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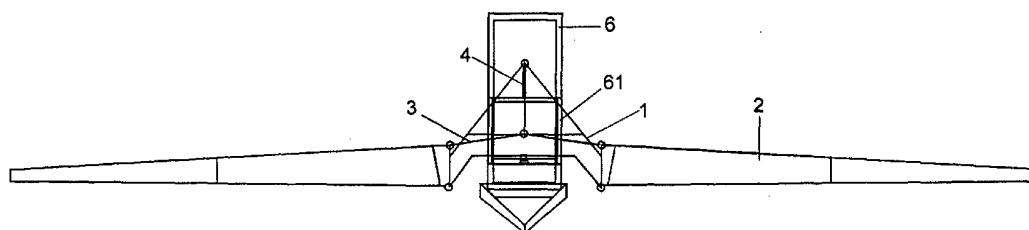
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(54) Title: IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTO-  
GRAPHIC SYSTEM



(57) Abstract: This invention refers to a novel agricultural defense and fertilizer pulverizing machine mounted on a tractor-powered trailer and provided with a pantographic and pendular articulated system that maintains pulverizing bars stable and parallel to the ground even in sloped and/or irregular terrain. The machine comprehends a central frame of the bar (1) oscillating through a pin (5) in the bar height set frame (61) that slides onto the tower (6) fixed in the machine frame, with the lower vertices for the pulverizing lateral arms (2) pivoted on the central frame (1), while the upper vertices of the arms (2) are articulated through stems (3) that, in their turn, are united and pivoted on the plunger of a hydraulic cylinder (4), also pivoting on the upper vertex of the frame (1). The rod (11) of the machine trailer has a connector (10) that has a ball joint (12) for connection through a pin in tractor's traction bar, a central bushing (13) for free rotation and a vertical pin (14) with bushing (15) for offsetting the oscillating movement that is transferred to pulverizing arms' ends (2).

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**“IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTOGRAPHIC SYSTEM”.**

This invention refers to a novel agricultural defense and fertilizer pulverizing machine mounted on a tractor-powered trailer and provided with a pantographic and pendular articulated system that maintains pulverizing bars stable and parallel to the ground even in sloped and/or irregular terrain.

The flood-irrigated rice farming requires the systematization or mud-walling, which are low height terraces enough leveled and near each other for maintaining a continued ground water throughout soil surface that, depending on declivity, shall be the distance between them.

The pulverization of agricultural defenses made before flooding requires the uniformity of the drop amount per applied and aspersed area at an optimum height from the ground, in order that they reach the target (invading grass, insects, funguses or the very soil).

Pulverizers are equipment coupled to tractors and intended for aspersing liquid agricultural defenses on farming, such as herbicides, insecticides, and fungicides. Pulverizers are also employed for aspersing liquid fertilizers, for instance, urea. Basically, a pulverizer is formed by a reservoir, a pump and a pulverizing bar located on the rear of the pulverizing machine, behind the defense reservoir. The pulverizing bars have a trussed structure supporting a long length horizontal piping that may exceed 40m, depending on terrain conditions and culture type. The bars are arranged crosswise machine course, so as to form swinging arms at the both sides. Along the piping, on a spaced and regular basis, aspersing nozzles are distributed so as to uniformly distribute the agricultural defense on the farming. Nozzles' height is also important, in order to avoid problems related to defense derivation, that is, the deviation caused by the wind. Arms' trussed structure should be articulated so as to allow them to be guarded alongside the machine when they are not in use, making possible its passage through doors and parking inside sheds.

Conventional tractor-powered drag pulverizers have, because of land irregularity, particularly in rice farming, the following problems:

- difficulty in maintaining the arms forming the pulverizing bar parallel to the

ground and at the minimum recommended height in relation to the adopted  
aspersing nozzle, without requiring operator interference, mainly in plan and  
laterally sloped terrain once the arm, on the ascending side, tends to touch the  
ground, while, at the descending side, it is quite apart from the ground, so as  
5 that both situations are undesirable, because in the first one the jets cover a  
smaller area and in the second one derivation occurs because of the wind;

- occurrence of disordered advances and retreats with pulverizing bar ends  
causing a defense non-uniform application, the so-called repassage, which is  
the effect of machine passing with only one wheel on mud-wall, terraces or  
10 trenches;
- difficulty in the application visual control for avoiding superposition or failure in  
applying the defense because of the pulverizing bar being located on machine  
rear portion, distant from the operators, and partially obstructed by the  
reservoir.

15 Some pulverizers already have a pendulum device that causes the  
entire bar to centrally pivot on machine connecting support. However, the  
pendulum acts on the entire bar, generating very high moments in the view of its  
long length, the inertia of which creates a dwelling in position correction. On the  
other hand, the pendulum also does not solve the problem arising out of the  
20 laterally sloped terrain, which requires the adoption of feeling stems or the  
correction through the hydraulic system that inclines the pulverizing bar as a  
whole, under operator's control. The problem related to the agricultural defense  
application repassage, caused by the passing of one of the wheels on some  
terrain depression or prominence, which generates a torsion effect to the bar,  
25 causing its ends to accelerate on a disordered basis, is likewise not solved by the  
simple pendulum.

The purpose of this invention is the improvement developed in a  
pulverizing machine capable of solving, on an effectively basis, the  
aforementioned problems found in the state of the art. The machine of the  
30 invention comprehends a set of solutions intended to keep the pulverizing bar  
stable and at an optimum set height. It is obtained through a pantographic and  
pendular system that comprises one central bar frame where the lateral articulated

arm bases are pivoted, with the central frame oscillating through a pin in a height set frame, which vertically slides onto a fixed tower on the pulverizing machine frame. On the top, the arms are articulated through stems (connecting rods) that, in their turn, are united and pivoted on the plunger of a hydraulic cylinder, also pivoting on the central frame. A trailer rod connector for the pulverizing machine offsetting the lateral oscillating movement caused by tractor traveling complements the improvement. Rubber stoppers positioned between the central frame of the bar and the height set sliding frame cushions the movement arising out of arms' lateral oscillations. The arrangement of the pulverizing bar in front of the machine promptly upon the tractor, and, therefore, near the tractor operator, improves its visual control.

The improvement of the pulverizing machine subject matter of the invention results in the following advantages on other designs of the state of the art:

- a) in the case of machine lateral inclination caused by terrain declivity, the pantographic system acts keeping arms parallel to the ground;
- b) the pendular system vertically oscillates on irregular terrain pursuant to the machine movement, causing arms' extremities to keep balanced and stable;
- c) the hydraulic cylinder acts as a pendulum, not transferring to the bars the vertical oscillation resulting from machine frame inclination when it overcomes any obstacle (mud-walls, terraces, depressions etc.);
- d) the hydraulic cylinder also performs the function of suspending pulverizing bar ends, if required;
- e) the pulverizing bar may be raised on a levelly basis through a height set frame, which vertically slides onto a fixed tower on pulverizing machine frame;
- f) rubber stoppers, which cushion lateral arm oscillations, are positioned between the central frame of the bar and the height set sliding frame;
- g) the machine frame rod is provided with an oscillating movement connection that offsets the lateral oscillation transferred by the tractor;
- h) the pulverizing bar is positioned at the trailer front portion and near the operator, making its visual control easier.

The improvement in pulverizing bar of the invention may be better

comprehended through the following detailed description, which is based on the attached drawings listed below, which illustrate a preferred embodiment that should not be deemed as to limit the invention, where:

5 Figure 1 - schematic front drawing of a machine of the state of the art with a simple pendular system;

Figure 2 - front breakdown drawing of the invention pendular pantographic system;

Figure 3 - front drawing of the invention system operating in a sloped terrain;

Figures 4 and 5 - front and upper drawings of the invention pantographic system;

Figure 6 - front schematic drawing of the invention system in the raising function;

10 Figure 7 - front schematic drawing of the invention system in the pendulum function;

Figures 8 and 9 - front schematic views of the invention system subjected to lateral machine inclinations due to ground irregularities;

15 Figures 10 and 11 - front drawings of invention system simulation subjected to small and big ground irregularities, respectively;

Figure 12 - upper drawing of the machine with trailer provided with tandem wheels;

Figure 13 - upper drawing of the machine rod connection system in different situations;

Figure 14 - upper drawing detailing the central frame of the bar;

20 Figures 15 and 16 - front drawings of the machine illustrating bar elevations.

Figure 1 illustrates a conventional pulverizing machine with simple pendular system that causes the entire bar to centrally pivot on machine connection support. Moreover, the simple pendulum acts in relation to the whole bar, generating quite high moments because of bar long length, the inertia of which creates a retard in position correction. In such simply pendular system the bar remains suspended by rods on the height set tower on a sliding frame, it keeping relatively self-stable, although on a horizontal basis, regardless of ground lateral sloping, requiring therefore height corrections for the ends through a tractor operator interference. Such system tends to keep bar in a horizontal position, regardless of ground declivity.

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Figure 2 illustrates the pulverizing machine of the invention that comprehends a structure divided into the following basic components: one frame

(1) fixed on an oscillating basis to the machine trailer frame (illustrated in Figures 5 and 12), where the lower vertices of the lateral articulated arms (2) are pivoted. On the top, the arms (2) are articulated through stems (3) that, in their turn, are united and pivoted on the plunger of a hydraulic cylinder (4), also pivoting in relation to the frame top vertex. Such system, when the cylinder (4) is not active, causes a simple pendulum effect, but when the cylinder (4) is active, it operates as a settable pantograph.

Figure 3 illustrates the pulverizing machine of the invention with pantographic and pendular system, the bar (2) lateral sections of which are kept pivoted on the frame (1), on a equilibrated basis, through their bases, and interconnected among each other in top vertices by their stems (3), which, in their turn, are articulated in a pivoting element (4) on the top of the frame (1). In such system, the bar (2) remains automatically parallel to the ground, even on laterally sloped terrain. Said element is a two-function hydraulic cylinder (4): when it is shut, it suspends the bar ends (2), see figure 6, and when it is opened, it serves as a pendulum (figure 7).

Figures 4 and 5 illustrate a preferred embodiment for the invention where the frame (1) oscillating through a pin (5) at machine trailer frame tower (6) may be observed. Rubber stoppers (7) are placed between the central frame of the bar (1) and the bar height set frame, in order that they can cushion the lateral oscillating movement projected by the arms (2), better detailed in figure 12.

Figures 8 e 9 detail the system acting as a pendulum, so as to correct bar (2) position when the frame (1) is leaned to the left or right, respectively, due to some irregularity on the ground. Figure 10 simulates such vertical oscillations caused by sped and ground irregularities, resulting in a relative stability of arm ends (2), by inertia.

Figure 11 simulates arms (2) oscillations upon machine passage on a mud-wall or terrace.

Figure 12 shows the pulverizing machine mounted on a trailer with a tandem-type traction system, which is the subject matter of the letters patent number PI 9202896-9. The bar (1) central frame pivots through a pin (5) at the tower (6) fixed to the machine trailer frame. The rubber stoppers (7) are placed

between the central bar (1) and machine tower (6), in order to cushion the lateral movements transmitted by the arms (2).

The pulverizing bar (2) is pivoted on the frame (1), which, in its turn, is mounted, on an oscillating basis, at machine frame tower (6) in front of the defense tank (8) and right behind the tractor (not illustrated) for an operator's better visual control, avoiding thereby a pulverizing superposition and making possible the check of an eventual obstruction of any aspersing nozzle. In being located between the machine (9) and the tractor's wheel set, the bar (2) is in the center of a tandem, place knowingly having the lowest height oscillation in connection with the ground. It is also observed on the rod front-end (11) a connector (10) for coupling the tractor machine.

Figure 14 individually shows the central frame of the bar (1), pivoting through the pin (5) in the bar height set frame (61) that vertically slides onto the tower (6). The rubber stoppers (7) are placed between the central frame (1) and the bar height set frame (61).

Figures 15 and 16 exemplify extreme height positions of the central bar (1) due to the elevation or retreat of the height set frame (61) in the tower (6) fixed in the frame.

Figure 13 details such connector (10) that has a ball joint (12) for connection through a pin in the tractor traction bar, a central bushing (13) for free rotation and a vertical pin (14) with bushing (15). When the tractor and pulverizing machine set pass by a mud-wall or terrace on a crosswise basis, an oscillating movement is generated in the traction bar, which is transferred to arms' ends (2). Such undesired movement is offset by the connector (10), if it is provided with articulation in accordance with a vertical axle.

## CLAIMS

### **1 - "IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTOGRAPHIC SYSTEM"**

characterized by comprehending a central frame of the bar (1) oscillating through a pin (5) in the bar height set frame (61) that slides onto the tower (6) fixed in machine frame, with the lower vertices of the lateral pulverizing arms (2) pivoted on the central frame (1) while the upper vertices of the arms (2) are articulated through stems (3) that, in their turn, are united and pivoted on the plunger of a hydraulic cylinder (4), also pivoting on the frame upper vertex (1).

### **2 - "IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTOGRAPHIC SYSTEM"**

in accordance with claim 1, characterized by having rubber stoppers (7) placed between the central frame (1) and the height set frame (61), which slides onto the tower fixed on machine frame (6), cushioning the lateral movements transmitted by the arms (2).

### **3 - "IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTOGRAPHIC SYSTEM"**

in accordance with claim 1, characterized by having a pulverizing bar (2) pivoted on the frame (1) mounted in front of the defense tank (8) and right behind the tractor, between machine's and tractor's wheel set (9).

### **4 - "IMPROVEMENT IN PULVERIZING MACHINES WITH BARS ARTICULATED THROUGH PENDULAR PANTOGRAPHIC SYSTEM"**

in accordance with claim 3, characterized by having, in the rod (11) of the machine trailer, a connector (10) that has a ball joint (12) for connection through a pin in the tractor's traction bar, a central bushing (13) for free rotation and a vertical pin (14) with bushing (15) for offsetting the oscillating movement that is transferred to the ends of the pulverizing arms (2).



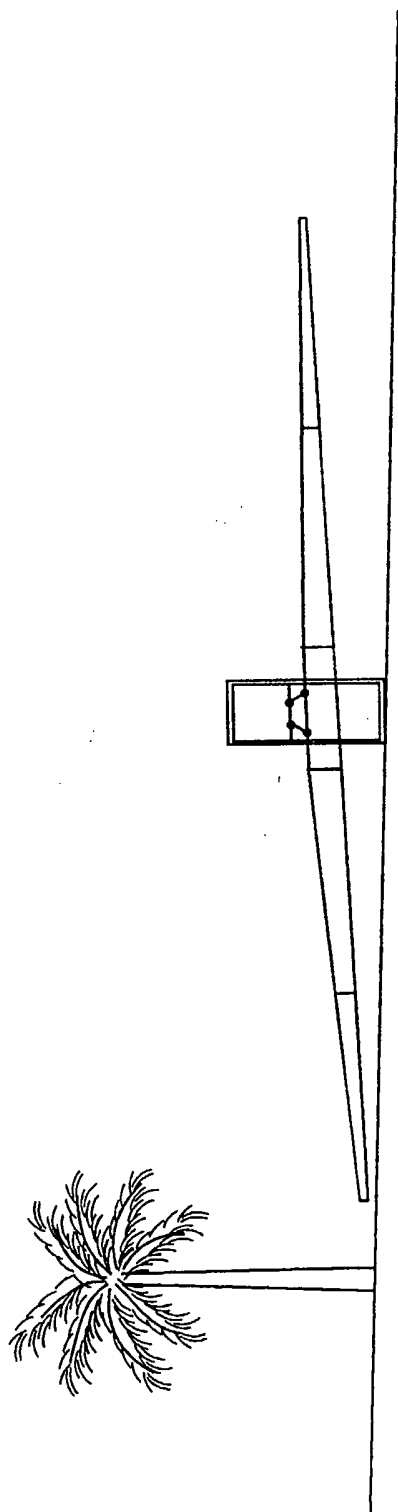


FIG. 1

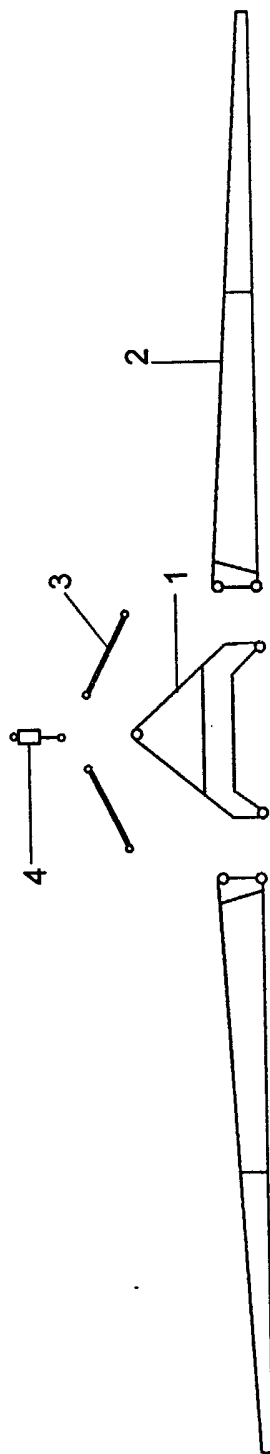


FIG. 2

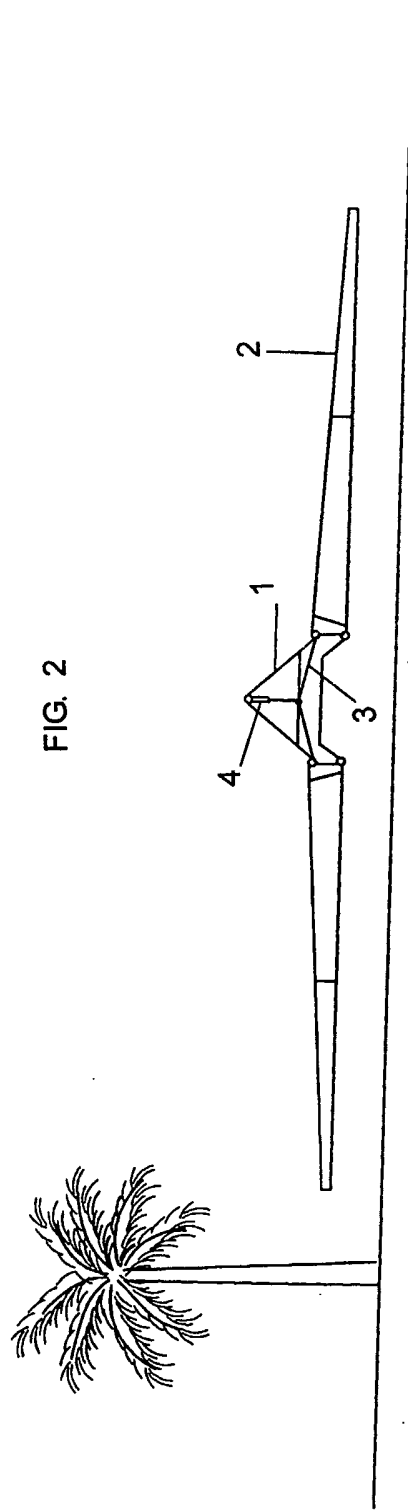


FIG. 3

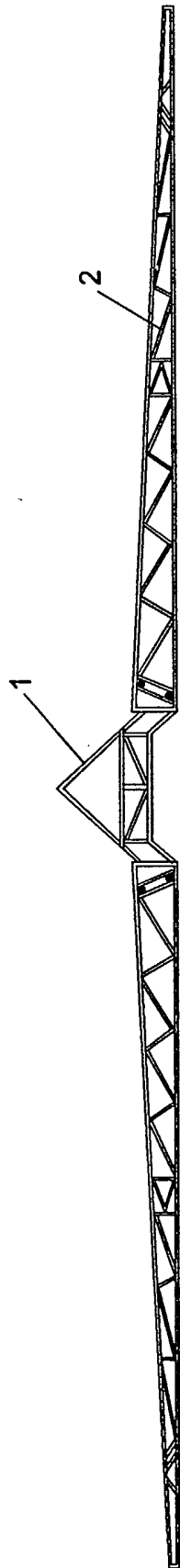


FIG. 4

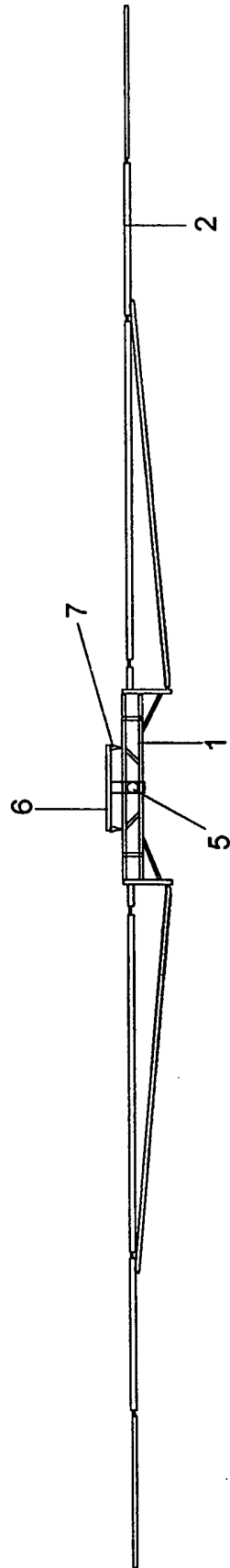


FIG. 5

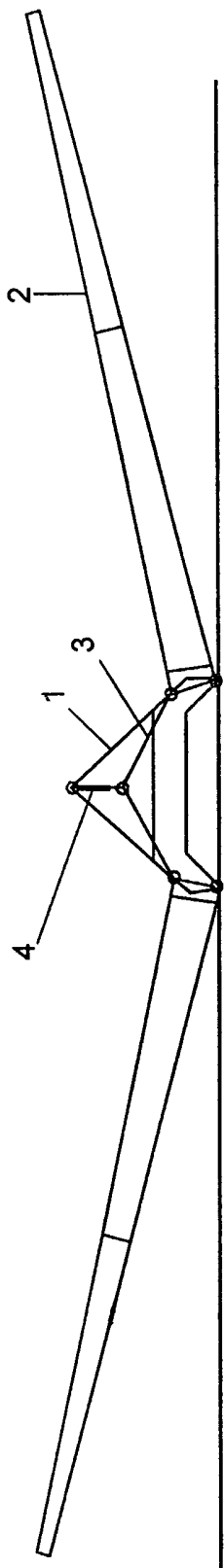


FIG. 6

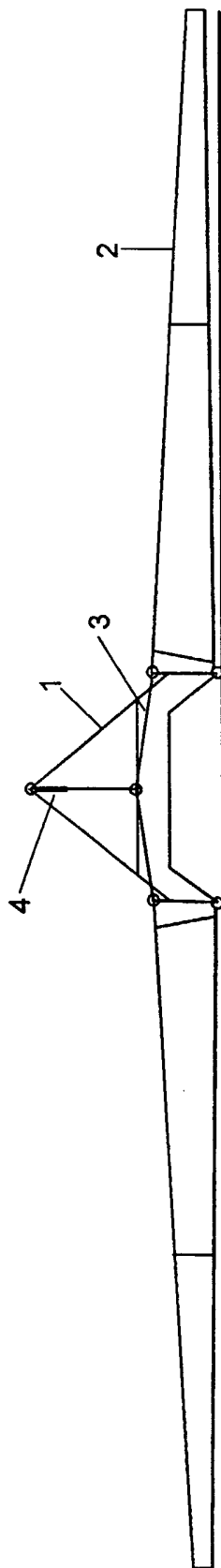


FIG. 7

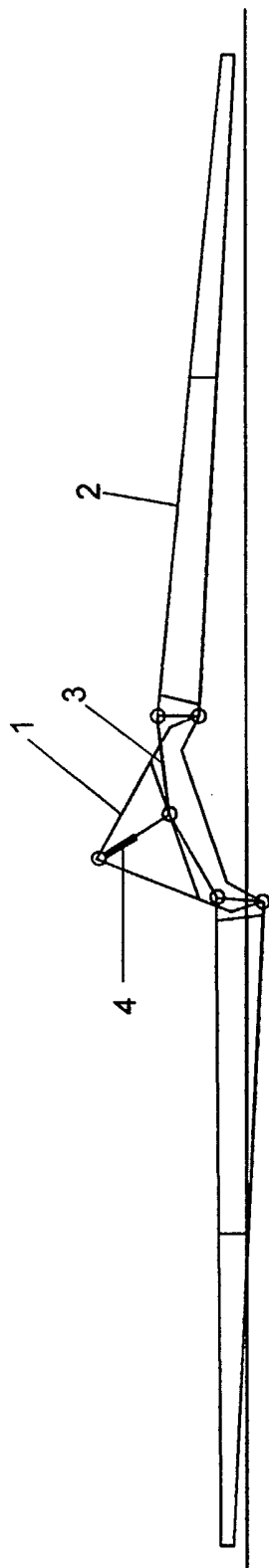


FIG. 8

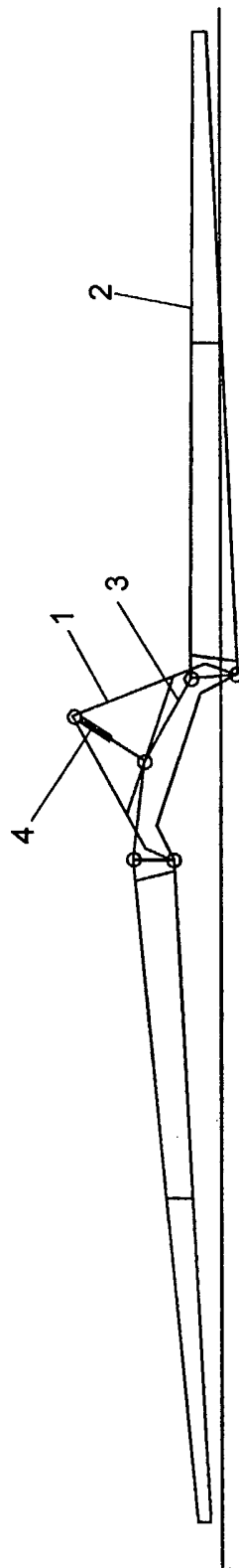


FIG. 9

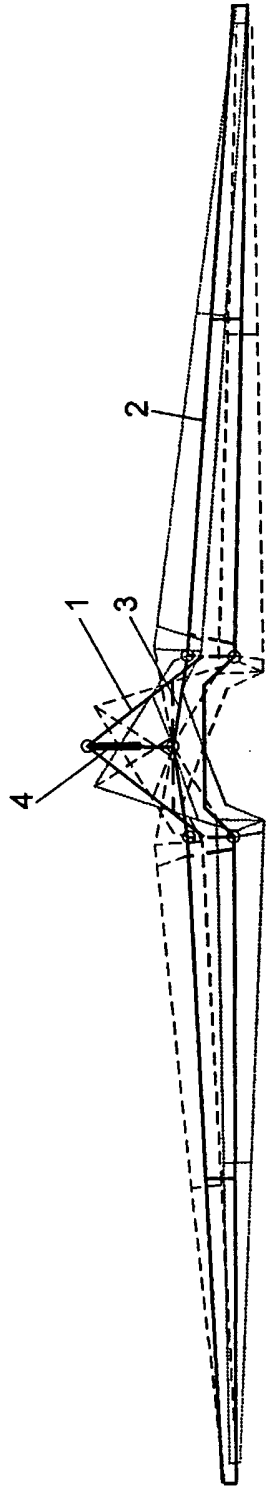


FIG. 10

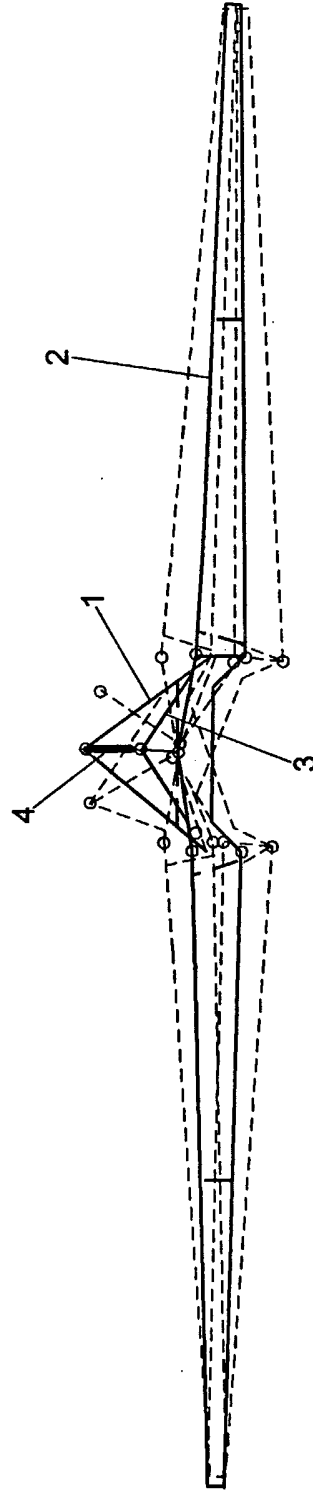


FIG. 11

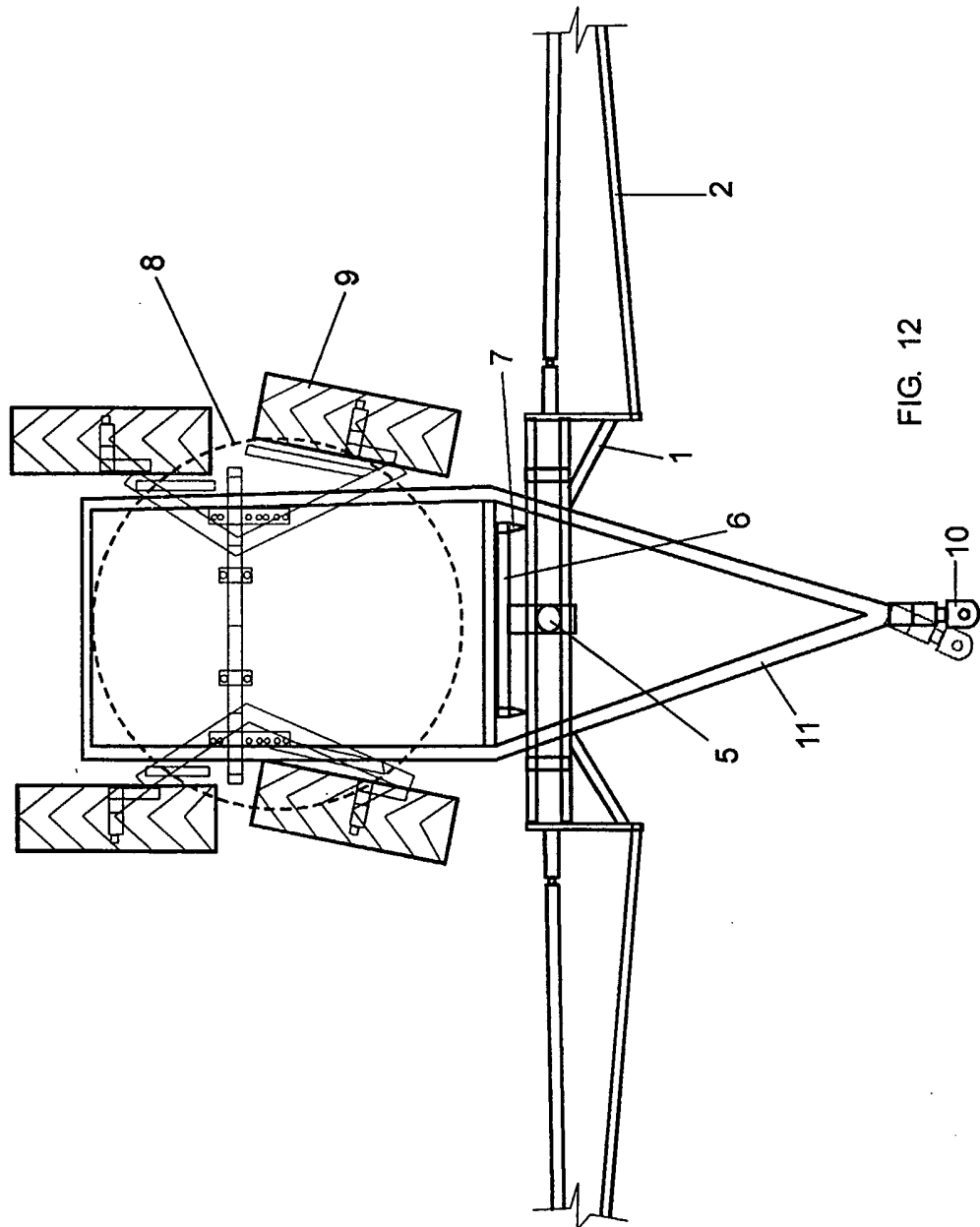


FIG. 12

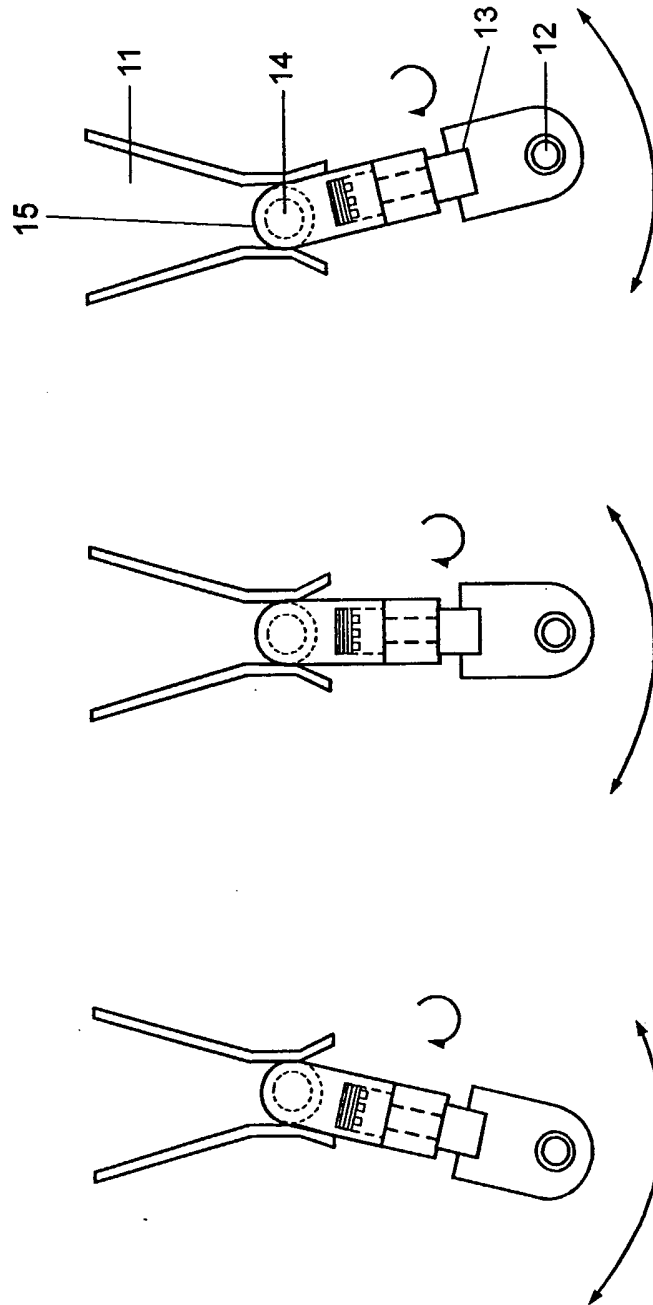


FIG. 13

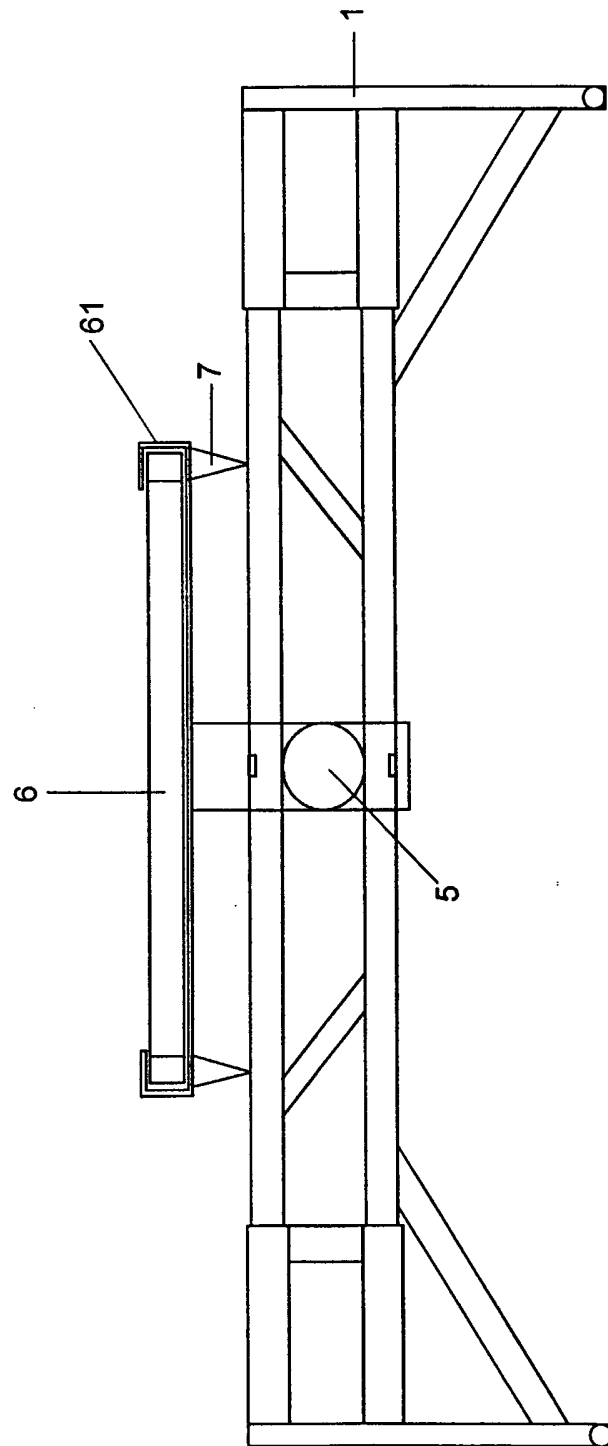


FIG. 14



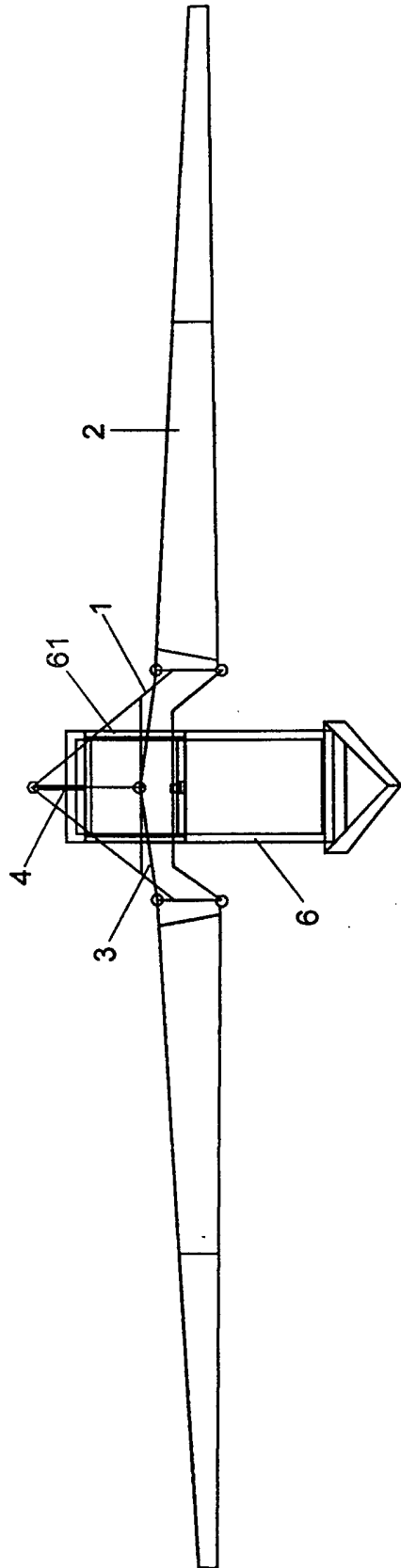


FIG. 15

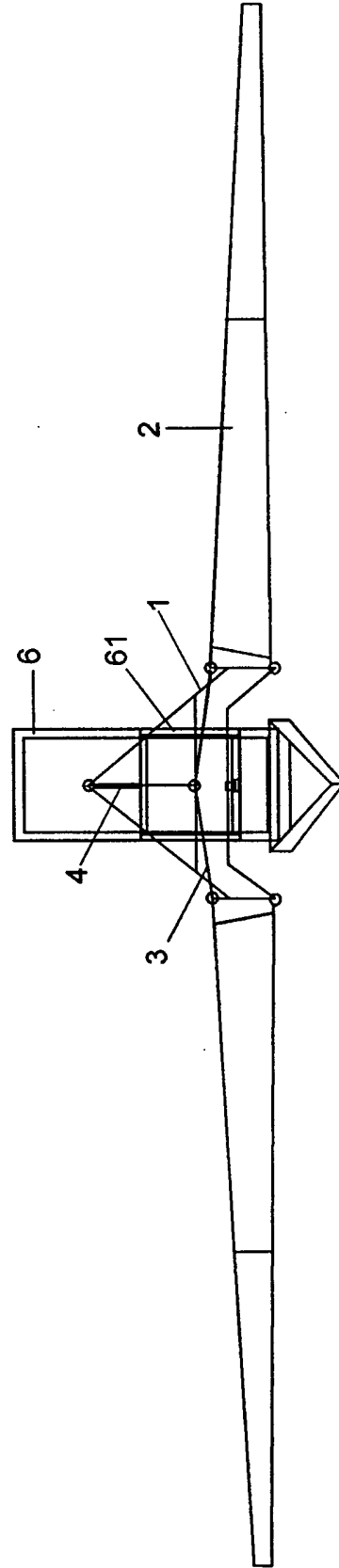


FIG. 16

# INTERNATIONAL SEARCH REPORT

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PCT/BR 2004/000245

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC <sup>7</sup> : A01C 15/00, 23/00 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC <sup>7</sup> : 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) EPODOC; PAJ; WPI		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3203210 C1 (CONSTRUCTIEWERKHUIZEN ALLAEYS N.V.) 9 December 1982 (09.12.1982) <i>abstract, figures 1-3a.</i>	1, 3
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A	US 4441655 A (BLUMHARDT) 10 April 1984 (10.04.1984) <i>abstract, figure.</i>	1
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A	DE 3938867 A1 (AMAZONEN-WERKE DREYER H) 29 May 1991 (29.05.1991) <i>abstract, figures 1-9.</i>	1, 3
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<input type="checkbox"/> Further documents are listed in the continuation of Box C. <span style="margin-left: 100px;"><input checked="" type="checkbox"/> See patent family annex.</span>		
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Name and mailing address of the ISA/ AT <b>Austrian Patent Office</b> Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24 / 535		Authorized officer RIEMANN B. Telephone No. +43 / 1 / 534 24 / 363

# INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report			Publication date	Patent family member(s)			Publication date
DE A	3203210			US A	4728038		1988-03-01
				DK A	441683		1983-09-27
				ES A1	8400219		1984-01-16
				CA A1	1196610		1985-11-12
				WO A1	8302544		1983-08-04
				EP A1	0100342		1984-02-15
DE A1	3938867		1991-05-29	CS A3	9005730		1992-04-15
				EP A1	0429934		1991-06-05
				HU A2	59554		1992-06-29
US A	4441655		1984-04-10	CA A1	1188660		1985-06-11