(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 October 2008 (16.10.2008)

PCT

(10) International Publication Number
WO 2008/123985 A1

(51) International Patent Classification:
E04H 6/18 (2006.01)

(21) International Application Number:
PCT/US2008/004260

(22) International Filing Date: 2 April 2008 (02.04.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/921,406 2 April 2007 (02.04.2007) US

(71) Applicant *(for all designated States except US)*: **LIBERMAN, Barnet, L.** [US/US]; 421 Hudson Street, New York, NY 10014 (US).

(74) Agent: **WEISZ, Edward, M.**; Cohen Pontani Lieberman & Pavane Llp, 551 Fifth Avenue, New York, NY 10176 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(54) **Title:** AUTOMATED PARKING SYSTEM FOR VEHICLES

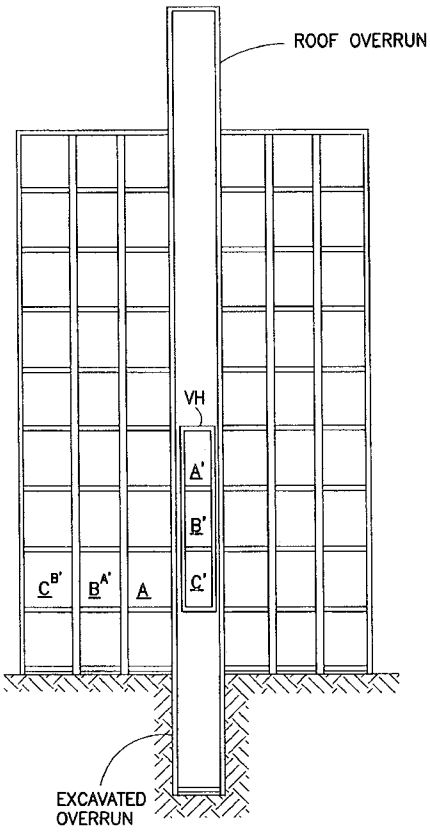


FIG.6

(57) **Abstract:** A system and method for providing a multi level, vertical and horizontal (VH) elevator that can move to a pre-designated parking slot or parking space within an automated parking garage and remove at least one car or vehicle that is positioned in front of a desired car or vehicle that is parked behind the at least one car or vehicle, wherein a multi-level VH elevator is used to permit the storage of at least one car on at least one level of the VH elevator that can be immediately replaced in the slot after a desired car is placed on a VH elevator position that corresponds to the pick up position.

WO 2008/123985 A1

AUTOMATED PARKING SYSTEM FOR VEHICLES

RELATED APPLICATIONS

This application claims priority from U.S. Provisional Patent Application Serial No. 60/921,406 which was filed on April 2, 2007.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to automated parking systems, and more particularly, to a method and system for decreasing the time associated with retrieving and parking automobiles in an automated parking facility.

2. Description of the Related Art

According to the International Parking Institute in Fredericksburg, Virginia, parking is a $26 billion industry. According to the institute, there are approximately 40,000 parking garages and other facilities with 105 million parking spaces between them. In the article "Park It! NYC 2007 " published in Park It! Guides, Margot J. Tohn describes that there are 1,110 off-street parking garages and lots in Manhattan, New York, with a total of 104,000 parking spaces. However, most motorists complain that this number of parking spaces in Manhattan is insufficient. According to surveys completed by the National Parking Association, a

trade organization based in Washington, the average cost of building a parking spot averages about $14,000 nationally and about $18,000 in the New York area.

There is a proliferation of high-rise condo construction in major urban areas and typically these types of construction have small footprints that do not offer enough room for traditional garages. Urban theorists and policy makers are increasingly studying the effects of parking on traffic, development, pollution and energy efficiency. In addition, developers, urban planners and architects are discussing new ideas/ways to manage automobiles even when the automobiles are stationary, such as via the use of automated garage systems.

One such system is designed by AutoMotion Parking Systems LLC ("AutoMotion"). This system is the latest trend in high-end luxury condos, because of its ability to maximize space, its cutting edge technology, and the convenience to users or drivers. The AutoMotion system integrates laser and computer technology with conventional elevator components to offer a parking solution that eliminates most of the drawbacks of conventional parking and doubles, sometimes tripling the capacity of similarly sized conventional garages. According to AutoMotion, this system requires a driver to perform three steps, i.e., park, swipe and leave, which

are all the driver needs to do when parking a car in an AutoMotion parking lot, after which the automatic parking system takes over.

Apparently, the AutoMotion system provides developers with the benefit of a compact and customizable design, which often allows for the creation of a parking system where a conventional garage would not fit. For example, in one particular parking lot, the developers were able to transform a 100 car capacity parking lot into a 67 car automated parking garage, a 24 unit apartment building, and ground floor retail space because of the compact design of the AutoMotion system. As a result, the developer was able to build a residential building and retail space that required the loss of only 33 parking spaces.

Specific operation of the AutoMotion system is as follows. The driver enters through a traditional overhead garage door, parks the vehicle on a pallet inside an "entry and exit room", swipes his credit card or magnetic key, takes a receipt, and walks away. Sensors scan the entry/exit room and make sure there is no one inside. Lasers analyze the dimensions of the vehicle to determine if it will fit in the system and where to place the car. Once the sensors determine everything is ok to proceed, the pallet with the car upon it, which sits on a lift, lowers or raises the vehicle into the system.

At this point, control of the parking process is managed by the main component of the system, i.e., a storage and retrieval unit ("SRU"). Using a "Quick Exchange" system, the pallet with the car is rolled from the lift onto the SRU and the empty pallet from the SRU replaces the occupied one on the lift. The lift returns to the entry/exit room with an empty pallet and is ready to receive the next vehicle. Meanwhile, the SRU, essentially an elevator on tracks, begins the process of storing the vehicle in one of the spots. When the SRU reaches the spot where the car is being placed the "Quick Exchange" process is repeated and the empty pallet from the rack is replaced with the occupied pallet. The SRU returns, with the empty pallet, back to the lift to accept the next car to park.

When the driver returns to pick up his car, he swipes his credit card or magnetic key again, which reinitiates the retrieval process. The system, using the credit card or magnetic key information to identify the appropriate vehicle (or more accurately the appropriate pallet) begins the retrieval process. The SRU travels back to the spot where the car was stored and the process is reversed.

According to AutoMotion, this process for retrieving an automobile can occur in less than three minutes. The advantages associated with such a system are thus clear.

For the developer, automated parking garages offer cost advantages in construction and operation. By omitting ramps and walkways, about twice as many cars can be tucked into the space. Labor and insurance costs are lower, and getting cars in and out of a parking garage occurs much faster.

Such a conventional method of placing cars on pallets for subsequent lifting into storage spots uses elevators that move both horizontally and vertically, and for then loading the pallet bearing the automobile into a parking slot has a clear problem, i.e., speed of auto delivery. That is, there is room for improvement. Such conventional methods for parking automobiles load cars in a one or two deep arrangement, on either side of a vertical and horizontal (VH) elevator. It is clear that such a system works rapidly or optimally when implemented in a system in which cars are placed in a one-car-deep arrangement. However, when cars are loaded in a two deep arrangement, i.e., one behind the other, and the deeper car must be retrieved, the VH elevator must first pick the pallet that is located closet to the shaft in which the elevator moves, i.e., the VH elevator shaft, remove the pallet to a vacant space located elsewhere in the service quadrant of the elevator and then return to retrieve the deeper pallet to deliver the associated car to the pick up position. This process requires two

cycles to retrieve the desired car. Naturally, it will be appreciated that such a dual cycle process consumes time to retrieve and deliver a car or vehicle. The problem is further compounded for a three-car-deep arrangement, and so on.

SUMMARY OF THE INVENTION

Disclosed is a system and method for providing a multi level, vertical and horizontal (VH) elevator that can move to a pre-designated parking slot or parking space within an automated parking garage and remove at least one car or vehicle that is positioned in front of a desired car or vehicle that is parked behind the at least one car or vehicle. The disclosed system and method uses a multi-level VH elevator that permits the storage of at least one car on at least one level of the VH elevator that can be immediately replaced in the slot after a desired car is placed on a VH elevator position that corresponds to the pick up position.

The powered equipment resides on the VH elevator itself. As a result, modification of existing systems may be performed easily with minimal retrofitting to the remainder of the system. In accordance with the system and method, the pallets can be withdrawn from "slots" or placed into slots by the use of worm gear driving screws attached to pallets or at least one sprocket gear driving

chain that moves or places the pallets into position. Alternatively, conventional hydraulics can move or place the pallets into position. The multi-level VH elevator can have a top "over run" or bottom "pit", depending on local building conditions, zoning height limits, or ground water levels, for example.

The disclosed system and method advantageously permits the achievement of an even greater parking density than currently achieved by the conventional parking systems, i.e., one aisle can be used for the VH elevator so as to cover 6 or more spaces horizontally. Conventional systems are only permitted to cover 4 horizontal spaces. In addition, the system and method permit a reduction of the costs associated with operating an automated parking system. Moreover, the time to retrieve a vehicle is reduced because the cycle time associated with moving and placing cars in the conventional manner is eliminated.

Other objects and features of the present invention will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are designed solely for purposes of illustration and not as a definition of the limits of the invention, for which reference should be made to the appended claims. It should be further understood that

the drawings are not necessarily drawn to scale and that, unless otherwise indicated, they are merely intended to conceptually illustrate the structures and procedures described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other advantages and features of the invention will become more apparent from the detailed description of the preferred embodiments of the invention given below with reference to the accompanying drawings in which:

FIG. 1 is an illustration of cut-away isometric view of an exemplary pallet upon which parked cars are stored and/or moved;

FIG. 2 is an illustration of a gearmotor with pinion for driving the pallet of FIG. 1 though meshing of the pin and teeth of the pallet rack;

FIG. 3 is an illustration of a conventional comb system platform;

FIG. 4 is an illustration of a conventional comb system dolly;

FIG. 5(a) is a schematic block diagram of the extended VH elevator in accordance with the contemplated embodiments;

FIG. 5(b) is an alternative embodiment of the extended VH elevator of FIG. 5(a);

FIG. 6 is an exemplary block diagram of a multilevel, multi-depth automated parking garage in which the method and system of the invention can be implemented; and

FIG. 7 is an exemplary plan view of the multilevel, multi-depth automated parking garage of FIG. 1.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Disclosed is a system and method for providing a multi level, vertical and horizontal (VH) elevator that can move to a pre-designated parking slot or parking space within an automated parking garage and remove at least one car or vehicle that is positioned in front of a desired car or vehicle that is parked behind the at least one car or vehicle. The system and method uses a multi-level VH elevator that permits the storage of at least one car on at least one level of the VH elevator that can be immediately replaced in the slot after a desired car is placed on a VH elevator position that corresponds to the pick up position.

In general, there are four known types of transport systems that are in used for automatically parking vehicles, i.e., (i) separate transport devices for vertical movements ("lifts") and horizontal movement ("shuttles"), (ii) single transport devices that provide both vertical movement and horizontal movement in one

device ("trans-lift"), circular transport devices and (iv) rotary lifts.

Typically, the vehicle pallet is manufactured from a product that is sufficiently strong enough to support an automobile, such as galvanized steel. The vehicle pallet is incorporated into the system to transport the vehicle to and from a specific parking space. In addition, the pallet is dimensioned such that it can accommodate 100 percent of all passenger vehicles, such as 7 feet wide by 19 feet in length.

One example of a vehicle pallet utilized within a parking garage provided with the system and method of the invention is shown in FIG. 1. As shown in FIG. 1, the pallet may include wheels to run in the horizontal rail system of the elevators, entrance and exit portals, and storage stalls. The wheeled bogies of the wheel locations provides for weight acceptance and smooth passage between the extend VH elevator and the storage stalls. The wheel bogies and pallet strengthening bar is under the typical wheel width of the cars that will be parked. The configuration of the pallet in accordance with the contemplated embodiment also includes a toothed rack on the underside that meshes with a drive mechanism, such as gearmotor-driven pinions imbedded within the storage stalls, elevator decks, and entrance and exit portals.

The gearmotor-driven pinion mechanisms are imbedded in the rail system in the manner shown in FIG. 2. Here, the gearmotor drive mechanism is spring mounted because there is no certainty of exact meshing of pinion teeth and rack teeth when a pallet is passed to or from the elevator to a storage stall or entrance or exit portal, or between inboard and outboard storage stalls. If they do not mesh, the receiving gearmotor will be forced down so its pinion teeth, not meshing with the rack teeth, will ride on the tops of the rack teeth. When the delivering pinion loses contact with the last tooth of the rack, the pallet will momentarily stop, at which time the receiving pinion teeth will continue rotating and rise into the rack tooth dedendum (bottom).

Another type of platform is a slotted rack or comb system. Here, the platform is typically raised above the facility surface to accommodate dolly access under the vehicle, as shown in FIG. 3.

A dolly is a motorized device that is typically used in the comb system to transport the vehicle in a horizontal direction. This device operates in conjunction with the vertical elevator and can be utilized to transport the vehicle to and from the specific parking space. The dolly, powered by a device, such as an electric motor, slides under the vehicle and elevates it off the lift with steel arms. The dolly then

transports the vehicle to the specific parking space and sets the vehicle onto a pallet or brackets set in a comb-like formation, as shown, for example, in FIG. 4. It should be understood that the operation of the dolly is separate from the extended VH elevator use in the system and method of the invention and that the dolly can park or retrieve a vehicle while the VH elevator continues to the next park process.

In conventional automatic parking facilities, lifts are incorporated into an automated parking garage to transport vehicles vertically between levels. The lift is typically located adjacent to a transport aisle and has a depth that corresponds to the depth of a parking space.

In general a single lift is an industrial device that is configured to provide a weight capacity of approximately 5750 pounds for the vehicle plus a pallet weight of approximately 1500 pounds and a tested safety factor commonly of four times the normal load as required by American Society of Mechanical Engineers (ASME) code for the machinery. In one configuration, the lift is at a fixed location and does not move horizontally, where the single lift operates independently of all other devices within an Automated Parking Facility for maximum delivery times.

Another configuration of the lift is called a TransLift or stacker crane. Here, such a lift raises the vehicle vertically while simultaneously moving in a horizontal direction. The device is typically mounted on fixed rails and moves in an atrium that is located at the interior of the storage vault of an automated parking facility with one or more rows of parking spaces on each side. In accordance with the system and method of the invention, such a Translift is modified so as to provide the above-described extended VH elevator. Here, the extended elevator is configured to provide a weight capacity of approximately three times 5750 pounds, plus three times a pallet weight of approximately 1500 pounds.

Automated parking garages may also use a shuttle, which is a motorized pallet on wheels in a guide rail used to transport the vehicle horizontally to and from the specific parking space. It is the dolly, however, that moves the vehicle in and out of the specific parking space. Typically, shuttles operate on guide rails in a transport aisle at each level of the vehicle parking space. Upon arrival at the computer designated parking space or at the transfer compartment, the vehicle is transferred by the dolly or other mechanical means onto the shuttle. This device is driven by an electric motor and controlled by a main control device (PCT or PLC). The operation of this device is independent of all other

devices within the system, such as the lift, thus allowing the park/retrieve mode to continue separately.

FIG. 5(a) is a schematic block diagram of the extended VH elevator in accordance with a contemplated embodiment. As shown in FIG. 5(a), the VH elevator (shown essentially in cross-section) is comprised of multiple pallets or dollies **50**, raised or lowered by means of a hoisting or lifting mechanism. This mechanism includes inner lift bracket **52** and outer lift bracket **44** that are essentially identical in cross-section with principal inner bracket **52** and principal outer bracket **56** of each level. Brackets **52** and **54**, however, have widths corresponding to the width of lift-well at their respective locations. Lift brackets **52** and **54** move in guides (not shown) in inner and outer walls **62**, **60** and are raised or lowered by inner cables **56** and outer cables **58**. The necessary lift can be provided by any suitable hoist located above the upper most level of the automated park garage. It should be appreciated that the configuration of the VH elevator shown in FIG. 5(a) is exemplary and that other configurations of the VH elevator may be employed within the scope of the disclosed embodiments of the system and method of the invention.

FIG. 5(a) is shown with three pallets or dollies. However, it should be understood that a pallet or dolly

is placed into position in the extended VH elevator and moved accordingly. Thus, it is possible to load an individual pallet vertically within the extended VH elevator until all of the positions are filled with retrieved cars.

An embodiment of the extended VH elevator of FIG. 5(a) is shown in FIG. 5(b). In the present contemplated embodiment, the pallet or dolly **50** and the bulk of the lifting mechanism is unchanged. However, the lifting mechanism is augmented by a rigid tie in the form of plate **55** joining inner lift bracket **52** and outer lift bracket **54**. This plate **55** is located beneath the pallet or dolly **50** and is of comparable width thereto, and serves to further fix inner lift bracket 52 and outer lift bracket **54** relative to each during raising and lowering of parking platform **50**, particularly when carrying a vehicle. The plate **55** may also be provided with rollers or other comparable mechanisms to facilitate the sliding of each parking platform onto the lifting mechanism, particularly when loaded with a vehicle.

Optionally, the pairs of principal inner and outer brackets **52, 56** may also be provided with such a tie or ties, but as these brackets **52, 56** are not moved during the operation of the extended VH elevator car park this is regarded as less important.

FIG. 6 is an exemplary block diagram of a multilevel, multi-depth automated parking garage in which the method and system of the invention can be implemented. Here, the building is shown with three cars on either side of the VH elevator, and a building that is nine levels high. However, it should be appreciated that different building configurations are possible. In addition, it is also possible for the building to extend downward, i.e., in an underground garage system.

As shown in FIG. 6, a desired car for pickup is shown in a position C. However, the car at position C is obstructed by cars at positions B and A. In accordance with the system and method of the invention, the car at position A is placed on a pallet and moved to position A' and raised on the VH elevator. Next, the car at position B is placed on another pallet and raised to position B' on the VH elevator. Finally, the system retrieves the desired car at position C for delivery to the driver associated with this car.

With respect to the cars at position A' and B', these cars are replaced into positions CB' and BA' such that the parking slot A is now empty. This occurs at the same time that the pallet with the car being delivered to the driver is in motion.

It should be noted that the building may also require a modification to the roof area to accommodate

the extended VH elevator of the system and method of the invention, because when cars are retrieved from the top level of the building the VH elevator could require the additional "headroom" created by the building modification. In much the same way, a modification to the lower level may also be required to accommodate the extended VH elevator when retrieving cars on the lower level of the automatic parking garage.

As shown in FIG. 7, a desired car for pickup is indicated by a position C. However, the car at position C is obstructed by cars indicated at positions B and A. In accordance with the system and method of the invention, the car at position A is placed on a pallet and moved to position A' (not shown) and raised on the VH elevator. Next, the car indicated by position B is placed on another pallet and raised to position B' (not shown) on the VH elevator. Finally, the system retrieves the desired car at position C for delivery to the driver associated with this car.

With respect to the cars at position A' and B', these cars are replaced into positions CB' and BA' (see FIG. 1) such that the parking slot A is now empty. As stated previously, this occurs at the same time that the pallet with the car being delivered to the driver is in motion.

The powered equipment for operation of the extended VH elevator resides on the elevator itself. As a result, modification of existing systems may be performed easily with minimal retrofitting to the remainder of the system. In accordance with the system and method, the pallets can be withdrawn from "slots" or placed into slots by the use of worm gear driving screws attached to pallets or at least one sprocket gear driving chain that moves or places the pallets into position. Alternatively, conventional hydraulics can move or place the pallets into position. The multi-level VH elevator can have a top "over run" or bottom "pit", depending on local building conditions, zoning height limits, or ground water levels, for example.

The system and method advantageously permit the achievement of an even greater parking density than currently achieved by the conventional parking systems, i.e., one aisle can be used for the VH elevator so as to cover 6 or more spaces horizontally. Conventional systems are only permitted to cover 4 horizontal spaces.

The system and method permit a reduction of the costs associated with operating an automated parking system. In addition, the time to retrieve a vehicle is reduced because the cycle time associated with moving and placing cars in the conventional manner is eliminated.

It is also contemplated that the system and method may utilize information technology to make parking easier and more efficient. For example, the system permits a driver to retrieve a car by various communication methods, such as by mobile phone or the Internet. Here, the driver would contact the parking garage prior to arriving at the parking garage so that the car would be retrieved and thus waiting upon the drivers arrival for pick-up. As a result, the time associated with a driver waiting for delivery of their car is eliminated.

Moreover, it is also possible to provide information upon car drop off, such as the specific information as to a precise pick up time, so that the car will be returned to the driver without waiting when the driver arrives to pick up the car.

The control system of the automated automobile parking garage is not specifically described herein, because such a control system is an assembly of available and conventional micro-processor sub-systems. When a car is parked on a pallet, it must be parked correctly so no part of the car will be damaged as the vehicle is moved into and out of storage. Electric-eye controllers are available that will inform the driver that he/she has improperly parked the car, and prevent mechanism operation until the vehicle is properly parked. When the driver signals his/her safe retreat from the car on the

pallet, sequence controllers will make the pallet move onto and off the elevator, move the extended VH elevator to the proper level, and start and stop the gearmotor drivers to put the pallet into and out of storage. Parking control hardware and software is similarly available to keep track of where the vehicle is stored, and develop the charge and payment acceptance details in returning a vehicle to its driver. Such features are described, for example, in D. Monahan, "Guide to the Design & Operation of Automated Parking Facilities", Automated & Mechanical Parking Association and the Parking Consultants Council of the National Parking Association, February 27, 2003.

Thus, while there are shown, described and pointed out fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the invention. Moreover, it should be recognized that structures shown and/or described in connection with any disclosed form or embodiment of the invention may be incorporated in any other disclosed or described or suggested form or embodiment as a general matter of design choice.

CLAIMS

What is claimed is:

1. A system for decreasing times associated with retrieving and parking automobiles; comprising:

a multi-level vertical and horizontal (VH) elevator, said VH elevator being configured to permit storage of a plurality of cars on a plurality of levels of said VH elevator and being configured to replace each of said plural cars in a parking slot after a desired car is placed on the VH elevator in a position that corresponds to the pick up position; and

an automated parking garage configured to permit extension of the VH elevator beyond the plurality of levels corresponding to said plural levels of the VH elevator.

2. The system of claim 1, wherein a plurality of parking slots are arranged on both sides of the VH elevator at multiple levels of the automated parking garage.

3. The system of claim 1, wherein a roof area of the automated parking garage is configured to accommodate the extended VH elevator.

4. The system of claim 3, wherein the roof area of the automated parking garage permits retrieval of cars located at an upper level of the automated parking garage.

5. The system of claim 1, wherein a lower level of the automated parking garage is configured to accommodate the extended VH elevator.

6. The system of claim 5, wherein the lower level of the automated parking garage permits retrieval of cars located at the lower level of the automated parking garage.

7. The system of claim 1, wherein the extended VH elevator is configured to position a car at a first position on a pallet and raise the car to a corresponding first position on the extended VH elevator.

8. The system of claim 7, wherein the extended VH elevator is configured to position a second car at a second position on a second pallet and move the second car to a second corresponding position on the VH elevator, and wherein the system retrieves the desired car from the parking slot for delivery to the driver associated with the desired car.

9. A method for decreasing times associated with retrieving and parking automobiles in an automated parking garage; comprising:

moving a first car in a first parking slot onto a first pallet and moving the first pallet with the first car into a first corresponding position on an extended vertical and horizontal (VH) elevator;

moving a second car in a second adjacent parking slot onto a second pallet and moving the second pallet with the second car into a second corresponding position on the extended VH elevator;

retrieving a desired car from an obstructed parking slot in the automated parking garage; and

delivering the desired car from the obstructed parking slot in the automated parking garage to a driver associated with the desired car.

10. The system of claim 9, wherein a plurality of parking slots are arranged on both sides of the VH elevator at multiple levels of the automated parking garage.

11. The system of claim 9, wherein a roof area of the automated parking garage is configured to accommodate the extended VH elevator.

12. The system of claim 11, wherein the roof area of the automated parking garage permits retrieval of cars located at an upper level of the automated parking facility.

13. The system of claim 9, wherein a lower level of the automated parking garage is configured to accommodate the extended VH elevator.

14. The system of claim 13, wherein the lower level of the automated parking garage permits retrieval of cars located at the lower level of the automated parking garage.

15. The method of claim 9, further comprising:

moving the first car on the first pallet from the extended VH elevator to the parking slot of the delivered desired car; and

moving the second car on the second pallet from the extended VH elevator to obstruct the first car which has been moved into the parking slot of the delivered desired car.

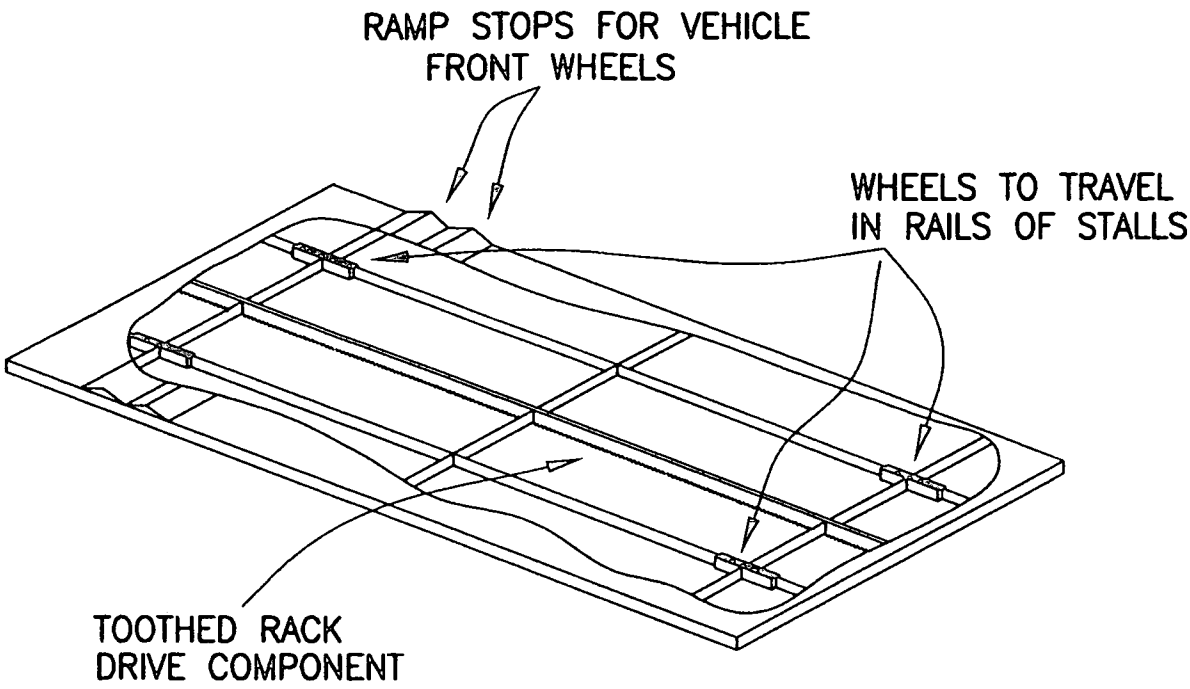

RAMP STOPS FOR VEHICLE
FRONT WHEELS
WHEELS TO TRAVEL
IN RAILS OF STALLS
TOOTHED RACK
DRIVE COMPONENT

FIG.1

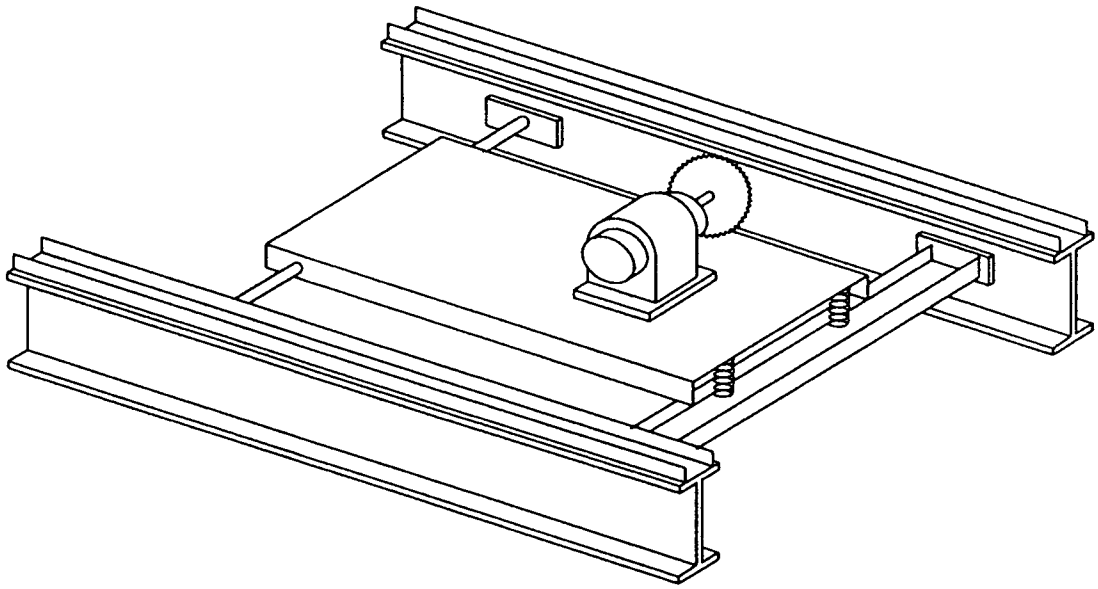
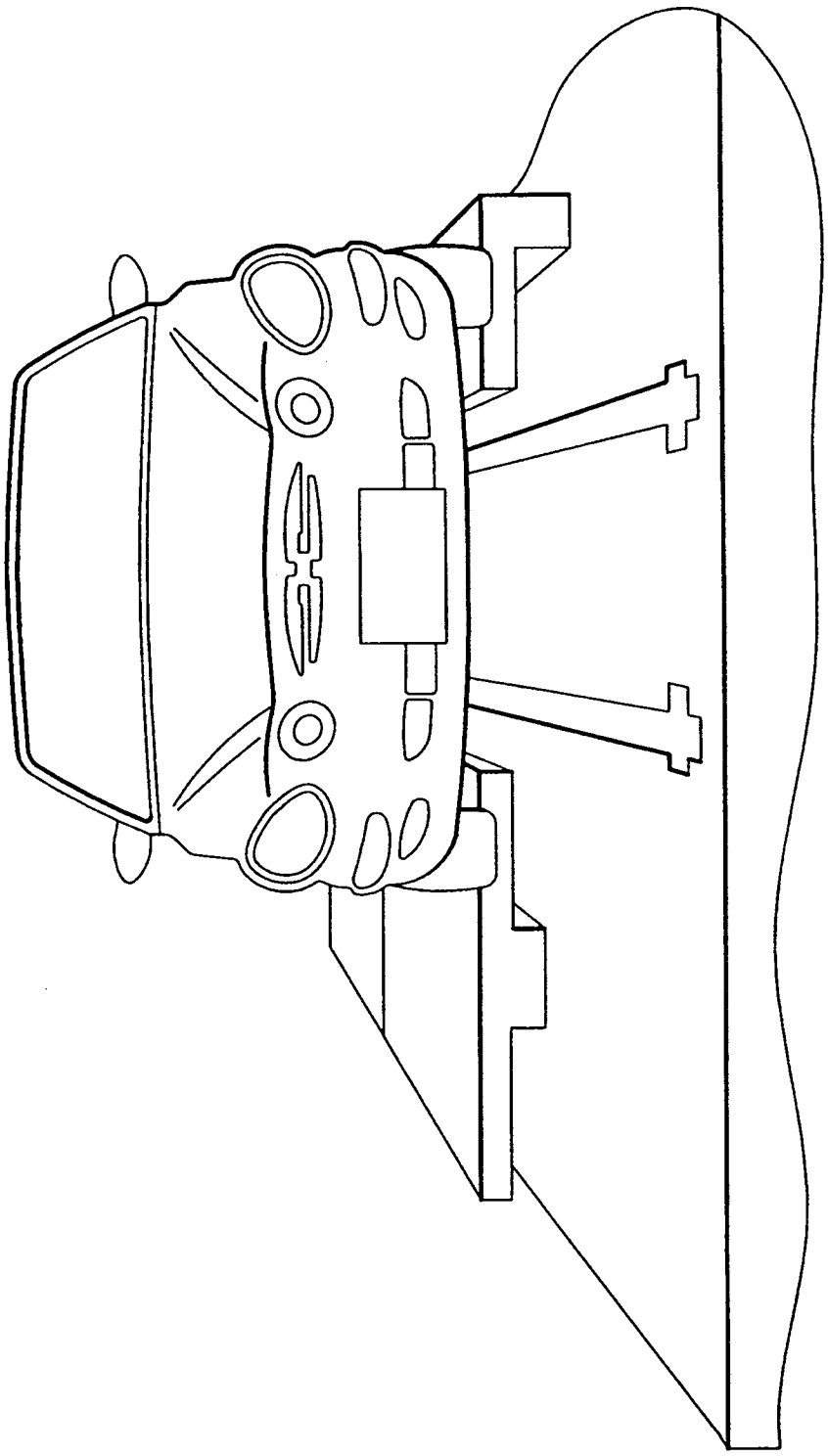


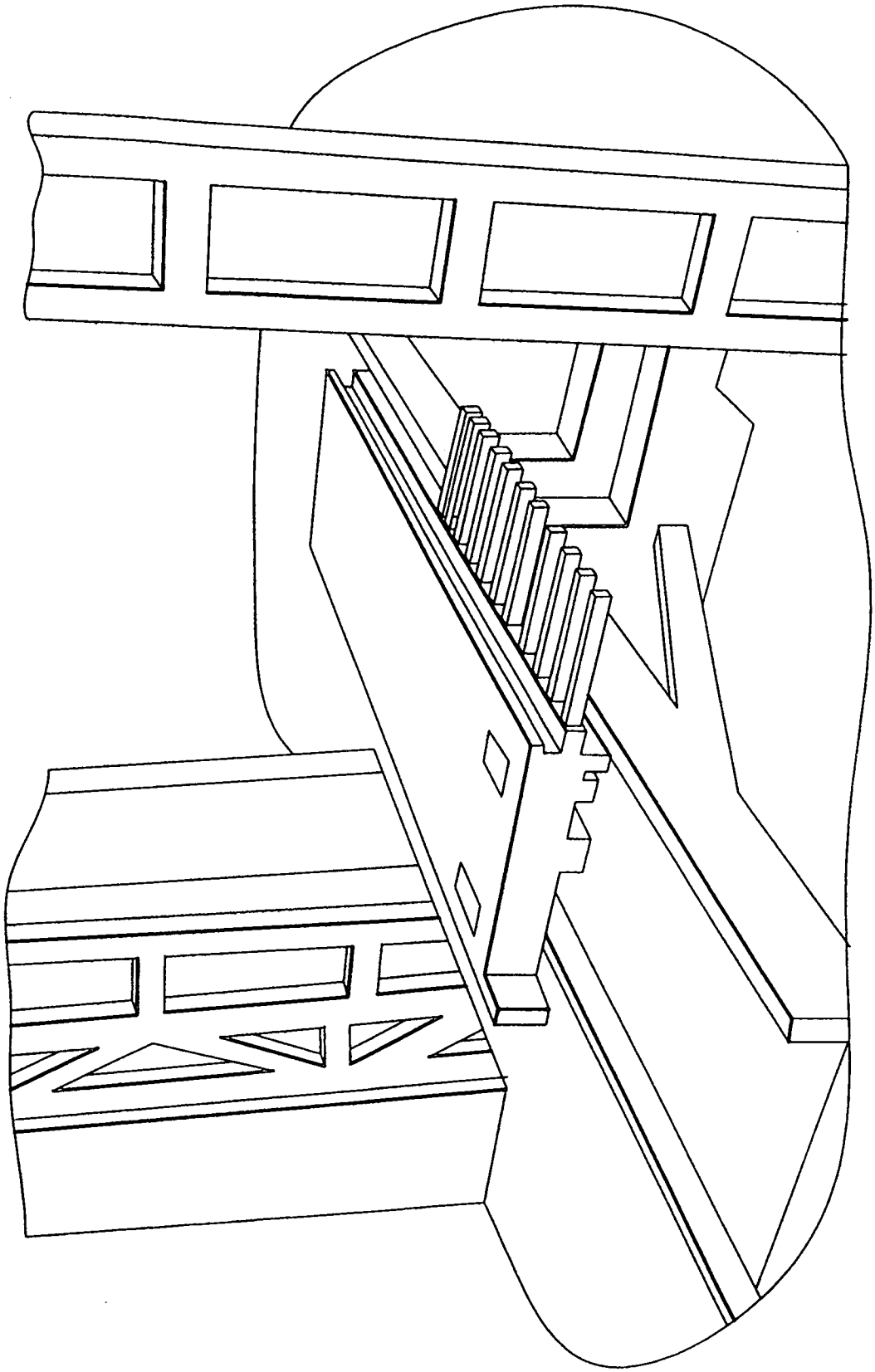
FIG.2



COMB SYSTEM PLATFORMS

FIG.3

PRIOR ART



COMB SYSTEM DOLLY

FIG.4
PRIOR ART

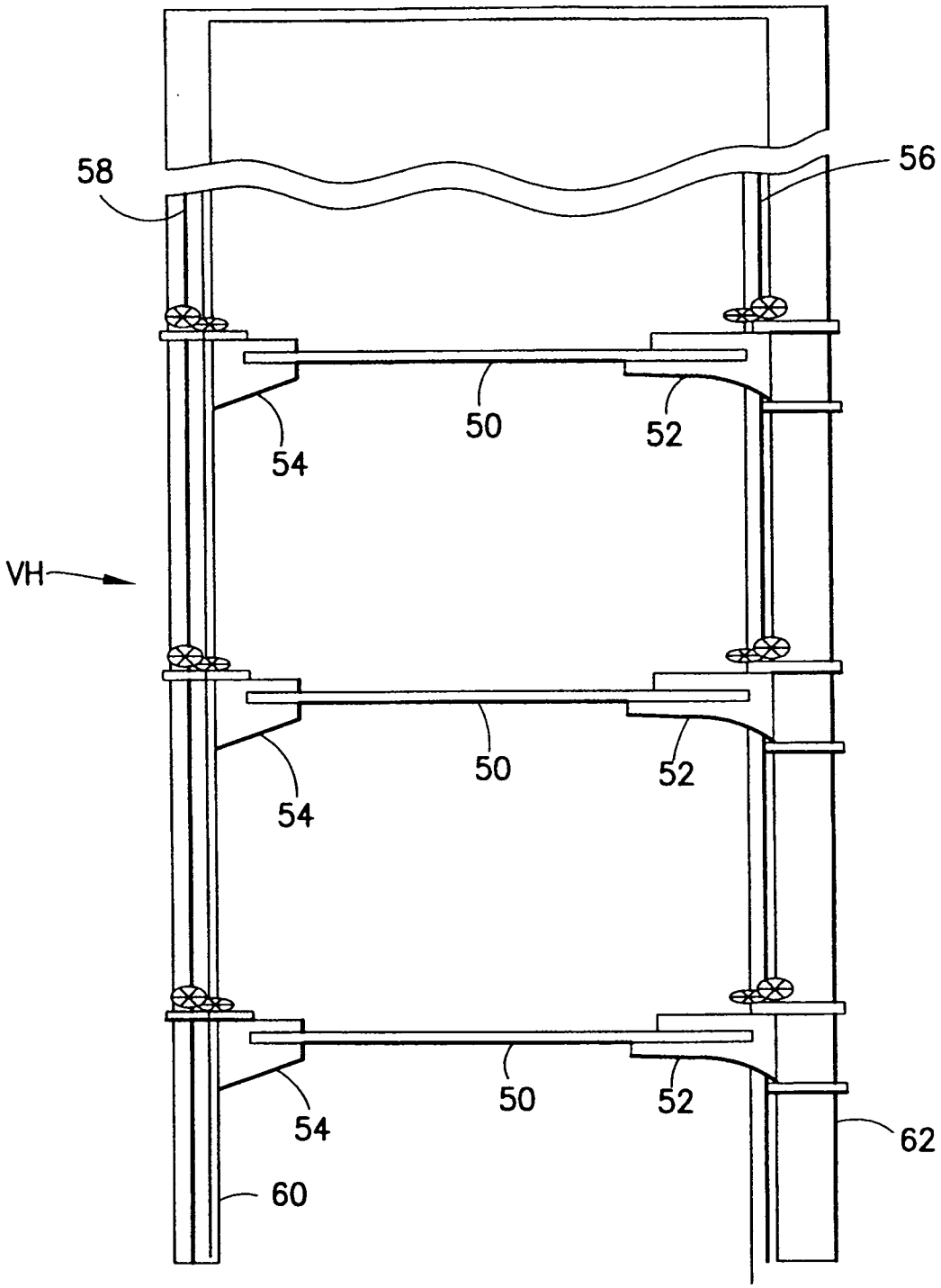


FIG.5a

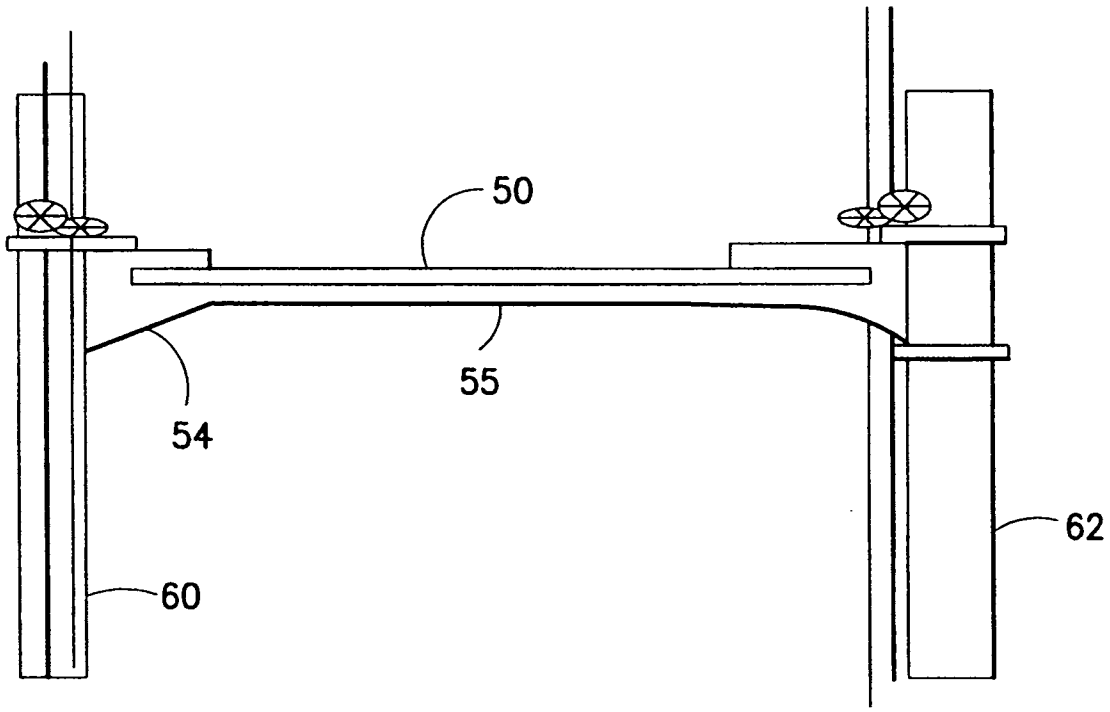


FIG.5b

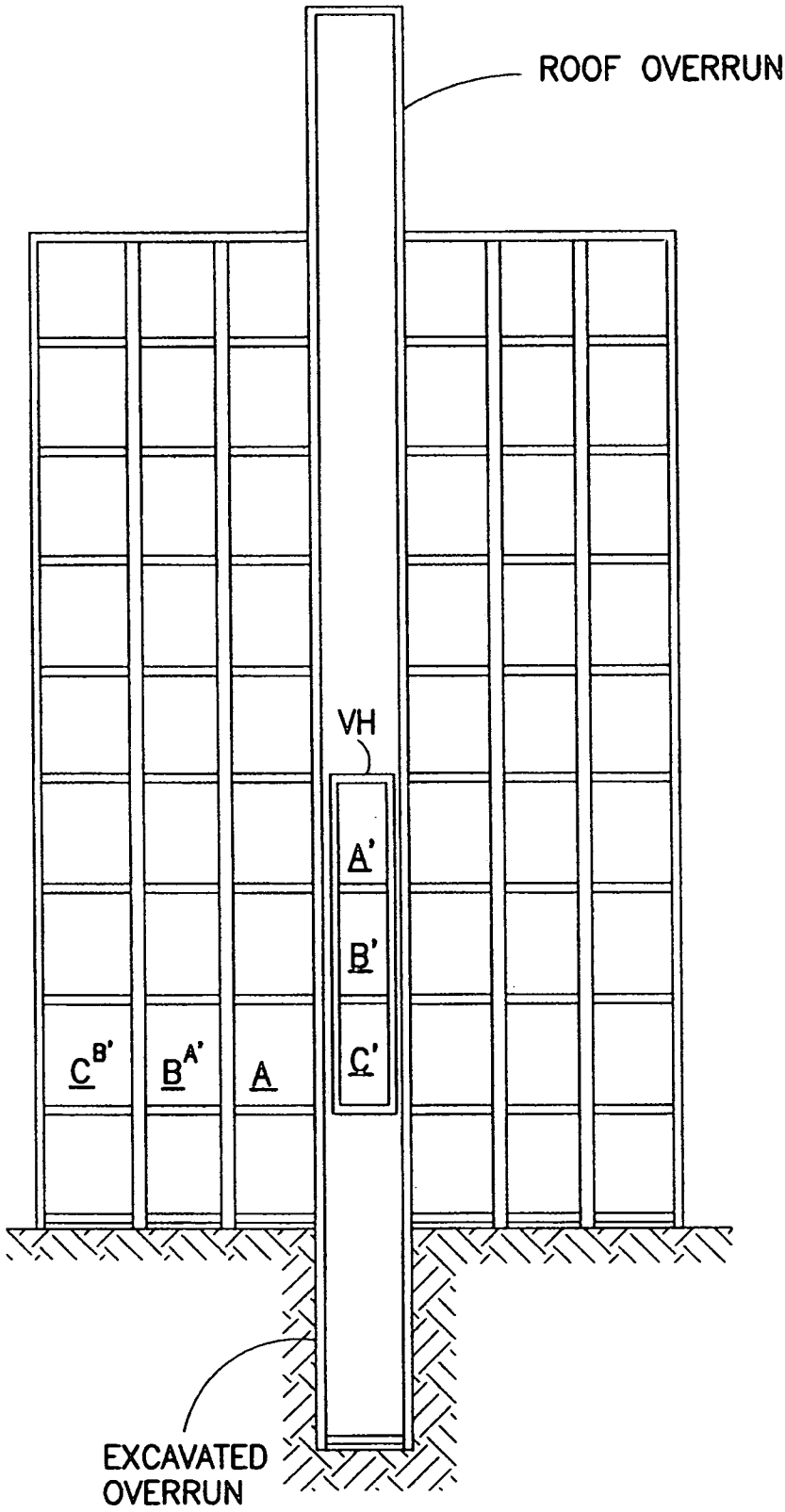


FIG.6

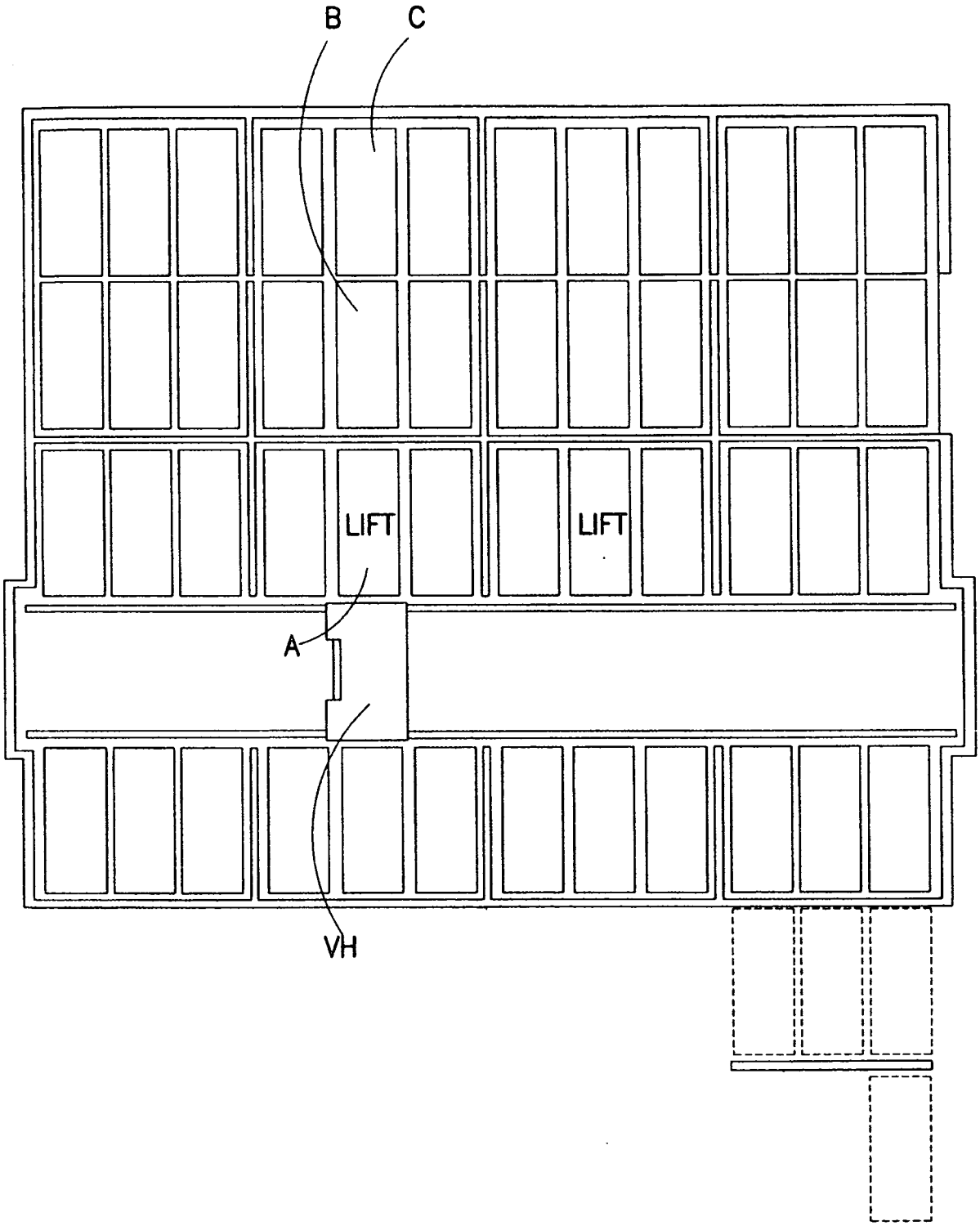


FIG.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/04260

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E04H 6/18 (2008.04)
USPC - 414/260
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(8) - E04H 6/18 (2008.04)
USPC - 414/260

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 414/227, 253, 260 - search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO-WEST, Google. search terms:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2005/0074314 A1 (Hart) 7 April 2005 (07.04.2005) abstract, para [0013]-[0015]	9 --- 7, 8, 10-15
Y	US 4,986,714 A (Fernston) 22 January 1991 (22.01.1991) abstract; fig 6-10	1-8, 10-15
Y	US 5,000,642 A (Matoba) 19 March 1991 (19.03.1991) col 9 ln 56 to col 10 ln 7	1-8, 11-15
A	High Density Metro Parking by NARPAC, 14 March 2007 (14.03.2007); http://web.archive.org/web/20070314210308/http://www.narpac.org/METROPRK.HTM. Downloaded from internet 16 March 2008 (16.03.2008) entire document	1-15

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 June 2008 (16.06.2008)	27 JUN 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)