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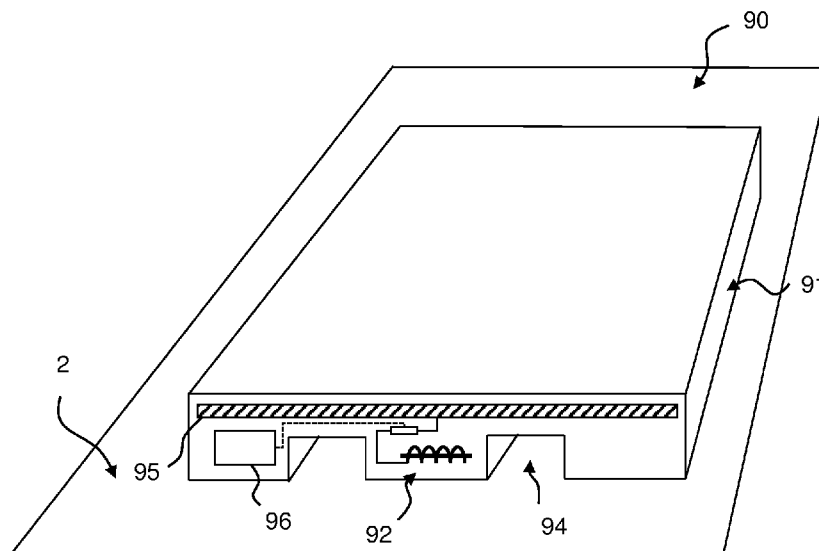


FIG. 2

(57) Abstract: The present disclosure relates to techniques in the context of vehicles, and to an electronic pallet for transporting stacked objects. According to a first aspect, the disclosure relates to an electronic pallet (90), arranged to be loadable onto a vehicle (1). The electronic pallet (90) comprises electromagnet (92), energy storage device (95) and a control device (96). The electromagnet (92) is arranged to, upon actuation, apply a magnetic force on a surface (2) comprising a ferro magnetic material, on which surface 2 the electronic pallet (90) is disposed. The energy storage device (95) is configured to provide energy required for actuating the electromagnet (92) and the control device (96) is configured to control actuation of the electromagnet (92). The disclosure also relates to a corresponding method and to a computer program for performing the proposed method.

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Electronic pallet comprising an electromagnet and method for controlling actuation of the electromagnet

Technical field

- 5 The present disclosure relates to techniques in the context of vehicles, and to an electronic pallet for transporting stacked objects. The disclosure also relates to a corresponding method, computer program and computer program product for performing the proposed method.

Background

- 10 In vehicle transportation, pallets are commonly used to move goods from place to place (e.g. warehouse to retail store). When a desired amount of goods has been loaded or stacked on the pallet, a fork lift, hand jack, or other device is typically slid under and/or through the pallet such that the pallet can be lifted vertically off the ground. When hoisted up, the pallet and the products stacked thereon may be
15 transported to a storage area in a warehouse, loaded onto a truck used to distribute the goods, or taken to some other location as desired. Using pallets, numerous products may be conveniently moved and stored in groups to increase shipping and transportation delivery.

- During transportation pallets typically need to be secured to the vehicle on which
20 they are transported. This is traditionally done using strapping, stretch wrap or shrink wrap, which requires manual interaction e.g. by a driver. However, with the increasing use of autonomous vehicles, there might not be a driver present that can manually secure the pallets to the vehicle. Within the technical area of transportation other methods for securing pallets to a vehicle have been
25 proposed. For example, DE102007018908 A1 describes a method involving holding load items and / or at least one load item carrier in the load space by magnetic force. In DE102007018908 A1 magnetic sources are integrated in the load space to generate the magnetic force. However, it is foreseen that there will be an increased need for ways of securing a load during transport.

- 30 Furthermore, loss of goods due to theft during transportation on vehicles is a recognized problem, as pallets may relatively easily be unloaded using a fork lift

or similar. If no driver is present that can prevent a theft, further measures to also actually prevent the theft being made are desirable.

Summary

It is an object of the disclosure to alleviate at least some of the drawbacks with the prior art. Thus, it is an object to provide a solution that prevents a pallet loaded on a vehicle from moving around during transportation, which requires less interaction from e.g. a driver. Furthermore, it is an object of some embodiments to provide a solution that prevents the electronic pallet from being stolen.

According to a first aspect, the disclosure relates to an electronic pallet, that is arranged to be loadable onto a vehicle. The electronic pallet comprises an electromagnet, an energy storage device and a control device. The electromagnet is arranged to, upon actuation, apply a magnetic force on a surface comprising a ferro magnetic material, on which surface the electronic pallet is disposed. The energy storage device is configured to provide energy required for actuating the electromagnet and the control device is configured to control actuation of the electromagnet. Thereby, the electronic pallet can be held on to the surface, on which it is disposed, for example to avoid that the electronic pallet is moving around during transportation.

In some embodiments, the control device is configured to control the magnitude and/or the direction of the magnetic force. Thereby, the magnetic force may be used for different purposes e.g. to facilitate loading, to secure the electronic pallet during transport or to prevent theft. Furthermore, power may be saved, as the force may be adapted to the circumstances.

In some embodiments, the control device is configured to control the electromagnet to generate a force that holds the electronic pallet on the surface. Thereby, the electronic pallet may be held to a vehicle during transport or it may be secured to a foundation during storage in order to prevent theft.

In some embodiments, the control device is configured to control the electromagnet to generate a force that lifts the electronic pallet from the surface.

Thereby, moving the pallet may be facilitated, as the force may assist in lifting and moving the pallet.

In some embodiments, the control device is configured to receive control data from a remote device and to control actuation of the electromagnet, based on the
5 received control data. Thereby, a user such as a driver may control the electromagnet (e.g. by a user terminal) to achieve the effects mentioned above and below.

In some embodiments, the control data comprises driving data indicative of driving behavior of a vehicle on which the electronic pallet is loaded. Thereby, the force
10 generated by the electromagnet may be autonomously adapted to the driving behavior.

In some embodiments, the control device is configured to hold the electronic pallet on the surface upon the driving data indicating turning, acceleration, retardation and/or a suspension level that meets a respective predetermined threshold value.
15 Thereby, unintended movement of the electronic pallet during transportation may be avoided.

According to a second aspect, the disclosure relates to a corresponding method, performed by a control device in an electronic pallet arranged to be loadable onto a vehicle and comprising an electromagnet arranged to, upon actuation, apply a
20 magnetic force on a surface comprising a ferro magnetic material, on which surface the electronic pallet is disposed. The method comprises receiving control data and controlling actuation of the electromagnet, based on the control data.

In some embodiments, the method comprises controlling the magnitude of the magnetic force and/or the direction of the magnetic force.

25 In some embodiments, the method comprises controlling the electromagnet to generate a force that holds the electronic pallet on the surface.

In some embodiments, the method comprises, controlling the electromagnet to generate a force that lifts the electronic pallet from the ferro magnetic material.

In some embodiments, the control data comprises driving data indicative of driving behavior of a vehicle on which the electronic pallet is loaded and wherein the method comprises controlling actuation of the electromagnet based on the driving data.

- 5 In some embodiments, the method is configured to hold the electronic pallet on the surface upon the driving data indicating a rotation, acceleration, retardation and/or suspension level that meets a respective predetermined threshold value.

According to a third aspect, the disclosure relates to a computer program comprising instructions which, when the program is executed by a computer,
10 cause the computer to carry out the method according to the second aspect.

According to a fourth aspect, the disclosure relates to a computer-readable medium comprising instructions which, when executed by a computer, cause the computer to carry out the method according to the second aspect.

Brief description of the drawings

- 15 Fig. 1 illustrates a vehicle carrying an electronic pallet.
Fig. 2 illustrates an electronic pallet.
Fig. 3 is a control device configured to implement the proposed method in more detail.
Fig. 4 illustrates a flow chart of a method performed by a control device in an
20 electronic pallet.

Detailed description

- An “electronic pallet” herein refers to a pallet that cannot only carry goods but that can also do other things e.g. carry and communicate information about the goods
25 on the pallet. An electronic pallet typically comprises an integrated energy storage such as a battery. The battery generally powers electronic circuitry of the electronic pallet such that the electronic pallet can send and receive signals using a transmitter and a receiver.

The present disclosure relates to an electronic pallet that can also secure itself to the surface on which it is disposed e.g. to the floor of a cargo compartment of a commercial vehicle. More specifically, this disclosure proposes an electronic comprising an electromagnet that can apply a magnetic force on a surface
5 comprising a ferro magnetic material. The electromagnetic force can be controlled such that the electronic pallet is secured to the vehicle during transport and released while loading the vehicle. The magnetic force may also be used to facilitate the loading and unloading of the pallet. The proposed technique will now be described with reference to the figures.

10 Fig. 1 illustrates a vehicle 1, here a lorry, having an electronic pallet 90 carrying goods 70 loaded thereon. A vehicle will normally transport a plurality of pallets, but for simplicity only one pallet is described in this example. The vehicle 1 is herein embodied as a lorry, but it must be appreciated that the electronic pallet 90 may be loaded on any manned or unmanned vehicle. The vehicle 1 may be
15 autonomously or remotely operated. In other words, it may be driverless. An autonomous vehicle is for example controlled by an off-board system that instructs the vehicle to perform missions. A mission is e.g. to drive a route between a first position and a second position.

The vehicle 1 comprises a plurality of electrical systems and subsystems.

20 However, for simplicity only some parts of the vehicle 1 that are associated with the proposed technique is shown in Fig. 1. Thus, the vehicle 1 of Fig. 1 comprises an electrical engine 21, an energy storage device 22 and a control unit 20.

The electrical engine 21 is configured to propel, and possibly also to brake, the vehicle 1. The energy storage device 22 is configured to supply power to the
25 electrical engine 21.

The control unit 20 (or Electrical Control Unit, ECU) is basically a digital computer that controls one or more electrical systems of the vehicle 1 based on e.g. information read from sensors and meters placed at various parts and in different components of the vehicle 1. ECU is a generic term for a control unit that is used in

automotive electronics for any embedded system that controls one or more functions of the electrical system or sub systems in a transport vehicle.

The control unit 20 illustrated in Fig. 1 is a control unit configured to control the load of the vehicle 1.

- 5 The control unit 20 comprises one or more communication interfaces. Typically, the control unit 20 comprises one interface, e.g. a Controller Area Network, CAN, used to handle communication between the various control units in the vehicle 1. The CAN uses a message-based protocol. Often, several connected CAN networks are arranged in the vehicle 1.
- 10 In some embodiments, the control unit 20 also comprises an interface configured to communicate with the electronic pallet 90. For example, the electronic pallet 20 performs some kind of hand-shake with the control unit 20 of the vehicle 1 upon loading. Then energy may be exchanged between the vehicle 1 and the electronic pallet 90 e.g. via an inductive interface (not shown).
- 15 Fig. 2 illustrates the electronic pallet 90 in further detail. The electronic pallet 20 comprises a structural foundation 91, which allows handling and storage of goods. The electronic pallet 90 is configured to be loaded at a vehicle 1. The structural foundation 91 is commonly wooden, but can also be made of plastic, metal, paper, and/or other materials. Wooden pallets typically consist of three or four stringers
- 20 that support several deck boards, on top of which goods are placed. However, other designs are also possible, and the proposed technique may in general be implemented on any type of electronic pallet 90. Therefore, in the illustration of the electronic pallet 90 of Fig. 2, the structural foundation 91 is only conceptually illustrated.
- 25 The electronic pallet 90 comprises an electromagnet 92, fork openings 94, an energy storage device 95 and a control device 96.

The electromagnet 92 typically comprises a coil of wire wrapped around an iron core. In some embodiments, the electromagnet 92 is composed of several coils

that are distributed over the structural foundation 91. The strength of the generated magnetic field is proportional to the amount of current through the wire. The strength of the generated magnetic field may also be varied using the iron core. The electromagnet 92 is arranged such that, upon actuation, the generated magnetic field generates a vertical magnetic force on the surface 2 on which the electronic pallet 90 is positioned, provided that the surface 2 comprises a ferro magnetic material. For example, the electromagnet 92 is integrated in the structural foundation 91. Alternatively, the electromagnet 92 is positioned in cavities of the structural foundation 91. In some embodiments, the electromagnet 92 is placed at the lower part of the structural foundation 91. For example, it is placed to be in contact with the surface 2 or within a pre-determined distance (e.g. 5 mm) from the surface 2. If the distance between the electromagnet and the surface exceeds a predetermined distance, an extension pole may be used to extend the magnetic field in the direction of the surface. In other words, the electromagnet 92 can be arranged further away from the surface 2, if an extension pole is positioned between the electromagnet 92 and the surface 2. The extension pole may then be arranged to be in contact with the surface 2 or to be within a pre-determined distance (e.g. 5 mm) of the surface 2. The electromagnet 92 is typically placed such that no other components, e.g. the energy storage device 95 or other metal parts, shield the magnetic field between the electromagnet 92 and the surface 2.

In other words, the electromagnet 92 is arranged to, upon actuation, apply a magnetic force on a surface 2 comprising a ferro magnetic material, on which surface 2 the electronic pallet 90 is disposed. In some embodiments, a magnetic force is also (or alternatively) applied on the wall of a loading area, where the electronic pallet 90 is disposed.

The energy storage device 95 is e.g. a battery. The energy storage device 95 is configured to power the various components of the electronic pallet 90. In particular, the energy storage device 95 is configured to provide energy required for actuating the electromagnet 92. Thus, the energy storage device 95 is typically

electrically connected to, or connectable to, the electromagnet. More specifically, the energy storage device is arranged to supply power to the coil of the electromagnet 92. In some embodiments, the energy storage device 95 is also configured to exchange energy with the vehicle 1.

- 5 The control device 96 is configured to control the operation of the electronic pallet 90 and the components of the electronic pallet 90. Fig. 3 illustrates the control device 96 in more detail. In some embodiments, the control device 96 is a “unit” in a functional sense. Hence, in some embodiments the control device 96 is control circuitry comprising several physical control units that operate in corporation. The
- 10 control device 96 comprises hardware and software. The hardware basically comprises various electronic components on a Printed Circuit Board, PCB. The most important of those components is typically a processor 961 e.g. a microprocessor, along with a memory 962 e.g. EPROM or a Flash memory chip. The software is typically lower-level software code that runs in the microcontroller.
- 15 The control device 96 is typically configured to control the operation of the electronic pallet 90 by running computer program code (stored in the memory 962) in the processor 961 of the control device 96. In general, the control device 96 is configured to perform all aspects of the method described in connection with Fig. 4.
- 20 In some embodiments, the control device 96 comprises a first communication interface 963a configured to enable communication with a vehicle 1 at which the electronic pallet 90 is loaded. The first communication interface is e.g. implemented using Near-Field-Communication, NFC, Bluetooth, Wi-Fi. In some embodiments, the control device 96 is configured to send a deactivation signal to
- 25 (a control device 20 of) the vehicle 1 using the first communication interface 963a, based on the determined displacement.

In some embodiments, the control device 96 comprises a second communication interface 963b configured to enable communication with an external device, such as an off-board system. The first communication interface is e.g. implemented

30 using 2G, 3G, 4G, and the control device 96 is configured to send an alert to an

external device using the second communication interface 963b, based on the determined displacement. In some embodiments, the second communication interface is integrated with, or same as, first communication interface.

Furthermore, the control device 96, or more specifically the processor 961 of the
5 control device 96, is configured to control the actuation of the electromagnet 92, based on the control data. The control data may be digital or analogue. More specifically, the control device 96 is configured to control the current flowing through the electromagnet 92. For example, the control device 96 sends control data to a regulator (not shown), arranged to control the current supplied to the
10 electromagnet 92.

The magnetic force may be controlled in different manners. For example, by changing the direction of the current flowing through the coil, the magnetic force may be reversed. In other words, in some embodiments, the control device 96 is configured to control the direction of the magnetic force.

15 If a high current is supplied, a strong force may be generated, that may in principle “lock” the electronic pallet 90 to the foundation. Stated differently, it may prevent the electronic pallet 90 from moving (e.g. sliding or vibrate) around in relation to the surface 2. In other words, in some embodiments, the control device 96 is configured to control the electromagnet 92 to generate a force that holds the
20 electronic pallet 90 on the surface 2.

If the current is reverted the force instead strive at lifting the electronic pallet 90 from the surface 2. This may make it easier to move the pallet as friction between the electronic pallet 90 and the surface 2 is decreased. In other words, in some embodiments, the control device 96 is configured to control the electromagnet 92
25 to generate a force that lifts the electronic pallet 90 from the surface 2.

In some embodiments, the control device 96 is configured to control the magnitude of the magnetic force. As power is required to generate the magnetic force, it may be desirable to only activate the magnetic force when required. Hence, the magnitude or size of the magnetic force may be adjusted, in order not

to waste the battery. This is for example done by controlling the amount of current flowing through the coil of the electromagnet 92. The larger current, the higher force and the more power will be required.

5 In some embodiments, the control device 96 is configured to receive control data from a remote device and to control actuation of the electromagnet 92, based on the received control data. For example, the control device 96 receives control data from the vehicle 1 on which it is loaded, using the communication interface 963a. In some embodiments, the control data comprises driving data indicative of driving behavior of the vehicle 1.

10 Alternatively, the control device 96 receives control data from another remote device, such as a user device. The user device may be a software application installed on a personal computer or smartphone or it may be any other control device.

15 If the control device 96 receives control data comprises driving data, then the force generated by the electromagnet may be autonomously adapted based on the driving. Thereby, the force may be increased in situations when it is otherwise likely (or possible) that the electronic pallet 90 would slide around on the surface 2. In some embodiments, the control device 96 is configured to hold the electronic pallet 90 on the surface upon the driving data is indicating turning, acceleration, 20 retardation and/or a suspension level that meets a respective predetermined threshold value.

The proposed technique will now be described in further detail with reference to the flow chart of Fig. 3. Fig. 3 illustrates a flow chart of a method performed by a control device 96 in an electronic pallet 90 arranged to be loadable onto a vehicle 25 1 and comprising an electromagnet 92 arranged to, upon actuation, apply a magnetic force on a surface 2 comprising a ferro magnetic material, on which surface 2 the electronic pallet 90 is disposed, such as the vehicle of Fig. 1. The method may be performed when the electronic pallet is transported by (i.e. loaded on) the vehicle 1. In other words, the method is performed when the electronic

pallet 90 is loaded on a vehicle 1 for transporting goods 70 (Fig. 1). In some embodiments, there is an electrical and/or wireless connection is established between the electronic pallet 90 and the vehicle 1 upon loading. The method may alternatively be performed when the electronic pallet 90 is stored e.g. in a warehouse.

The method is typically implemented as a computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method. According to some embodiments the computer program is stored in a computer-readable medium that comprises instructions which, when executed by a computer, cause the computer to carry out the method.

In some embodiments, the electronic pallet 90 is controlled by an external source such as a user (e.g. a driver), a vehicle 1 or an off-board system. However, it may not be desirable to let anyone control the electronic pallet or the force generated by the electromagnet 92. Hence, typically some type of authentication is required to verify that the external source is trusted. In other words, in some embodiments, the method comprises authenticating S0 an external source. This is e.g. implemented using commonly known methods such as exchange of credentials or cryptographic keys.

The method then comprises obtaining S1 control data. For example, control data defining or indicating how to control the electromagnet 92 is obtained from the external source. The control data may be received from an external source e.g. from a vehicle 1 on which the electronic pallet 90 is loaded, from a user terminal or from an off-board system. Alternatively, the control data may be received from internal components, such as sensors, within the electronic pallet 90.

The method further comprises controlling S2 actuation of the electromagnet 92, based on the control data. Thus, the force generated by the electromagnet is controlled for different purposes, as described above.

In some embodiments the controlling S2 comprises controlling the magnitude of the magnetic force and/or the direction of the magnetic force. In some embodiments, the control data is e.g. sensor data. For example, data indicating a speed or acceleration of the vehicle 1 carrying the electronic pallet. Then the
5 controlling comprises analyzing and evaluating the control data and determining the magnetic force based on the control data.

Alternatively, the control data directly indicates an amount and/or a direction of the magnetic and controlling S2 comprises controlling the magnetic force accordingly.

In some embodiments the controlling S2 comprises controlling the electromagnet
10 92 to generate a force that holds the electronic pallet 90 on the surface. In other words, it keeps the electronic pallet 90 on the same position on the surface. In some embodiments the controlling S2 comprises controlling the electromagnet 92 to generate a force that lifts the electronic pallet 90 from the ferro magnetic material.

15 In some embodiments the controlling S2 comprises controlling the electromagnet 92 to hold the electronic pallet 90 on the surface upon the driving data indicating a rotation, acceleration, retardation and/or suspension level that meets a respective predetermined threshold value. The predetermined threshold value corresponds to a driving behavior where the electronic pallet 90 is likely to start moving around
20 due to the forces caused by the driving. The magnetic force may then be used to mitigate such movement.

Another possibility is that an error in the vehicle 1 has been detected. For example, the suspension is broken, which may cause vibrations that may cause electronic pallet 90 to move around. In such a force may be generated that
25 prevents this.

Another possibility is that the control data indicates events in the surroundings. For example, an accident (or an increased risk for an accident) in the proximity may also cause the electronic pallet 90 to lock itself to the surface 2.

In some scenarios the magnetic force may be used to prevent theft. If the electronic pallet 90 is stored on a ferro-magnetic surface in a vehicle 1 or in a storage, then the electromagnet may be activated to prevent theft. This may be done by an authorized driver or by an off-board system. In some embodiments, the locking is triggered by a burglar alarm. For example, if the burglar alarm is activated, then the electronic pallet 90 is controlled to lock itself to the surface 2, whereby it cannot be moved. For systems comprising autonomous vehicles, where no driver is present, this may be useful as there will be no driver present to detect a theft. Then the electronic pallet may only be unlocked from the surface 2 by an authorized source. Thus, the electromagnet 92 may serve as a theft protection device.

The terminology used in the description of the embodiments as illustrated in the accompanying drawings is not intended to be limiting of the described method; control arrangement or computer program. Various changes, substitutions and/or alterations may be made, without departing from invention embodiments as defined by the appended claims.

The term "or" as used herein, is to be interpreted as a mathematical OR, i.e., as an inclusive disjunction; not as a mathematical exclusive OR, unless expressly stated otherwise. In addition, the singular forms "a", "an" and "the" are to be interpreted as "at least one", thus also possibly comprising a plurality of entities of the same kind, unless expressly stated otherwise. It will be further understood that the terms "includes", "comprises", "including" and/ or "comprising", specifies the presence of stated features, actions, integers, steps, operations, elements, and/ or components, but do not preclude the presence or addition of one or more other features, actions, integers, steps, operations, elements, components, and/ or groups thereof. A single unit such as e.g. a processor may fulfil the functions of several items recited in the claims.

Claims

1. An electronic pallet (90), arranged to be loadable onto a vehicle (1), the electronic pallet (90) comprising:
 - an electromagnet (92) arranged to, upon actuation, apply a magnetic force on a surface (2) comprising a ferro magnetic material, on which surface (2) the electronic pallet (90) is disposed,
 - an energy storage device (95) configured to provide energy required for actuating the electromagnet (92), and
 - a control device (96) configured to control actuation of the electromagnet (92).
2. The electronic pallet (90) according to claim 1, wherein the control device (96) is configured to control the magnitude and/or the direction of the magnetic force.
3. The electronic pallet (90) according to any of the preceding claims, wherein the control device (96) is configured to control the electromagnet (92) to generate a force that holds the electronic pallet (90) on the surface (2).
4. The electronic pallet (90) according to any of the preceding claims, wherein the control device (96) is configured to control the electromagnet (92) to generate a force that lifts the electronic pallet (90) from the surface (2).
5. The electronic pallet (90) according to any of the preceding claims, wherein the control device (96) is configured to receive control data from a remote device and to control actuation of the electromagnet (92), based on the received control data.
6. The electronic pallet (90) according to, wherein the control data comprises driving data indicative of driving behavior of a vehicle (1) on which the electronic pallet (90) is loaded.

7. The electronic pallet (90) according to claim 6, wherein the control device (96) is configured to hold the electronic pallet (90) on the surface upon the driving data indicating turning, acceleration, retardation and/or suspension level that meets a respective predetermined threshold value.

5

8. A method, performed by a control device (96) in an electronic pallet (90) arranged to be loadable onto a vehicle (1) and comprising an electromagnet (92) arranged to, upon actuation, apply a magnetic force on a surface (2) comprising a ferro magnetic material, on which surface (2) the electronic pallet (90) is disposed, the method comprising:

10

- obtaining (S1) control data and
- controlling (S2) actuation of the electromagnet (92), based on the control data.

15

9. The method according to claim 8, comprising controlling the magnitude of the magnetic force and/or the direction of the magnetic force.

10. The method according to any one of claims 8 to 9, comprising controlling the electromagnet (92) to generate a force that holds the electronic pallet (90) on the surface.

20

11. The method according to any one of claims 8 to 10, comprising controlling the electromagnet (92) to generate a force that lifts the electronic pallet (90) from the ferro magnetic material.

25

12. The method according to any one of claims 8 to 11, wherein the control data comprises driving data indicative of driving behavior of a vehicle (1) on which the electronic pallet (90) is loaded and wherein the method comprises controlling (S2) actuation of the electromagnet (92) based on the driving data.

30

13. The method according to any one of claims 12, comprising controlling the electromagnet (92) to hold the electronic pallet (90) on the surface upon the driving data indicating a rotation, acceleration, retardation and/or suspension level that meets a respective predetermined threshold value.

5

14. A computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method of any one of the claims 9 to 13.

10

15. A computer-readable storage medium comprising instructions which, when executed by a computer, cause the computer to carry out the method of any one of the claims 9 to 13.

15

1/2

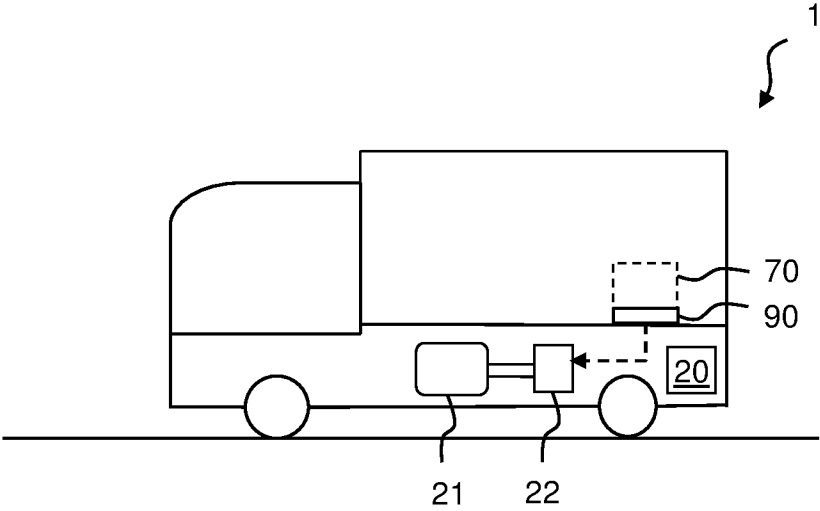


FIG. 1

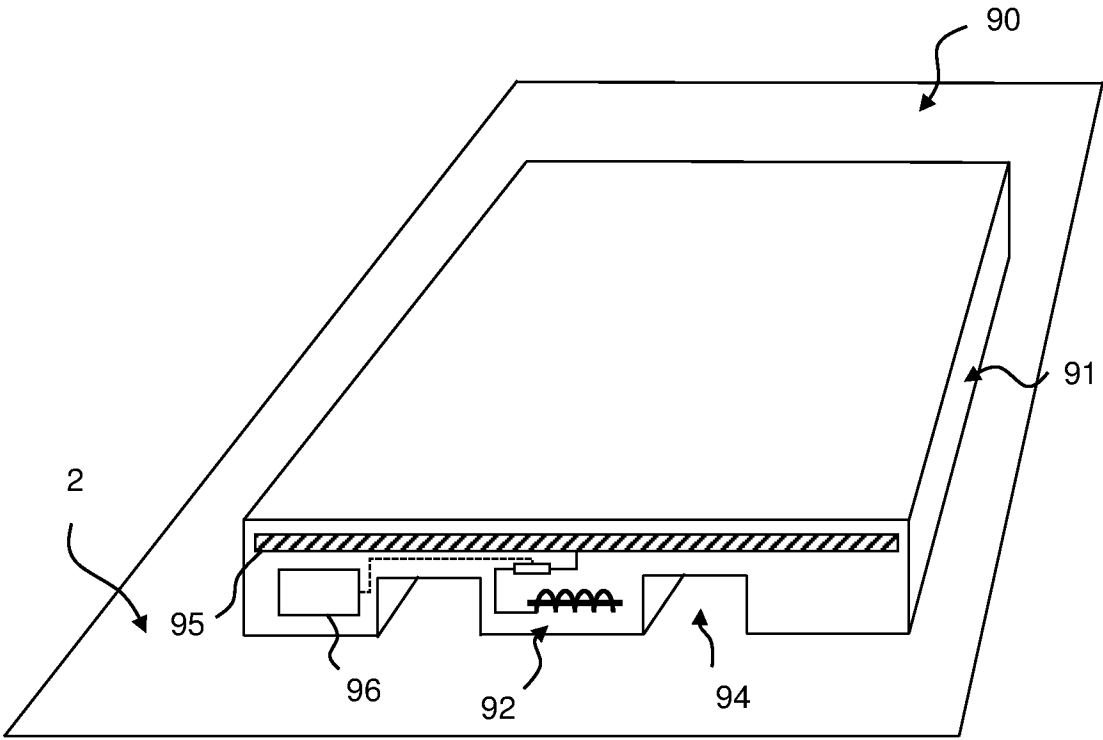


FIG. 2

2/2

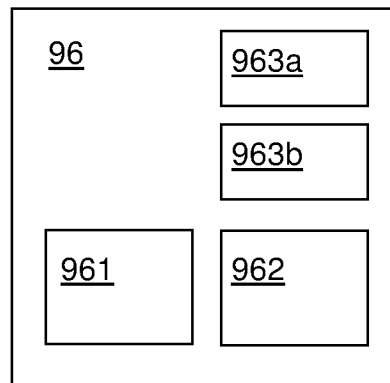


FIG. 3

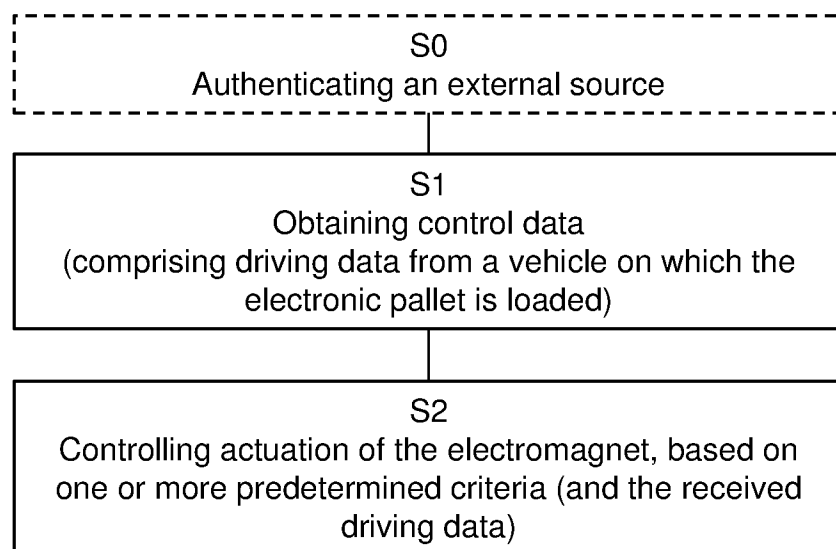


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2019/051173

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60P, B65D

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 20170137235 A1 (THOMPSON JOHN P ET AL), 18 May 2017 (2017-05-18); paragraphs [0019]-[0026]; figures 3B, 5-6 --	1-5, 8-11, 14-15
A	JP 2004148463 A (PASCAL ENG CORP), 27 May 2004 (2004-05-27); claims 1-2 --	1-15
A	CN 107298311 A (FU ZHONGHUA), 27 October 2017 (2017-10-27); claims 1-3 --	1-15
A	CN 202624742 U (BEIJING HAILI JIETE MACHINERY EQUIPMENT CO LTD), 26 December 2012 (2012-12-26); claims 1-3 --	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2019/051173

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 102007018908 A1 (ALLSAFE JUNGFALK GMBH & CO KG), 30 October 2008 (2008-10-30); paragraphs [0021]-[0031]; figure 1 -- -----	1-15

Continuation of: second sheet

International Patent Classification (IPC)

B65D 19/38 (2006.01)

B60P 7/08 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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