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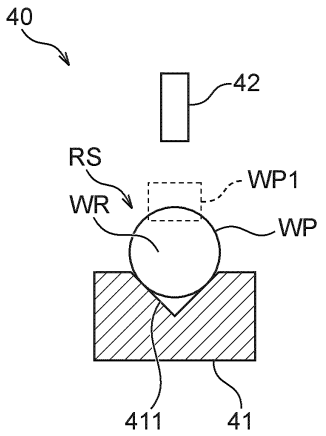
(54) **TOBACCO FILTER INSPECTION APPARATUS**

(57) Provided is a tobacco filter inspection apparatus with which it is possible to improve detection accuracy on foreign matters at a glued site of a paper web of a filter rod continuous body. The tobacco filter inspection apparatus comprises a filter supporting guide that supports a filter rod continuous body being transported, the filter rod continuous body being formed by winding a paper web on a rod member formed of filter material and sticking overlapping portions of the paper web together with glue, and a sensor arranged above the filter rod continuous body being transported along the filter supporting guide and directed to a glued site of the paper web. The filter supporting guide includes at least two flat surfaces that support the filter rod continuous body as viewed in a perpendicular cross-section to a direction that the filter rod continuous body is transported.

Fig. 3



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Description

TECHNICAL FIELD

[0001] The invention relates to tobacco filter inspection apparatus.

BACKGROUND ART

[0002] A tobacco filter (filter rod) comprises a rod member formed of filter material and a paper web wrapping the rod member. Specifically, the filter rod is formed by winding the paper web on the rod member, sticking the overlapping portions of the paper web together with glue to form a filter rod continuous body, and cutting the filter rod continuous body into predetermined length pieces.

[0003] Before the filter rod continuous body is cut into the predetermined length pieces after the overlapping portions of the paper web are stuck together with glue, an inspection apparatus is used to inspect whether there are foreign matters (glue crumbs, for example) adhering to the glued site of the paper web. The inspection apparatus comprises a filter supporting guide that supports the filter rod continuous body being transported and a sensor arranged above the filter rod continuous body being transported and directed to a glued site of the paper web.

[0004] A conventional filter supporting guide includes a U-shaped groove (hereinafter, also referred to as a U groove) as viewed in a perpendicular cross-section to the direction that the filter rod continuous body is transported. The width of the U groove is not set according to the diameter of the filter rod but set greater than the maximum diameter of the filter rod having various diameter.

[0005] The filter rod continuous body being transported is supported by the filter supporting guide only at one point at the bottom of the U groove and therefore might meander while being transported. Also if the foreign matters, after dropping during the transportation of the filter rod continuous body, are accumulated in the lower portion of the filter supporting guide, there is a possibility that the filter rod continuous body comes into contact with the foreign matters and meanders while being transported.

[0006] If the filter rod continuous body meanders while being transported, the glued site of the paper web deviates from a focus position of the sensor, which decreases detection accuracy of the inspection apparatus on foreign matters.

[0007] A measurement device used in the tobacco processing industry for measuring strands is known. Such a measurement device comprises a protection tube that transports a strand and strand guide devices arranged at the inlet and outlet of the protection tube and designed to guide the strand (see Patent Literature 1, for example). In this measurement device, three-jaw chucks are used as the strand guide devices, and a strand is radially supported at multiple points and transported within the protection tube.

CITATION LIST

PATENT LITERATURE

[0008] PTL 1: Japanese Unexamined Patent Application Publication (Kokai) No. 2013-192560

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0009] According to the measurement device disclosed in Patent Literature 1, a strand is radially supported at multiple points by means of three-jaw chucks as strand guide devices. On the other hand, the strand is not supported at multiple points in the measurement range of the measurement device and therefore might move freely. Furthermore, if the strand has a smaller diameter than the protection tube, the strand is liable to meander while being transported within the protection tube. Also if the foreign matters are accumulated in the protection tube, the strand is liable to meander while being transported within the protection tube. Detection accuracy on foreign matters therefore cannot be improved by applying the measurement device of Patent Literature 1 to the aforementioned inspection apparatus. The filter rod continuous body has the shape of a thin rod with a diameter of 8.2 mm or less. Such a thin filter rod is transported at a velocity of 500 meters or greater per minute and therefore might widely meander when making contact even with a minute foreign matter.

[0010] The invention has been made to solve the foregoing problem at least partially. An object of the invention is to obtain a tobacco filter inspection apparatus with which it is possible to improve detection accuracy on foreign matters at a glued site of a paper web of a filter rod continuous body.

SOLUTION TO PROBLEM

[0011] A first mode of the invention provides a tobacco filter inspection apparatus. The tobacco filter inspection apparatus comprises a filter supporting guide configured to support a filter rod continuous body being transported, the filter rod continuous body being formed by winding a paper web on a rod member formed of filter material and sticking overlapping portions of the paper web together with glue, and a sensor arranged above the filter rod continuous body being transported along the filter supporting guide and directed to a glued site of the paper web. The filter supporting guide includes at least two flat surfaces for supporting the filter rod continuous body as viewed in a perpendicular cross-section to a direction that the filter rod continuous body is transported. The filter rod continuous body being transported is thus supported by the filter supporting guide at the at least two flat surfaces

for supporting the filter rod continuous body, which restrains the filter rod continuous body from meandering during transportation. If foreign matters drop during the transportation of the filter rod continuous body, the foreign matters are accumulated on lower parts of the at least two flat surfaces, with which the filter rod continuous body does not come into contact. This also restrains the filter rod continuous body from meandering during transportation. It is therefore possible to improve detection accuracy on foreign matters at the glued site of the paper web of the filter rod continuous body.

[0012] In a second mode of the invention according to the first mode, the filter supporting guide is a groove having a V-like shape (hereinafter, also referred to as a V groove) as viewed in the perpendicular cross-section to the direction that the filter rod continuous body is transported. The filter rod continuous body is thus supported by the filter supporting guide at two points in the V groove and therefore restrained from meandering while being transported. If foreign matters drop during the transportation of the filter rod continuous body, the foreign matters are accumulated in a lower portion of the V groove, with which the filter rod continuous body does not come into contact. This also restrains the filter rod continuous body from meandering during transportation. It is therefore possible to improve detection accuracy on foreign matters at the glued site of the paper web of the filter rod continuous body.

[0013] In a third mode of the invention according to the first or second mode, the tobacco filter inspection apparatus further comprises a drive mechanism that is capable of moving the filter supporting guide toward or away from the sensor. Since the drive mechanism moves the filter supporting guide relative to the sensor, the filter supporting guide can be applied to filter rods with various diameters without being exchanged according to filter rod diameters.

[0014] In a fourth mode of the invention according to the third mode, the filter supporting guide includes a first flat surface and a second flat surface. An angle formed between the first flat surface and second flat surface is 2θ. The drive mechanism is capable of moving the filter supporting guide between a first position that is farthest to the sensor and a second position that is closest to the sensor. A distance between the first position and the second position is $1.4\times(1+1/\sin\theta)$ mm. This allows a conceivable range of filter rod diameter to be covered with a minimum motion amount, which makes it possible to minimize the drive mechanism.

[0015] In a fifth mode of the invention according to any one of the first to fourth modes, the tobacco filter inspection apparatus further comprises a filter holding member arranged above the filter rod continuous body being transported along the filter supporting guide so as not to interfere with the sensor and configured to regulate a vertical displacement of the filter rod continuous body being transported. This restrains the glued site of the paper web from deviating from a focus position of the sensor and improves detection accuracy on foreign matters at the glued site of the paper web of the filter rod continuous body.

[0016] In a sixth mode of the invention according to any one of the first to fifth modes, the sensor is a reflective optical sensor. This makes it possible to detect whether there are foreign matters adhering to the glued site of the paper web by measuring the amount of light reflection. The sensor therefore can perform inspection in a non-contact manner without contacting the filter rod continuous body.

[0017] In a seventh mode of the invention according to the six mode, the sensor outputs an abnormal signal to an external device when a light reflection amount at the glued site of the paper web exceeds a predetermined threshold value. Since the abnormal signal is outputted when the light reflection amount exceeds the predetermined threshold value, that is, when it is detected that foreign matters adhere to the glued site of the paper web, a filter rod manufacturing apparatus can be stopped.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

Fig. 1 is a configuration view of a filter rod manufacturing apparatus according to one embodiment of the invention.

Fig. 2 is a configuration view showing the details of an inspection section according to one embodiment of the invention.

Fig. 3 is a cross-section of the inspection section as viewed from an arrow 3-3 shown in Fig. 2.

Fig. 4 is a schematic diagram for explaining a motion amount of a drive mechanism according to one embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0019] Embodiments of the invention will be explained below with reference to the attached drawings. In the drawings below, similar or corresponding constituent elements are provided with the same reference signs, and overlapping explanations are omitted. A tobacco filter inspection apparatus according to the invention corresponds to an inspection section in a filter rod manufacturing apparatus.

[0020] In consideration that a filter rod is something the user holds in his or her mouth, a filter rod intended by the invention has a maximum diameter of 8.2 mm, a minimum diameter of 5.4 mm, and a circularity of 95% or more but less than 100%, for example.

[0021] Fig. 1 is a configuration view of a filter rod manufacturing apparatus according to one embodiment of the invention. As illustrated in Fig. 1, the filter rod manufacturing apparatus 100 roughly includes a tow processing section 10, a forming section 20, a wrapping section 30, an inspection section 40, and a cutting section 50.

[0022] The tow processing section 10 comprises a package (bale) 11 containing filter material made, for example, of cellulose acetate fibers, that is, tow T. A tow path 12 extends from the package 11. Arranged in the tow path 12 in the order from the package 11 side are a primary banding jet 13, a guide roller 14, a pair of pretension rollers 15, a pair of blooming rollers 16, and a secondary banding jet 17. The secondary banding jet 17 is positioned at the end of the tow path 12.

[0023] When the tow T passes through the primary banding jet 13, the primary banding jet 13 ejects compressed air from the package 11 side toward the tow T. The ejected compressed air opens or breaks the tow T and moderately stretches creases (crimps) in the tow T.

[0024] When the tow T reaches the guide roller 14, the guide roller 14 directs a feeding direction of the tow T toward the pair of pretension rollers 15. The tow T then passes between the pair of pretension rollers 15. At this point, the pair of pretension rollers 15 holds the tow T subjected to fiber-opening processing and applies predetermined tension to the tow T in consort with the pair of blooming rollers 16, to thereby further stretch the creases in the tow T.

[0025] When the tow T later passes between the pair of blooming rollers 16, the pair of blooming rollers 16 splits the tow T subjected to the fiber-opening processing into a plurality of bundles and feeds these bundles to the second banding jet 17.

[0026] When a split bundle of the tow T passes through the secondary banding jet17, the secondary banding jet 17 ejects the compressed air toward the split bundle. The compressed air opens the fibers of the split bundle. The split bundle is accordingly broadened in a width direction of the tow path 12 to form a flat filter web WF. The filter web WF is then delivered to the forming section 20.

[0027] The filter web WF delivered to the forming section 20 is transported toward a trumpet guide 21 and passes through the trumpet guide 21. At this point, the filter web WF is squeezed to have a rod-like shape by the trumpet guide 21 to be formed into a rod member WR. The width of the flat filter web WF is gradually reduced as the filter web WF is transported toward the trumpet guide 21. The rod member WR is thereafter delivered to the wrapping section 30.

[0028] The wrapping section 30 comprises an endless garniture tape 31. The garniture tape 31 runs on a horizontal forming bed, not shown, in a direction that the rod member WR is transported. At an inlet of the wrapping section 30, a paper web WP is fed onto the garniture tape 31.

[0029] The paper web WP is guided from a paper roll through a reservoir and a spray gun 32 to the garniture tape 31. The paper roll and the reservoir are not shown. The spray gun 32 applies adhesive agent, or so-called rail paste, to the center of the paper web WP as viewed in the width direction of the paper web WP.

[0030] The rod member WR that is fed from the trumpet guide 21 is overlaid on the paper web WP at the inlet. At this point, the rod member WR and the paper web WP are bonded together through the rail paste.

[0031] The rod member WR and the paper web WP then run on the forming bed with the garniture tape 31 and pass through a tong 33, a wrapping former 34, a heater 35, and a cooler 36 in the order named.

[0032] The tong 33 further compresses the rod member WR through the garniture tape 31 and the paper web WP in consort with the forming bed. In this process, the rod member WR is formed into a circle in cross-section, and the paper web WP and the garniture tape 31 are bent to have a U-like shape in cross-section. At this point, a lower half portion of the rod member WR is covered with the paper web WP.

[0033] In a subsequent process where the rod member WR passes through the wrapping former 34, one side edge portion of the paper web WP is covered on one side of an upper half portion of the rod member WR with the garniture tape 31 intervening therebetween. At the same time, the spray gun, not shown, of the wrapping former 34 applies seam paste to the other side edge portion of the paper web WP.

[0034] The other side edge portion of the paper web WP is then covered on the rod member WR with the garniture tape 31 intervening therebetween in a similar manner and overlaid on the one side edge portion of the paper web WP through seam paste. At this point, both side edge portions of the paper web WP are bonded together with seam paste, and the rod member WR is completely wrapped with the paper web WP, whereby a filter rod continuous body RS is formed.

[0035] The seam paste is dried when the filter rod continuous body RS formed in the wrapping former 34 passes through the heater 35. The seam paste is cooled when the filter rod continuous body RS passes through the cooler 36. On rare occasions, the seam paste sticks out of overlapping portions of the paper web WP during the aforementioned process and adheres to the paper web WP as glue crumbs.

[0036] The inspection section 40 inspects the filter rod continuous body RS formed in the wrapping section 30 as to whether there are foreign matters (glue crumbs, for example) adhering to the glued site of the paper web WP, before the filter rod continuous body RS is cut by the cutting section 50 discussed below. A specific configuration of the inspection section 40 will be discussed later.

[0037] The cutting section 50 comprises a rotating knife 51. The rotating knife 51 cuts the filter rod continuous body RS transported from the inspection section 40 into predetermined length pieces, to thereby form discrete filter rods FR.

[0038] The inspection section 40 illustrated in Fig. 1 will be explained in details with respect to Figs. 2 and 3. Fig. 2 is a configuration view showing the details of an inspection section according to one embodiment of the invention. Fig. 3 is a cross-section of the inspection section as viewed from an arrow 3-3 shown in Fig. 2. In Figs. 2 and 3, the inspection section 40 comprises a filter sup-

porting guide 41, a sensor 42, a drive mechanism 43, and a brush (filter holding member) 44.

[0039] The filter supporting guide 41 is horizontally provided between the wrapping section 30 and the cutting section 50. The filter supporting guide 41 supports the filter rod continuous body RS transported from the wrapping section 30 and passes the filter rod continuous body RS to the cutting section 50.

[0040] The sensor 42 is arranged above the filter rod continuous body RS transported along the filter supporting guide 41 and directed to a glued site WP1 of the paper web WP. In other words, the sensor 42 is so arranged that a focus position thereof comes to the glued site WP1 of the paper web WP. The sensor 42 does not necessarily have to be arranged immediately above the filter rod continuous body RS as long as the focus position comes to the glued site WP1 of the paper web WP.

[0041] The sensor 42 is preferably a reflective optical sensor. Amount of light reflection from the glued site WP1 of the paper web WP changes depending on the state of the glued site WP1. Whether foreign matters adhere to the glued site WP1 of the paper web WP therefore can be detected by measuring the amount of light reflection. As the sensor 42 thus configured, for example, a FU-35FZ (produced by Keyence Corporation) may be utilized.

[0042] If a reflective optical sensor is utilized as the sensor 42 to measure the amount of light reflection, it is possible to detect the presence of foreign matters adhering to the glued site WP1 of the paper web WP. The inspection sensor 42 therefore can perform the inspection in a non-contact manner without contacting the filter rod continuous body RS.

[0043] The sensor 42 determines that foreign matters adhere to the glued site WP1 of the paper web WP when the amount of light reflection at the glued site WP1 of the paper web WP exceeds a predetermined threshold value, and may output an abnormal signal to an external device that controls the operation of the filter rod manufacturing apparatus 100. If the sensor 42 is configured this way, when the amount of light reflection exceeds the predetermined threshold value, that is, when it is detected that foreign matters adhere to the glued site WP1 of the paper web WP, the filter rod manufacturing apparatus 100 can be stopped.

[0044] As illustrated in Fig. 3, the filter supporting guide 41 includes a V-shaped groove (V groove) 411 in a perpendicular cross-section to a direction that the filter rod continuous body RS is transported. The transported filter rod continuous body RS is therefore supported by the filter supporting guide 41 at two points in the V groove 411, regardless of filter rod diameter. This restrains the filter rod continuous body RS from meandering during transportation.

[0045] In a case where foreign matters drop during the transportation of the filter rod continuous body RS, the foreign matters are accumulated in a lower portion of the V groove 411, with which the filter rod continuous body RS does not come into contact. This also restrains the filter rod continuous body RS from meandering during transportation.

[0046] Since the filter rod continuous body RS is restrained from meandering while being transported as described, it is possible to improve detection accuracy on foreign matters at the glued site WP1 of the paper web WP of the filter rod continuous body RS in the inspection section 40.

[0047] Furthermore, the portions of the rod member WR and the paper web WP which are bonded together with the rail paste becomes a lower part of the filter rod continuous body RS during transportation, and the lower part of the filter rod continuous body RS does not interfere with the lower portion of the V groove 411. Therefore, even if excess rail paste overflows from the paper web WP to be accumulated in the lower portion of the V groove 411, this does not cause the filter rod continuous body RS to meander during transportation.

[0048] The filter supporting guide 41 is described as including the V-shaped groove (V groove) 411 as viewed in the perpendicular cross-section to the direction that the filter rod continuous body RS is transported. However, the filter supporting guide does not necessarily have to be configured that way and may include at least two flat surfaces for supporting a filter rod continuous body. In such a case, too, the filter rod continuous body being transported is supported by the filter supporting guide on at least two flat surfaces for supporting the filter rod continuous body, regardless of filter rod diameter. This restrains the filter rod continuous body from meandering during transportation. In the case where foreign matters drop during the transportation of the filter rod continuous body, the foreign matters are accumulated at lower parts of the at least two flat surfaces, with which the filter rod continuous body does not come into contact. This also restrains the filter rod continuous body from meandering during transportation.

[0049] The drive mechanism 43 is configured to be capable of moving the filter supporting guide 41 toward or away from the sensor 42. To be specific, the drive mechanism 43 may comprise jackscrews or jack motors that are provided at both ends of the filter supporting guide 41 and configured to adjust the position (height) of the filter supporting guide 41 in relation to the sensor 42. Since the drive mechanism 43 moves the filter supporting guide 41 relative to the sensor 42, the filter supporting guide 41 can be applied to filter rods having various diameters without being exchanged according to filter rod diameter.

[0050] Motion amount by which the drive mechanism 43 illustrated in Figs. 2 and 3 moves the filter supporting guide 41 will be discussed below with reference to Fig. 4. Fig. 4 is a schematic diagram for explaining motion amount of a drive mechanism according to one embodiment of the invention.

[0051] In Fig. 4, the left-side drawing shows a situation where the filter supporting guide 41 supports the filter rod

continuous body RS having a conceivable maximum diameter of 8.2 mm and is located at a first position that is farthest to the sensor 42. In

[0052] Fig. 4, the right-side drawing shows a situation where the filter supporting guide 41 supports the filter rod continuous body RS having a conceivable minimum diameter of 5.4 mm and is located at a second position that is closest to the sensor 42.

[0053] At this point, the drive mechanism 43 is configured to be capable of moving the filter supporting guide 41 between the first position and the second position. A first-to-second position motion amount X can be set as below. The filter supporting guide 41 includes a first flat surface 412 and a second flat surface 413 which configure the V groove 411, and an angle formed between the first flat surface 412 and the second flat surface 413 is 2θ.

[0054] Assuming that the filter supporting guide 41 is located at the first position, a distance X1 from the sensor 42 at the first position to the lowest portion of the V groove 411 is obtained by the following expression (1), where L is a distance from the sensor 42 to the glued site WP1 of the paper web WP, and r1 is radius of the filter rod continuous body RS.

$$X1=L+r1+r1/\sin\theta \quad \ldots(1)$$

[0055] Assuming that the filter supporting guide 41 is located at the second position, a distance X2 from the sensor 42 at the second position to the lowest portion of the V groove 411 is obtained by the following expression (2), where L is a distance from the sensor 42 to the glued site WP1 of the paper web WP, and r2 is radius of the filter rod continuous body RS.

$$X2=L+r2+r2/\sin\theta \quad \ldots(2)$$

[0056] The first-to-second position motion amount X is therefore obtained by the following expression (3).

$$\begin{aligned} X&=X1-X2\\ &=(r1+r1/\sin\theta)-(r2+r2/\sin\theta)\\ &=(r1-r2)+(r1-r2)(1/\sin\theta)\\ &=(r1-r2)(1+1/\sin\theta) \quad \ldots(3) \end{aligned}$$

[0057] In consideration that a filter rod is something the user holds in his or her mouth, a filter rod intended by the invention has a maximum diameter (2r1) of 8.2 mm and a minimum diameter (2r2) of 5.4 mm. Accordingly, the motion amount X of the drive mechanism 43 can be expressed by $1.4 \times (1+1/\sin\theta)$ mm. A conceivable range of filter rod diameter therefore can be covered with a minimum motion amount. This makes it possible to minimize the drive mechanism 43.

[0058] The brush 44 is arranged above the filter rod continuous body RS transported along the filter supporting guide 41 so as not to interfere with the sensor 42. The brush 44 regulates a vertical displacement of the filter rod continuous body RS by coming into contact with the filter rod continuous body RS being transported. This restrains the glued site WP1 of the paper web WP from deviating from a focus position of the sensor 42 and improves detection accuracy on foreign matters at the glued site WP1 of the paper web WP of the filter rod continuous body RS.

[0059] An attachment position for the brush 44 and the number of brushes 44 to be attached are not limited to those illustrated in Fig. 2. The brush 44 may comprise one or more than three brushes 44. If the brush 44 is provided closer to the wrapping section 30 than to the sensor 42, the foreign matters adhering to the glued site WP1 of the paper web WP can be removed before inspection. If the brush 44 is provided immediately before the cutting section 50, the brush 44 holds the filter rod continuous body RS, which facilitates the cutting by the rotating knife 51.

[0060] In the inspection section 40 according to one embodiment of the invention, the filter supporting guide 41 does not surround the sensor 42. Accordingly, even if there is a significant change in the outer shape of the filter rod continuous body RS or if the filter supporting guide 41 deviates from a proper position, a transportation path of the filter rod continuous body RS is not closed. Furthermore, there is space above the filter supporting guide 41, which makes it possible to remove the foreign matters accumulated in the lower portion of the V groove 411 without difficulty and therefore achieve good maintainability.

[0061] According to the inspection section 40 thus configured, the filter rod continuous body RS is restrained from meandering while being transported. Therefore, as long as the sensor 42 is properly installed, and sensor application is properly set, it is possible to detect foreign matters (glue crumbs, for example) having a diameter of 0.5 mm or more when the filter rod continuous body RS runs at a transportation velocity of 600 meters per minute.

[0062] Several embodiments of the invention which have been discussed are intended not to limit the invention but to facilitate the understanding of the invention. The invention may be altered or modified without deviating from the gist thereof and includes equivalents thereof. The configurations of the embodiments described in the claims and description may be combined or omitted as long as the foregoing problem can be at least partially solved or the foregoing effects can be at least partially provided.

REFERENCE SIGN LIST

[0063]

WP: Paper web
WP1: Glued site

FR: Filter rod
WF: Filter web
WR: Rod member
RS: Filter rod continuous body
T: Tow
10: Tow processing section
11: Package
12: Tow path
13: Primary banding jet
14: Guide roller
15: Pretension roller
16: Blooming roller
17: Secondary banding jet
20: Forming section
21: Trumpet guide
30: Wrapping section
31: Garniture tape
32: Spray gun
33: Tong
34: Wrapping former
35: Heater
36: Cooler
40: Inspection section
41: Filter supporting guide
42: Sensor
43: Drive mechanism
44: Brush
50: Cutting section
51: Rotating knife
100: Manufacturing apparatus
411: V groove
412: First flat surface
413: Second flat surface

Claims

1. A tobacco filter inspection apparatus comprising:

a filter supporting guide configured to support a filter rod continuous body being transported, the filter rod continuous body being formed by winding a paper web on a rod member formed of filter material and sticking overlapping portions of the paper web together with glue, and
a sensor arranged above the filter rod continuous body being transported along the filter supporting guide and directed to a glued site of the paper web,
the filter supporting guide including at least two flat surfaces for supporting the filter rod continuous body as viewed in a perpendicular cross-section to a direction that the filter rod continuous body is transported.

2. The tobacco filter inspection apparatus according to Claim 1,
wherein the filter supporting guide is a groove having a V-like shape as viewed in the perpendicular cross-section to the direction that the filter rod continuous body is transported.

3. The tobacco filter inspection apparatus according to Claim 1 or 2, further comprising a drive mechanism that is capable of moving the filter supporting guide toward or away from the sensor.

4. The tobacco filter inspection apparatus according to Claim 3,

wherein the filter supporting guide includes a first flat surface and a second flat surface, and an angle formed between the first flat surface and the second flat surface is 2θ, and
wherein the drive mechanism is capable of moving the filter supporting guide between a first position that is farthest to the sensor and a second position that is closest to the sensor, and a distance between the first position and the second position is $1.4\times(1+1/\sin\theta)$ mm.

5. The tobacco filter inspection apparatus according to any one of Claims 1 to 4, further comprising a filter holding member arranged above the filter rod continuous body being transported along the filter supporting guide so as not to interfere with the sensor, the filter holding member being configured to regulate a vertical displacement of the filter rod continuous body being transported.

6. The tobacco filter inspection apparatus according to any one of Claims 1 to 5,
wherein the sensor is a reflective optical sensor.

7. The tobacco filter inspection apparatus according to Claim 6,
wherein the sensor outputs an abnormal signal to an external device when a light reflection amount at the glued site of the paper web exceeds a predetermined threshold value.

Fig. 1

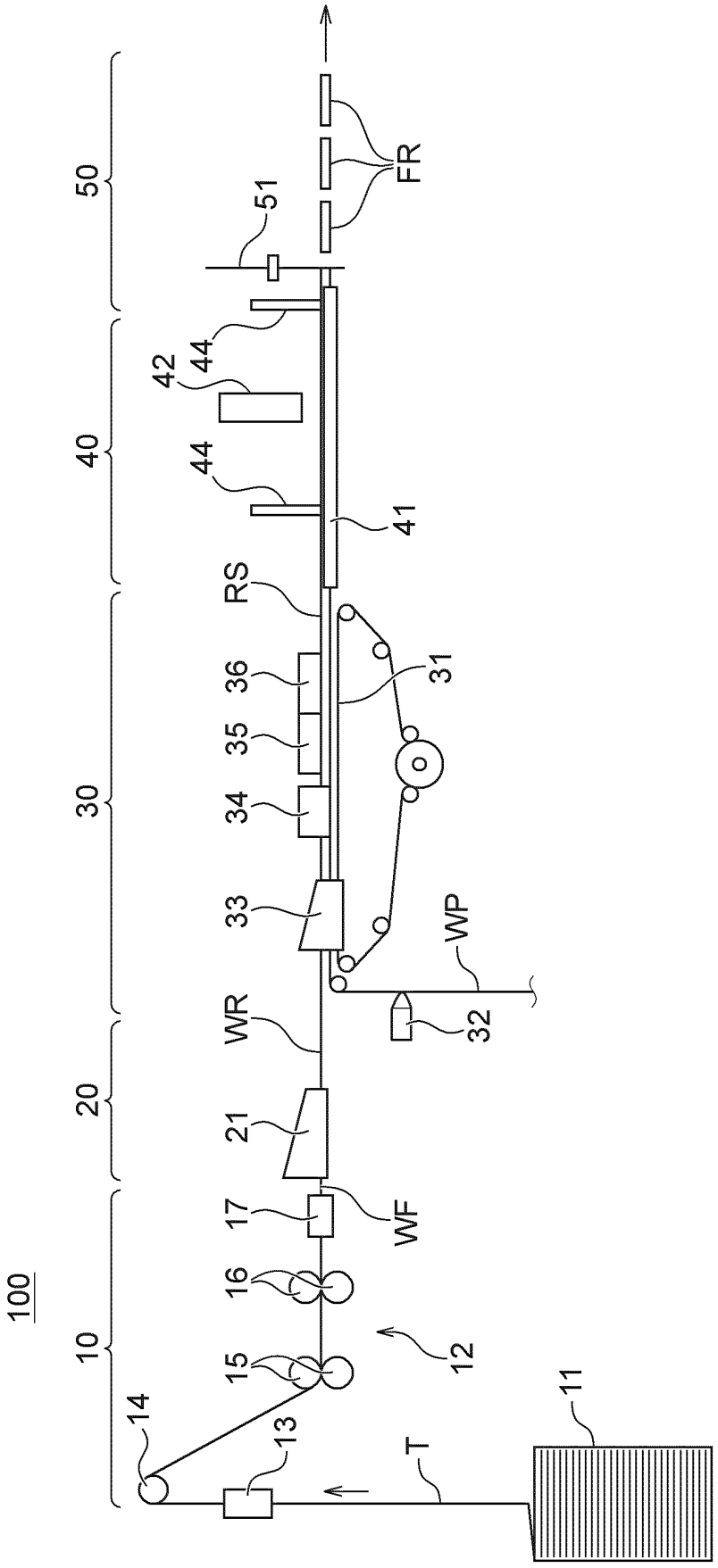
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Fig. 2

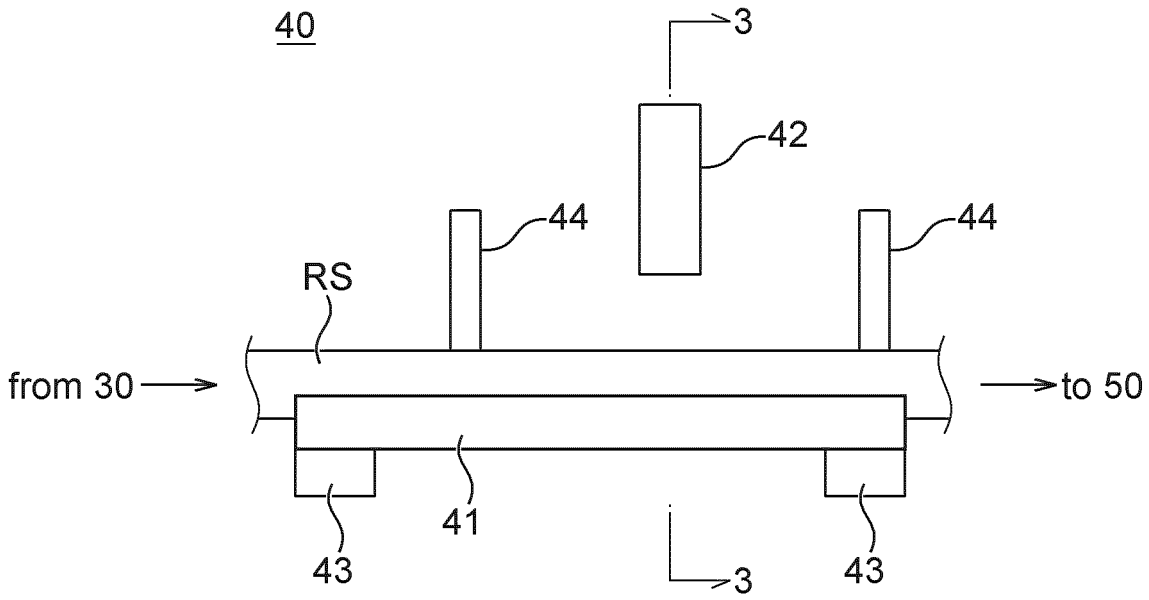


Fig. 3

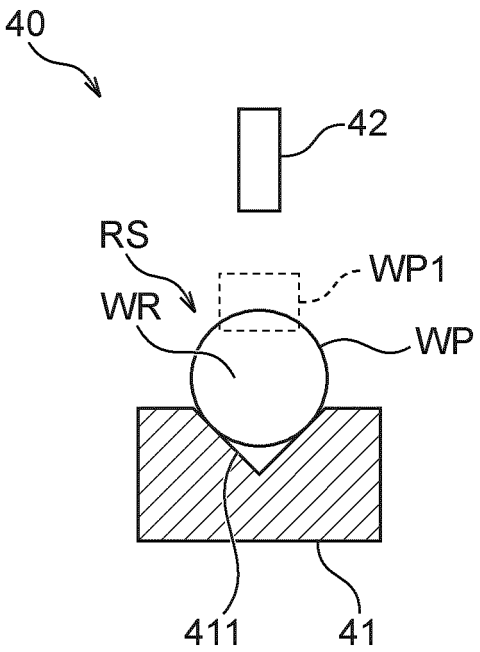
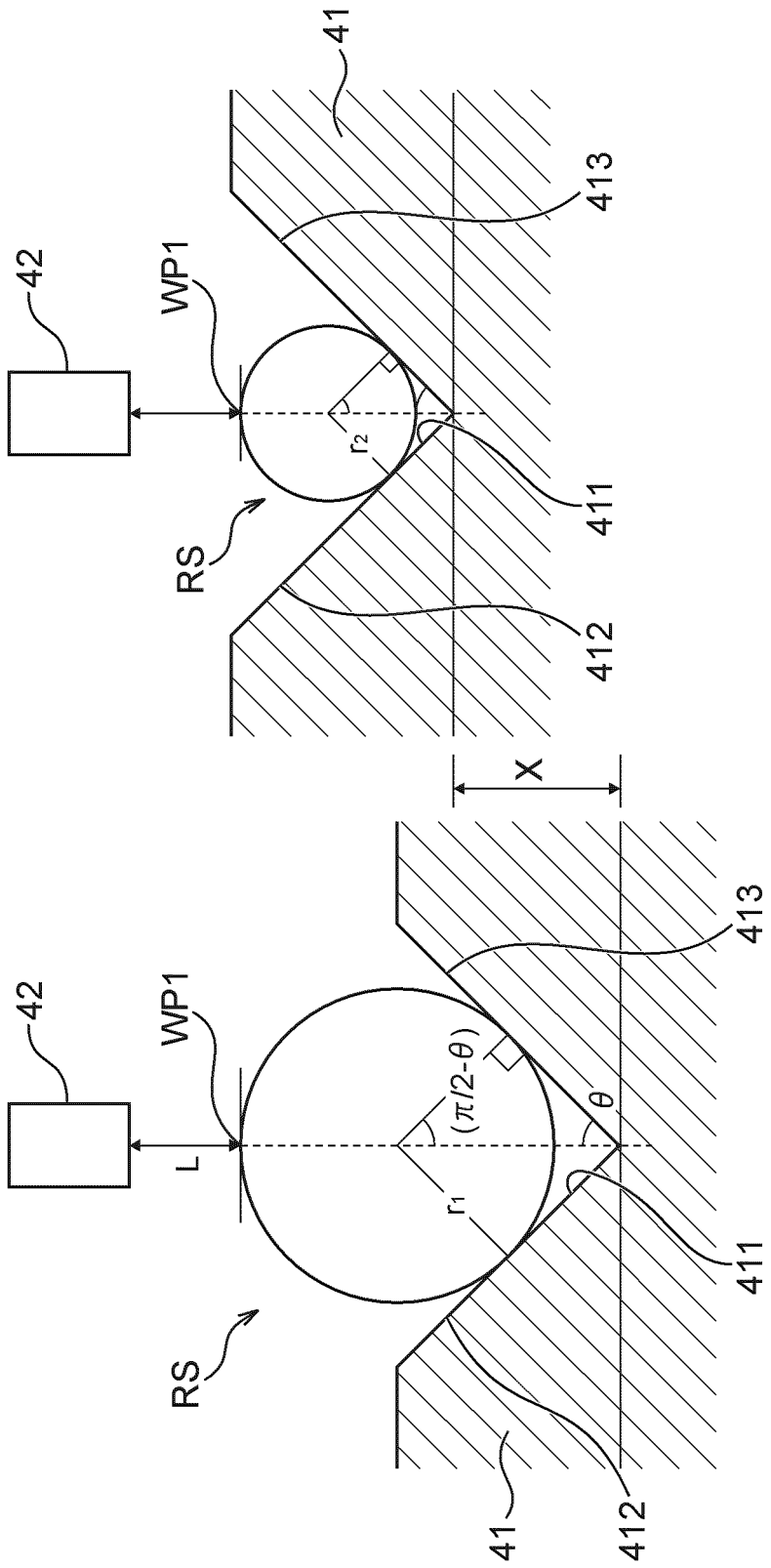


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/000172

A. CLASSIFICATION OF SUBJECT MATTER
A24D 3/02(2006.01)i
FI: A24D3/02
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)
A24D3/02

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2013-192560 A (HAUNI MASCHINENBAU AG) 30 September 2013 (2013-09-30) paragraphs [0001]-[0041], fig. 1-4	1-7
Y	JP 59-227285 A (HAUNI-WERKE KOERBER & CO. KG) 20 December 1984 (1984-12-20) page 4, upper left column, line 12 to page 6, lower left column, line 11, fig. 1-3	1-7
Y	EP 2756768 A1 (HAUNI MASCHINENBAU AC) 23 July 2014 (2014-07-23) paragraphs [0021]-[0028], fig. 1-7	1-7
A	JP 10-314651 A (HAUNI MASCHINENBAU AG) 02 December 1998 (1998-12-02) entire text, all drawings	1-7
A	WO 2017/187502 A1 (JAPAN TOBACCO INC.) 02 November 2017 (2017-11-02) entire text, all drawings	1-7

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

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Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2021 (17.02.2021)	09 March 2021 (09.03.2021)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/000172

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2013-192560 A	30 Sep. 2013	EP 2641487 A2 DE 102012102337 A1 CN 103355741 A	
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