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Method and seeder for sowing an individual seed in a seed location

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The present invention relates to a method for sowing an individual seed in a seed location and to a seeder therefor.

The method for sowing an individual seed in a seed location according to the invention comprises arranging a seed on a surface adjacent to an opening that leads to a guide channel that extends to the seed location; flushing the seed from the surface into the opening by directing a fluid over the surface in the direction of the opening; and guiding the seed that is flushed into the opening to a seed location by means of the guide channel.

The seeder for sowing a seed in a seed location according to the invention comprises at least one opening that leads to a guide channel that extends to a seed location; a surface that is configured to be arranged adjacent to the at least one opening; and a selectively operable fluid supply for each opening, each fluid supply having at least one nozzle that is arranged for directing fluid supplied thereto over the surface toward the opening.

Method and seeder for sowing an individual seed in a seed location

The present invention relates to a method for sowing an individual seed in a seed location and to a seeder therefor.

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For seedling production, individual seeds are sown in a seed location. The seed location is generally a respective compartment of a seed tray having a plurality of tray compartments, each filled with a growth substrate such as soil. One seed is to be sown in each tray compartment.

It is known to sow individual seeds in a respective compartment of a seed tray by hand.

10 Although sowing by hand allows for accurate sowing of individual seeds, it is laborious and thus costly.

It is also known to sow individual seeds in respective tray compartment of a seed tray by mechanised sowing methods. In known mechanised methods for sowing an individual seed in a tray compartment, an individual seed is arranged adjacent to an opening of a tray compartment while being held by vacuum on the tip of a needle of a so-called needle seeder. The tip of the needle of such needle seeder is provided with an air opening against which the individual seed is held by the vacuum. Once arranged adjacent to the opening of the tray compartment, the seed is released from the tip of the needle, generally by releasing the vacuum and blowing the seed from the tip of the needle into the tray compartment by blowing air through the air opening after releasing the vacuum. It is also known to arrange an individual seed adjacent to an opening of a tray compartment while being held by vacuum on the surface of a drum of a so-called drum seeder. The surface of the drum of such drum seeder is provided with an air opening against which the individual seed is held by the vacuum. Once arranged adjacent to the opening of the tray compartment, the seed is released from the surface of the drum, generally by releasing the vacuum and blowing the seed away from the surface into the tray compartment by blowing air through the air opening against which the seed was held after releasing the vacuum.

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Although sowing by means of these known mechanised methods is less laborious relative to sowing by hand, these known mechanised methods have a number of drawbacks.

These known mechanised methods for instance require accurate placement of the individual seeds on respectively the air opening on the tip of the needle and the air opening on the surface of the drum. In practice accurate placement of the individual seeds on the respective air openings is unreliable, resulting in compartments of a seed tray being left empty.

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Furthermore, for reliable holding a seed on respectively the tip of the needle and the surface of the drum, these known mechanised methods require that the size and shape of the air opening and of the surface around the air opening against which the seed is held, is adapted to the

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size and shape of the seeds to be sown. The latter requires changing the size and/or shape of the air opening and of the surface around the air opening when another type of seed is to be sown, for instance by exchanging the needle or drum that has an air opening having a size and shape adapted to a first type of seed, with a needle or drum having an air opening of a different size and/or shape adapted to a second type of seed.

A known solution to these drawbacks is to pellet individual seeds. By pelleting individual seeds, the size and shape of individual seeds can be changed, and thus can be optimized for accurate placement of the individual pelleted seeds on the respective openings of the needle or drum. Furthermore, different types of seeds having different shape and size can be provided with a uniform size and shape, such that a needle or a drum having air openings that are adapted to the uniform size and shape of the pelleted seeds, can be used to sow different types of seed without replacement of the needle or drum. Although providing a solution to the above drawbacks, pelleting of seeds itself has the drawback that it is costly.

One of the objects of the present invention is to address at least one of the drawbacks of the known methods for sowing an individual seed in a seed location.

The present invention provides a method for sowing an individual seed in a seed location, comprising:

- arranging a seed on a surface adjacent to an opening that leads to a guide channel that extends to the seed location;
- flushing the seed from the surface into the opening by directing a fluid over the surface in the direction of the opening;
- guiding the seed that is flushed into the opening to a seed location by means of the guide channel.

The method according to the invention does not require an air opening in the surface for holding on the seed by vacuum and for blowing the seed into the seed location, such as in known methods. By flushing the seed into an opening that leads to a guide channel that extends to the seed location and by guiding the seed that is flushed into the opening to a seed location by means of the guide channel, the orientation of the surface is independent from the seed location, and can be such that it is not required to hold the seed onto the surface against an air opening by means of vacuum. Furthermore, by flushing, according to the invention, the seed from the surface into the opening by directing a fluid over the surface in the direction of the opening, there is no requirement for an air opening in the surface for blowing the seed into the opening. Requiring no air opening in the surface for holding on the seed by vacuum and for transporting the seed into the seed location, has

the advantage over the known methods that placement of the seed on the surface requires less accuracy. As long as the seed is in the path of the fluid that is directed over the surface, the seed is flushed into the opening. Furthermore, the surface can be shaped independent from the size and shape of the seed, and thus it is not required to adapt the surface to the size and shape of the seeds to be sown. This allows seeds of different size and shape to be sown by means of the method according to the invention without exchanging the surface. There is no need to pallet the seeds for applying the method according to the invention. However, if pelleting of the seeds is required for other reasons than providing the seeds with a uniform size and shape, the method according to the invention can be applied for sowing pelleted seed and bare seeds without exchanging the surface.

The fluid that according to the present invention is directed over the surface in the direction of the opening for flushing the seed from the surface into the opening is a gas, a liquid, or a combination thereof, for instance a gas having dispersed therein drops of a liquid. Preferably, the fluid is air.

Preferably the surface is a flat surface. This has the advantage of reduced influence of the surface on the seed while being arranged on the surface and while being flushed from the surface relative to a surface that is not flat, as well as reduced influence of the surface on the fluid that is directed over the surface. Preferably the surface is a substantially horizontal surface.

In a preferred embodiment of the method according to the invention, the surface is a conveyor surface, the seed is conveyed along the opening on the conveyor surface, and the seed is flushed into the opening when the seed is adjacent to the opening. The features of this embodiment allow the seed to be placed on the conveyor surface at a location different from the location of the opening and subsequently convey the seed on the conveyor surface to the location of the opening in order to arrange the seed adjacent to the opening. Preferably, the conveyor surface with arranged thereon the seed is conveyed along the opening. This provides control over the location and speed of the seed while its being conveyed from the location where it is arranged on the conveyor surface and the location of the opening. Preferably, the conveyor surface is a surface of a linear conveyor. More preferably the surface of a conveyor belt. Alternatively, the conveyor surface is a surface of a rotary surface, for instance a surface of a rotary table. In an advantageous embodiment of the method according to the invention wherein the surface is a conveyor surface, the opening in which the seed is flushed is a selected one of a plurality of openings arranged along the conveyor surface, wherein each opening leads to a respective guide channel that extends to a respective seed location.

In a further advantageous embodiment of the method according to the invention the seed that is flushed into the opening is a selected one of a plurality of seeds. In a preferred embodiment

thereof, the plurality of seeds is arranged in a row of seeds on the surface and conveyed along the opening on or over the surface in a direction parallel to the row. In an advantageous embodiment of thereof the seeds are arranged in a row of individual seeds on the surface by moving the surface with a conveying speed, and arranging a batch of seeds on a shaker conveyor that debouches on the surface, wherein the shaker conveyor is configured to channel the batch of seeds into a flow of seeds having a flow speed that is lower than the conveying speed of the surface. Preferably, the number of seeds in the batch of seeds that is arranged on the shaker conveyor is counted.

In an advantageous embodiment of the method according to the invention described herein above wherein the seed that is flushed into the opening is a selected one of a plurality of seeds, the method further comprises: determining a selection characteristic of each of the plurality of seeds that is arranged on the surface; and selecting the seed to be flushed into the opening at least based on the determined selection characteristic of the seed. According to the invention a seed can be selected on the basis of one or more than one determined selection characteristic. Selection characteristics can include any internal or external morphological or physiological characteristic, such as size, shape, colour, chlorophyll content, water content, etc. In an advantageous embodiment thereof the selection characteristic of each of the plurality of seeds is determined using at least one selection sensor. Preferably, the at least one selection sensor includes a camera, and the selection characteristic is determined by analysing images of the seed on the surface obtained by means of the camera. The choice of selection sensor(s) is made based on the selection characteristic(s) used for the selection. A camera is for instance particularly suitable for determining external morphological or physiological characteristics such as size, shape, and colour of a seed. Examples of other selection sensors suitable for determining internal morphological or physiological characteristics are X-ray sensors and Terahertz sensors.

In a further advantage embodiment of the method according to the invention, the method comprises: determining the location of the seed on the surface, and flushing the seed from the surface into the opening when it is determined that the seed is adjacent to the opening. In an advantageous embodiment thereof the location of the seed on the surface is determined using at least one location sensor. Preferably, the at least one location sensor includes a camera, and the location of the seed on the surface is determined by analysing images of the seed on the surface obtained by means of the camera. A camera is particularly suitable for determining location of the seed on the surface. An example of other location sensors that may be used for determining the location of the seed on the surface includes an infrared sensor.

In an advantageous embodiment of the method according to the invention as described herein above wherein the location of the seed on the surface is determined, first the seed is arranged on the surface at a first location and subsequently the surface is moved along the opening so as to arrange the seed at a second location adjacent to the opening. After being arranged on the surface and before reaching the second location, the location of the seed on the surface is determined and associated with the location of the surface relative to the second location. When it is determined that the location of the surface that is associated with the seed is at the second location the seed is flushed from the surface into the opening.

The present invention further relates to a seeder for sowing a seed in a seed location. In particular the present invention relates to a seeder configured for executing the method according to the invention, more in particular for executing at least one of the above described embodiments of the method according to the invention.

The seeder according to the invention comprises:

- at least one opening that leads to a guide channel that extends to a seed location;
- a surface that is configured to be arranged adjacent to at least one opening; and
- a selectively operable fluid supply for each opening, each fluid supply having at least one nozzle that is arranged for directing fluid supplied thereto over the surface toward the opening.

The fluid supply is in particular selectively operable such that fluid is directed over the surface at a selected moment in time, in particular a moment in time wherein a seed that is to be flushed into the opening is adjacent to the opening.

Preferably, the seeder further comprises a seed supply for arranging a seed on the surface.

Preferably, at least when arranged adjacent to the opening, the surface is substantially flat.

Furthermore, preferably, at least when arranged adjacent to the opening, the surface is substantially horizontal.

In a preferred embodiment of the seeder according to the invention, the surface is a conveyor surface, the conveyor surface is configured to be moved along a path, and the at least one opening is arranged adjacent to the path of the conveyor surface. Preferably, the conveyor surface is configured to be conveyed along the opening. Preferably, the conveyor surface is a surface of a linear conveyor. More preferably the conveyor surface is the surface of a conveyor belt. Alternatively, the conveyor surface is a surface of a rotary surface, for instance a surface of a rotary table.

In an advantageous embodiment of the seeder according to the invention wherein the surface is a conveyor surface, a plurality of openings is arranged along the path of the conveyor surface, wherein each opening leads to a respective guide channel that extends to a respective seed location. In a preferred embodiment thereof the openings are arranged along opposite edges of the conveyor surface that are parallel to the path of the conveyor surface, wherein preferably the nozzles of the selectively operable fluid supplies associated with the openings are arranged above the conveyor surface in between the opposite edges.

In an advantageous embodiment of the seeder according to the invention, the seed supply comprises: a shaker conveyor that debouches on the conveyor surface, wherein the shaker conveyor is configured to channel a batch of seeds into a flow of seeds; and a seed distributor configured for batch wise distributing seeds to the shaker conveyor. The additional features of this advantageous embodiment are in particular advantageous in the above described embodiment of the seeder according to the invention that comprises the feature that the surface is a conveyor surface configured to be conveyed along the path thereof.

In an advantageous embodiment the shaker conveyor is configured to channel the batch of seeds into two flows of seeds debouching on opposite sides of the nozzles. The additional feature of this advantageous embodiment is in particular advantageous in combination with the embodiment of the seeder according to the invention wherein openings are arranged along opposite edges of the conveyor surface that are parallel to the path of the conveyor surface and wherein the nozzles of the selectively operable fluid supplies associated with the openings are arranged above the conveyor surface in between the opposite edges.

In a preferred embodiment of the seeder according to the invention wherein the seed supply comprises a shake conveyor, the seed supply comprises a seed counter arranged and configured for counting the number of seeds in the batch of seeds that is distributed to the shaker conveyor.

The accompanying drawings are used to illustrate present non-limitative preferred exemplary embodiments of the method and seeder of the present invention. The above stated and other advantages, features and objectives of the invention will become more apparent, and the invention better understood, from the following detailed description when read in combination with the accompanying drawings, in which:

Figures 1 to 3 illustrate the general steps of embodiments of a method according to the invention as well as general components of embodiments of a seeder according to the invention;

Figure 4 shows the result of the method steps illustrated by figures 1 to 3;

Figures 5 and 6 illustrate an embodiment of the method according to the invention in which the general steps shown in figures 1 to 3 are used as well as an embodiment of the seeder according to the invention in which the general components of the seeder shown in figures 1 to 3 are incorporated;

Figures 7 to 11 illustrate an embodiment of the method and seeder according to the invention that is an advantageous further development of the embodiment illustrated by figures 5 and 6.

Figures 12 and 13 illustrate an embodiment of the method and seeder according to the invention that is an advantageous further development of the embodiment illustrated by figures 7 to 11;

Figure 14 shows a first embodiment of a seed distributor that is arranged above the shaker conveyor 47 shown in figures 12 and 13;

Figures 15 to 17 show a second embodiment of a seed distributor that is arranged above the shaker conveyor 47 shown in figures 12 and 13 in different phases of the operation thereof;

Figure 18 illustrates an embodiment of the method and seeder according to the invention that is an advantageous further development of the embodiment illustrated by figures 12 to ;

Figure 19 shows a seed tray that is arranged underneath the conveyor belt of the embodiment shown in figure 18.

In figures 1 to 3, general steps of a method according to the invention are shown as well as general components of a seeder according to the invention.

In figure 1 is shown that a seed 1 is arranged on a surface 3 adjacent to an opening 5 that leads to a guide channel 7 that extends to a seed location that in figure 1 is embodied by a tray compartment 9 of a seed tray. As shown, the tray compartment 9 holds a growth substrate 11. The surface 3 is a flat surface. Furthermore, the surface 3 is a substantially horizontal surface. The guide channel 7 is provided at its upper end with a perforated slanted guiding wall 13 on the side of the opening 5 opposite the side of the opening 5 where the surface is. Preferably side walls that serve as side borders of the opening 5 extend from opposite sides 13.1, 13.2 of the slanted wall 13 towards the surface 3. In figure 1 such side walls are not shown as they would partly obstruct the view on the seed 1.

The guide channel 7 has at its lower end an outlet 15. The guide channel 7 funnels towards the outlet 15. On the side of the surface 3 opposite the side where the opening 5 is arranged, a nozzle 17 is arranged that is connected to a fluid source (not shown) via a selectively operable valve 19. The fluid is preferably air and the fluid source preferably a source of compressed air.

In figure 2 is shown that the seed 1 is flushed from the surface 3 into the opening 5 by directing, using the nozzle 17, a fluid 21 over the surface 3 in the direction of the opening 5. The fluid 21 is supplied from the fluid supply to the nozzle 17 after opening the selectively operable valve 19. As shown in figure 2, the seed 1 is flushed against the perforated slanted wall 13. The fluid 21 exits through the perforations in the perforated slanted wall 13, such that the fluid 21 is not directed down into the guide channel 7.

As shown in figure 3, the seed 1 is guided by means of the guide channel 7 to the tray compartment 9. In particular, the seed 1 is directed by means of the perforated slanted wall 13 down into the guide channel 7, where the seed 1 is guided via the funnel-shaped part to the outlet 15 that has an outlet opening 23 under which outlet opening 23 the tray compartment 9 is arranged.

The result of the above steps is shown in figure 4: the seed 1 is sown in the seed location embodied by the tray compartment 9.

In figures 5 and 6 an embodiment of the method according to the invention is shown in which the general steps shown in figures 1 to 3 are used. Figure 5 and 6 also show an embodiment of a seeder according to the invention.

In particular is shown that after sowing the seed 1 into tray compartment 9 in accordance with the steps shown in figures 1 to 3, the tray compartment 9 is moved in the direction of arrow A and a second tray compartment 25 that is attached thereto is arranged underneath the outlet opening 23 of the guide channel 7. Furthermore, a second seed 27 is arranged on the surface 3 adjacent to the opening 5 as schematically indicated by arrow B. Once the second seed 27 is arranged on the surface 3 and the second tray compartment 25 is arranged underneath the outlet opening 23, the second seed 27 can be sown in the second tray compartment 25 by executing the general steps illustrated in figures 1 to 3. The above can be repeated with a third, fourth, fifth, ect. tray compartment and seed. Thus a seed can be sown in each of a row of tray compartments of a seed tray.

In figures 7 to 11 an embodiment of the method and the seeder according to the invention is shown that is an advantageous further development of the embodiment illustrated by figures 5 and 6. In figure 7 is shown that the surface 3 is a conveyor surface, in particular a surface of a conveyor belt 29. The conveyor belt 29 is led over two pulleys 31, 33 and driven such that the surface thereof moves in the direction of arrow C. When the conveyor belt 29 moves in the direction of arrow C, the conveyor surface 3 is moved along a path P. Along path P is arranged a camera 35 that is arranged above the surface of the conveyor belt 29 such that the surface of the conveyor belt 29 is in its view. Along path P is further arranged opening 5 that as shown in figure 1

leads to the guide channel 7 that extends to a seed location that is embodied by a tray compartment 9 of a seed tray. The camera 35 is connected to a controller 37. The controller 37 is furthermore connected to the selectively operable valve 19. At the end of path P a receptacle 39 is arranged. As schematically illustrated in figure 7 by means of arrow D, seed 1 is placed on the conveyor surface 3 at a location near the start of path P. As shown in figure 8, since the surface of the conveyor belt 29 moves in the direction of arrow C, once the seed 1 is placed on the conveyor surface 3, the seed 1 and the conveyor surface 3 are moved together in the direction of arrow C along the path P. As shown in figure 9 seed 1 is thus conveyed along the camera 35. It is also shown that while seed 1 is conveyed along the camera 35, a second seed 27 is placed on the conveyor surface 3 as schematically illustrated by means of arrow D.

The camera 35 periodically sends images of the surface of the conveyor belt 29 to the controller 37. The controller 37 is provided with a processor that is configured to analyse the images received from the camera 35. The processor is configured to detect the seed 1 on the images while seed 1 is conveyed along the camera 35, and to determine a selection characteristic of the seed 1, for instance the shape of the seed 1. The processor is provided with selection criteria for the selection characteristic and is configured to select the seed for flushing into the opening 15 in case the determined selection characteristic meets the selection criteria. In the present case it is determined by the processor that seed 1 meets the selection criteria, and thus seed 1 is selected to be flushed into the opening 5 when seed 1 is arranged adjacent to the opening 5. The processor of the controller 37 is furthermore configured to determine the location of the seed 1 relative to the conveyor surface 3 based on the analyses of the images received from the camera 35 and to associate the determined location of the seed 1 relative to the conveyor surface 3 with the location of the conveyor surface 3 relative to the location of the opening 5. In the present embodiment, the controller 37 is connected to an angular rotation sensor 41 that is configured to sense angular rotation of pulley 33. The processor of the controller 37 is provided with data regarding the amount of angular rotation of the pulley 33 that is required to move a first location E on the surface of the conveyor belt 29 at a first edge 43 of the view of the camera 35 to a location F adjacent to the opening 15. The processor of the controller 37 furthermore is provided with data regarding the amount of angular rotation of the pulley 33 that is required to move a second location G on the surface of the conveyor belt 29 at a second edge 45 of the view of the camera 35 to a location F adjacent to the opening 15. Through analysis of images received from the camera 35, the processor of the controller 37 is configured to determine the location H of the seed 1 relative to the locations E and G. The processor is configured to calculate based on the above referenced data on the movement of locations E and F and based on the determined location H of the seed 1 relative to the locations E and G, the amount of angular rotation of the pulley 33 that is required to move the

location H of the seed 1 on the surface of the conveyor belt 29 to the location F adjacent to the opening 15. The processor is configured to determine based on the angular rotation of the pulley 33 sensed by means of the angular rotation sensor 41 when the location H of the seed 1 has arrived at the location F adjacent to the opening 15. When it is determined that the location H of the seed 1 has arrived at the location F adjacent to the opening 15, as shown in figure 10, the processor is configured to control the selectively operable valve 19 such that the valve 19 is opened and fluid 21 is supplied to nozzle 17 for directing the fluid 21 over the conveyor surface 3 in the direction of the opening 15. As a result the seed 1 is flushed into the opening 15 and guided into the tray compartment 9 as schematically illustrated by means of arrow I and as described herein above under reference to figures 1 to 4. After the seed 1 is sown into the tray compartment 9, the tray compartment 9 is moved in the direction of arrow A and a second tray compartment 25 that is attached thereto is arranged underneath the outlet opening 23 of the guide channel 7. In an advantageous embodiment the processor is configured to store an image of each seed that is detected together with information on whether or not the seed was selected to be flushed into an opening. Also information is advantageously stored regarding the tray compartment in which each selected seed is sown.

While seed 1 is conveyed along the opening 15, the second seed 27 is conveyed along camera 35. Analogous to what is described herein above under reference to figure 9, the processor of the controller 37 detects the second seed 27 on the images received from the camera 35 while the second seed 27 is conveyed along the camera 35, and determines a selection characteristic of the seed 27, for instance the shape of the seed 27. The processor determines whether the determined selection characteristic meets the selection criteria. In the present case it is determined by the processor that second seed 27 does not meet the selection criteria, and thus second seed 27 is not selected by the processor to be flushed into the opening 5. As a result of not being selected for flushing into the opening 5, the second seed 27 is conveyed along the opening 5 without being flushed into opening 5. As shown in figure 11, at the end of the path P of the conveyor belt 29, the second seed 27 falls into the receptacle 39.

In figures 12 and 13 an embodiment of the method and seeder according to the invention is shown that is an advantageous further development of the embodiment illustrated by figures 7 to 11. As shown in figures 12 and 13, a shaker conveyor 47 is arranged at the front end 49 of the conveyor belt 29. The shaker conveyor 47 debouches on the conveyor surface 3. The shaker conveyor 47 is configured to convey a batch 51 of seeds that is arranged on a shaker surface 53 thereof to the end 55 of the shaker conveyor 47 where the shaker conveyor 47 debouches on the

conveyor surface 3. The shaker surface 53 is mounted on a row of spring elements 57 and is driven by a drive (not shown) such that a shaking movement of the shaker surface 53 is generated that is schematically illustrated by means of the double arrow J. The shaking movement J causes a forward movement of the seeds arranged on the shaker surface 53 parallel to the shaker surface 53 schematically illustrated by means of arrow K and the upward movement of the seeds arranged on the shaker surface 53 perpendicular to the shaker surface 53 schematically illustrated by means of arrow L. The upward movement L causes seeds that are arranged on top of each other to move away from each other. The forward movement K conveys the seeds towards the end 55 of the shaker conveyor 47. As shown in figure 13, the shaker surface 53 tapers towards the end 55 of the shaker conveyor 47 such that the batch 51 of seeds is channelled into a flow of seeds that debouches on the conveyor surface 3 in single file. The shaker movement is set such that the forward movement K of the seeds that debouch on the conveyor surface 3 is lower than the speed of the conveyor belt 29 in the direction of arrow C. As a result a row of individualized seeds 1, 27, 59 is arranged on the conveyor surface 3 and conveyed along the path P in the direction of arrow C along camera 35. As shown in figures 12 and 13 a fourth seed 61 is about to be arranged on the conveyor surface. Analogous to what is described under reference to figures 7 to 11, each seed of the row of seeds is identified by the processor of the controller 37 that is connected to camera 35. For each seed that is conveyed along the camera a selection characteristic is determined by the processor and for each seed the processor determines whether or not the seed meets the selection criteria and is selected to be flushed in the opening 5. In the shown embodiment, four openings 5a-d are arranged along the path P. Each of the openings 5a-d leads to a respective guide channel 7a-d that extends to a respective seed location embodied by a respective tray compartment 9a-d. In case the processor determines that a seed that is conveyed along the camera 35 meets the selection criteria, the processor selects one of the openings 5a-d as the opening to flush the seed into. Analogous to what is described under reference to figures 9 and 10, the processor determines the location of the seed on the conveyor surface 3 and determines when the seed is adjacent to the opening that is selected to flush the seed in. In the shown embodiment opening 5d is selected by the processor to flush seed 1 in. Thus analogous to what is described under reference to figures 9 and 10, when it is determined by the processor that the location H of the seed on the conveyor surface 3 is at location F of the opening 5d, the processor controls the selectively operable valve 19d such that the valve 19d is opened and fluid is supplied to nozzle 17d for directing the fluid over the conveyor surface 3 in the direction of the opening 5d. The seed 1 is then flushed into the opening 5d and guided by means of guide channel 7d into the tray compartment 9d as schematically illustrated by means of arrow I. Analogous to what is noted under reference to figure 1, side walls that serve as side borders of the openings 5a, 5b, 5c, 5d preferably extend from opposite sides of each of the slanted

walls 13 towards the surface 3. In figure 12 such side walls are not shown. Such side walls provide a separation between neighbouring openings 5, thereby preventing a seed to be flushed not into the selected opening but into a neighbouring opening.

As shown in figures 12 and 13 a row 63 of tray compartments 9a-d is arranged under the guide channels 7a-7d, each tray compartment 9a-d is arranged under a respective guide channel 7a-7d. In case each of the first four shown seeds 1, 27, 59, 61 is selected to be flushed into an opening, the processor of the controller 37 selects for each of the selected seeds 1, 27, 59, 61 a respective one of the openings 15a-d, such that one seed is sown into each one of the tray compartments 9a-d.

As shown in figure 13 the row 63 of tray compartments 9a-9d is one row of a seed tray 65 having a plurality of parallel rows 63, 67, 69 of tray compartments. Once all tray compartments 9a-9d of the row 63 have arranged therein one seed, the seed tray 65 is moved by means of a linear conveyor (not shown) on which the seed tray is arranged in the direction of arrow A, such that a next row 67 with tray compartments 25a-d is arranged under the guide channels 7a-7d, wherein each tray compartment 25a-d is arranged under a respective guide channel 7a-7d. Subsequently, analogous to the sowing of seeds 1, 27, 59, 61 in tray compartments 9a-d, in each of the compartments 25a-d, a seed is sown that is selected from the continuous flow of individual seeds that is arranged on conveyor surface 3. Once all tray compartments 25a-d of the row 67 have arranged therein one seed, the seed tray 65 is again moved by means of the linear conveyor (not shown) on which the seed tray is arranged in the direction of arrow A, such that a next row 69 with tray compartments is arranged under the guide channels 7a-7d, wherein each tray compartment of row 69 is arranged under a respective guide channel 7a-7d. Subsequently, in each tray compartment of row 69, a seed is sown that is selected from the continuous flow of individual seeds that is arranged on conveyor surface 3.

In a preferred embodiment, starting from the situation shown in figures 12 and 13, opening 5d is selected for seed 1, opening 5c is selected for seed 27, opening 5b is selected for seed 59, and opening 5a is selected for seed 61. In that case the next seed 71 of the continuous row of seeds that is arranged on the conveyor surface 3, which seed 71 is in figures 12 and 13 arranged on the shaker surface 53, will be located where seed 1 is located in the situation shown in figures 12 and 13, once seeds 1, 27, 59, and 61 are flushed into the tray compartments 9a-d. Then the time that it takes for the conveyor belt 29 to convey seed 71 to the location f of the opening 5d is available for moving seed tray 65 in the direction of arrow A such that the tray compartments 25a-d of the row 67 are arranged underneath the guide channels 7a-d. This allows the conveyor belt 29 to be continuously driven. It is noted, that it is for instance possible that the time that is required to move seed tray 65

in the direction of arrow A such that the tray compartments 25a-d of the row 67 are arranged underneath the guide channels 7a-d, is shorter than the time that it takes for the conveyor belt 29 to convey a seed from the location H of seed 1 shown in figures 12 and 13 to location F of the opening 5d. In that case openings 5a-d may be selected in another sequence by the processor for subsequent seeds of the continuous row of seeds without having to stop or slow the conveyor belt 29 in order to move seed tray 65 in the direction of arrow A such that the tray compartments of a subsequent row are arranged underneath the guide channels 7a-d.

Analogous to what is described under reference to figures 7 to 11, in case a determined selection characteristic of a seed of the continuous row of seed that is arranged on the conveyor surface 3 does not meet the selection criteria, the processor of the controller 37 does not select the seed for flushing into one of the openings and allows the seed to fall into the receptacle 39 at the end of path P.

In figure 14 a first embodiment is shown of a seed distributor 73 that is configured for batch wise distributing seeds to the shaker conveyor 47. The seed distributor is arranged above the shaker conveyor 47 of figures 12 and 13. The seed distributor 73 has a container 75 that, as schematically illustrated by means of double arrow L is selectively tiltable around tilting axis 83. The container 75 is selectively tiltable by means of a mechanism (not shown) that is controlled by the controller 37. As shown in figure 14, the container 75 holds seeds 77. By tilting the container 75, a plurality of the seeds held in the container 75 are batch wise arranged on the shaker conveyor surface 53, such that a batch 51 of seeds is arranged on the shaker conveyor 53 that, as described herein above under reference to figures 12 and 13, is channelled into the flow of seeds that debouches on the conveyor surface 3 in single file. The controller 37 is connected to the seed distributor 73 and configured to selectively tilt the container 75 when a batch of seeds is to be arranged on the shaker surface 53. As shown in figure 14, a seed counter 79 is arranged such that the seeds that fall out of the container 75 when the container 75 is tilted pass the seed counter 79. In the shown embodiment the seed counter 79 has an opening 81 through which the seeds pass when falling out of the container 75. Along the circumference of the opening 81 light sources and cooperating light sensors are arranged that allow for detecting a single seed that passes the opening 81. The seed counter 79 is configured to provide the controller 37 with data on the number of seeds that have passed the seed counter 79. On the basis of the number of seeds that have passed the seed counter 79 and on the basis of data on the number of seeds that have passed the camera 35, the controller 37 is configured to determine at least an indication of the number of seeds that is arranged on the shaker conveyor 47. Based on the determined number of seeds that is arranged on

the shaker conveyor 47, the controller 37 is configured to control the tilting of the container 75 in order to ensure that a proper amount of seeds is arranged on the shaker conveyor 47 to enable proper execution of the sowing process. Both underfilling and overfilling of the shaker conveyor 47 may result in the shaker conveyor to stop functioning or to deliver a flow of seeds on the conveyor surface 3 with a flow velocity that is unsuitable for providing on the conveyor surface 3 a row of individualised seeds. In order to distribute small batches of seeds to the shaker conveyor, the controller 37 is advantageously configured to tilt the container 75 and shake seeds out of the container 75 by generating an oscillating tilting motion with a relatively small angular movement around the tilting axis 83. The seed container 75 is in an advantageous embodiment arranged on a carousel on which a plurality of seed containers can be arranged. This makes it possible after sowing seeds from a first container into the tray compartments of a seed tray, to sow seeds from another seed container into the tray compartments of a subsequent seed tray, by rotating the carousel such that the other seed container is arranged above the shaker surface 53 of the shaker conveyor 47 and by subsequently tilting the other seed container in order to distribute seeds to the shaker surface 53. In case the seeds of the other seed container are of another type, and seeds of the previous type are still arranged on the shaker surface 53 or on the conveyor surface 3, the seeds of the previous type are first conveyed to the receptacle 39 at the end of path P of the conveyor 29 before the seeds of the other type are distributed to the shaker conveyor. In an advantageous embodiment a system is provided for removing seeds from the receptacle 39.

In figures 15 to 17 a second embodiment is shown of a seed distributor 173 that is configured for batch wise distributing seeds to the first shaker conveyor 47. The seed distributor 173 has a second shaker conveyor 174 having an first end 174a arranged above the surface 53 of the first shaker conveyor 47 of figures 12 and 13. The seed distributor 173 furthermore includes a container 175. The container 175 is selectively tiltable between a first position and a second position. The container 175 is selectively tiltable by means of a mechanism (not shown) that is controlled by the controller 37. In figure 14 is shown that the container 175 has been tilted from the first position (indicated with dashes) into a second position above a second end 174b of the second shaker conveyor 174, such that all the seeds that were held in the container 175 have been arranged on the surface 176 of the second shaker conveyor 174. The shaker surface 176 is mounted on a row of spring elements 157 and is driven by a drive (not shown) controller by controller 37. The second shaker conveyor 174 is configured such that a shaking movement of the shaker surface 176, schematically illustrated by means of the double arrow N, can be generated by means of the drive. Once the seeds have been arranged on the shaker surface 176 of the second shaker conveyor 174, the controller 37 can control the drive such that the shaking movement of the shaker surface 176 is

generated. The shaking movement N causes a forward movement of the seeds arranged on the shaker surface 176 parallel to the shaker surface 176 schematically illustrated by means of arrow O. The forward movement O conveys the seeds towards the first end 174a of the second shaker conveyor 174. At the first end 174a, the seeds fall down onto the surface 53 of the first shaker conveyor 47. As shown in figure 15, a seed counter 79 is arranged such that the seeds that fall from the shaker surface 176 pass the seed counter 79. In the shown embodiment the seed counter 79 has an opening 81 through which the seeds pass. Along the circumference of the opening 81 light sources and cooperating light sensors are arranged that allow for detecting a single seed that passes the opening 81. The seed counter 79 is configured to provide the controller 37 with data on the number of seeds that have passed the seed counter 79. On the basis of the number of seeds that have passed the seed counter 79 and on the basis of data on the number of seeds that have passed the camera 35, the controller 37 is configured to determine at least an indication of the number of seeds that is arranged on the first shaker conveyor 47. Based on the determined number of seeds that is thus arranged on the first shaker conveyor 47, the controller 37 is configured to control the shaking movement of the shaker surface 176 of the second shaker conveyor 174 in order to ensure that a proper amount of seeds is arranged on the shaker surface 53 of the first shaker conveyor 47 to enable proper execution of the sowing process. Both underfilling and overfilling of the shaker conveyor 47 may result in the shaker conveyor to stop functioning or to deliver a flow of seeds on the conveyor surface 3 with a flow velocity that is unsuitable for providing on the conveyor surface 3 a row of individualised seeds. The controller 37 is advantageously configured to stop the shaking movement of the shaker surface 176 before the number of seeds that is arranged on the first shaker conveyor 47 is such that overfilling occurs and to start the shaking movement of the shaker surface 176 again before underfilling occurs.

As shown in figure 16, the empty container 175 can be tilted into its first position while the second shaker conveyor 174 is operated to distribute seeds to the first shaker conveyor 47.

The shaker surface 176 of the second shaker conveyor 174 can be tilted about a tilt axis 183 in the direction of arrow Q from the position shown in figures 15 and 16 into a position shown in figure 17. This allows to return seeds that are arranged on the shaker surface 176 of the second shaker conveyor 174 into the empty container 175 in the direction of arrow R. The seeds are for instance returned into the container 175 when the sowing of seeds in a seed tray is finished and another type of seeds is to be sown in a subsequent seed tray.

The seed container 175 is in an advantageous embodiment arranged on a carousel on which a plurality of seed containers can be arranged. This makes it possible after sowing seeds from a first container into the tray compartments of a seed tray, to sow seeds from another seed container into the tray compartments of a subsequent seed tray. To that effect, after returning the

seeds into the first container 175, the carrousel is rotated such that the other seed container is arranged at the second shaker conveyor 174. Subsequently the steps described herein above under reference to figure 15 are repeated in order to distribute seeds held in the other container to the shaker conveyor 47.

5 The seed distributor 173 shown in figures 15 to 17 allows for all the seeds held in a container 175 to be arranged on the second shaker conveyor 174 before distributing seeds to the first shaker conveyor 47. This has the advantage that the distribution is less selective relative to distribution with the seed distributor 73 shown in figure 14 where seed is distributed directly from the container 75. Being less selective is in particular relevant when the method and seeder
10 according to the invention are used to sow a representative sample of a batch of seeds.

In figure 18 an embodiment of the method and seeder according to the invention is shown that is an advantageous further development of the embodiment illustrated by figures 12 and 13. In the shown embodiment openings 5a, 5b, 5c, and 5d, are arranged along a first longitudinal edge 85
15 of the conveyor belt 28, which first edge extends parallel to the path P of the conveyor belt 29. Furthermore, along the second longitudinal edge 86 opposite to the first edge 85 four additional openings 87a, 87b, 87c, 87d, are arranged opposite the openings 5a, 5b, 5c, and 5d. As shown in figure 15, the nozzles 17a-d that are associated with the openings 5a-d are arranged above the conveyor surface in between the opposite longitudinal edges 85, 86. Also arranged above the
20 conveyor surface in between the opposite longitudinal edges 85, 86 are nozzles 89a-d that associated with the openings 87a-d. Each of the nozzles 89a-d is associated with and directed to a respective one of the openings 87a-d. Each of the nozzles 17a-d and 89a-d is selectively operable to direct a fluid over the conveyor surface 3 in the direction of the opening associated therewith.

25 As shown in figure 18 the shaker conveyor 91 is configured to channel the batch of seeds 51 arranged on the shaker surface 93 into two flows of seeds 95, 97 debouching on opposite sides of the nozzles 17a-d and 89a-d that are arranged above the conveyor surface 3 in between the longitudinal edges 85, 86. Each of the two flows of seeds 95, 97 that debouche on the conveyor surface 3 results, analogous to what is described under reference to figures 12 to 14, in a
30 continuous row of individualised seeds that is arranged on the conveyor surface 3. The first row is schematically illustrated by means of axis 99 and extends in between the openings 5a-d and the nozzles 17a-d associated therewith. The second row is schematically illustrated by means of axis 101 and extends in between the openings 87a-d and the nozzles 89a-d associated therewith. While, analogous to what is described under reference to figures 12 and 13, the openings 5a-d lead to
35 respective guide channels under which a row of respective tray compartments can be arranged, the

openings 87a-d lead to respective guide channels under which another row of respective tray compartments can be arranged. Thus in the embodiment shown in figure 16, two rows of tray compartments of a seed tray can be sown before having to move the seed tray to arrange a subsequent row of compartments to be sown underneath the outlet openings of the guide channels.

5 Both rows of seeds pass the camera 35 that is arranged above the conveyor surface 3. The processor of the controller 37 is configured to analyse the images received from the camera 35 and to detect individual seeds of each of the rows passing the camera 35.

In figure 19 a seed tray 65 is shown that is arranged underneath the conveyor belt 29 of the embodiment shown in figure 16. The seed tray 65 has four rows 63, 67, 69, 103 of tray compartments, wherein in figure 16 row 103 is arranged underneath the outlet openings 23a-d that are associated with the openings 5a-d and row 69 is arranged underneath the outlet openings 105a-d that are associated with the openings 87a-d. In the tray compartments of row 63 and 67 seeds have already been sown. A second camera 107 is arranged above the path along which the seed

10 tray 65 is moved in the direction of arrow A, such that each of the rows of the seed tray 65 pass underneath the second camera 107 after the tray compartments thereof have passed the outlet openings 23a-d and 105a-d of the guide channels. The second camera 107 is connected to the controller 37. The processor is configured to analyse the images received from the second camera 107. The processor is configured to detect in which of the tray compartments of the row passing

15 underneath the second camera 107 have arranged a seed therein. The processor is furthermore configured to determine whether each of the tray compartments passing underneath the second camera 107 that according to data regarding the sowing should have a seed arranged therein, indeed has arranged a seed therein. The result is logged and/or the operator of the seeder is informed of the result, such that the operator can decide in case of any discrepancy how to respond.

20 The operation could for instance in case of a missing seed in one of the tray compartments seed a seed in the tray compartment by hand. It is also possible that the processor 37 is configured to respond to any discrepancy by moving the seed tray 65 back in the direction of arrow S until the tray compartment that has no seed arranged therein is underneath one of the outlet openings 23a-d and 105a-d and subsequently seed a seed in that tray compartment. The feature of the second

25 camera 107 can also advantageously be applied in the embodiments of the method and seeder shown in any of the figures 1 to 13. Both embodiments of the seed distributor shown in figures 14 to 17 may be used to distribute seed to the shaker conveyor 91 of the embodiment shown in figures 18 and 19.

Although the embodiments of the method and seeder according to the invention described herein above are in particular suitable for sowing seeds in tray compartments of a seed tray, equivalent embodiments are advantageously used for sowing seeds in other seed locations. In stead of tray compartments of a seed tray, compartments of other single- or multi-compartment
5 receptacles, for instance compartments of a microtiter plate, may be filled with seeds by means of embodiments of the method and seeder according to the invention. In order to adapt the embodiments of the seeder according to the invention shown in figures 1 to 19 to other single- or multi-compartment receptacles, the guide channels are advantageously replaced with guide channels that extend to another seed location.

10 By advantageously modifying the described embodiments such that in stead of tray compartments are arranged and/or moved underneath the outlet opening(s) of the guide channel(s), the outlet opening(s) of the guide channel(s) are arranged and/or moved above a location in a field, embodiments of the method and seeder according to the invention can be used to sow seed in the open field.

15 Although the principles of the invention have been set forth above with reference to specific embodiments, it must be understood that this description is given solely by way of example and not as limitation to the scope of protection, which is defined by the appended claims.

Conclusies

1. Werkwijze voor het zaaien van een individuele zaad op een zaadlocatie,
omvattende

- 5 - het arrangeren van een zaad op een oppervlak aanliggend aan een opening die leidt naar een geleidingskanaal dat zich uitstrekt naar de zaadlocatie;
- het spoelen van de zaad van het oppervlak af in de opening door het richten van een fluïdum over het oppervlak in de richting van de opening;
- het geleiden van de zaad die in de opening is gespoeld naar een zaadlocatie door middel
- 10 van het geleidingskanaal.

2. Werkwijze volgens conclusie 1,
waarbij

- 15 - het oppervlak een in hoofdzaak vlak oppervlak is.

3. Werkwijze volgens conclusie 1 of 2,
waarbij

- het oppervlak een transporteuropervlak is;
- de zaad langs de opening wordt getransporteerd op het transporteuropervlak; en
- 20 - de zaad in de opening wordt gespoeld wanneer de zaad aanliggend aan de opening is.

4. Werkwijze volgens conclusie 3,
waarbij

- 25 - het transporteuropervlak het oppervlak is van een transporteurband.

5. Werkwijze volgens conclusie 3 of 4,
waarbij

- de opening waarin de zaad wordt gespoeld een geselecteerde opening is van een veelvoud
- openingen die zijn gearrangeerd langs het transporteuropervlak, waarbij elke opening leidt naar
- 30 een respectief geleidingskanaal dat zich uitstrekt naar een respectieve zaadlocatie.

6. Werkwijze volgens één van de conclusies 1 tot en met 5,
waarbij

- 35 - de zaad die in de opening wordt gespoeld een geselecteerde zaad is van een veelvoud zaden.

7. Werkwijze volgens conclusie 6,
 waarbij

- de veelvoud zaden op het oppervlak is gearrangeerd in een rij van individuele zaden en op of over het oppervlak langs de opening wordt getransporteerd in een richting parallel aan de rij.

5

8. Werkwijze volgens conclusie 7,
 waarbij de zaden in een rij van individuele zaden op het oppervlak zijn gearrangeerd door middel van:

- het bewegen van het oppervlak met een transportsnelheid; en
- het arrangeren van een partij zaden op een schudtransporteur die uitmondt op het oppervlak, waarbij de schudtransporteur is geconfigureerd om de partij zaden te kanaliseren in een stroom van zaden met een stroomsnelheid die lager is dan de transportsnelheid van het oppervlak.

10

9. Werkwijze volgens conclusie 8,

15 omvattende

- het tellen van het aantal zaden in de partij zaden die wordt gearrangeerd op de schudtransporteur.

10. Werkwijze volgens één van de conclusies 6 tot en met 9,

20 omvattende

- het bepalen van een selectiekaracteristiek van elke van het veelvoud zaden dat is gearrangeerd op het oppervlak;
- het selecteren van de zaad die in de opening te spoelen is ten minste gebaseerd op de bepaalde selectiekaracteristiek van de zaad.

25

11. Werkwijze volgens conclusie 10,

waarbij

- de selectiekaracteristiek van elke van de veelvoud zaden wordt bepaald door gebruikmaking van ten minste één selectiesensor.

30

12. Werkwijze volgens conclusie 11,

waarbij

- de ten minste ene selectiesensor een camera omvat; en
- de selectiekaracteristiek wordt bepaald door het analyseren van beelden van de zaad op het oppervlak die zijn verkregen door middel van de camera.

35

13. Werkwijze volgens één van de conclusies 1 tot en met 12,
omvattende

- het bepalen van de locatie van de zaad op het oppervlak;
- het spoelen van de zaad van het oppervlak in de opening wanneer is bepaald dat de zaad

5 aanliggend is aan de opening.

14. Werkwijze volgens conclusie 13,
waarbij

- de locatie van de zaad op het oppervlak wordt bepaald door gebruikmaking van ten

10 minste één locatiesensor.

15. Werkwijze volgens conclusie 14,
waarbij

- de ten minste ene locatiesensor een camera omvat; en
- de locatie van de zaad op het oppervlak wordt bepaald door het analyseren van beelden

15 van de zaad op het oppervlak die zijn verkregen door middel van de camera.

16. Werkwijze volgens één van de conclusies 13 tot en met 15,
waarbij

- de zaad wordt gearrangeerd op het oppervlak op een eerste locatie en vervolgens het

20 oppervlak wordt bewogen langs de opening teneinde de zaad te arrangeren op een tweede locatie
aanliggend aan de opening; en

waarbij

- na te zijn gearrangeerd op het oppervlak en vóór het bereiken van de tweede locatie, de

25 locatie van de zaad op het oppervlak wordt bepaald en geassocieerd met de locatie van het
oppervlak ten opzichte van de tweede locatie;

- de zaad van het oppervlak af wordt gespoeld in de opening wanneer is bepaald dat de

locatie van het oppervlak dat is geassocieerd met de zaad op de tweede locatie is.

17. Zaaier voor het zaaien van een zaad op een zaadlocatie,
omvattende

- ten minste één opening die leidt naar een geleidingskanaal dat zich uitstrekt naar een

zaadlocatie;

- een oppervlak dat is geconfigureerd om te worden gearrangeerd aanliggend aan de ten

35 minste ene opening;

- een selectief bedienbare fluïdumtoevoer voor elke opening waarbij elke fluïdumtoevoer ten minste één uitstroomopening heeft die is gearrangeerd voor het richten van een fluïdum dat daaraan wordt toegevoerd over het oppervlak richting de opening.

5 18. Zaaier volgens conclusie 17,
verder omvattende:

- een zaadtoevoer voor het arrangeren van een zaad op het oppervlak.

10 19. Zaaier volgens conclusie 17 of 18,
waarbij

- het oppervlak in hoofdzaak vlak is.

20. Zaaier volgens één van de conclusies 17 tot en met 19,
waarbij

15 - het oppervlak een transporteuropervlak is;
- het transporteuropervlak is geconfigureerd om te worden bewogen langs een pad;
- de ten minste ene opening is gearrangeerd aanliggend aan het pad van het
transporteuropervlak.

20 21. Zaaier volgens conclusie 20,
waarbij

- het transporteuropervlak een oppervlak van een transporteurband is.

25 22. Zaaier volgens conclusie 20 of 21,
waarbij

- een veelvoud openingen is gearrangeerd langs het pad van het transporteuropervlak,
waarbij elk opening leidt naar een respectief geleidingskanaal dat zich uitstrekt naar een
respectieve zaadlocatie.

30 23. Zaaier volgens conclusie 22,
waarbij

- de openingen zijn gearrangeerd langs tegenoverliggende randen van het
transporteuropervlak welke randen parallel zijn aan het pad van het transporteuropervlak.

35 24. Zaaier volgens conclusie 23,
waarbij

- de uitstroomopeningen van de selectief bedienbare fluïdumtoevoeren die geassocieerd zijn met de openingen, boven het transporteuropervlak zijn gearrangeerd tussen de tegenoverliggende randen in.

- 5 25. Zaaier volgens één van de conclusies 20 tot en met 24,
verder omvattende een zaadtoevoer voor het arrangeren van een zaad op het oppervlak,
waarbij de zaadtoevoer omvat:
- een schudtransporteur die uitmondt op het transporteuropervlak, waarbij de schudtransporteur is geconfigureerd om een partij zaden te kanaliseren in een stroom van zaden; en
 - 10 - een zaaddistributeur die is geconfigureerd voor het partijgewijs distribueren van zaden aan de schudtransporteur.

26. Zaaier volgens conclusies 24 en 25.,
waarbij
- 15 - de schudtransporteur is geconfigureerd om de partij zaden te kanaliseren in twee zaadstromen die uitmonden aan tegenoverliggende zijden van de uitstroomopeningen.

27. Zaaier volgens conclusie 25 of 26,
waarbij de zaadtoevoer omvat:
- 20 - een zaadteller die is gearrangeerd en geconfigureerd voor het tellen van het aantal zaden in de partij van zaden die gedistribueerd wordt aan de schudtransporteur.

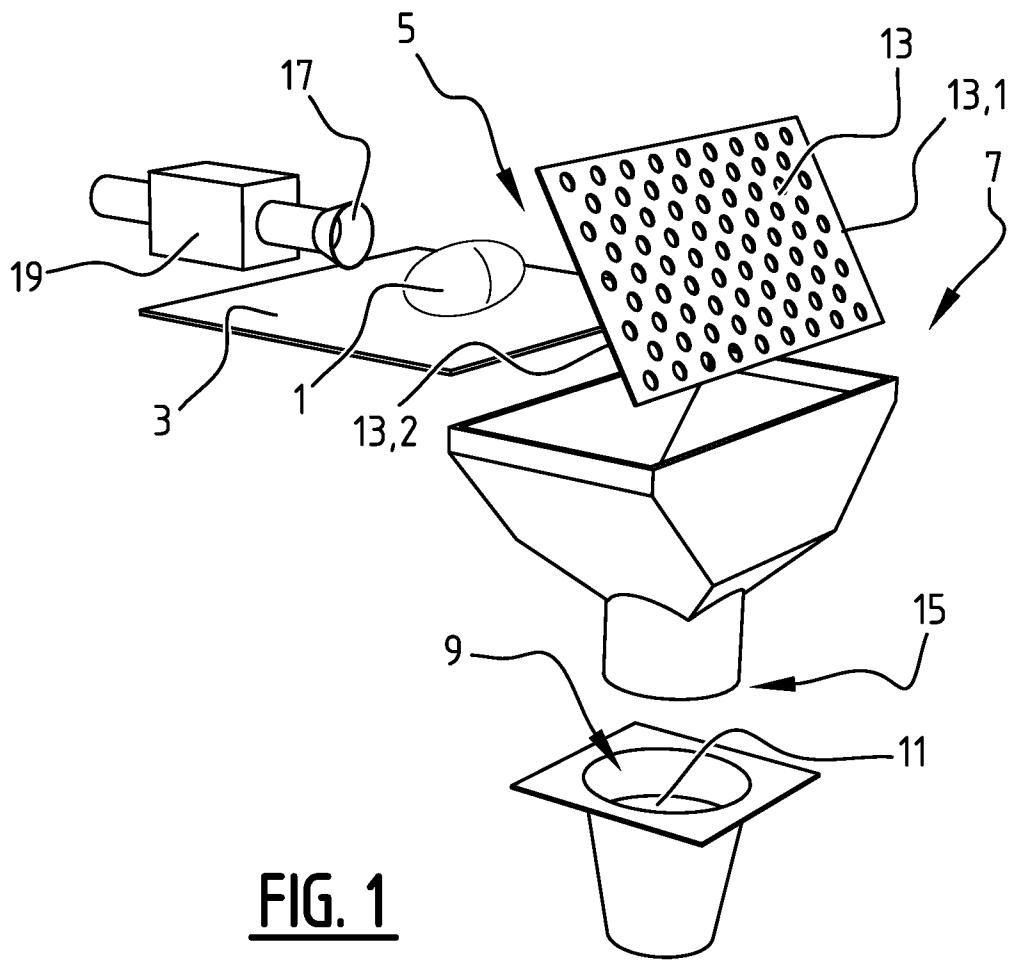


FIG. 1

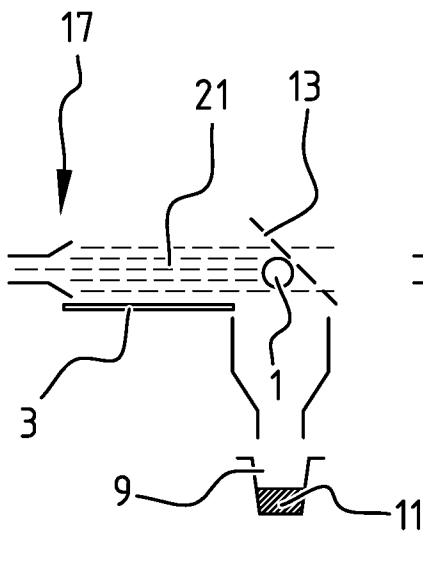


FIG. 2

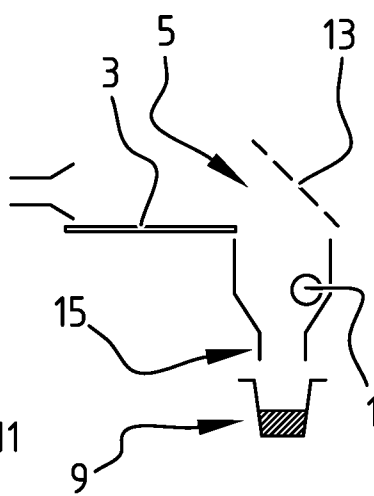


FIG. 3

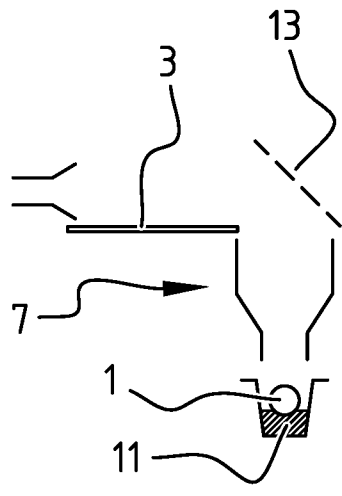


FIG. 4

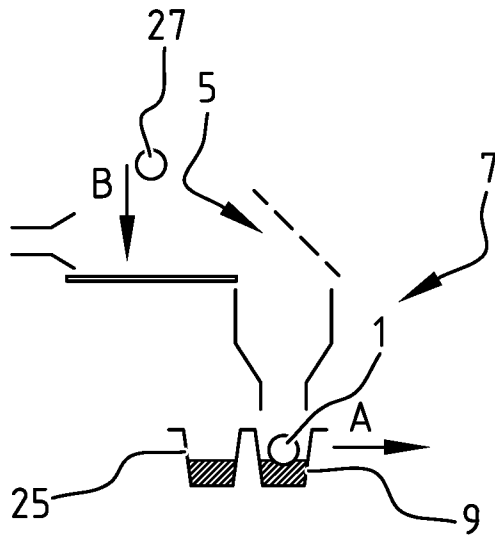


FIG. 5

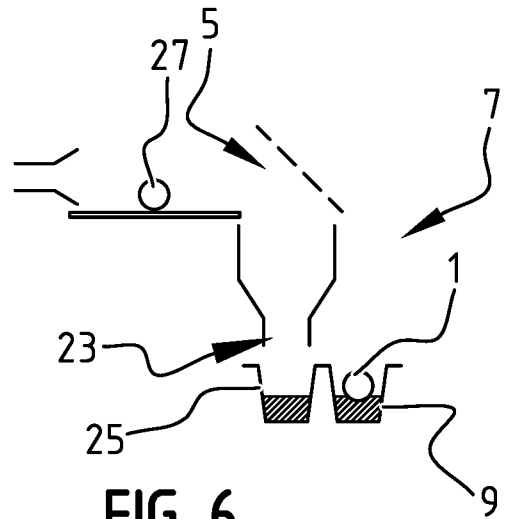


FIG. 6

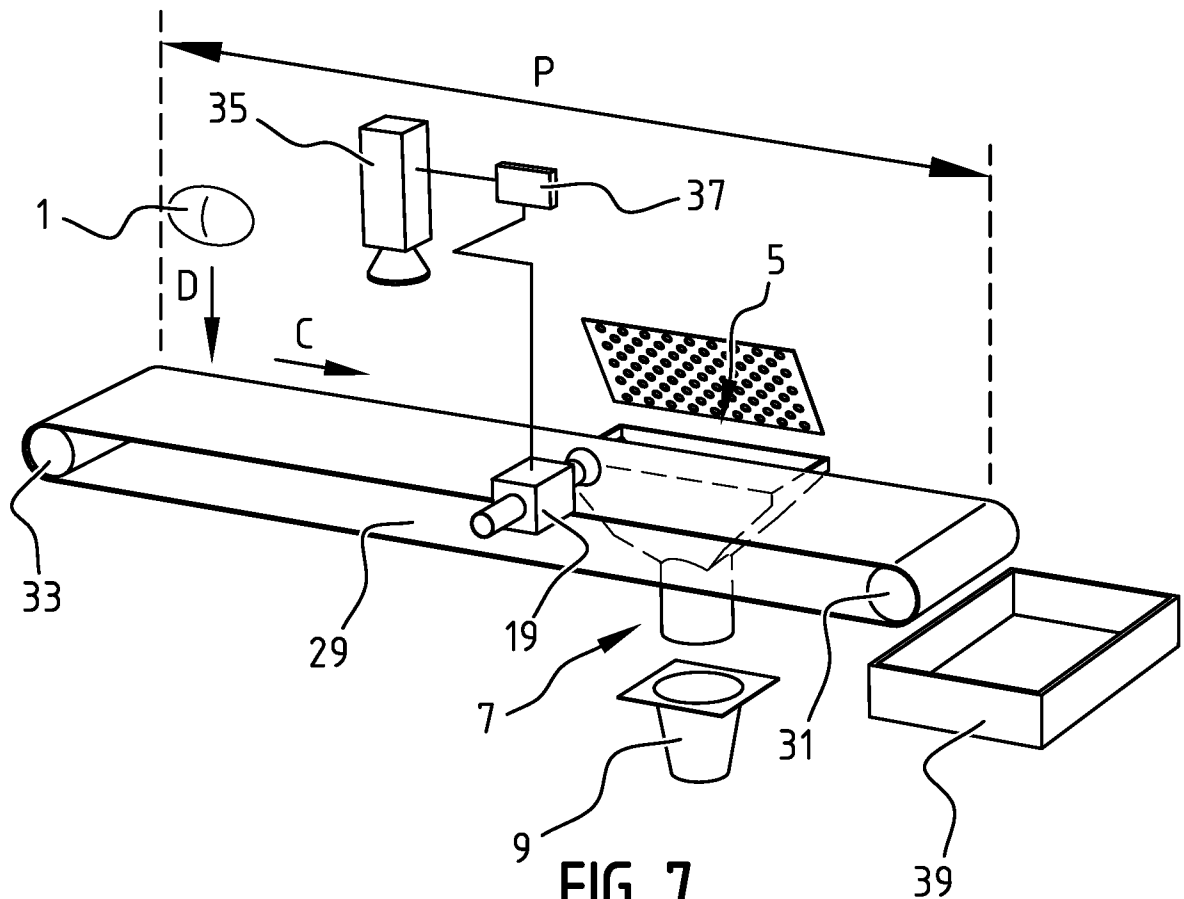


FIG. 7

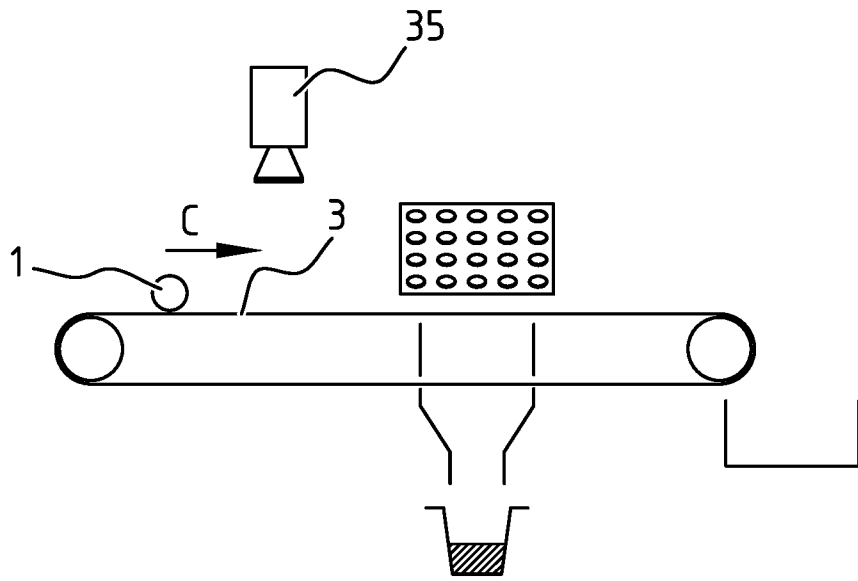


FIG. 8

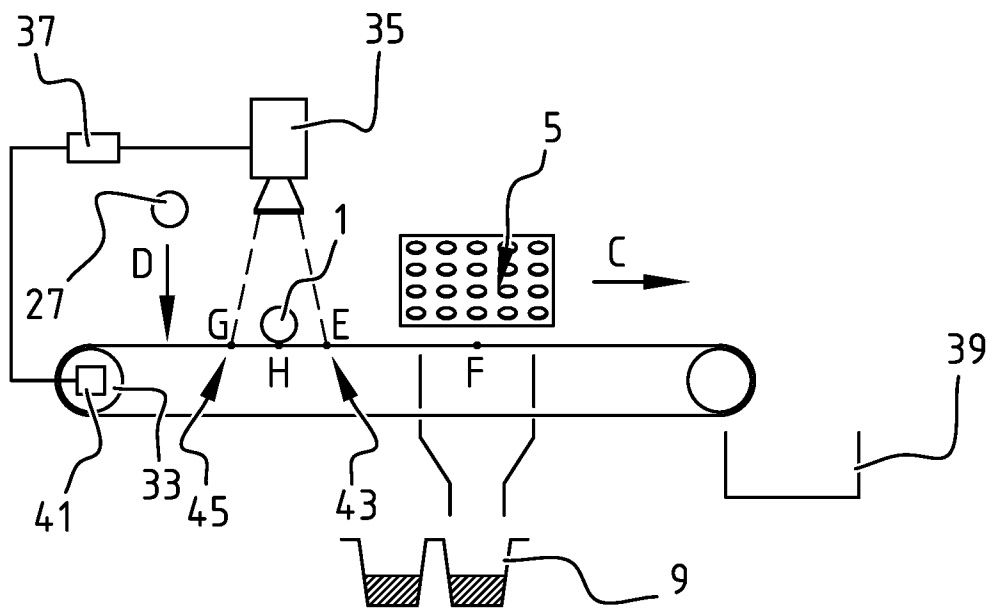
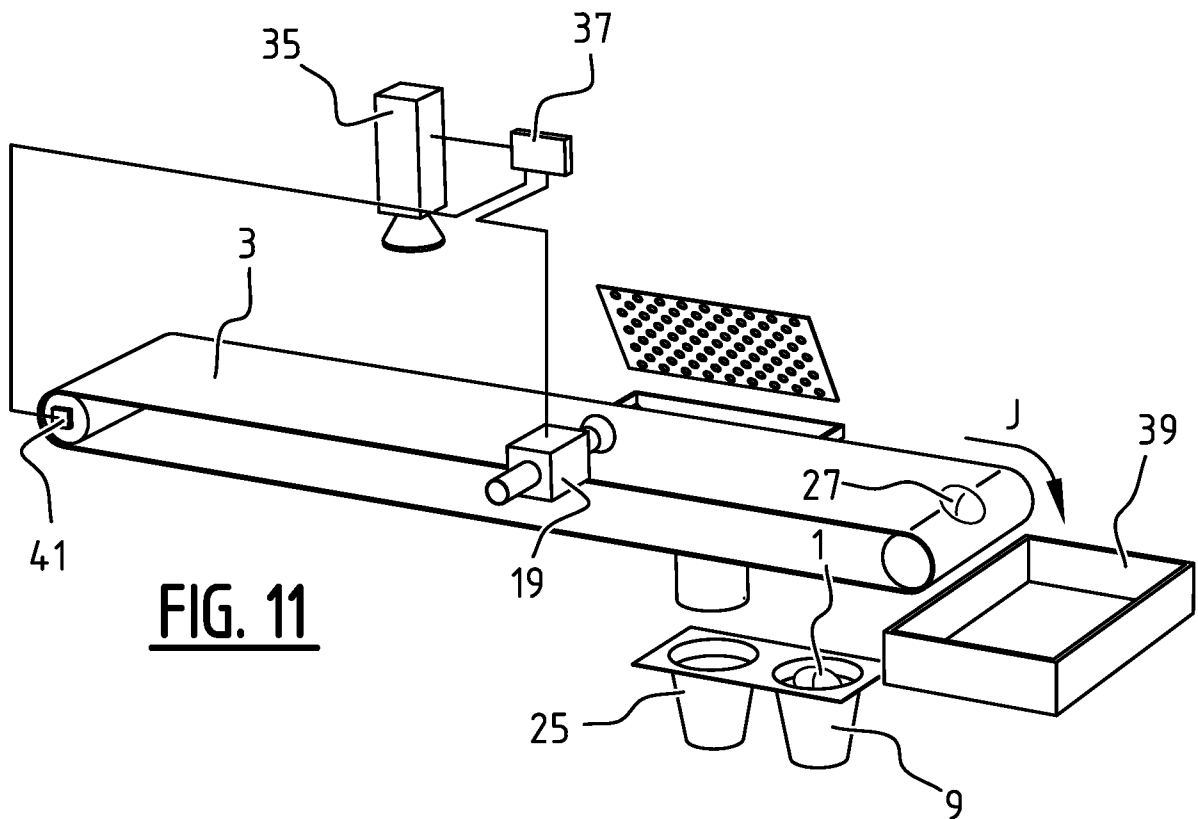
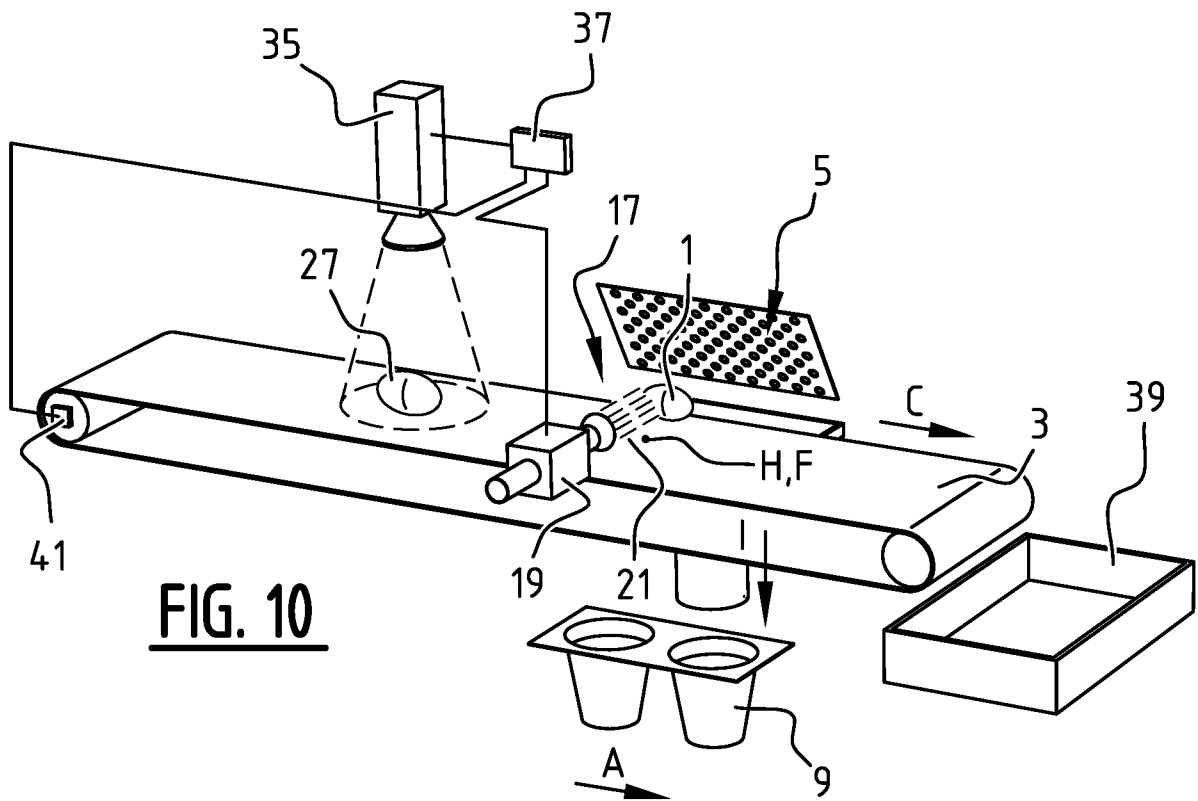


FIG. 9

4/11



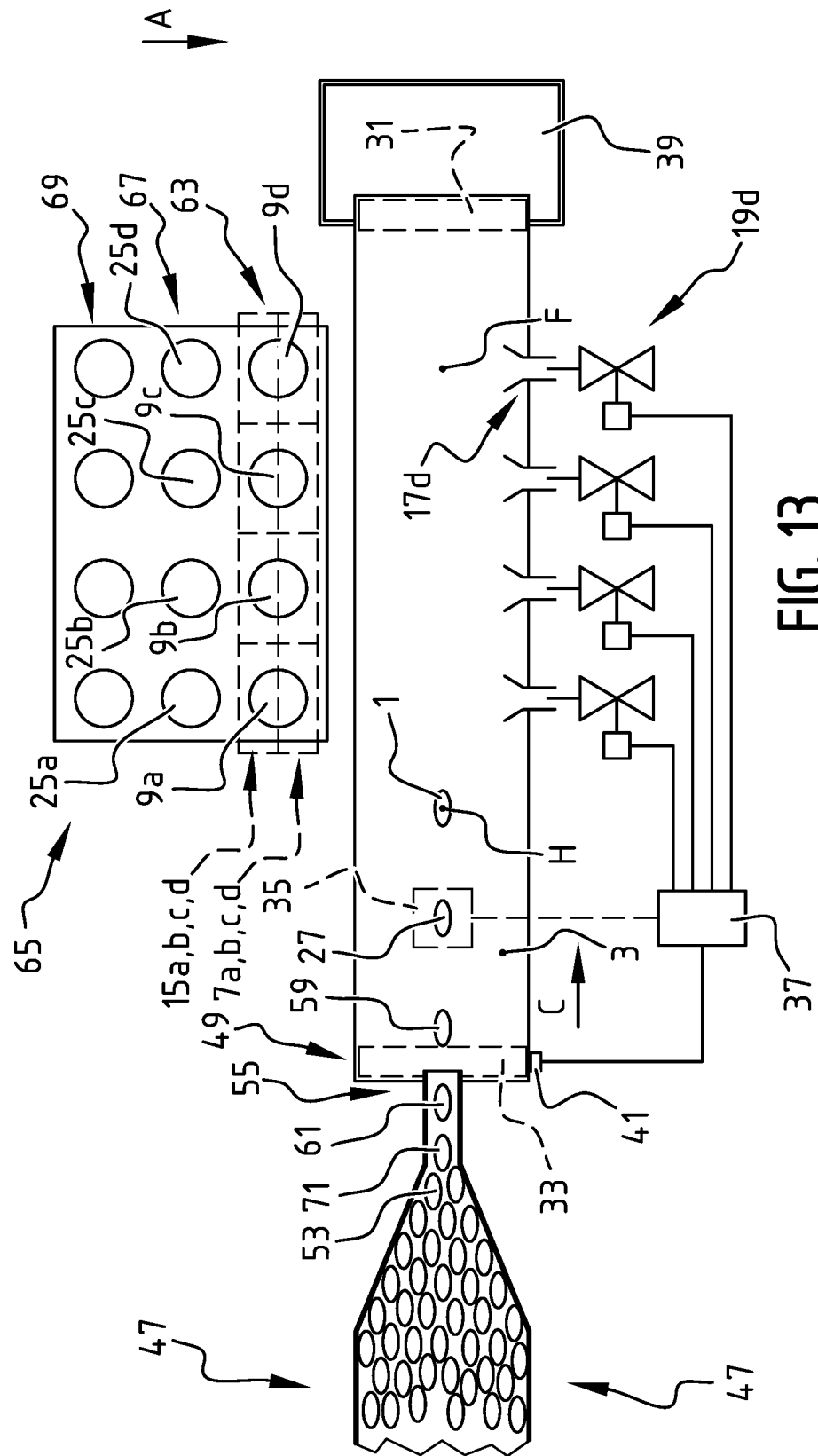


FIG. 13

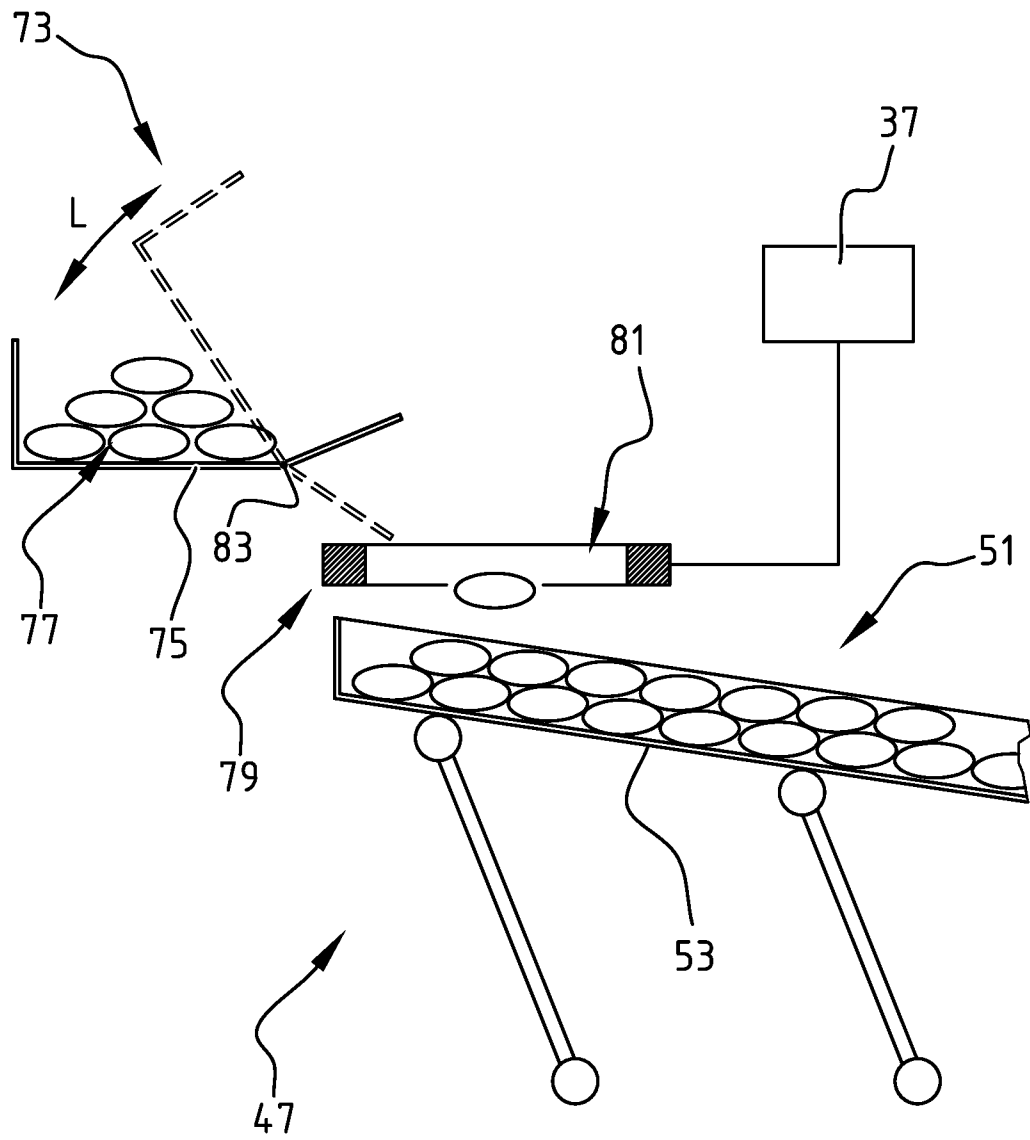
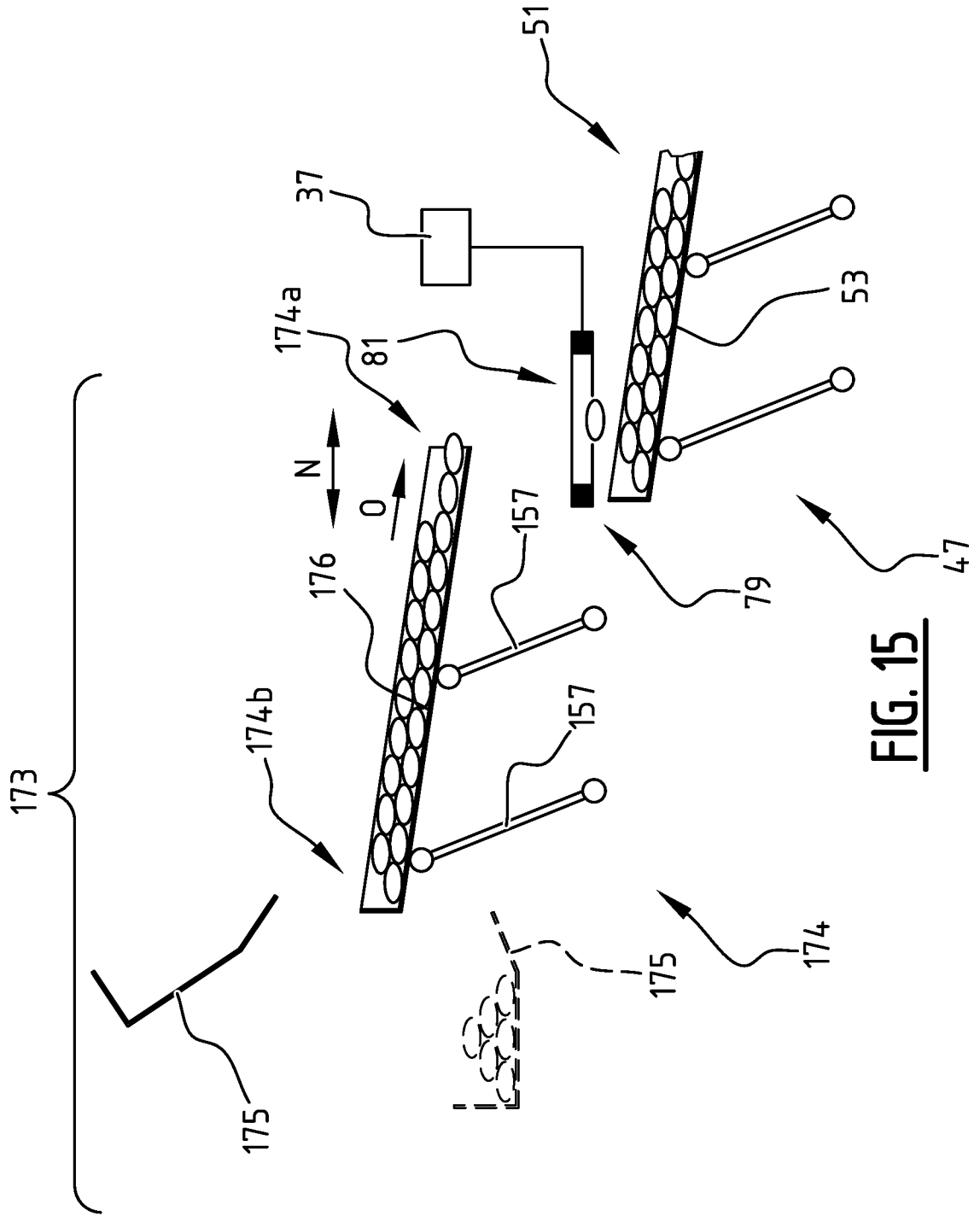
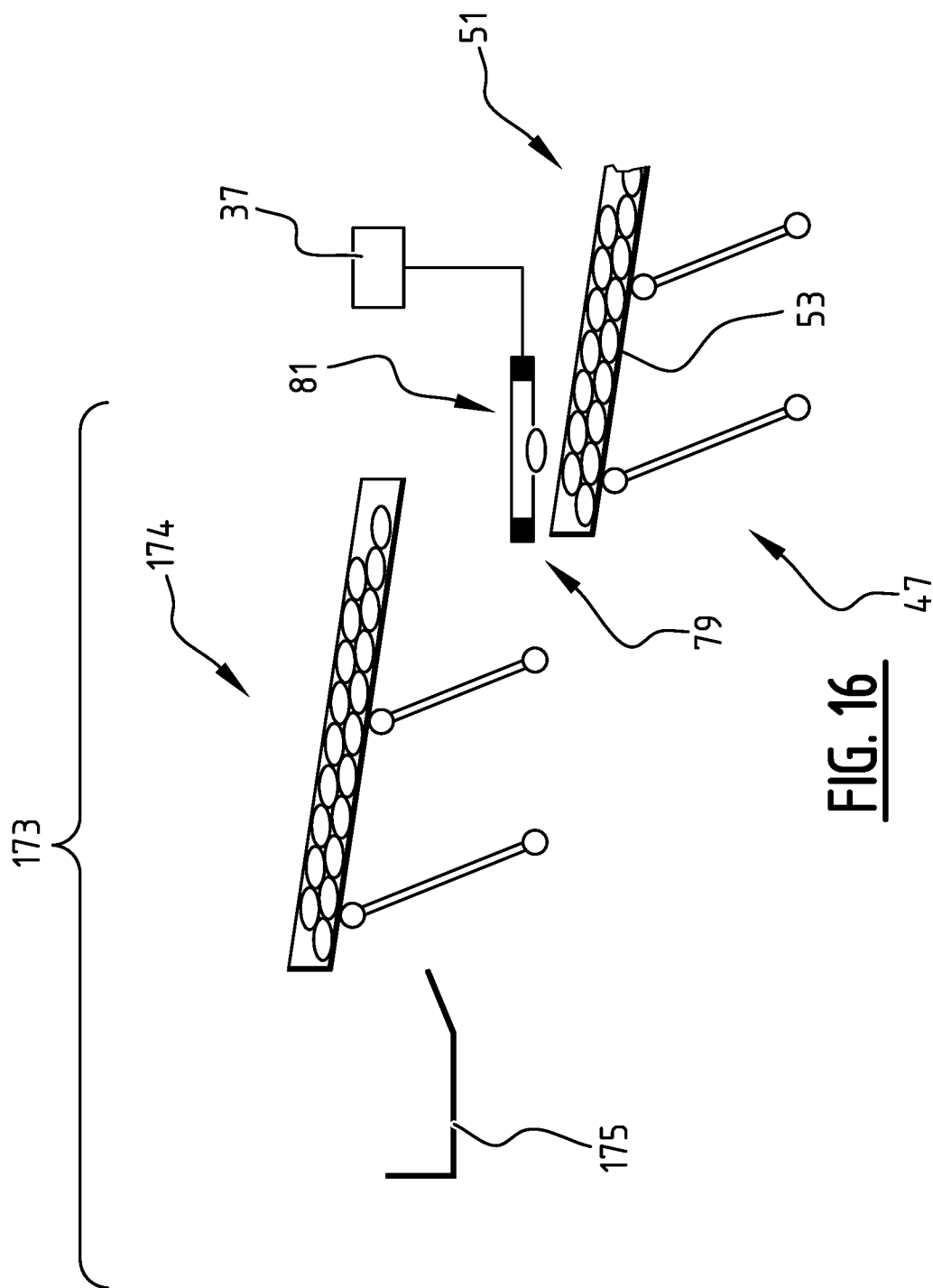
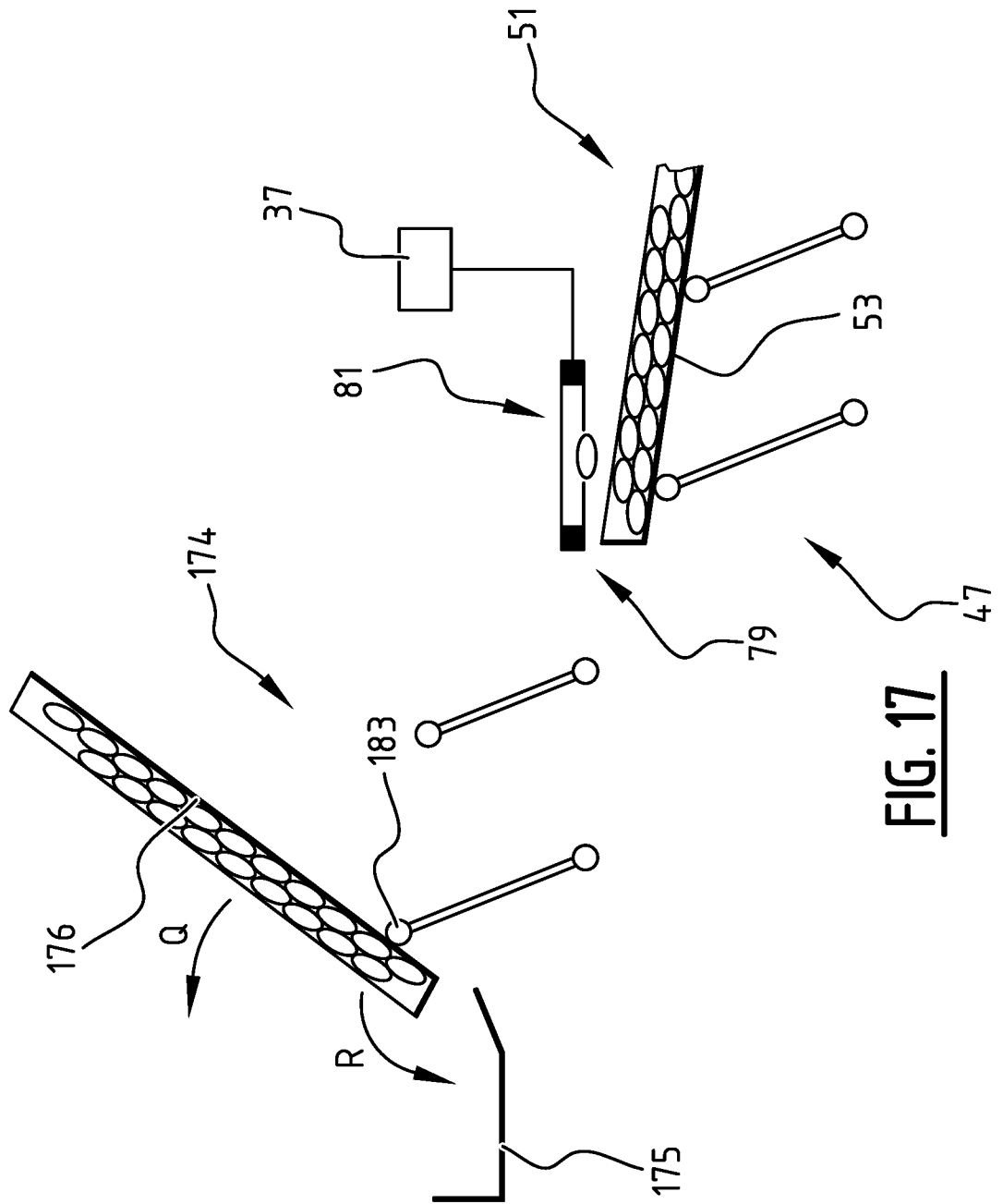


FIG. 14







Abstract

The present invention relates to a method for sowing an individual seed in a seed location and to a seeder therefor.

5 The method for sowing an individual seed in a seed location according to the invention comprises arranging a seed on a surface adjacent to an opening that leads to a guide channel that extends to the seed location; flushing the seed from the surface into the opening by directing a fluid over the surface in the direction of the opening; and guiding the seed that is flushed into the opening to a seed location by means of the guide channel.

10 The seeder for sowing a seed in a seed location according to the invention comprises at least one opening that leads to a guide channel that extends to a seed location; a surface that is configured to be arranged adjacent to the at least one opening; and a selectively operable fluid supply for each opening, each fluid supply having at least one nozzle that is arranged for directing fluid supplied thereto over the surface toward the opening.

15

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE 2X/2TH56/57		
Nederlands aanvraag nr. 2017192	Indieningsdatum 19-07-2016		
	Ingeroepen voorrangsdatum		
Aanvrager (Naam) Enza Zaden Beheer B.V., et al			
Datum van het verzoek voor een onderzoek van internationaal type 17-12-2016	Door de instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN67970		
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)			
Volgens de internationale classificatie (IPC) A01G9/08;A01C1/00;B07C5/342;G01N1/00			
II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK			
Onderzochte minimumdocumentatie			
Classificatiesysteem	Classificatiesymbolen		
IPC	A01C;A01G;B07C;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 2017192

A. CLASSIFICATIE VAN HET ONDERWERP

INV. A01G9/08

ADD. A01C1/00

B07C5/342

G01N1/00

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

B. ONDERZOCHETE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)

A01C A01G B07C 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.
X	WO 2005/011358 A1 (HOLLY JOHN [AU]) 10 februari 2005 (2005-02-10) * bladzijde 4, regel 30 - bladzijde 5, regel 26; figuren 2,7,14,22 * * bladzijde 7, regel 4 - regel 9 * * bladzijde 20, regel 8 - regel 31 * * bladzijde 22, regel 12 - regel 22 * * bladzijde 30, regel 27 - bladzijde 31, regel 4 *	1-3,5-9, 13, 17-20, 22-27
A	US 4 010 778 A (AGGEN ALVIN F) 8 maart 1977 (1977-03-08) * samenvatting; figuur 2 *	1,4,17, 21
X	EP 1 661 631 A1 (DAIICHI JITSUGYO VISWILL CO LT [JP]) 31 mei 2006 (2006-05-31)	17-26
A	* samenvatting; figuren 1,2,3,5,7 *	1-16,27

☐ Verdere documenten worden vermeld in het vervolg van vak C.

☒ 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" niet-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 verheldering 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

"Z" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

24 maart 2017

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

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De bevoegde ambtenaar

Weinmüller, C

**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 2017192

In het rapport genoemd octrooigescrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
WO 2005011358	A1	10-02-2005	CA 2534794 A1 10-02-2005
			EP 1659851 A1 31-05-2006
			US 2006278726 A1 14-12-2006
			WO 2005011358 A1 10-02-2005
US 4010778	A	08-03-1977	GEEN
EP 1661631	A1	31-05-2006	EP 1661631 A1 31-05-2006
			US 2005040082 A1 24-02-2005
			WO 2005014190 A1 17-02-2005

WRITTEN OPINION

File No. SN67970	Filing date (day/month/year) 19.07.2016	Priority date (day/month/year)	Application No. NL2017192
International Patent Classification (IPC) INV. A01G9/08 ADD. A01C1/00 B07C5/342 G01N1/00			
Applicant Enza Zaden Beheer B.V., et al			

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 Weinmüller, C
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WRITTEN OPINION

Application number

NL2017192

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	4, 10-12, 14-16
	No: Claims	1-3, 5-9, 13, 17-27
Inventive step	Yes: Claims	4, 10-12, 14-16
	No: Claims	1-3, 5-9, 13, 17-27
Industrial applicability	Yes: Claims	1-27
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application number

NL2017192

Box No. VII Certain defects in the application

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

1 **Re Item V**

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1 WO 2005/011358 A1 (HOLLY JOHN [AU]) 10 februari 2005
(2005-02-10)

D3 EP 1 661 631 A1 (DAIICHI JITSUGYO VISWILL CO LT [JP]) 31
mei 2006 (2006-05-31)

1.2 The present application does not meet the criteria of patentability, because the subject-matter of claims 1 and 17 is not new.

1.3 Independent Claim 1:

D1 discloses for the independent claim 1:

Werkwijze voor het zaaien van een individuele zaad op een zaadlocatie (page 4, lines 30-31; page 5, lines 7-8), omvattende

-het arrangeren van een zaad op een oppervlak (surface of drum (1) at seed inlet; fig. 2) aanliggend aan een opening (opening of (56) at seed release point (19)) die leidt naar een geleidingskanaal (56) dat zich uitstrekt naar de zaadlocatie (page 5, lines 19-22);

-het spoelen van de zaad van het oppervlak af inde opening door het richten van een fluïdum over het oppervlak in de richting van de opening (page 20 lines 8-18; fig. 2: (18,19));

-het geleiden van de zaad die in de opening is gespoeld naar een zaadlocatie door middel van het geleidingskanaal (page 20, lines 27-31; fig. 2: (56)).

Hence, the subject-matter of claim 1 is not new.

1.4 Independent Claim 17:

D1 discloses for the independent claim 17:

Zaaier voor het zaaien van een zaad op een zaadlocatie (page 4, lines 30-31; page 5, lines 7-8), omvattende

- ten minste één opening (opening of (56) at seed release point (19)) die leidt naar een geleidingskanaal (56) dat zich uitstrekt naar een zaadlocatie (page

5, lines 19-22);

- een oppervlak dat is geconfigureerd om te worden gearrangeerd aanliggend aan de ten minste ene opening (fig. 2);

- een selectief bedienbare fluïdumtoevoer voor elke opening waarbij elke fluïdumtoevoer ten minste één uitstroomopening heeft die is gearrangeerd voor het richten van een fluïdum dat daaraan wordt toegevoerd over het oppervlak richting de opening (page 20 lines 8-18; fig. 2: (18,19)).

Further, the apparatus as disclosed in D3 is suitable for sorting and transporting seeds according to claim 17 (abstract; fig. 1).

Hence, the subject-matter of claim 17 is not new.

1.5 Dependent claims 2, 3, 5 to 9, 13 and 18 to 27 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, the reasons being as follows:

1.5.1 Claim 2 is not novel: D1 discloses that a drum with a smooth surface; even though the small curvature of the drum in relation to the seed can be regarded as flat (fig. 2). Further, it is obvious to the person skilled in the art prior art that the drum can be replaced by a disc singulator with a flat surface.

1.5.2 Claim 3 is not novel: D1 discloses the drum as the transport surface, which transports the seed to the opening (fig. 2).

1.5.3 Claims 5, 6 and 7 are not novel: D1 discloses that a plurality of singulation rows on the drum (fig. 14).

1.5.4 Claim 8 is not novel: D1 discloses (39) to decelerate the seeds and support their placement on the drum surface (page 22, lines 12-22).

1.5.5 Claim 9 is not novel: D1 discloses a sensor to count the seeds (66; page 30, line 27 - page 31, line 4)

1.5.6 Claim 13 is not novel: D1 discloses that the seed is flushed away at a defined location (fig. 22)

1.5.7 Claim 18 is not novel: D1 discloses a seed reservoir (31); and in D3 (1).

1.5.8 Claim 19 is not novel: D1 discloses that a drum with a smooth surface; even though the small curvature of the drum in relation to the seed can be regarded as flat (fig. 2); and in D3 (7).

- 1.5.9 Claim 20 is not novel: D1 discloses the drum as the transport surface, which transports the seed to the opening (fig. 2); and in D3 (7).
- 1.5.10 Claim 21 is not novel: disclosed in D3 (7).
- 1.5.11 Claims 22, 23, 24 and 26 are not novel: D1 discloses that a plurality of singulation rows on the drum (fig. 14) with air jet nozzles (fig. 2); in D3 (fig. 2, 5, 7).
- 1.5.12 Claim 25 is not novel: D1 discloses (39) to decelerate the seeds and support their placement on the drum surface (page 22, lines 12-22); in D3 (2,4).
- 1.5.13 Claim 27 is not novel: D1 discloses a sensor to count the seeds (66; page 30, line 27 - page 31, line 4).

- 1.6 Dependent claims 4, 10-12, 14-16 do appear to contain additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step.

2 Re Item VII

Certain defects in the application

- 2.1 Independent claims 1 and 17 are not in the two-part form.
- 2.2 The features of the claims are not provided with reference signs placed in parentheses.
- 2.3 The relevant background art disclosed in D1 to D3 is not mentioned in the description, nor is this document identified therein.

3 Re Item VIII

Certain observations on the application

- 3.1 Claim 1 is not supported by the description, as its scope is broader than justified by the description and drawings.