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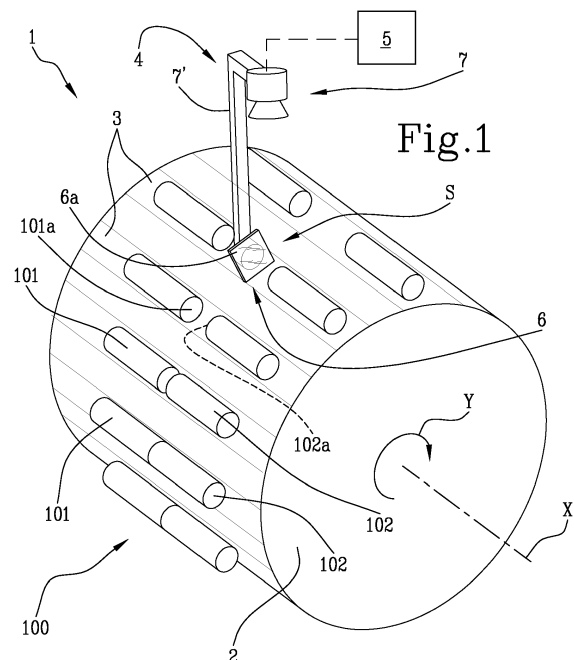
(54) **METHOD AND APPARATUS FOR INSPECTING THE ENDS OF ROD-SHAPES SEGMENTS OF THE TOBACCO INDUSTRY**

(57) This invention relates to a method for inspecting the ends of rod-shaped segments of the tobacco industry, comprising the steps of:

- feeding a plurality of pairs (100) of rod-shaped segments (101, 102) of the tobacco industry into respective successive peripheral flutes (3) of a rotary drum (2), each pair (100) comprising a first and a second segment (101, 102) disposed coaxially and able to be axially spaced from each other;

- capturing images of inner ends (101a, 102a) of the first and second segments (101, 102), wherein the inner ends (101a, 102a) are disposed to face each other.

The step of capturing is carried out by capturing means (4) which are at least partly interposed between the two segments (101, 102) of the pair (100) to be inspected.



EP 3 520 631 A1

Description

[0001] This invention relates to a method and an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry.

[0002] The invention is applicable in particular in the production of articles comprising an active portion designed to release an inhalable substance - for example, smoking articles (cigarettes).

[0003] More specifically, the term "cigarette" is used generally to denote any rod-shaped article comprising at least a filter, an active portion, designed to release an inhalable substance, and a connecting strip for connecting the active portion and the filter to each other.

[0004] The cigarette may, for example, be a traditional cigarette which can be smoked by burning the end of the active portion, or it may be an electronic cigarette which may be smoked by heating but not burning the active portion.

[0005] In effect, the active portion may comprise at least one cigarette segment comprising tobacco of the traditional type or at least one segment defining an aerosol-generating element, that is, a product containing a heat-not-burn type tobacco. In this case, the tobacco may be, for example, pre-treated, reconstituted, homogenised or cast-leaf tobacco.

[0006] In machines for making articles for the tobacco industry, it is usual practice to combine segments of different kinds to obtain articles capable of meeting a variety of production needs.

[0007] Typically, the segments are made by cutting continuous rods of the tobacco industry material into pieces whose length is a multiple of the length of the segments that will form part of the smoking articles. The pieces of rod are fed to specific combining and spacing rollers which act in conjunction with suitable cutting devices to make segments of the required length which can be combined with each other in predetermined sequences according to known technology.

[0008] In order to obtain articles of high quality, the Applicant has found that it is necessary to inspect the ends of the segments before the article is fully formed.

[0009] In effect, once the article is finished, the ends of the segments (excepting those defining the visible, outer ends of the articles) are no longer visible because they are joined end to end with other segments and covered by the connecting strip.

[0010] More specifically, given a pair of segments placed coaxially in a respective flute on a drum, the Applicant has found that it is necessary to inspect the inner ends of the pair of segments, opposite to the outer ends.

[0011] In this context, the technical purpose which forms the basis of this invention is to propose a method and an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry to overcome one or more of the above mentioned drawbacks of the prior art.

[0012] More specifically, this invention has for an aim to provide an efficient method for inspecting the ends of

rod-shaped segments of the tobacco industry to improve the quality of the articles to be made by preventing unsuitable segments from being included in the articles.

[0013] Another aim of this invention is to provide an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry allowing the ends of the segments to be inspected in-process, during the production of the article.

[0014] The technical purpose indicated and the aims specified are substantially achieved by a method and an apparatus for inspecting the ends of rod-shaped articles of the tobacco industry comprising the technical features set out in one or more of the appended claims.

[0015] More specifically, this invention provides a method for inspecting the ends of rod-shaped articles of the tobacco industry comprising the step of feeding a plurality of pairs of rod-shaped segments of the tobacco industry into respective successive peripheral flutes of a rotary drum, each pair comprising a first and a second segment disposed coaxially and able to be axially spaced from each other.

[0016] Advantageously, the method also comprises a step of capturing images of inner ends of the first and second segments, where the inner ends are disposed to face each other.

[0017] More specifically, the step of capturing is carried out by capturing means which are at least partly interposed between the two segments of the pair to be inspected.

[0018] Interposing the capturing means at least partly between the pair of segments thus makes it possible to capture images of the inner ends of the two segments in order to inspect them.

[0019] Capturing the images of the inner ends allows checking the quality of the inner ends and, if necessary, a command is issued to reject the inner ends that do not conform with predetermined conditions of acceptability.

[0020] The invention also provides an apparatus for inspecting the ends of rod-shaped articles of the tobacco industry comprising a rotary drum provided with a plurality of successive peripheral flutes, where each peripheral flute is adapted to receive a respective pair of rod-shaped segments of the tobacco industry.

[0021] Each pair of segments comprises a first and a second segment disposed coaxially and able to be axially spaced from each other. The apparatus also comprises means for capturing images of inner ends of the first and second segments, where the inner ends are disposed to face each other and where the capturing means are at least partly interposed between the segments of the pair of segments. Thanks to the capturing means at least partly interposed between the segments, it is thus possible to inspect the inner ends of the segments, thereby improving the efficiency of the production process.

[0022] The dependent claims, which are incorporated herein by reference, correspond to different embodiments of the invention.

[0023] Further characteristics and advantages of the

invention are more apparent in the detailed description below, with reference to a preferred, non-limiting, embodiment of an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry, illustrated in the accompanying drawings in which:

- Figure 1 is a schematic perspective view of an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry according to this invention;
- Figure 2 is a schematic cross section of the apparatus of Figure 1;
- Figures 3A and 3B are schematic top views of a portion of the apparatus according to this invention in a first embodiment of it, schematically showing successive steps of capturing images of the ends of the segments according to a first embodiment of the method for inspecting the ends of rod-shaped segments of the tobacco industry according to this invention;
- Figures 4A-4C are schematic top views of a portion of the apparatus according to this invention in a second embodiment of it, schematically showing successive steps of capturing images of the ends of the segments according to a second embodiment of the method for inspecting the ends of rod-shaped segments of the tobacco industry according to this invention; and
- Figures 5 and 6 illustrate possible embodiments of the reflective elements according to this invention.

[0024] With reference to the accompanying drawings, the numeral 1 denotes in its entirety an apparatus for inspecting the ends of rod-shaped segments of the tobacco industry, hereinafter referred to simply as "apparatus 1".

[0025] The term "rod-shaped segments" as used herein generically denotes any elongate, typically cylindrical segment.

[0026] The apparatus 1 comprises a rotary drum 2, rotating about an axis of rotation X and provided with a plurality of successive peripheral flutes 3, each peripheral flute 3 being adapted to receive and hold a respective pair 100 of rod-shaped segments of the tobacco industry.

[0027] In other terms, each pair 100 of segments 101, 102 is disposed inside a respective peripheral flute 3, as illustrated in the accompanying drawings.

[0028] Preferably, the peripheral flutes 3 are provided with suction holes, not illustrated in the accompanying drawings, configured to hold the pairs of segments 100 by suction while the drum 2 rotates about its axis of rotation X.

[0029] Each pair 100 comprises a first and a second segment 101, 102 disposed coaxially and able to be axially spaced from each other.

[0030] Each pair 100 may also comprise a first and a second segment 101, 102 disposed coaxially and already axially spaced from each other.

[0031] The invention is, however, also applicable to multisegment rods comprising more than two segments.

[0032] The apparatus 1 also comprises capturing means 4 for capturing images of inner ends 101a, 102a of the first and second segments 101, 102 - that is to say, inner ends 101a, 102a which are disposed to face each other.

[0033] Advantageously, the image capturing means 4 are at least partly interposed between the segments 101, 102 of the pair of segments 100.

[0034] In other words, the apparatus 1 allows inspecting the substantially plane, circular inner end surface of each segment 101, 102.

[0035] Preferably, the capturing means 4 are fixed relative to the rotation of the drum 2. Therefore, the capturing means are disposed in such a way as to be at least partly inserted between the segments 101, 102, so that during rotation of the drum 2 it is possible to capture images of the inner ends 101a, 102a moving one after the other past the capturing means 4, as will become clearer as this description continues.

[0036] In other terms, as it rotates, the drum 2 places the segments 101, 102 in at least one station S for imaging their inner ends 101a, 102a in such a way that the capturing means 4 are at least partly interposed between the ends 101a, 102a.

[0037] The apparatus 1 preferably also comprises a control and drive unit 5 connected to the capturing means 4 and configured to receive the images captured by the capturing means 4 in order to inspect the inner ends 101a, 102a of the segments 101, 102.

[0038] More specifically, the unit 5 can be advantageously configured to check whether the images captured conform with predetermined acceptability criteria, for example by comparing the captured images with reference images.

[0039] Advantageously, the unit 5 may be configured to issue a command for activating a rejection station, not illustrated in the accompanying drawings, located downstream of the drum 2, where the non-conforming segments 101, 102 (detected as a result of the inspection carried out by the unit 5) can be rejected to prevent them from being used to make smoking articles.

[0040] In a possible embodiment of the apparatus 1 of this invention, illustrated in the accompanying drawings, the capturing means 4 comprise at least one reflective element 6, disposed between the segments 101, 102 of the pair 100, and at least one capturing device 7 disposed externally of the drum 2 and configured to capture at least one image of the inner end 101a, 102a of the first segment and/or the second segment 101, 102 reflected by the reflective element 6.

[0041] In other words, the reflective element 6 allows reflecting the image of the inner end 101a, 102a, thus diverting the sight range between the inner end 101a, 102a and the lens of the capturing device, towards a capturing device 7 advantageously located on the outside of the drum 2 in a zone where it can be easily placed.

[0042] That way, by reflecting the images using the reflective elements 6 (which may be small enough to be easily interposed between the segments 101, 102) it is not necessary to interpose the capturing device 7 (which is often large compared to the space available or obtainable between the two segments 101, 102) between the two segments 101, 102.

[0043] For example, if the segments 101, 102 of the pair 100 are spaced apart by a distance equal to the length of an additional segment, not illustrated, which must be placed between the two segments 101, 102 at a later stage, it is possible to use a reflective element 6 whose size is such that it can be easily interposed between the segments 101, 102 so that the inner ends 101a, 102a can be inspected without having, for example, to space the segments 101, 102 further apart for the sole purpose of capturing images of them.

[0044] For simplicity of illustration, Figure 1 shows only one reflective element 6 and only one capturing device 7 for capturing, for example, the inner end 102a of the second segment 102.

[0045] Thanks to the reflective element 6, therefore, all that is necessary is for the image of the ends 101a, 102a to be reflected in such way that it can be captured by a capturing device 7.

[0046] Preferably, as illustrated in Figures 1 and 2, the reflective element 6 is mounted on the capturing device 7 or on a supporting structure 7' of the capturing device 7.

[0047] With reference to Figure 2, the reflective element 6 may preferably also comprise at least one reflective surface 6a lying in a reflecting plane which is inclined relative to the inner end 101a, 102a of the first or second segment 101, 102 at an inclination angle α of between 120° and 150° , preferably equal to 135° .

[0048] With reference to the embodiments illustrated in Figures 3A-3B and 4A-4C, the capturing means 4 may preferably comprise a first reflective element 6' (illustrated in Figures 3A and 4B) configured to reflect a first image of the inner end 101a of the first segment 101 and a second reflective element 6'' (illustrated in Figures 3B and 4C) configured to reflect a second image of the inner end 102a of the second segment 102, where the second reflective element 6'' is disposed downstream of the first reflective element 6' in the rotation direction Y of the drum 2.

[0049] In other terms, as it rotates, the drum 2 places the segments 101, 102 in a first station S1 for imaging the inner end 101a of the first segment 101 and then, in a second station S2 for imaging the inner end 102a of the second segment 102, as schematically illustrated in Figure 5.

[0050] The reference characters F1 and F2 in the drawings schematically indicate the reflected projections of the inner ends 101a, 102a of the two segments 101, 102 on the reflective surfaces 6a', 6a'' of the reflective elements 6', 6''.

[0051] In a possible alternative embodiment, illustrated in Figure 6, the reflective element 6 may be in the form

of a double reflective element, that is to say, a reflective element having a first reflective surface 6a' lying in a reflecting plane that is inclined at an angle to the inner end 101a of the first segment 101, and a second reflective surface 6a'' lying in a reflecting plane that is inclined at an angle to the inner end 102a of the second segment 102, where the reflective surfaces 6a', 6a'' are opposite to each other. In the same way, the first and second reflective elements 6', 6'' can be positioned in such a way that they are juxtaposed and opposite to each other.

[0052] In this embodiment, the drum 2 is configured in such a way that, as it rotates, it places the segments 101, 102 in a single imaging station S3, provided with the double reflective element 6, where the inner ends 101a, 102a of the segments 101, 102 of the pair 100 are imaged simultaneously by at least one capturing device 7.

[0053] Preferably, the capturing means 4 may also comprise a first capturing device 7A (as illustrated in Figures 3A and 4B) configured to capture the first image of the inner end 101a of the first segment 101, reflected by the first reflective element 6', and a second capturing device 7b (as illustrated in Figures 3B and 4C) configured to capture a second image of the inner end 102a of the second segment 102, reflected by the second reflective element 6''.

[0054] Alternatively, it is possible to have a single capturing device 7 configured to capture both of the images of the inner ends 101a, 102a, for example, using further reflective elements, not illustrated in the accompanying drawings, configured to redirect the reflected images towards the capturing device 7, or by capturing the images from the double reflective element 6 of the type described above and processing the captured images with software capable of rectifying them.

[0055] Advantageously, therefore, the capturing means 4 according to this invention provide:

- a reflective element 6 having two reflective surfaces 6a', 6a'' (Figure 6) suitably inclined to each other to allow a single capturing device 7 to capture a first reflected image F1 of the inner end 101a of the first segment 101 and a second reflected image F2 of the inner end 102a of the second segment 102 (or a single image which comprises both the first and the second image); or
- a reflective element 6 having two reflective surfaces 6a', 6a'' (Figure 6) suitably inclined to each other to allow a first capturing device 7a to capture a first reflected image F1 of the inner end 101a of the first segment 101 and a second capturing device 7b to capture a second reflected image F2 of the inner end 102a of the second segment 102; or
- a first reflective element 6' capable of reflecting the first inner end 101a of the first segment 101 and a second reflective element 6'' capable of reflecting the second inner end 102a of the second segment 102, in such a way that a single capturing device 7 can be configured to capture a first and a second

reflected image F1, F2 of the inner ends 101a, 102a of the segments 101, 102; or

- a first reflective element 6' capable of reflecting the first inner end 101a of the first segment 101 and a second reflective element 6'' capable of reflecting the second inner end 102a of the second segment 102 (Figures 3A, 3B and 4B, 4C), in such a way that a first capturing device 7 can be configured to capture a first reflected image F1 of the inner end 101a of the first segment 101 and a second capturing device 7b can be configured to capture a second reflected image F2 of the inner end 102a of the second segment 102.

[0056] As illustrated, the apparatus 1 of the first embodiment (Figures 3A-4B) and of the second embodiment (Figures 4A-4C) comprises further capturing devices 8a, 8b configured to image the outer ends 101b, 102b of the segments 101, 102 of each pair 100.

[0057] In particular, with reference to the first embodiment of Figures 3A and 3B, a first further capturing device 8a is configured to capture a first image of the outer end 101b of the first segment 101 simultaneously with the capturing of a first image of the inner end 101a of the self same segment 101 (Figure 3A), while a second further capturing device 8b is configured to capture a second image of the outer end 102b of the second segment 102 simultaneously with the capturing of a second image of the inner end 102a of the self same segment 102 (Figure 3B).

[0058] Advantageously, it is thus possible to concurrently inspect both the inner and outer ends 101a, 101b, 102a, 102b of a segment 101, 102, so as to obtain a one-to-one match between the images captured.

[0059] With reference to the second embodiment, on the other hand (Figures 4A-4C), the images of the outer ends 101b, 102b are captured simultaneously. It should be noted that in Figure 4A, the two segments 101, 102 are placed in abutment end to end, as explained in more detail as this description continues.

[0060] With reference to the second embodiment (Figures 4A-4C), the images of the inner ends 101a, 102a may be captured in succession one after the other (see Figure 4B for one, and Figure 4C for the other) and both of them after capturing the images of the outer ends 101b, 102b (see Figure 4A).

[0061] In other words, capturing at least one image of the outer end 101b, 102b of the first or second segment 101, 102 is preferably carried out simultaneously with, or after, the step of capturing the image of the inner end 101a, 102a of the self same segment 101, 102.

[0062] The apparatus 1 preferably also comprises cutting means, not illustrated in the accompanying drawings, configured to cut a plurality of multiple segments into the plurality of pairs 100 of segments 101, 102.

[0063] In a possible embodiment, not illustrated in the accompanying drawings, the drum 2 is preferably adapted to receive the plurality of multiple segments, not illus-

trated in the accompanying drawings, in the peripheral flutes 3 and the cutting means are configured to cut the plurality of multiple segments into the plurality of pairs 100 of segments 101, 102 in the peripheral flutes 3.

[0064] Alternatively, the multiple segments can be fed to a further drum, not illustrated, located upstream, on which they are cut by the cutting means, and only after being cut by the cutting means is the pair 100 of segments 101, 102 thus formed transferred to the drum 2.

[0065] Preferably, with reference to Figure 1, the drum 2 is configured as a spacing drum of the tobacco industry, so the peripheral flutes 3 are defined at least partly by housing portions 3a (shown in Figure 2) along a direction parallel to the axis of rotation X of the drum 2 and configured to move the first and second segments 101, 102 of each pair 100 axially apart in such a way as to dispose them at a first distance from each other such as to allow capturing the images of the inner ends 101a, 102a of the first and second segment 101, 102 of each pair 100.

[0066] Advantageously, therefore, the movable housing portions 3a allow the drum 2 to receive pairs 100 of segments 101, 102 just cut (and thus placed in abutment along their inner ends 101a, 102a) and to move the segments 101, 102 apart to allow their inner ends 101a, 102a. to be imaged.

[0067] According to another aspect of it, this invention also provides a method for inspecting the ends 101a, 101b, 102a, 102b of rod-shaped segments 101, 102 of the tobacco industry; more specifically, the apparatus 1 implements the method of this invention.

[0068] The method comprises the step of feeding the plurality of pairs 100 of segments 101, 102 disposed coaxially and able to be axially spaced from each other in the respective peripheral flutes 3 of the rotary drum 2.

[0069] The method then comprises a step of capturing images of inner ends 101a, 102a of the first and second segments 101, 102, where the step of capturing is carried out by the capturing means 4 which are at least partly interposed between the two segments 101, 102, or rather, between the inner ends 101a, 102a which are disposed to face each other.

[0070] Preferably, the step of capturing is accomplished by capturing with at least one capturing device 7 at least one image F1, F2 reflected by at least one reflective element 6.

[0071] With reference to Figure 1, the step of feeding the plurality of pairs 100 also comprises the following steps:

- disposing the pairs 100 in respective peripheral flutes 3 of the drum 2 in such a way that the two segments 101, 102 of each pair 100 are substantially in mutual contact, where the two segments 101, 102 are preferably obtained by cutting a multiple segment fed to the drum 2; and
- moving the two segments 101, 102 of each pair 100 axially apart until spaced by a first distance suitable for allowing image capturing to be performed.

[0072] Advantageously, therefore, the provision of movable housing flutes 3a makes it possible to move the segments 101, 102 apart to allow capturing the images of their inner ends 101a, 102a.

[0073] More specifically, after the step of image capturing, the two segments 101, 102 of each pair 100 are moved apart in an axial direction until spaced by a second distance suitable for receiving at least one further segment, not illustrated, between the two segments of the pair 100. Still more preferably, the second distance value is greater than the first distance value.

[0074] Preferably, the step of image capturing comprises a first sub-step of capturing a first image of the inner end 101a of the first segment 101 and a second sub-step of capturing a second image of the inner end 102a of the second segment 102, where the second sub-step is carried out downstream of the first sub-step in the direction of rotation of the drum 2.

[0075] Preferably, the method also comprises a step of capturing at least one image of the outer end 101b, 102b of the first or second segment 101, 102 of each pair 100.

[0076] This step may be carried out by simply capturing the images of the outer ends 101b, 102b at the front and rear ends of the peripheral flutes 3, as illustrated in Figures 3A, 3B, 4A, for example using the further image capturing devices 8a, 8b.

[0077] More specifically, the step of capturing the images of the outer ends 101b, 102b, as illustrated in Figure 4A, may be accomplished on the further drum located upstream of the drum 2, and still more preferably, before the multiple segment is cut into the two segments 101, 102 of the pair 100.

[0078] Still more preferably, the step of capturing at least one image of the outer end 101b, 102b is carried out simultaneously with the step of capturing the image of the inner end 101a, 102a of the self same segment 101, 102.

[0079] That way, it is advantageously possible to simultaneously inspect both ends 101a-101b, 102a-102b of the same segment 101, 102 so that inspection of the segment 101, 102 is completed immediately and without having to associate an outer end 101b, 102b with an inner end 101a, 102a by post processing.

[0080] This invention achieves the preset aims, overcoming the disadvantages of the prior art, by providing an apparatus and a method for inspecting the ends of rod-shaped segments of the tobacco industry, improving the quality of the end product by ensuring that the segments making up the article are precisely inspected before they are combined and wrapped in the connecting strips.

Claims

1. A method for inspecting the ends of rod-shaped segments of the tobacco industry, comprising the steps

of:

- feeding a plurality of pairs (100) of rod-shaped segments (101, 102) of the tobacco industry into respective successive peripheral flutes (3) of a rotary drum (2), each pair (100) comprising a first and a second segment (101, 102) disposed coaxially and able to be axially spaced from each other;
- capturing images of inner ends (101a, 102a) of the first and second segments (101, 102), the inner ends (101a, 102a) being disposed to face each other;

wherein the step of capturing is carried out by capturing means (4) which are at least partly interposed between the two segments (101, 102) of the pair (100) to be inspected.

2. The method according to claim 1, wherein the capturing means (4) comprise at least one reflective element (6), disposed between the segments (101, 102), and at least one capturing device (7) disposed externally of the drum (2) and configured to capture at least one image of the inner end (101a, 102a) of the first segment and/or second segment (101, 102), the step of capturing the at least one image being carried out by capturing, through the at least one capturing device (7), at least one image of the inner end (101a, 102a) reflected by the at least one reflective element (6).

3. The method according to claim 1 or 2, wherein the step of feeding the plurality of pairs (100) comprises the steps of:

- disposing the pairs (100) in respective peripheral flutes (3) of the drum (2) in such a way that the two segments (101, 102) of each pair (100) are substantially in mutual contact, the two segments (101, 102) being preferably obtained by cutting a multiple segment fed to the drum (2);
- moving the two segments (101, 102) of each pair (100) axially apart until spaced by a first distance suitable for allowing image capturing to be performed.

4. The method according to claim 3, wherein after the step of image capturing, the two segments (101, 102) of each pair (100) are moved apart in an axial direction until spaced by a second distance suitable for receiving at least one further segment between the two segments (101, 102) of the pair (100).

5. The method according to claim 1 wherein the step of image capturing comprises a first sub-step of capturing a first image of the inner end (101a) of the first segment (101) and a second sub-step of capturing

a second image of the inner end (102a) of the second segment (102), and wherein the second sub-step is carried out downstream of the first sub-step in the direction of rotation of the drum (2).

6. The method according to one or more of the preceding claims, further comprising a step of capturing at least one image of the outer end (101b, 102b) of the first or second segment (101, 102) of each pair (100), the step of capturing at least one image of the outer end (101b, 102b) of the first or second segment (101, 102) being preferably carried out simultaneously with, or after, the step of capturing the image of the inner end (101a, 102a) of the self same segment (101, 102).

7. The method according to one or more of the preceding claims, wherein the capturing means (4) are located at a fixed position.

8. An apparatus (1) for inspecting the ends of rod-shaped segments of the tobacco industry, comprising:

- a rotary drum (2) provided with a plurality of successive peripheral flutes (3), each peripheral flute (3) being adapted to receive a respective pair (100) of rod-shaped segments (101, 102) of the tobacco industry comprising a first and a second segment (101, 102) disposed coaxially and able to be axially spaced from each other;
- capturing means (4) for capturing images of inner ends (101a, 102a) of the first and second segments (101, 102), the inner ends (101a, 102a) being disposed to face each other;

wherein the image capturing means (4) are at least partly interposed between the two segments (101, 102) of the pair (100).

9. The apparatus (1) according to claim 8, wherein the capturing means (4) are fixed relative to the rotation of the drum (2).

10. The apparatus according to claim 8 or 9, comprising a control and drive unit (5) connected to the capturing means (4) and configured to receive the images captured by the capturing means (4) to inspect the inner ends (101a, 102a) of the segments (101, 102).

11. The apparatus (1) according to one or more of claims 8-10, wherein the capturing means (4) comprise at least one reflective element (6), disposed between the segments (101, 102), and at least one capturing device (7) disposed externally of the drum (2) and configured to capture at least one image of the inner end (101a, 102a) of the first segment and/or second segment (101, 102) reflected by the at least one re-

flective element (6).

12. The apparatus (1) according to claim 11, wherein the at least one reflective element (6) comprises at least one reflective surface (6a) lying in a reflecting plane which is inclined relative to the inner end (101a, 102a) of the first or second segment (101, 102) at an inclination angle (α) of between 120° and 150°, preferably equal to 135°.

13. The apparatus (1) according to claim 11 or 12, wherein the capturing means (4) comprise a first reflective element (6') configured to reflect a first image (F1) of the inner end (101a) of the first segment (101) and a second reflective element (6'') configured to reflect a second image (F2) of the inner end (102a) of the second segment (102), wherein the second reflective element (6'') is disposed downstream of the first reflective element (6') in the direction of rotation of the drum (2).

14. The apparatus (1) according to claim 13, wherein the capturing means (4) comprise a first capturing device (7a) configured to capture the first image (F1) of the inner end (101a) of the first segment (101), reflected by the first reflective element (6'), and a second capturing device (7b) configured to capture a second image (F2) of the inner end (102a) of the second segment (102), reflected by the second reflective element (6'').

15. The apparatus (1) according to one or more of claims 11-14, wherein the at least one reflective element (6, 6', 6'') is mounted on the at least one capturing device (7, 7a, 7b) or on a supporting structure (7') of the at least one capturing device (7, 7a, 7b).

16. The apparatus (1) according to one or more of claims 8-15, comprising cutting means configured to cut a plurality of multiple segments into the plurality of pairs (100) of segments (101, 102).

17. The apparatus (1) according to claim 16, wherein the drum (2) is adapted to receive the plurality of multiple segments in the peripheral flutes (3) and wherein the cutting means are configured to cut the plurality of multiple segments into the plurality of pairs (100) of segments (101, 102) in the peripheral flutes (3).

18. The apparatus (1) according to one or more of claims 8-17, wherein the drum (2) is configured as a spacing drum of the tobacco industry and wherein the peripheral flutes (3) are defined at least partly by housing portions (3a) which are movable along a direction parallel to the axis of rotation (X) of the drum (2) and configured to move the first and second segments (101, 102) of each pair (100) of segments (101, 102)

axially apart in such a way as to dispose them at a first distance from each other such as to allow capturing the images of the inner ends (101a, 102a) of the first and second segment (101, 102) of each pair (100).

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19. The apparatus (1) according to one or more of claims 8-18, comprising further capturing devices (8a, 8b) configured to capture images of outer ends (101b, 102b) of the segments (101, 102) of each pair (100), wherein a first further capturing device (8a) is configured to capture a first image of the outer end (101b) of the first segment (101) simultaneously with the capturing of a first image of the inner end (101a) of the self same segment (101), and wherein a second further capturing device (8b) is configured to capture a second image of the outer end (102b) of the second segment (102) simultaneously with, or after, the capturing of a second image of the inner end (102a) of the self same segment (102).

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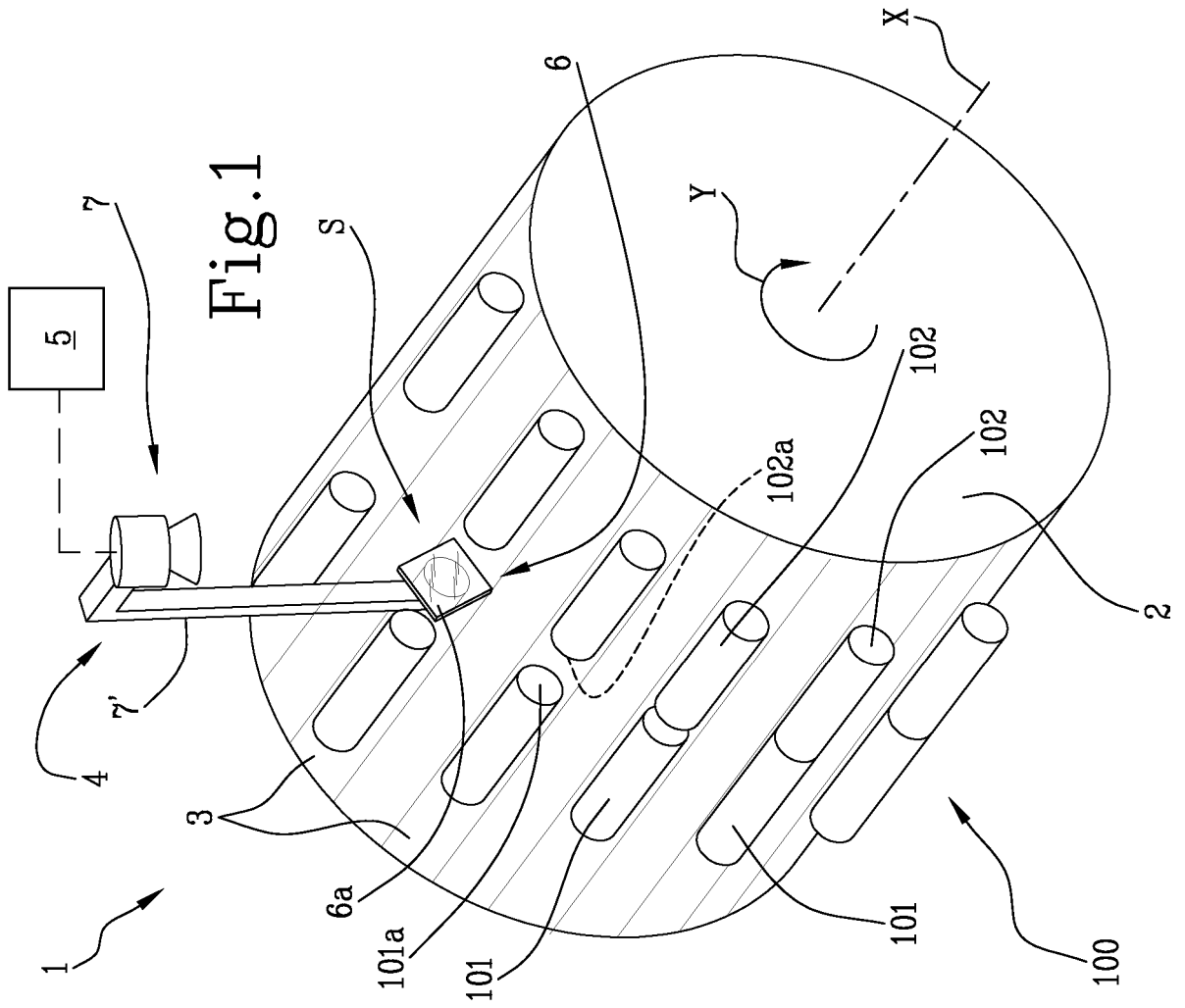


Fig. 1

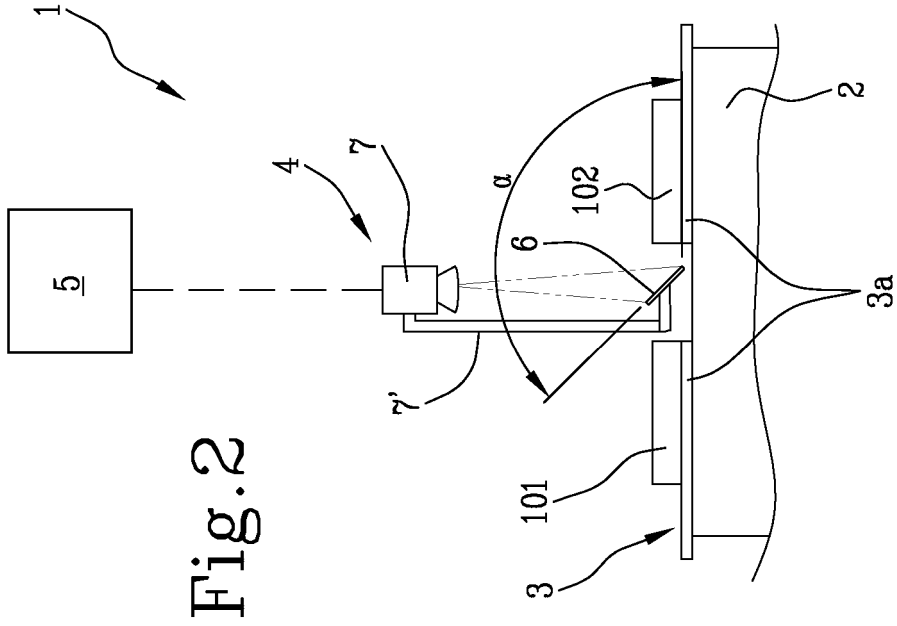


Fig.3A

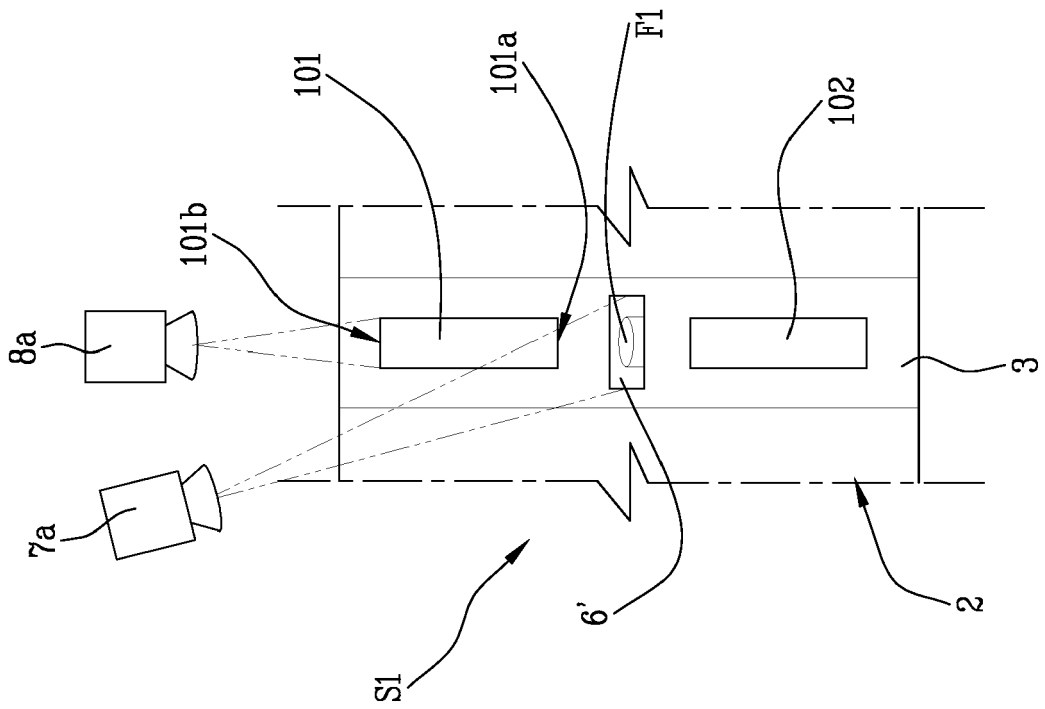


Fig.3B

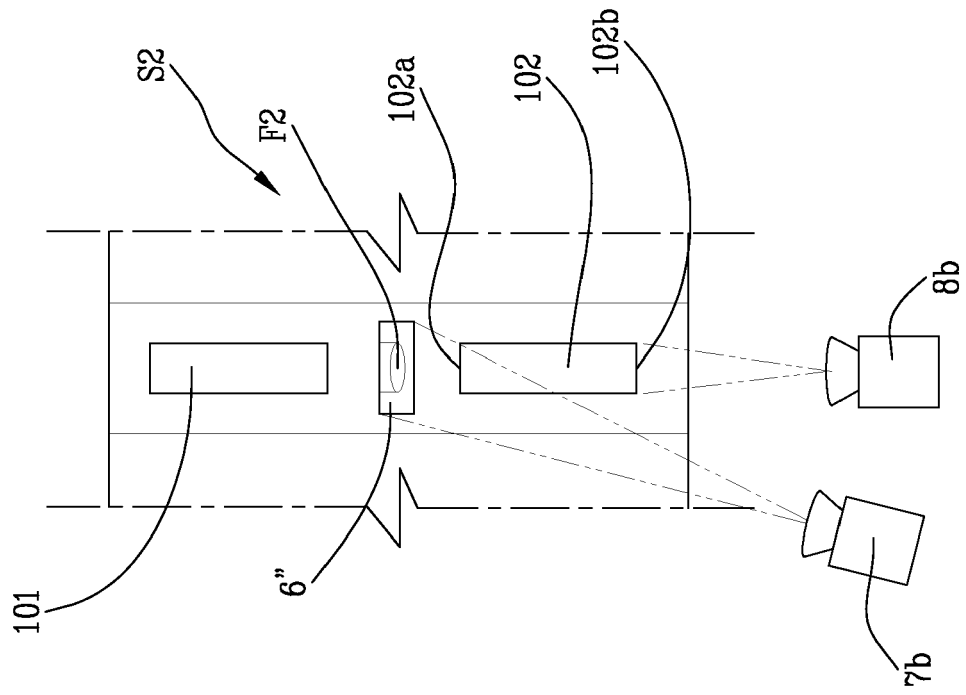


Fig. 4C

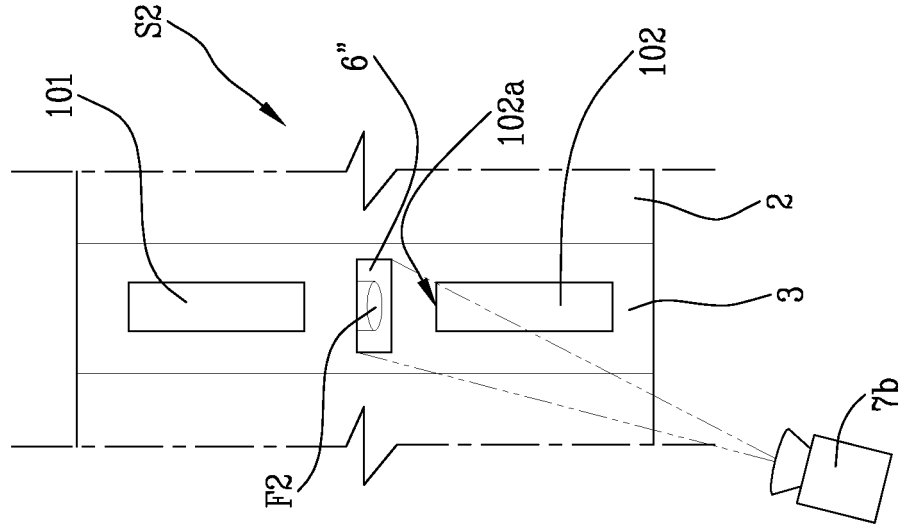


Fig. 4B

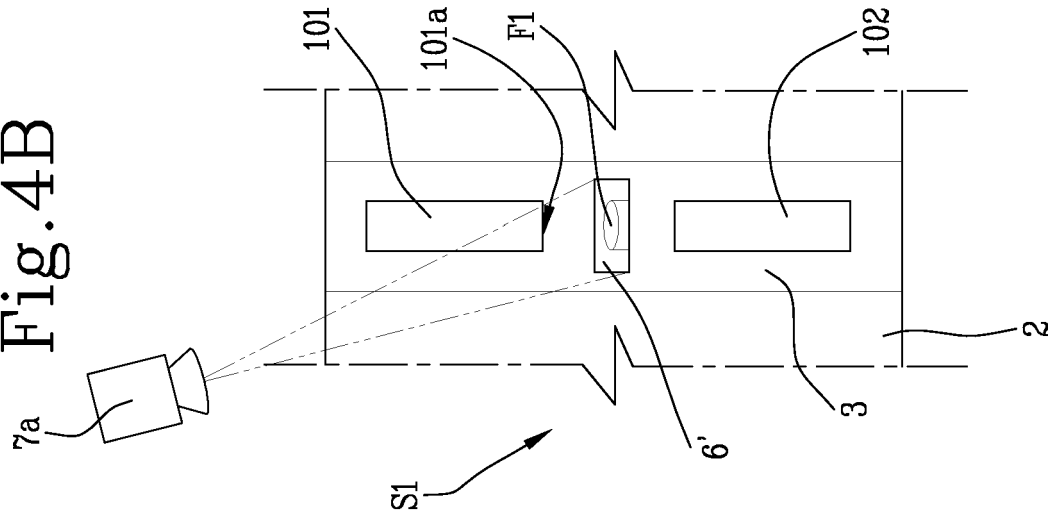


Fig. 4A

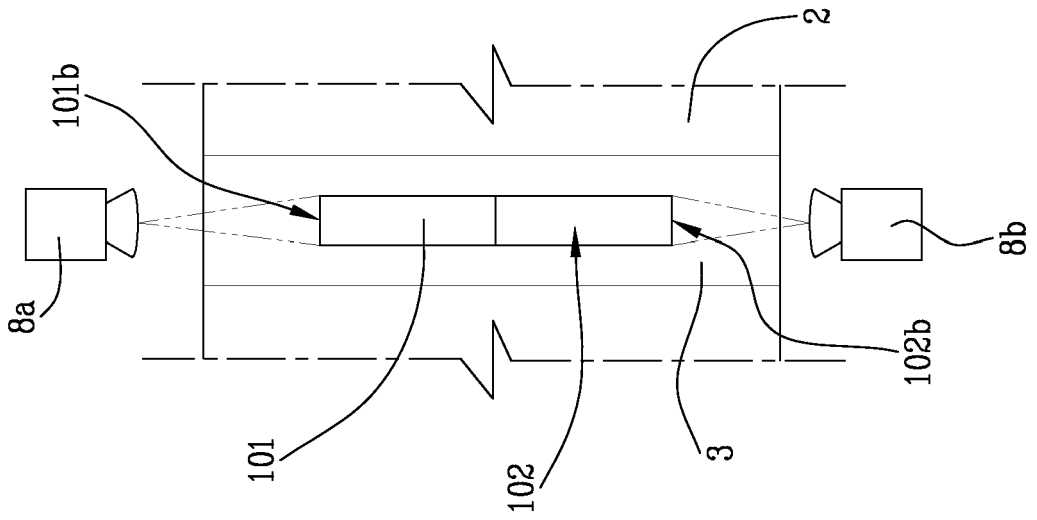


Fig. 5

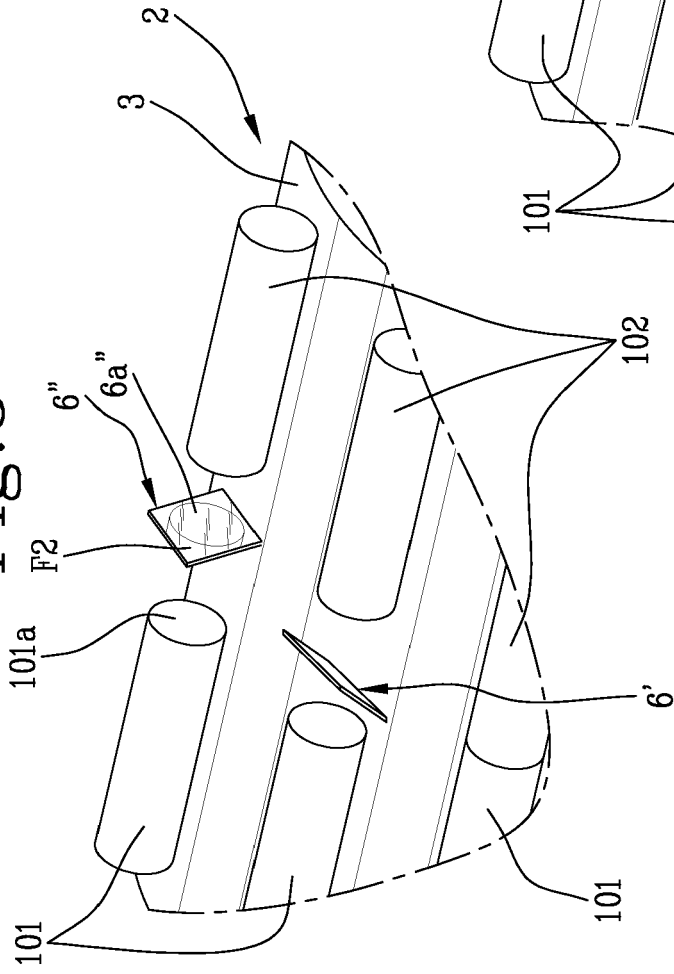
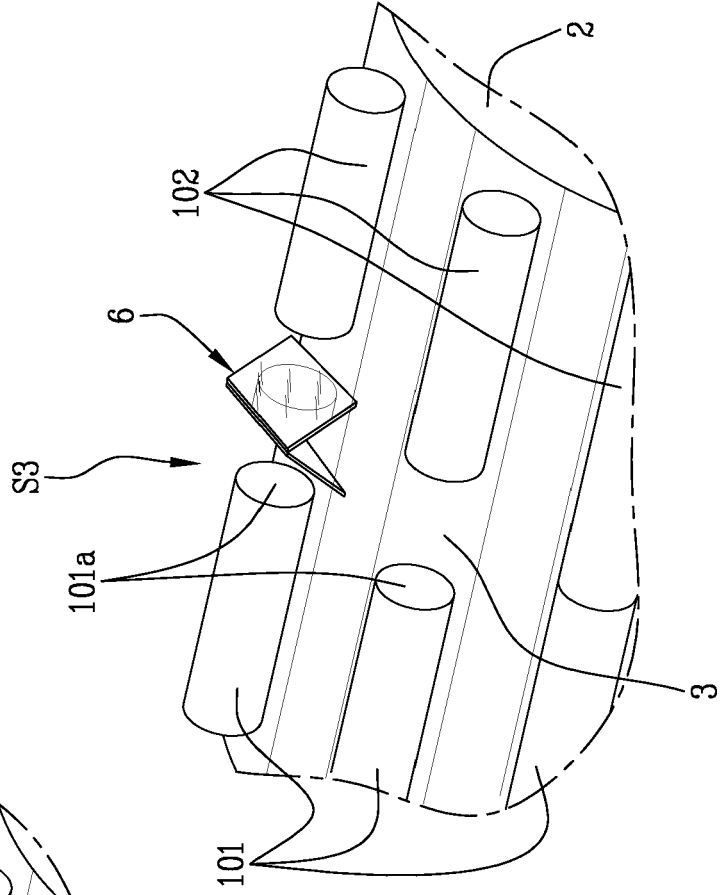


Fig. 6





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A	* paragraph [0071] - paragraph [0077]; figures 1-7 *	5,13,14	
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The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-05-2019

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