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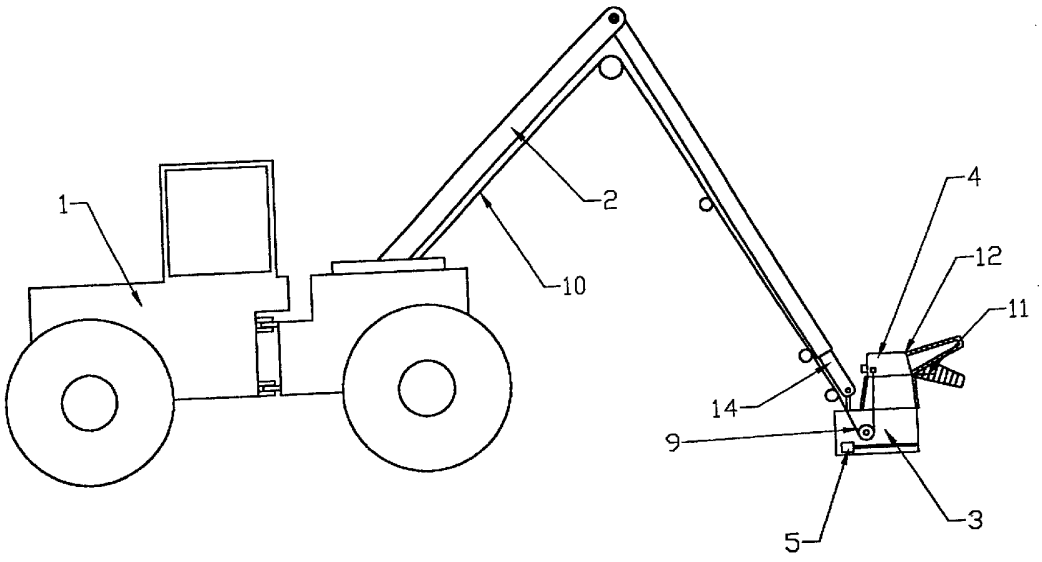
(54) Title: DELIMBING APPARATUS



(57) Abstract: A delimbing apparatus for the delimbing of trees, which can be connected to a moving vehicle via a boom system, said apparatus comprising a frame part (3) and a delimbing head (4). The frame part (3) is provided with gripping elements (15), by means of which it is fastened against the trunk of the tree at a desired height for the time of the delimbing work. The apparatus comprises a delimbing head (4) which is separate from the frame part and is provided with a gripping device (12) by means of which it grips the trunk of the tree and is moved by drive means (13) along the tree trunk, and at least one delimbing cutter (11) and a feed and control cable (10) for transmitting operating power, connected between teh delimbing head (4) moving along the trunk of the tree and the frame part (3).

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DELIMBING APPARATUS

The present invention relates to a delimbing apparatus as defined in the preamble of claim 1 for the delimbing of trees.

Today, harvester heads are known that can be connected to a forestry machine, by means of which trees are felled, delimbed and cut into pieces of desired length in one operation in the forest. This type of harvester heads are thus only applicable for the felling of trees and subsequent handling of logs.

The object of the invention is to achieve a completely new type of delimbing apparatus that is applicable for pre-delimbing desired parts of living standing trees and, when necessary, also for thinning and felling.

It is also an object of the invention to achieve an apparatus for producing high-quality forest, by means of which trees can be delimbed while they are still alive, by removing dried-up and otherwise unviable branches from the trees during their growth period, thus producing wood that is excellently suited for use as raw material in wood industry.

The delimbing apparatus of the invention uses a separate delimbing device that, driven by a drive mechanism, is able to climb up the clear trunk of a tree and cut off twigs and branches encountered and, when necessary, also to fell the tree in given lengths from above or to cut it as a trunk from the base.

The details of the features characteristic of the delimbing apparatus of the invention are presented in the claims below.

In the following, the invention will be described in detail by the aid of an example with reference to the attached drawings, wherein

Fig. 1 presents a delimbing apparatus according to the invention, fitted on a forestry machine,

Fig. 2 presents the delimbing apparatus of the invention fitted on forestry machine, delimbing a standing tree,

Fig. 3 presents the delimbing head in side view,

Fig. 4 presents the frame part and the delimbing head with a rotating upper cutter, ready to cut off the top of a tree,

Fig. 5 presents the frame part and the delimbing head with the rotating upper cutter in a position for cutting heavy branches, and

Fig. 6 presents the frame part and the delimbing head with the rotating upper cutter in rest position.

Fig. 1 and 2 present a delimbing apparatus used for the delimbing of standing trees 0 and designed to be mounted on a driving carrier 1, which may be a forestry machine moving on wheels or caterpillar chains, e.g. a forest tractor, or even an agricultural tractor, a garden tractor, a snow sledge or a corresponding forest vehicle. The delimbing apparatus is attached to a forestry machine via a boom system 2, which is an A-shaped fully rotatable feeble-constructed mechanism provided with additional extensions 14 reaching to a large distance.

The delimbing apparatus comprises a frame part 3 pivotally connected to the boom system. Connected to the frame part is a multi-function flexible hose system 10 for the transmission of operating power. Using a double cable reel 9 provided in the frame part 3, the hose system is also extended to the separate delimbing head 4 which climbs up the trunk of the tree 0, so that the cable follows the trunk from the reel and its length is automatically adjusted between the frame part 3 and the delimbing head 4. The frame part is provided with a cutter 5, by means of which trees can also be felled/thinned, and jaws 15 that keep the frame part immovable during the delimbing and possible cutting. The jaws 15 are also applicable for removal of the trunk cut off, e.g. when the trunks are loaded onto a load carrier following the forestry machine. The frame part 3 of the delimbing head is connected to the boom system via a swivel joint that allows the frame part to be turned in a desired direction, which makes it easier to delimb trees standing close by each other side by side and one behind the other without moving the vehicle.

The delimbing head 4 engages the living standing tree 0 by means of edged laminae 11 that are tightened around the trunk by means of an accordion-type

tightening device 12. In addition to the edged laminae, the delimbing head 4 may also be provided with a device for sawing large branches, such as a circular saw, which is used when necessary. The delimbing head 4 moves up and down along the trunk by means of inclinable toothed gears 13 (Fig. 3 – 6), which are rotated by drive motors and which, actuated by the accordion-type tightening device, bite into the bark of the tree and, if necessary, into the trunk. The power source of the delimbing head may consist of a hydraulic, pneumatic or electric drive and an electronic control unit or a combination of these, which receives its driving power via the boom system and the frame part from the power engine by means of the continuous multi-function control and operating cable which, following the tree trunk, controls and operates the delimbing head. Due to the inclinable motion gear structure, the delimbing head can turn horizontally, and it moves along the trunk, rotating about it if necessary, according to operator control.

The delimbing head 4 has a light construction, consisting of steel, aluminum or plastic components, and it requires no heavy boom system or supporting structure. Using bayonet couplers, the delimbing head 4 can be replaced to suit the forest type and the trunk diameter. The delimbing head can be provided with a top cutter 8, which is used in improvement and finishing felling areas. It can be turned between vertical and horizontal positions, so it can also be used to cut large branches. The delimbing head may be controlled using voice, light, radio or similar control, which can be programmed as required in each case. A felling cutter 5 cuts the tree at its root in a desired direction, and the trunk, being held by the jaws of the frame part, can be moved to a desired place. The upper cutter 6 of the delimbing head cuts off the top at a desired height in the case of improvement and other felling. The accordion-type tightening device 7 is operated by hydraulic, pneumatic or electric power or by a combination of these. The top cutter 8 removes the unnecessary e.g. in improvement felling. In addition, the upper part of the frame part 3 has a conical, downward widening shape, so the branches falling down will not be caught on it but fall to the sides of it. When the delimbing head is coming down, the cone of the frame part guides it back onto its carrier.

The apparatus can be provided with location and measuring devices needed for registering the growing and treated wood stock. In connection with the treatment, the measuring devices perform an evaluation telling the tree, location,

size, top height etc., which makes it easier for the forest owner to monitor the situation. Thus, each growing tree is individualized and follow-up becomes easier. A log sheet or the like produced from this registration will later facilitate the determination of wood quality e.g. in connection with a sale.

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CLAIMS

1. Delimbing apparatus for the delimbing of trees, which can be connected to a moving vehicle via a boom system, said apparatus comprising a frame part (3) and a delimbing head (4), **characterized** in that the frame part (3) is provided with gripping elements (15), by means of which it is fastened against the trunk of the tree at a desired height for the time of the delimbing work, and that
the apparatus comprises a delimbing head (4) which is separate from the frame part and is provided with a gripping device (12) by means of which it grips the trunk of the tree, drive means (13) for moving the delimbing head along the tree trunk and at least one delimbing cutter (11), and
a feed and control cable (10) for transmitting operating power and/or control, connected between the delimbing head (4) moving along the trunk of the tree and the frame part (3).

2. Apparatus according to claim 1, **characterized** in that the delimbing head is provided with at least one cutter (8) for cutting branches and/or the trunk.

3. Apparatus according to claim 1, **characterized** in that the drive means are wheels or rollers rotated by a drive motor and controlled by a control unit.

4. Apparatus according to claim 1, **characterized** in that the drive means are inclinable, so that the delimbing cutter can be caused to move in a desired direction along the trunk of the tree.

5. Apparatus according to claim 1, **characterized** in that the delimbing cutter is fitted in conjunction with the gripping device, and the gripping device (12) comprises controllable elements that can be tightened around the trunk of the tree, such as a controllable accordion-type tightening device.

6. Apparatus according to claim 1, **characterized** in that the frame part (3) is so shaped that it widens conically downward, allowing the delimbing head to be easily parked in an initial position.

7. Apparatus according to claim 1, **characterized** in that the frame part (3) of the delimbing head is connected to the boom system via a swivel joint that allows the frame part to be turned in a desired direction, which makes it easier to

delimb trees standing close by each other side by side and one behind the other, without moving the vehicle.

8. Apparatus according to claim 1, **characterized** in that the boom system connecting the frame part (3) of the delimbing head to the vehicle is substantially A-shaped.

9. Apparatus according to claim 1, **characterized** in that the boom system between the frame part (3) of the delimbing head and the vehicle is fitted to the vehicle so as to be fully rotatable.

10. Apparatus according to claim 1, **characterized** in that the cable between the delimbing head (4) and the frame part (3) follows the trunk of the tree and moves parallel to it.

11. Apparatus according to claim 1, **characterized** in that the delimbing head (4) is coupled to the apparatus by means of bayonet couplers, so that it can be replaced to suit the forest type and the trunk diameter.

12. Apparatus according to claim 1, **characterized** in that the top cutter (8) fitted to the delimbing head can be turned between vertical and horizontal positions, so that, in addition to cutting the tree, it can also be used for cutting branches.

13. Apparatus according to claim 5, **characterized** in that the controllable elements are edged laminae that are arranged in a curved shape bending around the trunk of the tree.

14. Method for delimbing standing trees, **characterized** in that it is based on supplying energy to a separate delimbing head (4) via a feed cable (10), which delimbing head uses said energy to climb up the tree by making use of the trunk of the tree, cutting off the branches that it encounters as it advances.

15. Method for delimbing standing trees, **characterized** in that the separate delimbing head cuts the trunk into pieces of desired length as it is coming down, and that the tree is finally cut at the root.

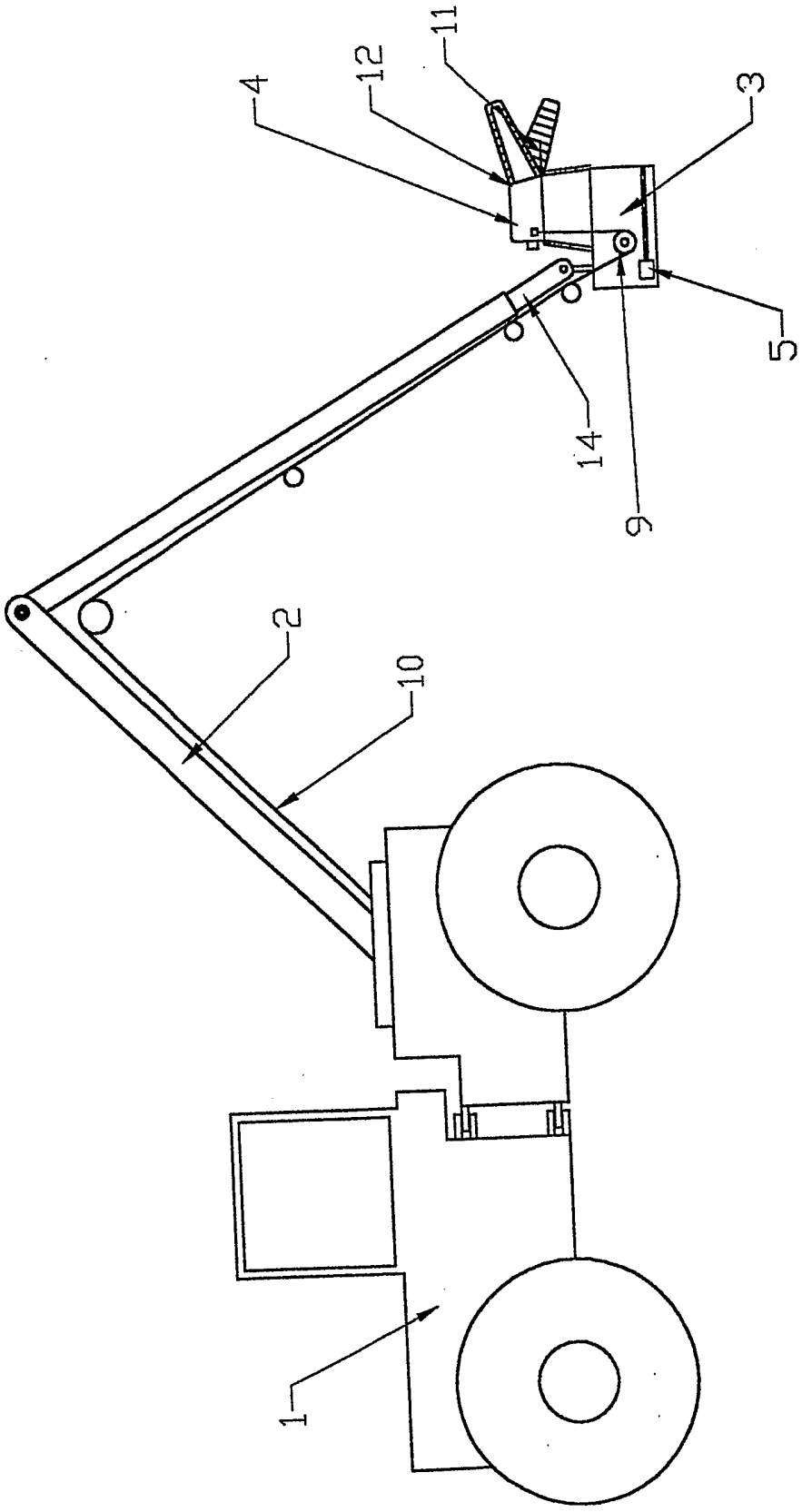


Fig. 1

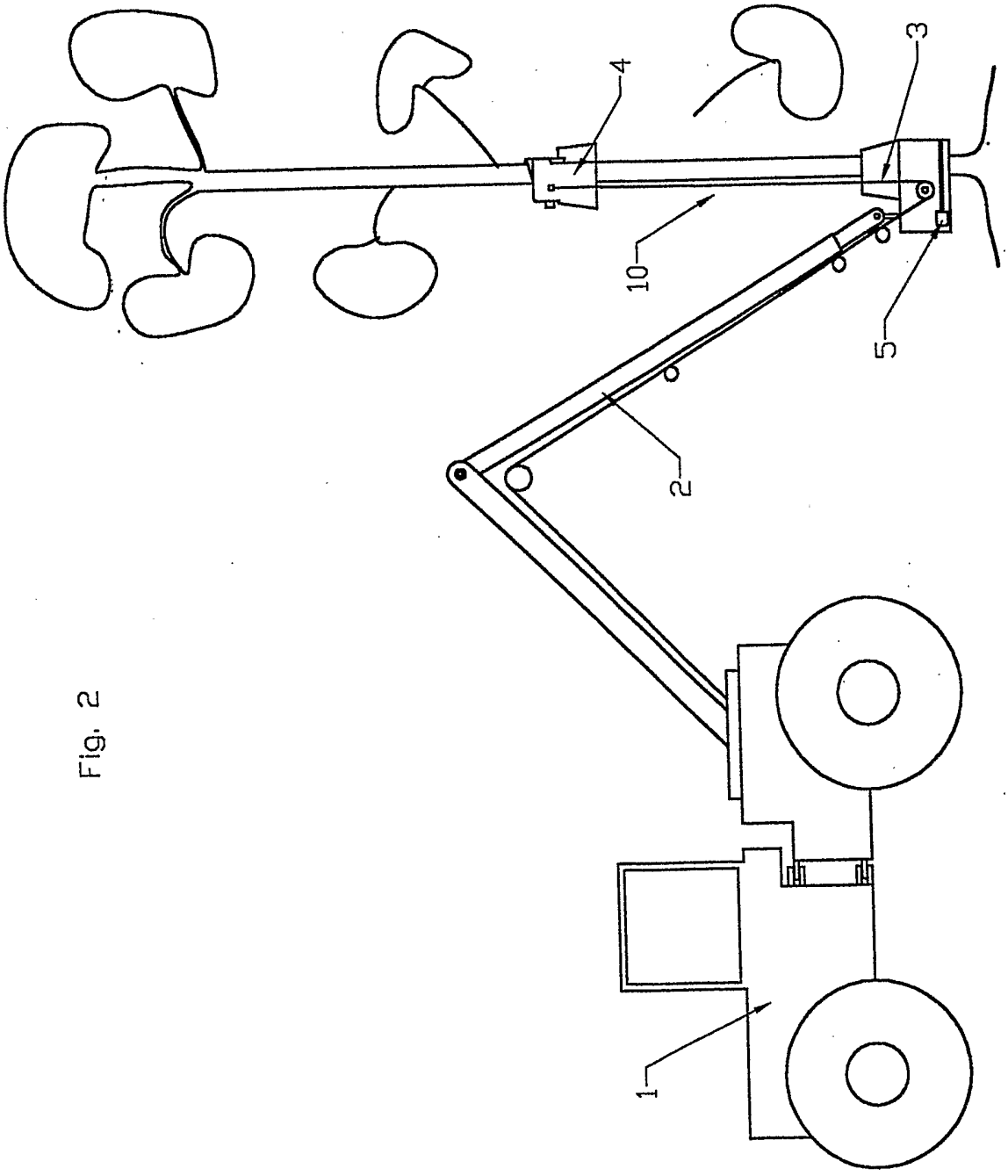


Fig. 2

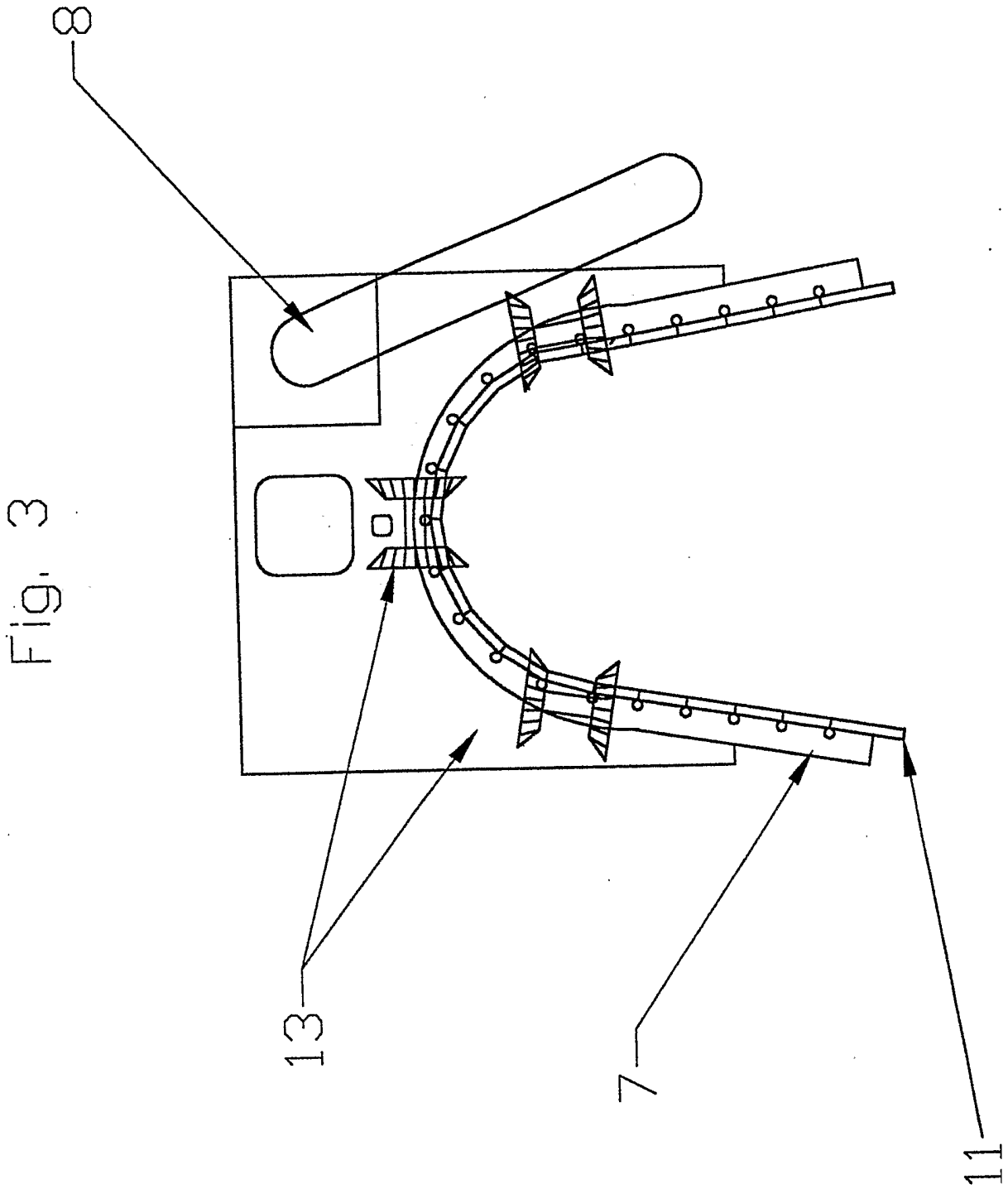


Fig. 3

Fig. 4

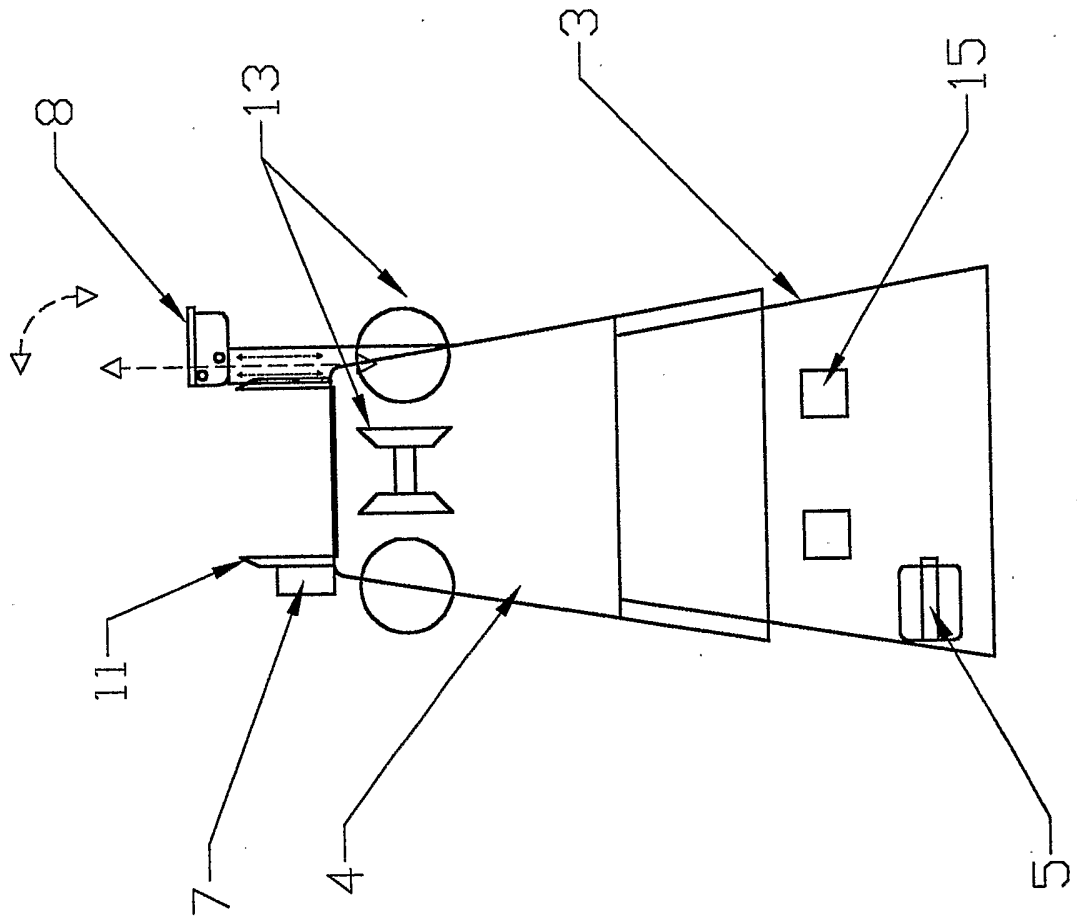


Fig. 5

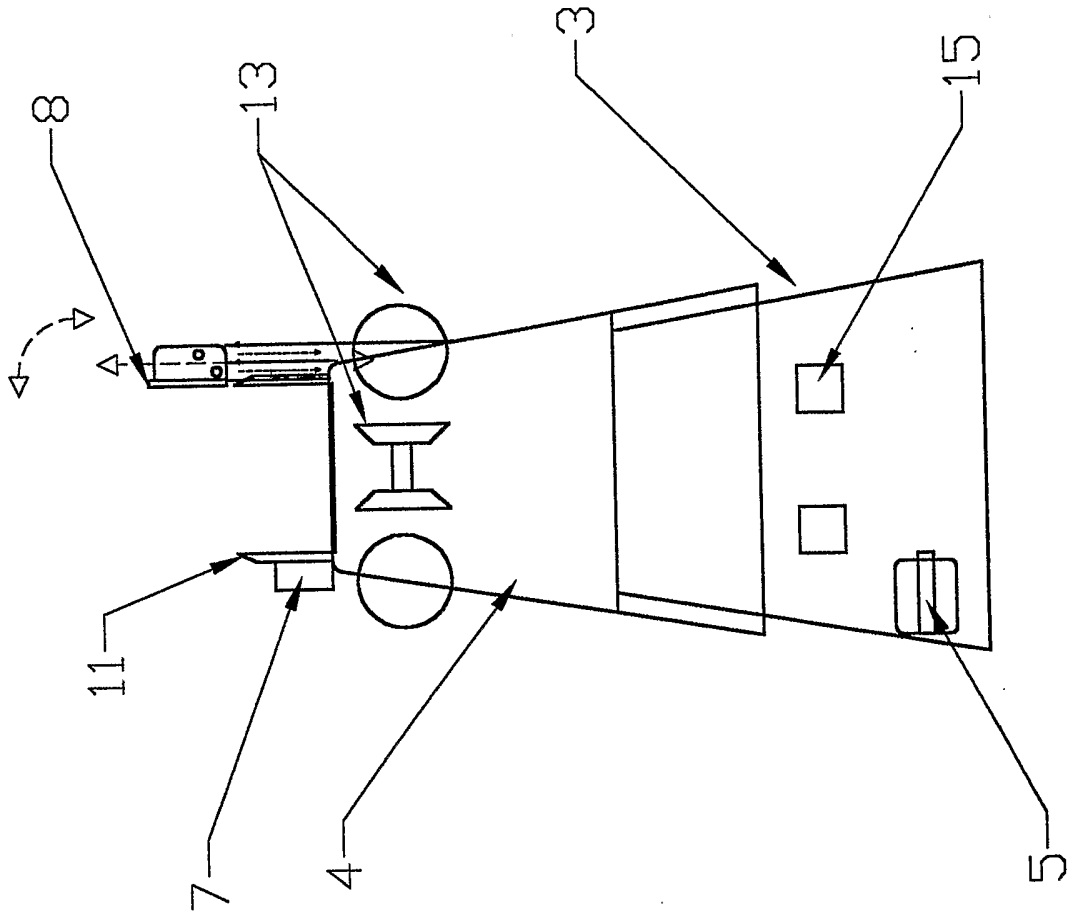
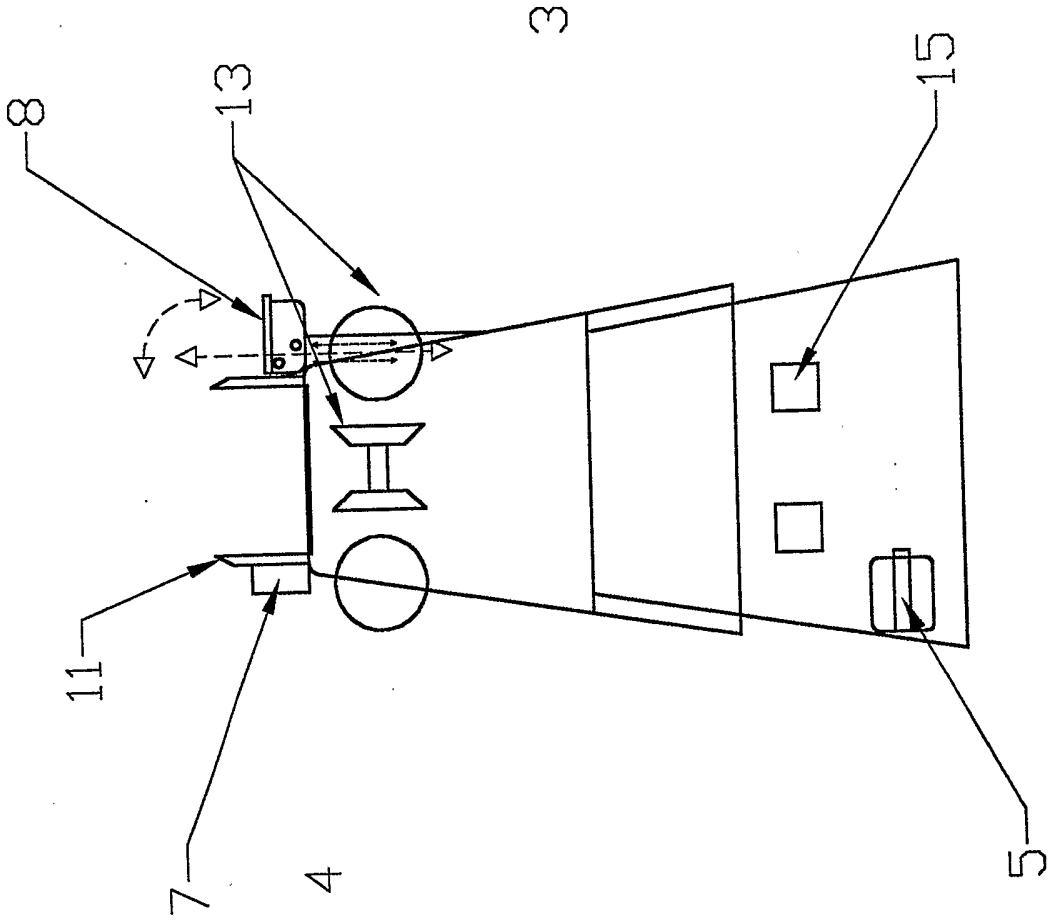


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00663

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01G 3/08, A01G 23/08
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)

IPC7: A01G

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0407322 A1 (RAFFAELLO, HENRI), 9 January 1991 (09.01.91), claim 1, abstract	1,8-10,14
Y	claim 1, abstract	2-4,7,15
A	abstract	5,6,11,12,13
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Y	US 3364962 A (G. OTTERBACH ET AL), 23 January 1968 (23.01.68)	3,4
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2002	06 -11- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Eddy Leopold/MP Telephone No. +46 8 782 25 00

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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.
Y	DE 3702760 A1 (EGGERT, JENS), 11 August 1988 (11.08.88) -- --------	7

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/09/02

International application No.
PCT/FI 02/00663

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DE 3702760 A1	11/08/88	NONE	