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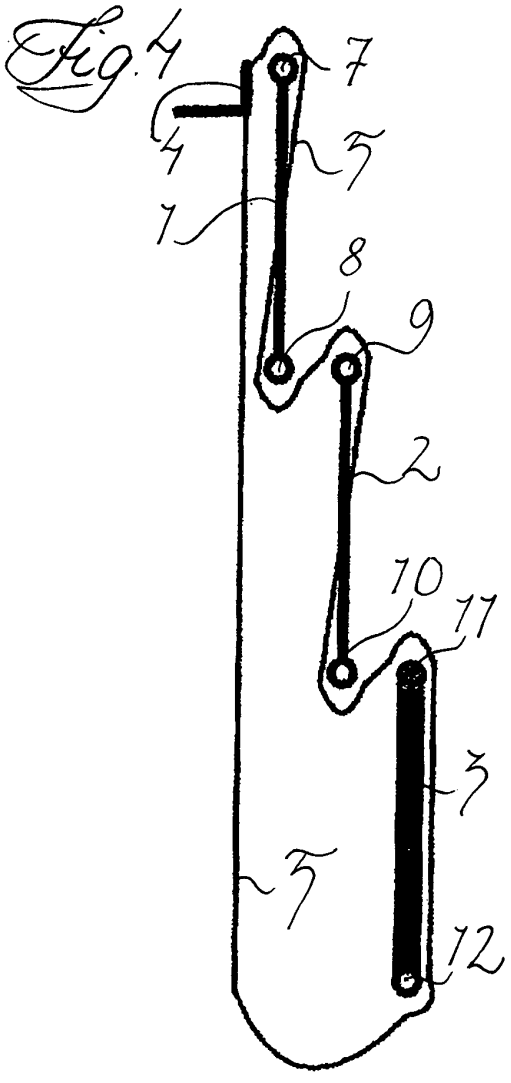
(54) Altimeter for fork trucks

(57) Altimeter for fork truck comprising a wire (5) with one end (6) fastened to the upper side of a fork carrier (4). The wire then extends upward and runs over a first pulley (7) in top of a first (top) mast section (1). From the first pulley the wire extends down to a second pulley (8) arranged in the bottom of the first mast section (1), under this upward and upward to a third pulley (9) in top of an intermediate mast section (2), over this and then down to a fourth pulley (10) in the bottom of the intermediate second mast section and further up to a fifth pulley (11) in top of a third mast (3) fastened in the truck. From the top of the third mast (3) the wire continues down to a sixth pulley (12) and from this up to the bottom of the fork carrier (4). The fifth pulley (11) is provided with a bearing of known type that measures the rotation thereof, for instance by a toothed disc, the teeth on rotation passing a led and a light sensor delivering a pulse for each tooth. The number of pulses can then be counted by an on board computer or by a separate display device calculating the fork height from the pulses.



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Description

[0001] The heights to which fork trucks of today are expected load and unload goods are very high and the passages between storing racks are narrow placing the truck driver very close to the rack into which he has to load goods into or retrieve goods from. The result is that it is difficult for the driver or operator to see if he is at the right level with the forks or not since his or her viewing angle will be almost parallel to the rack. The work also has to be done quickly. Consequently the operators need altimeters.

[0002] From JP8-143296 it is known to measure the fork level in a mast by arranging in the mast one pulley in the top thereof and one pulley at the bottom with a wire in an endless lope between the pulleys. Where the ends of the wire are joined they are also connected with to a fork carrier. When the forks move up and down the wire will move also and the movements are monitored by monitoring the rotation of the lower pulley.

[0003] High lifting trucks are however provided with masts comprising several mast segments that can move telescopically relative each other. This arrangement allows high lifting at loading and unloading without compromising a good travel stability. Normally the movements of the mast segments are coupled so that each mast section moves the same distance relative its proximate segments. This in turn means that at least two movements have to be monitored in order to obtain a total height value for the forks at high lifting trucks with the device according to the above JP 8-143296. Also an adding device will be needed. In addition to the need of two altimeters and the adding of their readings one of these will have to be connected via a cable passing between moveable mast sections or by a battery powered wireless transfer. The number of devices will not only increase the complexity and failure risk but also the expenditure.

[0004] The object of the invention is to solve the above problems and to provide a more simple and rugged altimeter for trucks with masts that have one or several moveable mast sections and a so called free lift movement of the forks in the top mast section.

[0005] The need to keep track of the fork position today is greater than it used to be, not only are the lifting heights increasing, but also the lifting pattern has changed. In the old days the freelift was first engaged at lifting and the last on lowering since the cylinders for the free lift and the mast lift being coupled in parallel and the freelift always being lighter. In this way only one control valve was needed. Today free lift and mast lift may be engaged in arbitrary order and also simultaneously in order to minimize work time and energy and it is thus more difficult to keep track of the movement. An accurate position monitoring also allow target level programming including energy minimizing with the use of both free lift and mast lift.

[0006] The above object is in accordance with the invention solved with a wire that runs from the forks or their carrier up over a first pulley in the upper end of the first (top) mast section, in which the forks are moveable vertically. The wire then continues down to the bottom of the same mast section below a second pulley and up to a third pulley in the top of the next mast section, that is the one in which the first mast section is moveable. This pattern of wire and pulleys is then repeated for all moveable mast sections and then the wire is led over a pulley in the top end of the mast section that does not move vertically and from there to one or several pulleys in the lower end of the mast section that is not moveable vertically, this pulley or these pulleys leading the wire back to the forks or their carrier, and that means are arranged to register the lengthwise movements of the wire relative the mast section that is not moveable vertically.

[0007] When only the forks move relative the mast section in which the fork carrier is journalled this movement cause the wire to move the same distance as the forks and this movement will be the same as the movement of the wire. When the mast sections move relative each other the wire lengths between the sections will change in length as much as the movement of said two proximate sections. The wire will serve as a mechanical adder, adding all these changes in length to a total movement of the wire in relation to the vertically not moveable mast section enabling the measuring of the totally lifted height in one reliable and simple device.

[0008] The wire part running over the pulleys mounted on the mast sections will at lifting become shorter precisely corresponding to increases in lift height. The second part of the wire that runs from the pulley or pulleys at the bottom of the mast up to the fork carriage will on lifting increase it length with precisely the change in total lift height. The wire will have the same length all the time and is fully controlled, and kept in place on its pulleys providing a very simple and reliable solution to fork height measuring

[0009] In a preferable embodiment the wire movements are registered via a pulley in the fixed mast section that is provided with an angle registering bearing. The wire can be kept taut by spring or tensioning means arranged between one end of the wire and the fork carrier.

[0010] Further developments and advantages of the invention are apparent from the following described preferable embodiment of the invention, with reference to the enclosed drawings. In the drawings fig 1 schematically depicts a truck mast with three sections in their bottom positions as well as the freelift, fig 2 the same truck mast with freelift fully lifted, fig 3 freelift in top and the mast sections partly lifted and fig 4 mast and freelift maximally extended.

[0011] The truck mast shown in the drawings has three sections. In the top one 1 a fork carrier 4 is arranged moveable up and down. The first mast section is journalled vertically moveable in a second mast section 2 that in turn is journalled vertically moveable in a third mast 3 that is not vertically moveable and fastened in the truck or moveable horizontally out from this.

[0012] A wire 5, belt or the like is in one end 6 fastened to the upper side of the fork carrier 4, extends upward and runs over a first pulley 7 in top of the first mast section 1. From the first pulley the wire extends down to a second pulley 8 arranged in the bottom of the first mast section 1, under this and upward to a third pulley 9 in top of the intermediate mast section 2, over this and then down to a fourth pulley 10 in the bottom of the intermediate second mast section and further up to a fifth pulley 11 in top of the third mast. From the top of the third mast 3 the wire continues down and under a sixth pulley 12 and from this up to the bottom of the fork carrier 4.

[0013] The fifth pulley 11 is provided with a bearing of known type that measures the rotation thereof, for instance by a toothed disc, the teeth on rotation passing a led and a light sensor delivering a pulse for each tooth. The number of pulses can then be counted by an on board computer in the truck or by a separate display device. The fifth pulley 11 may be wide in order to accommodate several turns of the wire in order to eliminate slip.

[0014] When the forks are moved up and down in the first mast section without mast movement the wire will quite simply transfer this movement over the pulleys 7-11.

[0015] When the mast is extended the parts of the wire that run between the mast sections will become shorter and the corresponding distance will correspond to a lengthening of the distance between the fork carrier and the sixth pulley in the bottom of the fixed mast section 3 and the wire will remain taut.

[0016] As a result of the mast movement the wire will cause a rotation of the fifth pulley 11 precisely corresponding to the lifting of the mast and the lifting of the forks in the first mast, that is, the fork height.

[0017] The invented device thus measures the total height of the forks independent of where the movement is achieved.

[0018] Instead of using a toothed disc at the bearing the wire may be exchanged for a toothed belt or the wire may be provided with other types of marking that can be deducted, for instance by induction.

[0019] Advantageously the parts of the wire that change in length are arranged in parallel with or with the same angle relative the lifting direction. If needed additional pulleys may be arranged in order to achieve this. Preferably these parts of the wire may be arranged vertically.

[0020] The invention provides a reliable measuring that require little space at a low cost and absolutely no need of complicated signal transferring and it is also easy to install and service.

Claims

1. Altimeter for fork lift trucks with mutually moveable mast sections and a fork carrier in a top mast section, **characterized in that** a wire (5) runs from the forks or their carrier (4) up over a first pulley (6) in the upper end of the first (top) mast section (1), in which the forks are moveable vertically, the wire (5) then continues down to a second pulley (7) at the bottom of the first mast section (1) below this second pulley (7) and then up to a third pulley in the top of the next mast section (2), that is the one in which the first mast section (1) is moveable, this pattern of wire and pulleys is then repeated for all moveable mast sections and then the wire is led from the bottom pulley (10) in the last movable mast section (2) over a pulley (11) in the top end of the mast section (3) that is not moveable vertically and from there via one or several pulleys (12) in the lower end of the mast section that is not moveable vertically back to the forks or their carrier (4), and that means are arranged to register the lengthwise movements of the wire in the mast section that is not moveable vertically.

2. Altimeter according to claim 1, **characterized in that** the wire (5) is kept taut by spring or tensioning means arranged between one end of the wire and the fork carrier.

3. Altimeter according to claim 1, **characterized in that** the means registering the lengthwise movement is a pulley (11) in the mast section (3) that is not moveable vertically, said pulley being provided with a an angle registering bearing.

4. Altimeter according to claim 1, 2 or 3, **characterized in that** the wire parts that change their lengths at vertical movements of forks and or mast sections are in parallel with the direction of movement at lifting and lowering.

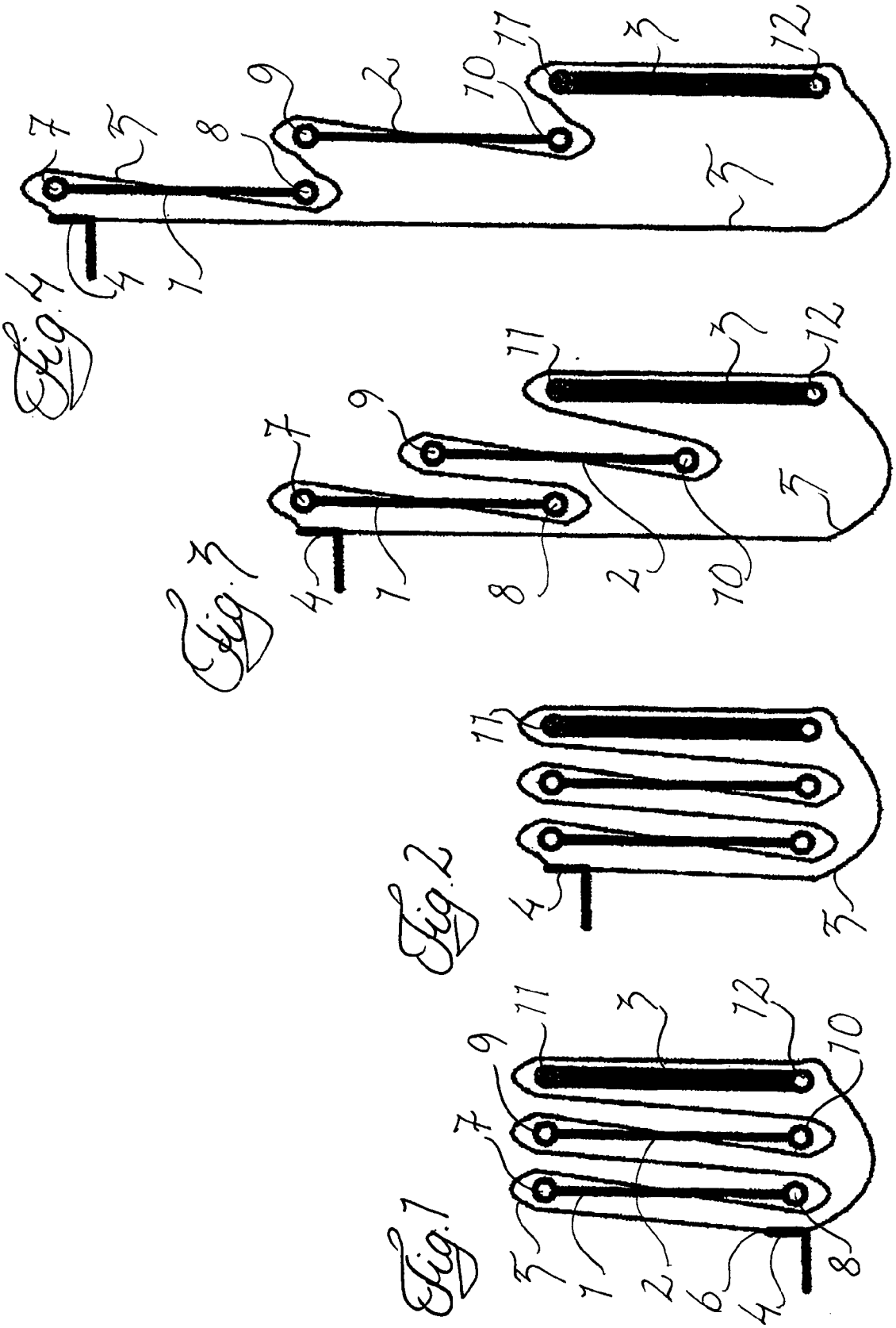
Fig.1
Fig.2
Fig.3
Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 09 44 5015

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 November 2009	Rupcic, Zoran

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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