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(54) **ON-LINE PERFORATING STRUCTURE AND METHOD FOR TIPPING PAPER BASED ON CIGARETTE DATA DETECTION**

(57) The present disclosure provides an on-line perforating structure and method for tipping paper based on tobacco rod data detection, and relates to the technical

field of tobacco rod preparation. The on-line perforating structure includes a tobacco rod making part, a tobacco rod assembling part, a cutting part, a conveying part, a laser beam perforating part, a first detector head, a second detector head and a third detector head, wherein the third detector head includes an isotope scanner and infrared probes, and the laser beam perforating part includes laser output heads and a power controller; both the first detector head and the second detector head are electrically connected with the isotope scanner; and both the infrared probes and the isotope scanner are electrically connected with the power controller. The present disclosure has the advantages that the settings are simple; the detector heads additionally arranged are configured to acquire materials, thicknesses and number of layers of the tipping paper and the wrapping paper, and feed back the paper data to the laser beam perforating part in real time, and therefore the power of the laser beam perforating part is allowed to be regulated as required to effectively ensure the perforation of the tipping paper and the wrapping paper; the laser beam perforating power is allowed to be regulated according to the compactness of the tows to ensure the ventilation rate of the tobacco rod; and the on-line perforating structure and method are applicable for perforation of different tobacco rods.

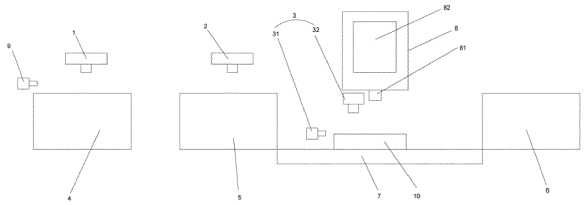

FIG.1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of tobacco rod preparation, in particular to an on-line perforating structure and method for tipping paper based on tobacco rod data detection.

BACKGROUND ART

[0002] Materials for cigarettes, mainly including "three types of paper and one filter rod" (i.e., cigarette paper, tipping paper, wrapping paper and filter rod), directly determine the physical parameters of cigarettes, affect the combustion state of the cigarettes, and play a key role in appearance quality, mainstream smoke components, sensory quality and the like of the cigarettes. The materials for cigarettes are one of main control factors for smoke indexes in cigarette production, which may be divided into a combustion end of the cigarette paper and a filtration end of the filter rod according to the action mechanism. The materials for cigarettes determine the combustion state of conventional cigarettes to some extent, and affect the proportion of the mainstream smoke components by filtration and dilution so as to influence the sensory quality of smoke finally. Design and proportioning of the parameters of materials for cigarettes are one of the most direct and simplest conventional technical approaches to improve the smoke indexes and sensory quality of the cigarettes. The materials for cigarettes determine the combustion state of conventional cigarettes to some extent, and affect the proportion of the mainstream smoke components by filtration and dilution so as to influence the sensory quality of smoke finally. Design and proportioning of the parameters of materials for cigarettes are one of the most direct and simplest conventional technical approaches to improve the smoke indexes and sensory quality of the cigarettes.

[0003] The ventilation of the tipping paper is realized in two ways, which include on-line perforation and pre-perforation. The method of pre-perforation is mostly used in production, that is, a high porosity filter rod made from high porosity wrapping paper, and a tobacco column are assembled by perforated tipping paper (electrostatic perforation or laser beam perforation). The mainstream smoke is diluted or reduced by ventilation of the filter rod to achieve the purpose of tar reduction. Linear circumferential perforation is applied to the tipping paper currently. Perforated zones are generally controlled at 1 to 5 rows, and 10 to 25 holes are allowed to be formed in each row according to the diameter of the cigarettes.

[0004] Furthermore, a laser beam on-line perforating mechanism is simplex mechanical currently, and only the power and time of laser beam perforation are set to perforate the tipping paper and the wrapping paper. For example, Chinese patent for invention CN101862910A has disclosed a parallel laser beam perforating method for cigarette tipping paper, which included the steps of coupling and transmitting K numbered branches of pulse laser beams output from a laser array consisting of K numbered branches of pulse lasers which are arranged in parallel by utilizing a light path transformation system, and then focusing on a surface of cork paper which is in continuous motion so as to form K numbered branches of perforating pulse laser which are closely arranged in a straight line or an oblique line along the width direction of the cork paper; detecting the motion speed of the cork paper in real time by an on-line speed detection system of the cork paper, feeding back the speed information to a control system, and controlling the bright dipping timing sequence, pulse frequency and pulse interval of the pulse lasers in the laser array through a control signal sent from the control system; and perforating the surface of the cork paper to form small holes distributed in a mode of figures or characters in cooperation with the continuous motion of the cork paper, wherein K is between 2 and 10. The above disclosure has further provided a device for implementing the above method, and the device features simple structure, stable operation and high processing efficiency.

TECHNICAL PROBLEM

[0005] However, the above laser beam perforating method still has the following problems that during perforation in the tipping paper, as the positions of the tipping paper on different tobacco rods, number of layers of filter rod wrapping paper, and lap positions of the tipping paper are different, by taking perforation of the most extreme ternary composite filer rod cigarette as an example (the perforating position is at the lap position of the tipping paper), if the lap positions of filer base rod wrapping paper, primary compound wrapping paper and secondary compound wrapping paper are all located at the same position, during the on-line perforation of the tipping paper, 8 layers of paper need to be perforated at the lap position, while only 4 layers of paper need to be perforated at other positions; as the power of laser beam perforating equipment is the same, and the perforating positions are unfixed (the number of layers of paper to be perforated is between 4 and 8), the paper may be not perforated due to more layers of paper at some positions, and consequently the ventilation effect cannot be achieved. According to the proportion of a lap width of 2 mm to the cigarette circumference (17 mm for slim cigarettes, 20 mm for medium cigarettes, and 24 mm for conventional cigarettes), the 10% ventilation rate is generally affected if no perforation is not implemented at the lap position, thereby resulting in large fluctuation of tar and sensory quality; and furthermore, the filling property of tow in the filter rod cannot be detected, and therefore dynamic change cannot be implemented according to the difference of the internal tow compactness.

[0006] Therefore, in order to solve the above problems,

it is necessary for us to design a reasonable and efficient on-line perforating structure for tipping paper based on tobacco rod data detection.

TECHNICAL SOLUTION

[0007] The present disclosure aims to provide an on-line perforating structure for tipping paper based on tobacco rod data detection, which has the advantages that the settings are simple; detector heads additionally arranged are configured to acquire materials, thickness and number of layers of tipping paper and wrapping paper, and feed back the paper data to a laser beam perforating part in real time, and therefore the power of the laser beam perforating part is regulated as required to effectively ensure the perforation of the tipping paper and the wrapping paper; the laser beam perforating power is allowed to be regulated according to the compactness of the tows to ensure the ventilation rate of the tobacco rod; and the tipping paper on-line perforating structure and method are applicable for perforation of different tobacco rods.

[0008] In order to fulfill the above objective, the present disclosure provides the following technical solution:

[0009] An on-line perforating structure for tipping paper based on tobacco rod data detection includes a tobacco rod making part, a tobacco rod assembling part, a cutting part, a conveying part arranged between the tobacco rod assembling part and the cutting part, a laser beam perforating part arranged above the conveying part, a first detector head arranged on a side face of the tobacco rod making part and configured to acquire a material of wrapping paper, a second detector head arranged on a side face of the tobacco rod assembling part and configured to acquire a material of tipping paper, and a third detector head arranged at the conveying part, wherein the third detector head includes an isotope scanner and infrared probes, and the laser beam perforating part includes laser output heads and a power controller electrically connected with the laser output heads; the isotope scanner is arranged in an axial extension direction of a tobacco rod on the conveying part, and both the first detector head and the second detector head are electrically connected with the isotope scanner; and both the infrared probes and the laser output heads are arranged in a radial extension direction of the tobacco rod on the conveying part, and both the infrared probes and the isotope scanner are electrically connected with the power controller.

[0010] As a preference of the present disclosure, a fourth detector head configured to acquire a material of tows in the tobacco rod is further arranged on the side face of the tobacco rod making part, and the fourth detector head is arranged in the axial extension direction of the tobacco rod on the tobacco rod making part.

[0011] As a preference of the present disclosure, both the infrared probes and the isotope scanner are electrically connected with the fourth detector head.

[0012] As a preference of the present disclosure, fixtures used for clamping and rotating the tobacco rod are arranged on the conveying part.

[0013] As a preference of the present disclosure, at least one laser output head is provided.

[0014] As a preference of the present disclosure, if one laser output head is provided, the fixtures are connected with telescopic rods used for driving the fixtures to move in the axial extension direction of the tobacco rod.

[0015] As a preference of the present disclosure, if at least two laser output heads are provided, the plurality of laser output heads are arranged in a straight line, and the straight line along which the plurality of laser output heads are arranged is parallel with the axial extension direction of the tobacco rod.

[0016] As a preference of the present disclosure, at least one infrared probe is provided.

[0017] The present disclosure further provides an on-line perforating method of the on-line perforating structure for tipping paper based on tobacco rod data detection, which includes the following steps:

S1: acquiring a material of wrapping paper of a tobacco rod by a first detector head when the tobacco rod is made at a tobacco rod making part;

S2: acquiring a material of tipping paper of the tobacco rod by a second detector head when the tipping paper is bonded on the made tobacco rod through a tobacco rod assembling part;

S3: scanning the wrapping paper and the tipping paper by an isotope scanner arranged in an axial extension direction of the tobacco rod when the assembled tobacco rod passes through a conveying part, and generating thicknesses and number of layers of the wrapping paper and the tipping paper based on the materials of the wrapping paper and the tipping paper obtained in steps S1 and S2;

S4: controlling and regulating output power of laser output heads to perforate the tobacco rod by a power controller arranged in a laser beam perforating part above the conveying part after the materials, thicknesses and number of layers of the wrapping paper and the tipping paper are acquired;

S5: acquiring real-time laser beam perforating images by infrared probes arranged in a radial extension direction of the tobacco rod to regulate the output power of the laser output heads; and

S6: conveying the perforated tobacco rod to a cutting part for cutting through the conveying part.

[0018] As a preference of the present disclosure, the method further includes the steps of acquiring a material of tows in the tobacco rod by a fourth detector head at the

tobacco rod making part when performing step S1;

acquiring surface areas of the tipping paper, the wrapping paper and the tows by the isotope scanner when performing step S3, and further acquiring a compactness of the tows while acquiring the thicknesses and number of layers of the wrapping paper and the tipping paper;

acquiring the compactness of the tows by the controller to regulate the output power of the laser output heads when performing step S4; and

further acquiring a temperature change at a perforating position by the infrared probes when performing step S5, and judging whether the tows are burnt or not, if yes, reducing the output power of the laser output heads, or else, skipping the operation.

BENEFICIAL EFFECTS

[0019] The on-line perforating structure and method for the tipping paper based on tobacco rod data detection in the present disclosure have the beneficial effects that the settings are simple; the detector heads additionally arranged are configured to acquire materials, thickness and number of layers of the tipping paper and the wrapping paper, and feed back the paper data to the laser beam perforating part in real time, and therefore the power of the laser beam perforating part is allowed to be regulated as required to effectively ensure the perforation of the tipping paper and the wrapping paper; the laser beam perforating power is allowed to be regulated according to the compactness of the tows to ensure the ventilation rate of the tobacco rod; and the on-line perforating structure and method are applicable for perforation of different tobacco rods.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a structural schematic diagram of an overall structure in an embodiment of an on-line perforating structure for tipping paper based on tobacco rod data detection according to the present disclosure;

FIG. 2 is a schematic diagram illustrating a position of a third detector head in an embodiment of an on-line perforating structure for tipping paper based on tobacco rod data detection according to the present disclosure;

FIG. 3 is a flow diagram of an on-line perforating method of an on-line perforating structure for tipping paper based on tobacco rod data detection according to the present disclosure;

[0021] In the drawings: 1. First detector head, 2. Second detector head, 3. Third detector head, 31. Isotope scanner, 32. Infrared probe, 4. Tobacco rod making part, 5. Tobacco rod assembling part, 6. Cutting part, 7. Conveying part, 8. Laser beam perforating part, 81. Laser output head, 82. Power controller, 9. Fourth detector head, 10. Tobacco rod, 101. Laser hole.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] The followings are specific embodiments of the present disclosure, the technical solutions of the present disclosure are further described, but the present disclosure is not limited to these embodiments.

[0023] Exemplary embodiments of the present disclosure will be described in detail with reference to the drawings. It should be noted that unless otherwise specified, relative arrangement and steps of modules and steps illustrated in these embodiments do not limit the scope of the present disclosure.

[0024] Meanwhile, it should be understood that in order to facilitate description, flows in the drawings are not merely performed alone, but a plurality of steps are performed in a cross-over manner.

[0025] In the description of the present disclosure, it should be understood that orientation or position relationships indicated by terms "center", "upper", "lower", "left", "right", "vertical", "horizontal", "inner", "outer", and the like are orientation or position relationships shown in the drawings, or orientation or position relationships based on which products of the present disclosure are usually placed, are adopted not to indicate or imply that indicated devices or elements must be in specific orientations or structured and operated in specific orientations but only to conveniently describe the present disclosure and simplify description, and thus should not be understood as a limitation to the present disclosure. In addition, terms "first", "second" and the like are merely for distinguishing description and should not be understood as indication or implication of relative importance.

[0026] The following description of at least one exemplary embodiment is actually illustrative merely, and never acts as any limitation to the present disclosure or application or use thereof.

[0027] Technologies, methods and systems known to those of ordinary skill in the related art may not be discussed in detail, but are to be regarded as a part of the granted specification where appropriate.

[0028] Embodiment 1: As shown in FIG. 1 and FIG. 2, it is one of embodiments of the present disclosure; an on-line perforating structure for tipping paper based on tobacco rod data detection includes a tobacco rod making part 4, a tobacco rod assembling part 5, a cutting part 6, a conveying part 7 arranged between the tobacco rod assembling part 5 and the cutting part 6, a laser beam perforating part 8 arranged above the conveying part 7, a first detector head 1 arranged on a side face of the tobacco rod making part 4 and configured to acquire a

material of wrapping paper, a second detector head 2 arranged on a side face of the tobacco rod assembling part 5 and configured to acquire a material of tipping paper, and a third detector head 3 arranged at the conveying part 7, wherein the third detector head 3 includes an isotope scanner 31 and infrared probes 32, and the laser beam perforating part 8 includes laser output heads 81 and a power controller 82 electrically connected with the laser output heads 81; the isotope scanner 31 is arranged in an axial extension direction of a tobacco rod on the conveying part 7, and both the first detector head 1 and the second detector head 2 are electrically connected with the isotope scanner 31; and both the infrared probes 32 and the laser output heads 81 are arranged in a radial extension direction of the tobacco rod on the conveying part 7, and both the infrared probes 32 and the isotope scanner 31 are electrically connected with the power controller 82.

[0029] In the present disclosure, a production process of the tobacco rod is as follows: tows for the tobacco rod and a filter rod are wrapped with the wrapping paper at the tobacco rod making part 4, and then conveyed to the tobacco rod assembling part 5 for filter assembling; in the tobacco rod assembling part 5, the tipping paper is led out of a bobbin device, and sliced by a tipping paper cutting drum after passing through an automatic tipping paper splicer, a paper feed roller and an adhesive dispensing device; the tipping paper is bonded on an outer side of the tobacco rod wrapped with the wrapping paper after being conveyed to a close-up and aligning drum, and subjected to rolling and drying by heating, and therefore adhesive on the tipping paper is iron-dried; finally, the assembled filter rod is conveyed to the cutting part 6 through the conveying part 7 for cutting to obtain a subsequent in-process tobacco rod; and the laser beam perforating part 8 is arranged above the conveying part 7, and configured to perforate the peripheral side of the tobacco rod.

[0030] In the embodiment, the first detector head 1 configured to acquire the material of the wrapping paper is arranged on the side face of the tobacco rod making part 4, the second detector head 2 configured to acquire the material of the tipping paper is arranged on the side face of the filter rod assembling part 5, and the third detector head 3 is arranged at the conveying part 7, wherein the third detector head 3 includes the isotope scanner 31 and the infrared probes 32, and the laser beam perforating part 8 includes the laser output heads 81 and the power controller 82 electrically connected with the laser output heads 81.

[0031] Then, when the tobacco rod is made at the tobacco rod making part 4, the first detector head 1 is allowed to acquire the material of the wrapping paper, and send it to the isotope scanner 31; when the tobacco rod is assembled at the tobacco rod assembling part 5, the second detector head 2 is allowed to acquire the material of the tipping paper, and send it to the isotope scanner 31; before the tobacco rod arriving at the conveying part 7 is perforated at the laser beam perforating part 8, the isotope scanner 31 takes a cross section image of the tobacco rod, and the thicknesses and number of layers of the wrapping paper and the tipping paper can be obtained according to the previously obtained materials of the wrapping paper and the tipping paper based on distribution of surface areas of different materials, and fed back to the power controller 82; and the power controller 82 generates corresponding power parameters and send them to the laser output heads 81, and the side face of the tobacco rod 10 is perforated by laser beams of the leaser output heads 81 to form laser holes 101.

[0032] Furthermore, the infrared probes 32 of the third detector head 3 detect temperature of the laser holes 101 in real time to avoid the situation that the cut tobacco tows in the tobacco rod are burnt due to over-high temperature during laser beam perforation and consequently the suction quality of cigarettes is affected. The burning temperature of the wrapping paper and the tipping paper is different from that of the tows herein; the infrared probes 32 detect the temperature of the perforating position in real time, and send signals to the power controller 82 once the cut tobacco tows are burnt, to correct laser beam perforating parameters, that is, the output power of the laser output heads 81 is reduced; and otherwise, the wrapping paper and the tipping paper are perforated by laser burning, and no correction signals are sent.

[0033] Certainly, the laser holes 101 are formed in the periphery of the tobacco rod 10 in the transverse direction, that is, the tobacco rod is allowed to rotate, and thus is circumferentially perforated; moreover, a plurality of rows of laser holes are formed sometimes (as shown in FIG. 2), and as a result, the distribution and number of layers of paper at different positions are not the same; the isotope scanner 31 acquires the parameters of the paper on the side close to the laser output heads 81, and then sends them to the power controller 82; and the above operation is repeated for many times in the tobacco rod rotating process.

[0034] In this way, regardless of the position of the tipping paper, the overlapping position of the tipping paper and the wrapping paper or the lap position of the tipping paper, the paper is ensured to be perforated based on different distribution and number of layers of the paper, with no cut tobacco tows burnt, and thus the ventilation rate of the tobacco rod is ensured effectively.

[0035] It should be noted that a fourth detector head 9 configured to acquire the material of the tows in the tobacco rod is further arranged on the side face of the filter rod making part 4, and the fourth detector head 9 is arranged in the axial extension direction of the filter rod on the filter rod making part 4; that is, when the tobacco rod is made, the fourth detector head 9 acquires the material of the tows in the tobacco rod, and sends it to the isotope scanner 31; the isotope scanner 31 is also allowed to generate a surface area distribution diagram of the material according to the material of the tows during image scanning, and then a filling compactness (also called

density) of the cut tobacco tows filled in the inner side of the wrapping paper can be obtained, and sent to the power controller 82; and the power controller 82 properly corrects the output power of the laser output heads 81 according to the compactness of the cut tobacco tows.

[0036] Generally, if the tows in the tobacco rod are compact, a filtration area is relatively small, and the output power of the laser output heads 81 should be higher to improve the ventilation effect of this part and increase the ventilation rate; on the contrary, if the tows are loose, the filtration area is large, and the output power of the laser output heads 81 needs to be lower to reduce the ventilation effect of this part, so as to achieve a stable ventilation rate of the tows with different compactness.

[0037] The on-line perforating structure for the tipping paper based on filter rod data detection in the present disclosure has the advantages that the settings are simple; the detector heads additionally arranged are configured to acquire materials, thicknesses and number of layers of the tipping paper and the wrapping paper and feed back the paper data to the laser beam perforating part in real time, and therefore the power of the laser beam perforating part is allowed to be regulated as required to effectively ensure the perforation of the tipping paper and the wrapping paper; the laser beam perforating power is allowed to be regulated according to the compactness of the tows to ensure the ventilation rate of the filter rod; and the on-line perforating structure and method are applicable for perforation of different filter rods.

[0038] Embodiment 2, as shown in FIG. 1 and FIG. 2, it is one of embodiments of the present disclosure; on the basis of Embodiment 1, in an on-line perforating structure for tipping paper based on filter rod data detection in the present disclosure, fixtures used for clamping and rotating a tobacco rod are arranged on a conveying part 7, and used for preventing the tobacco rod 10 from moving randomly, and rotating the tobacco rod for circumferential perforation.

[0039] Moreover, at least one laser output head 81 is provided.

[0040] If one laser output head 81 is provided, the fixtures are connected with telescopic rods used for driving the fixtures to move in an axial extension direction of the tobacco rod; and the telescopic rods are preferably multistage telescopic links, and a telescoping length of the telescopic links in one time is a distance between two rows of laser holes 101.

[0041] On the contrary, if at least two laser output heads 81 are provided, the plurality of laser output heads 81 are arranged in a straight line, and the straight line along which the plurality of laser output heads 81 are arranged is parallel with the axial extension direction of the tobacco rod.

[0042] Finally, at least one infrared probe 32 is provided. The plurality of infrared probes 32 are arranged around the laser output heads 81, and the orientation of the infrared probes 32 is the same as that of the laser output heads 81; and therefore, the condition of the perforating position of the laser output heads 81 is allowed to be observed, and the power of the laser output heads 81 is corrected.

[0043] Actually, the infrared probes 32 are allowed to be directly arranged on a front end face of the laser beam perforating part 8, surrounding the laser output heads 81.

[0044] Embodiment 3, as shown in FIG. 3, the present disclosure further provides an on-line perforating method of the on-line perforating structure for the tipping paper based on filter rod data detection in the above embodiment, including the following steps:

S 1: a material of wrapping paper of a tobacco rod is acquired by a first detector head when the tobacco rod is made at a tobacco rod making part;

S2: a material of the tipping paper of the tobacco rod is acquired by a second detector head when the tipping paper is bonded on the made tobacco rod through a tobacco rod assembling part;

S3: the wrapping paper and the tipping paper are scanned by an isotope scanner arranged in an axial extension direction of the tobacco rod when the assembled tobacco rod passes through a conveying part, and thicknesses and number of layers of the wrapping paper and the tipping paper are generated based on the materials of the wrapping paper and the tipping paper obtained in steps S1 and S2;

S4: output power of laser output heads is controlled and regulated to perforate the tobacco rod by a power controller arranged in a laser beam perforating part above the conveying part after the materials, thicknesses and number of layers of the wrapping paper and the tipping paper are acquired;

S5: real-time laser beam perforating images are acquired by infrared probes arranged in a radial extension direction of the tobacco rod to regulate the output power of the laser output heads; and

S6: the perforated tobacco rod is conveyed to a cutting part for cutting through the conveying part.

[0045] A fourth detector head acquires a material of tows in the tobacco rod at the tobacco rod making part when step S 1 is performed herein;

the isotope scanner acquires surface areas of the tipping paper, the wrapping paper and the tows when step S3 is performed, and further acquires a compactness of the tow while acquiring the thicknesses and number of layers of the wrapping paper and the tipping paper;

the controller acquires the compactness of the tows

to regulate the output power of the laser output heads when step S4 is performed; and

the infrared probes further acquire a temperature change at a perforating position when step S5 is performed, and judge whether the tows are burnt or not; if yes, the output power of the laser output heads will be reduced, or else no operation will not be performed.

[0046] The on-line perforating structure for the tipping paper based on cigarette data detection in the present disclosure has the advantages that the settings are simple; the detector heads additionally arranged are configured to acquire materials, thickness and number of layers of tipping paper and wrapping paper, and feed back the paper data to a laser beam perforating part in real time, and therefore the power of the laser beam perforating part is regulated as required to effectively ensure the perforation of the tipping paper and the wrapping paper; the laser beam perforating power is allowed to be regulated according to the compactness of the tows to ensure the ventilation rate of the tobacco rod; and the on-line perforating structure and method are applicable for perforation of different tobacco rods.

[0047] The present disclosure is not limited to the above specific implementations, and may have various replacements and changes. Any modification, equivalent replacement, improvement, etc. made to the above implementations according to the technical essence of the present disclosure should fall within the protection scope of the present disclosure.

Claims

1. An on-line perforating structure for tipping paper based on tobacco rod data detection, **characterized by** comprising a tobacco rod making part (4), a tobacco rod assembling part (5), a cutting part (6), a conveying part (7) arranged between the tobacco rod assembling part (5) and the cutting part (6), a laser beam perforating part (8) arranged above the conveying part (7), a first detector head (1) arranged on a side face of the tobacco rod making part (4) and configured to acquire a material of wrapping paper, a second detector head (2) arranged on a side face of the tobacco rod assembling part (5) and configured to acquire a material of tipping paper, and a third detector head (3) arranged at the conveying part (7), wherein the third detector head (3) comprises an isotope scanner (31) and infrared probes (32), and the laser beam perforating part (8) comprises laser output heads (81) and a power controller (82) electrically connected with the laser output heads (81); the isotope scanner (31) is arranged in an axial extension direction of a tobacco rod on the conveying part (7), and both the first detector head (1) and the second detector head (2) are electrically connected with the isotope scanner (31); and both the infrared probes (32) and the laser output heads (81) are arranged in a radial extension direction of the tobacco rod on the conveying part (7), and both the infrared probes (32) and the isotope scanner (31) are electrically connected with the power controller (82).

2. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 1, **characterized in that** a fourth detector head (9) configured to acquire a material of tows in the tobacco rod is further arranged on the side face of the tobacco rod making part (4), and the fourth detector head (9) is arranged in the axial extension direction of the tobacco rod on the tobacco rod making part (4).

3. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 2, **characterized in that** the isotope scanner (31) is electrically connected with the fourth detector head (9).

4. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 1, **characterized in that** fixtures used for clamping and rotating the tobacco rod are arranged on the conveying part (7).

5. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 4, **characterized in that** at least one laser output head (81) is provided.

6. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 5, **characterized in that** if one laser output head (81) is provided, the fixtures are connected with telescopic rods used for driving the fixtures to move in the axial extension direction of the tobacco rod.

7. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 5, **characterized in that** if at least two laser output heads (81) are provided, the plurality of laser output heads (81) are arranged in a straight line, and the straight line along which the plurality of laser output heads (81) are arranged is parallel with the axial extension direction of the tobacco rod.

8. The on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 1, **characterized in that** at least one infrared probe (32) is provided.

9. An on-line perforating method of the on-line perforating structure for the tipping paper based on tobacco rod data detection according to any one of claims

1-8, **characterized by** comprising the following steps:

S1: acquiring a material of wrapping paper of a tobacco rod by a first detector head when the tobacco rod is made at the tobacco rod making part;
S2: acquiring a material of tipping paper of the tobacco rod by a second detector head when the tipping paper is bonded on the made tobacco rod through a tobacco rod assembling part;
S3: scanning the wrapping paper and the tipping paper by an isotope scanner arranged in an axial extension direction of the tobacco rod when the assembled tobacco rod passes through a conveying part, and generating thicknesses and number of layers of the wrapping paper and the tipping paper based on the materials of the wrapping paper and the tipping paper obtained in steps S1 and S2;
S4: controlling and regulating output power of laser output heads to perforate the tobacco rod by a power controller arranged in a laser beam perforating part above the conveying part after the materials, thicknesses and number of layers of the wrapping paper and the tipping paper are acquired;
S5: acquiring real-time laser beam perforating images by infrared probes arranged in a radial extension direction of the tobacco rod to regulate the output power of the laser output heads; and
S6: conveying the perforated tobacco rod to a cutting part for cutting through the conveying part.

10. The on-line perforating method of the on-line perforating structure for the tipping paper based on tobacco rod data detection according to claim 9, **characterized by** further comprising the following steps:

acquiring a material of tows in the tobacco rod by a fourth detector head at the tobacco rod making part when performing step S1;
acquiring surface areas of the tipping paper, the wrapping paper and the tows by the isotope scanner when performing step S3, and further acquiring a compactness of the tows while acquiring the thicknesses and number of layers of the wrapping paper and the tipping paper;
acquiring the compactness of the tows by the controller to regulate the output power of the laser output heads when performing step S4; and
further acquiring a temperature change at a perforating position by the infrared probes when performing step S5, judging whether the tows are burnt or not, if yes, reducing the output power of the laser output heads, or else, skipping the operation.

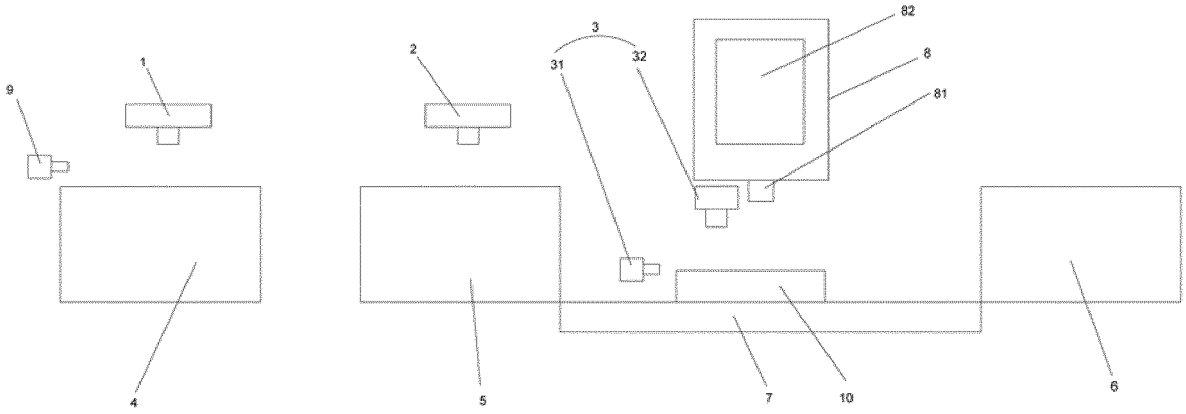

FIG.1

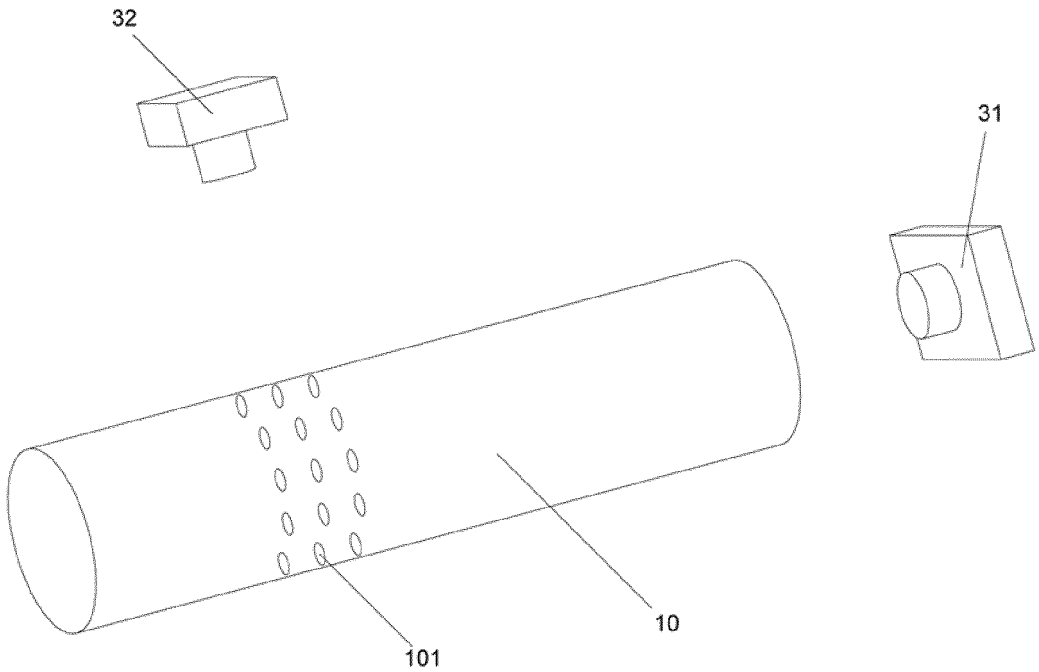

FIG.2

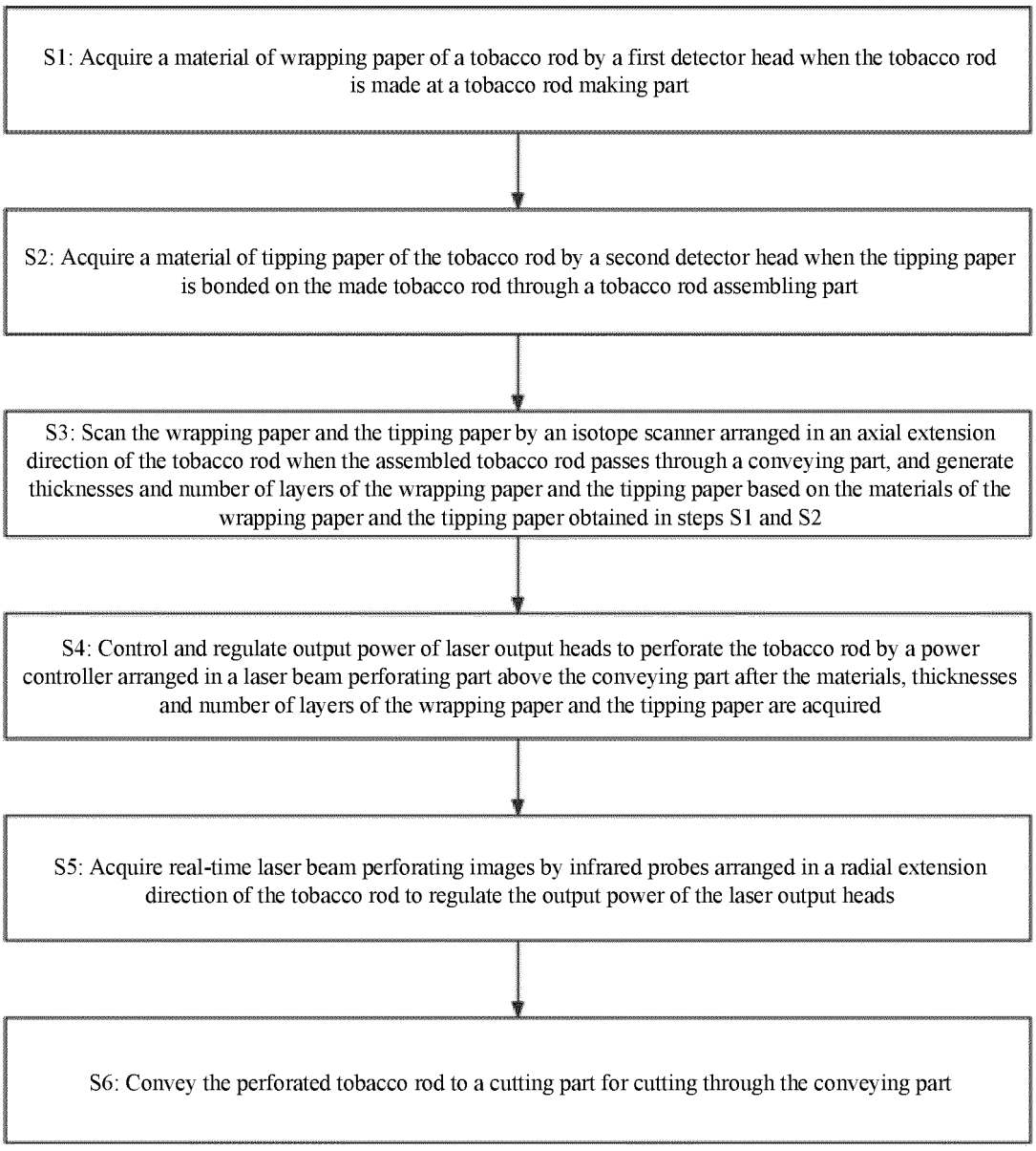
S1: Acquire a material of wrapping paper of a tobacco rod by a first detector head when the tobacco rod is made at a tobacco rod making part
S2: Acquire a material of tipping paper of the tobacco rod by a second detector head when the tipping paper is bonded on the made tobacco rod through a tobacco rod assembling part
S3: Scan the wrapping paper and the tipping paper by an isotope scanner arranged in an axial extension direction of the tobacco rod when the assembled tobacco rod passes through a conveying part, and generate thicknesses and number of layers of the wrapping paper and the tipping paper based on the materials of the wrapping paper and the tipping paper obtained in steps S1 and S2
S4: Control and regulate output power of laser output heads to perforate the tobacco rod by a power controller arranged in a laser beam perforating part above the conveying part after the materials, thicknesses and number of layers of the wrapping paper and the tipping paper are acquired
S5: Acquire real-time laser beam perforating images by infrared probes arranged in a radial extension direction of the tobacco rod to regulate the output power of the laser output heads
S6: Convey the perforated tobacco rod to a cutting part for cutting through the conveying part

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/118887

A. CLASSIFICATION OF SUBJECT MATTER

A24C 5/60(2006.01)i; A24C 5/00(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)

A24C,A24D,B23K

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)

CNTXT; WPABSC; ENTXT; WPABS; DWPI; ENTXTC; VEN; CNKI: 香烟, 卷烟, 烟支, 激光, 打孔, 穿孔, 开孔, 成型纸, 接装纸, 水松纸, 卷烟纸, 控制器, 成形纸, 探测器, 扫描仪; laser, punch, perforate, tipping paper, foriming paper, tobacco, cigarette, controller, detector, scanner

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114983006 A (CHINA TOBACCO YUNNAN INDUSTRIAL CO., LTD.) 02 September 2022 (2022-09-02) claims 1-10	1-10
A	CN 102626258 A (HAUNI MASCHINENBAU AG) 08 August 2012 (2012-08-08) description, paragraphs 44-64, and figures 1-4	1-10
A	US 4265254 A (HAUNI WERKE KOERBER & CO. KG) 05 May 1981 (1981-05-05) entire document	1-10
A	CN 110074451 A (NANJING ZHISHENGDA AUTOMATION TECHNOLOGY CO., LTD.) 02 August 2019 (2019-08-02) entire document	1-10
A	EP 3123876 A1 (JAPAN TOBACCO INC.) 01 February 2017 (2017-02-01) entire document	1-10
A	US 4249545 A (HAUNI WERKE KOERBER & CO. KG) 10 February 1981 (1981-02-10) entire document	1-10

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

* Special categories of cited documents:
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"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
22 December 2022	**19 January 2023**

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Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/118887

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/118887

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		WO 2015145747 A1	01 October 2015
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		DE 2750038 A1	10 May 1979
CN 110051035 A	26 July 2019	None	

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REFERENCES CITED IN THE DESCRIPTION

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