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(54) **Agricultural harvester with a measuring device behind a window and crop material processing method.**

(57) A conveying device (11.1, 11.2) of an agricultural harvester conveys crop material (B) along a window (3) which is inserted into a wall (4). A sensor (1, 2, 10.1) measures in a contactless manner a characteristic of the conveyed crop material (B). A fluid ejector (7.1, 7.2, 7.3) ejects a fluid jet (8.1. 8.2, 8.3) onto a surface (FF) formed in the interior of the harvester. The fluid is thereby provided in a space between the window (3) and the conveyed crop material (B).

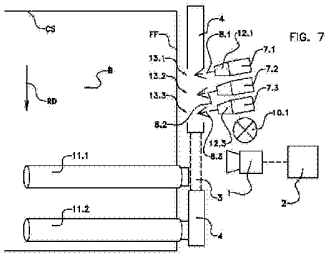

FIG. 7

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Agricultural harvester with a measuring device behind a window and crop material processing method

FIELD OF THE INVENTION

The invention refers to an agricultural harvester with a measuring device behind a window and a method for processing crop material by using such an agricultural harvester.

BACKGROUND OF THE INVENTION

An agricultural harvester processes loose crop material, e.g. presses or threshes the crop material or stores it in a storing room. It is desired to measure at least one characteristic of the crop material to be processed while the agricultural harvester conveys or processes this crop material. The loose or processed material is conveyed along a measuring device which measures the desired property.

In order to prevent pollution or a damage of the measuring device, a window is positioned between the measuring device and the conveyed loose material. The problem occurs that the window can be polluted by the loose material conveyed along the window. Several proposals for overcoming this problem were made.

US 7,372,034 B2 discloses an agricultural measuring device 16 which is mounted on board of an agricultural harvester with a feeding channel 10. A holding plate 22 of the measuring device 16 is mounted in the sidewall 12. A pane 24 is inserted into the plate 22. An optical sensor 18 is positioned behind the pane 24 and is connected with the plate 22 by means of two support rolls 20. An actuator 30 can pivot the entire measuring device 16 with respect to the sidewall 12 around a pivoting axis 28 which is perpendicular to the conveying direction 27, compare Fig. 2a with Fig. 1 and Fig. 5 with Fig. 3. In a first (measuring) position the plate 22 with the pane 24 is in flush with the sidewall 12, cf. Fig. 1 and Fig. 3. In a second (cleaning) position the plate 22 is pivoted and extends into the feeding channel 10. Crop material contacts the pane 24 and cleans it and removes debris from it.

US 8,115,923 B1 discloses a harvester with a curved wall 54 surrounding a feeding channel. Two spectrometers 80a, 80b are mounted in the wall 54. The respective window 84 is slightly pivoted into the feeding channel (angle of 3 to 5 degrees). The flow of crop material along the window 84 cleans the window 84.

SUMMARY OF THE INVENTION

A problem solved by the invention is to provide an agricultural harvester with the features of the preamble of claim 1 and a material processing method with the features of the preamble of claim 9 wherein the window is cleaned without the need of positioning the window in a position in which the window projects or slopes towards the conveyed crop material and without the need of making the window pivotal with respect to the wall.

This problem is solved by an agricultural harvester with the features of claim 1 and by a material processing method with the features of claim 9. Preferred embodiments are specified in the depending claims.

The agricultural harvester according to the invention comprises

- a conveying device,
- a wall,
- a measuring device, and
- at least one fluid ejector.

The measuring device comprises

- at least one sensor and
- a window inserted into the wall.

The window is positioned between

- the or every sensor and
- crop material which is conveyed along the window.

The harvester according to the invention operates as follows:

- The conveying device conveys crop material along the wall and thereby along the window.
- The sensor behind the window measures in a contactless manner a characteristic of the crop material conveyed along the window.
- The or every fluid ejector ejects a fluid jet against a receiving surface which is formed inside the harvester. The receiving surface is positioned and the fluid jet is directed such that fluid enters a space between the conveyed crop material and that surface of the window which points towards the conveyed crop material.
- The window is cleaned by the conveyed crop material containing fluid.

ADVANTAGES

According to the invention the or at least one sensor is arranged behind the window. The window protects the sensor from being polluted or even damaged by

the conveyed crop material. The space around the sensor and behind the window is kept free of debris and dirt. It is possible to control the air moisture and the temperature around the sensor independently from the conditions in the feeding channel or pressing chamber through which the crop material is conveyed. In addition the windows ensure that a minimal distance between the sensor and the crop material is kept. This minimal distance is often required for measuring the crop material characteristic.

The window protects the sensor. But crop material may pollute this window, e.g. as sugar particles stick on the window surface. A polluted window may yield wrong sensing results or may even block the sensor, in particular an optical sensor. In addition a high amount of particles sticking on the window may scratch the window or may influence the flow of crop material along the window in an undesired manner.

Thanks to the invention the window is automatically cleaned during operation. It is not necessary to interrupt the operation of the harvester for the purpose of cleaning the window. Therefore it is possible to use the measured characteristic of the crop material for automatically controlling a part of the harvester in an open-loop or closed-loop manner or for generating outputs for a human operator. The human operator can stay in a remote position from the harvester, e.g. in a driver's cabin of a pulling tractor.

The fluid reduces the friction between the conveyed crop material and the window surface pointing to the crop material. Thanks to the fluid the risk is reduced that the crop material conveyed along the window scratches the window.

Thanks to the invention the window is automatically cleaned by the fluid on the window surface. Crop material particles which may have polluted the window are automatically removed. In particular sugar crystals or further particles which may stick at the window surface are automatically removed from the window.

According to the invention the crop material is conveyed along the window. The sensor behind the window measures a characteristic of the crop material. In an agricultural harvester according to the invention the window is cleaned by a combination of the following two measures:

- The fluid which is transported by the fluid ejector and/or by a the crop material on the window's surface and which dissolves particles sticking at the window, e.g. sugar crystals, from the window and
- The crop material which is conveyed along the window and which takes away the dissolved particles from the window.

Thanks to the invention it is possible but not necessary to mount the window at or into the wall such that the window is sloping angularly with respect to the wall. The window can project but needs not necessarily project into a channel or cavity which is delimited by the wall and through which the crop material is conveyed.

Thanks to the invention it is possible that the window is in flush with the wall. This feature avoids a place at which debris may be collected. The flow of conveyed material is not influenced by the window when the window is in flush. In particular no undesired deflection or compression of the conveyed crop material is caused. The risk that the window is scratched is further reduced.

Thanks to the invention it is further possible but not necessary to make the window pivotal with respect to the wall. A pivotal window requires a retaining device which tends to pivot the window into a desired position or an actuator which pivots the window. The invention avoids the need for such a retaining device and such an actuator. In addition a window position sensor is saved.

Thanks to the invention it is possible but not necessary that a wiper cleans the window. Such a wiper must clean that surface of the window which points to the conveyed crop material. The wiper may come in contact with the conveyed crop material and can contribute to scratch the window. In addition the wiper needs space and a drive which oscillates the wiper. The invention saves the need for such a drive.

The invention only requires one moving part for cleaning the window, e.g. a pump for the fluid ejector. This moving part can be positioned at a desired position, in particular with a sufficient distance to the crop material and to the window. It suffices that the moving part is in fluid connection with the fluid ejector.

According to the invention a fluid ejector directs a jet of fluid against a surface in the interior of the harvester. It is possible to position this fluid ejector at a suitable place, in particular position the fluid ejector spaced apart from the conveyed crop material. It is therefore possible to inhibit that the conveyed crop material comes in contact with the fluid ejector and reduces its performance.

PREFERED EMBODIMENTS

The harvester can be a round baler, a cuboid baler, a loader wagon, a combine harvester, a field chopper, or a seed or drilling machine, e.g. The crop material can be crop material picked up from a field, seed material to be distributed onto the field, or fertilizer or preservatives, e.g.

The fluid can be a liquid or air. In one embodiment the fluid is warm or hot water, optionally with a solvent which is harmless for living beings.

The measuring device can detect the presence or absence of a given chemical substance in the crop material, can measure a chemical composition of the crop material, or can measure the color, the reflecting property or the or volume or amount of the conveyed crop material, e.g. In a further embodiment the actual speed with which the conveying device conveys the crop material is measured in a contactless manner by the measuring device.

In one embodiment the measuring device comprises an illumination source which emits light in the visible range or infrared or ultraviolet light or ultrasonic waves towards the conveyed crop material. The light or waves are reflected by the crop material. A receiver of the measuring device receives and analysis the reflected light or waves. Preferably the illumination source is also positioned behind the window.

In one embodiment the or at least one fluid jet is directed onto a surface of the window itself. In a further embodiment at least one fluid jet is directed onto an area of the wall wherein this wall area is positioned vertically or sloping above the window. Thanks to the force of gravity the fluid flows downwards onto the window surface. This embodiment makes it possible to select for receiving the fluid jet a wall area positioned above the flow of conveyed crop material. It is possible to apply the fluid onto the window even if a big amount of crop material is conveyed along the window and covers the entire window. It is not necessary to direct the fluid jet through the conveyed crop material.

In one implementation one fluid ejector ejects a fluid jet onto a wall area vertically above the window. A further fluid ejector ejects a further fluid jet onto a wall area angularly above the window. Thanks to this embodiment fluid reaches the window even if the harvester is operated with different inclinations, e.g. by being operated in a hilly environment.

In yet a further embodiment the feature is utilized that the conveying device conveys the crop material in a conveying direction along the window. The or at least one fluid jet is directed onto a wall area which is positioned upstream of the window – upstream seen in the conveying direction of the crop material. The crop material is first conveyed along this wall area and takes the fluid. Afterwards the crop material with the fluid is conveyed along the window. Thereby the crop material conveys the fluid along the window such that the window is cleaned.

In one embodiment the crop material is quite loose when be conveyed along the window. A characteristic of the loose crop material is measured. The results from the measuring device are available in an early stage of processing the crop

material.

In a further embodiment the crop material is compressed together before or when being conveyed along the window. A characteristic of the compressed crop material is measured. The expanding force of the compressed crop material improves the cleaning function of the conveyed crop material. The compressed crop material forms a surface while being conveyed along the wall. In one embodiment the fluid jet is directed onto the surface of the crop material itself at a place upstream of the window – see in the conveying direction of the crop material. The fluid directed onto this receiving surface is taken by the conveyed crop material and is conveyed along the window.

In one application the harvester forms round-cylindrical bales in a bale forming chamber. This bale forming chamber is drum-shaped and is limited by two opposing sidewalls and a bale forming means (pressing rollers and/or pressing belts, e.g.). The round-cylindrical bale has two front faces pointing towards the two sidewalls. The round-cylindrical bale is rotated in the bale forming chamber such that every front face is conveyed along the corresponding sidewall. Into at least one sidewall a window is inserted. The sensor is positioned behind this window. At least one fluid ejector ejects a fluid jet onto one front face of the bale which points towards the window. The front face provided with fluid is conveyed along the window and cleans the window.

In a further application the harvester according to the invention forms cuboid bales in a pressing channel with four sidewalls. A pressing member, e.g. an oscillating pressing piston, forms a string of crop material in the pressing channel. The window is inserted into one sidewall. At least one fluid jet is directed onto the string of material at a position upstream of the window. The string with the fluid cleans the window surface.

In one embodiment the or at least one fluid ejector ejects permanently a fluid jet. In a further embodiment the ejection of fluid jet depends on the amount of crop material before the window. The or at least one fluid jet is only ejected if the amount of crop material is below a given threshold. If the crop material amount is above this threshold, at least one fluid ejector does not eject at all a fluid jet. This embodiment ensures that a fluid yet is only ejected if it can reach the window or a wall area above the window and if the fluid jet is not absorbed due to a high amount of crop material.

In one embodiment an actuator can pivot the or at least one fluid ejector such that the direction of the fluid jet is changed. The fluid ejector can be pivoted according to a given pivoting scheme (open loop control) or depending on the measured amount or conveying velocity of the crop material.

It is also possible that the fluid ejector ejects the fluid jet in a time-triggered manner. A combination is also possible: The fluid ejector ejects the fluid jet if the crop material amount is below a given threshold or after the fluid jet ejection has been interrupted for a given time span.

In one embodiment the conveying device conveys dry fertilizer or seed material along the window. The measuring device measures a characteristic of the fertilizer or seed material.

These and other aspects of the invention and of the preferred embodiment will be even more apparent from the detailed embodiment as described below and will be elucidated in detail there.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows in a top view a first embodiment of the invention in which three fluid jets are directed on the window and on a wall surface above the window;

Fig. 2 shows the first embodiment of Fig. 1 in a side view in a viewing direction perpendicular to the conveying direction and towards the window;

Fig. 3 shows the first embodiment of Fig. 2 in a side view in a viewing direction parallel to the conveying direction;

Fig. 4 shows in a side view a second embodiment of the invention in which every fluid jet is directed onto a wall surface upstream of the window;

Fig. 5 shows in a top view a third embodiment of the invention in which three fluid jets are is directed onto a front face of a round-cylindrical bale;

Fig. 6 shows the third embodiment of Fig. 5 in a side view in a viewing direction perpendicular to the conveying direction and towards the bale wherein the front face of the bale is in the drawing plane;

Fig. 7 shows the third embodiment of Fig. 6 in a side view wherein the front face of the bale is perpendicular to the drawing plane.

DETAILED DESCRIPTION OF EMBODIMENT

In every embodiment the agricultural harvester is a baler with a pressing chamber or a loader wagon with a storing room. A pick-up unit picks-up loose material from the ground. A conveyor conveys the picked-up crop material towards a pressing chamber or towards the storing room (not shown).

In the first and second embodiments the picked-up loose crop material is automatically analyzed by a measuring device in a contactless manner while being

conveyed and before being injected into the pressing chamber or storage room. In the third embodiment the pressed crop material in the pressing chamber is automatically analyzed.

In every embodiment the signals from the measuring device are used for controlling a moved part of the harvester or for generating a message for the operator or for generating a communication which is transmitted to a remote data processing center, e.g.

In one application the measuring device analyzes the color of the crop material in the visible or infrared or ultraviolet light spectrum. In a further application the measuring device detects a chemical property of the crop material. In just a further application the volume or amount of crop material conveyed along the measuring device or the actual conveying speed are measured in a contactless manner.

Fig. 1 to Fig. 3 show a first embodiment of the invention and thereby of the measuring device and the fluid ejectors in three perpendicular viewing directions. Fig. 1 shows the first embodiment in a top view, Fig. 2 and Fig. 3 in two different side views. The viewing direction of Fig. 2 is perpendicular to the conveying direction and the viewing direction in Fig. 3 is parallel to the conveying direction.

Fig. 1 to Fig. 3 show schematically the following parts according to the first embodiment:

- a conveying belt 6 on which loose crop material is conveyed,
- two deflecting rollers 5.1, 5.2 around which the conveyor belt 6 is guided wherein at least one deflecting roller 5.1, 5.2 is driven,
- a wall 4 into which a window 3 is inserted,
- an opposing wall 9,
- two light sources 10.1, 10.2 which emit light onto the conveyed crop material CM,
- a camera 1 positioned behind the window 3,
- an image processing unit 2 which automatically processes signals from the camera 1, and
- three fluid ejectors 7.1, 7.2, 7.3 with three nozzles 12.1, 12.2, 12.3 which eject three fluid jets 8.1, 8.2, 8.3.

The conveying belt 6 is positioned between the walls 4, 9 and guides loose crop material in a conveying direction CD. This conveying belt 6 can be positioned in the feeding channel of a harvester or belong to the bottom conveyor below the storing room of a loader wagon. Fig. 1 to Fig. 4 show schematically the upper surface CM of the crop material which is conveyed on the belt 6. The window 3 is positioned between

the crop material CM and the camera 1. The window 3 is in the drawing plane of Fig. 2 and perpendicular to the drawing planes of Fig. 1 and Fig. 3.

At least one pump or further fluid conveying member (not shown) takes fluid out of a fluid source (also not shown). The fluid source is in fluid communication with the fluid ejectors 7.1, 7.2, 7.3.

The middle fluid ejector 7.2 directs a fluid jet 8.2 on that surface of the window 3 which points to the conveying belt 6 and thereby to the conveyed crop material CM. The other two fluid ejectors 7.1, 7.3 direct two fluid jets 8.1, 8.3 not onto the window surface but onto two wall surface areas 4.1 and 4.3, resp., of the wall 4 wherein the wall surface areas 4.1, 4.3 are positioned angularly above the window 3.

The fluid jet 8.2 is emitted in a direction perpendicular to the conveying direction CD. The two further fluid jets 8.1, 8.3 are ejected in two directions angular to the conveying direction CD. Thanks to the force of gravity the fluid which is ejected and which hits the wall surface areas 4.1, 4.3 flows downwards towards the conveying belt 6. As can be seen in Fig. 2 and Fig. 3 the fluid jets 8.1, 8.2, 8.3 are directed sloping downwards and angular towards the window 3 and the wall surface areas 4.1, 4.3, resp. As two fluid ejectors 7.1, 7.3 direct two fluid jets 8.1, 8.3 onto two different wall areas 4.1, 4.3 angularly above the center area of the window 3 and one fluid ejector 7.2 ejects a fluid jet 8.2 onto the window 3, at least one stream of fluid running downwards reaches the window 3 even in the case that the harvester is operated on a hilly environment and is significantly inclined with respect to a horizontal tilting axis perpendicular to the travelling direction.

The crop material CM is conveyed along the window 3 when the crop material is conveyed between the two walls 4, 9. The window 3 is made moistly by the fluid which is directed onto the window 3 and onto the wall surface area 4.1 above the window 3. The conveyed crop material wipes off sugar particles and other particles which stuck onto the window 3. Thanks to the fluid on the window 3 the crop material can easily remove the particles from the window surface.

In one implementation the fluid ejectors 7.1, 7.2, 7.3 always eject the fluid jets 8.1, 8.2, 8.3. In a further implementation it is automatically detected whether or not a center area of the window 3 is behind crop material or is free. Only if no crop material is between a fluid ejector 7.1, 7.2, 7.3 and the center area, the respective fluid ejector ejects a fluid jet 8.1, 8.2, 8.3. In one implementation the or at least one fluid ejector 7.1, 7.2, 7.3 interrupts the fluid ejection no longer than a given time period.

Fig. 4 shows a second embodiment of the invention in a side view.

Coinciding parts have the same numbers than in the first embodiment. The task of the second embodiment is the same than that of the first embodiment. As in the first embodiment the conveying belt 6 conveys loose crop material CM in the conveying direction CD and between the walls 4, 9. The crop material CM is thereby conveyed along the window 3. In contrast to the first embodiment fluid jets are neither directed onto the window 3 itself nor on a wall area above the window 3. A fluid ejector 7.4 with a nozzle 12.4 directs a fluid jet 8.4 onto a wall surface area 8.4 positioned upstream of the window 3. A further fluid ejector 7.5 directs a further fluid jet 8.5 onto a wall surface area 4.5 which is also positioned upstream of the window 3. The term “upstream” refers to the conveying direction CD. The wall surface area 4.5 is positioned between the wall surface area 4.4 and the window 3. The two wall surface areas 4.4, 4.5 are not on the same height but in different height levels such that moistened crop material reaches the window 3 even if the harvester is operated on an ascending ground. The conveyed crop material CM is moistened by the fluid from the fluid ejectors 7.4, 7.5 and cleans the window 3 when being conveyed along the window 3.

Fig. 5, Fig. 6, and Fig. 7 show a third embodiment of the invention. In this further embodiment the invention is used in a round baler which forms under pressure round-cylindrical bales in a drum-shaped bale forming chamber. The bale forming chamber is formed by two opposing sidewalls 4, 9. Only the sidewall 4 is shown in Fig. 5 and Fig. 7.

Crop material is injected into the bale forming chamber through a crop material inlet In. This inlet In is formed between the two pressing rollers (starter rollers) 11.1, 11.2. A bale forming means, e.g. several parallel pressing belts or pressing rollers, rotate the round-cylindrical bale B in the drum-shaped bale forming chamber around its own center axis. Thereby the bale B is rotated in the rotating direction RD. The front face FF facing towards the sensor 1, 2 is rotated along the sidewall 4.

Fig. 5 is a top view. Fig. 6 shows the third embodiment in a viewing direction parallel to the center axis of the round-cylindrical bale B. The viewing direction of Fig. 6 points onto the front face FF, i.e. seen in the viewing direction of Fig. 6 the bale B is behind the window 3 and behind the fluid ejectors 7.1, 7.2, 7.3. Fig. 7 shows the third embodiment in a side view wherein the front face FF of the bale B is perpendicular to the drawing plane of Fig. 7. The bale B is behind the pressing rollers 11.1, 11.2.

In this exemplary implementation of the third embodiment also three fluid ejectors 7.1, 7.2, 7.3 with three nozzles 12.1, 12.2, 12.3 are used. Of course a further number of fluid ejectors can also be used in this third embodiment. The window 3 and

three apertures 13.1, 13.2, 13.3 are inserted into the sidewall 4. Every nozzle 12.1, 12.2, 12.3 is situated behind a corresponding aperture 13.1, 13.2, 13.3. The fluid ejectors 7.1, 7.2, 7.3 direct three fluid jets 8.1, 8.2, 8.3 through the apertures 13.1, 13.2, 13.3 onto the front face FF of the bale B. In one implementation water is used as the fluid.

As can best be seen in Fig. 6, the three apertures 13.1, 13.2, 13.3 are situated upstream of the window 3. Fluid jets 8.1, 8.2, 8.3 are ejected and are directed through the apertures 13.1, 13.2, 13.3 onto the front face FF of the bale B. The fluid jets 8.1, 8.2, 8.3 moisten the front face FF. The moist front face FF is conveyed along the window 3 and cleans the window 3. The expanding force of the compressed crop material improves the cleaning function.

Reference signs used in the claims will not limit the scope of the claimed invention. The term “comprises” does not exclude other elements or steps. The articles “a”, “an”, and “one” do not exclude a plurality of elements. Features specified in several depending claims may be combined in an advantageous manner.

LIST OF REFERENCE SIGNS

1	camera, takes images from the conveyed crop material
2	image processing unit, processes signals from the camera 1
3	window inserted in the wall 4 and being in flush with the wall 4
4	wall in which the window 3 is inserted
4.1, 4.3	wall surface area above the window 3 against which the fluid jets 8.1, 8.3 are directed
4.4, 4.5	wall surface area upstream of the window 3 against which the fluid jets 8.4, 8.5 are directed
5.1, 5.2	deflecting rollers for conveying belt 6
6	conveying belt, guided around the rollers 5.1, 5.2, positioned between the walls 4, 9
7.1, 7.2, 7.3	fluid ejectors of the first and third embodiments, eject the fluid jets 8.1, 8.2, 8.3 onto the wall surface areas 4.1, 4.3 and onto the window 3, resp.
7.4, 7.5	fluid ejectors of the second embodiment, eject the fluid jets 8.4, 8.5 onto the wall surface areas 4.4, 4.5
8.1, 8.2, 8.3	fluid jets ejected by the fluid ejectors 7.1, 7.2, 7.3
8.4, 8.5	fluid jets ejected by the fluid ejectors 7.4, 7.5
9	opposing wall
10.1, 10.2	light source for illuminating the crop material CM, B
11.1, 11.2	pressing rollers rotating the bale B
12.1, 12.2, 12.3	nozzles of the fluid ejectors 7.1, 7.2, 7.3
13.1, 13.2, 13.3	apertures in the wall 4 through which the fluid ejectors 7.1, 7.2, 7.3 emit the fluid jets 8.1, 8.2, 8.3 onto the front face FF
B	round-cylindrical bale with the front face FF
CD	conveying direction of the belt 6
CM	crop material conveyed by the conveying belt 6
CS	circumferential surface of the round-cylindrical bale B
FF	front face of the round-cylindrical bale B pointing to the wall 4
In	crop material inlet
RD	direction in which the bale B is rotated

CONCLUSIES

1. Agrarische oogstmachine omvattende

- een transportinrichting (5.1, 5.2, 6, 11.1, 11.2),
- een wand (4), en
- een meetinrichting (1, 2, 3, 10.1, 10.2),

waarbij de meetinrichting (1, 2, 3, 10.1, 10.2) omvat:

- ten minste één sensor (1, 2, 10.1, 10.2) en
- een venster (3) dat in de wand (4) is aangebracht,

waarbij de transportinrichting (5.1, 5.2, 6, 11.1, 11.2) is ingericht om plantmateriaal (CM, B) langs de wand (4) en daardoor langs het venster (3) te transporteren,

waarbij het venster (3) zich bevindt tussen

- de sensor (1, 2, 10.1, 10.2) en
- het getransporteerde plantmateriaal (CM, B), en

waarbij de sensor (1, 2, 10.1, 10.2) is ingericht om op een contactloze manier een eigenschap van het langs het venster (3) getransporteerde plantmateriaal (CM, B) te meten,

met het kenmerk dat

de oogstmachine voorts ten minste één fluïdumejector (7.1, 7.2, ...) omvat,

waarbij de of iedere fluïdumejector (7.1, 7.2, ...) is ingericht om ten minste één straal (8.1, 8.2, ...) fluïdum tegen een in de oogstmachine gevormd ontvangend oppervlak (3, 4, FF) uit te stoten,

waardoor fluïdum wordt ingebracht in een ruimte tussen

- het getransporteerde plantmateriaal (CM) en
- dat oppervlak van het venster (3) dat naar het getransporteerde plantmateriaal (CM, B) is gericht.

2. Agrarische oogstmachine volgens conclusie 1,

met het kenmerk dat

de meetinrichting (1, 2, 3, 10.1, 10.2) is ingericht om een waarde te meten die indicatief is voor de hoeveelheid plantmateriaal (CM, B) die langs het venster (3) wordt getransporteerd,

waarbij de of ten minste één fluïdumejector (7.1, 7.2, ...) is ingericht

- om een fluïdumstraal (8.1, 8.2, ...) uit te stoten als de gemeten hoeveelheid materiaal lager ligt dan een bepaalde drempelwaarde en/of
- om het uitstoten te onderbreken zolang de hoeveelheid materiaal boven een bepaalde drempelwaarde ligt.

3. Agrarische oogstmachine volgens één der conclusies,

met het kenmerk dat

de of ten minste één fluïdumejector (7.1, 7.3) is ingericht om ten minste één fluïdumstraal (8.1, 8.3) op een zich boven het venster (3) bevindend wandoppervlak (4.1, 4.3) te richten.

4. Agrarische oogstmachine volgens één der voorgaande conclusies,

met het kenmerk dat

de transportinrichting (5.1, 5.2, 6, 11.1, 11.2) is ingericht om het plantmateriaal (CM) in een transportrichting (CD) langs de wand (4) te transporteren,

waarbij de of ten minste één fluïdumejector (7.4, 7.5) is ingericht om ten minste één fluïdumstraal (8.4, 8.5) op een wandoppervlak (4.4, 4.5) te richten dat zich – in de transportrichting (CD) gezien – stroomopwaarts voor het venster (3) bevindt.

5. Agrarische oogstmachine volgens één der voorgaande conclusies,

met het kenmerk dat

de agrarische oogstmachine is ingericht om het getransporteerde losse plantmateriaal (CM) tot een voorwerp (B) met een buitenste voorwerpoppervlak (FF) samen te persen,

waarbij de transportinrichting (5.1, 5.2, 6, 11.1, 11.2) is ingericht om het buitenste voorwerpoppervlak (FF) langs de wand (4) en daardoor langs het venster (3) te transporteren en

waarbij de of ten minste één fluïdumejector (7.1, 7.2, ...) is ingericht om ten minste één fluïdumstraal (8.1, 8.2, ...) op het buitenste voorwerpoppervlak (FF) te richten.

6. Agrarische oogstmachine volgens één der voorgaande conclusies,

met het kenmerk dat

de oogstmachine een fluïdumejector-actuator omvat,

waarbij de fluïdumejector-actuator is ingericht om de of ten minste één fluïdumejector (7.1, 7.2, ...) te draaien.

7. Agrarische oogstmachine volgens één der voorgaande conclusies,

met het kenmerk dat

het venster (3) verzonken in de wand (4) is aangebracht.

8. Agrarische oogstmachine volgens één der voorgaande conclusies,

met het kenmerk dat

ten minste één lens of optisch filter in het venster (3) is opgenomen.

9. Werkwijze voor het verwerken van los materiaal met behulp van een agrarische oogstmachine,

waarbij de oogstmachine omvat:

- een transportinrichting (5.1, 5.2, 6, 11.1, 11.2),
- een wand (4), en
- een meetinrichting (1, 2, 3, 10.1, 10.2),

waarbij de meetinrichting (1, 2, 3, 10.1, 10.2) omvat:

- ten minste één sensor (1, 2, 10.1, 10.2) en
- een venster (3),

waarbij het venster (3) in de wand (4) is aangebracht, en

waarbij de werkwijze de volgende stappen omvat:

de transportinrichting (5.1, 5.2, 6, 11.1, 11.2) transporteert plantmateriaal (CM) langs de wand (4) en daardoor langs het venster (3)

zodanig dat het venster (3) zich tussen de sensor (1, 2, 10.1, 10.2) en het getransporteerde plantmateriaal (CM, B) bevindt, en

de sensor (1, 2, 10.1, 10.2) op een contactloze manier een eigenschap van het plantmateriaal (CM, B) meet terwijl het plantmateriaal (CM, B) langs het venster (3) wordt getransporteerd,

met het kenmerk dat

de oogstmachine voorts een fluïdumejector (7.1, 7.2, ...) omvat,

waarbij de werkwijze de volgende verdere stap omvat:

de fluïdumejector (7.1, 7.2, ...) stoot ten minste één straal (8.1, 8.2, ...) fluïdum uit tegen een in de oogstmachine gevormd ontvangend oppervlak (3, 4, FF)

zodanig dat fluïdum in een ruimte wordt ingebracht tussen

- het getransporteerde plantmateriaal (CM, B) en
- dat oppervlak van het venster (3) dat naar het getransporteerde plantmateriaal (CM, B) is gericht.

10. Materiaalverwerkingswerkwijze volgens conclusie 9,

met het kenmerk dat

de oogstmachine

- het plantmateriaal (CM, B) samenperst tot een voorwerp (B) met een buitenste
- voorwerpoppervlak (FF) en
- het buitenste voorwerpoppervlak (FF) langs de wand (4) en daardoor langs het venster (3) transporteert,

waarbij de of ten minste één fluïdumejector (7.1, 7.2, ...) ten minste één fluïdumstraal (8.1, 8.2, ...) op het buitenste voorwerpoppervlak (FF) richt.

11. Materiaalverwerkingswerkwijze volgens conclusie 9 of conclusie 10,

met het kenmerk dat

een waarde wordt gemeten die indicatief is voor de hoeveelheid plantmateriaal (CM) die langs het venster (3) wordt getransporteerd,

waarbij de of ten minste één fluïdumejector (7.1, 7.2, ...) de of ten minste één fluïdumstraal (8.1, 8.2, ...) afhankelijk van de gemeten waarde uitstoot.

FIG. 1

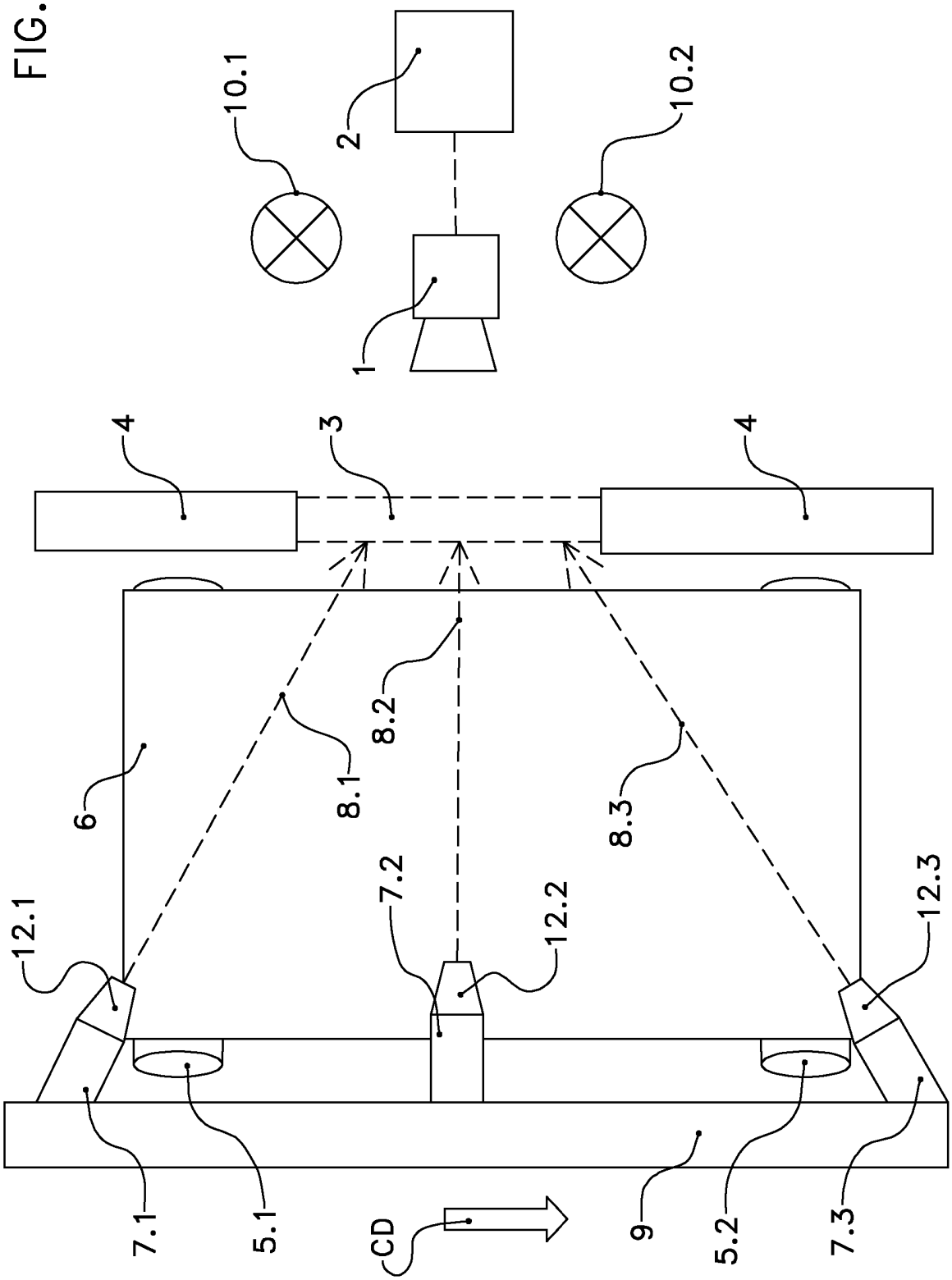


FIG. 2

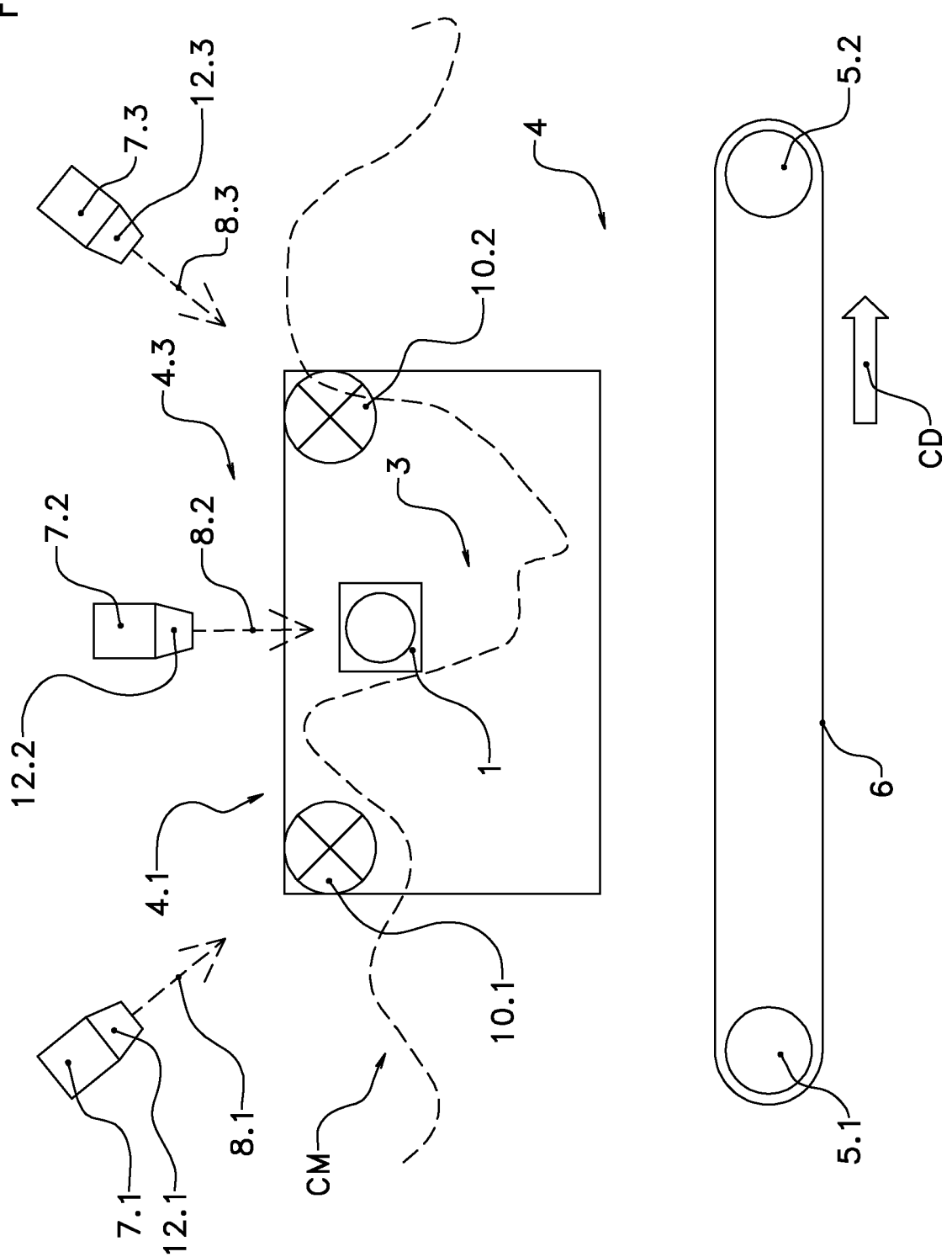


FIG. 3

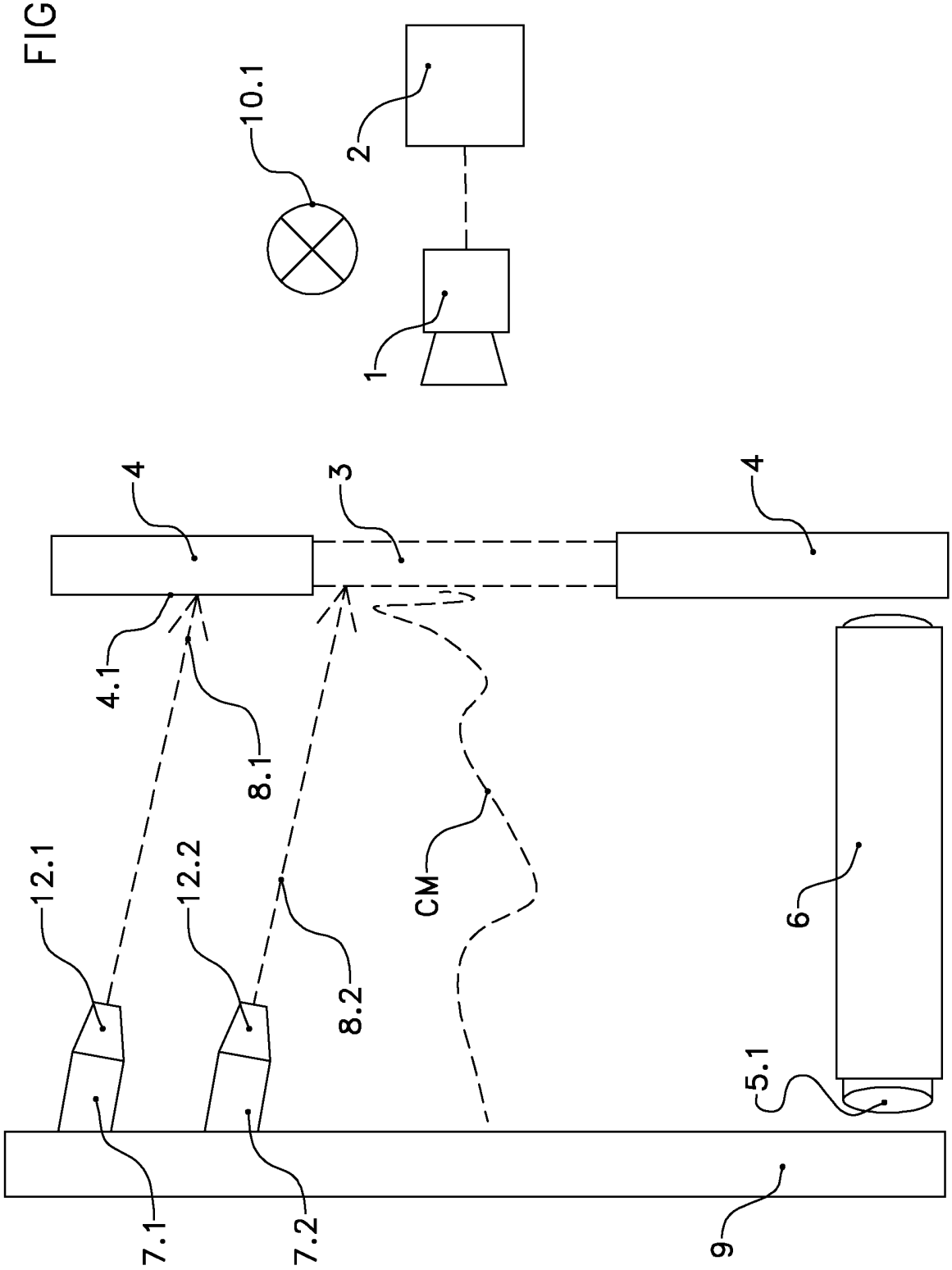


FIG. 4

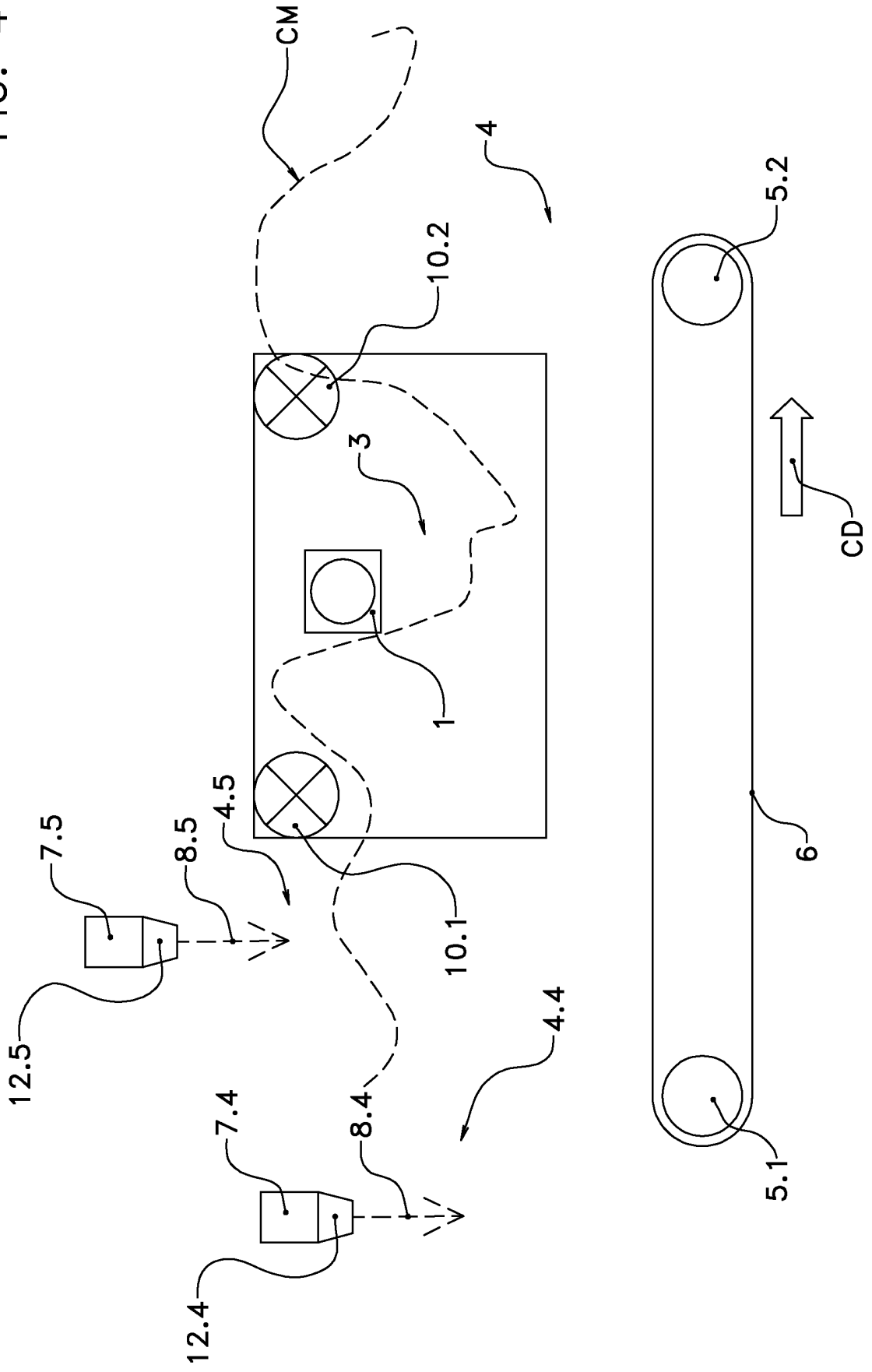


FIG. 5

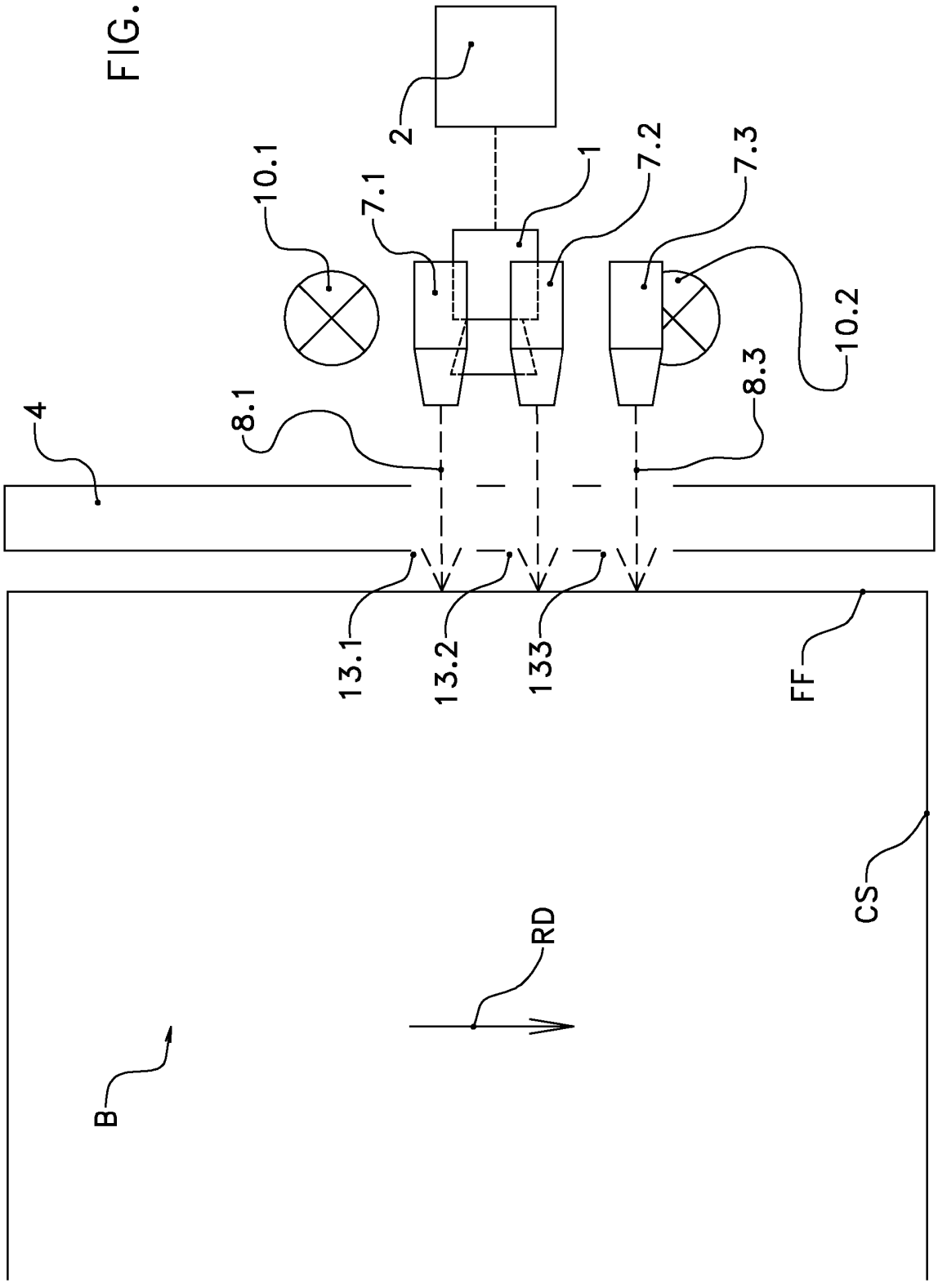


FIG. 6

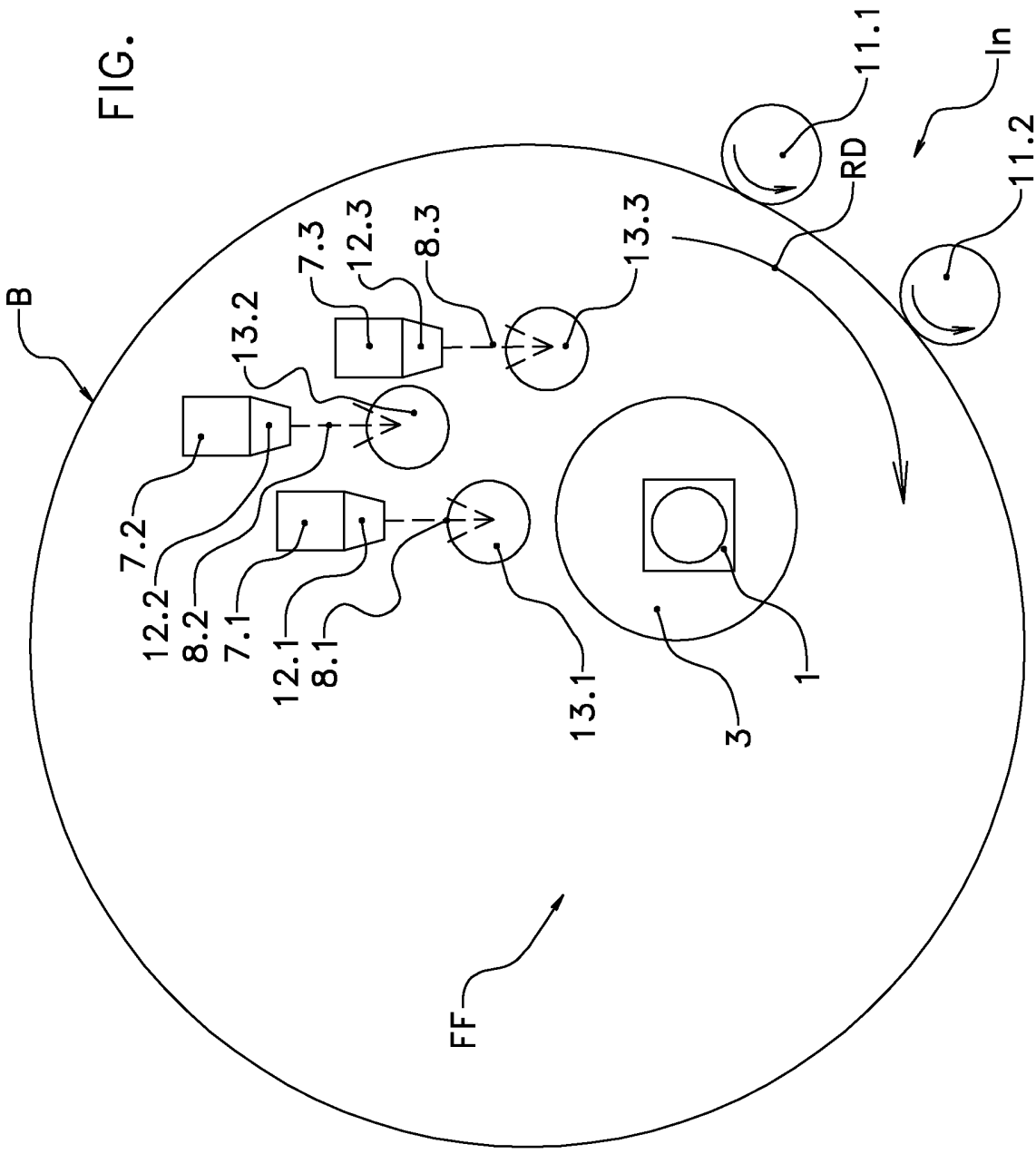
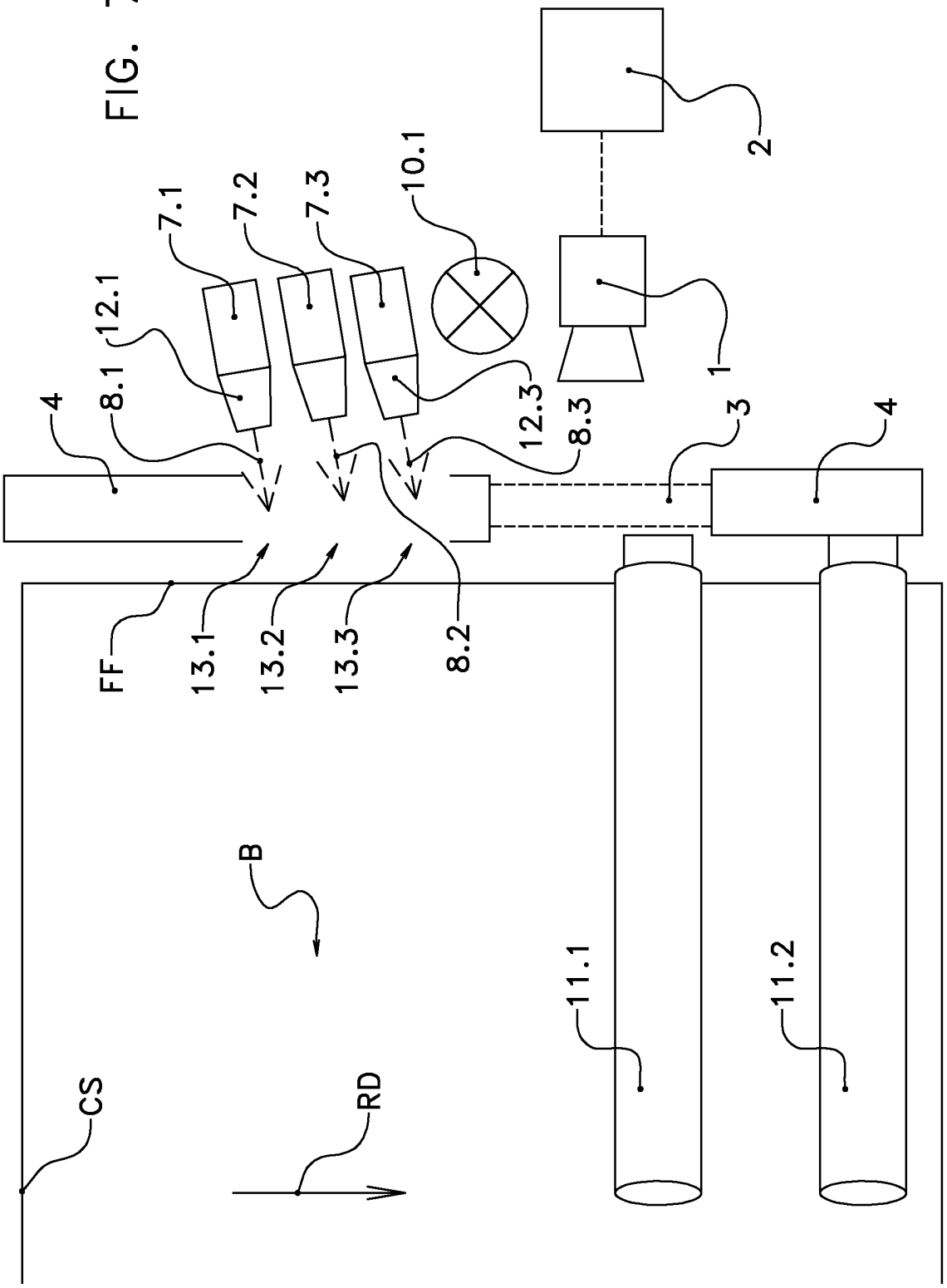


FIG. 7



ABSTRACT

A conveying device (11.1, 11.2) of an agricultural harvester conveys crop material (B) along a window (3) which is inserted into a wall (4). A sensor (1, 2, 10.1) measures in a contactless manner a characteristic of the conveyed crop material (B). A fluid ejector (7.1, 7.2, 7.3) ejects a fluid jet (8.1. 8.2, 8.3) onto a surface (FF) formed in the interior of the harvester. The fluid is thereby provided in a space between the window (3) and the conveyed crop material (B).

(Fig. 7)

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	D4848/NLP
Nederlands aanvraag nr. 2014592	Indieningsdatum 08-04-2015
	Ingeroepen voorrangsdatum
Aanvrager (Naam) Forage Innovations B.V.	
Datum van het verzoek voor een onderzoek van internationaal type 15-08-2015	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN 64672

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

A01D41/127 A01F15/08 G01N21/15

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen		
IPC	A01D	A01F	G01N

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III. ☐ GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingsblad)

IV. ☐ GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2014592

A. CLASSIFICATIE VAN HET ONDERWERP
INV. A01D41/127 A01F15/08 G01N21/15
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
A01D A01F G01N

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A,D	US 7 372 034 B2 (KORMANN GEORG [DE] ET AL) 13 mei 2008 (2008-05-13) in de aanvraag genoemd * kolom 4, regel 10 - regel 47 * * figuren 1-4 *	1,6,9
A	US 6 091 501 A (SAIKANMAEKI TIMO [FI] ET AL) 18 juli 2000 (2000-07-18) * kolom 1, regel 16 * * kolom 2, regel 40 - regel 61 * * figuren 1, 2 *	1,9
A	US 2013/081659 A1 (GRINI PER GERHARD [NO] ET AL) 4 april 2013 (2013-04-04) * alineas [0002], [0014], [0015], [0021] * * figuur 1 *	1,9

-/--

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvraag vermeld

"E" eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" met schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verhelderking van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
11 december 2015	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Baltanás y Jorge, R

2

Formulier PCT/ISA/201 (tweede blad) (januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2014592

C (Vervolg) VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	US 6 138 518 A (STRUBBE GILBERT J I [BE]) 31 oktober 2000 (2000-10-31) * kolom 9, regel 47 - regel 57 * * figuur 2 *	1,9
A	DE 197 44 481 A1 (CLAAS SELBSTFAHR ERNTEMASCH [DE]) 15 april 1999 (1999-04-15) * kolom 1, regel 41 - kolom 2, regel 59 * * figuur 2 *	1,9
A,D	US 8 115 923 B2 (PRIESNITZ RICO [FR] ET AL) 14 februari 2012 (2012-02-14) in de aanvraag genoemd * kolom 5, regel 32 - regel 39 * * figuur 2 *	1,4,9

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek: NL 2014592

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 7372034 B2 13-05-2008		DE 102004038408 A1	23-02-2006
		EP 1639879 A2	29-03-2006
		US 2006027750 A1	09-02-2006
US 6091501 A 18-07-2000		CA 2276769 A1	14-01-2000
		EP 0974828 A1	26-01-2000
		FI 981607 A	15-01-2000
		US 6091501 A	18-07-2000
US 2013081659 A1 04-04-2013		GEEN	
US 6138518 A 31-10-2000		EP 0856723 A2	05-08-1998
		GB 2321112 A	15-07-1998
		US 6138518 A	31-10-2000
DE 19744481 A1 15-04-1999		GEEN	
US 8115923 B2 14-02-2012		AU 2009203195 A1	20-05-2010
		CA 2683211 A1	30-04-2010
		DE 102008043377 A1	06-05-2010
		EP 2189781 A2	26-05-2010
		US 2010110428 A1	06-05-2010

WRITTEN OPINION

File No.	Filing date (day/month/year)	Priority date (day/month/year)	Application No.
SN64672	08.04.2015		NL2014592

International Patent Classification (IPC)
INV. A01D41/127 A01F15/08 G01N21/15

Applicant
Forage Innovations B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

Examiner
Baltanás y Jorge, R

Application number

WRITTEN OPINION

NL2014592

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-11
	No:	Claims	
Inventive step	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VIII Certain observations on the application

see separate sheet

Item V

Reference is made to the following documents:

D1 US 7 372 034 B2 (KORMANN GEORG [DE] ET AL) 13 mei 2008 (2008-05-13)in de aanvraag genoemd

D2 US 6 091 501 A (SAIKANMAEKI TIMO [FI] ET AL) 18 juli 2000 (2000-07-18)

D3 US 2013/081659 A1 (GRINI PER GERHARD [NO] ET AL) 4 april 2013 (2013-04-04)

D4 US 6 138 518 A (STRUBBE GILBERT J I [BE]) 31 oktober 2000 (2000-10-31)

D5 DE 197 44 481 A1 (CLAAS SELBSTFAHR ERNTEMASCH [DE]) 15 april 1999 (1999-04-15)

D6 US 8 115 923 B2 (PRIESNITZ RICO [FR] ET AL) 14 februari 2012 (2012-02-14)in de aanvraag genoemd

1 Document D1 discloses an agricultural harvester (see column 3, line 37) comprising a conveying device (10), a wall (12), and a measuring device (16), wherein the measuring device (16) comprises at least one sensor (18) and a window (24) arranged on the wall (12), wherein the conveying device (10) is arranged to transport plant material along the wall (12) and the window (24), wherein the window (24) is located between the sensor (18) and the transported plant material, and wherein the sensor measures in a contact-less manner (sensor 18 is a near-infrared range sensor) a property of the plant material transported along the window (24).

Claim 1 differs from D1 in that the harvester comprises at least a fluid ejector which projects a jet of fluid against a surface formed in the harvester, wherein the fluid is brought in a location between the transported plant material and the surface of the window oriented towards said transported plant material.

The technical effect of the differentiating features is that the window is reached by a fluid.

The objective technical problem solved by the invention can therefore be defined as providing an alternative means to clean the window of the measuring device.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step for the following reasons: the only documents disclosing the claimed solution (D2: see fluid ejector 3; D3: see fluid ejector 2) for solving the corresponding technical problem are to be found in the technical field of measuring devices intended for materials which are completely different from transported plant material (D2: paper webs; D3: water).

Thus, the skilled person would have not considered as suitable for the harvester of D1 -where crop material impinges on the window in such a way that dirt would stick to it with a considerable strength- the fluid cleaning provided by pressurized air in D2, and would have remarked as well that the nozzle 2 of D3 would constitute an obstacle for crop material if implemented into the transport channel of D1.

Finally, if the skilled person wished to provide an alternative cleaning means for the window of the measuring device, he would have had at his disposal other possibilities within the field of measuring devices in harvesters, such as the mechanical cleaners of D5 (see wipers 24, 32).

2 Since claim 9 basically consists of a method for using the device of claim 1, claim 9 is also considered to satisfy the requirements of novelty and inventive step on same grounds as detailed above.

3 Claims 2-8, 10 and 11 are respectively dependent on claims 1 or 8, and as such also meet the requirements with respect to novelty and inventive step

4 The industrial applicability of the invention is obvious.

Item VIII

Independent claims 1 and 9 respectively claim an agricultural harvester and a method for processing loose material with the help of an agricultural harvester.

However, some passages of the description suggest that the invention also comprises embodiments concerning agricultural machines other than harvesters.

More specifically, on page 4, lines 30 to 33, it is disclosed that "*The harvester can be [..] a seed or drilling machine*" and it goes on with "*The crop material can be [..] seed material to be distributed onto the field, or fertilizer or preservatives*".

Further on, on page 7, lines 5 to 7, it is disclosed that "*In one embodiment the conveying device conveys dry fertilizer or seed material along the window. The measuring device measures a characteristic of the fertilizer or seed material*".

Since a seed, drilling or fertilizing machine is not a harvester, said passages render the scope of protection sought by claims 1 and 9 unclear.

Moreover, both claims 1 and 9 claim that the measuring device window is oriented towards the plant material and measures a property of it, which is clearly not the case when such measuring device would measure a characteristic of the fertilizer or of a preservative.

For the purposes of the search and of drafting the current written opinion, it has been considered that the claimed invention concerns exclusively agricultural harvesters.