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(54) Title: DEVICE FOR FOLDING THE WORKING PARTS OF AGRICULTURAL MACHINERY

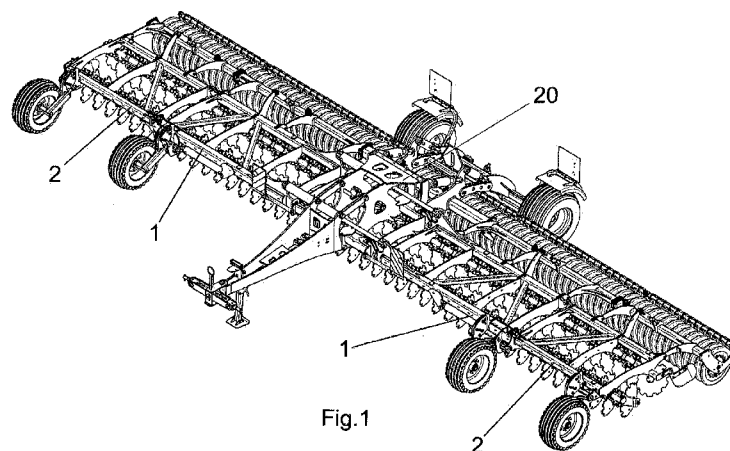


Fig.1

(57) Abstract: A device for folding the working parts of agricultural machinery, in particular a device for folding the working parts of an agricultural machine consisting of at least one stationary part (1) and at least one, stored in the stationary part (1), swiveling folding part (2), where the stationary part (1) and the folding part (2) are connected by at least one swivel connection (3) stored in their outer edges, which contains, in the stationary part (1) stored a linear drive device (5) pivotally connected to a rod (4) which is pivotally connected to the folding part (2), where the linear drive device (5) is located below the frame (12) of the stationary part (1).



Device for folding the working parts of agricultural machinery

Technical Field

The invention relates to a device for folding the working parts of agricultural machinery, particularly equipment for folding the working parts of an agricultural machine comprising at least one stationary part and at least one 180° swiveling part stored within a folding part.

State of the Art

Currently, folding of the side arms by 180° from the working position to the transport position mainly uses the following principles.

For the first type, the swivel point is located upon the edges of the frame of the stable and swivel parts of the machine. Furthermore, the stable and swivel parts contain hook attachment points, which are below the level of the horizontal swivel point and are also at some distance from the vertical swivel point. Two rods are at the opposite upper edge of the frame and are connected by one opening through which a control piston rod is connected. The piston rod is attached at the opposite end above the stationary frame.

The second type is similar to the first type, however the control rod fixed to the swiveling part of the machine is longer than the control rod fixed to the stationary part. These are mutually connected in such a way that the end of the longer rod extends beyond the shorter rod. The longer rod also extends beyond the opening for attachment of the control rod. The advantage of the second type of folding over the first is a far lower power requirement for folding the machine.

The disadvantage of both options is the large space requirement for mounting the control piston rod and its whole mechanism, thereby adversely increasing the clearance height. Given that the total width for road transport should not exceed 3 m and the height 4 m, the machine width is thus limited. Generally, a machine with one stationary arm and two folding arms is limited to a maximum width of 5.5 m.

The aim of the invention is the construction of a folding mechanism, which allows trouble free tilting of the folding parts of the the machine by 180° onto the stationary part, so as to be strong, statically stable, and yet simple and cheap to

produce, and allowing increased machine working widths while respecting road transport width restrictions.

Principle of the Invention

The afore mentioned deficiencies are for the most part removed and the aim of the invention met by a device for folding the the working parts of agricultural machinery, in particular, device for folding the working parts of an agricultural machine comprising at least one stationary part and at least one swiveling folding part, where the stationary part and the folding part are connected by at least one swivel connection mounted on their edges, which, according to the invention, is characterized in that it contains on the stationary part a linear drive device pivotally connected to a rod, which is pivotally connected to the folding part where the linear drive device is located below the frame of the stationary part. The advantage of this structural arrangement lies in the fact that clearance height of the machine frame is not increased thus enabling construction of machines with greater working widths which, when folded, meet the size and width requirements for road transport. Any potential lengthening of the rod can also positively influence power ratios thus making lower demands on the linear drive device.

It is preferable that the rod, in the course of folding or unfolding the folding parts, rests upon a rotary stop located in the stationary part whereas the rotary stop is preferably located on a shaft of the swiveling connection. The above provide for very stable tilting of the folding parts onto the stationary part.

Furthermore, it is preferred that the swivel mechanism of the linear drive device be provided with at least one roller, which during tilting or folding of the folding parts is guided by at least one guide track, whereas the most advantageous in terms of overall stability is when during tilting or folding, the roller is guided by an under guide track and/or an upper guide track. Guide tracks are usually located under the frame of the stationary part, whereas they may be widened at their ends to advantage, which facilitates movement of the rollers into the guide track.

In the first phase of folding, at least one guide track ensures the position of the rod. In the second phase, the rotary stop ensures the position. In contrast, when in

the unfolding phase, firstly the rotary stop and subsequently at least one guide track ensure the position.

In the preferred arrangement, there is a lateral guide track which increases the safety of roller guidance and further improves the stability of roller movement.

From the viewpoint of ensuring power necessary to perform the folding operation, it is advantageous that the linear drive device be a linear hydraulic drive.

In the working position it is advantageous for the swivel connection of the stationary part to the linear drive device, the linear drive device to the rod, and of the swivel connection to the folding parts to be located below the swivel connection of the stable part and the folding part. This allows for stable positioning of the folding parts in the working position.

The swivel connection of the stationary part and the folding part is preferably located in the upper edge of the frame of the stationary part and in the upper edge of the frame of the folding part so that after folding the folding part by 180° the stationary part and folding part lie adjacent to each other. This enables both stable placement of the folding part in the transport position, and it minimizes the transport dimensions.

As per the invention, the biggest advantage of the device for folding the working part of an agricultural machine according to the design is that the folding mechanism does not increase clearance height of the machine frame, which allows the design of machines with larger frames, which in the transport position meet the requirements for road transport.

As per the invention, the device for folding the working part of an agricultural machine uses the force of gravity so production is simple and inexpensive, and allows, compared to known state of the art technology, achieving further reductions in dimensions for the folding of folding parts, or further increases in the working widths of machines, while maintaining favorable transport dimensions. In addition, the design of the equipment for folding contributes to increased trouble free transportability and thus increasing the overall safety of the machine.

Overview of the Figures

The invention will be further elucidated using drawings, in which Fig. 1 shows the axonometric view of the overall layout of the agricultural machine with a folding device in the working position, Fig. 2 shows a detailed axonometric view of the device for folding of of an agricultural machine in the working position, Fig. 3 shows a close-up axonometric view of a swivel connection for folding the device, Fig. 4 shows a detailed axonometric view with a partial cross-section of the folding device in a partially folded state, Fig. 5 shows a detailed frontal view in partial cross-section of the folding device in a partially folded state, Fig. 6 shows a detailed axonometric view in partial cross-section for tilting the device in a folded state, Fig. 7 shows a frontal view of the general arrangement of an agricultural machine in various stages of folding.

Example of the Performance of the Invention

The device for folding (Fig. 2, Fig. 4, Fig. 5, Fig. 6) of the working parts of an agricultural machine (Fig. 1, Fig. 7) contains two stationary parts 1 and two folding parts 2 stored in the stationary part 1, whereas the stationary part 1 and folding part 2 are connected by one swivel connection 3 stored in their outer edges. On each of the stationary parts 1 a linear drive device 5 is stored and pivotally connected to a rod 4 which is pivotally connected to the the folding part 2. The linear drive device 5 is located under the frame 12 of the stationary part 1.

The shaft 7 of the swivel connection 3 (Fig. 3) is stored in the stationary part 1, by means of plates 18 which are part of the frame 12 of the stationary part 1, and in the folding part 2 is stored by means of plates 19 which are part of the frame 16 of the folding part 2.

The rod 4, during folding or unfolding of the folding part 2, rests upon the rotary stop 6 stored in the stationary part 1. The rod 4 rests upon the rotary stop 6 for half of the folding phase of the folding part 2. In the course of counter motion, the rod 4 rests upon the rotary stop 6 for half of the folding phase of the folding part 2.

The rotary stop 6 is stored on the shaft 7 of swivel connection 3.

The swivel connection of the linear drive device 5 to the rod 4 is provided with a pair of rollers 8, which are, in the course of folding or unfolding of the folding parts 2

conducted by the lower guide track 9 and/or the upper guide track 10. The guide tracks 9,10 are located beneath the frame 12 of the stationary part 1, and contain a lateral guide track 11 and are provided with their ends tapered 17.

The linear drive device 5 is a linear hydraulic drive.

The swivel connection 13 of the stationary part 1 and the linear drive device 5, the swivel connection 14 of the linear drive device 5 to the rod 4 and the swivel connection 15 to the rod 4 to the folding part 2 are in the working position of the folding part 2 located below the swivel connection 3 of the stationary part 1 and the folding part 2.

The swivel connection 3 of the stationary part 1 and the folding part 2 is located in the upper edge of the frame 12 of the stationary part 1 and in the upper edge of the frame 16 of the folding part 2, so that after folding the folding part 2 by 180°, the stationary part 1 and the folding part 2 are lying against each other.

For transition of agricultural machinery from the working to transport position, additional folding may be required. For this, the stationary part 1 becomes movable. And then together with the folding part 2 which is lying upon it, folds onto the central section 20, thus reaching minimum transport dimensions. This folding is usually carried out by equipment for folding which is structurally different from the folding device as described by the invention.

Industrial Application

The device for folding the working parts of agricultural machinery according to the invention can be used for folding the working parts of agricultural machinery, specifically for folding the working parts of agricultural machinery for soil cultivation.

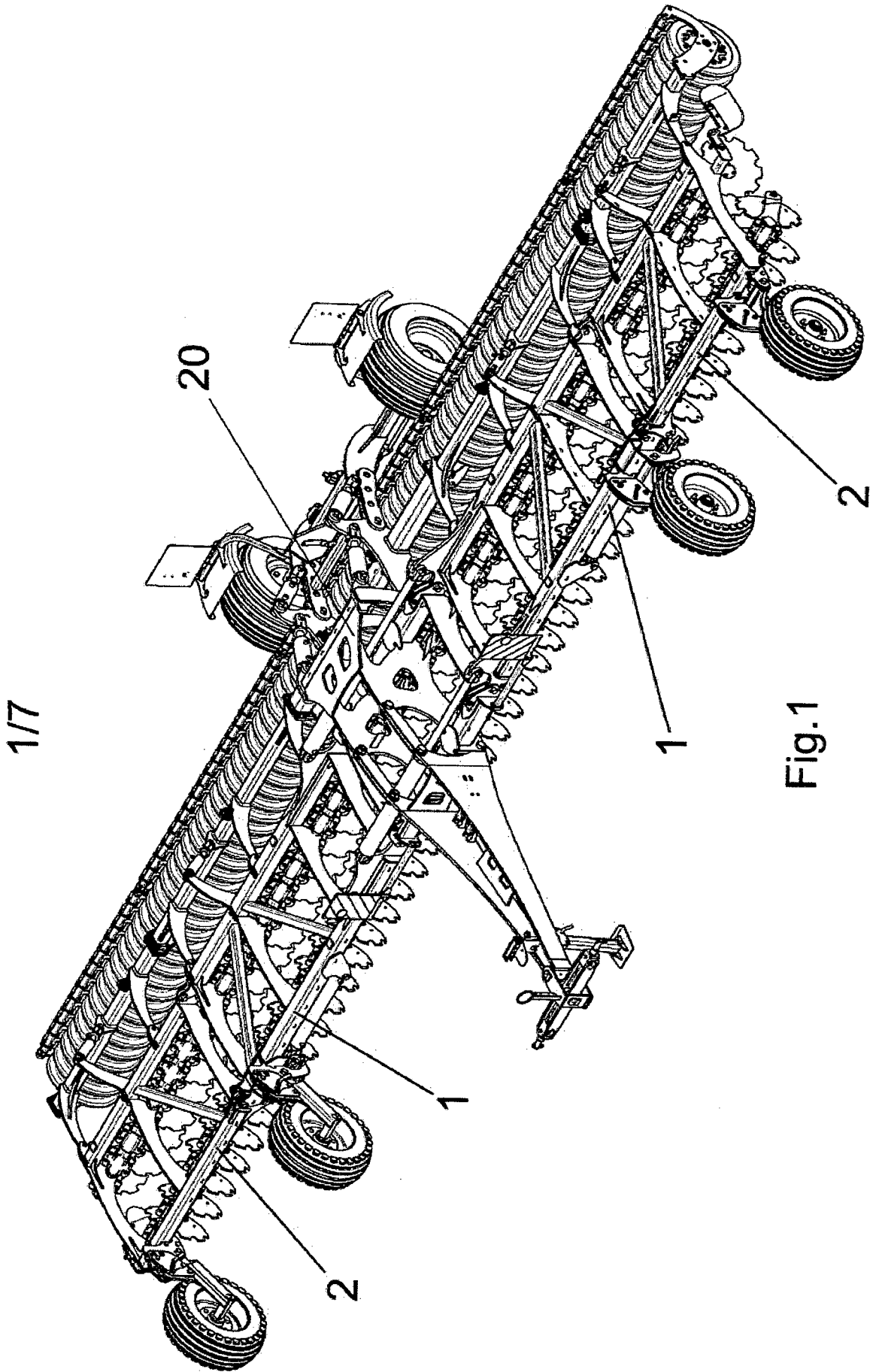
List of Reference Marks

- 1 stationary part
- 2 folding part
- 3 swivel connection I
- 4 rod
- 5 linear drive device
- 6 rotary stop
- 7 shaft
- 8 roller
- 9 lower guide track
- 10 upper guide track
- 11 lateral guide track
- 12 frame of the stationary part
- 13 swivel connection II
- 14 swivel connection III
- 15 swivel connection IV
- 16 frame of the folding part
- 17 end tapered
- 18 plate I
- 19 plate II
- 20 central section

Patent Claims

1. A device for folding the working parts of agricultural machinery, specifically a device for folding the working parts of an agricultural machine consisting of at least one stationary part (1) and at least one, swiveling in and held in the stationary part (1), folding part (2), where the stationary part (1) and the folding part (2) are connected by at least one swivel connection (3) stored in their outer edges, **characterized by** that contains within the stationary part (1) a linear drive device (5) is stored and pivotally connected by a rod (4) which is pivotally connected to the folding part (2), where the linear drive device (5) is located below the frame (12) of the stationary part (1).
2. The device for folding the working parts of an agricultural machine according to claim 1, **characterized by** that the rod (4), in the course of folding or unfolding of the folding part (2), rests upon a rotary stop (6) stored in the stationary part (1).
3. The device for folding the working parts of an agricultural machine according to claim 2, **characterized by** that the rotary stop (6) is stored on the shaft (7) of the swiveling connection (3).
4. The device for folding the working parts of an agricultural machine according to any of the preceding claims, **characterized by** that the swivel connection of the linear drive device (5) to the rod (4) is provided with at least one roller (8), which is, during folding or unfolding of the folding part (2) conducted by at least one a guide track (9,10).
5. The device for folding the working parts of an agricultural machine according to claim 4, **characterized by** that the roller (8) is, in the course of folding or unfolding of the folding part (2), guided by a lower guide track (9) and / or upper guide track (10).
6. The device for folding the working parts of an agricultural machine according to any of the preceding claims 4 and 5, **characterized by** that the guide tracks (9,10) contain a lateral track guide (11).
7. The device for folding the working parts of an agricultural machine according to any of the preceding claims, **characterized by** that the linear drive device (5) is a linear hydraulic drive.

8. The device for folding the working parts of an agricultural machine according to any of the preceding claims, **characterized by** that the swivel connection (13) of the stationary part (1) and the linear drive device (5), the swivel connection (14) of the linear drive device (5) and the rod (4) and the swivel connection (15) and the rod (4) and the folding part (2) are, in the working position of the folding part (2), located below the swivel connection (3) the stationary part (1) and the folding part (2).
9. The device for folding the working parts of an agricultural machine according to any of the preceding claims, **characterized by** that the swivel connection (3) of the stationary part (1) and the folding part (2) are located in the upper edge of the frame (12) of the stationary part (1) and the upper edge of the frame (16) of the folding part (2) so that after folding the folding part (2) by 180°, the stationary part (1) and the folding part (2) lie adjacent to each other.



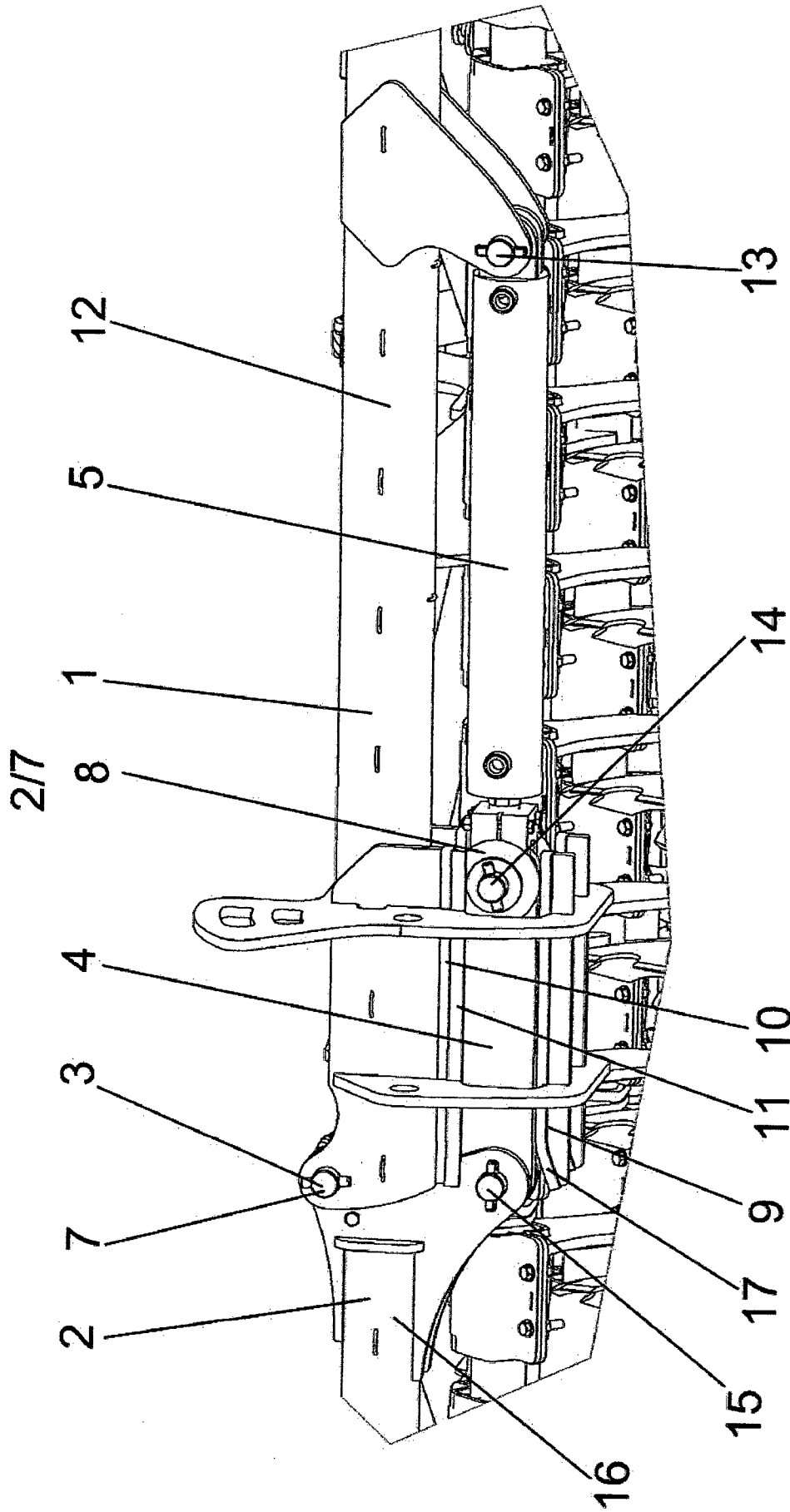


Fig.2

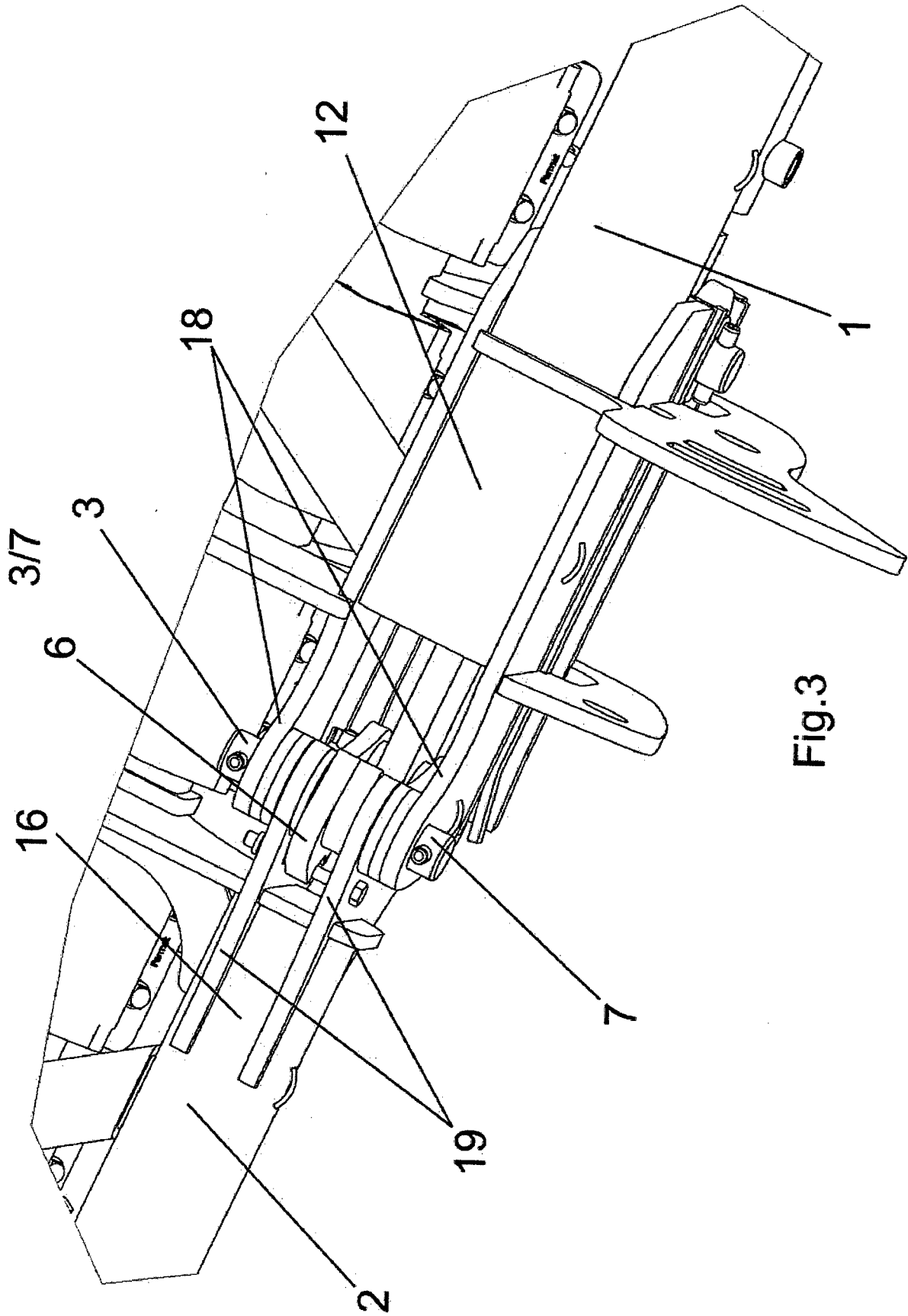


Fig.3

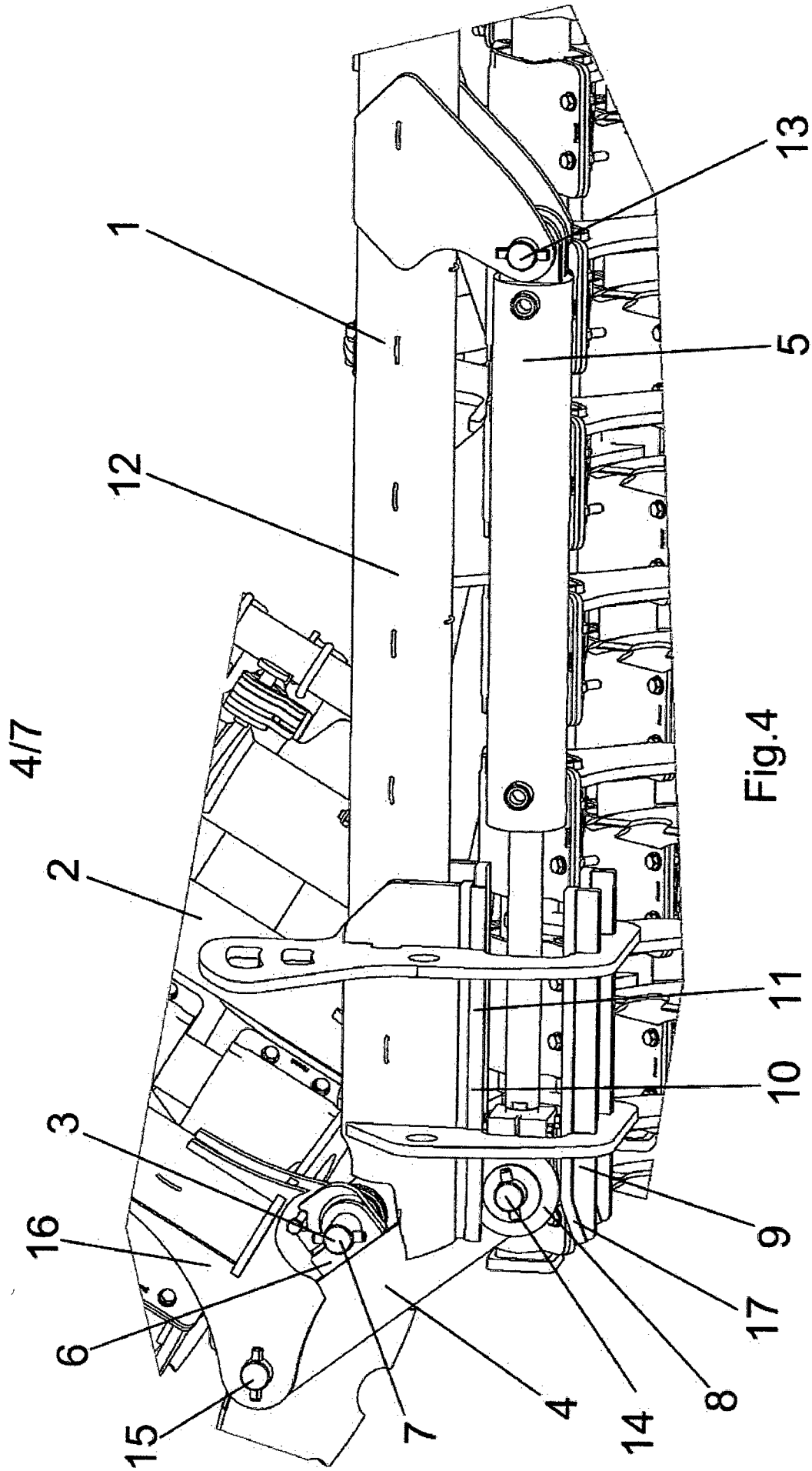
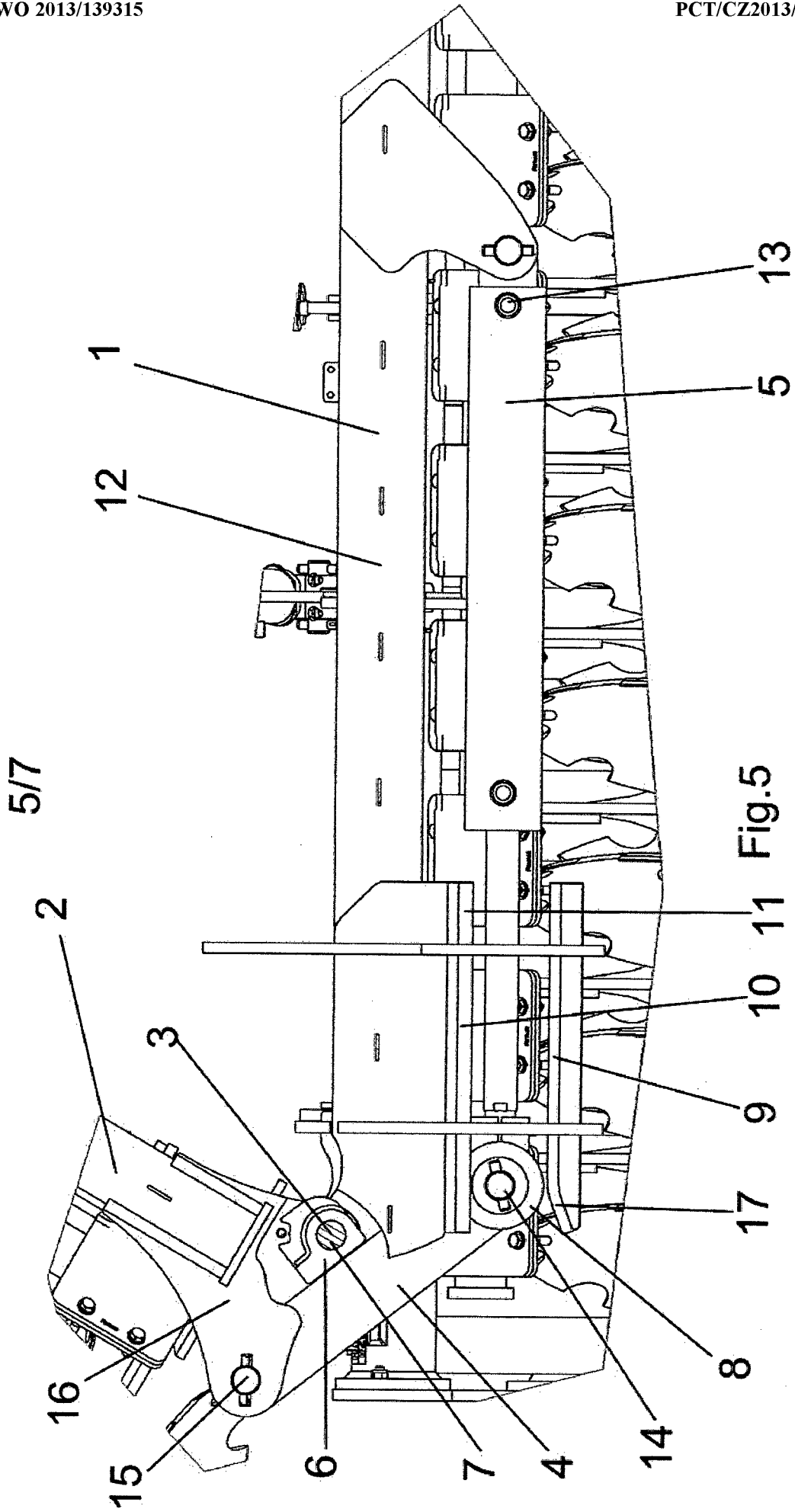
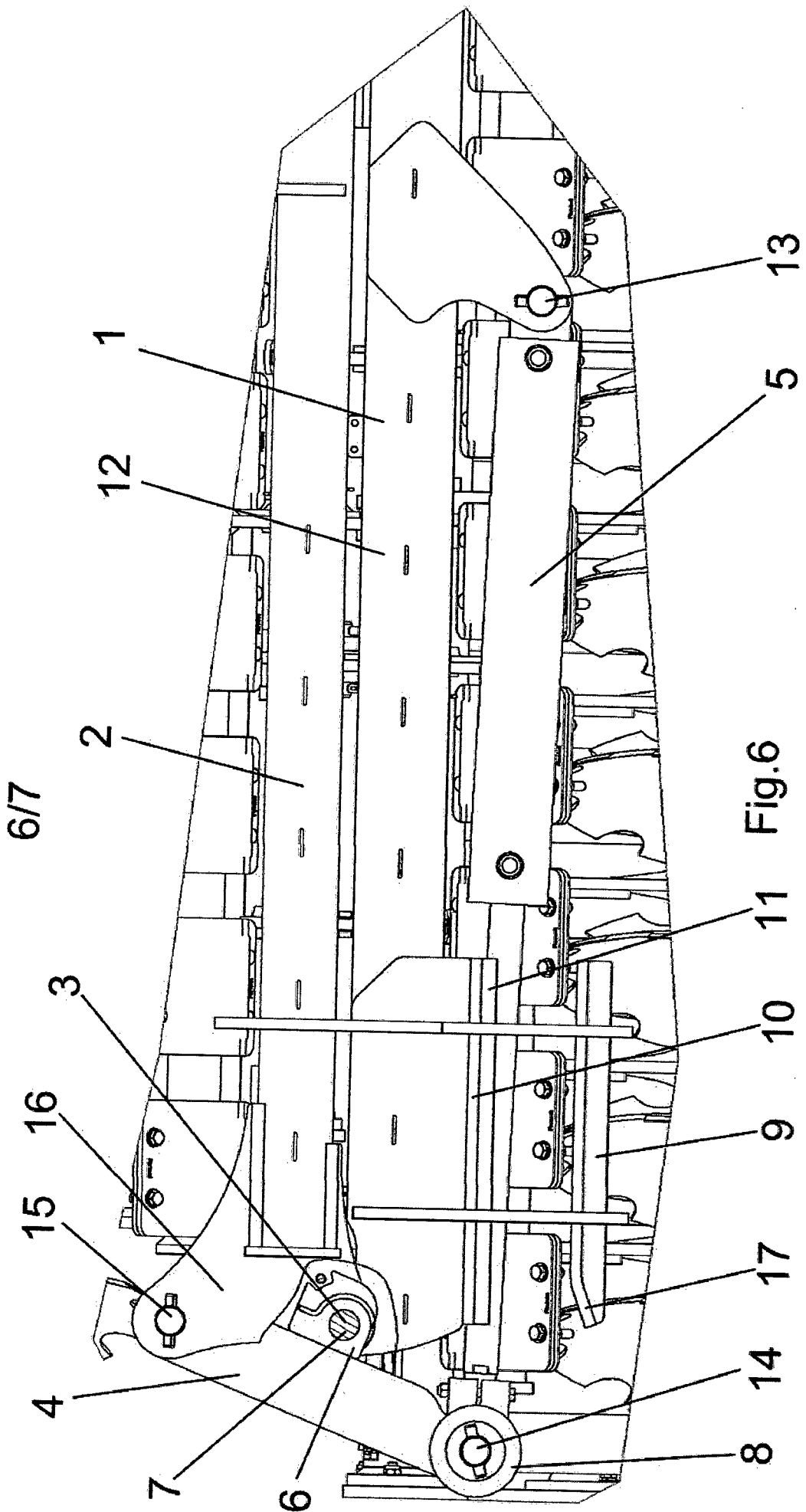


Fig.4





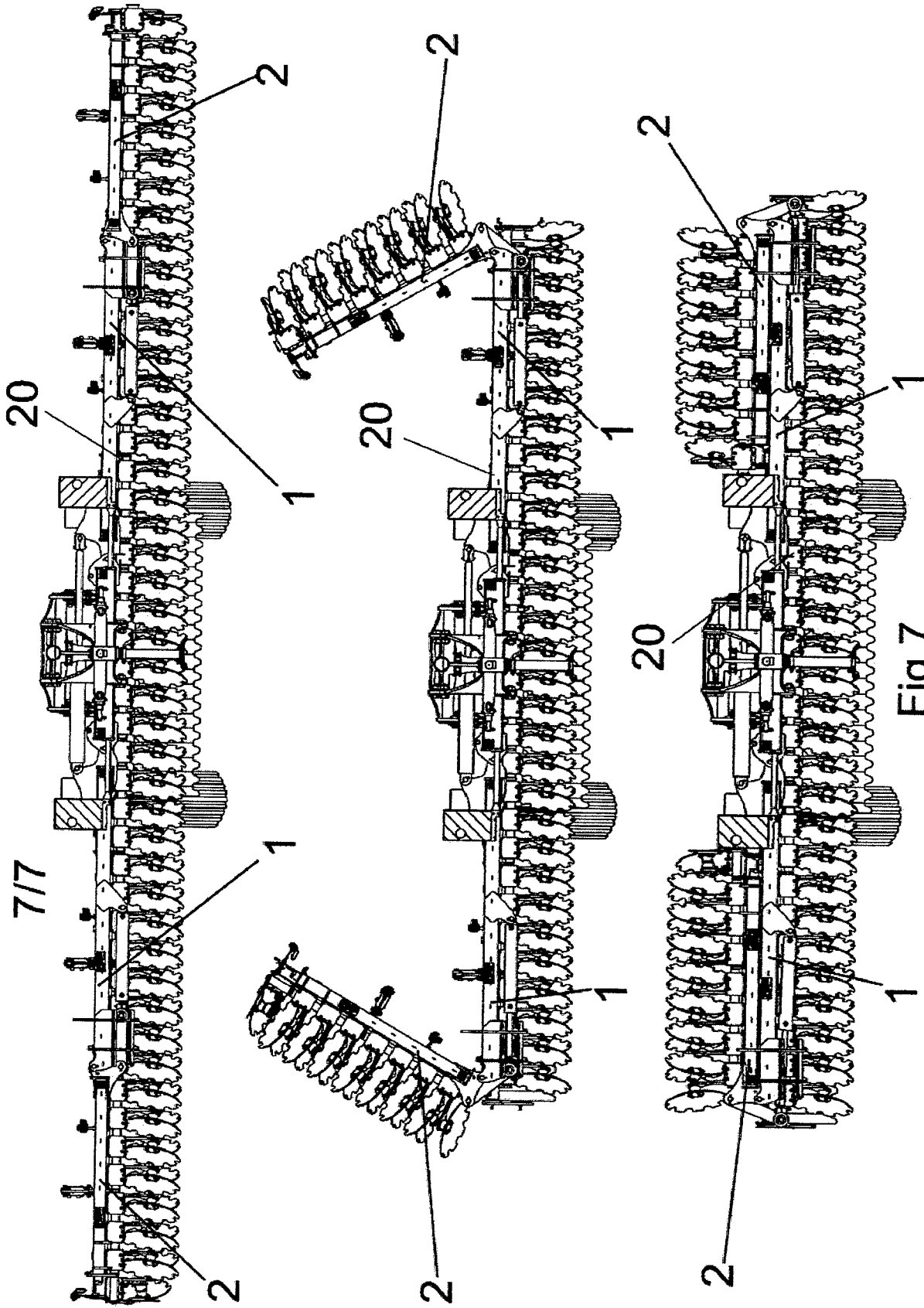


Fig.7

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2013/000039

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01B73/04
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	US 3 944 001 A (WARNER WILLIAM ET AL) 16 March 1976 (1976-03-16)	1,2,7-9
Y	abstract column 3, lines 14-18,46-54 column 4, line 25 - line 44 claims; figures	3-6
Y	----- US 4 453 601 A (ORTHMAN HENRY K [US] ET AL) 12 June 1984 (1984-06-12)	3-6
A	abstract column 3, line 31 - line 68 column 4, line 1 - line 35 claims; figures	1,2,7-9
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"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</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 19 June 2013	Date of mailing of the international search report 28/06/2013
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Oltra García, R
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INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2013/000039

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 271 711 A (VAVRA GARY J) 9 June 1981 (1981-06-09) abstract column 2, line 14 - line 62 claims; figures	1-3,7-9
A	----- US 4 418 763 A (BOETTO CHARLES [US]) 6 December 1983 (1983-12-06) abstract column 3, line 19 - line 44 claims; figures -----	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2013/000039

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3944001	A	16-03-1976	NONE
US 4453601	A	12-06-1984	NONE
US 4271711	A	09-06-1981	CA 1122471 A1 27-04-1982 US 4271711 A 09-06-1981
US 4418763	A	06-12-1983	NONE