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(54) System and method for assessment of smoking articles

(57) The present invention provides a system (1) for assessment of smoking articles (3), such as cigarettes or the like, having an inspection device (5) comprising at least one sensor (7) for inspecting or analysing the smoking articles (3) during transport of the smoking articles along a transport path (4). The inspection device (5) defines an inspection zone (6) that is arranged in the transport path (4). The inspection zone (6) is furthermore arranged or located between manufacturing equipment (M) for assembly of the smoking articles and packaging equipment (P) for packaging a predetermined number of the smoking articles into packs. The invention also provides a method of assessing the smoking articles.

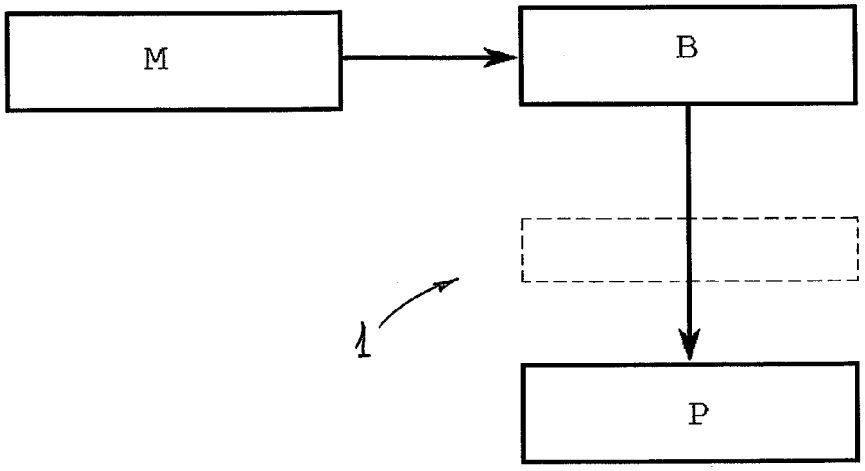

Fig. 1

EP 2 727 480 A1

Description

[0001] The invention relates to a system and method for assessment of smoking articles, such as cigarettes or the like. More particularly, the invention concerns a system and method that is designed to inspect and/or analyse the smoking articles to assure product quality.

[0002] Popular smoking articles, such as cigarettes, typically have a generally cylindrical rod shaped structure and include a charge, roll or column of smokable material such as shredded tobacco (e.g. in cut filler form) surrounded by a paper wrapper thereby forming a so-called "tobacco rod". Normally, also, a cigarette has a cylindrical filter element aligned in an end-to-end relationship with the tobacco rod. Typically, the filter element comprises cellulose acetate tow, and the tow is circumscribed by a paper material known as "plug wrap". Typically, the filter element is attached to one end of the tobacco rod using a circumscribing wrapping material known as "tipping paper".

[0003] In more recent years, various proposals have been made for modifying the sensory attributes of cigarettes by using the filter elements as vehicles for adding flavor to mainstream smoke of the cigarettes. For example, these proposals include incorporating smoke-altering solid objects such as rupturable flavor pellets or capsules, flavored or non-flavored strands, exchange resin beads, adsorbent/absorbent particles, and/or combinations thereof, into cigarette filters, in an automated fashion. Typically, during the manufacturing process, the filter material is formed into a continuous filter rod having the objects positioned within that rod along a longitudinal axis thereof. The continuous filter rod is then subdivided or cut at predetermined intervals to form a plurality of filter elements, such that each filter element includes at least one of the objects therein.

[0004] However, such processes for inserting objects within a filter rod may produce some defective filter elements. For example, one or more of the objects inserted within a filter rod may be missing, misoriented or, in the case of rupturable pellets or capsules, already ruptured. As such, it may be desirable to detect such defective filter rods such that any defective filter rod, or at least the defective portion(s) thereof, can be removed from the manufacturing process.

[0005] It is therefore an object of the present invention to provide an improved system and method for the assessment of smoking articles. In particular, it is an object of the invention to increase the yield of the manufacturing process for this type of smoking article and to more reliably prevent such smoking articles having a defective filter element from reaching a consumer.

[0006] In accordance with this invention, a system and a method for assessment of smoking articles having the features recited in claim 1 and claim 12, respectively, is provided. Advantageous or preferred features of the invention are recited in the dependent claims.

[0007] According to one aspect, therefore, the invention provides a system for assessment of smoking articles, such as cigarettes or the like, comprising: an inspection device comprising at least one sensor for inspecting or analysing the smoking articles during transport of the smoking articles along a transport path, wherein the inspection device defines an inspection zone arranged in the transport path, and wherein the inspection zone is located or arranged downstream of an installation or equipment for manufacturing or assembling the smoking articles. For example, the inspection zone could be located or arranged between the equipment for manufacturing or assembling the smoking articles and the equipment for packaging a predetermined number of the smoking articles into packs. In other words, the transport path in which the inspection zone is provided may convey the smoking articles from the manufacturing equipment to the packaging equipment.

[0008] In a preferred embodiment, the inspection zone is arranged in the transport path adjacent to, or immediately upstream of, the packaging equipment for packaging the smoking articles into packs. In this regard, the inspection device may be associated with or incorporated in a buffer for temporarily storing an accumulation of the smoking articles adjacent to, or immediately upstream of, the packaging equipment. As noted above, the system of the invention has particular application for use with smoking articles, such as cigarettes, which include one or more capsule incorporated in a filter element thereof. The inspection zone, and particularly the at least one sensor, is therefore desirably arranged to be adjacent a filter element of the smoking article as the smoking article is transported or conveyed along the transport path.

[0009] By arranging the inspection zone of the system adjacent to and/or immediately upstream of the packaging equipment, it has been found that the yield of the manufacturing process and the reliability of the assessment of the smoking articles overall can be dramatically improved. In addition, a position immediately prior to the packaging of the smoking articles presents a final opportunity for sorting defective smoking articles from the transport path, and thereby preventing them from inclusion in the final packaged product to be dispatched to consumers. In a preferred form, the at least one sensor is configured to detect or analyse the presence and/or the state or condition of an object in the smoking article, especially in a filter element of the smoking article, such as a strand or a rupturable pellet or capsule.

[0010] In a preferred embodiment, the system includes a transport device for transporting or conveying the smoking articles along the transport path. As already described, the smoking articles, such as cigarettes, are typically elongate, having a generally cylindrical, rod-like form, as is well-known in the art. Preferably, the transport device is configured for transporting or conveying the smoking articles in a direction transverse to a longitudinal axis of the smoking articles. Further, the transport device may be configured to transport or convey the smoking articles through the inspection zone substantially contin-

uously, and preferably at a substantially constant speed. The transport device may also be configured for adjustment of the speed of the smoking articles along the transport path and/or through the inspection zone.

[0011] In a particularly preferred embodiment, the transport device is configured to convey the smoking articles individually, or separately from one another, through the inspection zone. In this regard, the transport device may have a first conveyance for transporting or conveying the smoking articles along the transport path at a first predetermined speed, and a second conveyance (e.g. downstream of the first conveyance along the transport path) for transporting or conveying the smoking articles along the transport path at a second predetermined speed. Preferably, the second predetermined speed is higher than the first predetermined speed. By carefully selecting and regulating the first and second speeds of the first and second conveyances, respectively, the smoking articles can be separated from one another along the transport path. This, in turn, enables an improved and a more reliable inspection and analysis of the smoking articles via the at least one sensor in the inspection zone. The inspection zone of the system may thus, for example, be arranged in a part of the path in which the smoking articles are conveyed at the second predetermined speed.

[0012] In a preferred embodiment, the at least one sensor of the system is configured to inspect and/or analyse the smoking articles in a direction substantially transverse to the longitudinal axis thereof, preferably as the smoking articles are conveyed or transported through the inspection zone. In this regard, the at least one sensor may be integrated in a detection unit or detection head which is arranged adjacent a longitudinal extent of the smoking article positioned in the inspection zone. For example, the detection unit or detection head may be arranged or positioned adjacent a filter element at an end region of the smoking article. In this regard, the sensor(s) is/are preferably adapted to detect the presence and/or state or condition of an object in the filter element. The at least one sensor itself desirably includes one or more of a density sensor, a moisture sensor, a near-infrared (IR) sensor, an x-ray sensor, a capacitance sensor, an ultrasound sensor, a pressure sensor, and a thermal sensor.

[0013] In a particularly preferred embodiment, the system includes a sorting means for removing individual smoking articles from the transport path if they are detected by the at least one sensor as being defective. In this regard, the sorting means may be designed to eject a defective smoking article from the transport path, for example, by imparting an impulse to the defective smoking article.

[0014] According to another aspect, the invention provides a method of assessment of smoking articles, such as cigarettes or the like, comprising the steps of:

transporting or conveying the smoking articles along a transport path, preferably in a direction transverse to a longitudinal axis of the smoking articles; and

inspecting or analysing the smoking articles via one or more sensor in an inspection zone arranged in the transport path;

wherein the step of inspecting or analysing the smoking articles occurs after manufacture or assembly of the smoking articles.

[0015] As noted above, in a preferred embodiment the inspection zone is located between manufacturing equipment for assembling the smoking articles and packaging equipment for packaging them, and is preferably located in the transport path adjacent or immediately upstream of the packaging equipment. The step of inspecting or analysing the smoking articles thus typically occurs prior to packaging the smoking articles into packs. To provide for orderly and regulated operation, the method may include buffering or temporarily storing an accumulation of the smoking articles immediately upstream of the packaging equipment. Thus, the step of transporting or conveying the smoking articles along the transport path typically involves transferring the smoking articles to the packaging equipment from the buffer.

[0016] In a preferred embodiment, the at least one sensor inspects and/or analyses a smoking article in a direction transverse to a longitudinal axis thereof as the smoking article travels through the inspection zone.

[0017] In a particularly preferred embodiment, the smoking articles are transported or conveyed through the inspection zone substantially continuously, and preferably at a substantially constant speed. The method may also involve transporting or conveying the smoking articles through the inspection zone separately from one another or individually. Accordingly, the method preferably includes the step of separating the smoking articles such that they are spaced apart from one another on the transport path. In this way, the smoking articles, which are accumulated in a group in a storage or buffer zone, may be separated and/or transported individually on the transport path into the inspection zone, such that each smoking article can be more accurately inspected and assessed.

[0018] In a preferred embodiment, the method includes the step of sorting or removing a smoking article from the transport path if it is detected as defective by the at least one sensor during the step of inspecting or analysing. In particular, the method may include the step of ejecting a smoking article from the transport path if it is detected as being defective.

[0019] According to another aspect, the invention provides a system for assessment of elongate or rod-shaped smoking articles, such as cigarettes or the like, including: a transport device for transporting or conveying the articles along a transport path in a direction transverse to a longitudinal axis of the articles; and an inspection device comprising at least one sensor for inspecting and/or analysing the smoking articles, the inspection device defin-

ing an inspection zone arranged in the transport path. Preferably, the at least one sensor is configured to inspect and/or analyse the smoking articles in a direction substantially transverse to a longitudinal axis thereof. In this regard, the sensor(s) is/are preferably for remote sensing or analysis of the smoking articles; that is, they do not require physical contact.

[0020] As noted above, the transport device is preferably configured to transport or convey the smoking articles individually or separately from one another through the inspection zone. Thus, the transport device may be configured to separate the smoking articles to be spaced apart from one another as they are transported or conveyed along the transport path. Also, the transport device may be configured to transport or convey the smoking articles continuously through the inspection zone, e.g. at a substantially constant speed.

[0021] According to yet a further aspect, the invention provides a method of assessment of rod-shaped smoking articles, such as cigarettes or the like, comprising the steps of:

transporting or conveying the smoking articles along a transport path in a direction transverse to a longitudinal axis of the articles; and

inspecting and/or analysing the smoking articles in an inspection zone arranged in the transport path via at least one sensor;

wherein the at least one sensor is configured to inspect and/or analyse the smoking articles substantially transverse to a longitudinal axis thereof.

[0022] As before, the smoking articles are preferably transported or conveyed individually or separately from one another and substantially continuously through the inspection zone.

[0023] For a more complete understanding of the invention and the advantages thereof, exemplary embodiments of the invention are explained in more detail in the following description with reference to the accompanying drawing figures, in which like reference characters designate like parts and in which:

Fig. 1 is a diagram schematically illustrating a system for assessment of smoking articles according to an embodiment of the invention;

Fig. 2 is a front view schematically illustrating a part of the system of Fig. 1, including a transport device and an inspection device; and

Fig. 3 is a perspective view schematically illustrating part of the system of Fig. 1, including transport device and inspection device.

[0024] The accompanying drawings are included to provide a further understanding of the present invention and are incorporated in and constitute a part of this specification. The drawings illustrate particular embodiments of the invention and together with the description serve to explain the principles of the invention. Other embodiments of the invention and many of the attendant advantages of the invention will be readily appreciated as they become better understood with reference to the following detailed description.

[0025] It will be appreciated that common and well understood elements that may be useful or necessary in a commercially feasible embodiment are not necessarily depicted in order to facilitate a more abstracted view of the embodiments. The elements of the drawings are not necessarily illustrated to scale relative to each other. It will further be appreciated that certain actions and/or steps in an embodiment of a method may be described or depicted in a particular order of occurrences while those skilled in the art will understand that such specificity with respect to sequence is not actually required. It will also be understood that the terms and expressions used in the present specification have the ordinary meaning as is accorded to such terms and expressions with respect to their corresponding respective areas of inquiry and study, except where specific meanings have otherwise been set forth herein.

[0026] Referring firstly to Fig. 1 of the drawings, a system 1 for assessment of smoking articles, such as cigarettes, is shown schematically incorporated in a facility or installation for producing and packaging cigarettes. The box M schematically represents manufacturing equipment with which the cigarettes are produced or assembled, while the box B represents a buffer zone in which an accumulation of the cigarettes are collected or stored prior to their packaging via packaging equipment P. That is, the cigarettes may be continuously transported through the buffer zone B, e.g. along a conveyor assembly of determined length and at constant speed, towards the packaging equipment P. In other words, box P represents packaging equipment for packaging a predetermined number of the cigarettes into individual packs or packets. To be more specific, the packaging equipment P is configured to collect to package a group or charge typically of about 20 to 30 cigarettes into the individual packs or packets.

[0027] With reference also to Fig. 2 of the drawings, the system 1 of this particular embodiment includes a transport device 2 for transporting or conveying cigarettes 3 along a transport path 4 from the buffer zone B to the packaging equipment P. Furthermore, the system 1 includes an inspection device 5 which defines an inspection zone 6 in the transport path 4, within which the cigarettes 3 are individually inspected or analysed via one or more sensors 7.

[0028] Location of the inspection device 5 in the transport path 4 between the buffer zone B and packaging equipment P according to the invention is particularly advantageous. By use of the buffer zone B, the system 1 can be designed to provide a time gap or delay of specific duration between when the cigarette 3 is manufactured

and when it is assessed via the inspection device 5. For example, the system 1 may be designed to have a time gap or delay of at least about 5 minutes, and preferably in the range of about 5 to 20 minutes, between manufacture of the cigarette 3 and when it is tested or assessed via the inspection device 5. As the buffer zone B typically operates on a "first in, first out" basis, the time delay in the buffer B can be accurately estimated.

[0029] The sensor or sensors 7 are desirably configured to remotely sense the presence and/or the state or condition of an object 8 such as a pellet or capsule contained in cigarette 3 that is currently within or passing through the inspection zone 6. The sensor(s) 7 may be any one or more of a density sensor, a moisture sensor, an ultrasound sensor, a thermal sensor or a capacitance sensor.

[0030] Referring further to Fig. 2 of the drawings, it will be seen that the transport device 2 in this particular embodiment includes a first conveyance 9 having two oppositely arranged endless belt drives 10 which define a gap there-between for snugly receiving and conveying a series of cigarettes 3 in the downward direction along the transport path 4. This first conveyance 9 transports or conveys the cigarettes 3 in a direction transverse to a longitudinal extent or axis X of the cigarettes 3, as is also apparent from Fig. 3.

[0031] With reference also to Fig. 3 of the drawings, which shows a lower part of the arrangement in Fig. 2 schematically and in perspective view, it will be seen that when the individual cigarettes 3 leave the first conveyance 9, they travel along the transport path 4 into a second conveyance 11 which has a similar construction to the first conveyance 9. That is, the second conveyance 11 also includes two oppositely arranged endless belt drives 12 that define a gap there-between for receiving and transporting the individual cigarettes 3 along the transport path 4 in the same orientation.

[0032] Because the belt drives 12 of the second conveyance 11 run at a higher speed than the belt drives 10 of first conveyance 9, the cigarettes 3 in the second conveyance 11 are transported along the transport path 4 more quickly than the cigarettes 3 in the first conveyance 9, which in turn generates a space or gap between each of the cigarettes 3 being transported by the second conveyance 11. In this way, the cigarettes 3 are then each transported individually and separated from one another. As a result, each of the cigarettes 3 is transported into the inspection zone 6 individually to be inspected and analysed by the sensor(s) 7 on an individual basis. This significantly enhances both the reliability and accuracy of the inspection device 5.

[0033] Referring to Fig. 3 of the drawings, the pellet or capsule 8 is incorporated in a filter element 13 arranged at an end region of each cigarette 3. The second conveyance 11 conveys or transports the cigarettes 3 separately and individually into the inspection zone 6 between the sensors 7, where they are individually inspected and/or analysed. In particular, the sensors 7 scan or analyse the filter elements 13 of each cigarette 3 within or passing through the inspection zone 6 in a direction transverse to the longitudinal axis X of the cigarette. In this direction, the sensors 7 can be arranged in close proximity to the individual capsule or pellet 8 in each cigarette. If the inspection or analysis carried out by the sensors 7 indicate that a capsule 8 is not present in the filter element 13 or that a capsule has broken, causing its contents to prematurely leak into the filter material, that particular cigarette 3 will be deemed or designated as being "defective" and will be removed or sorted out from the rest of the cigarettes 3 passing to the packaging equipment P.

[0034] In this regard, the system 1 will typically include a control unit (not shown) for regulating operation of the transport device 2 and the inspection device 5. The control unit may, for example, include a processor with a micro-controller. If the sensors 7 of the inspection device 5 detect a defective cigarette, the control unit then activates a sorting device (not shown) to remove the defective cigarette from the path 4 to the packaging equipment P. In this connection, the sorting device may be designed to impart an impulse to the defective cigarette (e.g. via an impact or blast of air) to deflect the defective cigarette sideways out of the transport path 4 that otherwise conveys the cigarettes to the packaging equipment.

[0035] With the system of the invention, the detection of defective cigarettes 3, and particularly leaking pellets or capsules 8, is substantially improved or enhanced when a cigarette 3 is tested a minimum of about 5 minutes after its manufacture. If a pellet or capsule 8 is broken, for example, the contents of the capsule have time to diffuse into the filter material of the cigarette 3. Furthermore, the speed of the cigarettes 3 in the buffer zone B and prior to entering the packaging equipment P is significantly lower than their speed in the manufacturing equipment M or an outlet thereof. The present invention also employs a more favourable orientation of the smoking articles during inspection or analysis. In this way, the system and method of the present invention provide a more effective, more reliable, and more reproducible inspection of the smoking articles in and/or after a region of the buffer zone B and before packaging of the smoking articles, without employing costly detection equipment and sensors 7.

[0036] Although specific embodiments of the invention have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are only examples, and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment with-

out departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0037] In this document, the terms "comprise", "comprising", "include", "including", "contain", "containing", "have", "having", and any variations thereof, are intended to be understood in an inclusive (i.e. non-exclusive) sense, such that the process, method, device, apparatus or system described herein is not limited to those features or parts or elements or steps recited but may include other elements, features, parts or steps not expressly listed or inherent to such process, method, article, or apparatus. Furthermore, the terms "a" and "an" used herein are intended to be understood as meaning one or more unless explicitly stated otherwise. Moreover, the terms "first", "second", "third", etc. are used merely as labels, and are not intended to impose numerical requirements on or to establish a certain ranking of importance of their objects.

List of Reference Signs

[0038]

1	system
2	transport device
3	cigarette
4	transport path
5	inspection device
6	inspection zone
7	sensor
8	pellet or capsule
9	first conveyance
10	first endless belt drive
11	second conveyance
12	second endless belt drive
13	filter element
M	manufacturing equipment
B	buffer zone
P	packaging equipment
X	longitudinal axis of cigarette

Claims

1. A system (1) for assessment of smoking articles (3), such as cigarettes or the like, comprising:

an inspection device (5) comprising at least one sensor (7) for inspecting or analysing the smoking articles (3) during transport of the smoking articles along a transport path (4), the inspection device (5) defining an inspection zone (6) arranged in the transport path (4);
wherein the inspection zone (6) is arranged or located downstream of manufacturing equipment (M) for assembly of the smoking articles.

2. A system (1) according to claim 1, wherein the inspection zone (6) is arranged in the transport path (4) adjacent to and/or upstream of packaging equipment (P) for packaging a predetermined number of the smoking articles (3) into packs.

3. A system (1) according to claim 1 or claim 2, wherein the inspection device (5) is associated with or incorporated in a buffer (B) for temporarily storing an accumulation of the smoking articles (3) adjacent to, or immediately upstream of, the packaging equipment (P).

4. A system (1) according to any of claims 1 to 3, wherein the at least one sensor (7) is configured to inspect or analyse the smoking articles substantially transverse to a longitudinal axis (X) thereof as the smoking articles are transported or conveyed through the inspection zone.

5. A system (1) according to any of claims 1 to 4, further comprising a transport device (2) for transporting or conveying the smoking articles (3) along the transport path (4), preferably in a direction transverse to a longitudinal axis (X) of the smoking articles.

6. A system (1) according to claim 5, wherein the transport device (2) is configured to transport or convey the smoking articles (3) through the inspection zone (6) substantially continuously, preferably at substantially constant speed.

7. A system (1) according to claim 5 or claim 6, wherein the transport device (2) is configured for adjustment of a speed of the smoking articles (3) along the transport path (4) or through the inspection zone (6).

8. A system (1) according to any of claims 5 to 7, wherein the transport device (2) is configured to convey the smoking articles (3) individually and/or separately from one another through the inspection zone (6).

9. A system (1) according to any of claims 5 to 8, wherein the transport device (2) includes a first conveyance (9) for transporting or conveying the smoking articles (3) along the transport path (4) at a first predetermined speed, and a second conveyance (11) downstream of the first conveyance (9) for transporting or conveying the smoking articles (3) along the transport path (4) at a second predetermined speed, the second speed preferably being greater than the first speed, and wherein the inspection zone (6) is preferably arranged in a region of the transport path (4) in which the smoking articles are transported or conveyed at the second predetermined speed.

10. A system (1) according to any of claims 1 to 9, wherein the at least one sensor (7) is integrated in a de-

tection unit or detection head arranged laterally adjacent a longitudinal extent of a smoking article positioned in the inspection zone (6), preferably arranged laterally adjacent an end region of the smoking article.

11. A system (1) according to any of claims 1 to 10, wherein the at least one sensor (7) includes one or more of a density sensor, a moisture sensor, a near-infrared sensor, an x-ray sensor, a capacitance sensor, an ultrasound sensor, a pressure sensor, and a thermal sensor.

12. A method of assessing smoking articles, such as cigarettes or the like, comprising the steps of:

transporting or conveying the smoking articles along a transport path in a direction transverse to a longitudinal axis of the articles;
inspecting or analysing the smoking articles in an inspection zone arranged in the transport path via at least one sensor;
wherein the step of inspecting or analysing the smoking articles occurs after manufacture or assembly of the smoking articles.

13. A method according to claim 12, wherein the at least one sensor inspects or analyses the smoking articles transverse to a longitudinal axis thereof as the smoking articles travel through the inspection zone.

14. A method according to claim 12 or claim 13, wherein the smoking articles are transported or conveyed through the inspection zone separately from one another; and/or wherein the smoking articles are transported or conveyed through the inspection zone continuously, and preferably at a substantially constant speed.

15. A method according to any one of claims 12 to 14, including the step of rejecting a smoking article which is detected in the inspecting or analysing step as being defective, preferably comprising ejecting said smoking article from the transport path.

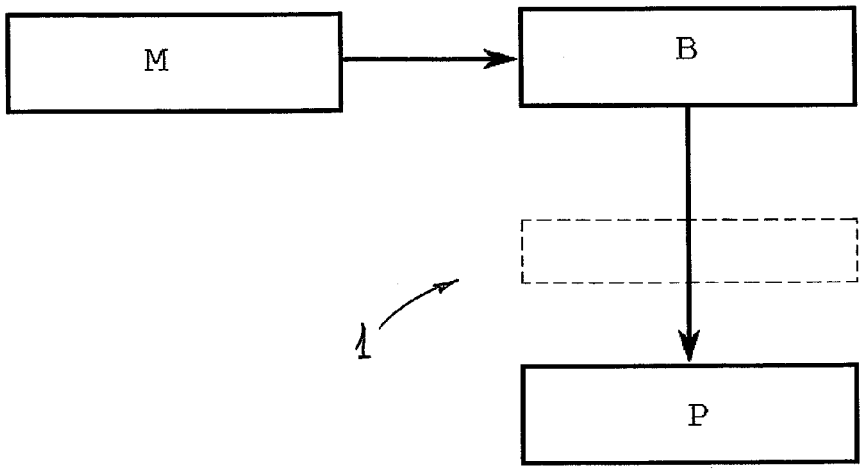

Fig. 1

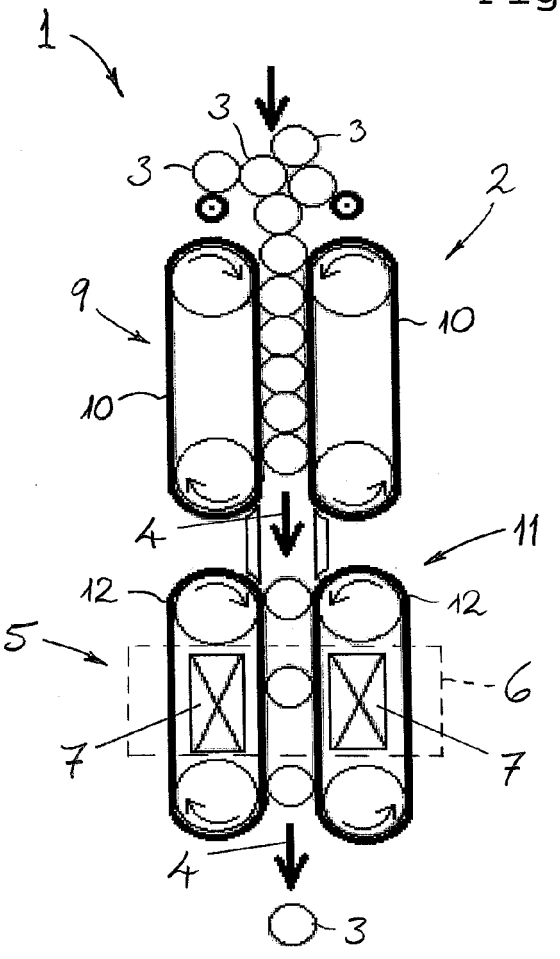

Fig. 2

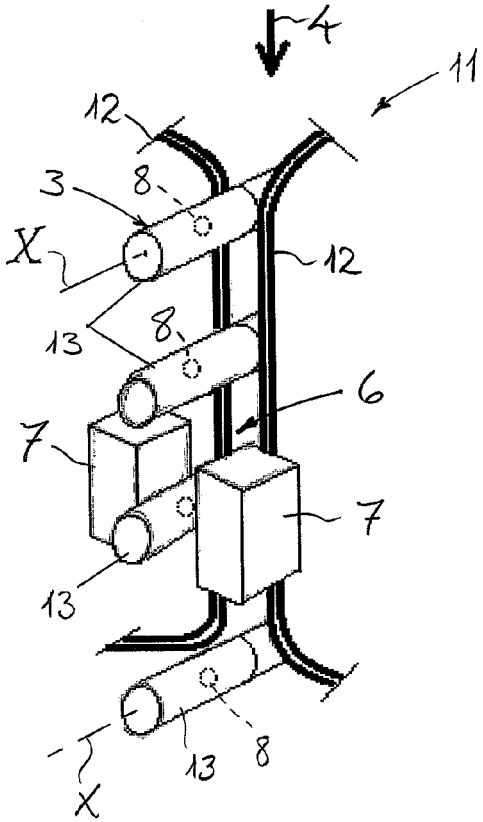

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 1381

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 April 2013	Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 19 1381

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
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