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(54) Title: A DEVICE FOR STUBBLE TREATMENT AND A VIBRATION-ABSORBING ARRANGEMENT THEREOF

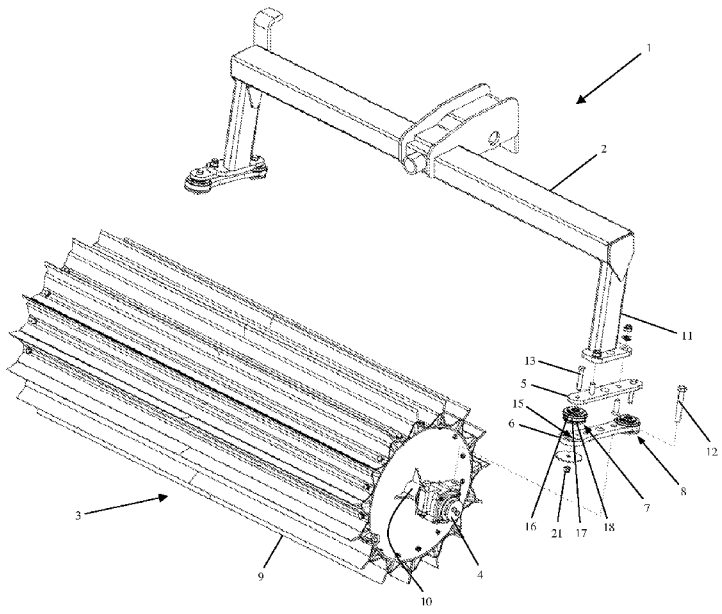


FIG.1

(57) Abstract: The invention relates to a device (1) for stubble treatment once a crop has been harvested, which device (1) comprises a frame (2), wherein at least one knife rolling segment (3) is adapted to be coupled to said frame (2) through a pair of bearings (4) and to operate substantially horizontally, said device (1) further comprises a vibration- absorbing arrangement (14) for each bearing (4), which vibration-absorbing arrangement (14) is adapted to be mounted between a bearing (4) and a free-end of said frame (2), wherein said vibration-absorbing arrangement (14) is at least partially made of a resilient material, wherein said vibration-absorbing arrangement (14) is adapted to isolate the frame (2) from vibrations generated at the rolling segment (3) and propagated to each bearing (4). Also, the invention relates to a vibration-absorbing arrangement (14) adapted to be mounted to a device (1) for stubble treatment as described above.

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A device for stubble treatment and a vibration-absorbing arrangement thereof

Field of the invention

The invention relates to a device for stubble treatment once a crop has been harvested, which device comprises a frame, wherein at least one knife rolling segment is adapted to be coupled to said frame through a pair of bearings and to operate substantially horizontally, said device further comprises a vibration-absorbing arrangement for each bearing, which vibration-absorbing arrangement is adapted to be mounted between a bearing and a free-end of said frame, wherein said vibration-absorbing arrangement is at least partially made of a resilient material.

Also, the invention relates to a vibration-absorbing arrangement adapted to be mounted to a device for stubble treatment once a crop has been harvested, which device comprises a frame, wherein at least one knife rolling segment is adapted to be coupled to said frame through a pair of bearings and to operate substantially horizontally, which vibration-absorbing arrangement is adapted to be mounted to said device between a bearing and a free-end of said frame, wherein said vibration-absorbing arrangement is at least partially made of a resilient material.

Background of the invention

A device for stubble treatment can be used for many types of residual plant matters such as sunflower, maize, rape, vegetables, tobacco and cotton. In order to achieve optimal cutting/comminuting of plant material, it is important that the blades of the knife rolling segments are mounted perpendicularly to the operational direction of the device such that an entire blade strikes into the ground at once. This impact provides critical vibrations, which are transmitted to the chassis frame. Due to the high speed at which the machine is driven for efficiently cutting stubbles (e.g. 25 km/h) and consequently the high frequency at which the roller works (e.g. 30 Hz), cracks easily form in the steel structure of the frame, thus the device gets quickly damaged. If the knives are mounted differently, the shredding of plant material is significantly less effective, because said "strike" does not take place, and the roller segments simply roll over the plant material. Thus, mounting of the blades slightly obliquely to the operational direction of the device is not an efficient solution to the vibration problem. Consequently, an alternative solution is to mitigate the effect of the vibrations by reinforcing the most

sensitive parts of the construction. Nevertheless, cracks will sooner or later also form in the other parts which have not been reinforced beforehand. Hence, this is not a durable and economic solution.

US 4407372 A illustrates a vibration-damping arrangement consisting of two C-shaped springs positioned in-between the frame and each of the bearings used for mounting the shaft of a harrow. Said arrangement provides graduated resilience at low impact loads by a first C-shaped spring and increased resilience at high impact loads by an additional C-shaped spring nested within the first C-shaped spring. Although damped, vibrations will still affect the frame, which will eventually experience cracks. Moreover, due to high impact loads and/or with time, the springs will get permanently deformed, thus stopping performing optimally and providing the desired damping effect.

Hence, there is a need in the technical field of devices for stubble treatment and related vibration-absorbing arrangements of overcoming the aforementioned drawbacks of the state-of-the-art solutions.

Objects of the invention

The first object of the invention is to provide an improvement to the state of the art. The second object of the invention is to solve the aforementioned drawbacks of the prior art. The third object of the invention is to alleviate the problems caused by the use of a knife rolling segment operated at high speed, such as preventing the formation of cracks and avoiding the need of applying reinforcements to the construction.

Description of the invention

The aforementioned objects of the invention are achieved by a device for stubble treatment as described in the preamble of claim 1, wherein said vibration-absorbing arrangement is adapted to isolate the frame from vibrations generated at the rolling segment and propagated to each bearing. Note that the vibration-absorbing arrangement may also be positioned at a free-end of a bracket attached to said frame.

The invention has the advantage that vibrations (e.g. at frequencies in the range between 15 and 40 Hz) propagating from the knife rolling segment to the frame of the

device are absorbed, thus no cracks form in the structure and no/less reinforcements are to be applied to the frame. For example, vibrations at around 30 Hz may cause problems to the durability of the chassis frame, as some of the frame's own resonance frequencies are hit. Therefore the invention leads to a more durable and economic solution.

Herein "knife rolling segment" is defined as a unit comprising an axle mounted perpendicularly to the operational direction of the device (i.e. the direction of travel) and a number of axial or mainly axial-extending knives, which are arranged regularly-spaced at the periphery of a central roller body.

Herein "substantially horizontal" refers to the axle of the one or more rolling segments (it may also be a common axle) lying on a plane that may deviate from a horizontal plane by a few degrees (e.g. 10°) when in operation, i.e. the extremities of the axle may be tilted off by a few degrees upwards/downwards with respect to the center of the axle.

In an embodiment of the invention said vibration-absorbing arrangement comprises at least a first plate and a second plate (e.g. metal plates), said first plate being adapted to be attached to the free-end of said frame and said second plate being adapted to be attached to said bearing, said plates being adapted to be fastened together, wherein one or more vibration-absorbing elements are positioned in-between said plates (e.g. two vibration-absorbing elements positioned symmetrically with respect to the centre of the plates). Moreover, the vibration-absorbing arrangement may be placed closer to the frame or closer to the bearing. Also, two vibration-absorbing arrangements, one positioned closer to the bearing and another one positioned closer to the frame may be envisioned. Finally, the width of the plate may vary depending on the available space between the frame and the knife rolling segment. An advantage of these embodiments is that the bearing can work at a certain vibration frequency without propagating the vibrations further to the frame (or the bracket).

In an embodiment of the invention, said second plate has a through hole for each vibration-absorbing element, wherein each vibration-absorbing element is formed such

that a first portion of each vibration-absorbing element is positioned in-between said plates, a second portion of each vibration-absorbing element is accommodated into said through hole and a third portion of each vibration-absorbing element is fastened underneath said second plate. An advantage of this embodiment is that the frame (or the bracket) and the bearing can be firmly attached to each other, for example, through one or more bolts (e.g. 2).

In an embodiment of the invention, said vibration-absorbing arrangement further comprises a third plate for each vibration-absorbing element, each third plate being positioned in-between the first plate and the second plate and having a through hole such that the second portion of each vibration-absorbing element is accommodated into said through hole, said third plate being adapted to be fastened to said second plate. Advantageously, the third plate is fastened to the second plate by means of one or more bolts (e.g. 4). Advantageously, a third plate may be produced as an integral part of a vibration-absorbing element. An advantage of this embodiment is the capability to better withstand vibrations due to the horizontal load, in addition to vibrations due to the vertical load.

In an embodiment of the invention, said one or more vibration-absorbing elements comprise a resilient material. Advantageously, said resilient material may be an elastomer such as rubber, vulcanized rubber, silicone, and any other suitable material having resilient properties, and combinations thereof. An advantage of this embodiment is that such materials are able to absorb vibrations in the aforementioned interval, which leads to a significant reduction/the elimination of vibrations in the frame.

In an embodiment of the invention, said one or more vibration-absorbing elements are springs, air cushions, and any other suitable item having resilient properties, and combinations thereof. An advantage of this embodiment is to provide alternative or complementary vibration-absorbing elements.

Also, the aforementioned objects of the invention are achieved by a vibration-absorbing arrangement as described in the preamble of claim 7, wherein said vibra-

tion-absorbing arrangement is adapted to isolate the frame from vibrations generated at the rolling segment and propagated to the bearing.

In an embodiment of the invention, said vibration-absorbing arrangement comprises at least a first plate and a second plate, said first plate being adapted to be attached to the free-end of said frame and said second plate being adapted to be attached to said bearing, said plates being adapted to be fastened together, wherein one or more vibration-absorbing elements are positioned in-between said plates.

In an embodiment of the invention, said second plate has a through hole for each vibration-absorbing element, wherein each vibration-absorbing element is formed such that a first portion of each vibration-absorbing element is positioned in-between said plates, a second portion of each vibration-absorbing element is accommodated into said through hole and a third portion of each vibration-absorbing element is fastened underneath said second plate.

In an embodiment of the invention, said vibration-absorbing arrangement further comprises a third plate for each vibration-absorbing element, each third plate being positioned in-between the first plate and the second plate and having a through hole such that the second portion of each vibration-absorbing element is accommodated into said through hole, said third plate being adapted to be fastened to said second plate.

In an embodiment of the invention, said one or more vibration-absorbing elements comprise a resilient material.

In an embodiment of the invention, said one or more vibration-absorbing elements are springs, air cushions, and combinations thereof.

Hereafter, the invention will be described in connection with drawings illustrating non-limiting examples of a device for stubble treatment and a vibration-absorbing arrangement thereof.

Brief description of the drawings

FIG.1: Assembling the various elements of a device for stubble treatment.

FIG.2: Close-up of a vibration-absorbing arrangement.

FIG.3: Close-up of a vibration-absorbing arrangement comprising two third plates.

Preferred embodiments of the invention

FIG.1 shows the different elements of a device 1 for stubble treatment according to the invention and an exemplary method for assembling them together. A roller segment 3 is provided with blades 9 and is connected to a bearing 4 through its axel 10. A frame 2 has a bracket 11 attached to its free-ends. The first plate 5 is attached at the free-end of the bracket 11 and the second plate 6 is attached at the top part of the bearing 4 (plates 5, 6 could also respectively be integrated in the bracket 11 and in the bearing 4). Two vibration-absorbing elements 7, 8 are interposed in-between the two plates 5, 6. The second plate 6 presents a through hole 15 per each vibration-absorbing element 7, 8 for accommodating a second portion 17 of each vibration-absorbing element 7, 8. Bolts 12, 13 and nuts 21, 22 are used to assemble the vibration-absorbing arrangement 14 together by fastening together the two plates 5, 6.

FIG.2 shows a close-up view of the vibration-absorbing arrangement 14 illustrated in FIG.1.

FIG.3 shows a close-up view of a vibration-absorbing arrangement 14 comprising two third plates 19, 20, each third plate 19, 20 accommodating the second portion 17 (not visible in FIG.3) of a vibration-absorbing element 7, 8 and being fastened to the second plate 6 by means of four bolts and nuts.

CLAIMS

1. A device (1) for stubble treatment once a crop has been harvested, which device (1) comprises a frame (2), wherein at least one knife rolling segment (3) is adapted to be coupled to said frame (2) through a pair of bearings (4) and to operate substantially horizontally, said device (1) further comprises a vibration-absorbing arrangement (14) for each bearing (4), which vibration-absorbing arrangement (14) is adapted to be mounted between a bearing (4) and a free-end of said frame (2), wherein said vibration-absorbing arrangement (14) is at least partially made of a resilient material, **characterized in that** said vibration-absorbing arrangement (14) is adapted to isolate the frame (2) from vibrations generated at the rolling segment (3) and propagated to each bearing (4).

2. A device (1) according to claim 1, **characterized in that** said vibration-absorbing arrangement (14) comprises a first plate (5) and a second plate (6), said first plate (5) being adapted to be attached to the free-end of said frame (2) and said second plate (6) being adapted to be attached to said bearing (4), said plates (5, 6) being adapted to be fastened together, wherein one or more vibration-absorbing elements (7, 8) are positioned in-between said plates (5, 6).

3. A device (1) according to claim 2, **characterized in that** said second plate (6) has a through hole (15) for each vibration-absorbing element (7, 8), wherein each vibration-absorbing element (7, 8) is formed such that a first portion (16) of each vibration-absorbing element (7, 8) is positioned in-between said plates (5, 6), a second portion (17) of each vibration-absorbing element (7, 8) is accommodated into said through hole (15) and a third portion (18) of each vibration-absorbing element (7, 8) is fastened underneath said second plate (6).

4. A device (1) according to claim 3, **characterized in that** said vibration-absorbing arrangement (14) further comprises a third plate (19, 20) for each vibration-absorbing element (7, 8), each third plate (19, 20) being positioned in-between the first plate (5) and the second plate (6) and having a through hole such that the second portion (17) of

each vibration-absorbing element (7, 8) is accommodated into said through hole, said third plate (19, 20) being adapted to be fastened to said second plate (6).

5. A device (1) according to any of claims 2-4, **characterized in that** said one or more vibration-absorbing elements (7, 8) comprise a resilient material.

6. A device (1) according to any of claims 2-5, **characterized in that** said one or more vibration-absorbing elements (7, 8) are springs, air cushions, and combinations thereof.

7. A vibration-absorbing arrangement (14) adapted to be mounted to a device (1) for stubble treatment once a crop has been harvested, which device (1) comprises a frame (2), wherein at least one knife rolling segment (3) is adapted to be coupled to said frame (2) through a pair of bearings (4) and to operate substantially horizontally, which vibration-absorbing arrangement (14) is adapted to be mounted to said device (1) between a bearing (4) and a free-end of said frame (2), wherein said vibration-absorbing arrangement (14) is at least partially made of a resilient material, **characterized in that** said vibration-absorbing arrangement (14) is adapted to isolate the frame (2) from vibrations generated at the rolling segment (3) and propagated to the bearing (4).

8. A vibration-absorbing arrangement according to claim 7, **characterized in that** said vibration-absorbing arrangement (14) comprises at least a first plate (5) and a second plate (6), said first plate (5) being adapted to be attached to the free-end of said frame (2) and said second plate (6) being adapted to be attached to said bearing (4), said plates (5, 6) being adapted to be fastened together, wherein one or more vibration-absorbing elements (7, 8) are positioned in-between said plates (5, 6).

9. A vibration-absorbing arrangement (14) according to claim 8, **characterized in that** said second plate (6) has a through hole (15) for each vibration-absorbing element (7, 8), wherein each vibration-absorbing element (7, 8) is formed such that a first portion (16) of each vibration-absorbing element (7, 8) is positioned in-between said plates (5, 6), a second portion (17) of each vibration-absorbing element (7, 8) is ac-

commodated into said through hole (14, 15) and a third portion (18) of each vibration-absorbing element (7, 8) is fastened underneath said second plate (6).

10. A vibration-absorbing arrangement (14) according to claim 9, **characterized in that** said vibration-absorbing arrangement (14) further comprises a third plate (19, 20) for each vibration-absorbing element (7, 8), each third plate (19, 20) being positioned in-between the first plate (5) and the second plate (6) and having a through hole such that the second portion (17) of each vibration-absorbing element (7, 8) is accommodated into said through hole, said third plate (19, 20) being adapted to be fastened to said second plate (6).

11. A vibration-absorbing arrangement (14) according to any of claims 8-10, **characterized in that** said one or more vibration-absorbing elements (7, 8) comprise a resilient material.

12. A device (1) according to any of claims 8-11, **characterized in that** said one or more vibration-absorbing elements (7, 8) are springs, air cushions, and combinations thereof.

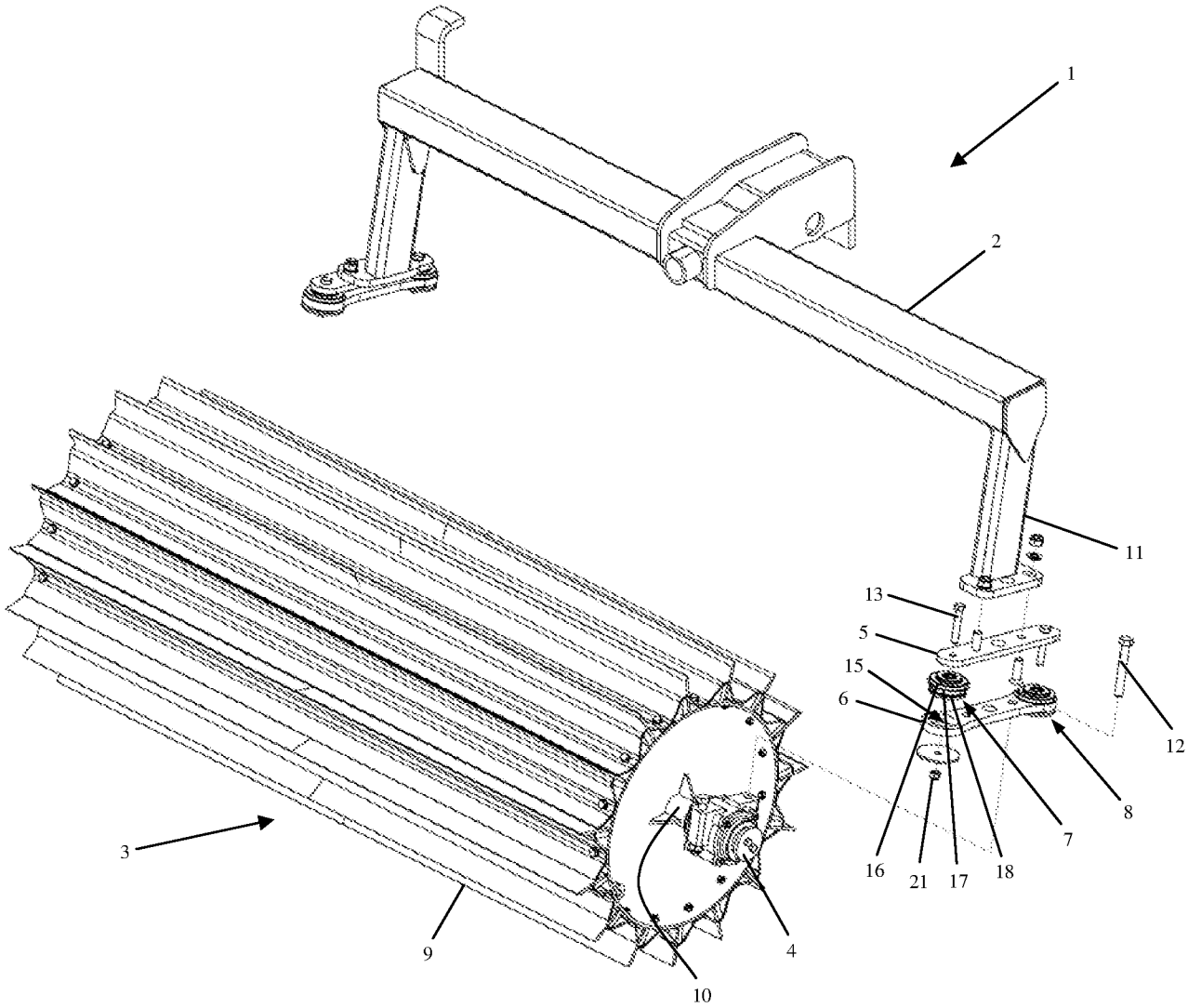


FIG.1

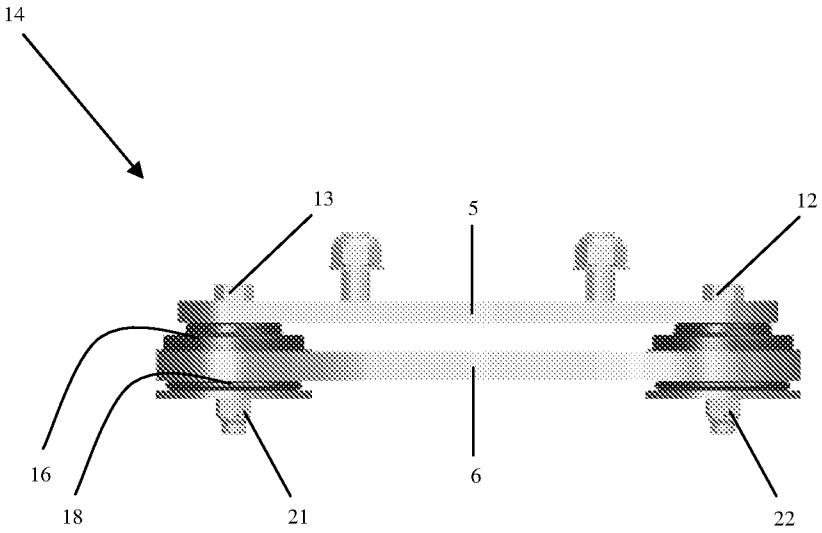


FIG.2

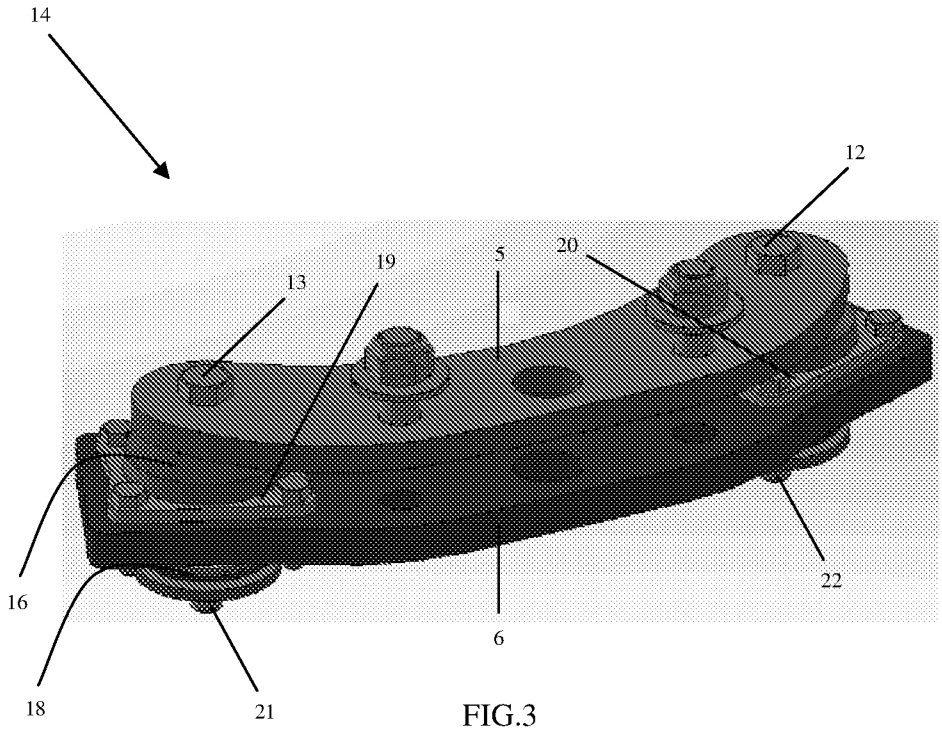


FIG.3

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2013/050354

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01B29/06
ADD.

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)
A01B

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.
X A	US 4 223 742 A (STARK KARL G C) 23 September 1980 (1980-09-23) column 1, line 65 - column 2, line 22; figures	1,2,5-8, 11,12 3,4,9,10

X	US 1 397 391 A (ADAMS JAMES V) 15 November 1921 (1921-11-15) page 1, line 64 - line 104; figures	1,7

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X A	US 2 308 281 A (GREEN CLARENCE W) 12 January 1943 (1943-01-12) page 1, line 31 - line 46; figures	7 1

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
4 February 2014	20/02/2014

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2013/050354

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 4 418 761 A (DIETRICH SR WILLIAM J [US] ET AL) 6 December 1983 (1983-12-06) column 3, line 13 - column 7, line 21; figures -----	7 1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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