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(54) RFID positioning

(57) An industrial truck (1) comprising a at least a first member (14), a second member (8), the first member (14) being arranged to be moved in relation to the second member (8); and means (20) for moving the first member (14). According to the invention is at least one RFID-tag (40.1) arranged on one of the first member (14) or the second member (8) and at least one RFID-reader (30) is arranged on the other of the first member (14) or the second member (8), so that information stored in said at least one RFID-tag (40.1) may be read by the RFID-reader (30); and a control system (17) arranged to determine the position of the first member (14) based on the information stored in said at least one RFID tag (40.1).

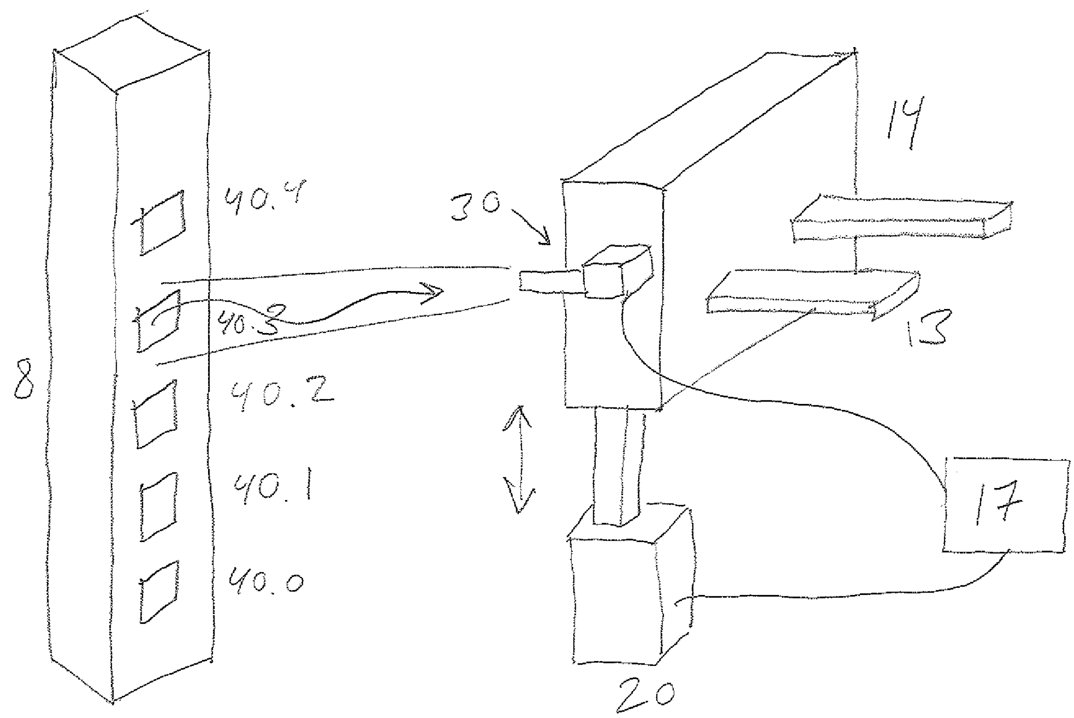

Figure 3

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Description

TECHNICAL FIELD

[0001] The present application relates to an industrial truck comprising at least a first member and a second member, the first member being arranged to be moved in relation to the second member; and means for moving the first member.

BACKGROUND ART

[0002] Industrial trucks are often provided with members that are movable, for example a fork carriage which is movable on a mast, or a mast configuration which is horizontally displaceable in the frame of a so called reach truck. Other movable members include for instance members for sideshifting, tilting and traversing of the forks. Various sensors may be arranged to determine the position of the relevant member. The sensor arrangement determines the position of the movable member and transmits a corresponding signal to the control system of the truck. The position of the member may be displayed to the driver of the truck. The control system may also be arranged to use the detected position to automatically displace the movable member to a predetermined position.

[0003] It is known to use a sensor bearing to determine the height of a movable fork carriage on the mast of the truck. The sensor bearing is arranged between the fork carriage and the mast of the truck such that the sensor bearing rotates along with the fork carriage when the fork carriage is raised or lowered on the mast. The sensor bearing generates a signal corresponding to its motion and the signal is used to determine the distance that the fork carriage is raised or lowered on the mast. Since the sensor bearing only indicates the relative displacement of the fork carriage from one position to another it needs to be regularly calibrated with reference sensors, e.g. inductive sensors that are arranged on absolute positions on the mast.

[0004] It is also know to use a sensor arrangement to determine the position of a horizontally displaceable mast in a reach truck. The sensor arrangement comprises inductive sensors and a metal ruler which has holes drilled in it. The inductive sensors detect the metal between the holes in the ruler and generate corresponding pulses. The position that the mast is displaced is then determined from the number of detected holes. Also this sensor arrangement only detects the relative displacement between positions and needs to be regularly zeroed against mechanical stops or reference sensors.

[0005] One problem with known sensor arrangements is that the accuracy of the sensor arrangement decreases between calibrations due to mechanical tolerances and drift of the sensors. A further problem is that the use of extra reference sensors increases the manufacturing cost of the truck. Yet another problem is that the calibration procedure is time consuming.

[0006] Thus, it is an object of the present invention to provide an industrial truck with improved and accurate determination of the positions of the movable members of the truck.

SUMMARY OF THE INVENTION

[0007] According to the invention this object is achieved by an industrial truck comprising at least a first member, a second member, the first member being arranged to be moved in relation to the second member; and means for moving the first member characterized by at least one RFID-tag arranged on one of the first member or the second member and at least one RFID-reader arranged on the other of the first member or the second member, so that information stored in said at least one RFID-tag may be read by the RFID-reader; and a control system arranged to determine the position of the first member based on the information stored in said at least one RFID tag. The position of the first movable member may thereby accurately be determined in a simple manner. The arrangement is inexpensive since it comprises few parts. Since the RFID-tags and the RFID-reader are fixed on respective first and second member of the truck no calibration is necessary and for the same reason are no costly reference sensors needed.

[0008] According to one alternative, may the ID-number of the at least one RFID-tag and the position of the at least one RFID-tag on the first or the second member be stored in the control system, wherein the control system is arranged to determine the position of the first member based on the ID-number and the position of said at least one RFID-tag stored in the control system.

[0009] When the ID-number of an RFID-tag is read by the RFID-reader the exact position of the tag may be retrieved from the control system. Thereby may the position of the first, movable member be determined with very high accuracy.

[0010] According to one alternative may at least one linear relationship and the position of a reference RFID-tag on the first or the second member be stored in the control system, wherein the control system is arranged to determine the position of the first member based on the ID-number of said at least one RFID-tag, the at least one linear relationship and the position of the reference RFID-tag stored in the control system.

[0011] The amount of information that needs to be stored in the control system in order to determine the position of the first member is thereby minimized.

[0012] Several RFID-tags may be distributed over the first or the second member.

[0013] The RFID-tags may be spaced with a short distance from each other on predetermined regions of the first or the second member and with a longer distance from each other on other pre-determined regions of the first or the second member.

[0014] The accuracy may thereby be increased in critical regions and the total number of RFID-tags is minimized.

[0015] According to one alternative, may several RFID-tags be arranged in at least one row on the first or the second member.

[0016] The RFID-reader may be arranged to approximately simultaneously read information from at least two RFID-tags.

[0017] The number of positions that may be determined is thereby doubled.

[0018] According to one alternative, may several RFID-tags be arranged in three rows, each row displaced to the previous row by 1/3 of the height of a RFID-tag.

[0019] The RFID-reader may be arranged to approximately simultaneously read information from at least nine RFID-tags.

[0020] The number of positions that may be determined is thereby increased six times.

[0021] According to one alternative, may several RFID readers be arranged in line on the same member, spaced a distance from each other.

[0022] Preferably, the distance between two RFID-readers divided by the size of a RFID tag equals an uneven number.

[0023] The number of position that may be determined is thereby increased three times.

[0024] According to one alternative, may the control system be arranged to analyze the strength of the signal from at least one RFID-tag, wherein the control system is arranged to determine the position of the first member from the strength of the signal.

[0025] The number of position that may be determined is thereby increased.

[0026] Preferably, may the first member be any of: an extendable mast segment a mast carriage for horizontally moving a mast, or a vertically movable load carriage, wherein the second member may be any of: a supporting element for a mast carriage, a fixed mast or mast segment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Figure 1 illustrates schematically a perspective view of an industrial truck according to a first embodiment of the invention.

Figure 2 illustrates schematically a side view of the industrial truck illustrated in figure 1.

Figure 3 illustrates schematically a detail of the truck showing the arrangement for position determination.

Figure 4 a-h illustrates schematically the determination of position using a RFID-reader with increased resolution.

Figure 5 a-d illustrates schematically the determination of position using a RFID-reader with increased resolution and three rows of RFID-tags.

Figure 6 a-d illustrates schematically the determination of position using two RFID-readers

Figure 7a-h illustrates schematically the determination of position by analyzing the strength of the signal from the RFID-tags.

DETAILED DESCRIPTION

[0028] Figure 1 illustrates an industrial truck according to a first preferred embodiment of the invention. The industrial truck described in figure 1 is a reach truck, which has a vertically extendable and horizontally movable mast. However the truck could also be any type of truck, for example a fix mast truck, an order picker truck, a stacker truck, a counterbalance truck or a tiller arm truck.

[0029] The industrial truck 1 comprises a frame 2 which in its forward part extends into two forward support legs 3 carrying support wheels 4. The frame 2 supports a housing 5 in which an electrical drive motor for propelling a drive wheel and a hydraulic motor for providing power for moving members on the truck is accommodated (these parts are not shown in the figure). The housing 5 further accommodates a driver's compartment 6, comprising controls for driving the truck and actuating members of the truck.

[0030] The frame 2 further supports a lifting mast 8 comprising at least two uprights 8.1 and 8.2 of e.g. H-beam shape. The mast may be telescopic and then comprises further uprights 8.1, 8.2, journalled in each other. A hydraulic lifting arrangement 10, powered by the hydraulic motor is arranged to lift the uprights of the telescopic mast in order to extend the mast to a desired height.

[0031] The lifting mast 8 is arranged to be moved horizontally forward and backwards on the support legs 3 (see figure 2). The horizontal movement of the mast is accomplished in that the mast is supported on a carriage 11, which is journalled in each of the support legs 3. A hydraulic piston 12, powered by the hydraulic motor, moves the carriage 11 back and forth on the support legs 3.

[0032] The lifting mast 8 further comprises a load carriage 14 which is journalled in the uprights of the mast. Means 20, e.g. a chain and pulley system or a hydraulic system, are arranged to move the load carriage 14 in a vertical direction along the mast 8. Forks 13 may be arranged on the load carriage. A hydraulic piston 19 may also be arranged to tilt the load carriage 14.

[0033] Figure 2 further shows the control system 17 of the truck which is accommodated in the truck housing. The control system, i.e. the truck computer, controls the performance of the motor of the truck. The control system is arranged to determine the position of various members of the truck. The control system also controls the means for moving the movable members on the truck. These means comprises for example, the means 10 for extending the mast or means 20 for moving the load carriage vertically on the mast, or the hydraulic piston for moving the mast horizontally on the support legs of the truck, or the piston 19 for tilting the load carriage.

[0034] In the following is referred to RFID-tags and RFID-readers. An RFID-tag, Radio Frequency Identification tag includes an integrated circuit (IC) and an antenna. The RFID-tag may comprise a battery or may obtain energy from an external reader. The IC in the RFID-tag comprises a memory in which a tag identifier, for example an ID-number is stored. The information stored in the RFID-tag can be read by an RFID-reader. The RFID-reader transmits energy to the tag via its reader antenna. When the RFID-tag receives the energy from the RFID-reader it transmits the information stored in its memory back to the RFID-reader.

[0035] Figure 3 illustrates schematically the arrangement of RFID-tags and a RFID reader for determining the position of movable parts in the truck. Shown in figure 3 is a view of a section of the mast 8 of the truck. Several RFID-tags 40.0, 40.1, 40.2 ...40.n are arranged on predetermined positions on the mast 8 of the truck. The RFID-tags are attached e.g. by adhesive on one of the uprights of the mast, on the side of the mast facing the load carriage. Preferably, the RFID-tags are distributed along the entire length of the mast. Figure 3 further shows an RFID-reader 30 arranged on the load carriage 14 and means 20 for moving the load carriage 14. Figure 3 also shows the control system 17 which is arranged to determine the position of the load carriage 14. The control system may be a part of the control system 17 of the truck, i.e the truck computer.

[0036] According to one alternative, the position of each RFID-tag is determined and the ID number of each tag and the corresponding position of the tag on the mast are stored in a memory in the control system 17 of the truck. The position of each RFID-tag is determined by measuring the distance from a reference point on the truck to the position of the tag. The reference point is typically the ground but may also be the base of the mast.

[0037] According to one alternative, the position of each RFID-tag on the mast is determined in the control system 17 from a linear relationship between the position "POSO" of a reference tag 40.0, the distance "K" by which the other tags 40.1, 40.2, 40.3 ...40.n are spaced from each other and the ID-number of the detected RFID-tag. The relationship and the values are stored in a memory in the control system. The position "POSO" of the reference tag, for example tag 40.0, is measured from the ground or base of the mast.

[0038] The linear relationship may for example be POSn = POSO + K*n where POSn is the position of a specific tag, e.g. the height of the tag on the mast measured from the base of the mast, "POSO" is the height of the reference tag measured from the ground or base of the mast, "K" is the distance between each tag and "n" is the number of the RFID-tag that is detected counted from a reference point, e.g. the base of the mast. The number "n" may be derived from the ID-number of the RFID-tag. The number "n" may also be stored in a memory in the control system.

[0039] According to a further alternative, a first group of tags having a distance "K1" from each other may be arranged on a first region of the mast and second group of tags having a distance "K2" from each other may be distributed on a second region of the mast. In this case two linear relationships, one for each group of tags may be stored in the control system. The position of each tag is then determined from a reference tag and a linear relationship for each group of tags.

[0040] The RFID-reader 30 is arranged on the load carriage 14, opposite the RFID-tags. The RFID-reader is directed towards the RFID-tags on the mast 8. Preferably, the RFID-reader is arranged on the back or on the side of the load carriage. When the load carriage is raised or lowered on the mast the RFID-reader 30 passes in front of the RFID-tags.

[0041] Some truck types comprise a telescopic mast and are arranged to perform free-lift and main-lift. In these truck types the load carriage is first raised on the stationary mast member, the so called free-lift. Thereafter is the extendable member of the telescopic mast raised, the so called main-lift. In this truck type, a first group of tags is arranged on the stationary member of the telescopic mast. A first RFID-reader is arranged on the load carriage as described above. A second group of tags are arranged on the extendable member of the telescopic mast. A second RFID-reader is arranged on the top of the stationary mast member and directed towards the tags on the extendable mast member.

[0042] In this truck type, the load carriage is first raised on the mast whereby the RFID-reader passes in front of the RFID-tags. Then, the extendable member of the mast is raised, whereby the RFID-tags on the extendable member of the mast passes in front of the second RFID-reader arranged on the top of the stationary mast.

[0043] When an RFID-tag is in front of the RFID-reader, the signal from the RFID-reader energizes the RFID-tag. The RFID-tag then emits a signal with its identification number. The identification number of the tag is detected by the RFID-reader and is transmitted to the control system 17 where the position of the detected RFID-tag is determined. When the RFID-tag and the RFID-reader are in front of each other, i.e. there is 0° angle between the RFID-tag and the RFID-reader, the position of the detected RFID-tag corresponds to the position of the member that is moved, e.g. the load carriage or the extendable mast. The position of the member that is moved, e.g. the load carriage or the extendable mast may then be determined from the position of the RFID-tag.

[0044] According to one alternative, the position of the RFID-tag is determined by retrieving the stored position of the detected RFID-tag from the control system.

[0045] According to a second alternative, the position of the detected RFID-tag is determined by the position of a reference tag, the distance "K" between the tags and a linear relationship which is stored in the control system of the truck.

[0046] For example, the linear relationship POSn = POSO + K*n is stored in the control system. The position of the reference tag "POSO" is 1 m and the RFID-tags are distributed with a distance of 0.05 m from each other. If RFID-tag 40.3 is detected, the position of that tag is the determined by the calculation POS3 = 1 + 3*0.05, thus 1.15 m.

[0047] The determined position may be displayed to the driver of the truck on a display, for example a liquid crystal display, LCD. The driver may then use the information of the position of the load carriage when manually controlling the truck.

[0048] The control system may also be arranged to use the determined position in a safety arrangement which monitors the movement of the load carriage when the driver manually controls the truck. In this case the control system is configured with a predetermined position, for example at the end of the mast or near the end of the mast. The controls system is arranged to activate a warning signal or to stop the movement when the driver manually has moved the load carriage to the predetermined position.

[0049] The control system may further be arranged to use the determined position to control automatic functions in the truck. According to one alternative the control system may be arranged to use the determined position to automatically move the forks to a predetermined position on the mast. The control system 17 is thereby arranged to receive a signal from the driver to move the load carriage to a predetermined position on the mast. This may be achieved in that the driver selects a height on a height selector on the control panel of the truck. The control system is thereby configured with the ID-number of a specific RFID-tag that corresponds to the selected height. Normally, the driver also selects a lifting or lowering cycle on a cycle selector. The control system is thereby configured with the direction of the movement.

[0050] The control system 17 then controls the actuating means 20 to move the load carriage vertically on the mast. As the load carriage is moved on the mast the RFID-reader passes in front of the RFID-tags. When the reader is in front of a tag the RFID-tag is energized by the signal from the reader. The RFID-tag then transmits a signal containing the ID-number of the tag to the RFID-reader. The RFID-reader continuously transmits the ID-numbers of the RFID-tags to the control system 17 of the truck.

[0051] The control system 17 determines the position of the detected RFID-tag as described above. When the transmitted ID-number corresponds to the ID-number of the selected height the control system stops the actuation means.

[0052] Since the RFID-tags have a specific size, for example 3X3 cm there is only room for a limited number of tags on the mast. This limits the number of predetermined positions that may be stored in the control system, whereby the accuracy of the position determination of the load carriage is limited.

[0053] The accuracy of the position determination may be improved by using several tags to determine one position. This is achieved in that the resolution of the reader, i.e. the area that the reader covers is adjusted so that the reader can detect signals from several tags approximately simultaneously. Several rows of RFID-tags and several RFID-readers may also be used to further increase the number of positions that may be detected.

[0054] When the resolution of the RFID-reader is increased, the RFID-reader may read the ID-signals from the RFID-tags in the area that the reader covers. The tags are read separately within a very short time interval between each signal and the detected ID-numbers are transmitted to the control system 17. The short time interval between readings when the RFID-reader is in front of several RFID-tags depends on the construction and type of the RFID-reader. Typically the time interval is a few milliseconds.

[0055] The position of each RFID-tag is stored in the control system as described above. As described, the positions may also be determined by a linear relationship. The control system is configured so that the signals from one specific RFID-tag, or the signals from several specific RFID-tags that are read within a short time interval, correspond to predetermined positions.

[0056] According to one alternative (see figures 4a-4h), several RFID-tags are arranged adjacent each other in a row. The resolution of the RFID-reader is adjusted so that the reader covers an area approximately equal to one RFID-tag. The RFID-reader may thereby detect the signal from one specific RFID-tag or the signals from two specific RFID-tags. The circle in figures 4a-4h indicates the area that the RFID-reader covers. The control system is configured so that the signal from one specific RFID-tag, or the signals from two specific RFID-tags correspond to predetermined positions.

[0057] For example, in figure 4a the RFID-reader detects the signal from RFID-tag 40.1. The control system is configured such that this ID-number corresponds to position 1, "POS1". In figure 4b the RFID-reader detects the signals from RFID-tags 40.1 and 40.2 within a short time interval. The control system is configured such that these two ID-numbers, when read within a short time interval, corresponds to position 2, "POS2". In figure 4c, RFID-tag 40.2 is read. This corresponds to position 3, "POS3". In figure 4e, RFID-tags 40.2 and 40.3 are read. This corresponds to position 4, "POS4". Figures 4e-h describes further positions. By this configuration of the reader and the control system the number of positions that is stored in the control system is multiplied by two whereby the accuracy of the position determination is doubled.

[0058] According to another alternative, several rows of RFID-tags are arranged adjacent each other on the mast. Each row is displaced vertically a distance in relation to the previous row. The distance may for example be the height of the tag divided by the number of rows. The resolution of the reader is increased to cover an area equal to the height of one or several tags times the total width of all the rows of tags. The control system is configured so that the signals from one specific RFID-tag, or the signals from several specific RFID-tags that are read within a short time interval, correspond to predetermined positions.

[0059] For example, figures 5a-5d shows three rows of RFID-tags arranged adjacent each other. The second row is arranged 1/3 of a tag height below the top of the first row. The third row is arranged 1/3 of a tag height below the top of the second row.. In figure 5a, RFID-tag 40.1 is read. This corresponds to position 1, "POS1". In figure 5b, RFID-tags 40.1, 40.2, 40.3 and 40.4 are read, corresponding to position 4, "POS4". In figure 5c, RFID-tags 40.1, 40.2, 40.3, 40.4 and 40.5 are read, corresponding to position 5, "POS5". In figure 5d, RFID-tags 40.2, 40.3, 40.4, 40.5 and 40. 6 are read, corresponding to position 6, "POS6". By the configuration described above the number of positions that may be detected is multiplied by 6.

[0060] According to a further alternative, the accuracy of the position determination is increased by using several RFID-readers to read the RFID-tags. The RFID-readers are preferably arranged in line and spaced a distance from each other. The distance should not be equally dividable with the size of the RFID-tag. As described, the resolution of each reader may be adjusted to cover a predetermined area, for example corresponding to the area of a tag. The RFID-readers simultaneously detects RFID-tags and transmit the ID-numbers of the tags to the control system. The control system is configured so that one or several specific tags, detected by a first reader and one or several specific tags detected by a second reader correspond to predetermined positions.

[0061] For example, figures 6a-6d shows two RFID-readers: 30 and 31, which are arranged in line. The RFID-readers simultaneous reads RFID-tags which are arranged in one row. In figure 6a, the first RFID-reader 30 read tag 40.1 and reader 31 transmits a null reading. The control system is configured such that this combination of readings by reader 30 and 31 corresponds to position 1. In figure 6b, reader 30 reads RFID-tag 40.2 and reader 31 transmits a null reading. This combination corresponds to position 2. In figure 6c, reader 30 reads tag 40.2 and reader 31 reads tag 40.1. This combination corresponds to position 4. In figure 6d, reader 30 reads tags 40.2 and 40.3 and reader 31 reads tag 40.1. This combination corresponds to position 5. The arrangement of two readers described above increases the number of positions by a multiple of 3 whereby the accuracy is tripled.

[0062] According to a further alternative, the accuracy of the position determination may be increased by analyzing the strength of the signals from the RFID-tags. The control system is thereby configured to that specific combinations of detected signal strength from one or several tags corresponds to predetermined positions.

[0063] For example, in figures 7a-h the reader detects the signal strength of the tags. The signal strength is analyzed in the control system and a position is determined. In figure 7a the reader only detects the signal from tag 40.1, this signal strength corresponds to position 1. In figure 7b, the RFID-reader detects the signals from tags 40.1 and 40.2. The signals are equally strong which corresponds to position 2. In figure 7c the reader detects signals from tags 40.1, 40.2 and 40.3. The signals from tags 40.1 and 40.2 are equally strong and the signal from 40.3 is weaker than the signal from the other tags. This corresponds to position 3. In figure 7e, signals from tags 40.1, 40.2 and 40.3 are equally strong but the signal from tag 40.4 is weak. This relationship of signal strength corresponds to position 5. In figure 7f tags 40.2 and 40.3 generates signals of equal strength. Tags 40.1 and 40.4 also generate signals of equal strength but of lower strength than the signals from 40.2 and 40.3. This corresponds to position 6. Figures 7g and 7h describe further examples.

[0064] According to yet another alternative, the RFID-tags may be arranged with different intervals on different regions of the mast. For example, the tags may be arranged close to each other on a region of the mast where accuracy is important, e.g. on the middle of the mast. The tags may be arranged further away from each other at the ends of the mast where less accuracy is needed. The accuracy is thereby improved locally and the total number of RFID-tags is optimized.

[0065] According to a second embodiment of the invention the RFID-tags and the RFID-reader are used to determine the position of the horizontally movable mast of the reach truck. In this case, the RFID-tags may be arranged on the inner side of one of the support legs 3 of the truck. The tags may also be arranged on the casing of the hydraulic cylinder 12 which moves the mast horizontally. The tags are arranged on predetermined position measured from a reference point, for example the position where the mast is fully retracted. As described above, the ID-number of each tag and its corresponding position are stored in the control system. As described above the position of tags may also be determined from a reference tag and linear relationships. The RFID-reader is arranged on the mast, and directed towards the RFID-tags. Preferably, the RFID-reader is arranged on the mast 8 of the truck. When the mast is moved horizontally, the RFID-reader reads the ID-numbers of the RFID-tags on the support legs of the truck and transmits the ID-numbers to the control system 17 which determines the position of the mast.

[0066] As described earlier, the detected position may be displayed on an LCD so that the driver may use the information of the position to manually control the truck.

[0067] The control system 17 may also be arranged to automatically control the horizontal movement of the mast. A predetermined position, e.g. the position when the mast is fully extended may be configured in the control system. The control system may be arranged to automatically move the mast horizontally until the predetermined position is reached.

[0068] When the driver manually controls the movement of the mast, the control system 17 may be arranged to monitor the movement of the mast and automatically slow down or stop the movement of the mast when the predetermined position is reached.

[0069] The RFID-tags and RFID-readers may also be arranged on other members of the truck which are movable in relation to each other. For example in a truck with side shifting of the forks, the RFID-tags may be arranged on one movable part of the load carriage and the RFID-reader on the fork yoke. In a truck with fork spreading the tags may be arranged on the load carriage and one RFID-reader may be arranged on each fork.

[0070] Although particular embodiments have been disclosed herein in detail, this has been done for purposes of illustration only, and is not intended to be limiting. Features of the disclosed embodiments may be combined. In particular, it is contemplated by the inventors that various substitutions, alterations, and modifications may be made to the invention within the scope of the appended claims. For instance, RFID-tags and RFID readers could be deployed to determine the tilting angle of the forks. The specific arrangement of the tags and the RFID-readers could be modified. For example, two RFID-readers may be used together with three rows of RFID-tags in order to increase the accuracy of the determination of the position of the movable member. Further, the velocity of the movable member may be determined from the time elapsed between the determination of two to position determination.

Claims

1. An industrial truck (1) comprising at least a first member (8, 11, 14), a second member (3, 8), the first member (8, 11, 14) being arranged to be moved in relation to the second member (3, 8); and means (10, 12, 20) for moving the first member (8, 11, 14) **characterized by** at least one RFID-tag (40.1) arranged on one of the first member (8, 11, 14) or the second member (3, 8) and at least one RFID-reader (30) arranged on the other of the first member (8, 11, 14) or the second member (3, 8), so that information stored in said at least one RFID-tag (40.1) may be read by the RFID-reader (30); and a control system (17) arranged to determine the position of the first member (8, 11, 14) based on the information stored in said at least one RFID tag (40.1).

2. The industrial truck (1) according to claim 1, **wherein** the ID-number of the at least one RFID-tag (40.1) and the position of the at least one RFID-tag (40.1) on the first or the second member is stored in the control system (17), wherein the control system (17) is arranged to determine the position of the first member (8, 11, 14) from the ID-number and the position of said at least one RFID-tag (40.1) stored in the control system (17).

3. The industrial truck according to claim 1, **wherein** at least one linear relationship and the position of a reference RFID-tag (40.0) on the first or the second member is stored in the control system (17), wherein the control system is arranged to determine the position of the first member (8,11, 14) from the ID-number of said at least one RFID-tag (40.1), the at least one linear relationship and the position of the reference RFID-tag (40. 0) stored in the control system (17).

4. The industrial truck according to any preceding claim, **wherein** several RFID-tags (40.1, 40.2, 40.3...40.n) are distributed over the first or the second member.

5. The industrial truck according to claim 4, wherein the RFID-tags are spaced with a short distance from each other on pre-determined parts of the first or the second member and with a longer distance from each other on predetermined parts of the first or the second member.

6. The industrial truck according to any preceding claim, **wherein** the RFID-reader (30) is arranged to approximately simultaneously read information from at least two RFID-tags.

7. The industrial truck (1) according to any preceding claim, **wherein** several RFID-tags (40.1, 40.2, 40.3...40.n) are arranged in at least one row on the first or the second member.

8. Industrial truck according to claim 7, **wherein** several RFID-tags (40.1, 40.2, 40.3...40.n) are arranged in three rows, each row displaced to the previous row by 1/3 of the height of a RFID-tag.

9. Industrial truck according to claim 8, **wherein** the RFID-reader (30) is arranged to approximately simultaneously read information from at least nine RFID-tags.

10. Industrial truck according to any preceding claims, wherein several RFID readers (30), (31) are arranged in line on the same member, spaced a distance from each other.

11. Industrial truck according to claim 10, **wherein** the distance between two RFID-readers divided by the

size of a RFID tag equals an uneven number.

12. Industrial truck according to any preceding claim, **wherein** the control system (17) is arranged to analyze the strength of the signal from at least one RFID-tag, wherein the control system to determine the position of the first member (8, 11, 14) from the strength of the signal.

13. Industrial truck according to any preceding claims, wherein the first member (8, 11, 14) is any of: an extendable mast segment (8), a mast carriage (11) for horizontally moving a mast, an or a vertically movable load carriage (14), wherein the second member (3, 8) is any of: a supporting element (3) for a mast carriage, a fixed mast or mast segment (8).

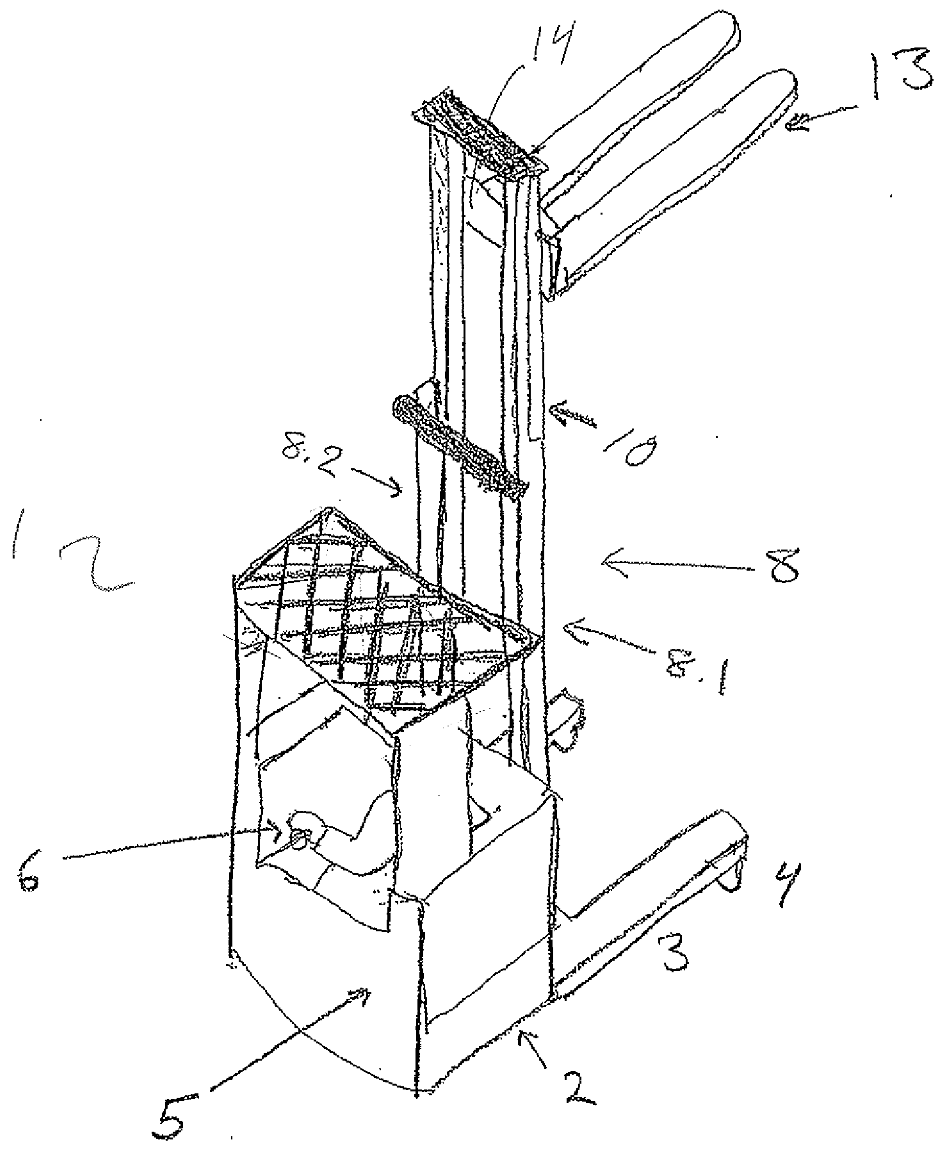

Fig 1

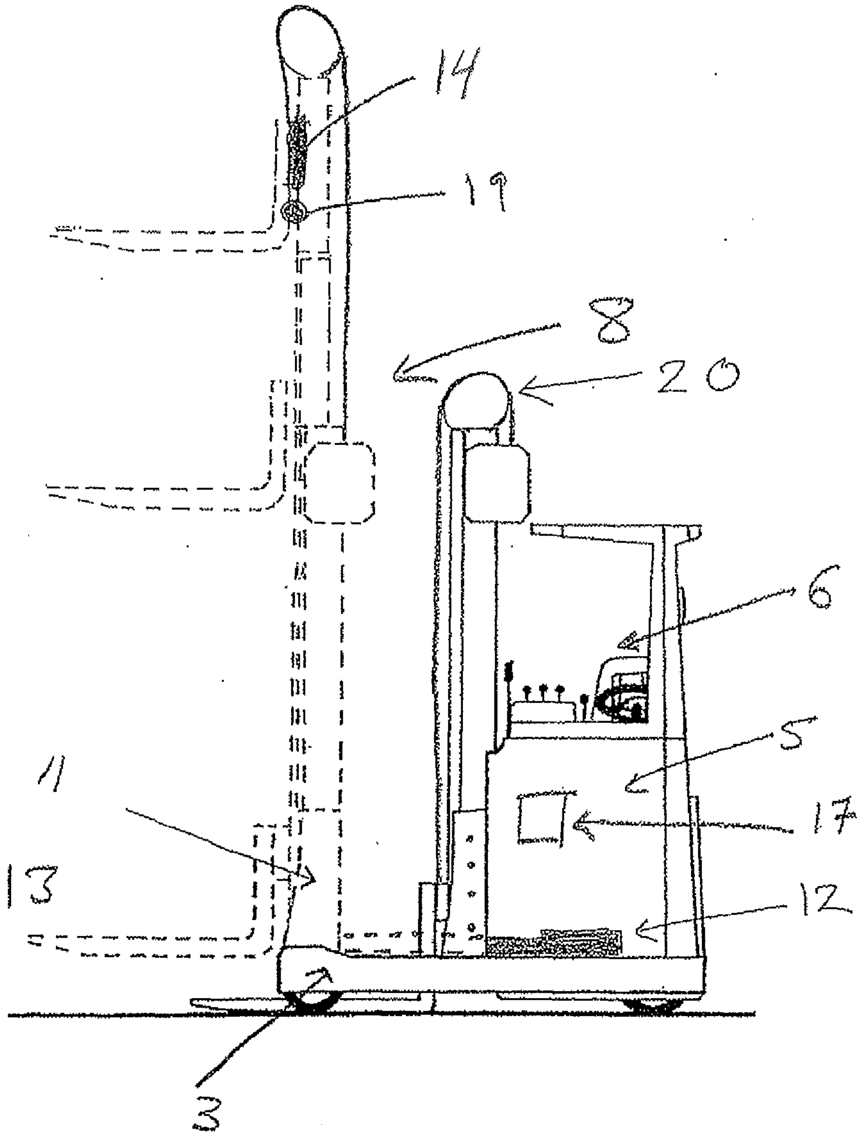

Fig 2

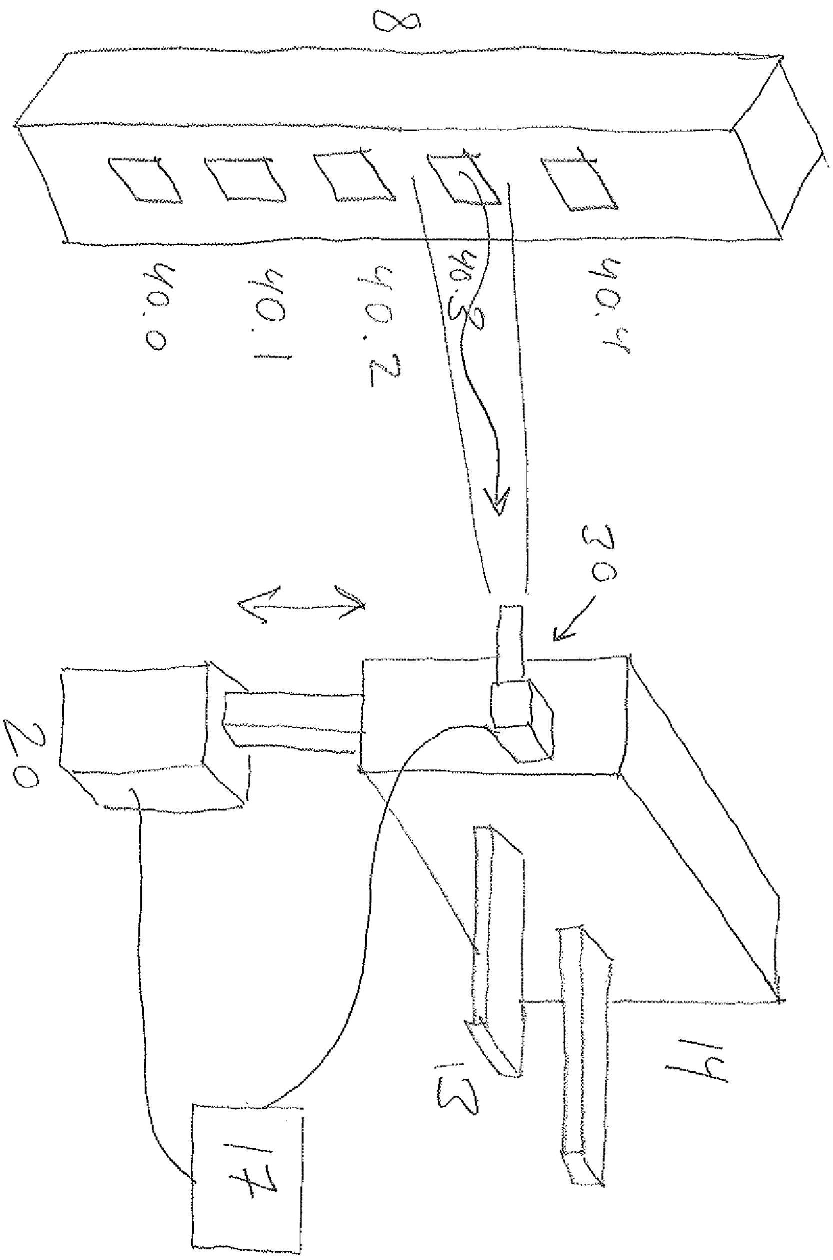

Figure 3

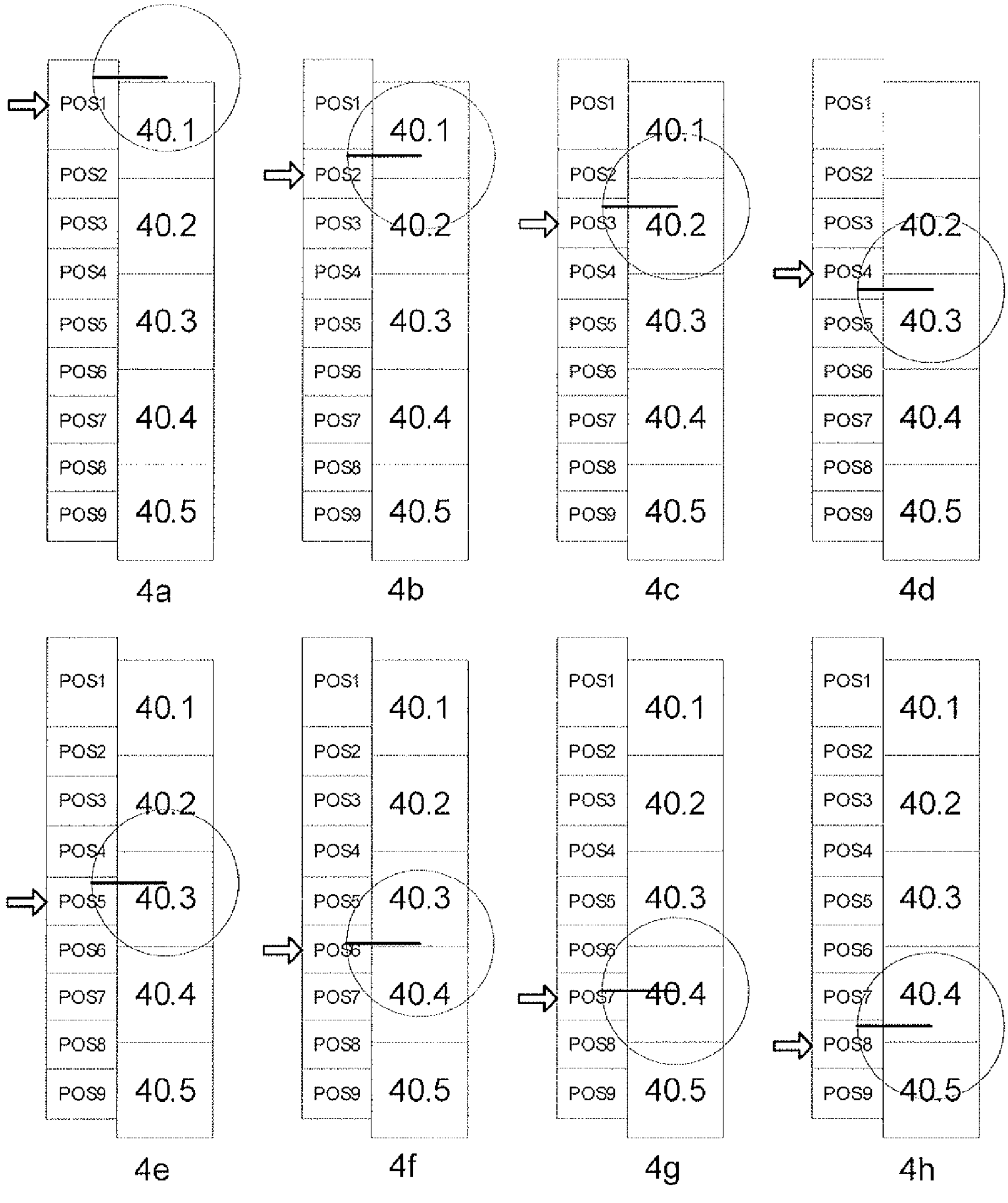
POS1
POS2
POS3
POS4
POS5
POS6
POS7
POS8
POS9
40.1
40.2
40.3
40.4
40.5
4a
4b
4c
4d
4e
4f
4g
4h

Figure 4 a-h

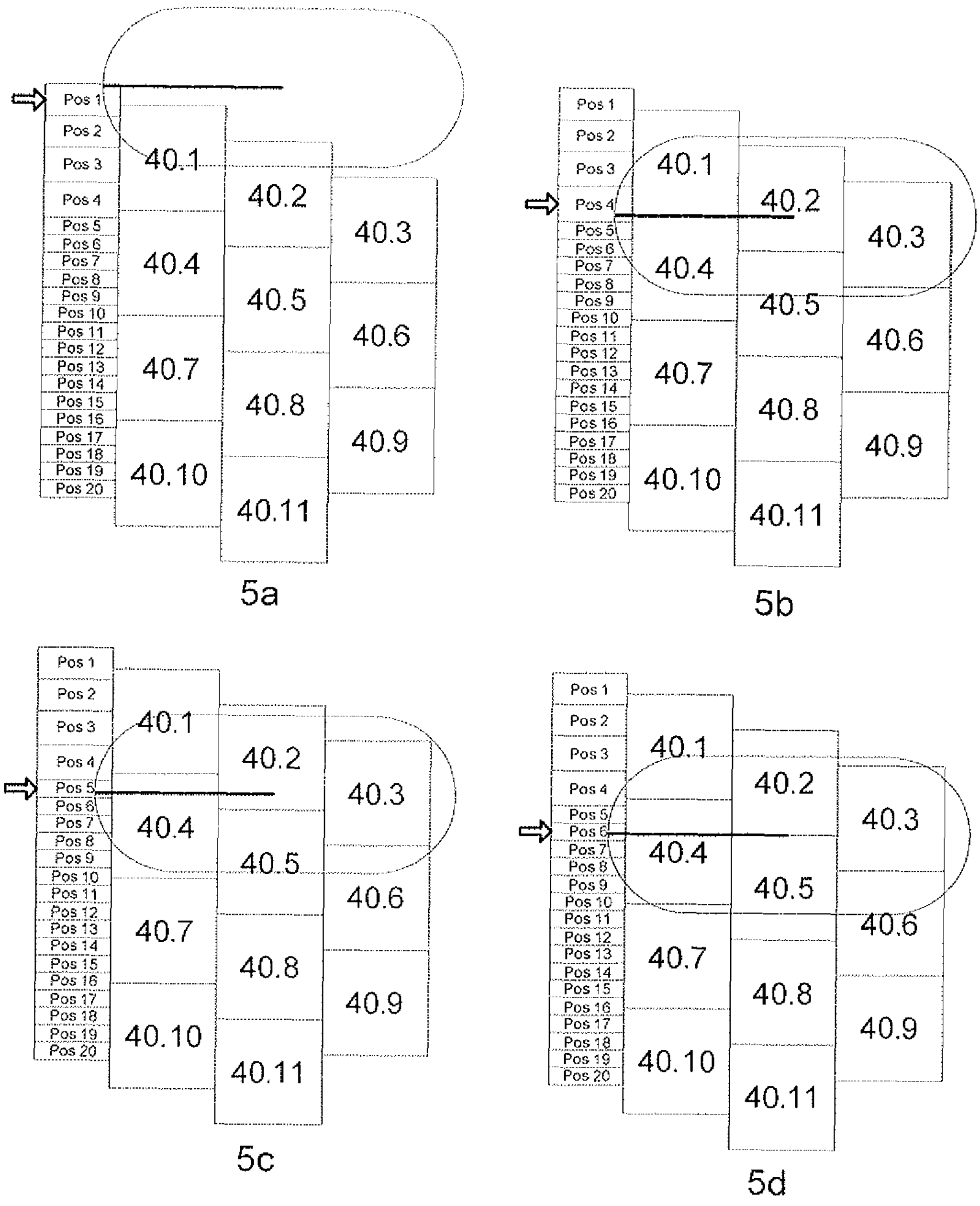
Pos 1
Pos 2
Pos 3
Pos 4
Pos 5
Pos 6
Pos 7
Pos 8
Pos 9
Pos 10
Pos 11
Pos 12
Pos 13
Pos 14
Pos 15
Pos 16
Pos 17
Pos 18
Pos 19
Pos 20
40.1
40.2
40.3
40.4
40.5
40.6
40.7
40.8
40.9
40.10
40.11
5a
5b
5c
5d

Figure 5 a – d

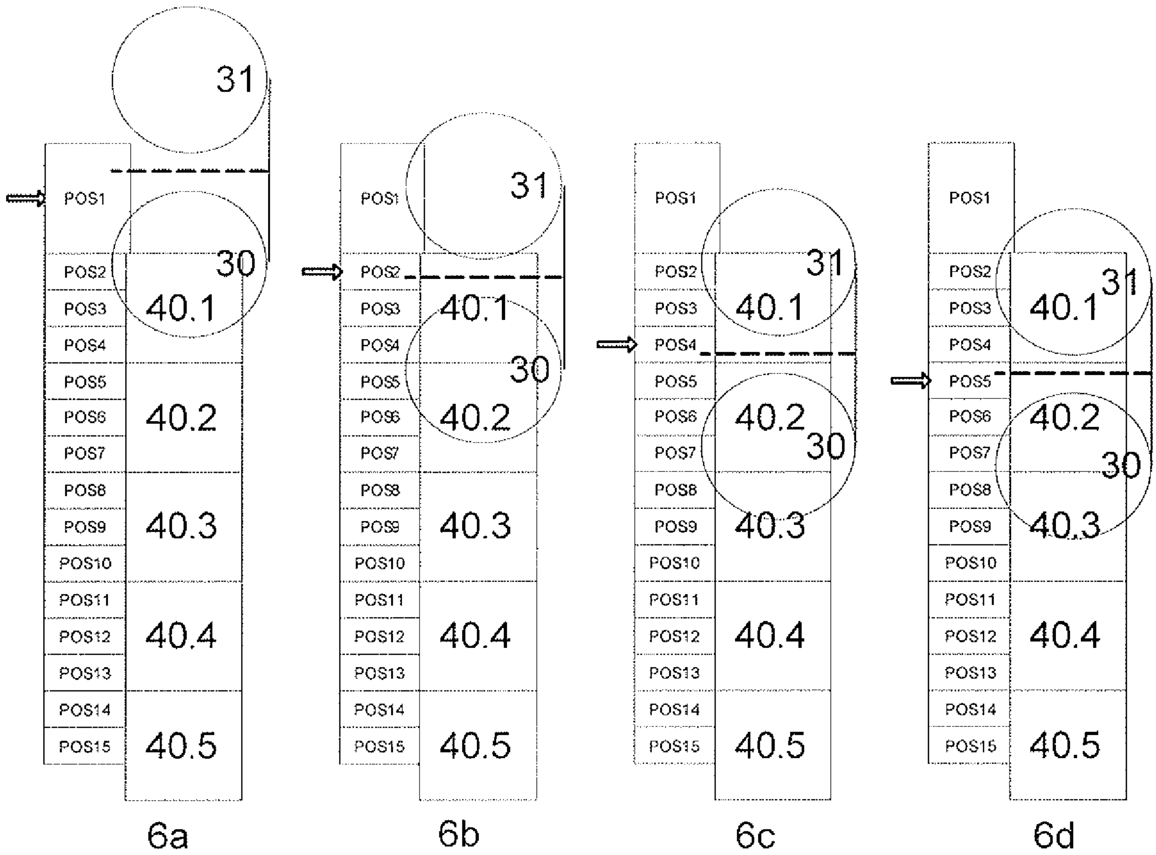
31
30
POS1
POS2
POS3
POS4
POS5
POS6
POS7
POS8
POS9
POS10
POS11
POS12
POS13
POS14
POS15
40.1
40.2
40.3
40.4
40.5
6a
6b
6c
6d

Figure 6 a-d

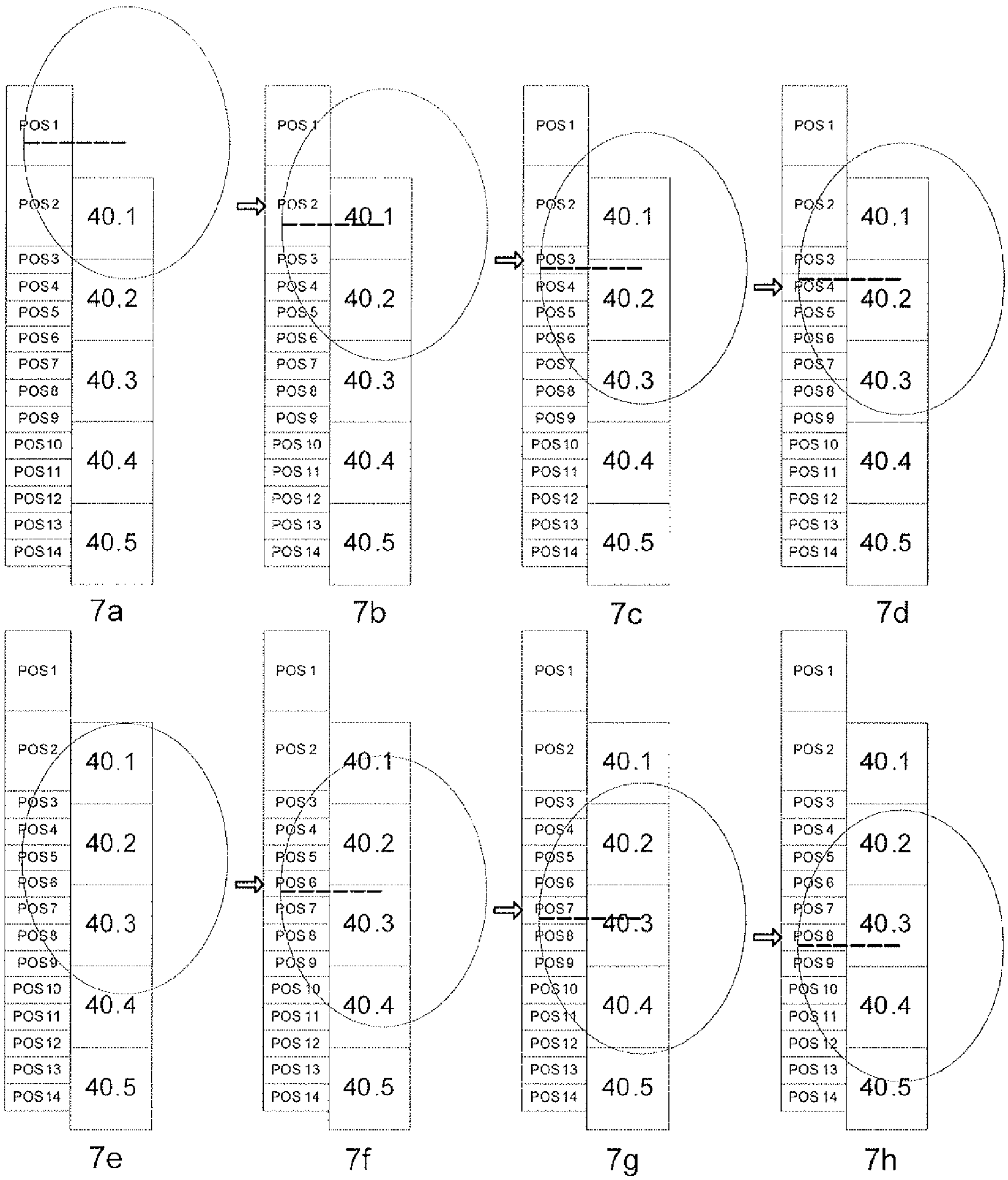
POS 1
POS 2
POS 3
POS 4
POS 5
POS 6
POS 7
POS 8
POS 9
POS 10
POS 11
POS 12
POS 13
POS 14
40.1
40.2
40.3
40.4
40.5
7a
7b
7c
7d
7e
7f
7g
7h

Figure 7 a-h

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EUROPEAN SEARCH REPORT

Application Number
EP 09 16 2732

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The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
The Hague	18 November 2009	Rupcic, Zoran

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