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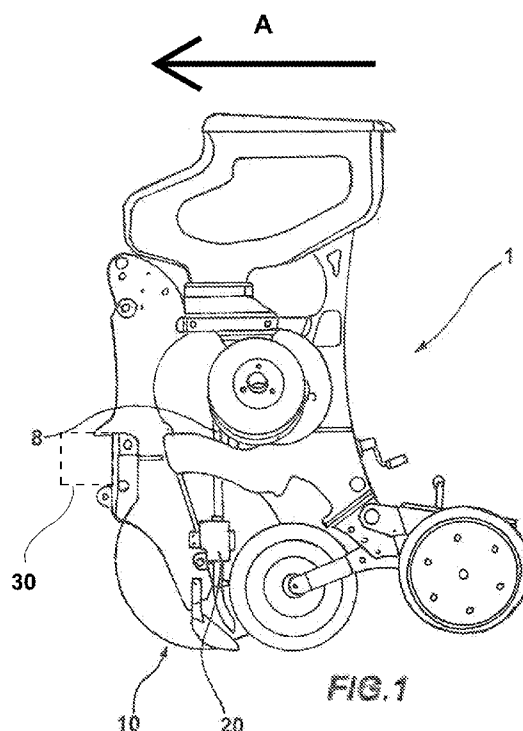
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(54) Title: SOWING ELEMENT FOR PRECISION PNEUMATIC SEED DRILLS



(57) Abstract: A sowing element (1) for pneumatic seed drills comprising a selector disc (2) for isolating the seed (S), the selector disc being rotatable about an axis (X), a conduit (8) for transporting the seed with an initial portion (12) which is proximal to a position for removing the seed from the selector disc and an intermediate portion (13) which extends in continuation of the initial portion. The conduit, at least in the initial portion and in the intermediate portion, is substantially rectilinear and substantially coaxial and has an axis (Y) which is located inside a plane which is substantially perpendicular to the sowing ground and parallel with the sowing advance direction.

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**SOWING ELEMENT FOR PRECISION PNEUMATIC SEED DRILLS**DESCRIPTION

The invention relates to a sowing element for precision pneumatic seed drills.

Typically, such sowing elements comprise a selector disc with one or more

5 rings of through-holes which extend between opposite surfaces of the disc.

The disc delimits in the sowing element two chambers which, by means of a pressurization system, are placed at different pneumatic pressures so that by

means of the pressure differential the seeds are isolated in the region of the through-holes in order to be released in the region of the conduit for

10 transporting the seed. An example of those seed drills is described in WO2010/059101.

In the technical field being referred to, there has arisen the requirement to accelerate the falling speed of the seed along the transport conduit in order to increase the sowing speed and the consequent productivity of the machine.

15 However, an increase in the irregularity of the sowing distance between two contiguous seeds of the same row acts counter to the increase in the sowing speed, with a consequent adverse affect on the regular development of the growth and maturation of the plant. In fact, it is simply necessary to have small differences in the transport speed of the seed along the transport  
20 conduit to cause irregularity of the spacing of the sowing which is completely unacceptable. It is evident that those occurrences of irregularity increase with the increase in the sowing speed and therefore act directly counter to the requirement for increasing the sowing speed.

The problem addressed by this invention is to provide a sowing element for  
25 precision pneumatic seed drills which is structurally and functionally configured

to overcome one or more of the disadvantages set out with reference to the prior art mentioned above, by improving in particular the constancy of the sowing spacing even at high sowing speeds.

This problem is confronted and solved by the invention by producing the  
5 conduit for transporting the seed in a rectilinear and coaxial manner to the greatest possible extent with a vertical orientation so as to prevent such deviations of travel of the seed in the transport conduit as to involve impacts and friction between the seed and the wall of the transport conduit itself.

In an embodiment, in order to make it easier to remove the seed from the  
10 selector disc towards the conduit for transporting the seed, the disc itself is inclined with respect to positioning with an axis parallel with the sowing ground. According to an aspect of the invention, the angle between a plane perpendicular to the axis of the conduit in the initial rectilinear portion and intermediate rectilinear portion of the same conduit and a plane perpendicular  
15 to the rotation axis of the disc is less than 90° and preferably between 60 and 80°.

In this manner, it is possible for the opening of the conduit to be able to be presented in an optimum manner with respect to the selector disc, for example, with a flute mouthpiece type cut, while maintaining the conduit for  
20 transporting the seed substantially rectilinear at least in the intermediate portion thereof and in the initial portion thereof, proximal to the disc.

Another advantage of the invention is that it is suitable for using a pneumatic flow accelerator to be arranged in the intermediate portion of the conduit for transporting the seed and preferably in the terminal portion of this  
25 intermediate portion, between it and a terminal portion of the conduit itself.

This flow accelerator can be produced with a compressed air injector in the conduit for transporting the seed, for example, as described in the patent application PD2013A320 of the same Applicant, the text and drawings of which are intended to be incorporated herein by reference. This flow accelerator  
5 produces inside the conduit a high-speed flow of air which greatly accelerates the movement of the seed.

The increase in the speed of the seed, which is much higher than that which would be obtained in a conventional falling system with only acceleration as a result of gravitational force, becomes evident as an equivalent substantial  
10 reduction in the transit time of the seed in the transport conduit and a reduced sensitivity of the seed itself to the vibrations of the sowing element and the impacts against the conduit for transporting the seed with a consequently improved regularity of the effective sowing pitch. This in turn allows a substantial increase in the sowing speed without the regularity of the sowing  
15 pitch being impaired thereby.

The characteristics and advantages of the invention will be better appreciated from the detailed description of a preferred but non-limiting embodiment thereof which is illustrated by way of non-limiting example with reference to the appended drawings, in which:

- 20 - Figure 1 is a partial schematic view of a sowing element according to the invention,
- Figure 2 is a detail of Figure 1,
- Figure 3 is a view in accordance with the section A-A of Figure 2 of a series of sowing elements which are arranged so as to be aligned in accordance with  
25 the assembly position thereof on a pneumatic seed drill,

- Figure 4 is a schematic view of a detail of Figure 3,
- Figure 5 is a side view of the elements of Figure 4,
- Figure 6 is a schematic perspective view of a detail of a sowing element according to the invention,
- 5 - Figure 7 is a cross-sectional view of a detail of a sowing element according to the invention, and
- Figure 8 is a cross-sectional view of another detail of a sowing element according to the invention.

In Figure 1 there is generally designated 1 a sowing element for precision  
10 pneumatic seed drills which is illustrated only schematically in terms of the necessary components thereof.

According to a preferred embodiment, the seed drill comprises a plurality of sowing elements 1 which are fixed in conventional manner to a support element 30 of the seed drill, which is schematically illustrated in the Figures by  
15 means of a bar. As shown in Figure 3, the support elements 30 are connected to the seed drill by means of suitable connection elements, which are not illustrated in the Figures, so as to be aligned in a direction T which is substantially perpendicular to the sowing advance direction A.

With reference then also to Figure 2, the sowing element 1 comprises a  
20 selector disc 2 which is for isolating the seed and which separates inside the sowing element two chambers 3, 4 which are intended to contain the seed to be isolated and to pressurize the sowing element, respectively. There is established between the above-mentioned chambers 3, 4 a pressure difference  $\Delta p$  which is generated by means of a pneumatic device, for example, a  
25 centrifugal fan with high head. The effect is in any case that of generating and

maintaining a pressure differential via a series of holes 6 which extend between the opposite surfaces of the selector disc 2, so as to cause a seed S to adhere there for each hole and to transport the seed which is isolated in this manner towards a conduit 8 for transporting the seed with which the seed  
5 S is removed from the selector disc and transported as far as the sowing furrow. That furrow is opened in the ground by a furrow opener 10, for example, of the type with a double disc coulters. A compaction wheel provides for retaining the seed S in the above-mentioned furrow and compressing it in the ground.

10 In order to obtain the isolation of the seed, the selector disc 2 is rotated about its own axis X which is generally perpendicular to the opposing surfaces of the selector disc 2 at a speed proportional to the advance speed of the sowing unit with respect to the ground. A runner 11 is arranged with quasi-adhesion against the opposite surface of the selector disc 2 to the one at which there  
15 are pneumatically gripped the seeds S so as to interrupt over a portion the pressure differential through the holes 6 and to bring about the detachment of the seeds selected from the selector disc and the introduction thereof into the opening 15 of the transport conduit 8.

There is defined in the conduit 8 an initial portion 12 which is proximal to the  
20 disc and which extends from the opening 15 away from the disc 2 and an intermediate portion 13 which extends in continuation of the initial portion 12 coaxially therewith. The conduit 8, at least in the initial portion 12 and in the intermediate portion 13, is substantially rectilinear and coaxial as well as being orientated with an axis substantially perpendicular to the sowing ground (or  
25 orientated backwards with respect to the sowing advance direction).

Where it may be necessary to adopt for structural reasons curves in the conduit 8, they will be mainly concentrated in a terminal portion 15 of the conduit itself. For example, in the terminal portion of the conduit there could be provided a curve with the intention of directing the trajectory of the seed  
5 under the compaction wheel, as will be illustrated in greater detail below.

As is then shown in Figures 2 and 3, the conduit 8 at least in the initial portion 12 and in the intermediate portion 13 has an axis Y which is inside a plane substantially perpendicular to the sowing ground G and parallel with the sowing advance direction A.

10 Therefore, when the sowing element 1 is mounted on the seed drill, the plane in which the axis Y of the conduit 8 is located is substantially perpendicular to the alignment direction T which is defined above.

Therefore, when the pneumatic seed drill is on planar ground, the conduit 8 in the above-mentioned portions has a substantially vertical extent.

15 The opening 15 of the conduit 8 is preferably cut partially in the manner of a flute mouthpiece so as to promote a greater approach of the opening 15 to the corresponding surface 2a of the disc 2. The flute-mouthpiece-like cut involves an oblique section of the conduit less than the total section thereof, that is to say, it does not reach the middle (axis Y) of the conduit 8 itself. Preferably, it  
20 is limited to between approximately a third and a fifth (or even less) of the circumferential section of the conduit 8 when it is constituted by a tube having a circular cross-section.

What is set out above prevents an excessive reduction of the inlet cross-section of the air into the conduit for transporting the seed by limiting the inlet  
25 speed of the air drawn into the conduit so as not to remove the seeds from the

holes before the interruption of the pressure differential by means of the runner 11.

The angle of incidence A between the surface 2a of the disc 2 facing the opening of the conduit 8 and the axis Y of the conduit itself is preferably  
5 between 10° and 30°. A preferred value is approximately 15°.

In other words, this means that the angle B between a plane P1 which is perpendicular to the axis Y of the conduit 8 in the rectilinear initial portion 12 and the rectilinear intermediate portion 13 and a plane P2 which is perpendicular to the rotation axis X of the selector disc 2 is less than 90°,  
10 preferably between 60° and 80°, more preferably is equal to 75°.

According to a preferred embodiment, the rotation axis X of the disc is transverse to the alignment direction T and with respect to the sowing surface G on which the seed drill is located.

A pneumatic accelerator 20 of the type with a ring type ejector 21, as  
15 illustrated in Figures 2, 6 and 8, is inserted between the intermediate portion 13 and the terminal portion 16.

This ejector 21 comprises a hollow sleeve-like member 22 in which there are inserted:

- a compressed air inlet 23 which is directed tangentially and preferably in a  
20 radial direction with respect to the hollow member 22,
- a seed inlet 24 which is tubular and the outer wall of which delimits in the hollow member 22 an annular chamber 25 which is substantially coaxial with the seed inlet,
- a conical portion 26 which narrows from the annular chamber 25 towards an  
25 outlet conduit 27 and which is arranged with respect to the seed inlet 24 so as

to form an annular passage 28 with a reduced cross-section with respect to the annular chamber 25 so as to generate a substantial acceleration in the air flow from the compressed air inlet 23 and to introduce this ring-like flow around the opening 29 of the seed inlet 24 into the ejector 21.

5 The pneumatic accelerator 20 is supplied with compressed air which is generated by a lobed compressor preferably of the positive-displacement type or by a compressor of the type with a side-channel blower.

As a result of the effect of the compressed air flow into the inlet 23, it is possible for the portion of the conduit 8 positioned upstream of the ejector 21  
10 to be located in a state of reduced pressure with respect to the portion of the conduit 8 downstream of the conduit itself, generating a high-speed air flow which contributes, together with gravity, to the transport of the seeds S along the conduit 8, significantly accelerating the transit speed thereof with respect to the gravitational effect alone. As a result, there are further reduced the  
15 transit times of the seed in the conduit 8 with less sensitivity in respect of the seed itself to the vibrations of the sowing element and the impacts against the conduit, which is generally advantageous for the regularity of the sowing pitch even at very high advance speeds of the sowing unit.

As a result of this increased speed, the terminal portion 16 of the conduit 8 for  
20 transporting the seed may have a curvature with a large radius without negatively affecting the regularity of the sowing pitch.

The relationship between the total length of the proximal portion 12 and the intermediate portion 13 and the length of the terminal portion 16 of the conduit 8 is preferably 2:1.

25 As a result of this condition, that is to say, the out-of-balance positioning of

the ejector 21 in favour of proximity to the terminal portion 16, there is afforded the advantage of using both the effect of aspiration of air into the proximal portion 12 and intermediate portion 13 of the conduit 8, which promotes the removal of the seed from the selector disc 2 and positively  
5 accelerates the movement thereof, and the effect of positive pressurization of the terminal portion of the conduit 8 which prevents soil, dust and other contaminants from being drawn into the conduit 8 and rather promotes the expulsion thereof. Furthermore, the seed at the time of passage through the flow accelerator is already provided with a high speed and is therefore less  
10 sensitive to the turbulence generated by the accelerator itself.

Any deviations from the rectilinear path of the conduit 8 for transporting the seed have radii of curvature greater than 0.2 m.

The invention thereby solves the problem set out, achieving at the same time a plurality of advantages. In particular, the sowing element according to the  
15 invention allows an improvement in the constancy of the sowing spacing even at high sowing speeds.

**Claims**

1. A sowing element (1) for pneumatic seed drills comprising a selector disc (2) for isolating the seed (S), the selector disc (2) being rotatable about an axis (X), a conduit (8) for transporting the seed (S) with an initial portion (12) which is proximal to a position for removing the seed (S) from the selector disc (2) and an intermediate portion (13) which extends in continuation of the initial portion (12), characterized in that the conduit (8), at least in the initial portion (12) and in the intermediate portion (13), is substantially rectilinear and substantially coaxial and has an axis (Y) which is located inside a plane which is substantially perpendicular to the sowing ground and parallel with the sowing advance direction.
2. A sowing element (1) according to claim 1, wherein the conduit in the initial portion (12) and in the intermediate portion (13) is substantially perpendicular to the sowing ground or orientated backwards with respect to the sowing advance direction.
3. A sowing element according to any of the preceding claims, wherein the conduit (8) at least in the initial portion (12) and in the intermediate portion (13) extends substantially vertically during use on a sowing surface (G) which is substantially planar.
4. A sowing element (1) according to any one of the preceding claims, wherein the angle (B) between a plane (P1) which is perpendicular to the axis (Y) of the conduit (8) in the rectilinear initial portion (12) and rectilinear intermediate portion (13) of the conduit (8) and a plane (P2) perpendicular to the rotation axis (X) of the selector disc (2) is less than 90°.
5. A sowing element (1) according to claim 5, wherein the angle (B) is

between 60° and 80°.

6. A sowing element (1) according to claim 5 or 6, wherein the angle (B) is substantially equal to 75°.

7. A sowing element (1) according to any one of the preceding claims, wherein  
5 the sowing element (1) comprises a pneumatic accelerator (20) which is arranged along the conduit for transporting the seed.

8. A sowing element (1) according to claim 8, wherein the pneumatic accelerator (20) is positioned between the intermediate portion (13) and a terminal portion (16) of the conduit (8).

10 9. A sowing element (1) according to claim 8, wherein the total of the extent of the initial portion (12) and the intermediate portion (13) is greater than the extent of the terminal portion (16).

10. A sowing element (1) according to claim 9, wherein the relationship between the total length of the initial portion (12) and the intermediate  
15 portion (13) and the length of the terminal portion (16) of the conduit (8) is 2:1.

11. A sowing element (1) according to any one of the preceding claims, wherein the entire conduit (8) for transporting the seed is substantially rectilinear.

20 12. A sowing element (1) according to either claim 9 or 10, wherein the terminal portion (16) has a curvature.

13. A sowing element (1) according to claim 12, wherein  
the deviation from the rectilinear path of the conduit (8) for transporting the seed (S) in the terminal portion (16) has a radius of curvature greater than  
25 0.2 m.

14. A sowing element according to any one of claims 8 to 13, wherein the pneumatic accelerator (20) is of the type including a ring type ejector (21).

15. A sowing element (1) according to claim 14, wherein the pneumatic accelerator (20) is supplied with compressed air which is generated by a lobed  
5 compressor of the positive-displacement type or by a compressor of the type with a side-channel blower.

16. A sowing element (1) according to any one of the preceding claims, wherein the pneumatic seed drill is of the type having a plurality of sowing elements (1) which are aligned in an alignment direction (T) which is  
10 substantially transverse to the sowing advance direction (A), the plane in which the axis (Y) of the conduit (8) is located being substantially perpendicular to the alignment direction (T).

17. A sowing element (1) according to any one of the preceding claims, wherein the rotation axis (X) is transverse to the alignment direction (T).

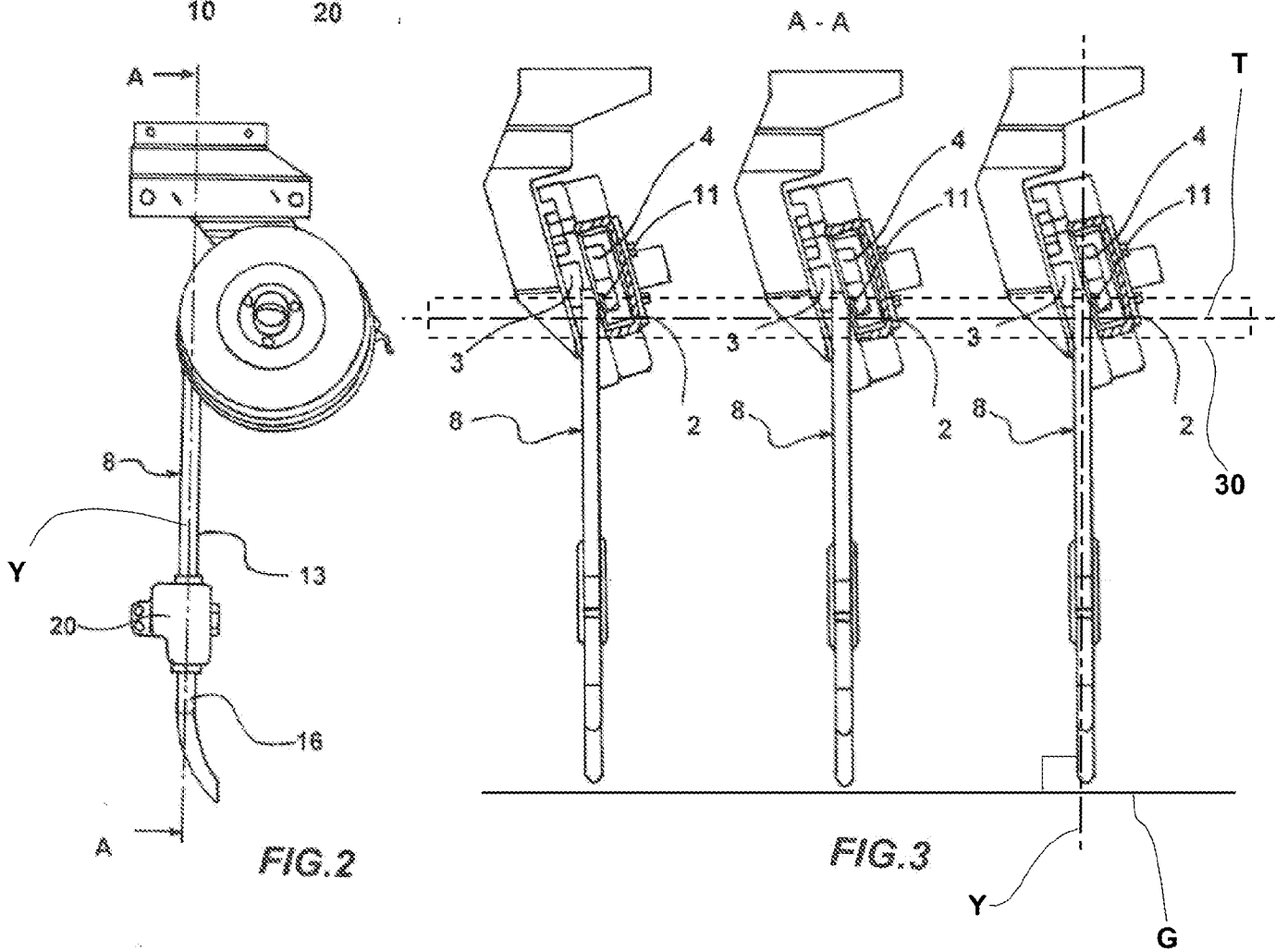
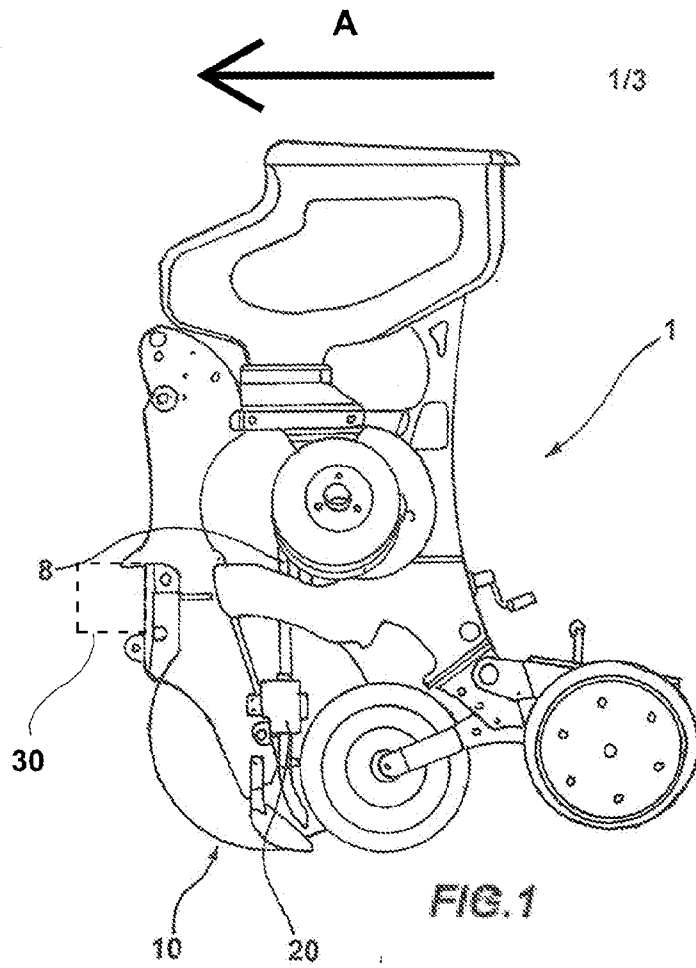
18. A sowing element (1) according to any one of the preceding claims, comprising a connection element with respect to the pneumatic seed drill, wherein the connection element is configured in such a manner that the  
15 conduit (8), at least in the initial portion (12) and in the intermediate portion (13), is substantially vertical when the sowing element (1) is connected to the pneumatic seed drill.  
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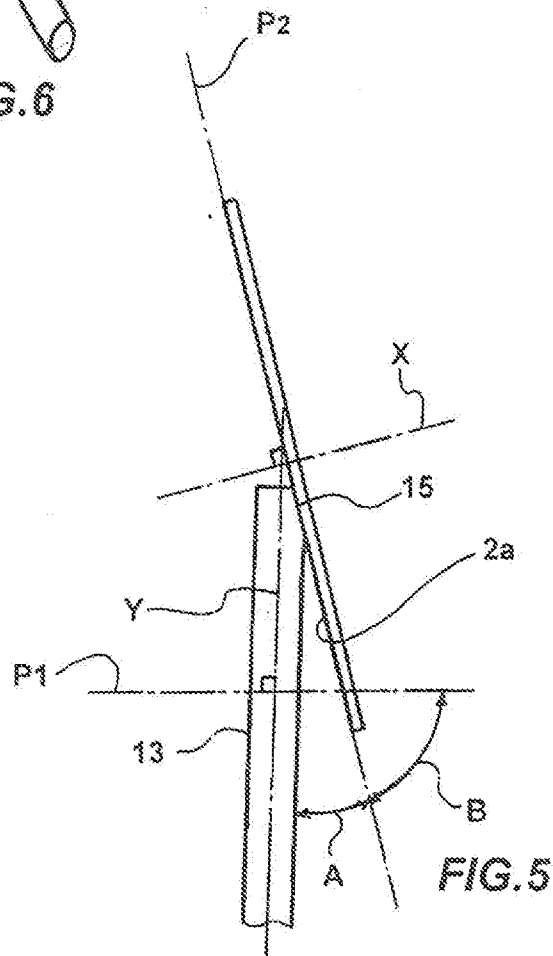
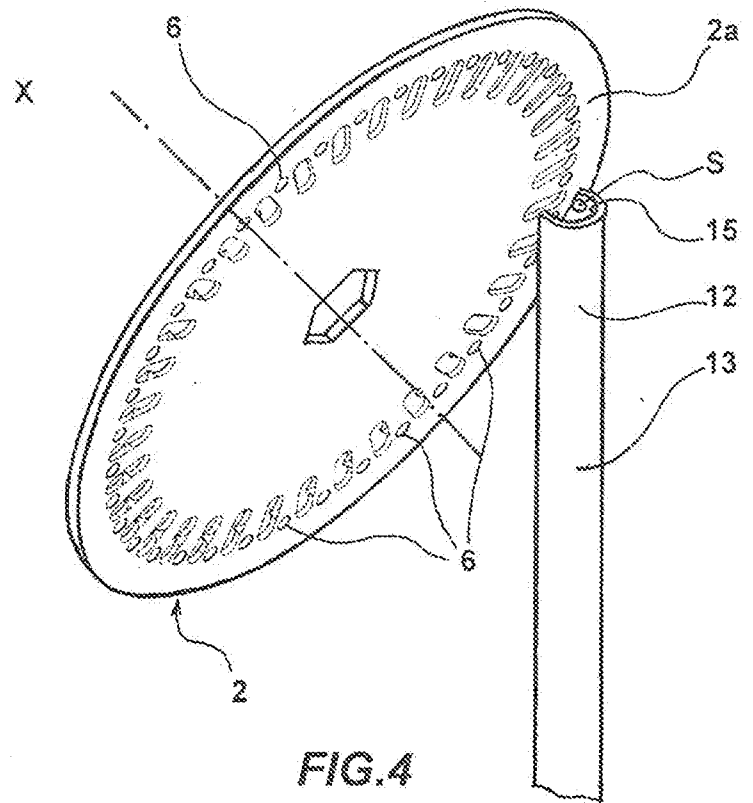
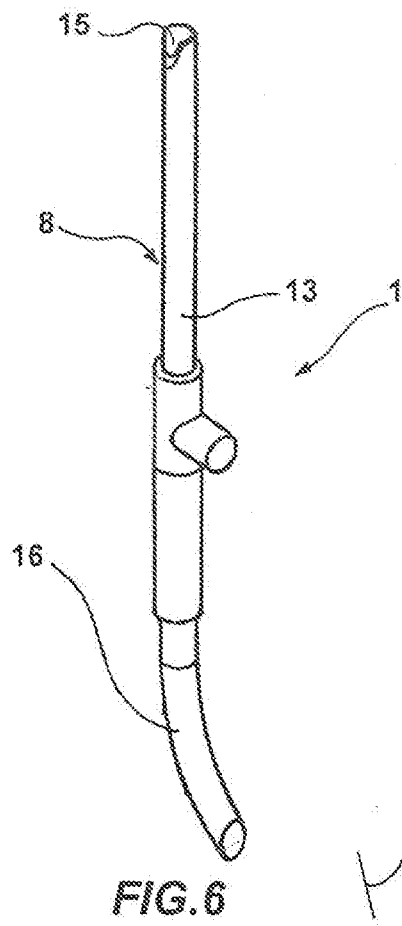
19. A pneumatic seed drill comprising a plurality of sowing elements (1) according to any one of the preceding claims, the sowing elements (1) being aligned in an alignment direction (T) which is substantially transverse to the sowing advance direction (A).

20. A pneumatic seed drill according to claim 19, comprising a support  
25

element (30) for the sowing elements (1), the support element (30) having an elongate form so as to define the alignment direction (T).

21. A pneumatic seed drill according to claim 19 or 20, wherein the conduit (8) of the sowing elements, at least in the initial portion (12) and in the  
5 intermediate portion (13), is substantially vertical.





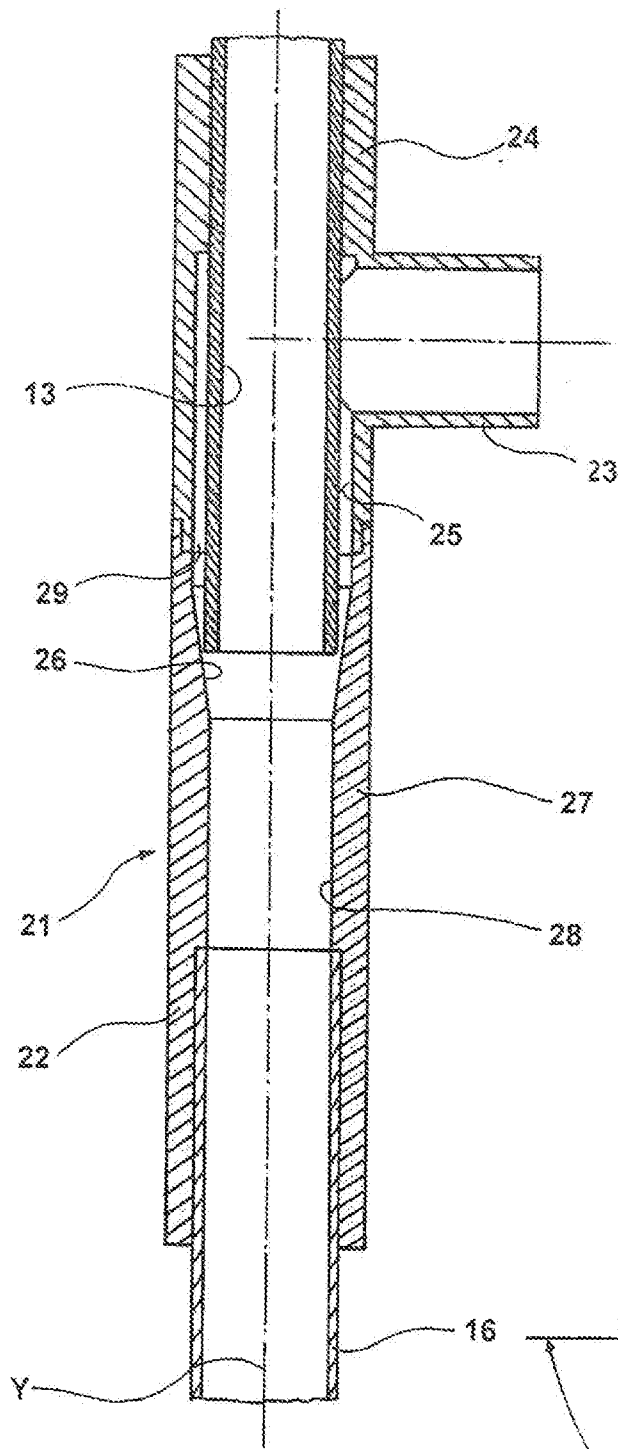


FIG. 8

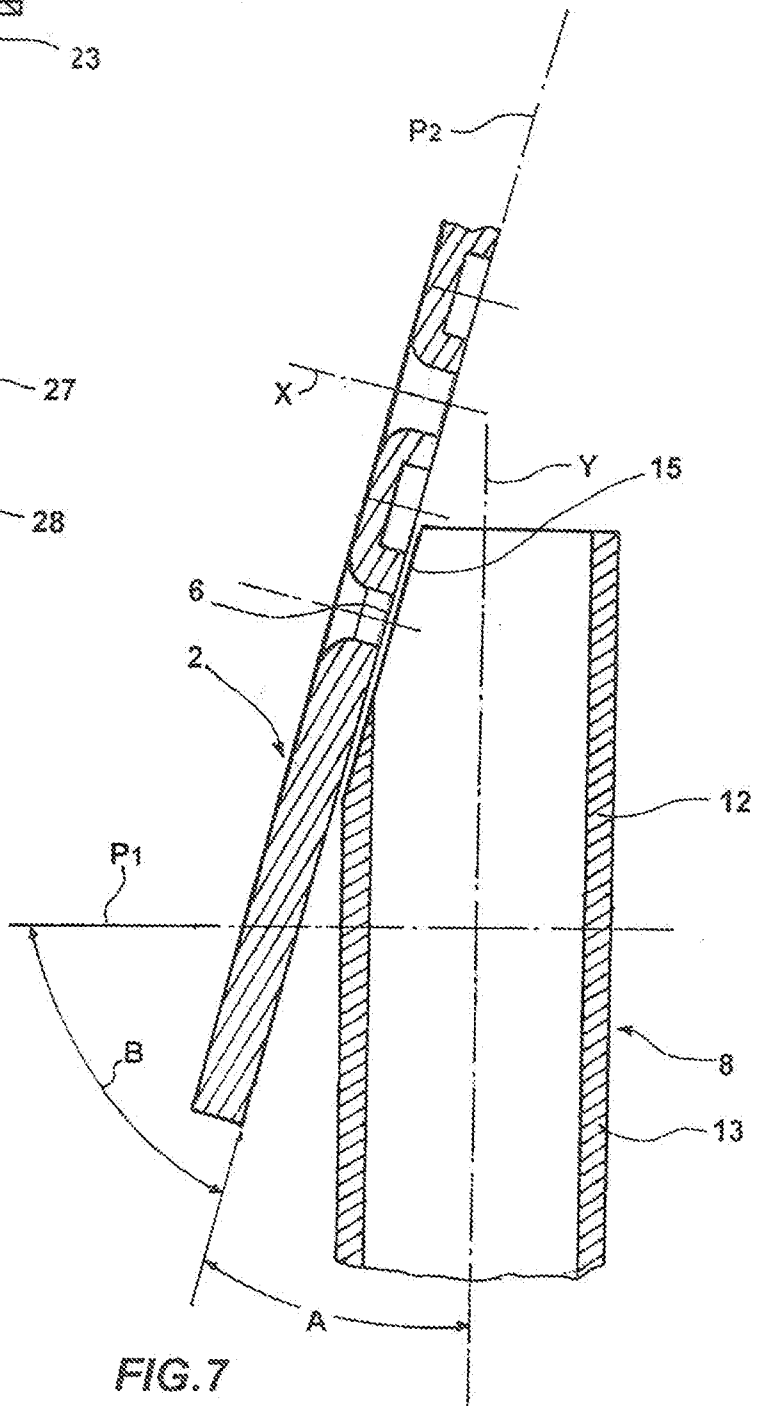


FIG. 7

## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2017/052309

## A. CLASSIFICATION OF SUBJECT MATTER

INV. A01C7/20

ADD. A01C7/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                      | Relevant to claim No.            |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
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| X         | EP 0 150 243 A1 (KIRCHBERGER FRANZ)<br>7 August 1985 (1985-08-07)<br><br>figure 1<br>page 1, lines 1-5<br>page 9, line 5 - page 10, line 2<br>-----<br>-/-                                                              | 1,2,<br>7-11,<br>15-17,<br>19,20 |



Further documents are listed in the continuation of Box C.



See patent family annex.

## \* Special categories of cited documents :

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Date of the actual completion of the international search

27 July 2017

Date of mailing of the international search report

04/08/2017

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## INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                              | Relevant to claim No.       |
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2017/052309

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                 | Publication<br>date                                                                            |
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