arranged orderly or disorderly; wherein, the order arrangement means that all reconstituted tobacco shreds are parallel to axial direction of a cigarette, and the disorder arrangement means that some reconstituted tobacco shreds are not parallel to axial direction of a cigarette. The reconstituted tobacco shreds fill in the smoke producing section with a density of 300mg/cm³-800mg/cm³.

[0022] The smoke producing section formed by the reconstituted tobacco shreds and a supporting section formed by a paper tube generate a composite rod A by composition of a binary filter rod, and a cooling section formed by diaphragm paper composite materials and a filtering section formed by bundles of filamentous cellulose acetate fiber shreds generate a composite rod B by composition of a binary filter rod; the composite rods A and B are rolled in a cigarette making machine and connected by a tipping paper to produce a heat-not-burn cigarette, which is generated by combination of "2+2" double binary compositions and connection with tipping paper. Preferably, the length of the smoke producing section formed by the reconstituted tobacco is 10mm-14mm, the length of the supporting section formed by the paper tube is 10mm-14mm, the length of the cooling section formed by diaphragm paper composite materials is 14mm-18mm, and the length of the filtering section formed by bundles of filamentous cellulose acetate fiber shreds is 6mm-10mm.

[0023] When the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, a secondary flavoring technology such as flavor spraying or flavor injection through the filter rod is used to transfer the flavor components to inside the base rod of the smoke producing section; the flavor components consist of one or more of tobacco flavor, tobacco liquid, tobacco extract and smoke agent; the dosage of the secondary flavoring is 1%-15% as calculated by the weight of the reconstituted tobacco. Preferably, when the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, a kind of paper-based composite material with the functions of heat insulation or heat reflection and uniform heat transfer, such as an aluminum foil, a tin foil or a graphene-containing forming paper, is used to wrap the reconstituted tobacco shreds and form the base rod of the smoke producing section.

[0024] The invention is further described in detail in combination with the embodiments as follows to make the purpose, technical solutions and advantages of the invention clearer. It should be understood that the embodiments described

herein are only for explanation of the invention but not limitation thereto.

Embodiment 1

5 **[0025]** Subjecting fluff pulp of coniferous woods to waterless defibration, and preparing dry-method base by air-laying process, with a fixed content of 20g/m². Preparing a coating liquid L and a coating liquid M, wherein, the particle size of tobacco particles in the coating liquid L is D90=106μm, and the particle size of tobacco particles in the coating liquid M is D90=75μm. The composition of coating liquids L and M in parts by weight is 10 parts of tobacco particles, 4 parts of smoke agent, 4 parts of adhesive, 3 parts of tobacco extract, 2 parts of dispersing agent, 3 parts of stabilizing agent, 2 parts of tobacco flavor and 80 parts of water. The solid percentage of the coating liquid L is 11.2%, and the viscosity is 750mPa·s; the solid percentage of the coating liquid M is 14.5%, and the viscosity is 910mPa·s. Transferring the coating liquid L to front and back faces of the base respectively through first and second spray coatings, and the coating liquid M to front and back faces of the base respectively through third and fourth spray coatings, with each coating weight being 25g/m²-30g/m², and obtaining a semi-finished product of reconstituted tobacco. Preparing a coating liquid X with tobacco extractum and smoke agent but no tobacco particles, with a solid percentage of 39% and viscosity of 1020 mPa·s. Transferring the coating liquid X by single-face roll coating to the base surface of the semi-finished product of reconstituted tobacco obtained after the four times of coating, drying the costing to obtain a semi-finished product of reconstituted tobacco, and subjecting the semi-finished product of reconstituted tobacco to polish pressing and polishing, adjustment and drying to obtain a finished product of dry-method reconstituted tobacco, with a fixed content of 123 g/m², thickness of 0.257mm, air permeability of 8530CU, and tightness of 0.478g/cm³, and corresponding sensory quality points of 78.5.

Embodiment 2

25 **[0026]** Subjecting fluff pulp of coniferous woods to waterless defibration, and preparing dry-method base by air-laying process, with a fixed content of 30g/m². Preparing a coating liquid L, a coating liquid M and a coating liquid S, wherein, the particle size of tobacco particles in the coating liquid L is D90=106μm, the particle size of tobacco particles in the coating liquid M is D90=75μm, and the particle size of tobacco particles in the coating liquid S is D90=48μm. The composition of coating liquids L, M and S in parts by weight is 15 parts of tobacco particles, 6 parts of smoke agent, 5 parts of adhesive, 4 parts of tobacco extract, 2 parts of dispersing agent, 3 parts of stabilizing agent, 3 parts of tobacco flavor and 80 parts of water. The solid percentage of the coating liquid L is 11.2%, and the viscosity is 650mPa·s; the solid percentage of the coating liquid M is 14.5%, and the viscosity is 870mPa·s; the solid percentage of the coating liquid S is 13.5%, and the viscosity is 980mPa·s. Transferring the coating liquid L to front and back faces of the base respectively through first and second spray coatings, the coating liquid M to front and back faces of the base respectively through third and fourth spray coatings, and the coating liquid S to the front or back face of the base through a fifth spray coating, with each coating weight being 25g/m²-30g/m², and obtaining a semi-finished product of reconstituted tobacco. Preparing a coating liquid X with tobacco extractum and smoke agent but no tobacco particles, with a solid percentage of 45% and viscosity of 1160 mPa·s. Transferring the coating liquid X by dip coating to the base surface of the semi-finished product of reconstituted tobacco obtained after the five times of coating, drying the costing to obtain a semi-finished product of reconstituted tobacco, and subjecting the semi-finished product of reconstituted tobacco to polish pressing and polishing, adjustment and drying to obtain a finished product of dry-method reconstituted tobacco, with a fixed content of 157 g/m², thickness of 0.224mm, air permeability of 5530CU, and tightness of 0.701g/cm³, and corresponding sensory quality points of 84.5.

Embodiment 3

45 **[0027]** Subjecting fluff pulp of coniferous woods to waterless defibration, and preparing dry-method base by air-laying process, with a fixed content of 40g/m². Preparing a coating liquid L, a coating liquid M and a coating liquid S, wherein, the particle size of tobacco particles in the coating liquid L is D90=150μm, the particle size of tobacco particles in the coating liquid M is D90=85μm, and the particle size of tobacco particles in the coating liquid S is D90=30μm. The composition of coating liquids L, M and S in parts by weight is 20 parts of tobacco particles, 9 parts of smoke agent, 6 parts of adhesive, 5 parts of tobacco extract, 3 parts of dispersing agent, 3 parts of stabilizing agent, 4 parts of tobacco flavor and 85 parts of water. The solid percentage of the coating liquid L is 14.4%, and the viscosity is 580mPa·s; the solid percentage of the coating liquid M is 12.7%, and the viscosity is 930mPa·s; the solid percentage of the coating liquid S is 15.2%, and the viscosity is 1050mPa·s. Transferring the coating liquid L to front and back faces of the base respectively through first and second spray coatings, the coating liquid M to front and back faces of the base respectively through third and fourth spray coatings, and the coating liquid S to front and back faces of the base through fifth and sixth spray coatings, with each coating weight being 25g/m²-30g/m², and obtaining a semi-finished product of reconstituted tobacco.

stituted tobacco. Preparing a coating liquid X with tobacco extractum and smoke agent but no tobacco particles, with a solid percentage of 55% and viscosity of 1320 mPa·s. Transferring the coating liquid X by single-layer curtain coating to the base surface of the semi-finished product of reconstituted tobacco obtained after the six times of coating, drying the costing to obtain a semi-finished product of reconstituted tobacco, and subjecting the semi-finished product of reconstituted tobacco to polish pressing and polishing, adjustment and drying to obtain a finished product of dry-method reconstituted tobacco, with a fixed content of 188 g/m², thickness of 0.184mm, air permeability of 3240CU, and tightness of 1.022g/cm³, and corresponding sensory quality points of 89.5.

[0028] Effect of the embodiments:

The fixed content, thickness, air permeability, tightness and tensile strength of the dry-method reconstituted tobacco prepared in the above embodiments have been tested, sensory quality assessments have been conducted as per the sensory assessment methods in YC/T 498-2014, Evaluation Methods of Sensory Quality for Reconstituted Tobacco (paper-process), and the final sensory quality points have been given, as shown in Table 1.

[0029] The test methods and standards for physical and chemical properties listed in Table 1:

GB/T 451.2-2002, *Paper and board - Determination of grammage*;

GB/T 451.3-2002, *Paper and board - Determination of thickness*;

GB/T12914-2008, *Paper and board - Determination of tensile properties and elongation*;

GB/T 23227-2018, *Materials Used as Cigarette Papers, Filter Plug Wrap and Filter Joining Paper, including Materials Having An Oriented Permeability - Determination of Air Permeability*;

Table 1: Comparison of Physical and Chemical Properties and Sensory Quality of Improved Dry-Method Reconstituted Tobacco and Traditional Dry-Method Reconstituted Tobacco

Sample number	Fixed content (g/m ²)	Thickness (mm)	Tightness (g/cm ³)	Air permeability (CU)	Tensile strength (N/m)	Moisture (%)	Smoke agent content (%)	Sensory quality points
Traditional dry-method reconstituted tobacco	100	0.263	0.380	10050	234	12.45	16.74	73.0
Embodiment 1	123	0.257	0.478	8530	448	11.74	16.23	78.5
Embodiment 2	157	0.224	0.701	5530	525	12.39	15.46	84.5
Embodiment 3	188	0.184	1.022	3240	637	12.51	16.85	89.5

[0030] It can be seen from Table 1 that, compared with the traditional dry-method reconstituted tobacco, the air permeability of the 3 kinds of improved dry-method reconstituted tobacco has dropped by 15.1%, 44.9% and 67.8%, and the tightness has risen by 25.7%, 84.5% and 168.9% respectively. With these two key indicators being reasonably adjusted and controlled, the sensory quality points are significantly improved accordingly as compared with the traditional dry-method reconstituted tobacco. Specifically, the smoke properties of the 3 kinds of improved dry-method reconstituted tobacco have been noticeably improved, including thickness, richness, smoothness, gentleness and clustering. In addition, the durability has been increased from 6-7 puffs to 10-12 puffs, and the stability and consistency of the first puffs and the later ones have also been improved compared with the control sample.

[0031] The dry-method reconstituted tobacco prepared according to the invention has adjustable and controllable air permeability (100CU-10000CU) and tightness (0.333g/cm³-1.250g/cm³), which solves the problems of overly high air permeability and low tightness of the existing dry-method reconstituted tobacco; the dry-method reconstituted tobacco with different air permeability and tightness can be selected based on the sensory quality requirements for the heated cigarette.

[0032] Although the invention is described with reference to the explanatory embodiments of the invention, it should be understood that many other modifications and embodiments can be designed by a person skilled in the art, and such modifications and embodiments shall fall within the spirit and terms of the claims herein. More specifically, within the scope disclosed by the Invention, a variety of modifications and improvements can be made to the components and/or layout of the theme, topic and layout. In addition to the modifications and improvements to the components and/or layout, other uses will also be apparent to a person skilled in the art.

Claims

1. A preparation method of dry-method reconstituted tobacco having adjustable air permeability and tightness, **characterized by** comprising the following steps:

step I, preparing dry-method base by air-laying process, with a fixed content of 10g/m²-70g/m²;
 step II, preparing a coating liquid L, a coating liquid M and a coating liquid S, wherein the composition of coating liquids L, M and S in parts by weight is as follows: 5-25 parts of tobacco particles, 2-12 parts of smoke agent, 2-8 parts of adhesive, 1-6 part(s) of tobacco extract, 1-3 part(s) of dispersing agent, 1-3 part(s) of stabilizing agent, 1-4 part(s) of tobacco flavor and 70-90 parts of water; the solid percentage of coating liquids L, M and S is 10%-20%, and the viscosity is 50mPa·s-3000mPa·s; tobacco particles in the coating liquid L are large, with a particle size of 250μm-106μm, those in the coating liquid M are medium, with a particle size of 106μm-48μm, and those in the coating liquid S are small, with a particle size of 48μm-25μm;
 step III, transferring at least two of the coating liquids L, M and S in step II to a front face of the dry-method base and at least two of the coating liquids L, M and S in step II to a back face of the dry-method base through multiple spray coating both in an order of coating liquid L, coating liquid M and then coating liquid S, with each coating followed by a hot air drying, thus obtaining a semi-finished product of the dry-method reconstituted tobacco;
 step IV, preparing a coating liquid X without tobacco particles, wherein the composition of the coating liquid X in parts by weight is as follows: 20-70 parts of tobacco extractum, 5-20 parts of smoke agent, 0-6 part(s) of adhesive and 10-70 parts of water; the solid percentage of coating liquid X is 20%-70%, and the viscosity is 50mPa·s-3000mPa·s;
 step V, transferring the coating liquid X prepared in step IV to the surface of the semi-finished product of the dry-method reconstituted tobacco obtained in step III by roll coating, dip coating, curtain coating or slit coating, and obtaining a semi-finished product of reconstituted tobacco after drying by hot air;
 step VI, subjecting the semi-finished product of reconstituted tobacco obtained in step V to surface finishing and thickness adjustment (0.16mm-0.30mm) by soft press polishing, and obtaining the final product of reconstituted tobacco with a fixed content of 100g/m²-200g/m², thickness of 0.16mm-0.30mm, air permeability of 100CU-10000CU, tightness of 0.333g/cm³-1.250g/cm³, smoke agent content of 10%-20%, and water content of 8%-16%.

2. The preparation method of dry-method reconstituted tobacco according to claim 1, **characterized in that** the spray coating includes air coating, high-pressure airless coating or air-mixed coating; the roll coating is made on a single or both faces, the dip coating is made on both faces, the curtain coating includes single- or multiple-layer curtain coating, and the slit coating includes single- or multiple-layer slit coating; the spray coating has a spreading rate of 75%-85%, and the roll coating, dip coating, curtain coating and slit coating have a spreading rate of 2%-40%.
3. A dry-method reconstituted tobacco, **characterized in that** it is obtained by the preparation method according to claim 1 or 2.
4. An application of the dry-method reconstituted tobacco, **characterized in that** when the dry-method reconstituted tobacco according to claim 3 is applied to production of heat-not-burn cigarette, a tobacco shred full-cutting technology is used to cut the dry-method reconstituted tobacco into filamentous tobacco shreds that are fully cut and totally separated from each other without entanglement or adhesion, with each reconstituted tobacco shred having a width of 0.6mm-1.2mm.
5. The application of the dry-method reconstituted tobacco according to claim 4, **characterized in that** the reconstituted tobacco shreds in a smoke producing section are arranged orderly or disorderly; wherein, the order arrangement means that all reconstituted tobacco shreds are parallel to axial direction of a cigarette, and the disorder arrangement means that some reconstituted tobacco shreds are not parallel to axial direction of a cigarette.
6. The application of the dry-method reconstituted tobacco according to claim 4, **characterized in that** the reconstituted tobacco shreds fill in the smoke producing section with a density of 300mg/cm³-800mg/cm³.
7. The application of the dry-method reconstituted tobacco according to claim 4, **characterized in that** the smoke producing section formed by the reconstituted tobacco shreds and a supporting section formed by a paper tube generate a composite rod A by composition of a binary filter rod, and a cooling section formed by diaphragm paper composite materials and a filtering section formed by bundles of filamentous cellulose acetate fiber shreds generate a composite rod B by composition of a binary filter rod; the composite rods A and B are rolled in a cigarette making

machine and connected by a tipping paper to produce a heat-not-burn cigarette, which is generated by combination of "2+2" double binary compositions and connection with tipping paper.

- 5 8. The application of the dry-method reconstituted tobacco according to claim 4, **characterized in that** when the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, a secondary flavoring technology such as flavor spraying or flavor injection through the filter rod is used to transfer the flavor components to inside the base rod of the smoke producing section; the flavor components consist of one or more of tobacco flavor, tobacco liquid, tobacco extract and smoke agent; the dosage of the secondary flavoring is 1%-15% as calculated by the weight of the reconstituted tobacco.
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9. The application of the dry-method reconstituted tobacco according to claim 4, **characterized in that** when the reconstituted tobacco is forming a base rod of the smoke producing section on a paper crumpling machine, an aluminum foil, a tin foil or a graphene-containing forming paper is used to wrap the reconstituted tobacco shreds and form the base rod of the smoke producing section.
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10. A heat-not-burn cigarette, **characterized in that** it is prepared by the application of the dry-method reconstituted tobacco according to any of claims 4-9.
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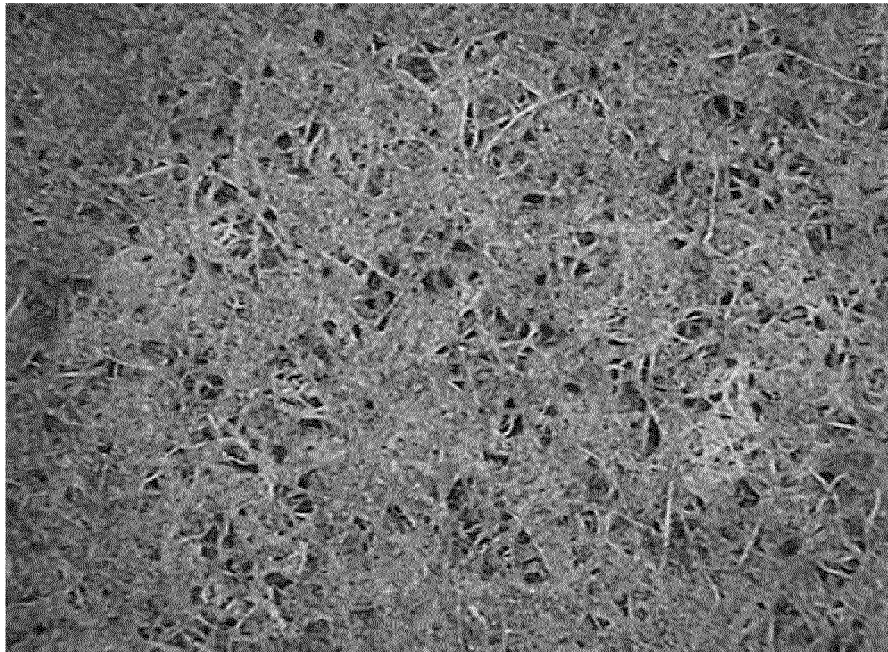


Fig. 1

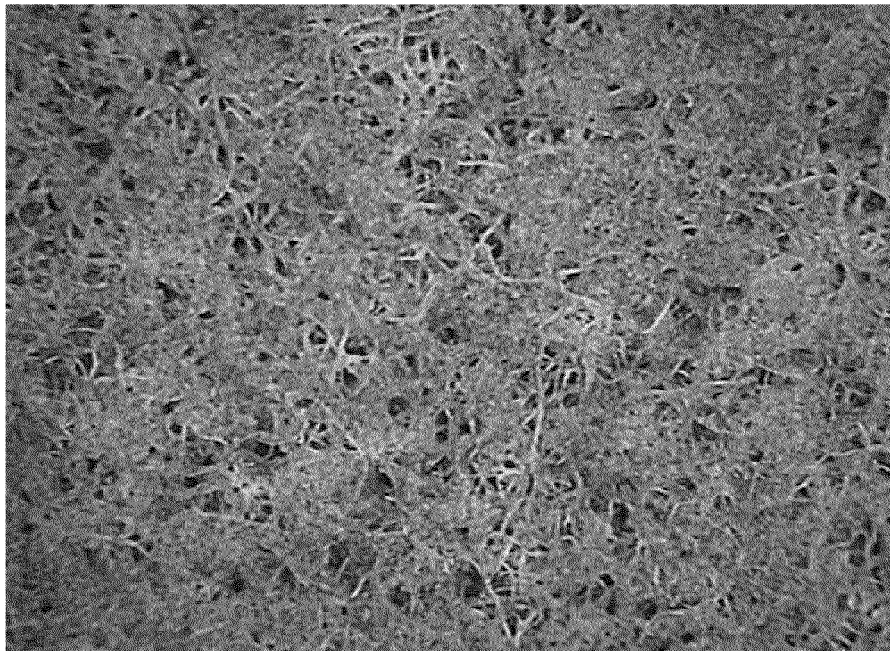


Fig. 2

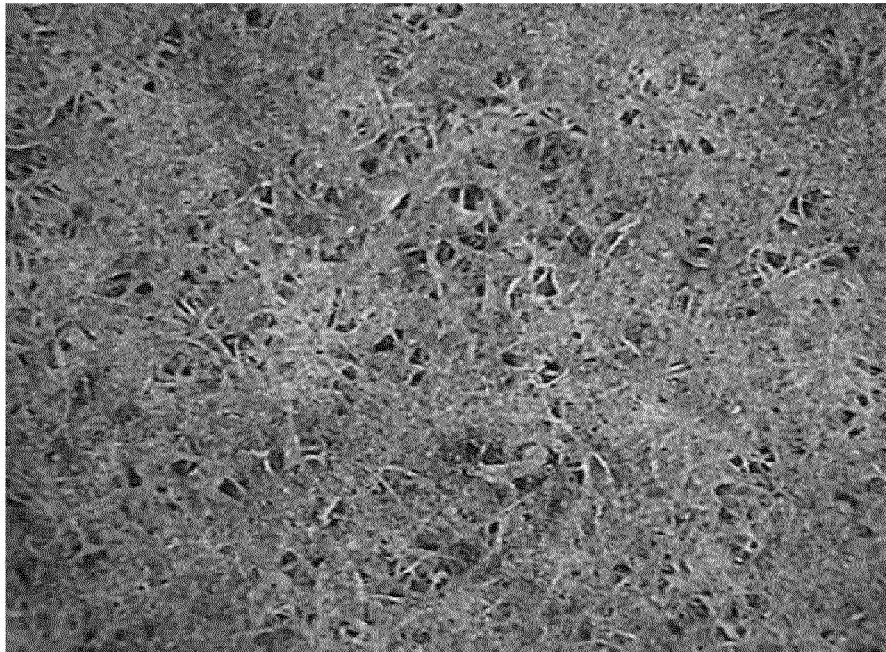


Fig. 3

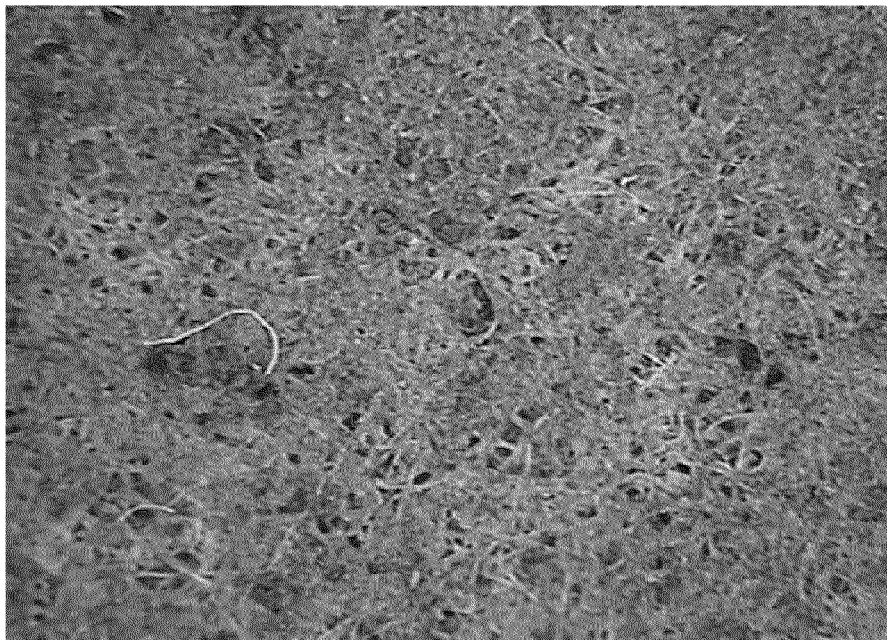


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/113252

A. CLASSIFICATION OF SUBJECT MATTER A24B 3/14(2006.01)i; A24B 15/12(2006.01)i; A24F 47/00(2020.01)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) A24B; A24F47/00																					
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) CJFD; VEN; SIPOABS; CNABS; CNKI: 干法, 再造烟叶, 透气度, 紧度, 压光, 颗粒, 粒径; dry, reconstituted tobacco, coat, air permeability, tightness, particle, press																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>PX</td> <td>CN 110833201 A (SICHUAN SANLIAN NEW MATERIAL CO., LTD. et al.) 25 February 2020 (2020-02-25) claims 1-10</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 109875097 A (CHINA TOBACCO GUANGDONG INDUSTRIAL CO., LTD. et al.) 14 June 2019 (2019-06-14) description, paragraphs 5-54</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 108451001 A (CHINA TOBACCO YUNNAN INDUSTRIAL CO., LTD.) 28 August 2018 (2018-08-28) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>US 5584306 A (BEAUMAN EMORY et al.) 17 December 1996 (1996-12-17) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>US 4989620 A (PHILIP MORRIS INC.) 05 February 1991 (1991-02-05) entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 104824824 A (SHAANXI LIGONG MECHANICAL AND ELECTRICAL TECHNOLOGY CO., LTD.) 12 August 2015 (2015-08-12) entire document</td> <td>1-10</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	PX	CN 110833201 A (SICHUAN SANLIAN NEW MATERIAL CO., LTD. et al.) 25 February 2020 (2020-02-25) claims 1-10	1-10	A	CN 109875097 A (CHINA TOBACCO GUANGDONG INDUSTRIAL CO., LTD. et al.) 14 June 2019 (2019-06-14) description, paragraphs 5-54	1-10	A	CN 108451001 A (CHINA TOBACCO YUNNAN INDUSTRIAL CO., LTD.) 28 August 2018 (2018-08-28) entire document	1-10	A	US 5584306 A (BEAUMAN EMORY et al.) 17 December 1996 (1996-12-17) entire document	1-10	A	US 4989620 A (PHILIP MORRIS INC.) 05 February 1991 (1991-02-05) entire document	1-10	A	CN 104824824 A (SHAANXI LIGONG MECHANICAL AND ELECTRICAL TECHNOLOGY CO., LTD.) 12 August 2015 (2015-08-12) entire document	1-10
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<table border="0"> <tr> <td style="vertical-align: top;"> * 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 </td> <td style="vertical-align: top;"> “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 </td> </tr> </table>	* 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																			
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Date of the actual completion of the international search 16 November 2020	Date of mailing of the international search report 26 November 2020																				
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.																				

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INTERNATIONAL SEARCH REPORT

International application No. PCT/CN2020/113252

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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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A	GB 1214049 A (ICI LTD.) 25 November 1970 (1970-11-25) entire document	1-10

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/113252

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 110833201 A	25 February 2020	None	
CN 109875097 A	14 June 2019	None	
CN 108451001 A	28 August 2018	None	
US 5584306 A	17 December 1996	None	
US 4989620 A	05 February 1991	None	
CN 104824824 A	12 August 2015	CN 104824824 B	08 June 2016
CN 103082392 A	08 May 2013	CN 103082392 B	04 February 2015
GB 1214049 A	25 November 1970	None	

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REFERENCES CITED IN THE DESCRIPTION

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