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(54) Optical sorting of asparagus

(57) A device for sorting asparagus (3) according to blooming comprises a light source (25) that directs structured light on asparagus and a camera (21) for taking a picture of the asparagus. The device also has electronic processing facilities (19) to analyze the image of the light projected on the asparagus and on the basis of this analysis to determine a qualification with regard to the blooming. Finally, the device comprises sorting facilities to sort the asparagus on the basis of this qualification.

The light source (25) illuminates the asparagus at an angle that differs from the angle at which the camera (21) takes a picture of the asparagus. Preferably the light source (25) illuminates the asparagus at a right angle to the longitudinal direction of the asparagus (3) and the camera (21) takes a picture of the asparagus (3) at an angle with regard to the longitudinal direction of the asparagus (3).

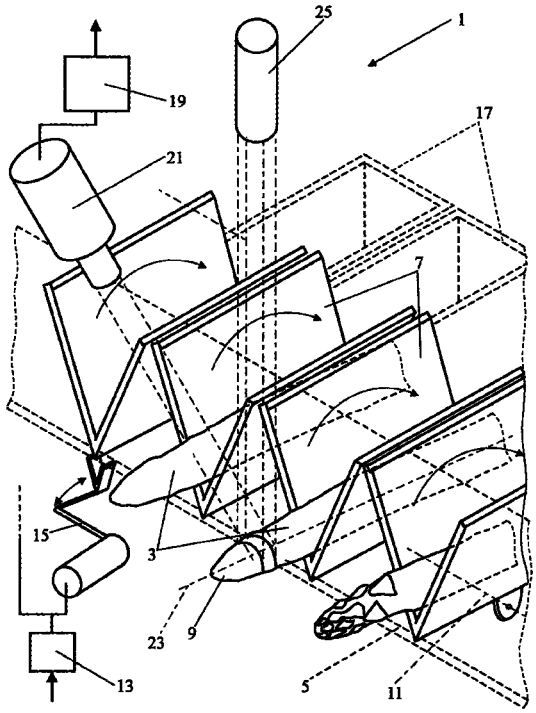

FIG. 1

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Description

BACKGROUND OF THE INVENTION:

Field of the invention

[0001] The invention relates to a device for sorting asparagus comprising transport facilities for the feeding of asparagus, a camera for taking a picture of an asparagus, electronic processing facilities in order to assign a qualification to the picture taken by the camera, and sorting facilities for sorting the asparagus according to the qualification.

Prior art

[0002] Such a device is known from the American patent US 4.271.967. In this known device the picture information is used to determine the diameter and length of the asparagus and then the asparagus is sorted according to diameter and length. However, in the processing of asparagus it is important whether the asparagus is blooming or not. This is because blooming asparagus are not sold as vegetables. If asparagus are blooming they are usually used for other purposes, such as in soup. For an efficient sorting of asparagus it is therefore desirable that they be sorted according to whether they are blooming or not. Thus far this has been done manually because no properly functioning equipment existed for that purpose.

Summary of the invention

[0003] An objective of the invention is to provide a device of the type described above in which asparagus can be sorted according to whether they are blooming or not. For this purpose the device according to the invention is characterized in that it comprises a light source for illuminating an asparagus, which light source emanates light in a structured manner, and the electronic processing facilities are such that they analyze the image of the light projected on an asparagus in order to establish a qualification for blooming of the tip of the asparagus. If structured light is projected on a smooth surface the image of the projection will be smooth and regular. On projection on an uneven surface such as the open tip of a blooming asparagus the image will be uneven and irregular. The degree of irregularity forms the qualification for the extent of blooming of the tip of an asparagus. Here the concept of structured light should be understood to mean light that has a defined form and/or demonstrates a defined pattern, for example a straight line or a meshwork of straight lines. The degree of blooming can be derived from the shape of the image of the light projected on the asparagus.

[0004] In order to facilitate the analysis of the image of the projected light on the asparagus an embodiment of the device according to the invention is characterized in that the light source illuminates the asparagus at an angle that differs from the angle at which the camera takes a picture of the asparagus. This shows irregularities of the asparagus more clearly. Preferably the light source illuminates the asparagus at an angle that is almost a right angle to the longitudinal direction of the asparagus and the camera takes a picture of the asparagus at an angle with regard to the longitudinal direction of the asparagus.

[0005] Another embodiment of the device is characterized in that, because the light source projects structured light on the tip of the asparagus and the electronic processing equipment only analyzes the image of the light projected on the tip of an asparagus. An asparagus only blooms on its tip. By only analyzing the image of the portion of the asparagus where blooming occurs, the sorting can be done more quickly than by analysis of an image over a larger portion of the asparagus.

[0006] To facilitate the illumination of the proper portion of the asparagus another embodiment of the device is characterized in that the device comprises holders for the asparagus in which all the asparagus are oriented in the same direction. This makes it unnecessary to first determine the tip of the asparagus in order to be able to ascertain whether it is blooming or not.

[0007] The invention also relates to a working method for sorting asparagus in which asparagus are transported to a camera, after which a picture of an asparagus is taken by the camera and using electronic processing equipment a qualification is established from the picture of the asparagus which is then sorted depending on the qualification of the asparagus.

[0008] As far as the working method is concerned the invention is characterized in that the structured light is projected on the asparagus to be sorted and the qualification is made on the basis of the image of the light projected on the asparagus, in which the degree of blooming of the tip of the asparagus is ascertained.

[0009] In order to better visualize irregularities and thus blooming of the asparagus, an embodiment of the working method according to the invention is characterized in that the asparagus is illuminated at an angle that differs from the angle at which the camera takes a picture of the asparagus. Preferably the asparagus is illuminated at an angle that is almost a right angle in terms of the longitudinal direction of the asparagus and the camera takes a picture of the asparagus at an angle with regard to the longitudinal direction of the asparagus.

[0010] In order to accelerate the analysis a further embodiment of the working method according to the invention is characterized in that structured light is projected on the tip of the asparagus and only the image of the light projected on the tip of an asparagus is analyzed.

[0011] In order to facilitate the illumination and viewing of the proper portion of the asparagus another

embodiment of the working method is characterized in that the asparagus to be sorted are all fed in the same position.

Brief description of the drawings

[0012] The invention will be elucidated more fully below on the basis of drawings in which an embodiment of the device according to the invention is shown. In these drawings:

Figure 1 shows a schematic image of the device for the sorting of asparagus;
Figure 2 shows an asparagus with a closed, not blooming tip with the image of a projected line on it; and
Figure 3 shows an asparagus with an open blooming tip with the image of a projected line on it.

Detailed description of the drawings

[0013] Figure 1 shows a schematic image of an embodiment of the device for sorting asparagus according to the invention. The device 1 comprises transport facilities for the feeding of asparagus 3. The transport facilities comprise a belt 5, schematically illustrated by broken lines, on which holders 7 for asparagus can be seen. In the holders 7 the asparagus 3 are oriented lengthwise with the tip 9 extending on one side. The holders 7 can rotate around an axis 11. The rotation is driven by sorting facilities 13 that can activate movable arms 15 that are located across from receptacles 17. Depending on a qualification code of an asparagus 3 present in a holder 7, the sorting facilities 13 will tilt the asparagus into the receptacle 17 belonging to the qualification.

[0014] The qualification originates in electronic processing facilities 19 that use the picture taken by a camera 21 to establish a qualification of the asparagus with regard to the blooming of the tip of the asparagus. This camera 21 is at an angle with regard to the longitudinal direction 23 of the asparagus 3 and takes a picture of the light that is projected by a light source 25 on the tip 9 of the asparagus. This light source 25 is at a right angle to the longitudinal direction 23 of the asparagus 3 and projects structured light in the form of a straight line diagonal to the asparagus, which is shown in more detail in the following figures.

[0015] Figure 2 shows a portion of an asparagus 27 with a closed tip (this is an asparagus that is not blooming) with the image 29 of a projected line on it in a view at an angle to the longitudinal direction of the asparagus. The projected straight line is perceived as a curved line, such that the shape of the asparagus is better visualized. This can better illustrate irregularities and thus blooming of the asparagus, as figure 3 shows. In this figure an asparagus 31 with an open tip (this is a blooming asparagus) is shown at the same angle. This asparagus 31 demonstrates blooming 33 on the tip such that the image 35 of the light is irregular, which represents a degree of blooming.

[0016] Although in the above the invention is explained on the basis of the drawings, it should be established that the invention is in no way limited to the embodiment shown in the drawings. The invention also extends to all embodiments deviating from the embodiment shown in the drawings within the context defined by the claims. For example instead of a straight line a curved line or a grille or other structured light whose shape is known can also be projected on the asparagus. In addition, cameras and light sources can be set up on both sides of the holders so that it does not matter on which side the tip of the asparagus extends, such that the feeding of the asparagus is made easier.

Claims

1. Device for sorting asparagus comprising transport facilities for the feeding of asparagus, a camera for taking a picture of an asparagus, electronic processing facilities in order to assign a qualification to the picture taken by the camera, and sorting facilities for sorting the asparagus depending on their qualification, characterized in that the device comprises a light source for illuminating an asparagus, which light source emanates structured light, and the electronic processing facilities are so organized as to analyze the image of the light projected on an asparagus in order to establish a qualification for blooming of the tip of the asparagus.

2. Device according to claim 1, characterized in that the light source illuminates the asparagus at an angle that differs from the angle at which the camera takes a picture of the asparagus.

3. Device according to claim 2, characterized in that the light source illuminates the asparagus at an angle that is at least almost a right angle to the longitudinal direction of the asparagus and the camera takes a picture of the asparagus at an angle to the longitudinal direction of the asparagus.

4. Device according to claim 1, 2 or 3, characterized in that the light source projects structured light on the tip of the asparagus and the electronic processing facilities only analyze the image of the light projected on the tip of an asparagus.

5. Device according to claim 1, 2, 3 or 4, characterized in that the device comprises holders for asparagus in which all the asparagus are oriented in the same direction.

6. Working method for sorting asparagus in which asparagus are transported to a camera, after which

a picture of an asparagus is taken by the camera and electronic processing facilities use the picture of the asparagus to establish a qualification for it and then, depending on its qualification, the asparagus is sorted, characterized in that structured light is projected on the asparagus to be sorted and the qualification takes place on the basis of the image of the light projected on the asparagus, at which time the degree of blooming of the tip of the asparagus is established.

7. Working method according to claim 6, characterized in that the asparagus is illuminated at an angle that differs from the angle at which the camera takes a picture of the asparagus.

8. Working method according to claim 7, characterized in that the asparagus is illuminated at an angle that is almost at a right angle to the longitudinal direction of the asparagus and the camera takes a picture of the asparagus at an angle with regard to the longitudinal direction of the asparagus.

9. Working method according to claim 6, 7, or 8, characterized in that structured light is projected on the tip of the asparagus and only the image of the light projected on the tip of the asparagus is analyzed.

10. Working method according to claim 6, 7, 8 or 9, characterized in that the asparagus to be sorted are all fed in the same position.

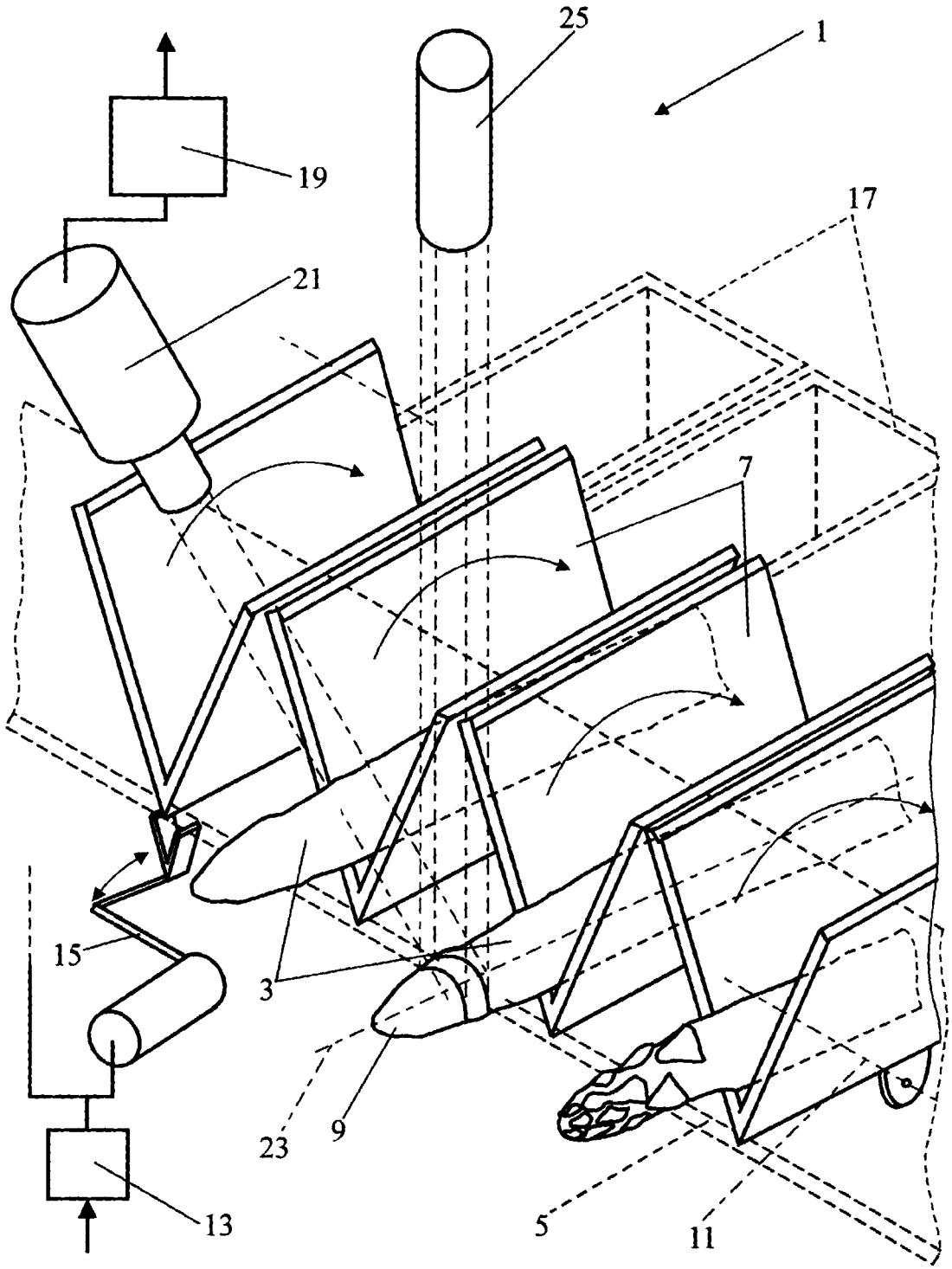

FIG. 1

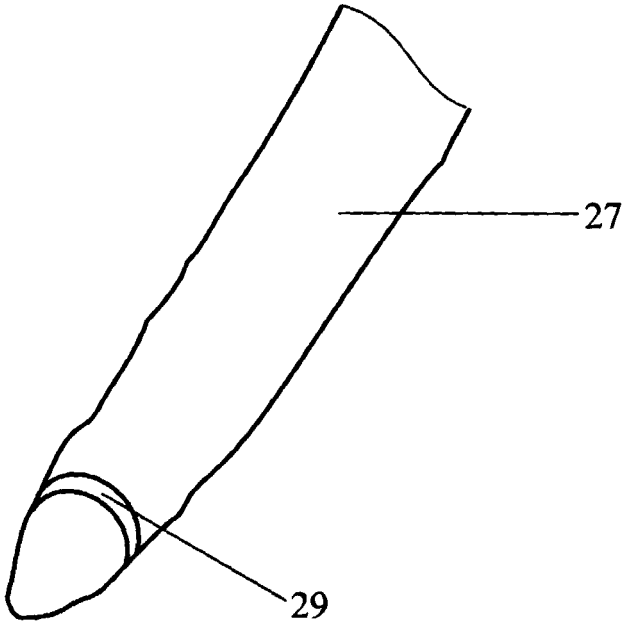

FIG. 2

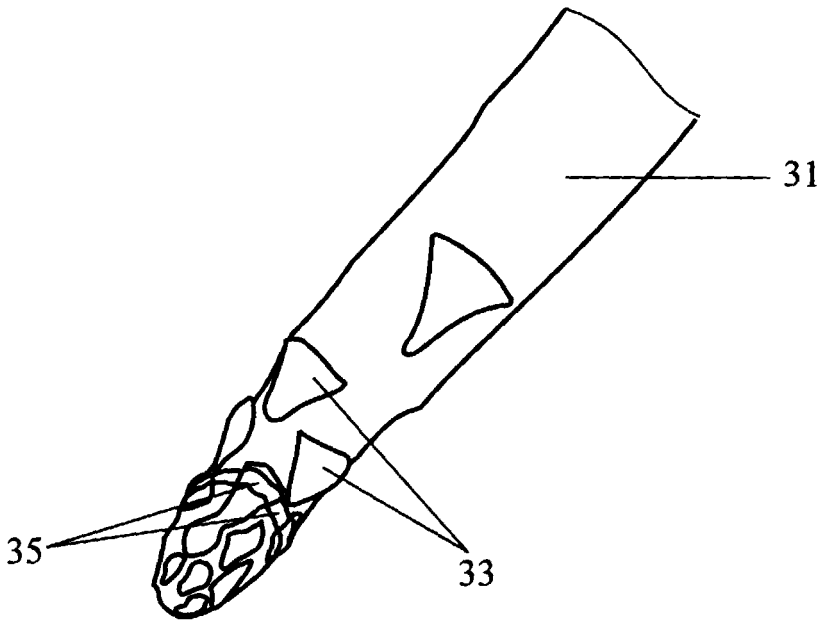

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 0188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	PATENT ABSTRACTS OF JAPAN vol. 016, no. 098 (C-0918), 11 March 1992 (1992-03-11) & JP 03 278870 A (TOSHIBA ENG CO LTD), 10 December 1991 (1991-12-10) * abstract *	1-10	B07C5/10
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A	* column 1, line 12 - column 4, line 1; figures *	1,6	
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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
THE HAGUE	27 April 2000	Gélébart, Y

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 00 20 0188

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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