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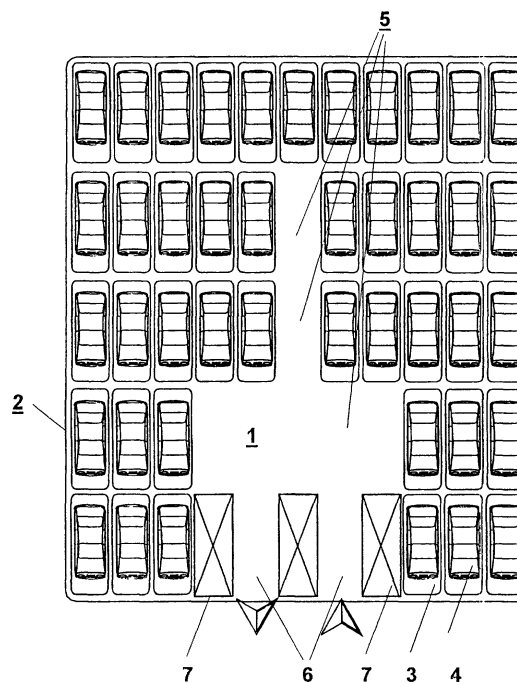
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(54) **Automatic carrying and storing method of objects with selfpropelled pallets and pallet for automatic storage purposes**

(57) An area (1) is defined by a fixed border (2) located at the same height of the side frames of pallets (3) in order to limit and guide them. On each pallet (3) a car (4) can be loaded, or another object to be parked, such as a machine, a piece of furniture, etc. The pallets (3) are alike, independent from one another and self-propelled, arranged according to a plurality of rows and of columns on the area (1). The pallets (3) have substantially rectangular shape and are capable of moving according to two orthogonal directions, i.e. the rows and the columns. For their manoeuvre spaces (5) are left free, each corresponding to the surface covered by each pallet (3). On a pallet (3) a car (4) is loaded or unloaded in a zone (6) of the area (1) that can be used as entrance or exit, near to which pedestrian platforms (7) are provided for getting on or of the car (4). The pallet are self-propelled, by means of electric steering drives on board and are independent from one another. Step movements in the two orthogonal directions are controlled by a send-receive computing fixed unit.

Fig. 1



Description

Field of the invention

[0001] The present invention relates to an automatic carrying and storing method for bulky objects such as for example cars, machines, stacks of objects, by means of self-propelled pallets.

[0002] Furthermore the object of the invention is a pallet for automatic storage purposes, in particular but not exclusively for parking cars.

Description of the prior art

[0003] It is well known and felt the problem of parking cars in metropolitan areas, where there is lack of parking space with respect to the needs, and where further crowded traffic and pollution are caused by people looking for a parking.

[0004] Notwithstanding new parking areas are built, a lot of space thereof is used for manoeuvres, entrance and exit passageways. In fact, the average space in a parking for each car is three times its actual encumbrance.

[0005] In garages, where personnel arrange the cars, this rate is slightly lower but, on the other hand, there is the problem of the time necessary for the entrance and the manoeuvres for locating and picking up the vehicle. This increases fuel consumption, wear, damages to the car bodies and finally the parking fees.

[0006] Not only the available space is not fully exploited, but the need of the space for manoeuvring prevents from parking cars in little areas and urban spaces such as: courtyards, air wells, basements of buildings, little areas between buildings, arcades, small squares, blind alleys.

[0007] Even in car factories and in the parking areas of cars being shipped or on sale similar problems arise owing to the huge space that is required.

[0008] The problem of storing objects different from cars is also present in industrial areas, where machines of various size have to be carried, requiring wide space for manoeuvre.

Summary of the invention

[0009] It is therefore object of the present invention to provide a method for carrying and storing automatically bulky objects such as for example cars, machines, stacks of objects, by means of self-propelled pallets, which allows in particular to arrange in a predetermined area as many objects as possible such as, autos, machines, stacks of material.

[0010] It is another object of the present invention to provide a self-propelled pallet capable of carrying out this method in an easy, cheap and effective way.

[0011] These and other objects are achieved by the method according to the present invention, whose characteristic is that it comprises the steps of:

acteristic is that it comprises the steps of:

- arranging a plurality of equal pallets, independent from one another and self-propelled, according to a plurality of rows and of columns on a parking area, the pallet having substantially rectangular shape and being capable of moving according to two orthogonal directions, at least a plurality of elementary spaces being left free for manoeuvre of the pallets, each space having area corresponding to the surface covered by one pallet;
- movement in turn of the pallets in at least a zone of the area that can be used as entrance or exit;
- loading or unloading in turn the objects onto/from the pallet present in turn in the entrance/exit station;
- entrance movement of the pallet with the loaded objects on free spaces of the area by translating them according to two orthogonal directions,
- exit movement of the pallet with objects to unload on free spaces of the area by translating them according to two orthogonal directions up to reaching the entrance/exit station,
- said entrance and exit movement being step movements that cover in turn spaces corresponding to the surface covered by one pallet, the step movements occurring at the same time or in succession for several pallets or several groups of pallets that move covering and freeing in turn the spaces;
- unloading the objects that in turn are carried by the pallet to the entrance/exit station.

[0012] Preferably, the entrance and exit movements and the step movements are operated by a fixed send-receive computing unit, the following being provided on board of each pallet;

- send-receive means for communicating with the computing unit,
- self-propelled means moveable according to two orthogonal directions,
- means for driving the self-propelled means responsive to signals coming from the computing unit,
- means for communicating to the computing unit the position of each pallet within the area.

[0013] Preferably, the movement of the pallet according to two orthogonal directions is carried out on steering wheels can be oriented in two directions.

[0014] Advantageously, the pallets are driven electrically and are equipped with batteries for driving the wheels for executing the step movements and for steering the wheels according to two orthogonal directions.

[0015] In a preferred embodiment, the pallets that cover the spaces of the area do contact one another on sliding means with minimum friction.

[0016] For charging the batteries at the sides of the pallets sliding brushes are provided running against fixed conductive paths arranged at the periphery of the

area.

[0017] According to another aspect of the invention, a pallet that can be used for carrying and storing objects on areas comprises:

- a base frame,
- a platform that covers the base frame and supports the objects;
- sliding means with minimum friction against adjacent pallets;
- wheeled means for moving said pallets on the area, the wheeled means being capable of steering according to two orthogonal directions.

[0018] Advantageously, the wheeled means comprise free rotating wheels and driven wheels steering in two orthogonal directions.

[0019] The sliding means with minimum friction against the adjacent pallets can comprise rollers sliding on the four peripheral sides of the frame, the sliding rollers of two opposite sides being on a plane different with respect to the sliding rollers of the other two peripheral sides, whereby two adjacent pallets do not have rollers that contact each other.

[0020] Advantageously, each pallet comprises also means for detecting the position with respect to a predetermined area and for communicating them the position on the area to a send-receive computing fixed unit. Furthermore, each pallet comprises means for operating and steering the steering drive wheels on the basis of signals coming from the send-receive computing fixed unit.

Brief description of the drawings

[0021] Further characteristics and/or advantages of the method and of the pallet according to the present invention will be made clearer with the following description of an embodiment thereof, exemplifying but not limitative, with reference to attached drawings wherein:

- figure 1 shows a top plan view of a parking operated with the method according to the invention;
- figure 2 shows a diagrammatical view of the control means of a pallet used for the parking figure 1;
- Figure 3 shows a succession of movements within a parking area carried out with the pallet and with the method according to the invention;
- Figure 4 shows a perspective view of the side frame of pallets self-propelled and independent from one another according to the invention;
- Figure 5 shows a perspective view of the supporting frame of the pallet of figure 4;
- Figure 6 shows a perspective view of the side frame of figure 4 with auto-steering wheels ;
- Figure 7 shows a perspective view of the body of the pallet of figures 4 and 5;
- Figure 8 shows an enlarged view of the pallet of fig-

ure 7 with a car parked thereon.

Description of the preferred embodiments

5 **[0022]** With reference to figure 1, a method for automatically carrying and storing objects, such as for example cars, machines, stacks of objects, it is possible on an available area 1.

10 **[0023]** Area 1 is defined by a side stiff border 2 arranged at the same height of the frames of pallet 3 in order to contain and guide them. On each pallet 3 (figure 4-7) a car 4 can be loaded.

[0024] Pallets 3 are alike, independent from one another and self-propelled, and arranged on area 1 according to a plurality of rows and of columns.

[0025] Pallets 3 have substantially rectangular shape and are capable of moving according to two orthogonal directions, i.e. the rows and the columns. For their manoeuvre spaces 5 are left free, each of area corresponding to that covered by each pallet 3.

20 **[0026]** Cars 4 are loaded or unloaded onto or from pallets 3 in a zone 6 of area 1 that are used as entrance or exit. Near zone 6 are provided pedestrian platforms 7 for getting on or off the car 4. The driver has only to bring the car in entrance or exit zone 6 and leave it receiving for example an receipt ticket. The car can be closed and turned off, whereby there is an energy saving and good air quality in the parking, since all the car present in the parking are turned off.

25 **[0027]** The pallets as hereinafter described are self-propelled, by means of electric drive, and are independent from one another. With reference to figure 2, each pallet 3 is equipped with motor wheels 10 and with steering means 11 on at least two of them. Step movements on the two orthogonal directions are operated by a send-receive computing unit 12, whereas on board of each pallet 3 send-receive means 13 are provided for communicating with computing unit 12.

30 **[0028]** Furthermore, infrared sensors 14 communicate to computing unit 12 the position of each pallet 3 within area 1. Adjacent pallets can also communicate among one another by means of proximity sensors.

35 **[0029]** The electrical supply is given by batteries 15 that have sufficient autonomy for many hours for a continuous motion. The autonomy is then of many days since that for almost all the time the motors for driving the pallets are still. The batteries 15 can be charged by contacting a path under voltage provided on perimeter 2.

40 **[0030]** The computing unit 12 can having an interface 16 for payment of tickets, for collecting parked cars and for issuing tickets or magnetic cards at the entrance.

45 **[0031]** As shown in figure 3, the area 1 is covered by a plurality of pallets 3 that are moved either for allowing the entrance or exit of other pallets or for entering or exiting themselves the parking, on demand from the users.

50 **[0032]** In the example of figure 3 with a different pat-

tern two pallet 3a at entrance and two pallet 3b at exit are indicated. In the entrance movement pallets 3a travel on free spaces of area 1 by translating according to two orthogonal directions.

[0033] Instead, in the exit movement pallets 3bb before traveling towards the entrance/exit station according to two orthogonal directions, their path is prepared by the movement of the groups of pallets encircled by the dotted lines.

[0034] Entrance and exit movements occur as step movements that cover in turn a space corresponding to the surface covered by each pallet.

[0035] With reference to figure 4-7, a pallet 3 has a base frame 30, a platform 31 that covers frame 30 and supports the object, that in the case of figure 7 is a car 4, and a side frame 32 of contact and relative sliding with the adjacent pallets. Frame 31 is sized for bearing loads according to the weights, the resistance of the pallets body and of the objects to transport.

[0036] The side frame 32 (fig. 4) is equipped with rollers 33 and 34 for a sliding with minimum friction. For avoiding that rollers of adjacent pallets hit against one another, rollers 33,34 of two opposite sides are always on different planes. This way, it is sufficient to orient the pallets always with upper rollers 34 for example in front and on the right and lower rollers 33 as a consequence behind and on the left, so that it is assure that all the rollers are always in rolling contact with only side frames 32 of the adjacent pallets.

[0037] With reference to figure 4 the means for moving pallets 3 comprise free pivoting wheels 35 and steering driven wheels 36, rotating in two orthogonal directions by means of a hydraulic system 37 and arms 38. It is sufficient the rotation of 90° of the steering wheels for having all the four possible orthogonal movements in the two directions, since the electric wheels 36 can rotate both clockwise and counter-clockwise.

[0038] Alternatively, as shown in figure 6 wheels 36 can be equipped with auto-steering motor reducers. Such wheels are not are described in detail being available on the market.

[0039] The means for detecting the position with respect to a predetermined area can be infrared sensors 14, and for communicating the position within the area to a fixed send-receive computing unit infrared send-receive means can be used as well. Furthermore, each pallet can communicate with an adjacent pallet with proximity sensors known in automatic pallet production lines.

[0040] Per better illustrating the method, a parking for cars on an area 1, (fig. 1) for example 25m x 22m corresponding to 550mq, is equipped with car supporting pallets 3, with the size 5m x 2m (10mq) and has three entrance/exit areas. The parking area can be divided into 55 spaces of 10mq each. Using 42 of such spaces for self-propelled pallets according to the invention 13 free spaces are free. Pallets 3 move, alone or in group, according to the coordinates broadcast by the process-

ing unit 12.

[0041] The parking can be arranged on more levels. For example, on three levels of which one underground, one at ground level and one elevated, appropriate slopes can be provided as well as hoists, ramps etc.

[0042] It is therefore possible with the method according to the invention:

- having an area, arranging the maximum number of cars, or machines or material that it can house, exploiting it up to 90%.
- housing in the parking areas all the pallets that they can receive, except from a row that allows the sliding of a pallet, or several pallets and/or groups of pallets simultaneously, for allowing the movement of other pallets going in and out the parking and from free spaces at every entrance/exit zone.
- Assuring the safety of the objects, since the area can be closed because it does not require personnel for manoeuvring. In the case of cars, moreover, the parked car once left at the entrance can be locked;
- Causing a minimum environmental pollution, thanks to the electric motors on the pallets and to the movimentation in the parking only of turned off cars.

[0043] The foregoing description of a specific embodiment will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Claims

1. A method for automatically carrying and storing bulky objects such as for example cars, machines, stacks of objects, by means of self-propelled pallets, **characterised in that** it comprises the steps of:

- arranging a plurality of equal pallets, independent from one another and self-propelled, according to a plurality of rows and columns on a parking area, said pallets having substantially rectangular shape and being capable of moving according to two orthogonal directions, for ma-

- noeuving said pallets at least a plurality of spaces being left free each corresponding to the surface covered by one pallet;
- movement in turn of said pallets in at least a zone of said area that can be used as entrance or exit;
 - loading or unloading in turn said objects onto/from the pallets present in turn in said entrance/exit station;
 - entrance movement in turn on said free spaces of pallets with objects loaded on by translation according to said two orthogonal directions,
 - exit movement in turn of pallets with objects to be collected by translation according to said two orthogonal directions up to reaching said entrance/exit station,
 - said entrance and exit movements being step movements that cover in turn spaces corresponding to the surface covered by each pallet, said step movements occurring also at the same time or in succession for several pallets or several groups of pallets present on the area that move covering and freeing in turn said spaces;
 - removing the objects at exit that in turn are left free on said pallets at said entrance/exit station.
2. Method according to claim 1, wherein said pallets that cover the many spaces of said area are in contact with one another on sliding means with minimum friction.
3. Method according to claim 1, wherein said entrance and exit movement and said step movements are controlled by a send-receive computing unit, on board of each pallet being provided::
- send-receive means for communicating with said computing unit,
 - self-propelled means according to said two orthogonal directions,
 - means for driving said self-propelled means responsive to signals coming from said computing unit,
 - means for communicating to said computing unit the position of each pallet within said area.
4. Method according to claim 1, wherein said movement of said pallets according to said two orthogonal directions is carried out on wheels steering according to said two directions.
5. Method according to claim 1, wherein said pallets are driven electrically and are equipped with batteries for driving said wheels for executing said step movements and for steering said wheels according to said two orthogonal directions.
6. Method according to claim 1, wherein means for charging said batteries are provided on each pallet comprising brushes sliding against fixed conducting means arranged at the peripheral border of said area.
7. A pallet that can be used for carrying and storing objects on areas **characterised in that** it comprises:
- a base frame
 - a platform that covers said base frame and supports said objects;
 - sliding means with minimum friction against adjacent pallets;
 - wheel means for movement on said area, said wheel means being capable of steering according to two orthogonal directions.
8. Pallet according to claim 7, wherein said wheel means comprise free rotating wheels and driven wheels steering in two orthogonal directions.
9. Pallet according to claim 7, wherein said sliding means with minimum friction against adjacent pallets comprise sliding rollers on the four sides of said frame, the rollers on two opposite sides being on a plane different with respect to the rollers on the other two sides, whereby the rollers of two adjacent pallets do not slide on one another but directly against said sides.
10. Pallet according to claim 7, wherein means are provided for detecting the position within the area and for communicating the position within said area to a fixed send-receive computing unit, each pallet comprising means for driving and steering said steering drive wheels responsive to signals coming from said send-receive computing fixed unit.

Fig. 1

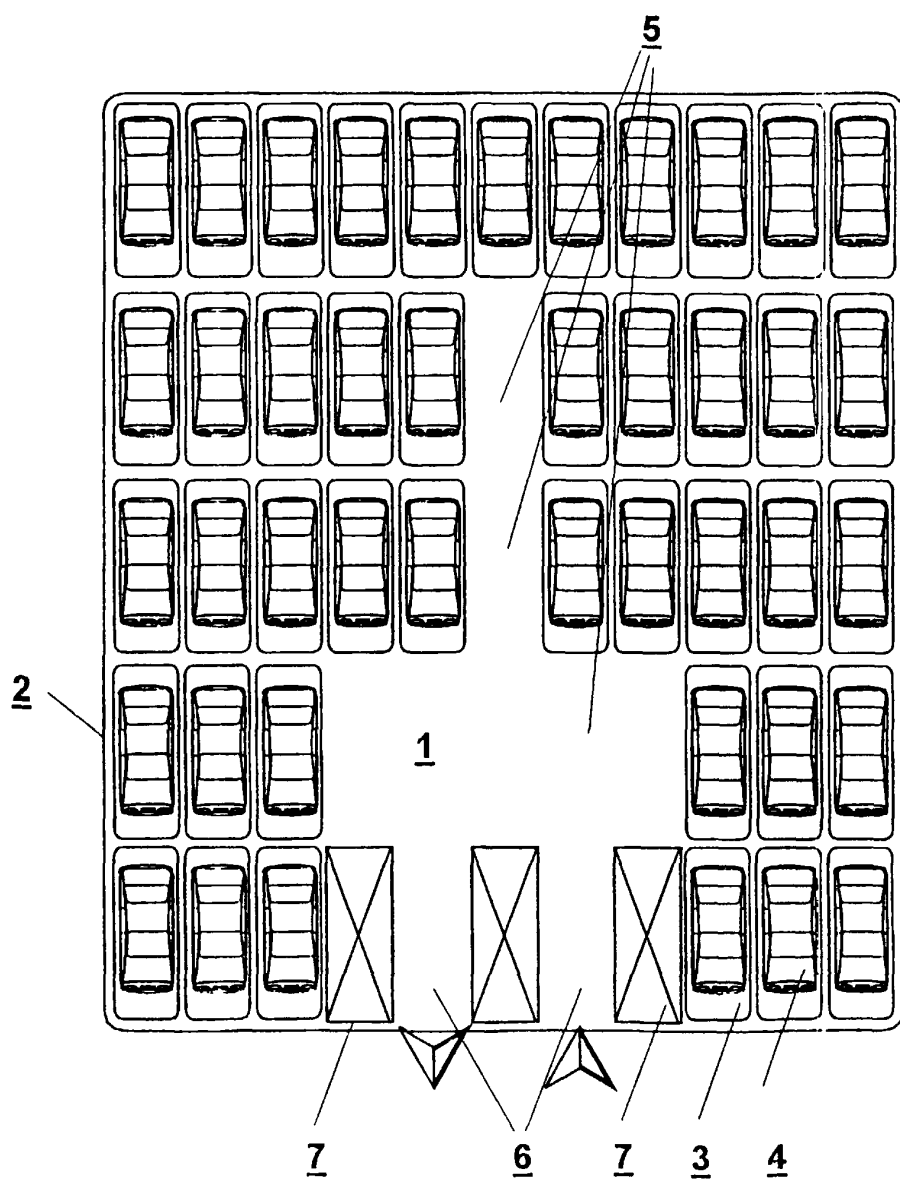


Fig. 2

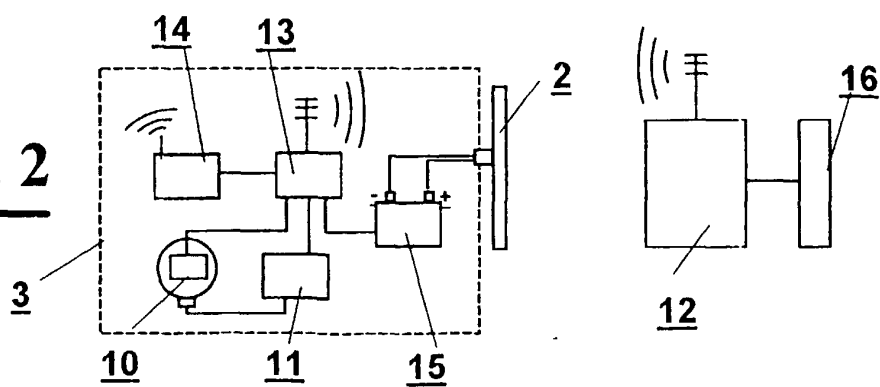


Fig. 3

