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

(11) **EP 4 480 329 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.12.2024 Bulletin 2024/52

(21) Application number: **24180505.0**

(22) Date of filing: **06.06.2024**

(51) International Patent Classification (IPC):
A24C 5/34 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A24C 5/3418

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

(30) Priority: **08.06.2023 IT 202300011721**

(71) Applicant: **G.D S.p.A.**
40133 Bologna (IT)

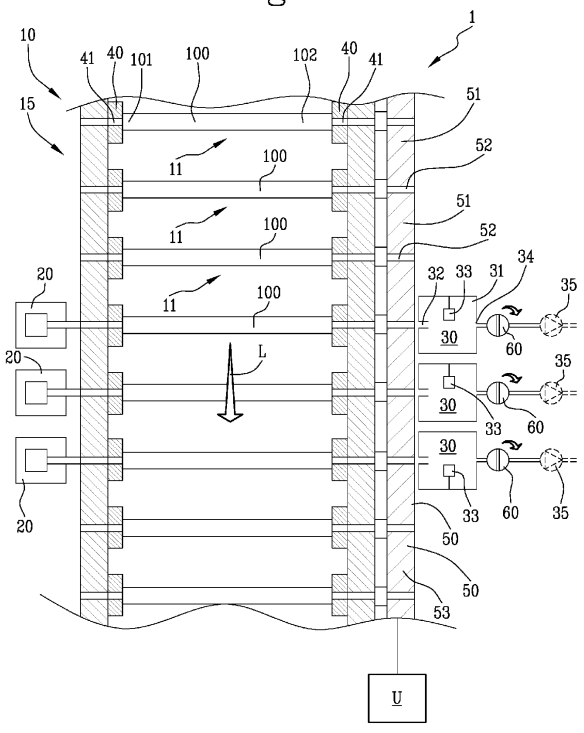
(72) Inventors:
- **DATTILO, GIANCARLO**
  BOLOGNA (IT)
- **MENGOLI, FAUSTO**
  BOLOGNA (IT)
- **ROMAGNOLI, MASSIMO**
  BOLOGNA (IT)

(74) Representative: **Bianciardi, Ezio**
Bugnion S.p.A.
Via di Corticella, 87
40128 Bologna (IT)

(54) UNIT AND METHOD FOR CHECKING THE INTEGRITY OF FLAVOURING CAPSULES IN SMOKING ARTICLES

(57) A unit (1) and a method for checking the integrity of flavouring capsules in rod-shaped smoking articles (100). The unit (1) comprises a conveyor (10) configured to convey a succession of rod-shaped articles (100) transversely along a conveying path (L) passing through an inspection area, a plurality of blowing devices (20) located in the inspection area and configured to deliver a jet or puff of air into a first end (101) of a respective article (100) in transit through the inspection area, and a plurality of detectors (30), located in the inspection area on a second side of the conveyor (10), opposite the first side, and configured to analyse at least one chemical and/or physical property of the air flow. The blowing devices (20) and the detectors (30) are operable simultaneously to perform a simultaneous inspection on two or more articles (100) moved simultaneously by the conveyor.

Fig.1



EP 4 480 329 A1

Description

[0001] This invention addresses the tobacco industry and relates to a unit and a method for checking the integrity of flavouring capsules in rod-shaped smoking articles.

[0002] In the field relevant to this invention, the prior art teaches that a wide range of flavours for smoking articles can be obtained by embedding a flavouring capsule in the filter of the smoking article. The capsule typically consists of a flavouring liquid enclosed in a seamless cover: the cover is made in such a way as to break easily when the capsule is squeezed. In other words, the cover breaks when a certain pressure is applied to it, allowing the flavouring liquid to impregnate the filter. On account of the fragility of the cover, however, the capsules are easily damaged during the process of manufacturing the smoking articles.

[0003] Known in the prior art, therefore, are a number of different devices for inspecting the integrity of flavouring capsules after they have been placed in the smoking articles.

[0004] Some inspection devices, for example, have olfactory sensors configured to analyse a gas flow made to pass through the smoking article containing the flavouring capsule so as to check the integrity of the capsule by measuring the concentration of the flavouring in the gas flow.

[0005] A solution of this kind is known from patent application WO2021/070302. In that solution, the device comprises a conveying drum configured to convey a succession of rod-shaped articles transversely along a conveying path by way of an inspection area where a jet of air generated at a first end of each article when the article passes through the inspection area flows out through the opposite end of the article to reach an inspection chamber. An olfactory sensor located in the inspection chamber is connected to a control unit and is configured to analyse the air jet to measure the concentration of flavouring in the air jet. If the concentration of the flavouring exceeds a certain threshold, the control unit runs a rejection routine to discard the defective smoking article.

[0006] The Applicant has found that the structural and functional aspects of that solution can be improved. In effect, this constructional solution has the disadvantage of not being able to ensure large quantities of samples analysed per unit time to high quality standards. In other words, the higher the production speed is, the lower the reliability and the quality of the individual analyses carried out.

[0007] Indeed, first of all, an analysis carried out too rapidly could negatively influence the precision of the results. This could occur because reducing the analysis time, necessary because of the higher production speed, could prevent the system from accurately capturing the data relating to the concentration of flavouring in the air jet.

[0008] Secondly, the air flow collected in the inspection chamber is substantially in communication with the environment outside the inspection chamber. As a result, the air sample to be analysed is subject to pressure pulses caused by the movement of the conveying drum which means that the air to be analysed in the inspection chamber does not remain correctly motionless. For example, on account of the movement of the conveying drum and the intrinsic speed of operations, part of the air sample is "sucked out" through the inlet opening and/or may be partly replaced by another air flow. The higher the feed speed of the articles, the more marked this problem is. The air sample to be analysed may also be contaminated by an air flow from the next article or by air left over from the previous sample analysed. Indeed, it should be noted that the time required for inspection to be carried out correctly depends on the type of sensor used and thus, when production speed is high, the transient times for blowing air in and removing it may be inadequate for inspection to be carried out correctly and, in particular, reliably enough.

[0009] Such operating conditions, therefore may result in the sensor producing inaccurate results, leading to its rejecting good articles and/or not detecting defective articles.

[0010] In this context, the basic technical purpose of this invention is to provide a unit and a method for checking the integrity of flavouring capsules in rod-shaped smoking articles to overcome the above mentioned disadvantages of the prior art.

[0011] In particular, the aim of this invention is to provide a unit and a method for checking the integrity of flavouring capsules in rod-shaped smoking articles and capable of ensuring a high production speed, and at the same time, an optimum level of reliability in the detection of a defective article.

[0012] The technical purpose indicated and the aim specified are thus achieved by a unit and a method for checking the integrity of flavouring capsules in rod-shaped smoking articles, comprising the technical features described in claims 1 and 16, respectively, and/or in one or more of the claims dependent thereon.

[0013] The invention is described below with reference to the accompanying drawings, which illustrate a non-limiting embodiment of it, in which:

- Figure 1 shows a schematic view of a preferred embodiment of a unit for checking the integrity of flavouring capsules in rod-shaped smoking articles according to this invention, in a first operating configuration;
- Figure 2 shows a schematic view of the unit of Figure 1 in a second operating configuration;
- Figure 3 shows a schematic view of the unit of Figure 1 in a third operating configuration.

[0014] The numeral 1 in the accompanying drawings denotes in its entirety a unit (represented schematically

and only partly in the accompanying drawings) for checking the integrity of flavouring capsules in rod-shaped smoking articles, denoted by the reference numeral 100.

[0015] In this disclosure, the term "smoking articles" is used broadly to mean finished products such as, for example, traditional cigarettes, HEETS or cigars, but also semi-finished products of the tobacco industry such as filters, for example, where these need to be inspected before final assembly of the finished product.

[0016] As shown in the drawings, the unit 1 comprises a conveyor 10.

[0017] The conveyor 10 is configured to convey a succession of rod-shaped smoking articles 100 transversely along a conveying path L passing through an inspection area. Preferably, the succession of articles is conveyed along the conveying path continuously and at a constant speed. The conveyor 10 has a plurality of receiving seats 11 for accommodating respective articles 100 and distributed in succession along the conveying path so as to be spaced from each other by a given spacing.

[0018] In the preferred embodiment, the conveyor 10 comprises a conveying drum 15 which has a state-of-the-art structure of known type and which is rotatable about an axis of rotation: the receiving seats 11 are distributed angularly around the axis of rotation of the conveying drum 15 at a position such as to be equidistant at a certain, constant spacing.

[0019] In alternative embodiments not illustrated, the conveyor 10 may comprise a linear conveyor, according to the general nature of the invention. The type of conveyor chosen depends on the specific production process requirements and on the products to be conveyed.

[0020] Preferably, the unit 1 comprises retaining means 40, configured for securely holding each article 100 at its ends 101, 102 at least in the inspection area. The retaining means 40 comprise, for each receiving seat 11, a pair of opposing pads movable around the conveyor 10 and synchronized with the conveyor 10. Preferably, the retaining means 40 are configured to gradually engage the ends of the article 100 as it approaches the inspection area and to gradually disengage the ends 101, 102 of the article 100 as it moves away from the inspection area. In particular, each pad has a through duct 41 and the through ducts 41 of each pair are aligned with each other and positioned, when in the inspection area, to be aligned with the blowing device 20 and with the detector 30. In other words, at a functional level, each article 100 is held securely at its ends 101, 102 at least in the inspection area by a pair of opposing pads which are synchronized with the conveyor 10. The pads gradually engage the ends 101, 102 of the article 100 as it approaches the inspection area and gradually disengage the ends 101, 102 of the article 100 as it moves away from the inspection area.

[0021] In the preferred embodiment, the pads are carried by, or form part of, respective opposite rings or discs (called "swash rings" or "swash plates"), disposed around the axis of rotation of the drum 15 and synchronized with the drum 15. In particular, the discs or rings are disposed on opposite sides of the drum 15 and have axes of rotation which are slightly inclined in a known way relative to the axis of rotation of the drum 15, so that each pad, as it rotates, also moves axially relative to the respective receiving seat 11 between a position where the article 100 is engaged and a position where it is disengaged.

[0022] According to an aspect of this invention, the unit 1 comprises a plurality of blowing devices 20. The blowing devices 20 are located in the inspection area on a first side of the conveyor 10 at a position such that they are simultaneously facing and aligned with a respective number of receiving seats in transit along the conveying path L: each blowing device 20 is configured to deliver a jet or puff of air into the first end 101 of a respective article 100 when the article 100 positioned on the conveyor 10 passes through the inspection area. This air flow, in the case of filter cigarettes, is concordant with the normal direction of the air when the smoker inhales. According to an aspect of this invention, the unit 1 comprises a plurality of detectors 30. The detectors 30 are located in the inspection area on a second side of the conveyor 10, opposite the first side. Structurally, each detector 30 has an inspection chamber 31 and an inlet opening 32, facing and aligned with a respective blowing device 20, to receive the air flowing out of the second end 102 of the respective article 100 and generated by the jet or puff of air. The inlet opening 32 allows the air flow to be conveyed into the respective inspection chamber 31. Each detector 30 also comprises an olfactory sensor 33 located in the respective inspection chamber 31 and configured to analyse at least one chemical and/or physical property of the air flow.

[0023] The number of detectors 30 corresponds to the number of blowing devices 20.

[0024] According to an advantageous aspect of this invention, the blowing devices 20 and the detectors 30 are operable simultaneously to perform a simultaneous inspection on two or more articles 100 moved simultaneously by the conveyor 10.

[0025] Preferably, also, as will become clearer as this description continues, the blowing devices 20 and the detectors 30 are operable simultaneously.

[0026] The unit 1 comprises a control unit U, connected at least to the olfactory sensors 33 and configured at least to receive and process the measurements made by the olfactory sensors 33.

[0027] In a variant embodiment, the detectors 30 and the blowing devices 20 are controllable individually, in particular, they can be switched on and off individually, so as to operate a subset of detectors 30 and blowing devices 20 (always greater than 1, however) where such a subset is selectable in controlled manner according to requirements. Preferably, this is accomplished by connecting the detectors 30 and the blowing devices 20 to the control unit so that it switches on the detectors 30 and

blowing devices 20 of the subset that is selected.

[0028] Structurally, the blowing devices 20 and the detectors 30 are preferably stationary. In other words, the blowing devices 20 and the detectors 30 are mounted on respective supports so they are fixed along the conveying path L of the articles 100.

[0029] Preferably, the blowing devices 20 are spaced apart at the aforesaid predetermined spacing. The detectors 30 are also spaced apart at the aforesaid predetermined spacing. In other words, each detector 30 is associated with a respective blowing device 20, thus defining operative pairs facing each other along the conveying path L.

[0030] In the preferred embodiment, the plurality of blowing devices 20 comprises a number of blowing devices 20 between 2 and 5, preferably 3 or 4. The plurality of detectors 30 also comprises a number of detectors 30 between 2 and 5, preferably 3 or 4. In other words, the number of articles 100 subjected to inspection simultaneously is between 2 and 5, preferably 3 or 4.

[0031] According to an advantageous aspect of this invention, each inspection chamber 31 comprises at least a first shutter 50 associated with the inlet opening 32 and configured to produce an alternating succession of open and closed configurations of the respective inlet opening 32 during the operation of the unit 1. Preferably, the first shutter 50 adopts an open configuration at least during the generation of the jet or puff of air, and adopts a closed configuration during at least part of the detecting process performed by the olfactory sensor 33.

[0032] Preferably, the first shutters 50 of the inspection chambers 31 are configured to produce the alternating succession of open and closed configurations simultaneously.

[0033] At a functional level, the succession of articles 100 is conveyed transversely along the conveying path L. When the articles 100 align with the blowing devices 20, each of them delivers the jet or puff of air into the first end 101 of the respective article 100. Since the articles 100 reach the respective blowing devices 20 simultaneously, the blowing devices are operated simultaneously.

[0034] The air flows traverse the respective articles 100 and flow out of the respective second ends 102 to be conveyed through the respective inlet openings 32 into the respective inspection chambers 31 of the detectors 30 and collected therein. The inlet openings 32 are now occluded by the first shutters 50, thus trapping the air flows in the respective inspection chambers 31. Preferably, the inlet openings 32 are kept open in the step of collecting the air flow collected and kept closed in the step of analysing the air flow collected. Via the olfactory sensors 33, therefore, the detectors 30 analyse at least one chemical and/or physical property of the air flow collected in the respective inspection chambers 31 to measure the concentration of the flavouring in the air flow, thus checking the integrity of the flavouring capsule. Once the air flow collected has been analysed, the inlet openings 32 of the inspection chambers 31 are re-opened. The inlet openings 32 are thus subjected to at least one open/close cycle between the step of analysing the air flow from the respective article 100 and the step of analysing the air flow from the next article 100.

[0035] In the preferred embodiment, the open/close cycle is synchronized, in particular automatically and/or mechanically, by rotating the drum 15 in such a way that the rate of opening and closing is the same as the rate at which groups of successive articles 100 pass through on the drum 15: the groups of articles 100 comprise a number of articles equal to the number of articles 100 inspected simultaneously.

[0036] Advantageously, the presence of the first shutters 50 allows the air flow sample to be isolated from the surrounding external space, and in particular, from the space in which the conveyor 10 is located. In other words, the presence of the first shutters 50 allows the air sample to be "captured" at least for the length of time necessary for it to be analysed. This technical feature, therefore, ensures that each air sample is not diluted or extracted from the respective inspection chamber 31 and keeps its composition unchanged.

[0037] According to an advantageous aspect of this invention, each detector 30 also comprises a respective outlet opening 34. Preferably, the outlet opening 34 is used to allow the air to flow out of the respective inspection chamber 31. Advantageously, this technical feature allows the air flow, which by now has already been analysed, to be expelled through an opening which is distinct from the inlet opening 31.

[0038] In effect, according to an advantageous aspect of the invention, there is a step of discharging the analysed air flows from the inspection chambers 31. Preferably, the step of discharging is carried out by expelling each analysed air flow through the respective outlet opening 34. Still more preferably, the step of discharging is carried out after analysing the air flow and before or at the same time as other air flows are collected for analysis. According to an advantageous aspect of this invention, each detector 30 comprises a respective air extraction device 35 associated with the respective inspection chamber 31 and configured to expel the air from the inspection chamber 31 through the respective outlet opening 34.

[0039] In an embodiment, as illustrated in Figure 1, each air extraction device 35 comprises a suction device connected to the outlet opening 34. In other words, the step of discharging the air flow from the respective inspection chamber 31 may be carried out by suction applied through the outlet opening 34.

[0040] In another, different embodiment, not illustrated, each air extraction device 35 comprises a nozzle connected to the inspection chamber 31 to cause a jet or puff of pressurized cleaning air to be introduced into the respective inspection chamber 31. In other words, the step of discharging the air flow from the inspection chambers 31 may be carried out by negative pressure applied through the respective outlet openings 34 by means of a

jet or puff of pressurized cleaning air delivered into the inspection chambers 31.

[0041] Advantageously, the air extraction devices 35, of whatever kind, ensure that the air flow that has already been analysed is correctly removed so it does not negatively influence the analysis of the air flow after it.

[0042] According to an advantageous aspect of this invention, each inspection chamber 31 comprises a respective second shutter 60 associated with the outlet opening 34 and configured to produce an alternating succession of open and closed configurations of the outlet opening 34 during the operation of the unit 1. Preferably, the outlet openings 34 are subjected to at least one open/close cycle between the step of analysing the air flow from the respective article 100 and the step of analysing the air flow from the next article 100.

[0043] Still more preferably, each second shutter 60 adopts an open configuration at least during the generation of the respective jet or puff of cleaning air, and adopts a closed configuration during at least part of the detecting process performed by the respective olfactory sensor 33 and, preferably while the air flow is entering the respective inspection chamber 31.

[0044] In the preferred embodiment, the open/close cycle is synchronized, in particular automatically and/or mechanically, by rotating the drum 15 in such a way that the rate of opening and closing is the same as the rate at which groups of successive articles 100 pass through on the drum 15: the groups of articles 100 comprise a number of articles equal to the number of articles 100 inspected simultaneously.

[0045] Advantageously, the presence of the second shutters 60 allows the respective air flow sample to be isolated from the surrounding external space, and in particular, from the external space to the outlet opening 34. This technical feature, therefore, ensures that the respective air flow does not flow out through the outlet opening 34 accidentally before detection is completed by the olfactory sensor 33.

[0046] In use, in a configuration of alignment between an article 100 and the respective blowing devices 20, the inlet openings 32 are kept open while the outlet openings 34 are closed. Thus, the air flow emitted by each article 100 reaches the respective inspection chamber 31 and remains confined therein (Figure 1).

[0047] Next, the inlet openings 32 are closed and the outlet openings 34 remain closed. The air thus remains trapped inside the respective inspection chamber 31, allowing the respective olfactory sensor 33 to perform detection (Figure 2). During this step, the article 100 (together with the other articles inspected simultaneously) continues moving forward, out of alignment with the respective blowing device 20.

[0048] Next, at the end of the step of detecting and when the next articles approach the inspection area, the outlet openings 34 are opened to allow air to be expelled from the inspection chamber 31 (Figure 3). At the same time, or after that, the inlet openings 32 are opened and the outlet openings 34 are closed to allow the next articles to be inspected. Described below in detail are two possible, exemplary hence non-limiting embodiments of the shutters 50 and 60.

[0049] Preferably, the first shutters 50 are of an automatic type and synchronized mechanically with the conveyor 10.

[0050] Also, in the embodiment illustrated, the second shutters 60 are of an electronically controlled type, as will become clearer as this description continues.

[0051] Alternatively, the first and second shutters 50, 60 may be of the same type (in particular, both automatic and synchronized mechanically with the conveyor 10 or both of the electronically controlled type).

[0052] The first shutters 50 are configured to adopt the open and closed configurations in an automatic, sequential manner, synchronized with the movement of the conveyor 10. In other words, opening and closing the inlet openings 31 are synchronized, in particular automatically and/or mechanically by moving the conveyor 10 in such a way that the rate at which they open and close is the same as the rate at which the successive articles 100 pass through on the conveyor 10.

[0053] In the preferred embodiment, opening and closing the inlet openings 31 are synchronized, in particular automatically and/or mechanically by rotating the drum 15 in such a way that the rate at which they open and close is the same as the rate at which the successive articles 100 pass through on the drum 15.

[0054] Structurally, each shutter 50 has at least one shutter portion 51 which is movable cyclically along a closed path defined by a respective axis of rotation and at least one flow orifice 52 which is movable cyclically along the closed path alternately with the shutter portion 51.

[0055] In the preferred embodiment, the shutters 50 are defined by a single shutter body 53, of a rotary type and made in the form of a disc that is rotatable about a respective axis of rotation, preferably coinciding with the axis of rotation of the drum 15. Preferably, the shutter body 53 is operated at a constant rotation speed. Still more preferably, the shutter is moved in synchrony with the drum 15.

[0056] In this solution, the flow orifices 52 are through holes which are angularly distributed on a peripheral portion of the shutter body 53. Further, the shutter portions 51 are defined by the walls of the shutter body 53 which, when the flow orifices 52 and the inlet openings 32 are out of alignment, close the inlet openings 32.

[0057] Structurally, in other words, the shutter body 53 has at least one group of shutter portions 51, whose number and position are such as to close the inlet openings 32 simultaneously: the shutter portions 51 are movable along a closed path defined by the rotation of the shutter body 53. The shutter body 53 has at least one group of flow orifices 52, alternated with the shutter portions 51, whose number and position are such as to open the inlet openings 32 simultaneously.

[0058] Functionally, the shutter body 53 is rotatable

about its own axis of rotation, which coincides with the axis of rotation of the drum 15, at a constant speed which is synchronized with that of the drum 15. In this embodiment, the speed of the shutter body 53 is substantially equal to the speed of the drum 15 and the flow orifices 52 are arranged on the peripheral portion so as to substantially reflect the arrangement of the receiving seats 11 of the drum 15 and of the respective inlet openings 32.

[0059] Preferably, also, independently of its structure, the shutter body 53 comprises sealing elements so it adheres by sliding contact to the outside wall of the detectors 30 and sealedly occludes the respective inlet openings 32.

[0060] The second shutters 60 are defined by respective controlled open/close valves, in particular, a valve with a rotary shutting element. In other words, opening and closing of each outlet opening 34 are determined by the angular position adopted by a rotary shutting element of the respective valve, where the rotary shutting element rotates continuously in the same rotation direction, creating a succession of controlled open and closed configurations at a rate determined directly by the angular rotation speed. The rotation speed of each rotary shutting element is controllable electronically so as to actively adjust the rate of the open and closed configurations, in particular in a manner corresponding to the rate at which the articles 100 pass through the inspection area.

[0061] The shutters 60 are preferably connected to the control unit U which manages their operation in synchrony with the conveyor 10.

[0062] In variant embodiments not illustrated, one or both of the shutters 50, 60 may be electrovalves, where each opening action is electronically controlled.

[0063] The invention achieves the above-mentioned aims by eliminating the drawbacks of the prior art: in this regard, it should be noted that the structure of the unit 1, and in particular, the presence of a plurality of detectors 30 and blowing devices 20, as claimed and/or described herein, is suitable for ensuring that there is enough time to analyse the air flow, hence that quality analyses are high standard, even at high production speeds.

[0064] It should also be noted that the structure of the unit 1, and in particular, the structure of the detectors 30, as claimed and/or described herein, is suitable for optimizing detection efficiency and accuracy.

[0065] This result is achieved by controlling the (open/-closed) state of the inlet openings 32 and/or of the outlet openings 34 so that the olfactory sensors 33 can operate under uniform conditions, without the air flow being diluted and/or contaminated.

Claims

1. A unit (1) for checking the integrity of flavouring capsules in rod-shaped smoking articles (100), comprising:

- a conveyor (10) configured to convey a succession of rod-shaped articles (100) transversely along a conveying path (L) passing through an inspection area; the conveyor (10) having a plurality of receiving seats (11) for accommodating respective articles (100) and distributed in succession along the conveying path (L) so as to be spaced from each other by a given spacing;

characterized in that it comprises:

- a plurality of blowing devices (20) located in the inspection area on a first side of the conveyor (10) at a position such that they are simultaneously facing and aligned with a respective number of receiving seats (11) in transit along the conveying path (L); each blowing device (20) being configured to deliver a jet or puff of air into a first end (101) of a respective article (100) when the article (100) positioned on the conveyor (10) passes through the inspection area;
- a plurality of detectors (30), each having an inspection chamber (31) and an inlet opening (32) located in the inspection area on a second side of the conveyor (10), opposite the first side, so that the inlet opening (31) of each detector (20) is facing and aligned with a respective blowing device (20) to receive an air flow coming out of the second end (102) of the respective article (100), generated by the jet or puff of air, and to convey the air flow into the respective inspection chamber (31); wherein each detector (30) also comprises an olfactory sensor (33) located in the inspection chamber (31) and configured to analyse at least one chemical and/or physical property of the air flow; and wherein the blowing devices (20) and detectors (30) are operable simultaneously to perform a simultaneous inspection on two or more articles (100) moved simultaneously by the conveyor (10).

2. The unit (1) according to claim 1, wherein the blowing devices (20) and the respective detectors (30) are fixed.

3. The unit (1) according to claim 1 or 2, wherein the blowing devices (20) are spaced from each other by the given spacing and wherein the detectors (30) are spaced from each other by the given spacing.

4. The unit (1) according to any one of the preceding claims, wherein the plurality of blowing devices (20) comprises a number of blowing devices (20) between 2 and 5, preferably 3 or 4.

5. The unit (1) according to any one of the preceding claims, wherein the conveyor (10) comprises a drum (15) which is rotatable about an axis of rotation, the

receiving seats (11) being angularly distributed around the axis of rotation.

6. The unit (1) according to any one of the preceding claims, wherein each inspection chamber (31) comprises a first shutter (50) associated with the respective inlet opening (31) and configured to produce an alternating succession of open and closed configurations of the inlet opening (31) during the operation of the unit (1); preferably, the first shutters (50) of the inspection chambers (31) being configured to produce the alternating succession of open and closed configurations simultaneously.

7. The unit (1) according to claim 6, wherein the first shutters (50) adopt the open configuration at least during the generation of the jet or puff of air, and adopt the closed configuration during at least part of the detecting process performed by the respective olfactory sensor (33).

8. The unit (1) according to any one of the preceding claims, wherein each detector (30) also comprises a respective outlet opening (34) to allow air to flow out of the inspection chamber (31).

9. The unit (1) according to claim 8, wherein each inspection chamber (31) comprises a second shutter (60) associated with the respective outlet opening (34) and configured to produce an alternating succession of open and closed configurations of the outlet opening (34) during the operation of the unit (1); preferably, the second shutters (60) being configured to produce the alternating succession of open and closed configurations simultaneously.

10. The unit (1) according to any one of claims 6 to 9, wherein the shutters (50, 60) are configured to adopt the open and closed configurations in an automatic, sequential manner, synchronized with the movement of the conveyor (10).

11. The unit (1) according to claims 5 and 10, wherein the shutters (50) are defined by a single shutter body (53), of a rotary type and made in the form of a disc that is rotatable about a respective axis of rotation, preferably coinciding with the axis of rotation of the drum (15); the shutter body (53) being preferably operated at a constant rotation speed; and still more preferably, the shutter body (53) being moved in synchrony with the drum (15).

12. The unit (1) according to claim 11, wherein the shutter body (53) comprises:

- at least one group of shutter portions (51), whose number and position are such as to close the inlet openings (32) simultaneously; the shutter portions (51) being movable along a closed path defined by the rotation of the shutter body (53); and
- at least one group of flow orifices (52), alternated with the shutter portions (51), whose number and position are such as to open the inlet openings (32) simultaneously.

13. The unit (1) according to any one of claims 6 to 9, wherein each shutter (50, 60) is defined by a controlled open/close valve.

14. The unit (1) according to any one of claims 8 to 13, wherein each detector (30) also comprises an air extraction device (35) associated with the respective inspection chamber (31) and configured to expel the air from the inspection chamber (31) through the outlet opening (34); the air extraction devices (35) being configured to operate simultaneously;
the air extraction device (35) preferably comprising a suction device connected to the outlet opening (34) or a nozzle connected to the inspection chamber (31) to cause a jet or puff of pressurized cleaning air to be introduced into the inspection chamber (31).

15. The unit (1) according to any one of the preceding claims, further comprising retaining means (40), configured for securely holding each article (100) at its ends (101, 102) at least in the inspection area, the retaining means (40) comprising, for each receiving seat (11), a pair of opposing pads movable around the axis of rotation of the drum (15) and synchronized with the drum (15), configured to gradually engage the ends (101, 102) of the article (100) as it approaches the inspection area and to gradually disengage the ends (101, 102) of the article (100) as it moves away from the inspection area, each pad having a through duct (41) and the through ducts (41) of each pair being aligned with each other and positioned, when in the inspection area, to be aligned with the blowing device (20) and with the detector (30).

16. A method for checking the integrity of flavouring capsules in rod-shaped smoking articles (100), in particular implemented by an inspection unit (1) according to any one of the preceding claims, comprising the following steps:

- transversely conveying a succession of rod-shaped articles (100) by means of a conveyor (10) along a conveying path (L) passing through an inspection area, the inspection area being provided with a plurality of blowing devices (20) and a plurality of detectors (30), each having an inspection chamber (31) and being associated with a respective blowing device (20);
- in the inspection area, delivering a jet or puff of

air into a first end (101) of a respective article (100) through each of the blowing devices (20) when the articles (100) positioned on the conveyor (10) pass through the inspection area;
- collecting the air flow, generated by the jet or puff of air, coming out of the second end (102), opposite the first end (101), of each of the articles (100), and flowing into the inspection chamber (31) of the respective detector (30) through a respective inlet opening (32) of the inspection chamber (31);
- analysing at least one chemical and/or physical property of the air flows collected in the respective inspection chambers (31) by means of an olfactory sensor (33) located in each inspection chamber (31).

17. The method according to claim 16, wherein the step of delivering the jets and puffs of air is carried out by the blowing devices (20) on the articles (100) simultaneously, and wherein the step of collecting and analysing the air flows collected is also carried out simultaneously in the respective inspection chambers (31).

18. The method according to claim 16 or 17, wherein the number of articles (100) subjected to inspection simultaneously is between 2 and 5, preferably 3 or 4.

19. The method according to any one of claims 16 to 18, wherein the succession of articles (100) is conveyed along the conveying path (L) continuously and at a constant speed.

20. The method according to any one of claims 16 to 19, wherein the inlet openings (32) can be opened and closed selectively, and wherein each of the inlet openings (32) is subjected to at least one open/close cycle between inspections of two consecutive articles (100).

21. The method according to any one of claims 16 to 20, further comprising a step of discharging the air flow from each inspection chamber (31), in particular by an air compressing action through a respective outlet opening (34) to expel the air from the inspection chambers (31), the step of discharging being carried out simultaneously on all the inspection chambers (31) associated with the articles (100) inspected.

22. The method according to claims 21, wherein the outlet openings (34) can be opened and closed selectively, and wherein each of the outlet openings (34) is subjected to at least one open/close cycle between inspections of two consecutive articles (100).

23. The method according to claim 20 or 22, wherein the open/close cycle is synchronized, in particular automatically and/or mechanically, by rotating the drum (15) in such a way that the rate of opening and closing is the same as the rate at which groups of successive articles (100) pass through on the drum (15), the groups of articles (100) comprising a number of articles equal to the number of articles (100) inspected simultaneously.

24. The method according to any one of claims 16 to 22, wherein the open/close cycle is controlled electronically, in particular through one or more controllable valves.

Fig.1

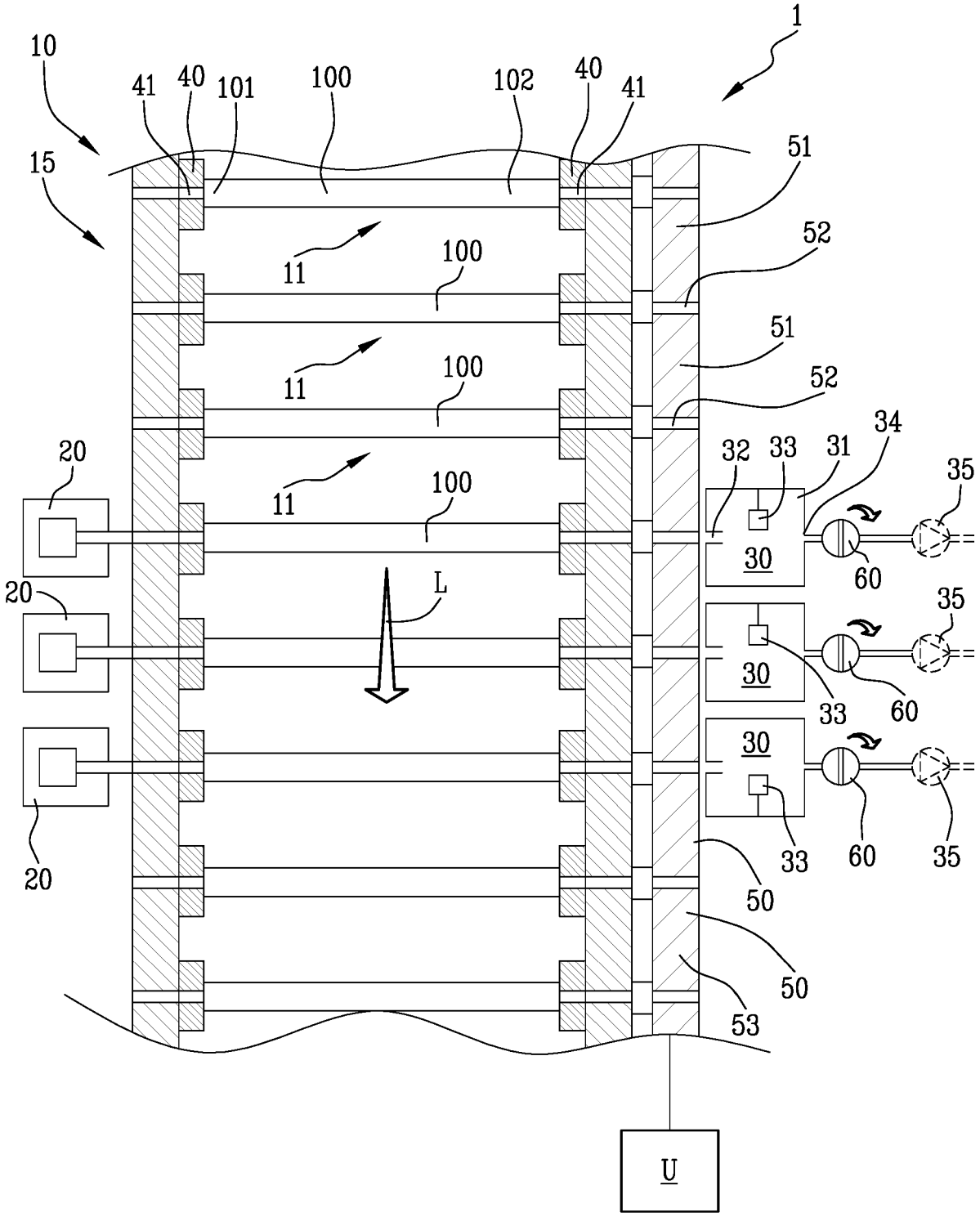

1
10
15
41
40
101
100
102
40
41
51
52
11
100
51
52
11
100
20
32
33
31
34
35
11
100
30
60
20
L
35
30
33
60
30
33
60
35
20
50
50
53
U

Fig.2

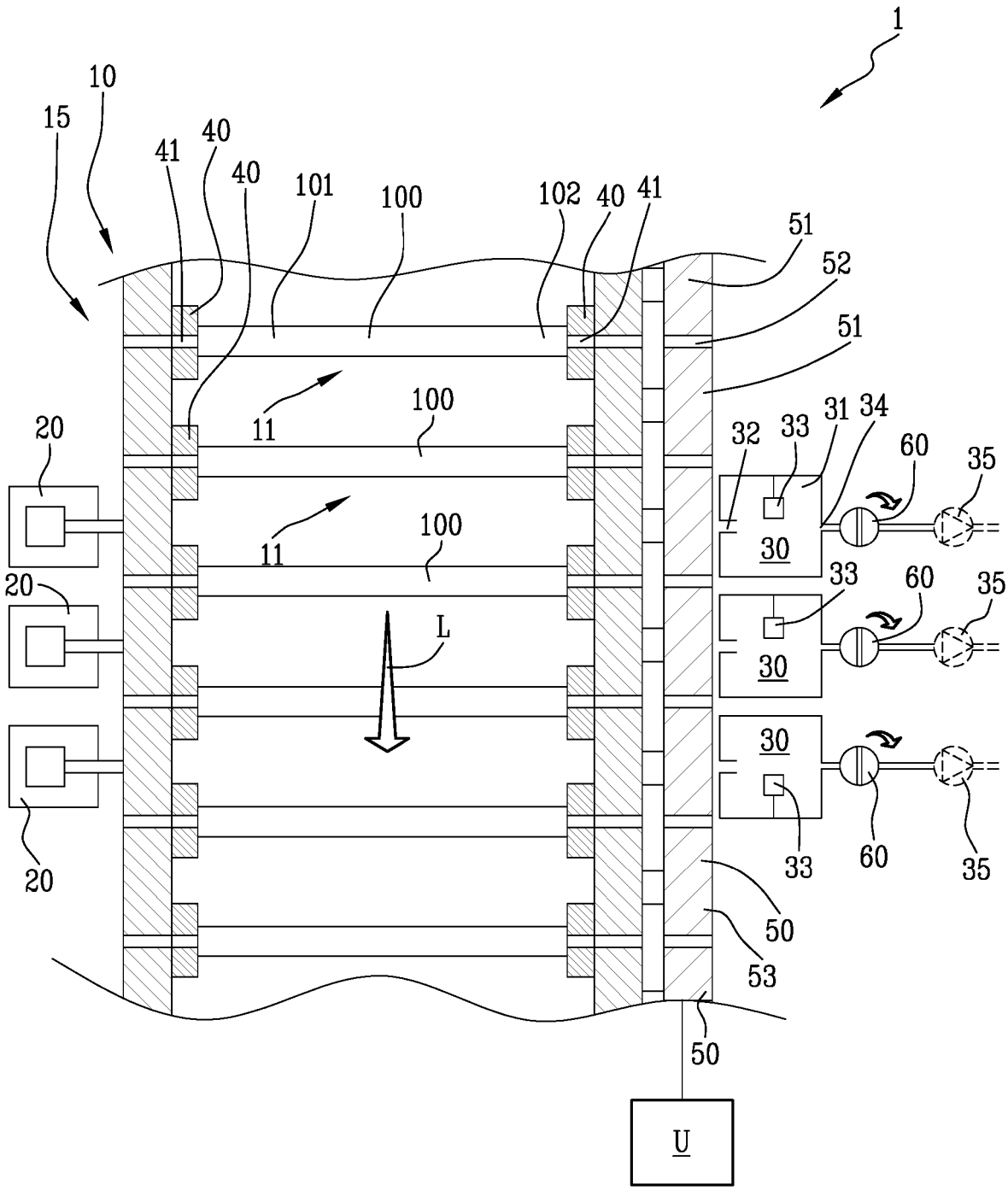
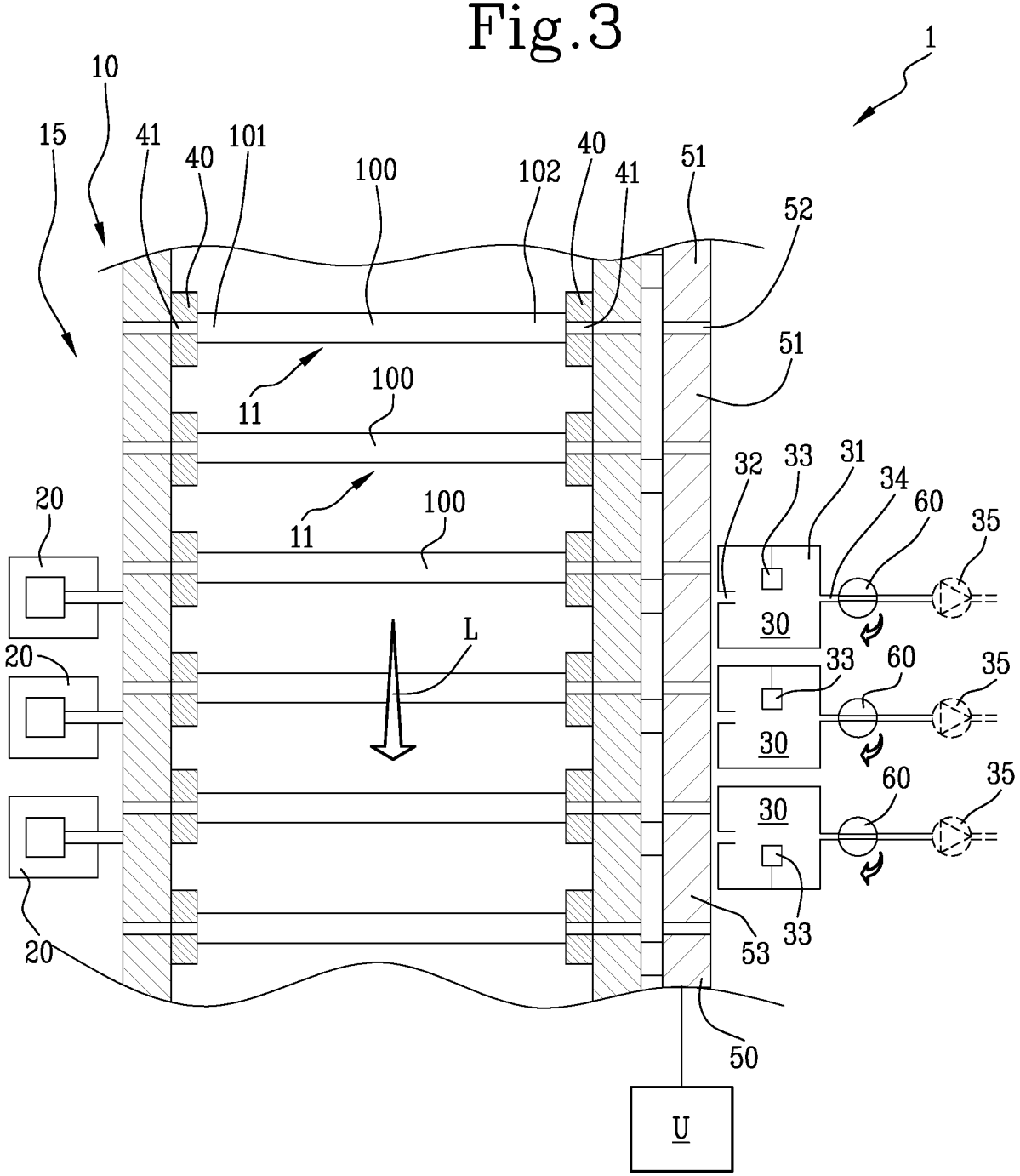

1
10
15
41
40
40
101
100
102
40
41
51
52
51
11
100
20
11
100
20
L
20
32
33
31
34
60
35
30
33
60
35
30
30
33
60
35
50
53
50
U

Fig.3


1
10
15
41
40
101
100
102
40
41
51
52
51
11
100
11
100
20
20
20
L
32
33
31
34
60
35
30
33
60
35
30
60
35
30
33
53
50
U

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 18 0505

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2016/107780 A1 (JT INT SA [CH]) 7 July 2016 (2016-07-07) * page 2, line 23 - page 3, line 1; claims; figures * * page 7, line 30 - page 8, line 3 * * page 8, line 24 - line 31 * * page 12, line 28 - page 13, line 1 * * page 14, line 18 - page 15, line 3 *	1-24	INV. A24C5/34
A	WO 2021/070302 A1 (JAPAN TOBACCO INC [JP]) 15 April 2021 (2021-04-15) * paragraph [0088] - paragraph [0118]; claims; figures 15,16 *	1-24	
			TECHNICAL FIELDS SEARCHED (IPC) A24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 October 2024	Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 18 0505

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. 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.

30-10-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2016107780 A1	07-07-2016	EA 201791510 A1	30-11-2017
		EP 3241023 A1	08-11-2017
		JP 6622312 B2	18-12-2019
		JP 6871996 B2	19-05-2021
		JP 2018506271 A	08-03-2018
		JP 2020058352 A	16-04-2020
		PL 3241023 T3	21-09-2020
		WO 2016107780 A1	07-07-2016
WO 2021070302 A1	15-04-2021	DE 112019007796 T5	11-08-2022
		JP 7042985 B2	28-03-2022
		JP WO2021070302 A1	15-04-2021
		TW 202115399 A	16-04-2021
		WO 2021070302 A1	15-04-2021

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- WO 2021070302 A **[0005]**