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(54) **Industrial truck with automated lateral movement of the load engagement means**

Flurförderzeug mit automatisierter seitlicher Bewegung der Lastaufnamemittel

Chariot de manutention avec déplacement latéral automatisé du moyen de prise de charge

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Description

TECHNICAL FIELD

[0001] The present invention relates to an industrial truck with vertically and laterally movable load engagement means arranged to be automatically returned to a predetermined lateral position.

BACKGROUND ART

[0002] Industrial trucks may be provided with forks that are laterally movable. This type of truck is normally described as industrial truck with side shift capability or fork spread capability. In trucks with side shift capability the forks are attached to a frame or a yoke which is arranged to be moved laterally. In trucks with fork spread capability each fork is displaceable laterally. Trucks with side shift capability are especially advantageous in narrow alleys since the need for manoeuvring the truck decreases. Trucks which comprise means for fork spreading enables handling of pallets of different dimensions.

[0003] However, it is a problem to determine the lateral position of the forks in relation to a predetermined position, especially during centring of the forks. When trucks with side shift capability are used in goods handling it is important to know the position of the forks in relation to the centre of the truck in order to avoid that the forks or a load on the forks for example hit the support legs of the truck during the vertical displacement of the forks.

[0004] Normally, the position of the forks is determined manually, e.g. optically by the driver. Attempts have also been made to determine the position of the forks by the use of analogue sensors. Such an arrangement is described in EP 1447376. The arrangement described in EP1447376 comprises an analogous sensor which is arranged on a fork yoke. The position of the fork yoke is determined in that the analogous sensor produces a signal which strength is relative to the distance between the fork yoke and a predetermined position. The signal is used to move the forks to the predetermined position. A drawback with the arrangement described in EP1447376 is that the signal from the analogous sensor could be influenced by external factors such as movement or play between mechanical components in the mast construction. The yoke position indicated by the sensor may therefore deviate from the true position of the yoke which could cause the yoke to be incorrectly positioned.

[0005] WO 91/08164 shows an industrial truck comprising a sensor arrangement comprising a Hall-effect sensor and a permanent magnet.

[0006] It is an object of the present invention to achieve an industrial truck with improved and simplified positioning of the forks.

SUMMARY OF THE INVENTION

[0007] The aforementioned object is achieved by the

industrial truck with vertically and laterally movable load engagement means comprising means for automatically returning said load engaging means to a predetermined lateral position on the truck characterized in that said means comprises at least a first digital magnetic sensor having a first side which senses a north pole of a permanent magnet and generates a first digital output signal and a second side which senses a south pole of a permanent magnet and generates a second digital output signal, whereby said at least a first digital magnetic sensor arranged on the truck, indicating a first predetermined position further comprising at least a first magnetic means which comprises a first permanent magnet that is arranged on the load engagement means such that its north pole faces said at least first digital sensor and a second permanent magnet that is arranged on the load engagement means such that its south pole faces said at least first digital magnetic sensor, arranged on the load engagement means, wherein the load engagement means is arranged to be moved to said predetermined position according to the first and second digital output signals generated by the digital magnetic sensor.

[0008] The industrial truck has the advantage that the load engagement means of the truck automatically may be moved from a displaced position exactly to a predetermined lateral position on the truck. This in turn, provides for easy and safe use of the truck. The digital magnetic sensor and the magnetic means are robust, easy to install and provides for a very accurate determination of the lateral position of the load engagement means.

[0009] The load engagement means may comprise a movable fork yoke which comprises the magnetic means. The load engagement means may thereby automatically be returned exactly to a central lateral position on the truck.

[0010] Two digital magnetic sensors may be arranged on the truck; wherein the load engagement means may comprise individually movable fork attachment means each comprising a magnetic means. The forks of the truck may thereby automatically be returned exactly to a predetermined fork width.

[0011] Three digital magnetic sensors may be arranged on the truck; wherein the individually movable fork attachment means are arranged on the movable fork yoke. The forks of the truck may thereby automatically be returned to a predetermined fork width and automatically centred to a central lateral position on the truck.

[0012] The magnets may be arranged side by side.

[0013] Alternatively, the magnets may be arranged at a distance from each other.

[0014] Each magnet may be arranged such that it extends from the middle of the fork engagement means to one end of the fork engagement means. Thereby is achieved an accurate determination of the displacement of the load engagement means in relation to a predetermined position over the total movement of the load engagement means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

- Figure 1: Shows schematically a part of the industrial truck of the invention according to a first preferred embodiment.
- Figure 2: Shows schematically a digital magnetic sensor and a magnetic means arranged in the industrial truck according to the invention.
- Figure 3a: Shows schematically the load engaging means of the industrial truck according to the invention in a predetermined lateral position.
- Figure 3b: Shows schematically the load engaging means of the industrial truck according to the invention displaced to the left of a predetermined lateral position.
- Figure 3c: Shows schematically the load engaging means of the industrial truck according to the invention displaced to the right of a predetermined lateral position.
- Figure 4: Shows schematically a part of the industrial truck of the invention according to a second preferred embodiment, comprising a movable fork yoke.
- Figure 5: Shows schematically a part of the industrial truck of the invention according to third preferred embodiment, comprising individually movable fork attachment means.
- Figure 6: Shows schematically a part of the industrial truck of the invention according to fourth preferred embodiment, comprising individually movable fork attachment means arranged on a movable fork yoke.

DETAILED DESCRIPTION

[0016] Figure 1 schematically describes a part of the industrial truck of the invention according to a first preferred embodiment. For clarity reasons only the parts relevant to the movement of the load engagement means are shown.

[0017] The truck comprises a load carriage 1 which is arranged to be moved vertically along two uprights 2(1), 2(2) comprised in the mast of the truck. The movement is performed by a chain and pulley arrangement (not shown). A load engagement means 3 is arranged in the load carriage 1. The load engagement means 3 is arranged to be moved laterally in the load carriage by an

actuation means 4, such as a hydraulic cylinder/piston. Laterally is defined as a direction transverse to the plane of the mast of the truck comprising the two uprights 2(1), 2(2).

[0018] In figure 1, the load engagement means 3 is a fork yoke onto which two forks are attached, whereby the fork yoke is arranged to be moved laterally.

[0019] Alternatively, it is possible that the load engagement means is a first fork attachment means and a second fork attachment means, each carrying one fork, whereby each fork attachment means is arranged to be individually moved laterally.

[0020] Alternatively, it is also possible that the load engagement means is a fork yoke which is arranged to be moved laterally whereby a first fork attachment means and a second fork attachment means are arranged on the fork yoke whereby each fork attachment means is arranged to be individually moved laterally.

[0021] The load engagement means 3 could also comprise a laterally movable frame which may comprise individually laterally movable fork attachment means.

[0022] A power source 5 such as motor, a battery or a hydraulic pump powers the actuation means 4. A control unit 6, such as regulator or computer is arranged to control the movement of the actuation means 4 via the power source 5. A driver input means 7 is connected to the control unit 6 in order to enable the driver of the truck to manually influence the movement of the load engagement means 3. By use of the input means 7 the driver can manually move the load engagement means 3 to the left or to the right. The driver can also send a signal to the control unit 6 to automatically return the load engagement means 3 to a predetermined position. The driver input means normally comprises press buttons and levers, such as a joystick.

[0023] The truck also comprises a sensor arrangement 8 which is arranged to determine the displacement of the load engagement means 3 in relation to a predetermined position on the truck. The sensor arrangement 8 comprises a digital magnetic sensor 9 which also is called magnetic switch and a magnetic means 10.

[0024] The digital magnetic sensor 9 has two sensing sides. One side senses a north pole of a magnet and the other side senses a south pole of a magnet. These two sides of the digital magnetic sensor 9 are called the north side and the south side of the sensor respectively. Each side of the magnetic sensor 9 generates an output signal. The output signal is a digital electrical signal such as a square wave. If the north side of the sensor senses a north pole of a magnet its output signal is changed from zero to one. If the south side of the sensor senses a south pole its output signal is changed from zero to one. If a south pole of a magnet approaches the north side of the sensor or a north pole approaches the south side of the sensor, the output signal of the respective side of the digital magnetic sensor 9 generates a zero output signal. The output signals from the north side and the south side of the digital magnetic sensor 9 are transmitted to the

control unit 6.

[0025] The digital magnetic sensor 9 is arranged on a predetermined position on the truck, for example on a transverse part of the load carriage 1. The predetermined position is the default position for the load engagement means of the truck. The default position may for example be a central lateral position on the truck, such that the forks are centred. It may also be a central lateral position of each individual fork attachment means, such that the forks are centred on the truck and that the distance between the forks correspond to a specific pallet size, for example the dimensions of a so called euro pallet.

[0026] The magnetic means 10 comprise two permanent magnets which are arranged side by side on the load engagement means 3. As described in figure 2 the first magnet, called the north magnet, is oriented so that its south pole faces the load engagement means 3 and its north pole faces the digital magnetic sensor 9. The second magnet, called the south magnet, is oriented so that its north pole faces the load engagement means 3 and its south pole faces the digital magnetic sensor 9.

[0027] The magnets are arranged on any distance from each other, for example side by side or 20 mm from each other. The thickness of the magnets may vary. Thicker magnets may be used if the distance between the load engagement means and the part of the truck where the digital magnetic sensor arranged is great. Normally, the thickness of the magnets is 8 mm. The distance that the magnets extend on the load engagement means, i.e. the length of the magnets, may also vary. Each magnet may for example extend from the middle of the load engagement means to one end of the load engagement means. However, normally are the lengths of the magnetic means adapted to the distance that the load engagement means moves. The digital magnetic sensor 9 is arranged on the truck and the magnetic means 10 is arranged on the load engagement means 3 in such way that the digital magnetic sensor 9 and the magnetic means 10 are exactly in front of each other when the load engagement means 3 is in the predetermined position, figure 3a. In this position, the north magnet is located in front of the north side of the magnetic sensor 9 and the south magnet is located in front of the south side of the magnetic sensor 9. The output signal from the north side of the sensor is therefore "one" and the output signal from the south side of the sensor is also "one".

[0028] If the load engagement means 3 is located to the left of the predetermined position as described in figure 3b, the north magnet is distant to the north side of the sensor 9 whereby it generates a "zero" output signal. However, the south magnet is still in front of the south side of the sensor 9, whereby it generates a "one" output signal.

[0029] If the load engagement means 3 instead is located to the right of the predetermined position as described in figure 3c, the south magnet is distant to the south side of the sensor 9 whereby it generates "zero" output signal. However, the north magnet is still in front

of the north side of the sensor 9, whereby it generates a "one" output signal.

[0030] The control unit 6 is arranged to control the actuation means 4 via the power source 5 in relation to the output signals from the digital magnetic sensor 9. For example, the control unit 6 is arranged to control the actuation means 4 to move the load engagement means 3 to the right as long as the north side of the magnetic sensor 9 generates a "zero" output signal and the south side of the sensor generates a "one" signal. Accordingly, the control unit 6 could be arranged to control the actuation means 4 to move the load engagement means 3 to the left as long as the south side of the sensor 9 generates a "zero" output signal and the north side of the sensor generates a "one" signal. The control unit 6 is also arranged to stop the movement of the actuation means 4 if both the north side and the south side of the digital magnetic sensor 9 generates a "one" output signal.

[0031] The load engagement means is automatically returned to a predetermined position in that the actuation of the load engagement means 3 is initiated by a signal to the control means. The initiation signal could be a signal from the drivers input means. The initiation signal could also be generated by the lowering of the load carriage on the mast or the starting of the truck.

[0032] Figure 4 describes a second preferred embodiment of the industrial truck according to the invention wherein the load engagement means 3 comprises a fork yoke 3.1 carrying two forks. The fork yoke 3.1 is arranged to be moved laterally by an actuation means 4. A digital magnetic sensor 9 is arranged on a predetermined central lateral position of the truck, for example on a transverse part of the load carriage 1 such that the north side of the sensor is to the left of the middle of the transverse part and the south side of the sensor is to the right of the middle of the transverse part. The magnetic means 10 is arranged in the middle of the fork yoke 3.1 in such way that the north magnet and the south magnet are located at the same distance from the middle of the fork yoke. By this arrangement an automatic centring of the forks is performed, thus automatic movement of the fork yoke 3.1 from a displaced position to the centre of the truck.

[0033] Figure 5 describes a third preferred embodiment of the industrial truck according to the invention. According to this embodiment, the load engagement means 3 comprises a first fork attachment means 3.1 and a second fork attachment means 3.2 each arranged to be moved laterally individually by actuation means 4.1, 4.2 respectively. A first and a second digital magnetic sensor 9.1, 9.2 are arranged at a first and a second predetermined position on the truck, for example a transverse part of the load carriage 1. The first and the second predetermined position are normally on the same distance from the middle of the load carriage, on each side of the middle of the load carriage, such that they indicate a central lateral position on the truck. The distance between the predetermined positions may for example cor-

respond to the dimensions of a specific pallet, such as euro pallets. A first and a second magnetic means 10.1 and 10.2 are arranged on first and second fork attachment means 3.1 and 3.2. By this arrangement an automatic movement of the forks to a predetermined fork spread is achieved. When the forks are returned to the predetermined fork spread they are centred laterally on the truck.

[0034] Figure 6 describes a forth preferred embodiment of the industrial truck according to the invention. According to this embodiment, the load engagement means 3 comprise a fork yoke 3.1 which is arranged to be moved laterally by an actuation means 4. The fork attachment means 3 also comprise a first fork attachment 3.2 and a second fork attachment 3.3 both arranged to be individually moved laterally on the fork yoke 3.1 by actuation means 4.1, 4.2, respectively. A first digital magnetic sensor 9.1 is arranged on a first predetermined position of the truck, such as on the middle of a transverse part of the load carriage 1. A first magnetic means 10.1 is arranged in the middle of the fork yoke 3.1. A second digital magnetic sensor 9.2 is arranged at a second predetermined position on the truck and a third digital magnetic sensor 9.3 is arranged at a third predetermined position. The second and the third predetermined positions are normally on the same distance from the middle of the load carriage, on each side of the middle of the load carriage. The distance between the second and the third predetermined position may for example correspond to the dimensions of a specific pallet, such as euro pallets. Second and a third magnetic means 10.2 and 10.3 are arranged on first and second fork attachment means 3.1 and 3.2. By this arrangement is achieved automatic returning of the fork yoke from a laterally displaced position to a central lateral position on the truck as well as automatic returning of each fork to a predetermined fork spread.

Claims

1. Industrial truck with vertically and laterally movable load engagement means (3) comprising means for automatically returning said load engaging means (3) to a predetermined lateral position on the truck **characterized in that** said means comprises at least a first digital magnetic sensor (9), having a first side which senses a north pole of a permanent magnet and generates a first digital output signal and a second side which senses a south pole of a permanent magnet and generates a second digital output signal, whereby said at least a first digital magnetic sensor is arranged on the truck, indicating a first predetermined position, further comprising at least a first magnetic means (10), which comprises a first permanent magnet that is arranged on the load engagement means (3) such that its north pole faces said at least first digital sensor (9) and a second permanent magnet that is arranged on the load engagement means (3) such that its south pole faces said at least first digital magnetic sensor (9), wherein the load engagement means (3) is arranged to be moved to said predetermined position according to the first and second digital output signals generated by the digital magnetic sensor (9).

ment magnet that is arranged on the load engagement means (3) such that its south pole faces said at least first digital magnetic sensor (9), wherein the load engagement means (3) is arranged to be moved to said predetermined position according to the first and second digital output signals generated by the digital magnetic sensor (9).

2. The industrial truck according to claim 1, wherein the load engagement means comprises a movable fork yoke (3.1) which comprises the magnetic means (10.1).
3. The industrial truck according to claim 1, wherein two digital magnetic sensors (9.1; 9.2) are arranged on the truck; wherein the load engagement means comprise individually movable fork attachment means (3.2; 3.3) each comprising a magnetic means (10.2; 10.3)
4. The industrial truck according to claims 1-3, wherein three digital magnetic sensors (9.1; 9.2; 9.3) are arranged on the truck; wherein the individually movable fork attachment means (3.1; 3.2) are arranged on the movable fork yoke (3.1).
5. The industrial truck according to any of claims 1 - 3 wherein the magnets are arranged side by side.
6. The industrial truck according to any of claims 1 - 3 wherein the magnets are arranged at a distance from each other.
7. The industrial truck according to any of claims 1 - 3 wherein each magnet is arranged such that it extends from the middle of the fork engagement means to one end of the fork engagement means.

Patentansprüche

1. Flurförderzeug mit vertikal und lateral bewegbarem Lasteingriffsmittel (3), das ein Mittel zum automatischen Zurückkehren des Lasteingriffsmittels (3) zu einer Vorbestimmten lateralen Position an dem Flurförderzeug aufweist, **dadurch gekennzeichnet, dass** das Mittel zumindest einen ersten digitalen Magnetsensor (9) aufweist, der eine erste Seite, die einen Nordpol eines Permanentmagneten erkennt und ein erstes digitales Ausgangssignal erzeugt, und eine zweite Seite aufweist, die einen Südpol eines Permanentmagneten erkennt und ein zweites digitales Ausgangssignal erzeugt, wobei der zumindest eine erste digitale Magnetsensor an dem Flurförderzeug angeordnet ist und eine erste Vorbestimmte Position angibt, ferner mit zumindest einem ersten magnetischen Mittel (10), das einen ersten Permanentmagneten, der an dem Lasteingriffsmittel

(3) so angeordnet ist, dass sein Nordpol dem zumindest ersten digitalen Sensor (9) gegenüberliegt, und einen zweiten Permanentmagneten aufweist, der an dem Lasteingriffsmittel (3) so angeordnet ist, dass sein Südpol dem zumindest ersten digitalen Magnet-sensor (9) gegenüberliegt, wobei das Lasteingriffs-mittel (3) zum Bewegen zu der Vorbestimmten Po-sition gemäß den ersten und zweiten digitalen Aus-gangssignalen, die durch den digitalen Magnetsen-sor (9) erzeugt werden, angeordnet ist.

2. Flurförderzeug nach Anspruch 1, bei dem das Lasteingriffsmittel ein bewegbares Gabeljoch (3.1) aufweist, welches das magnetische Mittel (10.1) aufweist.

3. Flurförderzeug nach Anspruch 1, bei dem zwei digi-tale Magnetsensoren (9.1; 9.2) an dem Flurförder-zeug angeordnet sind; wobei die Lasteingriffsmittel einzeln bewegbare Gabelanbringmittel (3.2; 3.3) aufweisen, die jeweils ein magnetisches Mittel (10.2; 10.3) aufweisen.

4. Flurförderzeug nach Ansprüchen 1 bis 3, bei dem drei digitale Magnetsensoren (9.1; 9.2; 9.3) an dem Flurförderzeug angeordnet sind; bei dem die einzeln bewegbaren Gabelanbringmittel (3.1; 3.2) an dem bewegbaren Gabeljoch (3.1) angeordnet sind.

5. Flurförderzeug nach einem der Ansprüche 1 bis 3, bei dem die Magneten Seite an Seite angeordnet sind.

6. Flurförderzeug nach einem der Ansprüche 1 bis 3, bei dem die Magneten mit einem Abstand zueinan-der angeordnet sind.

7. Flurförderzeug nach einem der Ansprüche 1 bis 3, bei dem jeder Magnet so angeordnet ist, dass er sich von der Mitte des Gabeingriffsmittels zu einem En-de des Gabeingriffsmittels erstreckt.

Revendications

1. Chariot industriel avec des moyens de mise en prise de charge verticalement et latéralement mobiles (3) comprenant des moyens pour ramener automati-quement lesdits moyens de mise en prise de charge (3) dans une position latérale prédéterminée sur le chariot, **caractérisé en ce que** lesdits moyens com-prennent au moins un premier capteur magnétique numérique (9), ayant un premier côté qui détecte un pôle nord d'un aimant permanent et génère un pre-mier signal de sortie numérique et un deuxième côté qui détecte un pôle sud d'un aimant permanent et génère un deuxième signal de sortie numérique, moyennant quoi ledit au moins un capteur magnéti-

que numérique est agencé sur le chariot, indiquant une première position prédéterminée, comprenant en outre au moins des premiers moyens magnéti-ques (10) qui comprennent un premier aimant per-manent qui est agencé sur les moyens de mise en prise de charge (3) de sorte que son pôle nord fait face audit au moins un premier capteur numérique (9) et un deuxième aimant permanent qui est agencé sur les moyens de mise en prise de charge (3) de sorte que son pôle sud fait face audit au moins un premier capteur magnétique numérique (9), dans le-quel les moyens de mise en prise de charge (3) sont agencés pour être déplacés dans ladite position pré-déterminée selon les premier et deuxième signaux de sortie numériques générés par le capteur magné-tique numérique (9).

2. Chariot industriel selon la revendication 1, dans le-quel les moyens de mise en prise de charge com-prennent une tête de fourche mobile (3.1) qui com-prend les moyens magnétiques (10.1).

3. Chariot industriel selon la revendication 1, dans le-quel deux capteurs magnétiques numériques (9.1; 9.2) sont agencés sur le chariot ; dans lequel les moyens de mise en prise de charge comprennent des moyens de fixation de fourche individuellement mobiles (3.2 ; 3.3), comprenant chacun des moyens magnétiques (10.2 ; 10.3).

4. Chariot industriel selon les revendications 1 à 3, dans lequel trois capteurs magnétiques numériques (9.1 ; 9.2 ; 9.3) sont agencés sur le chariot ; dans lequel les moyens de fixation de fourche individuel-lement mobiles (3.1 ; 3.2) sont agencés sur la tête de fourche mobile (3.1).

5. Chariot industriel selon l'une quelconque des reven-dications 1 à 3, dans lequel les aimants sont agencés côte à côte.

6. Chariot industriel selon l'une quelconque des reven-dications 1 à 3, dans lequel les aimants sont agencés à une distance l'un de l'autre.

7. Chariot industriel selon l'une quelconque des reven-dications 1 à 3, dans lequel chaque aimant est agen-cé de sorte qu'il s'étend à partir du milieu des moyens de mise en prise de fourche jusqu'à une extrémité des moyens de mise en prise de fourche.

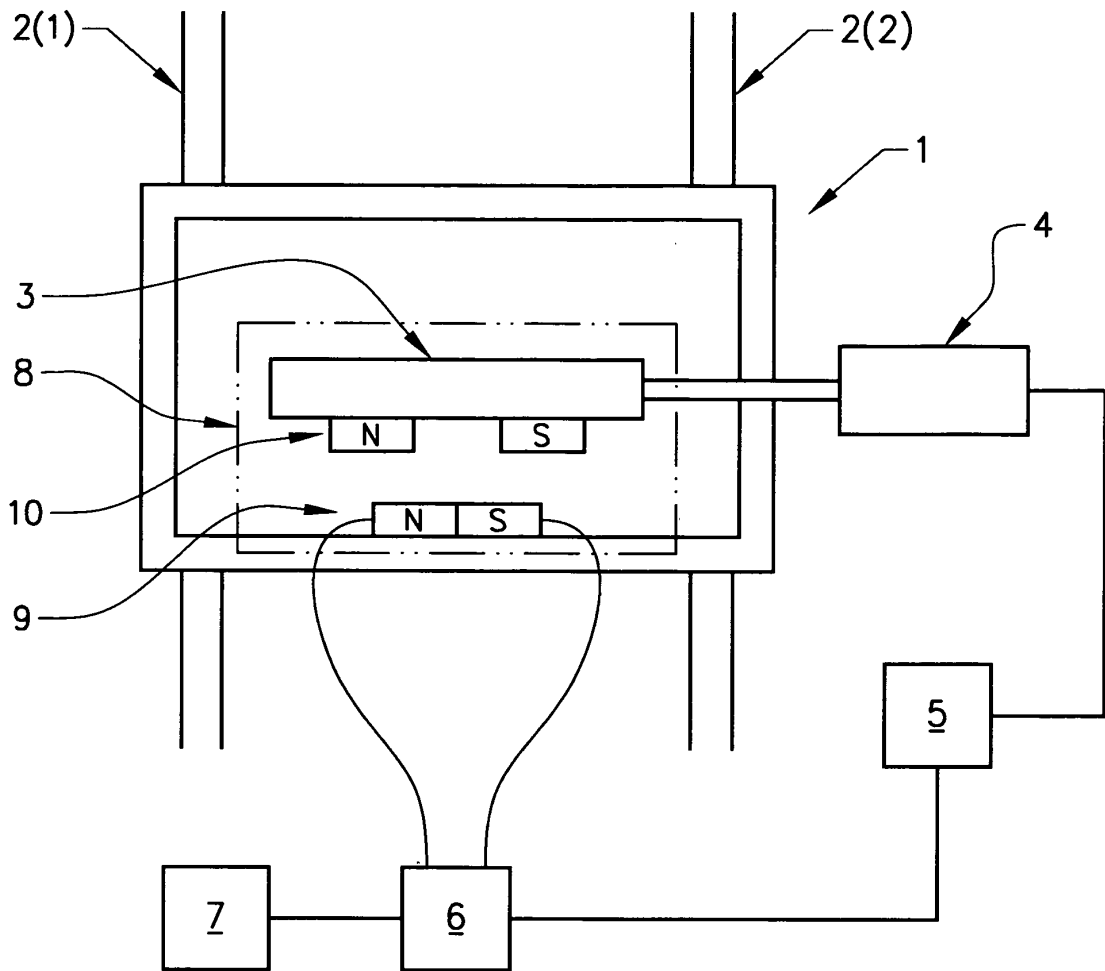


FIG. 1

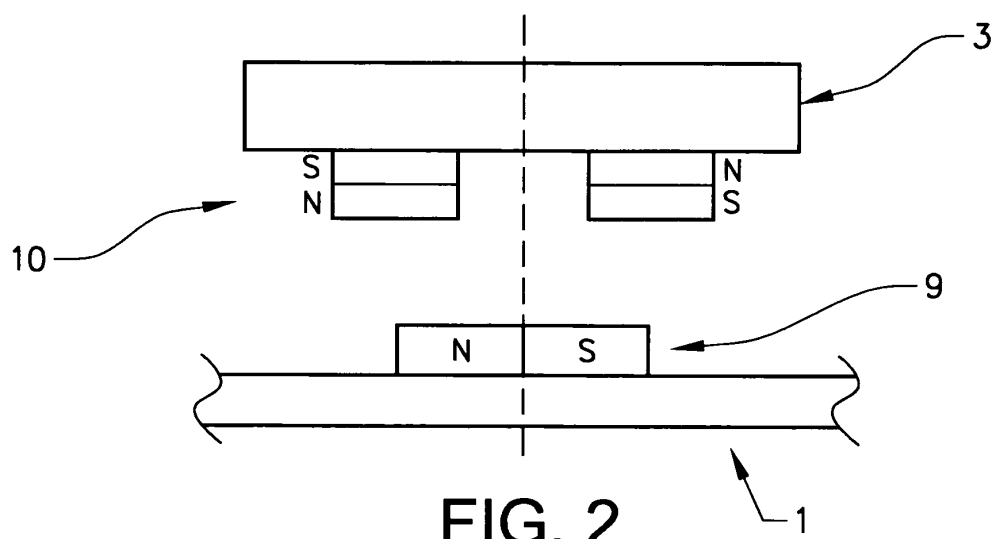


FIG. 2

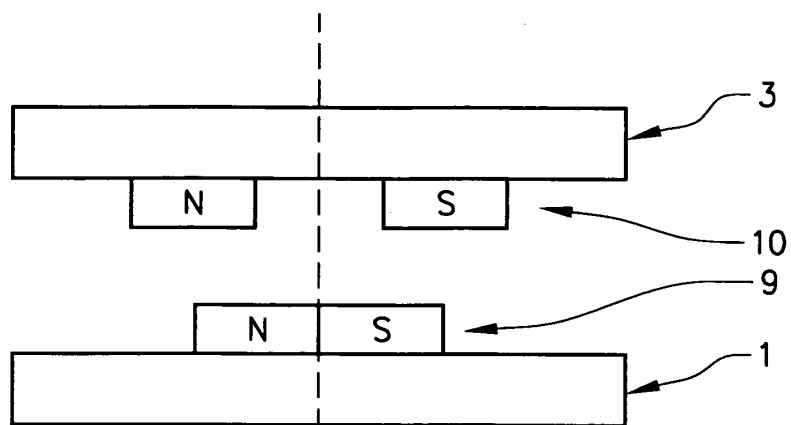


FIG. 3a

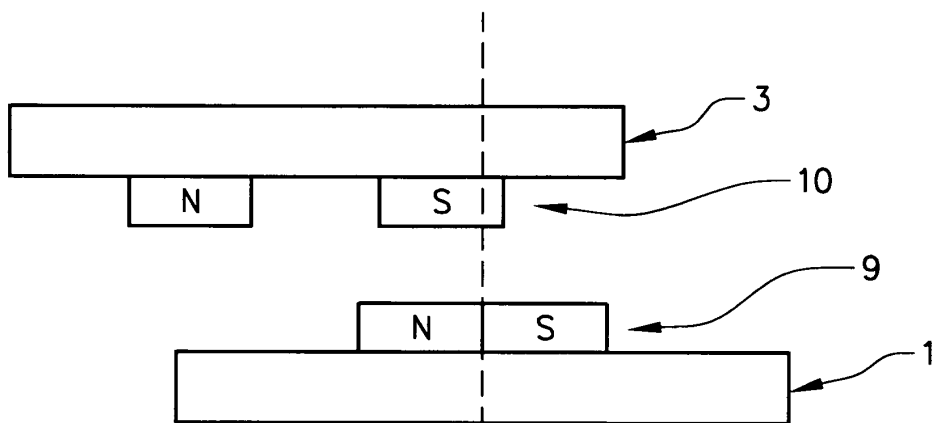


FIG. 3b

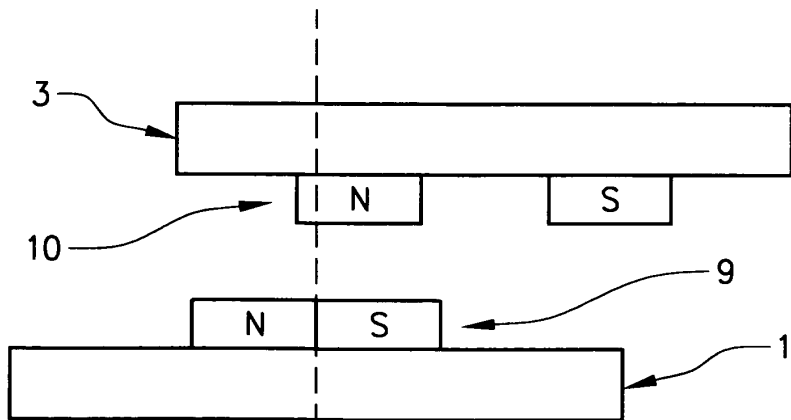
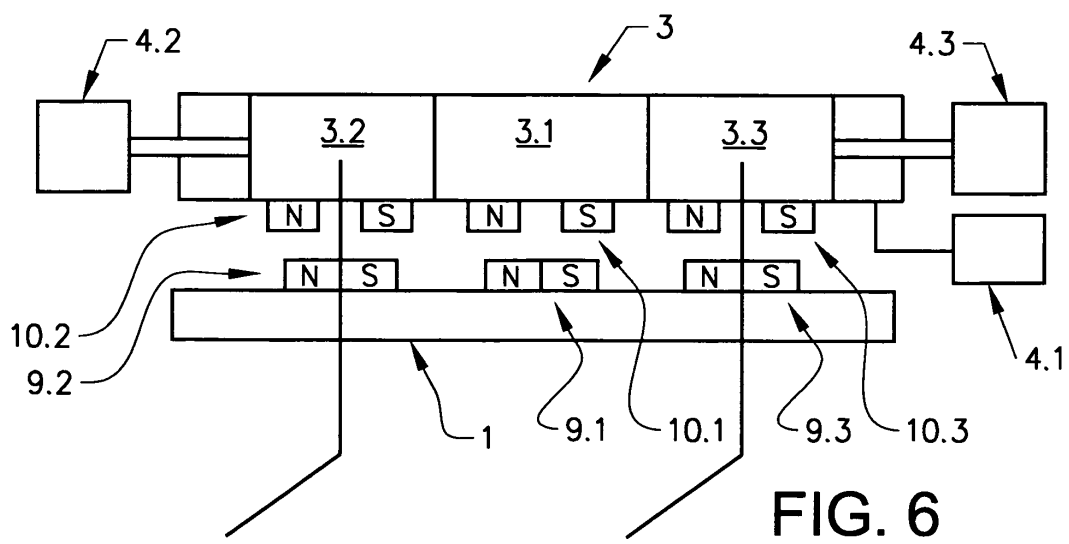
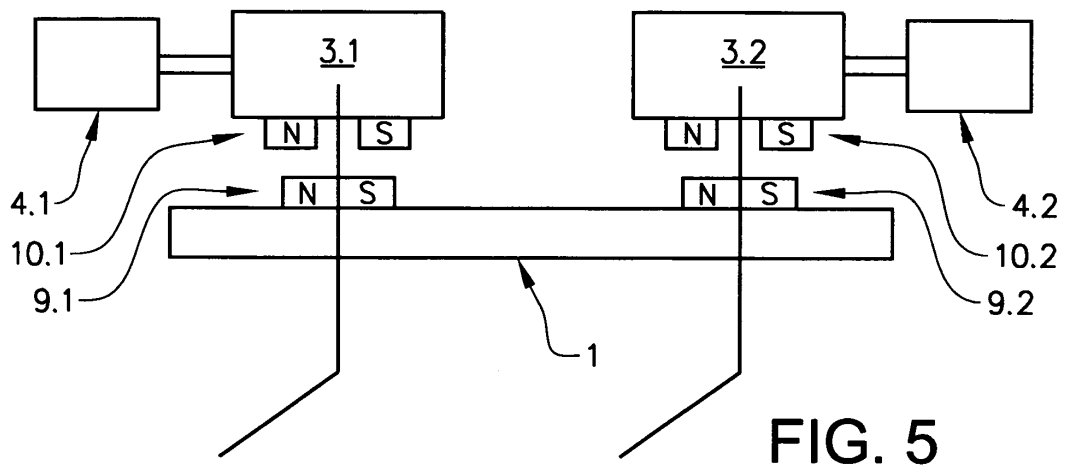
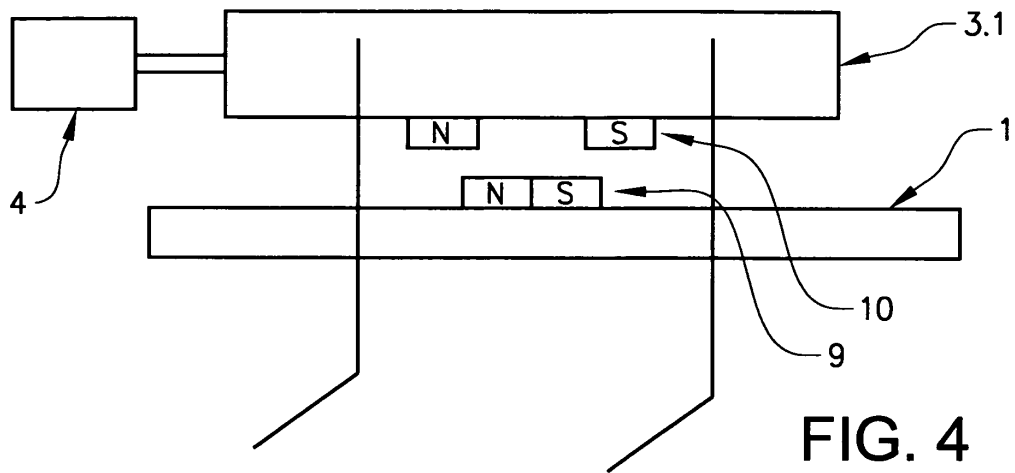


FIG. 3c



REFERENCES CITED IN THE DESCRIPTION

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