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(54) Method and device for automatically sorting articles

(57) The present invention relates to a method (100) of sorting articles in a sorting device (1), and such sorting device. The method comprises the steps of providing articles of one or several types on a vibrating plate (20), vibrating said vibrating plate to move the articles to a first transport band (30), transporting the articles by said first transport band in a first speed towards a second transport band (40), transporting the articles by said second transport band in a second speed being faster than said first speed towards a sorting device outlet (2), scanning the shape of each article during the transportation thereof on the first or second transport band using a line scan camera (50), comparing said scanned shape of an article with a predetermined shape, and removing the scanned article from the transport band back to the vibrating plate if the scanned shape do not correspond to the predetermined shape.

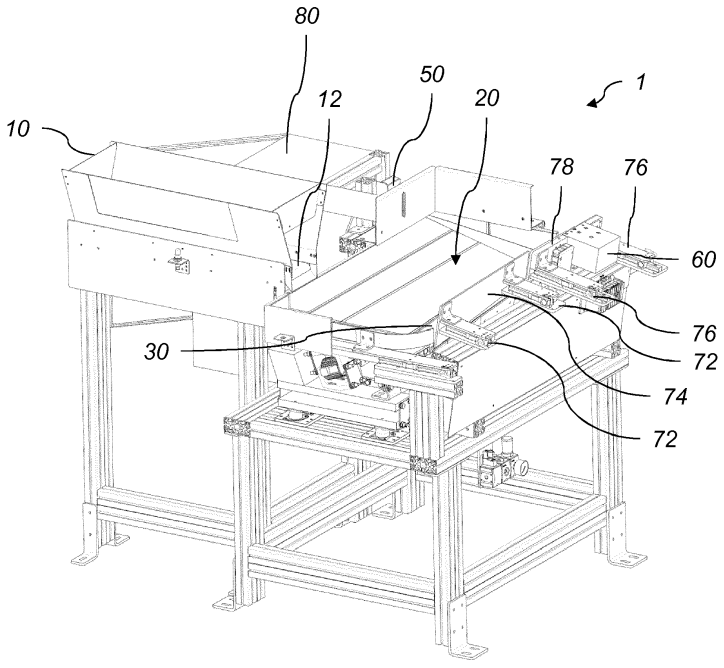

Fig. 1

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Description

Technical Field

[0001] The present disclosure relates to a method of sorting articles and a sorting device, especially for sorting using shape scanning of articles.

Background

[0002] Production lines handling large number of articles often comprise a step of sorting or separating articles. It may be made for collecting a certain number of a specific articles or separating one article type from another in a mixed collection thereof. Historically, and sometimes still today, was such work made manually by humans, picking articles. Such manual work is very time consuming and requires large amount of personnel.

[0003] Machines for sorting articles are nowadays more common and has often uses vibration plates to move, separate and direct articles to be sorted. Such sorting is however not exact, and the risk of mistakes made in the sorting is rather high. Further, such machines can normally only handle a small range of articles.

[0004] An alternative is using robotics for picking and sorting articles. Such arrangement would however become expensive and complicated to design and control, as well as having a low operating rate.

[0005] Consequently, there is a need for a way of sorting articles that is reliable, flexible and fast.

Summary

[0006] It is an object of the present invention to provide an improved solution that alleviates the mentioned drawbacks with present devices. Furthermore, it is an object to provide a fast and reliable way of sorting a large number of articles, of different sizes.

[0007] This is realized by a method of sorting articles in a sorting device comprising the steps of providing articles of one or several types on a vibrating plate, vibrating said vibrating plate to move the articles to a transport band, transporting the articles by said transport band in a first speed towards a sorting device outlet, scanning the shape of each article during the transportation thereof on the transport band using a line scan camera, comparing said scanned shape of an article with a predetermined shape, and removing the scanned article from the transport band back to the vibrating plate if the scanned shape do not correspond to the predetermined shape.

[0008] By using a line scan camera for scanning the shape of an article, a continuous analysis of the article shape may be made. This may provide a fast and secure analysis for identifying the articles. By using the method according to the present invention, articles provided in the sorting device may be identified and thereby sorted. Hence, different types of articles with different shapes or sizes may be provided and sorted. The present method may provide that articles of sizes at least between 3 mm and 300 mm may be sorted using the same method/apparatus. I.e. a very flexible method is provided for sorting a large spectrum of articles. By setting the predetermined shape corresponding to one type of article provided, only articles identified as corresponding to the predetermined shape may be transported to the sorting device outlet.

[0009] The predetermined shape may comprise information of an article shape in different views. The comparison of a scanned shape with the predetermined shape may thereby not be dependent on the orientation of the article when it was scanned by the line scan camera. In one embodiment may articles further be removed based on a status at the sorting device outlet, for instance that the rate of articles are too high, or that a system receiving articles at the outlet is busy.

[0010] In one embodiment, the step of vibrating the vibrating plate may comprise a step of moving articles to a first transport band, the step of transporting the articles may comprise a step of transporting the articles by the first transport band in a first speed towards a second transport band, and a step of transporting the articles by said second transport band in a second speed being faster than the first speed towards the sorting device outlet.

[0011] The two transport bands transporting articles in different speeds may provide a separation of articles that are transported, which in turn may improve the analysis, identification and sorting of articles.

[0012] In one embodiment, the line scan camera may be configured to scan along a line substantially perpendicular to the direction in which the articles are transported.

[0013] The scan line of the line scan camera may be a substantially vertical line crossing a substantially horizontally extending transport band. In one embodiment is the line scan camera arranged to scan at the second transport band on which articles have been separated when shifting from the first transport band to the second transport band. The line scan camera arranged with a scan line being perpendicular to the transport direction may provide analysis being reliable to cover all articles passing by.

[0014] In another embodiment, the method may further comprise a step of determining a second attribute of each article using a second analysis device, and a step of removing the scanned article from the transport band back to the vibrating plate if the determined attribute do not correspond to a predetermined value.

[0015] A further analysis of a second attribute of the articles may be used to further sort articles. The articles provided on the vibrating plate may include articles of similar shape, but in different colors, different material, different physical properties etc. The analysis of a second attribute may comprise an analysis of color of an article to sort similar articles of different colors. The predetermined value may in such embodiment include a specific color, and articles of other colors may be removed. Such scanning may be made by a camera, for instance a sec-

ond line scan camera. In another embodiment the second attribute may be magnetization of an article. The predetermined value may in such embodiment be set to identify magnetic or non-magnetic articles, such that articles not fulfilling the predetermined value may be removed. Such analysis may be made by a magnetization detection means. Alternatively, the second attribute may be weight of the article, which may be determined by a weighing device. The weighing device may be placed under one of the transportation bands, so as to measure the weight during transportation. Thereby, the operation rate or output is not affected. In one embodiment may the scanning by the line scan camera trigger the determination of a second attribute. For instance, the determination of a second attribute may only be activated when the scanned shape by the line scan camera corresponds to the predetermined shape.

[0016] The analysis of the second attribute may be made on articles scanned by the line scan camera and considered not to be removed.

[0017] In a further embodiment, the step of removing an article from the transport band may comprise a step of blowing the article off the transport band using compressed air.

[0018] Using compressed air to blow articles are advantageous since it may not require any moving parts interfering the transportation path of articles after the one being removed. Such removal may further be fast and precise when it comes to removal of a specific identified article to be removed. The compressed air may be used to blow an article off the transport band back to the vibrating plate.

[0019] In one embodiment, the step of scanning the shape of an article may be made continuously when the article passes the line at which the line scan camera operates.

[0020] The line scan camera is arranged to scan the shape of the articles when they is transported passed the scan line. The scanning may be made when the article is transported on the second transport band. A continuous scanning and analysis may provide a quick analysis and comparison to the predetermined shape.

[0021] In another embodiment, the step of comparing the scanned shape may be made continuously when the article is scanned by the line scan camera such that said article is removed from the transport band as soon as the scanned shape differs from the predetermined shape.

[0022] By continuously scanning the shape of an article passing the line scan camera, an immediate decision may be made as soon as the scanned shape is considered not to correspond to the predetermined shape. In a case wherein two or more articles lies partly on each other, possibly in a chain like manner, the scanning and comparison may result in a decision to remove the first article as soon as the second article, lying partly on the first article, reaches the scan line of the line scan camera. At least the first and the second article may then be removed from the transport band, and a scanning of the next article on the transport band may start. Using such scanning and comparison method, it may be avoided that the first article among two or more lying in a chain like manner may have already passed the position where it should been removed from the transport band when the last article in the chain has been scanned.

[0023] In another embodiment, the step of comparing the scanned shape may be made continuously when the article is scanned by the line scan camera such that said article is removed from the transport band at the moment when the scanned object has a longer extension than the predetermined shape. Thereby, If two articles that are to be sorted are not separated before being scanned, as explained above, the first article may be pushed onto the vibrating plate at the moment it passes the camera line, although the line still registers a shape (from the next article).

[0024] According to a second aspect of the invention, a sorting device for sorting articles is provided, comprising a vibrating plate onto which articles of one or several types are provided, a first transport band to which the vibrating plate is configured to move articles, wherein the first transport band is configured to transport articles in a first speed, a second transport band arranged to receive articles from the first transport band and configured to transport articles in a second speed, a line scan camera configured to scan the shape of articles transported on one of the transport bands, a comparing means configured to compare the scanned shape of an article with a predetermined shape, and an article removal means configured to remove an article from the transport band back to the vibrating plate if the scanned shape do not correspond to the predetermined shape.

[0025] By using a line scan camera for scanning the shape of an article, a continuous scanning of the article shape may be made. This may provide a fast and secure analysis for identifying the articles. The line scan camera may further be used for counting the articles passing. By using the sorting device according to the present invention, articles provided in the sorting device may be identified and thereby sorted. Hence, different types of articles with different shapes or sizes may be provided and sorted. The present sorting device may provide that articles of sizes at least between 3 mm and 300 mm may be sorted. I.e. a very flexible sorting device is provided for sorting a large spectrum of articles. By setting the predetermined shape corresponding to one type of articles provided, only articles identified as corresponding to the predetermined shape may be transported to the sorting device outlet.

[0026] The predetermined shape may comprise information of an article shape in different views. The comparison made by the comparing means of a scanned shape with the predetermined shape may thereby not be dependent on the orientation of the article when it was analyzed by the line scan camera. In one embodiment may articles further be removed based on a status at the sorting device outlet, for instance that the rate of articles

are too high, or that a system receiving articles at the outlet is busy.

[0027] In one embodiment, the transport band may comprise a first transport band and a second transport band, wherein the first transport band may be configured to transport articles to the second transport band in the first speed, and wherein the second transport band may be configured to receive articles from the first transport band and to transport articles in a second speed being faster than the first speed towards a sorting device outlet.

[0028] The two transport bands configured to transport articles in different speeds may provide a separation of articles that are transported, which in turn may improve the scanning, identification and sorting of articles.

[0029] In one embodiment, the line scan camera may be configured to scan along a line substantially perpendicular to the direction in which the transport band is arranged to transport articles.

[0030] The scan line of the line scan camera may be a substantially vertical line crossing a substantially horizontally extending transport band. In one embodiment is the line scan camera arranged to scan at the second transport band on which articles have been separated when shifting from the first transport band to the second transport band. The line scan camera arranged with a scan line being perpendicular to the transport direction may be configured to provide analysis being reliable to cover all articles passing by.

[0031] In another embodiment, the sorting device may further comprise means for determining a second attribute of articles transported on one of the transport bands, wherein the comparing means is configured to compare the determined second attribute with a predetermined value, and wherein the article removal means is configured to remove an article from the transport band if the determined second attribute do not correspond to the predetermined value.

[0032] A further analysis of a second attribute of the articles may be used to further sort articles. The articles provided on the vibrating plate may include articles of similar shape, but in different colors, different material, different physical properties etc. An analysis by the means for analyzing a second attribute may comprise means for determination of color of an article to sort similar articles of different colors. Such means may be a camera, for instance a second line scan camera. The predetermined value may in such embodiment include a specific color, and the removal means may be configured to remove articles of other colors. In another embodiment may the second attribute which the means may be configured to determine be magnetization of an article. The predetermined value may in such embodiment be set to identify magnetic or non-magnetic articles, such that articles not fulfilling the predetermined value may be removed. Such analysis may be made by a magnetization detection means. In another embodiment, the means for determining a second attribute may be a weighing device and the second attribute may be the weight of the article. The predetermined value may then by a threshold value of the weight of the article. Depending on which side of the threshold value the determined weight is, the article may be decided to be removed or not.

[0033] The means for analyzing the second attribute may be configured to analyze articles already scanned by the line scan camera and considered not to be removed. In one embodiment may the scanning by the line scan camera trigger the determination of a second attribute by the means therefore. For instance, the means for determining a second attribute may only be activated when the scanned shape by the line scan camera corresponds to the predetermined shape.

[0034] In a further embodiment, the article removal means may be an air blower of compressed air.

[0035] Using compressed air to blow articles are advantages since it may not require any moving parts interfering the transportation path of articles after the one being removed. An air blower may further be fast and precise when it comes to removing a specific identified article. The compressed air may be used to blow an article off the transport band back to the vibrating plate.

[0036] In one embodiment, the width of the first and the second transport band may be adjustable by a width adjusting arrangement.

[0037] The sorting device according to the present invention may be suitable for articles between 3 and 300 mm in width. To improve the performance of the analysis and comparison, the width of the transport bands may be adjusted to suit the size of the articles being sorted. The adjusting arrangement may comprise a wall limiting the available width of each transport band. The position of the wall may be controlled by an adjusting means, such as a motor or a manually controlled lever.

Brief Description of the Drawings

[0038] The invention will in the following be described in more detail with reference to the enclosed drawings, wherein:

Fig. 1 is a perspective view of a sorting device according to an embodiment of the invention;
Fig. 2 is a top view of a sorting device according to an embodiment of the invention;
Figs. 3a-c show schematic side views of a transport band with article being scanned according to an embodiment of the invention; and
Fig. 4 is a flow chart diagram of a method according to an embodiment of the invention.

Description of Embodiments

[0039] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed

as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements.

[0040] Figs. 1 and 2 illustrate a sorting device 1 according to an embodiment of the present invention. The sorting device 1 comprises a tray 10 for receiving articles to be sorted. The articles may be all of one type, or a mix of different article types. The tray 10 has an outlet 12 for providing the articles onto a vibrating plate 20. The vibrating plate 20 is used for moving the articles, by means of vibration, towards a first transport band 30. The vibration plate 20 is inclined away from the tray 10, and towards the first transport band 30. The vibration plate 20 is further divided into a plurality, in the illustrated embodiment four, sections 20a-d. The sections 20a-d are used for controlling the movement of the articles. Different sections may be controlled to vibrate differently to provide a desired movement of the articles.

[0041] The first transport band 30 is configured to move articles received at a first end 32 of the first transport band 30 towards a second end 34 of the first transport band 30. The first transport band 30 moves at a first speed.

[0042] At the second end 34 of the first transport band 30 is an intersection to a first end 42 of a second transport band 40. The second transport band 40 receives the articles from the first transport band 30 to transport the articles further towards a sorting device outlet 2. The second transport band 40 moves at a second speed different and faster than the first speed. Therefore, when the articles are received by the second transport band 40 from the first transport band 30, articles will be scattered. The scattering of the articles provides a more reliable managing, sorting and counting of the articles. In most cases this has effect that the articles are separated from each other so that their shape and other attributes may be individually evaluated.

[0043] At the outlet 2 are the sorted articles used for the desired purposes. They may be packed into bags, further fed to machining devices or otherwise provided to automated processes.

[0044] During the article transportation on the second transport band 40 are the articles scanned using a line scan camera 50. The line scan camera 50 is arranged to scan across the second transport band 40, substantially perpendicular thereto. The line scan camera 50 scans along a line or vertical plane 54 to scan the articles passing by the line 54 when being transported along the second transport band 40. The line scan camera 50 scans the shape of each article passing by. The scanned article shape is analyzed and compared to a predetermined shape. The predetermined shape represents an article type that is desired to sort out, i.e. to provide to the outlet 2.

[0045] The sorting device 1 comprises a control unit 80. The control unit 80 further comprises a comparing means to compare the scanned shape from the line scan camera 50 with the predetermined shape. The predetermined shape is stored in the control unit 80. The predetermined shape comprises information regarding shape of an article from different views. An article may thereby be identified as having the predetermined shape regardless of how it is oriented when it passes the line scan camera 50.

[0046] If the scanned shape is considered to correspond to the predetermined shape, the article is kept transported by the second transport band 40 to the outlet 2.

[0047] If the scanned shape is considered not to correspond to the predetermined shape, the article is sorted out and sent back to the vibration plate 20. The sorting device 1 further comprises a removal means 60 for removal of the article from the second transport band 40 back to the vibration plate 20. The removal means 60 is in the illustrated embodiment an air blower 60 of compressed air. The air blower 60 comprises nozzles 62 arranged to blow air to remove articles from the second transport band 40 back to the vibration plate 20. The second transport band 40 is arranged without any vertically extending edge along is side towards the vibration plate 20 in order to enable articles to be blown off the transport band 40 to the vibration plate 20. The sections 20a-d of the vibration plate 20 is configured to move articles removed from the second transport band 40 back to the first end 32 of the first transport band 30.

[0048] When the control unit consider an article's shape not to correspond to the predetermined shape, it controls the air blower 60 to remove said article from the transport band 40 back to the vibration plate 20. As a consequence, only articles corresponding in shape with the predetermined shape will pass the line scan camera and the removal means 60 to the outlet 2.

[0049] When articles are received by the second transport band 40 from the first transport band 30, it may happen that they are not scattered enough, but that two or more articles lies on the second transport band 40 on top of each other. Such articles would not be desired to transport to the outlet 2 since it may cause errors in the sorting of articles. When articles are on top of each other, they should be removed from the transport band 40.

[0050] This is further explained with figs. 3a-c wherein the second transport band 40 is illustrated, transporting articles 5 in a direction A. Along the scan line 54 is the line scan camera 50 scanning the articles 5 passing. In fig. 3a is the line scan camera 50 scanning the article 5. Simultaneously is the control unit 80 comparing the scanned shape with the predetermined shape. When the article 5 reaches the position as in fig. 3b the whole shape is scanned, and the control unit 80 recognizes that the shape has ended and it corresponds to the predetermined shape. Hence, the article 5 is left to pass on towards the outlet 2.

[0051] The situation in fig. 3c provides two articles 5, 5' that have been left on top of each other. When the

second article 5' reaches the scan line 54, the control unit will immediately realize that the shape of the combination of the two articles 5, 5' does not correspond to the predetermined shape, and a decision of removing the articles 5, 5' is taken. This has the advantage that it may be assured that the articles to be removed are still within range of the removal means 60 when the decision is taken. If the comparison of the scanned shape would not have been done until the entire continuous shape had been scanned, i.e. when all articles (two or more) lying on each other in a chain like manner had passed the scan line 54, there would be a risk that the first articles in the chain already had passed the reach of the removal means 60.

[0052] Referring back to fig. 2, a second attribute scanning device 90 is illustrated. The second attribute scanning device 90 is provided to determine a second attribute of the articles being transported on the second transport band 40, besides the scanning of the shape by the line scan camera 50. The determination is made on articles that already passed the scan line 54 and been considered to correspond to the predetermined shape. The second attribute scanning device 90 may be positioned at different locations on the sorting device 1 depending on which attribute it is configured to determine. The second attribute scanning device 90 may be a camera for determining attributes such as color, texture or size of the articles, a weighing device for determining the weight of the articles, or a magnetization device for determining the magnetization of the articles. The second attribute scanning device 90 is connected to the control unit 80 to provide the determined attribute to the control unit 80. The control unit 80 is configured to compare the determined second attribute to a predetermined value. The predetermined value depends on which second attribute the scanning device 90 is configured to determine. The control unit 80 is configured to decide if an article for which a second attribute has been determined should be removed. If yes, the removal means, i.e. air blower 60, is controlled to remove the article.

[0053] The sorting device 1 further comprises a width adjustment mechanism for adjusting the width of the first transport band 30 and/or the second transport band 40. A wall 74 is arranged along the first transport band 30. The wall 74 provides that articles are kept in place on the first transport band 30. First positioning devices 72 are provided to hold the wall 74. The first positioning devices 72 are adjustable to adjust the position of the wall 74 relative to the first transport band 30 and thereby widen or slim the first transport band 30. The width of the first transport band 30 may thereby be adapted to the size of the articles to be sorted. A correct width of the transport band 30 will facilitate the scanning by limiting the space for the articles.

[0054] A similar width adjusting mechanism is further provided at the second transport band 40 for adjustment of the width of the second transport band 40. A wall 78 is provided along the second transport band 40, and second positioning devices 76 are provided to hold and adjust the wall 78.

[0055] The first and second positioning devices 72, 76 may be manually operated, or communicatively connected to the control unit 80, such that the control unit may send signals to the positioning devices 72, 76 for them to adjust the position of the walls 74, 78.

[0056] Fig. 4 illustrates a method 100 of sorting articles in a sorting device 1 as described above. The method comprises a first step S1 of providing articles of one or more types on the vibration plate 20. Further the articles are vibrated S2 on the vibration plate to move the articles to the first transport band 30. The articles that have reached the first transport band 30 are transported S3 in a first speed towards the second transport band 40. When reaching the end 34 of the first transport band 30, the articles are further transported S4 by the second transport band 40 in a second speed being faster than the first speed towards the outlet 2 of the sorting device 1.

[0057] During the transportation S4 on the second transport band 40 is the shape of the article scanned S5 by a line scan camera 50. At the same time may the articles passing the line scan camera 50 be counted. The scanned shape of an article is compared S6 to a predetermined shape. This is done by a control unit 80 receiving information from the line scan camera 50 regarding the scanned shape. Finally, if the scanned shape is considered not to correspond to the predetermined shape, the scanned article is removed S7 from the second transport band 40 by a removal means back to the vibration plate 20. The removal S7 is preferably made by means of compressed air blowing the article of the transport band 40.

[0058] The method 100 may further comprise an optional step S8 of determining a second attribute of the articles and removing the article if the determined second attribute of the article does not correspond to a predetermined value.

[0059] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation, the scope of the invention being set forth in the following claims.

Claims

1. Method (100) of sorting articles in a sorting device comprising the steps of:

   providing (S1) articles of one or several types on a vibrating plate (20),
   vibrating (S2) said vibrating plate (20) to move the articles to a transport band (30, 40),
   transporting (S3, S4) the articles by said transport band (30, 40) in a first speed towards a sorting device outlet (2),

scanning (S5) the shape of each article during the transportation thereof on the transport band (30, 40) using a line scan camera (50),
comparing (S6) said scanned shape of an article with a predetermined shape,
removing (S7) the scanned article from the transport band (30, 40) back to the vibrating plate (20) if the scanned shape does not correspond to the predetermined shape.

2. Method according to claim 1, wherein the step of vibrating (S2) the vibrating plate (20) comprises a step of moving articles to a first transport band (30), wherein the step of transporting (S3, S4) the articles comprises a step of transporting the articles by the first transport band (30) in a first speed towards a second transport band (40), and a step of transporting (S4) the articles by said second transport band (40) in a second speed being faster than the first speed towards the sorting device outlet (2).

3. Method according to claim 1 or 2, wherein the line scan camera (50) is configured to scan along a line (54) substantially perpendicular to the direction in which the articles are transported.

4. Method according to any of the preceding claims, wherein the method further comprises a step of determining a second attribute of each article using a second analysis device (90), and a step of removing the scanned article from the transport band back to the vibrating plate (20) if the determined attribute do not correspond to a predetermined value.

5. Method according to any of the preceding claims, wherein the step of removing (S7) an article from the transport band (30, 40) comprises a step of blowing the article off the transport band using compressed air.

6. Method according to any of the preceding claims, wherein the step of scanning (S5) the shape of an article is made continuously when the article passes the line at which the line scan camera (50) operates.

7. Method according to any of the preceding claims, wherein the step of comparing the scanned shape is made continuously when the article is scanned by the line scan camera (50) such that said article is removed from the transport band as soon as the scanned shape differs from the predetermined shape.

8. A sorting device (1) for sorting articles comprising
a vibrating plate (20) onto which articles of one or several types are provided,
a transport band (30, 40) to which the vibrating plate is configured to move articles, wherein the transport band is configured to transport articles in a first speed,
characterized in that the sorting device further comprises
a line scan camera (50) configured to scan the shape of articles transported on the transport band (30, 40),
a comparing means (80) configured to compare the scanned shape of an article with a predetermined shape, and
an article removal means (60) configured to remove an article from the transport band back to the vibrating plate if the scanned shape does not correspond to the predetermined shape.

9. Sorting device according to claim 8, wherein the transport band comprises a first transport band (30) and a second transport band (40), wherein the first transport band (30) is configured to transport articles to the second transport band (40) in the first speed, and wherein the second transport band (40) is configured to receive articles from the first transport band and to transport articles in a second speed being faster than the first speed towards a sorting device outlet (2).

10. Sorting device according to claim 8 or 9, wherein the line scan camera (50) is configured to scan along a line (54) substantially perpendicular to the direction in which the transport band (30, 40) is arranged to transport articles.

11. Sorting device according any of the claims 8-10, further comprising means (90) for determining a second attribute of articles transported on one of the transport bands (30, 40), wherein the comparing means (80) is configured to compare the determined second attribute with a predetermined value, and wherein the article removal means (60) is configured to remove an article from the transport band if the determined second attribute do not correspond to the predetermined value.

12. Sorting device according to any of the claims 8-11, wherein the article removal means (60) is an air blower of compressed air.

13. Sorting device according to any of the claims 8-12, wherein the width of the first and the second transport band (30, 40) is adjustable by a width adjusting arrangement (72, 74, 76, 78).

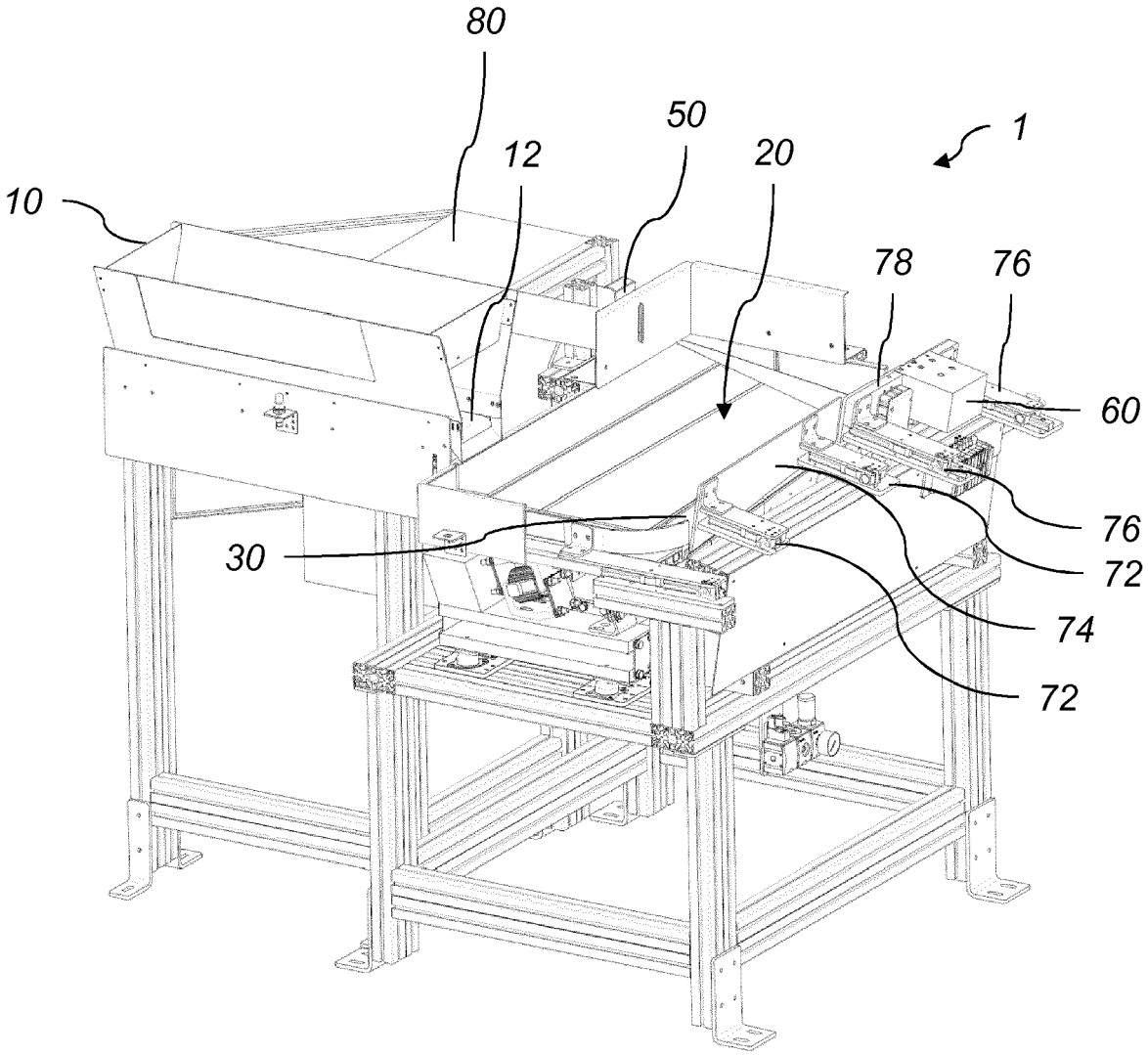

Fig. 1

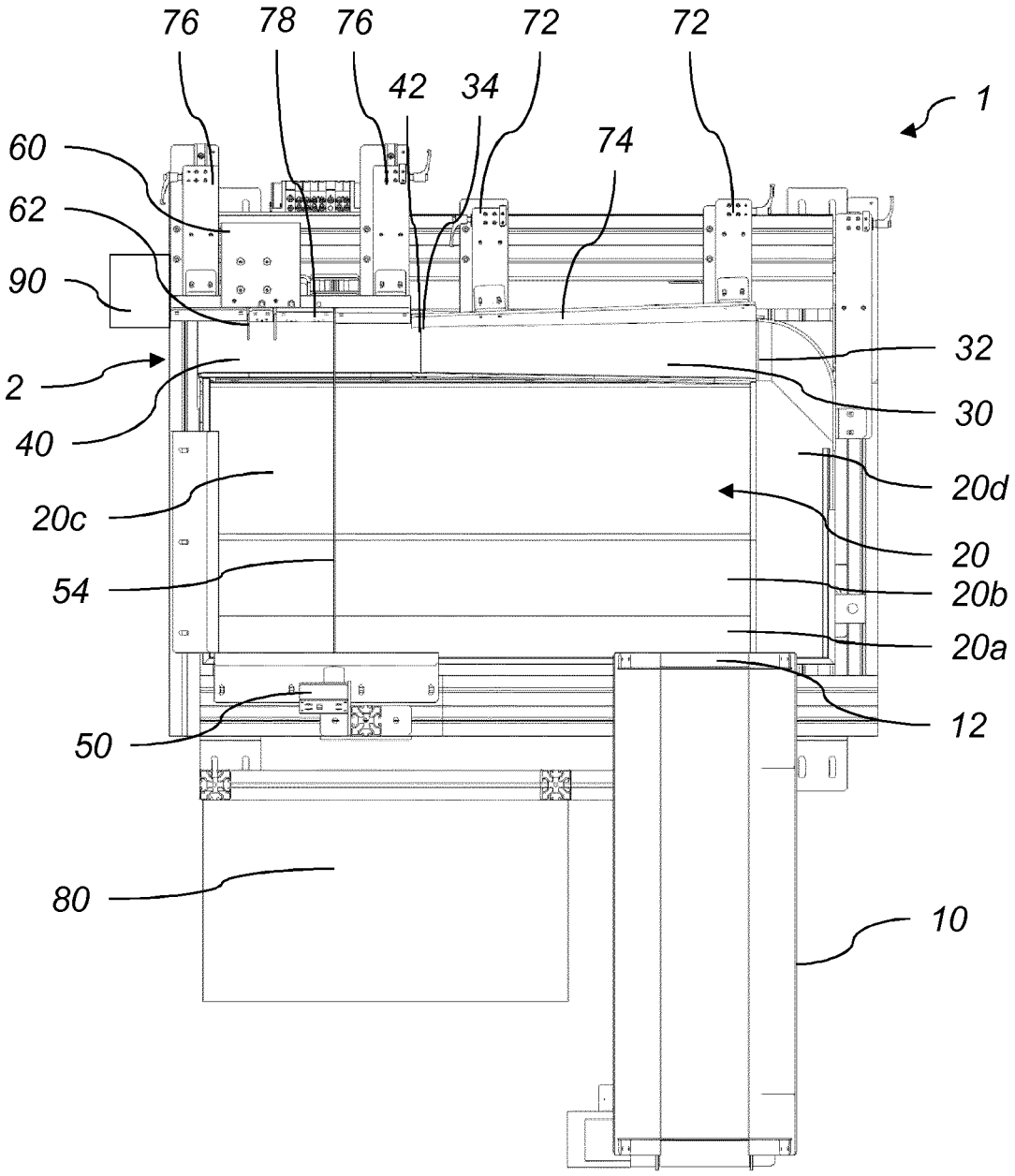
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Fig. 2

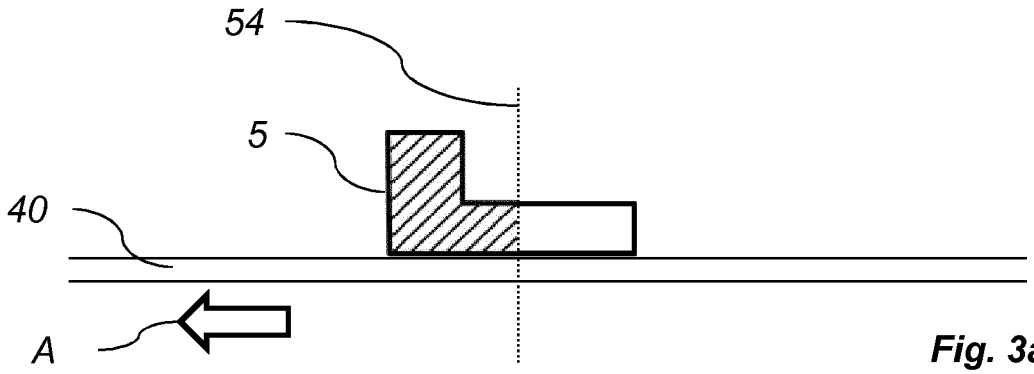

Fig. 3a

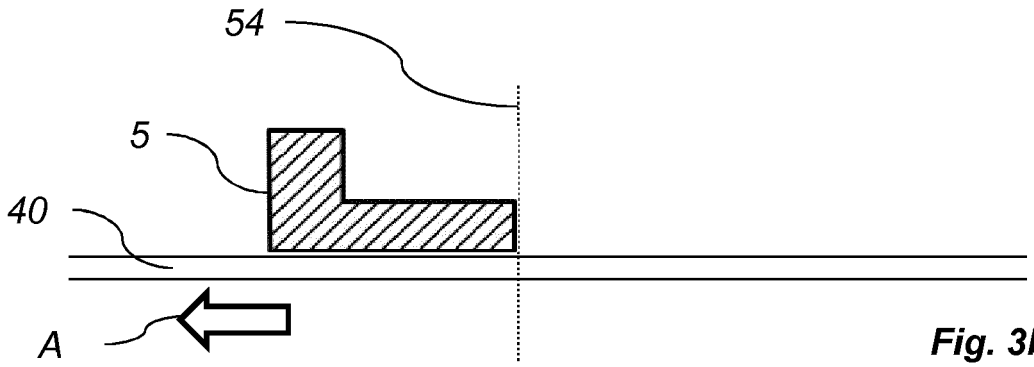

Fig. 3b

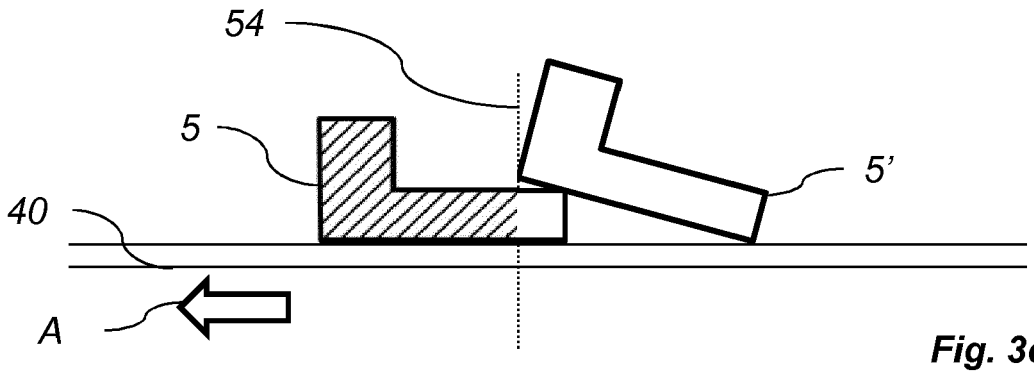

Fig. 3c

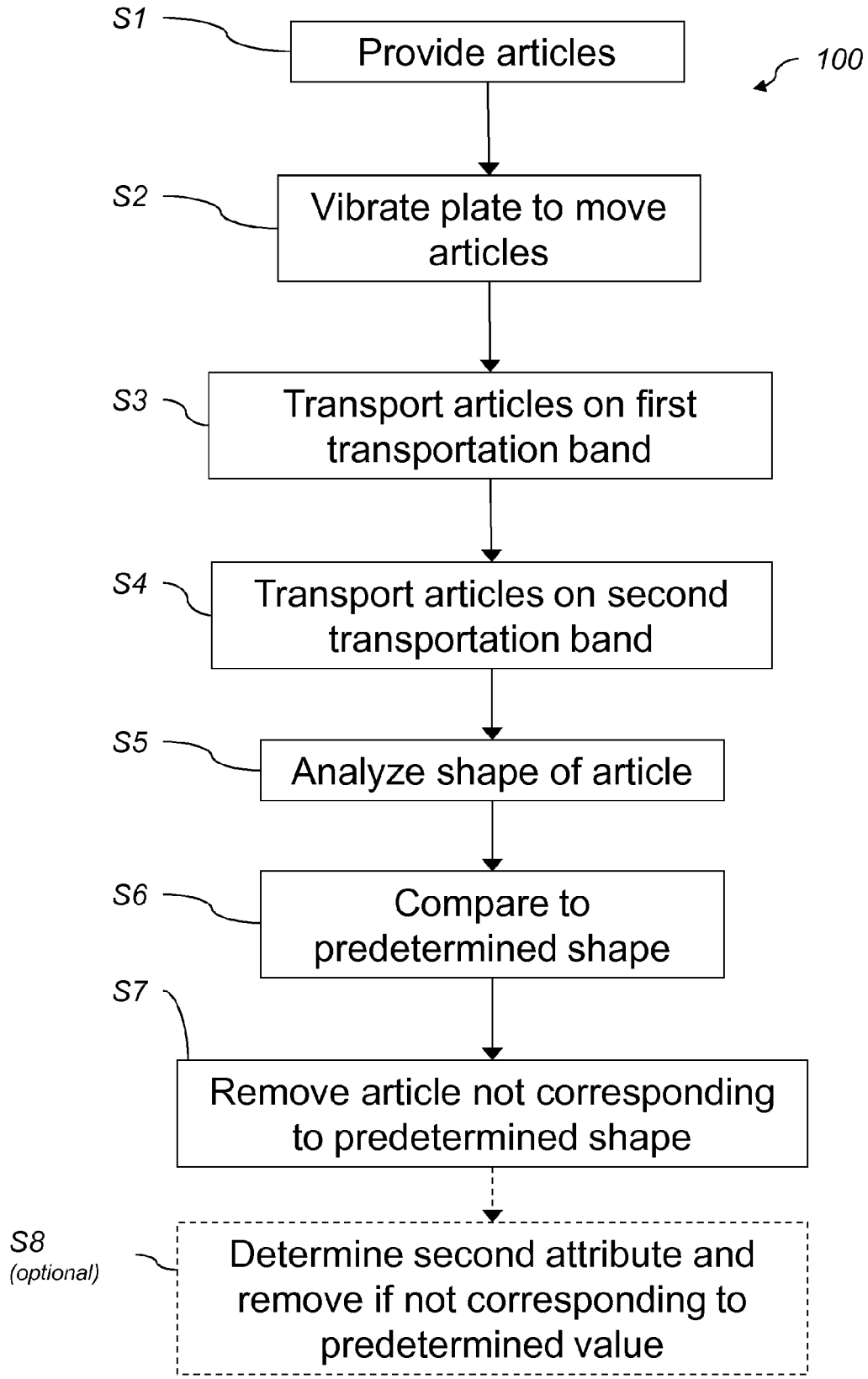
S1
Provide articles
100
S2
Vibrate plate to move articles
S3
Transport articles on first transportation band
S4
Transport articles on second transportation band
S5
Analyze shape of article
S6
Compare to predetermined shape
S7
Remove article not corresponding to predetermined shape
S8
(optional)
Determine second attribute and remove if not corresponding to predetermined value

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 14 20 0415

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	US 3 977 526 A (GORDON RODERICK J ET AL) 31 August 1976 (1976-08-31) * column 9, line 19 - column 19, line 2; figures *	1-13	INV. B07C5/02 B07C5/342
A	US 8 809 718 B1 (DOAK ARTHUR G [US] ET AL) 19 August 2014 (2014-08-19) * figures *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)
B07C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 June 2015	Wich, Roland

CATEGORY OF CITED DOCUMENTS

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US 3977526 A	31-08-1976	NONE	
US 8809718 B1	19-08-2014	NONE	

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