ABSTRACT

A roof-top parking system and method for automatically parking and retrieving a vehicle on a roof. The system includes a communication system adapted to receive a parking request or a retrieval request, and a vehicle positioning device which positions a vehicle a queuing space on the ground adjacent a building and a parking space assigned to the vehicle on the roof of the building.
FIELD OF INVENTION

The present invention relates to the parking of vehicles, in particular automatic parking thereof on the roofs of buildings.

BACKGROUND OF THE INVENTION

In many locations there is a dearth of available parking spaces. This is particularly true in crowded cities due to the large number of automobiles owned by those who live and come to work there.

Due to this issue, new buildings often include underground parking or are raised (on “stilts”) to provide parking under the first floor of the building. On the other hand, some new buildings do not provide for parking, which further exacerbates the above-mentioned parking issue. Also, there are many existing buildings that do not have a parking lot or underground parking; or simply have insufficient parking space.

To help provide a solution to the parking space issue in crowded locations, JP 6212822 and JP 1268937 both disclose roof parking devices.

The roof parking device of JP 6212822 comprises an elevator device constructed along an external wall of an existing building and trucks disposed on the roof for positioning cars. A car loaded via a pallet is lifted to a roof level corresponding to a specific parking space by a carriage. The truck for positioning the cars is moved to the carriage side and stopped and a driving rail on the carriage is slid to the truck side through sliding mechanism and transferred onto a roller rail on the truck side together with the pallet. The truck, on which the car is loaded, is moved horizontally at a specific position, brought to the same level as a roller rail on the parking space side, and housed together with the pallet.

JP 1268937 discloses a roof parking device that provides car storage racks on the roof of a building and the carrying of entering and exiting cars to and from optional storage spaces via a lifting device and a transferring device. Storage racks forming a plurality of multi-stage car storage spaces are installed on the building’s roof. The transferring device is incorporated into the storage racks and is capable of carrying entering and exiting cars. The lifting device, which performs vertical transfer of the cars, is provided between a home position at the ground level and a transfer position for the transferring device. A turning device rotates the cars to the appropriate direction at the transfer position.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide a parking system designed for positioning cars on a roof without the need for a parking garage thereon.

It is another object of the present invention that the parking system requires a minimal or essentially no support by the building whose roof is being parked thereon. In other words, the parking system exerts either a relatively minimal force on the roof of a building or no force at all—except for a parking rack associated with each parked car. Thus, virtually any building, including an existing building, is sturdy enough to allow cars to be parked on its roof without structural issue.

It is an additional object of the present invention that the parking system is adapted so that cars can be positioned in their spaces on the roof regardless the typical obstacles found on roofs, such as solar panels, storage huts and the like.

It is a further object of the present invention that the parking system is adapted to provide automatic parking of vehicles on a roof and with minimal space required on the roof and between vehicles parked thereon.

The present invention relates to a parking system for parking vehicles on the roof of a new or existing building as defined in the claims.

According to particular embodiments, the parking system is adapted for automatic operation whereby a driver can have his car parked in a pre-determined dedicated space by driving his car into a pier, located outside the perimeter of the roof (typically adjacent or adjoined to the roof and building) where a rack, dedicated for use with his car only, is used to help lift and position the car, and he can automatically retrieve his car via a communication system including, but not limited to, a command from a control panel or a remote control mechanism, which could be like a TV remote control or garage door remote control or even built in or programmed into other hand-held devices such as cell phones, personal digital assistants (PDAs), and the like. In this regard, the driver may also have the option to order his car to be ready at a certain hour.

The pier typically adjoins the exterior of the building, particularly in existing buildings, whereas in new buildings there is more flexibility in the arrangement.

It is a particular feature of the parking system that the positioning structure thereof is essentially or completely independent of the roof and/or building. By this it is meant that the positioning structure does not structurally exert a significant weight on the roof and/or building; and, according to particular embodiments, does not exert any weight on the roof and/or building with the exception of the parking rack associated with each car. In such a design, the positioning structure, including the pier, is designed to support the portion of the structure that overhangs the building above the roof, as well as support each car during transfer to and from its parking space—in particular while above the roof.

ADVANTAGES

Additional parking spaces are provided without any additional footprint.

One can park right at one’s workplace or apartment building/residence.

Low cost relative to providing underground parking lots or parking in an organized parking lot.

Simple operation and maintenance.

Time saving: parking/retrieving one’s car is quick and does not require the driver to park the car.

Space saving: (a) cars can be parked close to each other as drivers do not need space to exit/enter their cars; and (b) cars can be parked in a large portion of the roof, including the row opposite the pier.

Safer and better: as drivers do not park and retrieve their cars, there will not be traffic accidents during that time; and, parked cars will not be hit, dented, scratched by doors being opened, parked or retrieved.

Environmentally friendly: relieves traffic congestion as cars need not be driven in search of parking spaces.

Theft of one’s car is less likely during the time it is parked on the roof.

As the parking system’s structure is only marginally supported by the roof/building, or not supported by it
at all—with the exception of the parking rack of each car—the roof/building need only support the weight of the parking racks and cars parked thereon. Thus, virtually all existing buildings can use the parking system without need for strengthening of the roof/building.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The invention may be more clearly understood upon reading of the following detailed description of non-limiting exemplary embodiments thereof, with reference to the following drawings, in which:

[0026] FIG. 1 is a perspective view from above of an embodiment of a roof-top parking system in accordance with the present invention showing a car about to be parked (or shortly after retrieval was initiated);

[0027] FIG. 2 is a further perspective view of the parking system of FIG. 1 showing a car entering the parking system;

[0028] FIGS. 3A-3C are side sectional views of a portion of the parking system showing a car in various stages of being retrieved;

[0029] FIG. 4 is a perspective view of another embodiment of the parking system of the present invention wherein it comprises support beams resting on the roof;

[0030] FIGS. 5A-5C are side views of vehicle positioning device of the present parking system; and

[0031] FIGS. 6A and 6B are side views of vehicle positioning device of the present parking system.

DETAILED DESCRIPTION OF THE INVENTION

[0032] Referring first to FIGS. 1 and 2, there is shown a parking system of the present invention for parking vehicles on a roof 10 of a new or existing building 12. FIG. 1 shows an early stage of parking a car 14 in a (typically, its) parking space 16 (i.e. where the car is just entering the parking system); and FIG. 2 shows a late stage of parking the car 14 (where the car is nearly above its parking space at which time it will be lowered).

[0033] The parking system comprises a vehicle positioning device 18 comprising a system of support beams 20 and a system of car positioning beams 22, and a carriage 24, which is carried by one of the vehicle positioning beams. The support beams 20 typically include generally vertical beams 26 and generally horizontal beams 28—both of which typically include diagonally oriented structural members or diagonal beams 30. The support beams 20 and vehicle positioning beams 22 include beams that are located above the roof 10 and beams located outside the perimeter of the roof, which form a pier 32.

[0034] The carriage 24 is adapted for attaching to each of a plurality of platforms or racks 34 upon which each car 14 rests when it is within the parking system; i.e. when it is parked on the roof 10 and when it is being transferred (moved when on or near the roof, raised or lowered) for retrieving or parking thereof.

[0035] For raising the car 14 to the roof 10 when it is to be parked and lowering thereof when it is to be retrieved, as mentioned, certain of the support beams 20 are disposed at a position outside the perimeter of the roof 10 and form the pier 32, which may include walls for safety and aesthetic reasons. As noted, the pier 32 is located outside the perimeter of the roof 10, commonly adjoining or at least adjacent the building 12 and roof. However, particularly in existing buildings where there may exist space constraints or the desire not to block an existing window and the like, the pier 32 may be spaced apart from the building 12.

[0036] The lifting and lowering of the car 14 and rack 34 is accomplished by cables 35 (seen in FIG. 3C), which are coiled and uncoiled to perform such raising and lowering. The vehicle positioning beam 26 is not visible in FIG. 1 as it is within (at the top of) the pier 32 waiting to raise the car 14.

[0037] Balancing of the rack 34 and car 14 thereof can be performed automatically by the cables 35 using known systems as known in the field of cargo and shipping containers. The technology and mechanics involved in the transporting and positioning of cargo and shipping containers is also applicable to the present parking system for stabilizing and securing the carriage 24, and for example may include a male/female cone-like arrangement (not shown) wherein when the cables 35 completely raise the car 14, carriage 24 and rack 34 from the roof 10, they are secured so that they do not sway.

[0038] In the present embodiment the positioning beam 22 is longer than the length of the cars 14 (simply due to the fact that three rows available for parking and not merely one row) and, for this reason the pier 32 has an upper portion 36 that is wide enough to accommodate the positioning beam 26 which enters the pier prior to raising and lowering of the car.

[0039] The parking system may further include a shelter or shed 38 in which a driver 40 may wait for his car 14 to be retrieved and into which he may enter upon exiting his car when he leaves his car to be parked. The parking system may include a control panel 42 (seen in FIGS. 3A-3C), having features such as a display and/or keyboard (not visible) to enter information, to facilitate ordering the driver's car 14, and it may be housed in the shed 38. Alternatively, the parking system can be designed to accommodate remote commands, via a variety of devices such as used in automatic garage door openers; a command via a cell phone or PDA; and so on.

[0040] FIGS. 3A-3C emphasize the preferable design of the parking system wherein that the pier 32 is tall enough with relation to the roof 10 so that the positioning beams 20 are raised to a height whereby cars 14 moving in and out of the pier are raised higher than the tallest expected/allowed vehicle. As such, cars 14 can be parked opposite the pier 32, i.e. in a central row 44 in this case (FIG. 3A), which is the row between the rows of parked cars seen in FIGS. 1 and 2. Thus, it should be understood that the parking system could be designed with a pier height and related design modifications, such that a car could be parked in virtually any open area suitable for resting a car—including on the far side of or adjacent to objects typically found on roofs, represented by an elevator housing 46, although including solar panels or any other such objects.

[0041] In FIG. 3A the car 14 has been retrieved from its space 16 and is on its way to the pier 32; in FIG. 3B the car 14 has arrived at the top of the pier 32 and is about to be lowered to the ground; and in FIG. 3C the car 14 has arrived at the ground where the driver 40 is waiting.

[0042] In the above-described embodiments, the parking system does not touch the roof 10 and does not exert a force on the roof, with the exception of the parking racks 34, which are of relatively insignificant weight. Thus, the weight of any parked cars 14 is the most significant additional force on the roof 10. As the parking system is only marginally supported by the roof/building (i.e. only the parking racks 34 rest thereon), virtually all existing buildings can use the parking system without need for strengthening.
FIGS. 3A-3C also illustrate a communication system 52 of the parking system to allow the driver 40 to signal that the vehicle is to be retrieved, or parked. The communication system 52 is illustrated as located in the shelter 38. Alternatively, or in addition, the parking system can be adapted to allow remote communication via signals from a device or program in a cell phone (not shown) or the like.

According to a further embodiment, illustrated in FIG. 4, the positioning structure 20 further comprises a pair of beams 20a that rest on the roof 10 and provide additional support to the system. The parking system may be designed so that there is only a marginal force exerted on the roof 10 as a result of those beams 20a supporting a portion thereof. The remainder of the parking system is supported as understood from the above description; typically by means of cantilever-type support or as practiced by many modern building cranes. Again, as the parking system is only marginally supported by the roof/building, virtually all existing buildings can use the parking system without need for strengthening.

To clarify how the cars 14 are positioned, reference is made to FIGS. 5A-5C. First it is noticed that the positioning beams 22 have associated therewith an arrangement, illustrated by a pair of spoons or wheels 48, whereby they can slide/roll on the support beams 20 that are extending over the roof 10. This arrangement allows the car 14 to be moved in and out of the pier 34.

Further, to allow cars 14 to be parked in rows other than the central row 44 (in this case to a row adjacent to the edge of the roof 10), the parking system’s beams 22 may comprise an auxiliary pair of positioning beams 22a. The auxiliary positioning beams 22a have associated therewith an arrangement, illustrated by two pairs of spoons or wheels 50, whereby they can slide/roll with respect to positioning beams 22, in particular the horizontal beams 28, with a cantilever/telescoping effect. Wheels 51 at the non-free end of positioning beams 22a allow for the cantilevering, generally exerting an upward force on positioning beams 22 to balance the weight on the free end positioning beams 22a (namely the car 14, the carriage 24, the rack 34 and the extending portion of those beams 22a). It should be understood that depending upon the size, geometry and the like of the roof 10, there may not be a need for more than one pair of positioning beams; or there may be a preference for more than one pair of such beams 22a.

It should be understood from the aforementioned, that beams 22a can extend and retract whereby the upper portion 36 need not be significantly wider than the car 14. In other words, the pier 32 can be narrow throughout its height and one or more set of auxiliary beams 22a can be used to extend the car 14 to a remote parking space 16.

As should be understood from the above described embodiments, the parking system’s vehicle positioning device 18 is adapted so that the car 14 can be moved in X, Y and Z directions. Furthermore, the positioning beams 22 can be dimensioned to have additional beams whereby, via the XYZ movement, the parking system can be adapted to park the car 14 in virtually any open position on the roof 10. Raising and lowering of the car 14 in the pier 34 can be considered Z-direction movement; moving the car in and out of the pier 34, can be considered X-direction movement; and moving of the car to rows in a direction away from the central row 44 (opposite the pier 34) can be considered Y-direction movement.

FIGS. 6A and 6B illustrate another embodiment of the parking system of the present invention, which is similar to those described above, however, the positioning device 18 comprises a turning mechanism 54 for turning the carriage 24 whereby, for example, the cars 14 (parked in the positions as illustrated in FIG. 1) are turned 90 degrees during the time between when they are raised from their parking space 16 and when they enter the pier 32 (and vice versa). This allows the pier 32 to be oriented in a position 90 degrees to that shown in the figures thereby providing flexibility to the design which may be critical in consideration to space available for the pier.

OPERATION

Parking a vehicle: the driver 40 driving his car 14 approaches the building 12 (or upon arriving at the building) and activates the parking system (remotely or via the control panel 42) typically involving inputting a code (e.g. his own private code) and indicating whether he is parking or retrieving. According to particular embodiments, the system may include an option to verify whether a car 14 is parked on its rack 30 and thus know whether a command is for parking or whether it is for retrieving). At this stage, the vehicle positioning device 18 is automatically activated (aligned to the top of the pier 32) which identifies the parking space 16 designated to his car 14 (placed in a permanent site on the roof 10) and conveys the parking rack 30 to the bottom of the pier.

The driver 40 drives his car 14 onto its rack 30, turns off the car, leaves the car in the pier 32, exits the pier, and then activates the parking action (e.g. swipes a magnetic card, inputs a code via a press pad, provides a signal via a remote control device such as a cell phone, PDA, etc.). For safety, activation of the parking is preferably only possible from outside the pier 32. The activation actuates the vehicle positioning device 18, which conveys the rack 30 with the car 14 thereon up the pier 32 and into its predetermined space 16 on the roof 10. Placement of the rack 30 and car 14 into its designated space on the roof 10 may be facilitated by mutual identification of a sensor of the vehicle positioning device 18 with the parking space 16.

Upon activation of the parking mode, the positioning beam 26 moves the carriage 24 to the rack 30 of that car 14 and attaches thereto. The rack 30 is then conveyed along the positioning structure 20 to the pier 32 at which point the rack is lowered by uncoiling the cables 35. When and only when, the rack 30 reaches the floor of the pier 32, the driver 40 may drive his car 14 thereon. When the driver 40 exits his car 14 and the pier 32 and activates a park command, the car is raised by coiling the cables 35 until it reaches the upper portion 36 of the pier 32 at which time the car and rack 30 are translated out of the pier above the roof 10 and into its parking space 16. The last steps of parking require moving the car 14 and rack 30 perpendicular to the aforementioned translated direction and then lowering the rack, with the car thereon, onto the roof 10, by uncoiling the cables 35.

Retrieving the car 14 from its parking space occurs essentially in a manner reverse to that of parking it and may be actuated by means of a code in the remote control device, as mentioned above. The remote control device may have two modes or activation options:

a. A simple requisition requested at the time when the driver is at the building 12 (i.e. at the pier 32). The request may be made as mentioned above (e.g. by pressing a code, etc.); and
b. A timer-type requisition for requesting the driver's car 14 at a future time. Again, the request may be made as mentioned above (e.g. by pressing a code, etc), however the request is typically made from a remote location, though not necessarily, and obviously requires that the preferred time of retrieval is input and preferably the parking system provides a verification that the retrieval time is appropriate (i.e. there is no previous order in the time slot requested) or provides an indication of the nearest time slot available to that requested.

There can be various provisions for dealing with situations where a driver 40 remotely orders his car 14 and yet cannot arrive on time and another driver meanwhile initiates a retrieval attempt. For example, the car 14 ordered can be returned to its space 16 allowing the other car to be retrieved after which the ordered car is retrieved again—or it may signal the driver 40 who made the order who may then update the time at which he wishes to have his car ready.

It should be understood that there are various parking systems and methods that can be devised according to the present invention and that the above described embodiments are merely explanatory.

For example, in accordance with certain embodiments, each car 14 has its own pre-determined parking space 16 on the roof 10 of the building 12 and parking rack 30, which is associated with each space. In accordance with other embodiments, the driver 40 may park his car 14 in any available space 16 although typically a code is required. The system may be designed so that a fee is required to park; and may be adapted to collect those fees (e.g. automatically via a credit card).

According to another example, the carriage 24 may comprise an impact-mitigating touch down system, illustrated by springs 56 (FIGS. 5A-5C and 6A & 6B); however it could comprise various other devices such as one or more neoprene cushions or air pillows and the like.

Thus, the present parking system and method can be embodied in a variety of aspects falling within the scope of the present invention, mutatis mutandis.

COMPONENT LIST AND REFERENCE NUMBERS

- rooftop support beams 20a
- first pair of positioning beams 22a
- second pair of positioning beams 22b
- carriage 24
- vertically oriented beams 26
- horizontally oriented beams 28
- diagonal beams 30
- pier 32
- racks 34
- cables 35
- upper portion 36
- shelter or shed 38
- driver 40
- control panel 42
- central row 44
- elevator housing 46
- wheels 48
- wheels 50
- communication system 52
- turning mechanism 54
- springs 56
27. The parking system according to claim 26, wherein the control panel is disposed adjacent the first structure at the ground level.

28. The parking system according to claim 19, wherein the communication system is adapted to receive a wireless command signal.

29. The parking system according to claim 28, further comprising a remote control device for sending the wireless command signal.

30. The parking system according to claim 28, wherein the communication system is adapted to receive the wireless command signal from a communication device selected from the group consisting of a cellular phone and a personal digital assistant.

31. The parking system according to claim 19, wherein the communication system is adapted to generate an automatic retrieval request at a predetermined time, wherein the vehicle positioning device retrieves and lowers a parking rack from the parking space to the queuing space in response to the automatic retrieval request.

32. The parking system according to claim 19, wherein the carriage further comprises an impact-mitigating touch down system.

33. A method of parking a car on a roof of a building comprising:
   - executing a parking order, whereby a parking rack, which is dedicated to a vehicle and corresponds to a parking space located at a rooftop level, is retrieved from said parking space and is transported to a queuing space located at a ground level;
   - driving the vehicle onto said parking rack;
   - exiting the vehicle;
   - activating a parking command requesting that the vehicle be parked, whereby the loaded parking rack is raised to the rooftop level and positioned to the corresponding parking space; and
   - executing a retrieval order and activating a retrieval command requesting that the vehicle be retrieved, whereby the loaded parking rack is retrieved from said parking space and transported to the queuing space.

34. The method according to claim 33, wherein at least one of the steps of executing the parking order and executing the retrieval order is initiated remotely.