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(54) **A Forklift truck**

(57) The present invention relates to a forklift truck 10 which comprises a truck body 2, a fork lifting element 3, a control element 8, at least one communication element 6 and a system for providing information related to the height of the load support member 1. The fork lifting element 3 is arranged to support a load support member 1 and is vertically movable by means of the fork lifting element 3. The system for providing information related to the height of the load support member 1 comprises at least one sensor 5 and at least one detection causing element 7 arranged to cause the at least one sensor 5 to register detection of the detection causing element 7. Therein the at least one sensor 5 and the at least one detection causing element 7 are arranged in relation to each other such that they move in relation to each other as the load support member 1 moves vertically and such as they pass each other at a location corresponding to at least one predetermined height of the load support member 1 and such that the detection element causes the sensor 5 to register detection at the passage. The at least one communication element 6 is arranged at said at least one sensor 5 and it is arranged to send at least one signal to the control element 8 when the at least one sensor 5 registers that the load support member 1 is passing the at least one pre-determined height. Therein the control element 8 is arranged to receive and process signals from the at least one communication element 6. The at least one communication element 6 is also arranged to send a signal to the control element 8 at pre-determined times and the control element 8 is arranged to detect reception of the signals and then to determine

whether it is able to gain information from the communication element 6, based on the received signals and based on the pre-determined times.

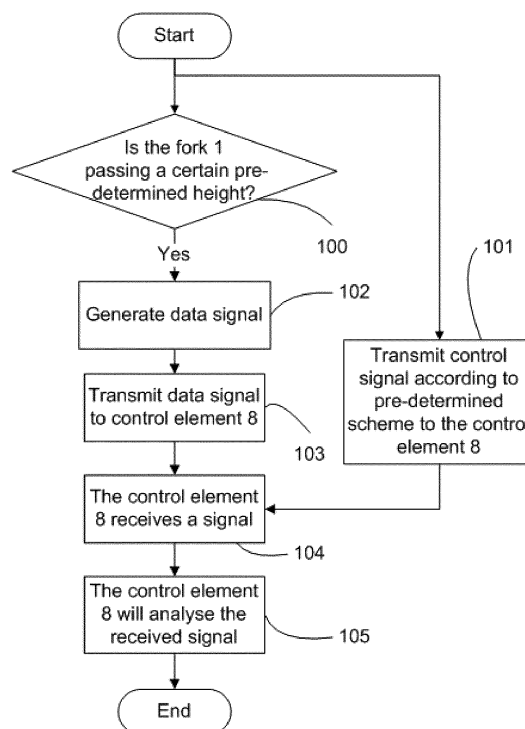


Fig. 3

Description

TECHNICAL FIELD

[0001] The present invention relates to a forklift truck comprising a system for providing information related to the height of a load support member of the forklift truck.

BACKGROUND ART

[0002] Forklift trucks are used to handle the movement of especially palletised goods in a fast and easy way. Since storage depots often are built with high heights to allow piling of goods, forklift trucks often allow the elevation of the fork to heights of several meters. Having heavy palletised goods on the forklift truck's load supporting member raised several meters above the floor can raise the centre of mass of the forklift truck substantially, thereby lowering its stability to fast changes of motion, especially acceleration, deceleration or changes of direction.

[0003] To prevent a tip-over of the forklift truck, which might result in damages both of the palletised goods, the forklift truck itself and/or human beings or other goods in the surrounding of the forklift truck, one usually tries to set constraints to the possible motion changes when the forklift truck's load supporting member is raised above a certain height.

[0004] This limitation of the allowed amounts of the changes of motions is usually implemented automatically to increase the safety of the operator of the forklift truck and to lower the number of steps needed for the operator to operate the forklift truck.

[0005] A vital element for limiting the allowed amounts of the changes of motions depending on the height of the load supporting member is that the actual height of the load supporting member is accessible to some control element of the forklift truck, which can then decide whether the amount of the changes of motions should be limited or not. For example, switches or one or more height detection elements can be used to determine the height.

[0006] There are several known implementations of a height detection element. One possible implementation is given in DE 3140 795 C2 where two measurement devices are working independently of each other, each comprising of incremental encoders, giving pulses as output, which are analysed by a counting element. The counting element can then from the result of the counting determine the height of the load support element. Two measurement devices are used for providing redundancy. The results can then be compared or may be analysed.

[0007] Another possible implementation is given in DE 197 31 687 A1 where at least one rolling device is attached to the forklift truck. The rolling devices turn around their own axes when the load support member changes its height. The rolling device interacts with a signalling device which feeds an electrical signal (corresponding, for example, to the angular position of the rolling device)

to an analysing unit. From the electrical signal the analysing unit determines the height of the load support member.

[0008] Problems of the aforementioned solutions are that the information of the height is lost if the forklift truck is turned off and it might be necessary to lower the load support member to a given reference level and from there raise it back to the wanted level to allow for the analysing units or the measurement devices to recalculate the height.

[0009] It is possible to avoid the need for this restarting procedure via an implementation as described in EP 1 203 743 B1, where a memory device, which keeps its value irrespective of the supply of electrical energy, is attached to sensors detecting the height of the load support member.

[0010] Another possible implementation is via one or more reed switches which change their switch setting depending on the influence of a nearby magnetic field originating from a magnet on the load support member. The switches can thereby tell whether the load support member is below or above a certain level. These switches can comprise of a memory keeping its value irrespective of the supply of electrical energy.

[0011] However, reed switches are susceptible for vibrations or changes in temperature and therefore might malfunction. Especially inside cold storage houses forklift trucks with reed switches face problems and tend not to work properly.

[0012] In EP 2 390 222 A1 it is described the storage of the latest value in a non-volatile memory instead of using memorable switches and combine that with a non-memorable switch, changing its state when the load support member passes by. Thereby an indication of the latest height is immediately available after a restart of the forklift truck while not relying on any memory-keeping capacity of the switch which might malfunction.

[0013] In case the load support member of a forklift truck is above a certain height, law regulations in several countries require limitations of some operating parameters of the forklift truck such as its speed. Even other safety or protection measures might be required by law. The limitation of the trucks performance is usually implemented in an automatic way, such that it requires no user interaction for that to be activated. Other safety means like folding sideguards might require some kind of user action to be activated or deactivated. The forklift truck might require that kind of user action to allow operability or full operability of the forklift truck if the load support member is above a certain height.

[0014] If the load support member of a forklift truck is wrongly detected as being above a certain height, the forklift truck might automatically reduce the allowed speed and or other parameters of operation and/or require some user action for safety means. The truck thus has an unwanted limitation of its performance where it might not be obvious for the truck driver why this limitation occurs.

[0015] On the other hand if the load support member of the forklift truck wrongly is detected as being below a certain height, the forklift truck might be able to being operated in an unsafe way, for example by allowing speeds that high that the truck might tilt at some manoeuvres.

SUMMARY OF THE INVENTION

[0016] One object of the invention is to facilitate the detection of any malfunctioning in a system for providing information about the height of the forks of a forklift truck.

[0017] The facilitated detection of malfunctioning in a system for providing information about the height of the forks of a forklift truck is in one embodiment achieved by means of a forklift truck according to claim 1. Due to the fact that the communication element sends signals to the control element at pre-determined times and due to the fact that the control element is arranged to detect reception of the signals and to determine whether it is able to gain information from the communication element based on the received signals and based on the pre-determined times, the forklift truck can check that the communication from the communication element to the control element works as expected, independent of the fact whether new information concerning the height of the forks of a forklift truck are communicated. The control element can thus at pre-determined times detect malfunction of the system for providing information related to the height of the forks. This is in contrast to known prior art implementations, where there was no way to detect malfunction of such a system without lowering or raising the forks.

[0018] In one embodiment the forklift truck comprises at least one non-volatile memory, which is connected to the at least one sensor and/or to the control element. Therein the at least one non-volatile memory is arranged to save at least the latest information related to the height of the forks. Information about the height of the forks is thereby stored so that it can be accessed after a re-start of the forklift truck.

[0019] In one embodiment of the forklift truck, more than one sensor is used to determine whether the forks have passed a certain pre-determined height. In using several sensors for gaining information about the height of the forks redundancy is provided in the system. Alternatively, the several sensors can be used for detecting in which direction the forks pass a pre-determined height. It is also possible to combine the providing of redundancy with the detection of the direction of the forks. Several sensors can also be used to detect different pre-determined heights. Several sensors can also be used to combine the detection of different heights with the detection of the direction of the forks and/or redundancy. Thereby information can be provided about the malfunction of a system for providing information related to several possible heights of the forks.

[0020] In one example of the forklift truck, the control element is arranged to limit the operating performance

of the truck based on a decision of the control element, that it is not able to gain information related to the height of the load support member, and/or based on the gained information related to the height of the load support member. The limited operating performance is in one example a limited speed and/or a limited acceleration/deceleration and/or limited changes of directions of the truck.

[0021] In one embodiment of the forklift truck, the communication element is arranged in relation to the sensor element in such a way that the communication element only sends signals when the sensor element is working properly. Thereby it is possible to further improve the detection of malfunctioning of the system, since even a malfunction of the sensor will be detectable.

[0022] In one embodiment the communication element and the sensor are implemented in the same element or in common unit.

[0023] In one embodiment of the forklift truck, the detection causing element comprises at least one magnet.

[0024] In one embodiment of the forklift truck, the at least one sensor comprises a Hall sensor element.

[0025] In one embodiment of the forklift truck the communication between said at least one communication element and the control element is by wire.

[0026] In one embodiment of the forklift truck the communication between said at least one communication element and the control element is wireless.

[0027] In one embodiment of the forklift truck, a signal which is sent from the at least one communication element to the control element is different, dependent on whether the signal is sent due to the fact that the at least one sensor has registered that the forks pass the at least one pre-determined height, or whether the signal is sent independently from the fact, whether the at least one sensor has registered that the forks pass the at least one pre-determined height. In one example the difference is different pulse lengths. In one example the difference is different amplitudes. In one example the difference is that the signal contains data bits and one or more data bits are used to indicate for what reason the signal is sent. In one example any combination of pulse lengths, amplitudes and/or data bits are used. However, it should be noted that any other kind of differences of the signals will do as well, as long as the control unit is able to detect that difference.

[0028] In one embodiment of the forklift truck, one or more signals are sent from the at least one communication element to the control element, irrespective of whether the at least one sensor registers that the forks pass the at least one height, at the time the forklift truck is turned on and/or restarted or at a fixed time thereafter.

[0029] In one embodiment of the forklift truck, one or more signals are sent from the at least one communication element to the control element, irrespective of whether the at least one sensor registers that the forks pass the at least one height, at recurrent pre-determined times.

[0030] In one embodiment of the forklift truck, the detection causing element is designed in such a way, that

the at least one sensor can determine from which direction and/or to which direction the forks pass the at least one pre-determined height. In one example, the detection causing element is arranged in such a way, that different magnetic poles affect the at least one sensor first, depending on from which side and/or to which side the forks pass the at least one pre-determined height.

[0031] In one embodiment of the forklift truck, signals from one communication element to the control element are distinctive from signals from another communication element, and the control unit is able to differ between the different signals, thereby being able to detect from which communication element the signal arrived. In one example, this is achieved by the signals containing one or more data bits, where the one or more data bits indicate from which communication element the signal is sent.

[0032] In one embodiment of the forklift truck, the communication element is designed to send a continuous signal to the control element when the at least one sensor registers that the forks are passing the at least one pre-determined height. The signal is then continuous until a new passing-by of the forks is registered. In one example the continuous signal has one specific amplitude when a passing-by of the forks is registered and another specific amplitude when a new passing-by of the forks is registered. If a third passing-by is registered the continuous signal will then have the first specific amplitude again. In one example one of the two specific amplitudes is zero, so that a signalling of a passing-by of the fork is given by a change between sending out a continuous signal from the communication element and not sending out a continuous signal from the communication element. However, in the present invention even any other distinctive feature of the continuous signals is possible, for example different frequencies.

[0033] In one embodiment the signals are inverted when the at least one sensor 5 registers that the fork is passing the at least one pre-determined height, i.e. even the signals which are sent to the control element at pre-determined times independently of the fact whether the fork passes a pre-determined height are inverted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034]

Figure 1 shows schematically an example of a forklift truck.

Figure 2 shows a schematic block scheme illustrating an example of a system for providing information related to the height of the forks.

Figure 3 is a flow chart illustrating an example of a method for providing information related to the height of the forks of a forklift truck.

Figures 4-7 illustrates signals sent from the commu-

nication element to a control element of a system according to Figure 2.

DETAILED DESCRIPTION

[0035] In Figure 1, a possible implementation of a forklift truck 10 comprises a truck body 2, a fork lifting element 3 and forks 1. In the illustrated example, the forklift truck 10 is a reach truck. The forklift truck 10 may instead be another type of forklift truck such as a rider stacker, a walkie stacker, a sideloader, an order picking truck or any other kind of forklift truck comprising an electrical power system.

[0036] The forklift truck 10 might, instead of or additionally to forks 1, contain any other kind of load support member, like grabbing means or any other means for loading, grabbing, clamping and/or supporting goods. For simplicity, if not otherwise stated, every time the word fork is used in this document any other kind of load support member can be used as well.

[0037] The fork lifting element 3 comprises in one example a stationary part and a movable part, where the movable part is arranged to move along the stationary part. The movable part is arranged to support the forks 1. The fork lifting element 3 comprises in one example one or more cog wheels and/or one or more chains for driving the movable part along the stationary part. In another example the fork lifting element 3 comprises hydraulic elements for driving the movable part along the stationary part. In another example the fork lifting element 3 comprises elements of both of the two previous examples. The stationary part comprises in one example one or more masts and/or one or more frames. The movable part can comprise one or more masts and/or one or more frames. In one example the movable part comprises attachment means for attaching the forks 1 to the movable part.

[0038] The fork lifting element 3 might be implemented in such a way, that the stationary part is attached to the truck body 2 and the forks 1 are attached to the movable part of the fork lifting element 3. The movable part of the fork lifting element 3 can be vertically moved along the stationary part. In one example this is implemented by connecting at least one chain to the forks 1 at one end while the other end(s) of the chain(s) are connected to the truck body 2. In another example the chain is connected to the movable part of the fork lifting element 3 at one end and to the truck body 2 at the other. In one example, the connection of the chain to the movable part of the fork lifting element 3 and/or the fork is done indirectly. In one example the other end(s) of the chain(s) are connected to the stationary part of the fork lifting element 3 instead of the truck body 2. In one example the connection of the chains to the truck body 2 and/or to the stationary part of the fork lifting element 3 is done indirectly. When the chains now are drawn on the truck body side and/or the stationary part side of the fork lifting element 3 of the forklift truck 10, the chains will through the

fork lifting element 3 higher the forks 1. On the other hand, when the chains on the truck body side and/or the stationary part side of the fork lifting element 3 of the forklift truck 10 are eased the forks 1 will be lowered by the effect of gravity. Instead of or in combination with chains, the use of one or more hydraulic elements can be as described for the chains. One end of the hydraulic element is connected to the fork and/or movable part of the fork lifting element 3 and the other end is connected to the truck body 2 and/or stationary part of the fork lifting element 3. Even any other type of implementation is thinkable as long as the forks 1 can be moved vertically by the fork lifting element 3. For reaching higher heights this might include combination of several chains, cog wheels, masts, telescoping masts, frames or any other of the elements described here as is done by known implementations of forklift trucks.

[0039] The truck has at least one motor which provides the power for operating the lifting/lowering of the fork. This motor can be driven electrically or by any kind of fuel, such as, for example, diesel, petrol or ethanol, but any other type of energy source will do as well.

[0040] In Figure 2, a system 5 for providing information related to the height of the forks 1 of a forklift truck 10 comprises a detection causing element 7, a sensor 5, a communication element 6 and a control element 8.

[0041] The detection causing element 7 and the sensor 5 are vertically movable relative to each other. In one example, this is achieved by making the sensor 5 vertically movable. Alternatively, the detection causing element 7 is vertically movable. In yet another example, both the detection causing element 7 and the sensor 5 are vertically movable.

[0042] In one example the detection causing element 7 is arranged at the fork or the movable part of the fork lifting element 3. The sensor 5 is then arranged at a part of the fork lifting element 3 which keeps its vertical position relative to the truck body 2 or at the truck body 2 directly. In another example the sensor 5 is arranged at the fork or at the movable part of the fork lifting element 3. The detection causing element 7 is then arranged at a part of the fork lifting element 3 which keeps its vertical position relative to the truck body 2 or at the truck body 2 directly.

[0043] In any of the two examples described above the causing of the detection at the sensor 5 by the detection causing element 7 will only appear when the detection causing element 7 and the sensor 5 are within a certain distance from each other. Due to the fact that one of the sensor 5 and the detection causing element 7 moves vertically with the forks 1, the vertical position of that element will relate directly to the height of the forks 1 of the forklift truck 10. Since the other element will not change its vertical position, the height of that element relates to a pre-determined height of the forks 1 of the forklift truck 10. The pre-determined height is in one example detected through one of the implementations described below when the lifting or lowering of the forks 1

brings the sensor 5 and the detection causing element 7 within a certain distance from each other. Even other arrangements of the sensor 5 and the detection causing element 7 in relation to the forks 1, the fork lifting element 3, and/or the truck body 2 are possible. It only has to be assured that the detection causing element 7 and the sensor 5 only are within the certain distance from each other when the fork is at a certain pre-determined height. Here, the certain relative position corresponds to the position which makes the detection causing element 7 causing detection at the sensor 5 as described below.

[0044] The detection causing element 7 is detectable for the sensor 5 when it is within a certain distance from the sensor 5. In one example this is implemented by arranging the detection causing element 7 in such a way that it is only detectable by the sensor 5 if the sensor 5 and the detection causing element 7 have the same vertical height, or at least that the vertical distance between the height of the sensor 5 and the detection causing element 7 is smaller than a pre-determined value. In one example, the pre-determined value is some few centimetres. In another example the pre-determined value is in the order of a centimetre or even only fractions of a centimetre.

[0045] In one example, the detection causing element 7 is arranged to give rise to a magnetic field. The sensor 5 is then arranged to signal when a pre-determined strength of the magnetic field is detected. Thereby it is assured that the distance between the sensor 5 and the detection causing element 7 is smaller than a certain value. This is in one example achieved by a sensor 5 comprising a Hall effect sensor. In one implementation, the detection causing element 7 is arranged to permanently or periodically send some kind of signal such as light or any other kind of electromagnetic waves which can only be detected by the sensor 5 when the sensor 5 is at a certain pre-determined relative position to the detection causing element 7. In a concrete example, the detection causing element 7 is arranged to send out a laser beam horizontally which can only be detected by the sensor 5, when they are at the same height, so that the laser beam hits the sensor 5. In one example, the sensor 5 is a photodiode. In another example of an implementation, the sensor 5 comprises a laser and a photodiode. The detection causing element 7 may then comprise a mirror. Thereby, the light from the laser is reflected by the mirror to the photodiode only when the sensor 5 is at a certain position relative to the detection causing element 7. Alternatively, any other type of action causing element and associated sensor 5 can be used to perform detection at a pre-determined position relative to each other.

[0046] The communication element 6 is arranged at the sensor 5. The communication element 6 is arranged to send signals to the control element 8. In one implementation, the communication element 6 is arranged to send signals of several types, for example data signals and control signals, to the control element 8. The data signals are sent based on the detection of the at least

one pre-determined height by the at least one sensor 5. The control signals are sent at pre-determined times, independent of what the sensor 5 has detected. Examples of control signals are described later, in relation to figures 4-7.

[0047] The pre-determined times of the control signals are in one example that the control signal is sent repeatedly after a certain time interval. This time interval is then known by the control element 8, which can conclude, that it is not able to gain information related to the height of the load support member 1 from the at least one communication element 6 if it did not receive any signal during the time interval. In another example, the pre-determined time is related to a certain event, for example, power-supplying the truck. Then, the control signal is sent as soon as the event occurs, i.e. in the above example as soon as the truck is power-supplied, or at a certain time interval after the event. The time interval is then again known by the control element 8, which can conclude, that it is not able to gain information related to the height of the load support member 1 from the at least one communication element 6 if it did not receive any signal during the time interval after the event. The two above examples can also be combined to send signals both in relation with a certain event and repeatedly after a certain time interval.

[0048] The communication element 6 and the sensor 5 are in one example arranged in relation to each other such that the communication element 6 will not be able to send any signals in case the sensor 5 is not working properly. For example, the communication element 6 and the sensor 5 may be connected to the same power circuit and constructed in such a way that the communication element 6 will not be power supplied when there is a power failure in the sensor 5.

[0049] In one example the communication element 6 and the sensor 5 are implemented in such a way that they form the same element 4.

[0050] The control element 8 can be arranged at any part of the truck. In one implementation, the control element 8 comprises an integrated circuit and/or a truck computer. The control unit is in one example arranged at the truck body 2. The control element 8 is arranged to receive and analyse signals from the communication element 6. The control element 8 might further be arranged to control any functions of the forklift truck 10. The communication between the communication element 6 and the control element 8 is in one example wireless or at least partly wireless. Alternatively, or in addition thereto, the communication is performed via wire. The control element 8 comprises elements to receive the signals and possibly also elements to convert the received signals into other forms in case this is needed for analysing the signals. The control element 8 comprises in one example a non-volatile memory. In another example a non-volatile memory is arranged at another part of the forklift truck 10 and the control element 8 is then arranged to get access to the content of the non-volatile memory. The con-

trol element 8 can then save information relating to the height of the forks 1 of the forklift truck 10 independent of its power supply.

[0051] The control element 8 is arranged to update information about the height of the forks 1 of a forklift truck 10 by analysing the received signals. In one example, if the previous information was that the height of the fork is under a certain pre-determined height and the control element 8 gets information that the fork passed this pre-determined height, the control element will then assume that the fork is above this certain pre-determined height. In one example, if the previous information was that the height of the fork was above a certain pre-determined height and the control element 8 receives information that the fork passed this pre-determined height, it will then assume that the fork is under this certain pre-determined height. The information relating to the height of the fork is, however, in no way limited to the above examples. The information relating to the height of the fork can have any information relating to the height of the fork, for example, but not limited to, in which direction a certain height has been passed and/or information of the height of the forks 1 in relation to several different pre-determined heights. This is in one example achieved by the fact that the information which is sent when the forks 1 pass one pre-determined height is different from the information which is sent when the forks 1 pass another pre-determined height. This is in one example achieved by arranging multiple instances of at least one sensor 5 and a corresponding communication element 6 at different places at the forklift truck 10. Then each arrangement of at least one sensor 5 and a corresponding communication element 6 is done for detecting a specific pre-determined height. Each arrangement of at least one sensor 5 and a corresponding communication element 6 is done as described for the arrangement of the first instance of at least one sensor 5 and a corresponding communication element 6. In one example the control element 8 is arranged to differ between different heights by analysing the length of a pulse which is sent, where the length of the pulse is different depending on which height the forks 1 have passed. In one example the control element 8 is arranged to differ between different heights by analysing the amplitude of the signal which is sent, where the amplitude of the signal is different depending on which height the forks 1 have passed. In one example the control element 8 is arranged to differ between different heights by analysing one or more data bits which are sent, where the one or more data bits are different depending on which height the forks 1 have passed. In one example the control element 8 is arranged to differ between different heights by analysing any combination of signal amplitude and/or pulse length and/or one or more data bits which are sent, where the combination of signal amplitude and/or pulse length and/or one or more data bits is different depending on which height the forks 1 have passed. To signal from which and/or to which direction the forks 1 are passing at least one pre-determined

height, one combination of signal amplitude and/or pulse length and/or one or more data bits can then be sent for one direction from which the forks 1 are passing at least one pre-determined height and another combination of signal amplitude and/or pulse length and/or one or more data bits can be sent for another direction from which the forks 1 are passing at least one pre-determined height.

[0052] The control element 8 is further arranged to gain information about whether information is received from the communication element 6 and/or whether the sensor 5 is working properly.

[0053] Based on the information about whether information is received and/or about the received information, the control element 8 is in one example arranged to set constraints to the operating parameters of the forklift truck 10, for example limiting the allowed speed.

[0054] In Figures 4, 5 and 6, signals are sent from the communication element 6 to the control element 8. In these implementations the signals consist of pulses wherein (T) denotes the time and (U) the strength of the pulse, for example its voltage.

[0055] Figure 4 shows the signalling of one embodiment of the invention. In accordance with this embodiment, the communication element 6 is arranged to send a signal with a constant strength as long as the communication element 6 is power supplied. Shortly after being power supplied the communication element will send a start pulse (UP). The control element 8 is arranged to analyse the start pulse, for example to conclude that it can receive pulses from the communication element 6 and that the communication element 6 is working properly. At a time when the fork passes a certain pre-determined height another pulse (MP), is sent from the communication element 6, as described above in relation to Figs. 1 and 2.

[0056] In Figure 5 another embodiment is shown where the communication element 6 is arranged to send control pulses (TP) after certain pre-determined time intervals. In accordance with this example, the communication element 6 is then also arranged to send another pulse (MP) when the fork passes a certain pre-determined height. The control element 8 is then arranged to conclude whether the pulse was sent due to the fact that the forks 1 passed a certain pre-determined height or whether the pulse was sent independently from that fact, based on the length of the pulse and/or the time of the transmission.

[0057] Figure 6 shows what happens in the embodiment of Fig. 5 when the passing by of the fork is detected at the same time as a repeated control-pulse (TP) should be sent from the communication element 6. By making the duration of the pulse for detecting a passing by of the fork (MP) longer than the duration of the control-pulse (TP) which is sent independently of the fact whether the fork is passing a certain pre-determined height, the control element 8 would by analysing the duration of the pulse be able at any time to decide whether a detection of the fork passing a pre-determined height has been communicated.

[0058] Figure 7 shows another embodiment of the invention, where the same notations as Figure 4, 5 and 6 is used. Here, the communication element 6 is designed to send a continuous signal to the control element 8 when the at least one sensor 5 registers that the forks 1 are passing the at least one pre-determined height. A detection of the passing by of the fork 1 at a certain pre-determined height is then signalled by an inverting of the signal (VT), i.e., in the example of Fig. 7 a change from one amplitude of the continuous signal to another amplitude of the continuous signal, where the other amplitude in this case is zero. Consequently, even the pulses (TP) which are sent at certain pre-determined times independently of the fact whether the fork passes a pre-determined height are inverted. The control element 8 is then arranged to gain information about the height of the forks 1 by detecting an inversion of the signal (VT). Still, the control element is also arranged to detect the pulses (TP) which are sent at certain pre-determined times independently of the fact whether the fork 1 passes a pre-determined height and is thus able to gain information about whether information is received from the communication element 6 and/or whether the sensor 5 is working properly as described earlier.

[0059] Figure 3 shows an example of a method for providing information related to the height of the forks 1 of a forklift truck 10. In this method one is looking whether the forks 1 pass a certain pre-determined height 100. If the forks 1 pass a certain pre-determined height, one or more signals of a first type, for simplicity called data signal, is generated 102. This data signal is then transmitted to a control element 103. Independent on the fact whether the forks 1 pass a certain pre-determined height, one or more signals of a second kind, for simplicity called control signal, is transmitted to the control element 8 according to a pre-determined transmission scheme 101. The pre-determined scheme is in one example based on certain time-intervals. In one example the pre-determined scheme is that the control signal is recurrently transmitted after a pre-determined period of time. In one example, the pre-determined scheme for the control signal is related to a certain event. In one example, this certain event is the turning-on of the forklift truck 10 or some elements of the forklift truck 10. Examples of data and control signals are given in the description of Fig. 4-7, however, any other kind of signals will do as well as long as the two kind of signals are different. The transmission of the signals is preferably done by at least one communication element 6.

[0060] The control element 8 is then receiving the control and/or data signal 104. After reception the control element 8 will analyse the received signal 105. A preferable first step in the analysis is to discriminate between control and data signals. A preferable later step in the analysis is to use the data signal to gain information regarding the height of the forks 1 of the forklift truck 10 and/or to use the control signal to gain information whether the communication element is working properly and/or

whether the communication between the at least one communication element 6 and the control element 8 is working properly. In one example the control element 8 is implemented to be aware of the pre-determined scheme. Therefore, a non-reception of a control signal according to the pre-determined scheme is in one example of a preferable later step in the analysis used to gain information whether the communication element is working properly and/or whether the communication between the at least one communication element 6 and the control element 8 is working properly. If the at least one communication element 6 is related to an apparatus for detecting the passing by of the forks 1 of the forklift truck 10 at a certain pre-determined height in such a way, that it is assured that the communication element is not able to send signals in case the apparatus is not working properly, the control element 8 is in one example of the method able to analyse whether the apparatus for detecting the passing by of the forks 1 of the forklift truck 10 at a certain pre-determined height works properly.

Claims

1. A forklift truck (10), comprising

- a truck body (2)
 - a fork lifting element (3) which is arranged to support a load support member (1) vertically movable by means of the fork lifting element (3)
 - a control element (8),
 - a system for providing information related to the height of the load support member (1), the system comprising at least one sensor (5) and at least one detection causing element (7) arranged to cause said at least one sensor (5) to register detection of said detection causing element (7), wherein said at least one sensor (5) and said at least one detection causing element (7) are arranged in relation to each other such that they move in relation to each other as the load support member (1) moves vertically and such as they pass each other at a location corresponding to at least one predetermined height of the load support member (1) and such that the detection element causes the sensor (5) to register detection at said passage, and
 - at least one communication element (6) arranged at said at least one sensor (5) and arranged to send at least one signal to the control element (8) when said at least one sensor (5) registers that the load support member (1) is passing said at least one pre-determined height, wherein the control element (8) is arranged to receive and process signals from the at least one communication element (6),
- characterised in that** said at least one communication element (6) is arranged to send a signal

to the control element (8) at pre-determined times, and **in that** the control element (8) is arranged to detect reception of the signals and to determine whether it is able to gain information related to the height of the load support member (1) from the at least one communication element (6) based on the received signals and based on the pre-determined times.

2. A forklift truck (10) according to claim 1, wherein more than one sensor (5) is used to determine whether the load support member (1) has passed a certain pre-determined height.
3. A forklift truck (10) according to any of the preceding claims, wherein the control element (8) is arranged to limit the operating performance of the truck based on a decision of the control element (8), that it is not able to gain information related to the height of the load support member (1), and/or based on the gained information related to the height of the load support member (1).
4. A forklift truck (10) according to any of the preceding claims, where the communication element (6) is arranged in relation to the sensor (5) in such a way that the communication element (6) only sends signals when the sensor (5) is working properly.
5. A forklift truck (10) according to any of the preceding claims, where the communication element (6) and the sensor (5) are implemented in one element (4).
6. A forklift truck (10) according to any of the preceding claims, wherein different pre-determined heights are detected by different sensors (5).
7. A forklift truck (10) according to any of the preceding claims, wherein the detection causing element (7) comprises at least one magnet.
8. A forklift truck (10) according to any of the preceding claims, wherein said at least one sensor (5) comprises a Hall sensor element.
9. A forklift truck (10) according to any of the preceding claims, wherein a signal which is sent from said at least one communication element (6) to the control element (8) is different, dependent on whether the signal is sent due to the fact that said at least one sensor (5) has registered that the load support member (1) passes said at least one pre-determined height, or whether the signal is sent independently from the fact, whether said at least one sensor (5) has registered that the load support member (1) passes said at least one pre-determined height.
10. A forklift truck (10) according to any of the preceding

claims, wherein one or more signals is sent from the at least one communication element (6) to the control element (8), irrespective of whether said at least one sensor (5) registers that the load support member (1) passes said at least one height, at the time the forklift truck (10) is turned on and/or restarted or at a fixed time thereafter.

11. A forklift truck (10) according to any of the preceding claims, wherein one or more signals is sent from the at least one communication element (6) to the control element (8), irrespective of whether said at least one sensor (5) registers that the load support member (1) passes said at least one height, at recurrent pre-determined times.
12. A forklift truck (10) according to any of the preceding claims, wherein the detection causing element (7) is designed in such a way, that said at least one sensor (5) can determine from which side and/or to which side the load support member (1) passes said at least one pre-determined height, preferably through arranging the detection causing element (7) in such a way, that different magnetic poles affect said at least one sensor (5) first, depending on from which side and/or to which side the load support member (1) passes said at least one pre-determined height.
13. A forklift truck (10) according to any of the preceding claims, wherein signals from one communication element (6) to the control element (8) are distinctive from signals from another communication element, and where the control unit is able to differ between the different signals, thereby being able to detect from which communication element the signal arrived.
14. A forklift truck (10) according to any of the preceding claims, wherein the signals are inverted when said at least one sensor (5) registers that the load support member (1) is passing said at least one pre-determined height.
15. A method for providing information related to the height of the load support member (1) of a forklift truck (10), the method comprising:
 - transmitting from at least one communication element (6) one or more signals of a first type upon detection that the load support member (1) passes at least one pre-determined height and
 - transmitting from the at least one communication element (6) one or more signals of a second type at pre-determined times based on a pre-determined transmission scheme,
 - at a control element (8) receiving the signals of the first and second type and
 - separating the signals of the first and second

type,

- providing information regarding the height of the load support member (1) based on the signal of the first type, and
- determining whether the communication element (6) and/or the communication between the communication element (6) and the control element (8) and/or the detection of the passing-by of the load support member (1) at at least one pre-determined height works properly based on the signal of the second type and based on the pre-determined transmission scheme.

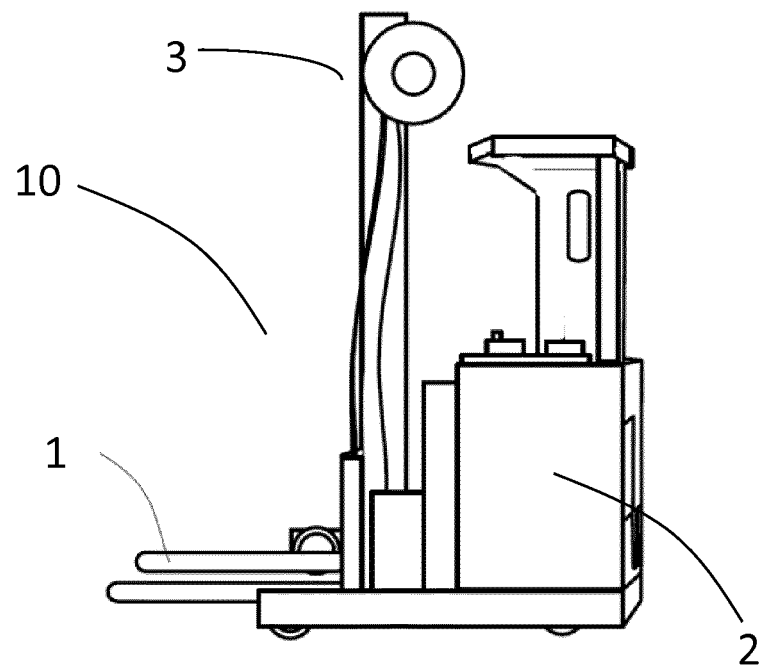


Fig. 1

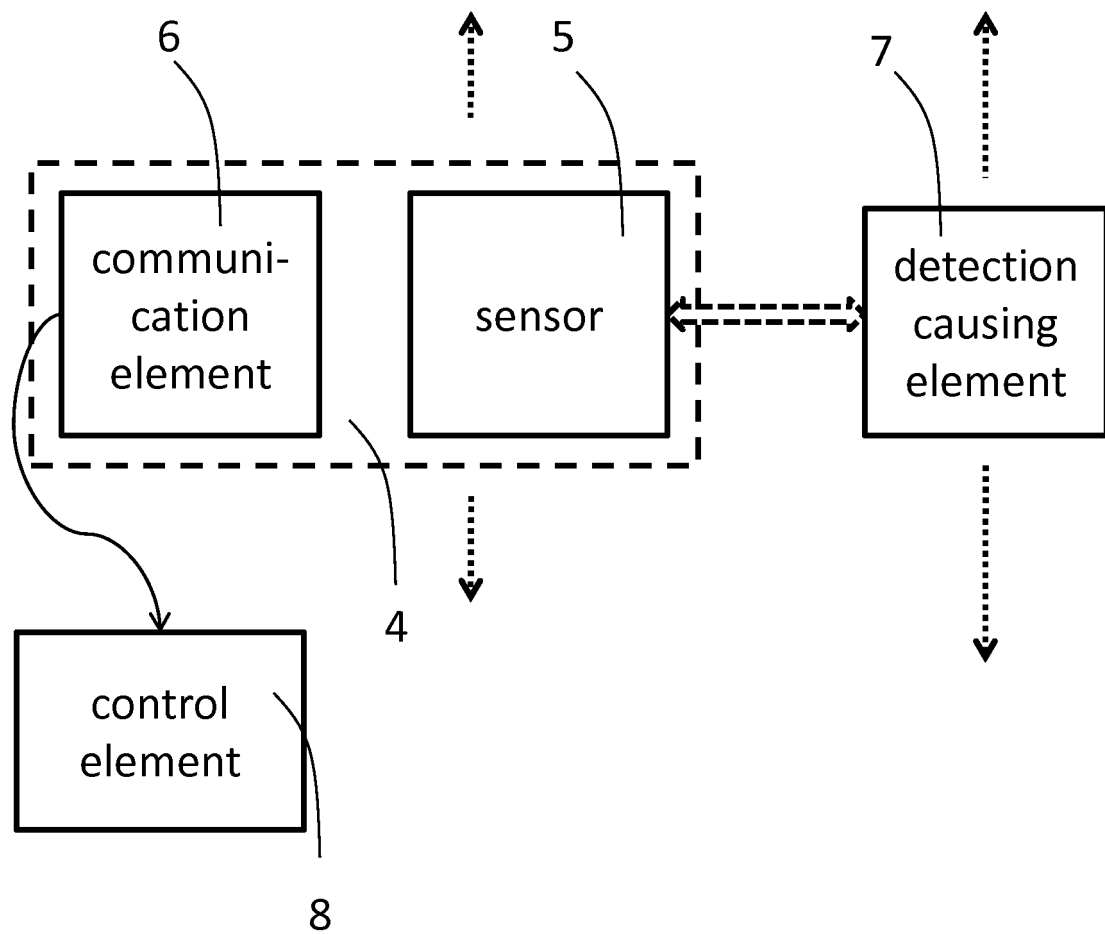


Fig. 2

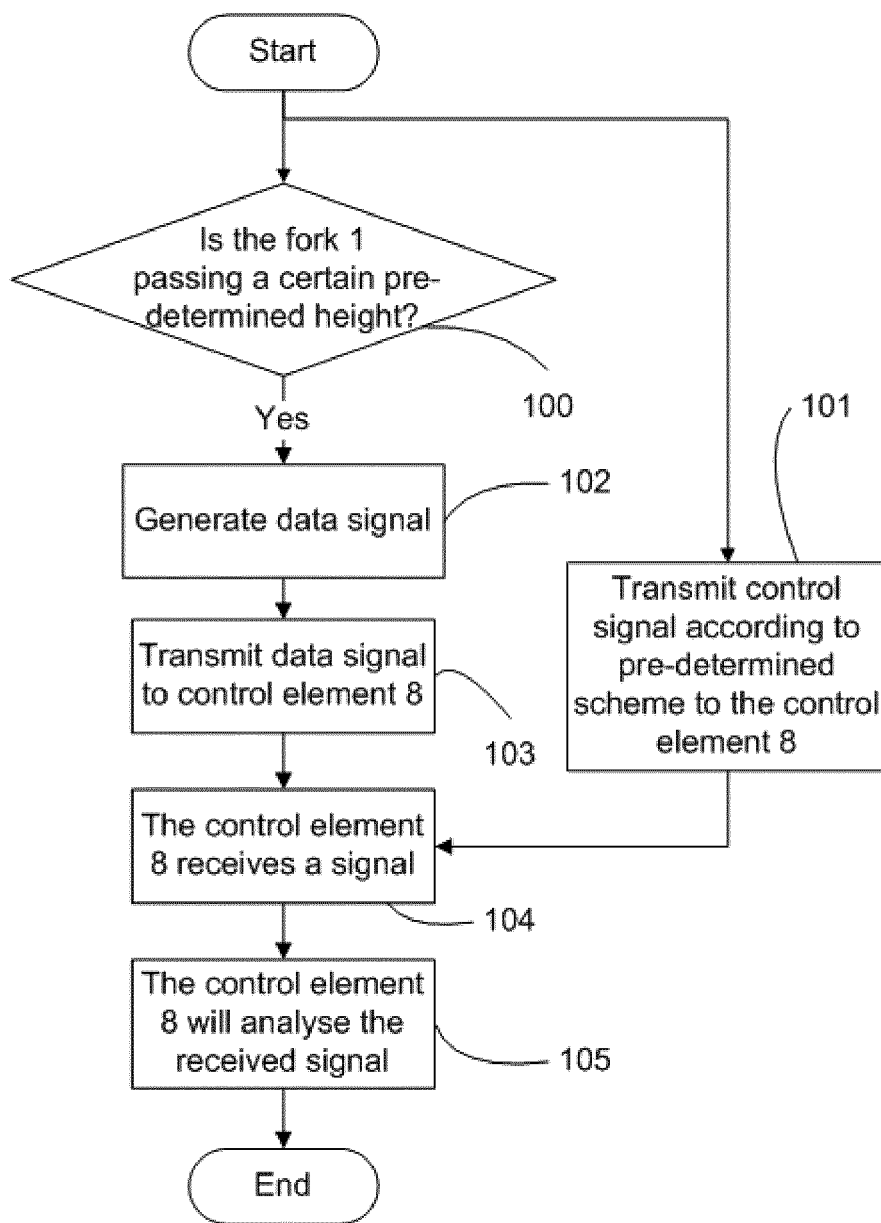
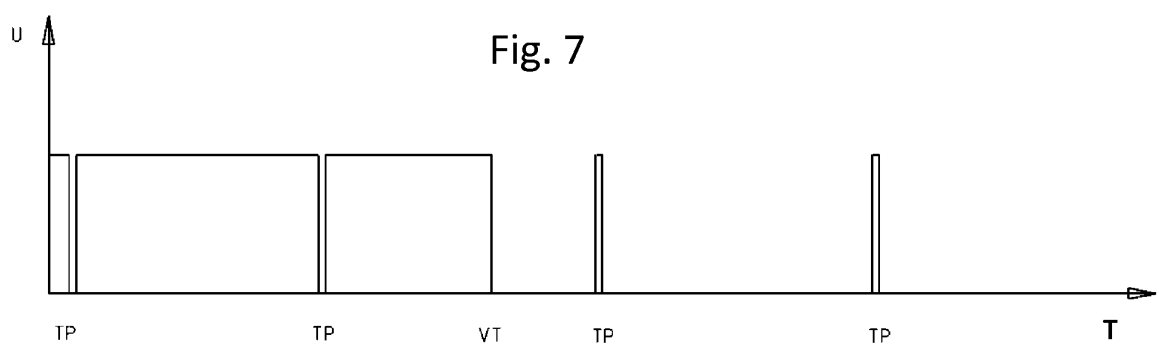
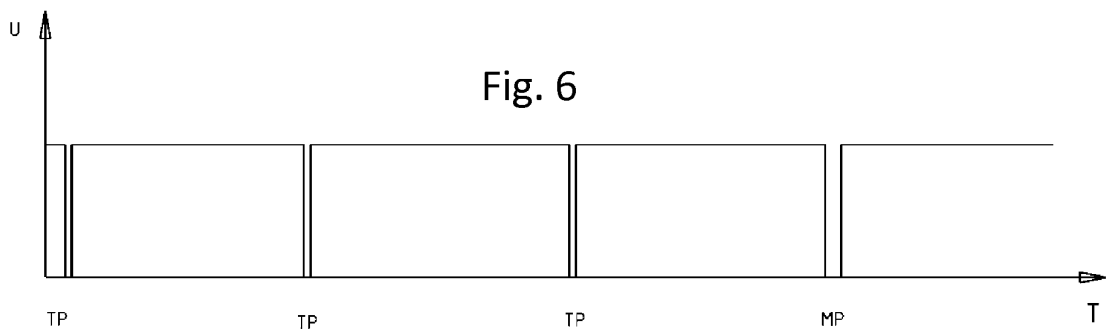
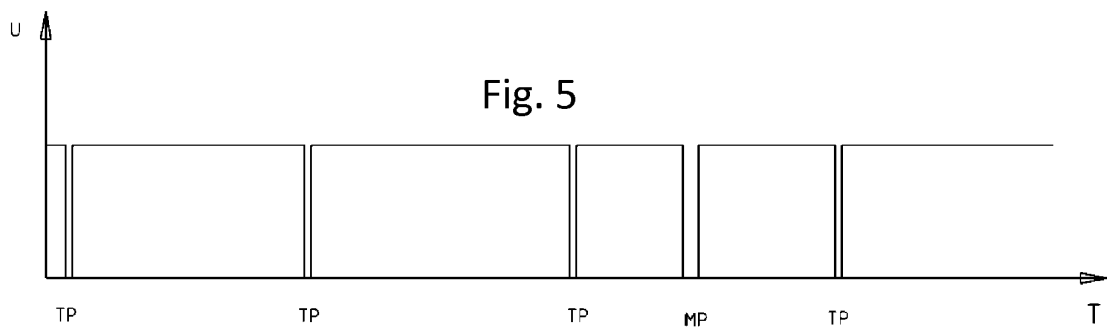
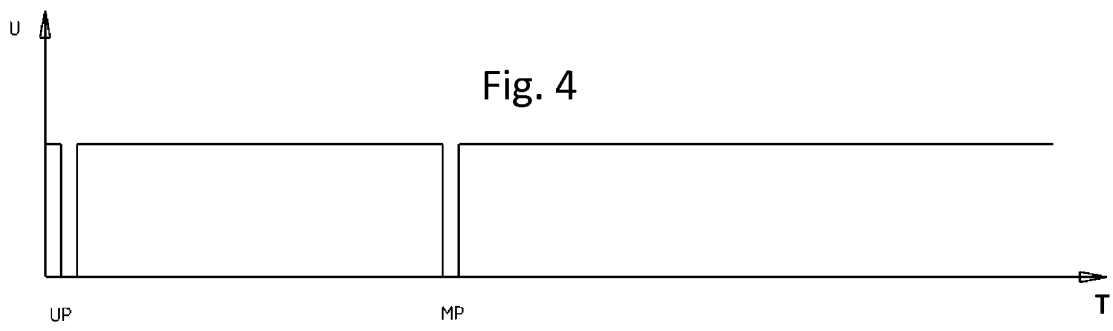


Fig. 3





EUROPEAN SEARCH REPORT

 Application Number
EP 13 15 7218

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2007 055363 A1 (BOSCH GMBH ROBERT [DE]) 28 May 2009 (2009-05-28) * paragraph [0033] *	1-15	INV. B66F9/075
A	US 2007/103107 A1 (HAYASHI TAKAO [JP]) 10 May 2007 (2007-05-10) * the whole document *	1-15	
A	EP 1 078 877 A1 (TOYODA AUTOMATIC LOOM WORKS [JP]; HONDA ELECTRONIC [JP] TOYOTA JIDOSHO) 28 February 2001 (2001-02-28) * the whole document *	1-15	
A,D	EP 1 203 743 B1 (STILL WAGNER GMBH & CO KG [DE]) 17 August 2005 (2005-08-17) * the whole document *	1,15	
A,D	EP 2 390 222 A1 (JUNGHEINRICH AG [DE]) 30 November 2011 (2011-11-30) * the whole document *	1,15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		18 July 2013	Faymann, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 15 7218

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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18-07-2013

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45

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55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102007055363 A1	28-05-2009	NONE	

US 2007103107 A1	10-05-2007	DE 102006048215 A1	05-07-2007
		KR 20070048585 A	09-05-2007
		US 2007103107 A1	10-05-2007

EP 1078877 A1	28-02-2001	DE 60019696 D1	02-06-2005
		DE 60019696 T2	19-01-2006
		EP 1078877 A1	28-02-2001
		JP 2001063985 A	13-03-2001
		US 6463009 B1	08-10-2002

EP 1203743 B1	17-08-2005	AT 302159 T	15-09-2005
		DE 10054792 A1	08-05-2002
		EP 1203743 A1	08-05-2002

EP 2390222 A1	30-11-2011	DE 102010022374 A1	01-12-2011
		EP 2390222 A1	30-11-2011

EPO FORM P0459

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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Patent documents cited in the description

- DE 3140795 C2 [0006]
- DE 19731687 A1 [0007]
- EP 1203743 B1 [0009]
- EP 2390222 A1 [0012]