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(54) **Parking facility**

(57) Parking facility for storing a plurality of standardized cars comprising an entrance (2), an exit (3) and means for moving cars from the entrance to the exit, the entrance and the exit being arranged above ground level and each comprising an elevator (21,31), wherein the parking facility further comprises an underground tunnel (5) connecting the entrance elevator with the exit elevator, wherein the tunnel is configured such that cars can move only along a single lane from the entrance to the exit.

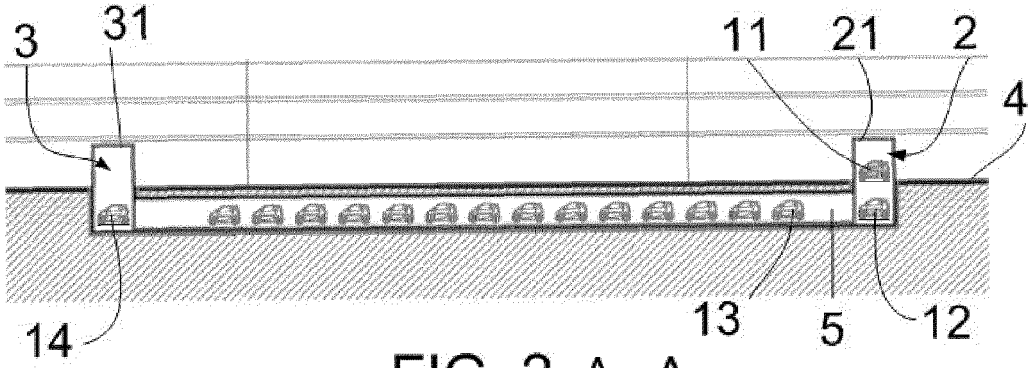

FIG. 2 A - A

EP 2 602 404 A1

Description

[0001] The present invention relates to parking facilities and more particularly is related to parking facilities for storing a plurality of standardized cars.

BACKGROUND ART

[0002] Cities around the world have been experiencing growing difficulties related to individual transportation systems, especially cars. Traffic jams and air pollution are well known phenomena in many cities. Additionally, for citizens using their cars it is becoming increasingly difficult to park their cars close to their destination. On-street parking space is being reduced in the more densely populated urban areas to leave additional room for pedestrians and cyclists, to create bus lanes or to devote it to other public uses. Scarce off-street parking is thus becoming increasingly expensive.

[0003] In order to cope with some of the car-generated problems, cities are actively supporting mass-transportation systems and alternative modes of transportation such as cycling. Nevertheless, such options cannot provide an effective service to everyone and car use is still quite generalized and will not disappear in the near future. Some of the car-generated problems may diminish with an increased use of hybrid and, especially, electric vehicles, a trend that seems unstoppable. However, even though electric cars may reduce air pollution in cities, its use cannot avoid other problems related to massive car use.

[0004] Some cities are also taking other complementary steps in order to reduce the fleet of cars circulating daily including various regulatory strategies to limit car circulation at a particular time and/or place. For example, some cities restrict the access of particular cars into an urban district based upon the last digits of the license number on pre-established days, or certain periods, normally the peak hours. Other cities have developed a cordon road pricing, where some categories of motor vehicles must pay to drive at certain hours within the most congested areas.

[0005] Another trend starting to be observed in cities around the world is "car sharing". Car sharing is a form of car rental where people rent cars for short periods of time, e.g. for an hour or a few hours. Car sharing may be particularly attractive to drivers who make only occasional use of a car. The extensive use of car sharing may substantially reduce the total number of cars occupying space in a city. If the car sharing fleets were electric, city air quality may further be improved. However, this cannot in itself solve the problems related to the parking of cars.

[0006] Document US2003/0014302 describes an urban transportation system which comprises a pool of rental urban vehicles all having the same size and physical configuration. The system further comprises a computer-controlled mechanized facility for delivering, receiving, processing, servicing and storing the vehicles.

[0007] Document EP 2159349 describes a parking facility in spiral form for electric vehicles. However, these systems are relatively expensive, and appear unsuitable for densely built urban areas.

[0008] There still exists a need to develop a parking facility for a pool of standardized vehicles which at least reduces some of the aforementioned problems.

SUMMARY OF THE INVENTION

[0009] In a first aspect, a parking facility for storing a plurality of standardized cars is provided. The parking facility comprises an entrance, an exit and means for moving cars from the entrance to the exit, the entrance and the exit being arranged above ground level and each comprising an elevator. The parking facility further comprises an underground tunnel connecting the entrance elevator with the exit elevator. The tunnel may be configured such that cars can move only along a single lane from the entrance to the exit.

[0010] All throughout the present description and claims, the term *standardized* applied to a plurality of cars should be interpreted as a fleet of cars having substantially the same perimeter dimensions in cross section.

[0011] According to this aspect, the parking facility comprises an underground tunnel in which the cars can move only along a single lane. Inside the tunnel, the cars follow a well-defined path in order to find their way out. It is thus substantially simple to operate. Furthermore, the tunnel may be substantially shallow and narrow as it only requires space to accommodate the cars of substantially the same size and occasionally personnel from the operator company. This way, the parking facility provided may be substantially compact. Even though the present invention especially concerns a parking facility for storing a plurality of standardized electric cars, embodiments of the present invention may also be suitable for hybrid or non-electric cars.

[0012] In some embodiments, the tunnel may be configured such that the single lane forms a straight line. A tunnel along a straight line may be simpler to build and operate.

[0013] In some implementations, the tunnel may be arranged in an unused underground area underneath a street. Due to its compact and simple structure, the tunnel may easily be fitted underground alongside e.g. the sidewalk. In some implementations, at street level, above the location of the parking for standardized cars, an on-street parking area may be arranged. Furthermore such a location is particularly useful for arranging the entrance and exit elevators in such a way that they do not disturb traffic. In other cases, the space alongside the sidewalk, above the location of the parking for standardized cars, may be used to expand sidewalks, for bicycle paths or for urban furniture instead of on-street parking. An aspect of these implementations is that the entrance and exit elevators may be easily integrated in the street while, at the same time, the space available at street level is sub-

stantially not reduced.

[0014] As such, a parking space may be created effectively in a space of the public domain that was previously unused.

[0015] Optionally, the tunnel may be arranged between utility pipes underneath a sidewalk and a general collector arranged underneath the street. In many urban areas, most utilities are placed either under the sidewalk or in the middle of the street. Water supply pipes, electrical cables, telecommunication cables, gas and other utility pipes generally have a well-defined location under the sidewalks, where they are more accessible. This way, parking facilities according to the present invention may be arranged in those unused underground areas, in which no pipes, wires or collectors are placed, taking advantage of their compact design.

[0016] In some embodiments, the means for moving cars from the entrance to the exit may comprise a remote activation mechanism adapted to actuate the standardized cars. Such a system may be located in a remote central office from which it may start the cars' engine and move them forward inside the tunnel and towards the exit. This may be useful for moving a car that has just entered the parking up to its position behind the last car, but may also be useful for moving each car individually so that a mechanical conveyor system may be dispensed with. On the other hand, the cars inside the tunnel may be advanced to get the next car to be used inside the exit elevator.

[0017] In other embodiments, the means for moving cars from the entrance to the exit may comprise a conveyor system arranged inside the tunnel. Such a conveyor system may be adapted to move the cars along the tunnel. In some of these embodiments, the conveyor system may be adapted to move each car separately. In some cases, the conveyor system may further be adapted to move the standardized cars substantially simultaneously. This way, when a car enters the tunnel it can be moved along the tunnel by the conveyor system up to e.g. the car that has been previously stored in the tunnel. Different kinds of conveyor systems are generally known in the art and may be implemented in embodiments of the present invention without difficulty. Such conveyor systems may be controlled locally or remotely.

[0018] Optionally, such a conveyor system may further comprise traction means for moving the standardized cars from the elevators to the tunnel and vice-versa. Alternatively, the elevators may comprise a surface that may be inclined such that cars can roll on or off.

[0019] In some embodiments, the tunnel may comprise inductive charging means at predefined locations along its length. In implementations configured for use with electric cars, inductive charging may take place during a car's stay in the parking. As the cars are standardized and its position along the tunnel can be precisely controlled, inductive means (e.g. windings) provided in the cars may be lined up accurately with inductive charging means provided at one or more locations along the length of the tunnel. Furthermore, the strong electromagnetic fields that may be induced for charging are provided below ground, such that there are no health risks. In other embodiments, the tunnel may comprise one or more plugs arranged at predefined positions along its length, such that standardized electric cars comprising corresponding sockets may be charged.

[0020] In some embodiments, the tunnel may further comprise a prolongation extending in front of the entrance elevator or past the exit elevator. This way, there is an underground space in which one or more cars may be left e.g. for maintenance.

[0021] Another aspect provides a parking network comprising a plurality of parking facilities substantially as hereinbefore described.

[0022] Additional objects, advantages and features of embodiments of the invention will become apparent to those skilled in the art upon examination of the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Particular embodiments of the present invention will be described in the following by way of non-limiting examples, with reference to the appended drawings, in which:

Figure 1a shows a schematic top view of a parking facility according to a first embodiment;

Figure 1b shows a detail of the view of figure 1a;

Figure 2 shows a longitudinal section of the parking facility of figure 1;

Figure 3 shows a cross-sectional view of the parking facility of figure 1; and

Figure 4 shows a top view of an area in a city provided with a parking facility according to an embodiment;

Figure 5 shows a longitudinal section of the parking facility according to a second embodiment;

Figures 6a and 6b show perspective views of the parking facility according to an embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Figure 1a shows a top view of a parking facility for storing a plurality of standardized cars 1 according to a first embodiment. These standardized cars may belong to a fleet of a car sharing program. Figure 1a further shows an example of a location of such a parking facility: underneath a street 6, along the length of a housing block 71.

[0025] Figure 1b shows a detail of figure 1a wherein the sidewalk 7 (see figure 1a) has been left out in order

to show at least some of the utilities that may be placed underneath the sidewalk 7. Such utilities may be for example: low-voltage electricity lines 72, telephone and telecommunication wires 73, medium-voltage electricity lines 74, pneumatic waste collection pipes 75, gas pipes 76, water pipes 77, waste water collection 78 and street lighting and traffic lights 79. Figure 1b further shows a general collector 10 arranged underneath the street 6.

[0026] Figure 2 shows a longitudinal section along line A-A of figure 1a. The parking facility may comprise an entrance 2 and an exit 3 which may be arranged above ground (reference sign 4 shows the ground level line). The entrance 2 and the exit 3 may each comprise an elevator 21, 31. The parking facility may further comprise an underground tunnel 5 connecting the entrance elevator 21 with the exit elevator 31. The tunnel 5 may be configured as a single straight line connecting the elevators 21, 31. A car 11 may thus be driven by a user towards and into the entrance elevator 21 arranged above ground. The user can then leave the car. The entrance elevator 21 may lower the car 12 underground where it can be moved, either through remote activation of the car itself or by means of a conveyor system, towards the car 13 that was last stored. When a new user arrives and requests a car, the car 14 may be moved towards the exit elevator 21. The exit elevator 21 may raise the car and the user can pick up the car from the exit elevator at ground level. In some cases the elevators may be in the form of a platform that raises or lowers the cars respectively.

[0027] Web-linked and on board communication systems may provide the user with on-line information about the state of the parking facility. In some cases, the parking facility may be compatible with smartphones and intelligent transport systems to facilitate information to users.

[0028] Also, the parking entrance and exit may further be provided with external panels informing the users about the availability at the parking facility.

[0029] Figure 3 shows a cross-sectional view along line B-B of figure 1a. As mentioned above, utilities 72 - 79 may be arranged underneath sidewalks 7. Sewers 9 may also run alongside the façades connecting to the main collectors 10 in specific places, often in the crossroads 80 (see figure 4). In such cases, they do not interfere with a parking facility substantially as hereinbefore described. In addition, sewers 9 may usually be arranged at ground level on the streets 6 next to the sidewalks 7. The pipes of such sewers 9 may run towards a general collector 10 that may be arranged underneath the street 6. Depending on specific local circumstances, the construction of the tunnel 5 may require some adaptations in the existing connections between sewers 9 and main collectors 10. In general, the area of the street 6 close to the sidewalk may be practically unused and thus suitable for the construction of a parking facility as shown in figure 3. This is particularly true for relatively wide streets. On the contrary, at street level there may be substantially no visible modifications after the construction of a parking facility substantially as hereinbefore described.

[0030] In the embodiment shown in figure 3, the tunnel 5 of the parking facility may be arranged between an underground area underneath the sidewalk 7 and the general collector 10. Due to its compactness, the tunnel 5 may fit in the indicated small unused areas.

[0031] It will be clear however, that parking facilities substantially as hereinbefore described may also be arranged in other suitable locations, such as for e.g. underneath parks, or squares.

[0032] Figure 4 shows a top view of the same embodiment. According to figure 4, between the entrance 2 and the exit 3 arranged above ground, there may be an on-street zone, which may normally be used as an on-street parking 61. The entrance and exit elevators may thus be well integrated in the street. Said on-street parking zone 61 may e.g. comprise a charging station for electric or hybrid cars, taking advantage of the fact that such charging facilities may already exist in the tunnel 5.

[0033] Figure 5 shows a longitudinal section of a parking facility for storing a plurality of standardized cars 1' according to a second embodiment wherein the tunnel 5' may comprise a prolongation 51 extending past the exit elevator 31'. In other alternatives such a prolongation may extend into a space arranged before the entrance elevator 31'. This way one or more cars 1" may be left in such a prolongation 51 e.g. for maintenance. In order to move the cars to the prolongation, the exit elevator or the entrance elevator may comprise a door which may be remotely opened. Alternatively, the elevators may be in the form of a simple platform raising and lowering the cars. Furthermore the cars may be moved either by means of a further conveyor/traction means arrangement or by means of a remote activation mechanism substantially as explained above.

[0034] In some of these embodiments comprising a prolongation, it may further be possible to park one or more cars which may not belong to the fleet of a car sharing program in a parking facility substantially as hereinbefore described. These cars may have substantially similar dimensions as the standardized cars of the fleet of the car sharing program in order to fit in the elevators and to be moved by e.g. a conveyor system arranged inside the tunnel for moving the cars from the entrance to the exit.

[0035] This way, when a car not belonging to the fleet of the car sharing program is the last car awaiting in line and a customer requests a standardized car of the car sharing program before the owner of such a car not belonging to the fleet of the car sharing program arrives, then the car not belonging to the fleet of the car sharing program may be left in the prolongation in order to leave space for the next standardized car of the car sharing program.

[0036] Figures 6a and 6b each show a perspective view of the parking facility according to an implementation. Figure 6a is a perspective view from the top, whereas figure 6b provides a lateral view. In both cases, the

sidewalk 7 is shown separated a distance d from the on-street parking area 61 so as to see inside the tunnel 5. Inside the tunnel 5, some standardized cars 1 may be parked. Simultaneously, some cars 62, 63 may be parked at the on-street parking area 61. Figure 6a and 6b clearly show that a parking facility substantially as hereinbefore described may be rather compact and may fit in a rather small area. In addition, such a parking facility does not substantially reduce already existing on-street parking areas. Only the space used for the entrance and exit elevators is needed. Furthermore, such a parking facility does not substantially interfere with normal traffic circulating on the street or with pedestrians walking on the sidewalks.

[0037] According to different embodiments, cars may be moved from the entrance to the exit using different means, for example a conveyor system. In some cases, the cars, particularly electric cars, may be adapted to be controlled by a remote activation mechanism, e.g. an operator or a computer in a central office.

[0038] In general, a conveyor system may be provided capable of moving the cars only in one direction, but in accordance with circumstances necessary it may be configured for a two-way operation.

[0039] Although only a number of particular embodiments and examples of the invention have been disclosed herein, it will be understood by those skilled in the art that other alternative embodiments and/or uses of the invention and obvious modifications and equivalents thereof are possible. Furthermore, the present invention covers all possible combinations of the particular embodiments described. Thus, the scope of the present invention should not be limited by particular embodiments, but should be determined only by a fair reading of the claims that follow.

Claims

1. Parking facility for storing a plurality of standardized cars comprising an entrance, an exit and means for moving cars from the entrance to the exit, the entrance and the exit being arranged above ground level and each comprising an elevator, wherein the parking facility further comprises an underground tunnel connecting the entrance elevator with the exit elevator, wherein the tunnel is configured such that cars can move only along a single lane from the entrance to the exit.

2. Parking facility according to claim 1, wherein the tunnel is configured such that the single lane forms a substantially straight line.

3. Parking facility according to any of claims 1 or 2, wherein the tunnel is arranged in an unused underground area underneath a street.

4. Parking facility according to any of claims 1 - 3, wherein the tunnel is arranged between utility pipes underneath a sidewalk and a general collector arranged underneath the street.

5. Parking facility according to any of claims 1 - 4, wherein the tunnel is arranged underneath a parking zone at street level.

6. Parking facility according to any of claims 1 - 5, wherein the means for moving cars from the entrance to the exit comprise a remote activation mechanism adapted to actuate the standardized cars.

7. Parking facility according to any of claims 1 - 6, wherein the means for moving cars from the entrance to the exit comprise a conveyor system arranged inside the tunnel and adapted to move the standardized cars along the tunnel.

8. Parking facility according to claim 7, wherein the conveyor system is adapted to move each standardized car separately.

9. Parking facility according to claim 8, wherein the conveyor system is further adapted to move the standardized cars substantially simultaneously.

10. Parking facility according to any of claims 7 - 9, wherein the conveyor system further comprises traction means for moving the standardized cars from the elevators to the tunnel and vice-versa.

11. Parking facility according to any of claims 7 - 10, wherein the conveyor system is further adapted to move the standardized cars only in one way.

12. Parking facility according to any of claims 1 - 11, wherein the tunnel comprises inductive charging means at predefined locations along its length.

13. Parking facility according to any of claims 1 - 11, wherein the tunnel comprises one or more plugs or sockets arranged at a predefined position along its length, and wherein the standardized cars comprise the other of the plug or socket.

14. Parking facility according to any of claims 1 - 13, wherein the tunnel further comprises a prolongation extending in front of the entrance elevator or past the exit elevator.

15. Parking network comprising one or more parking facilities according to any of claims 1 - 14.

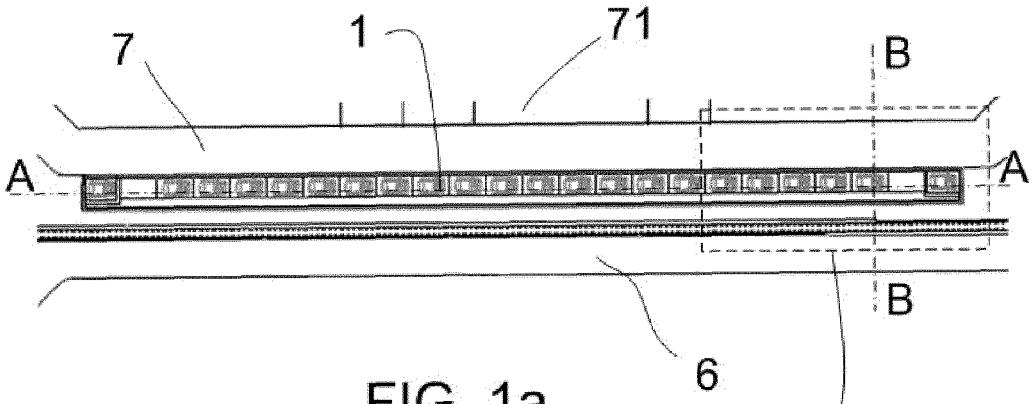

FIG. 1a

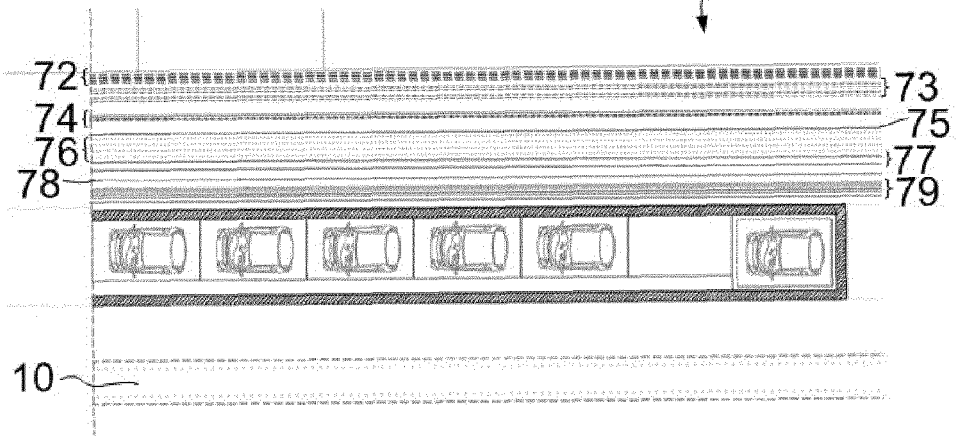

FIG. 1b

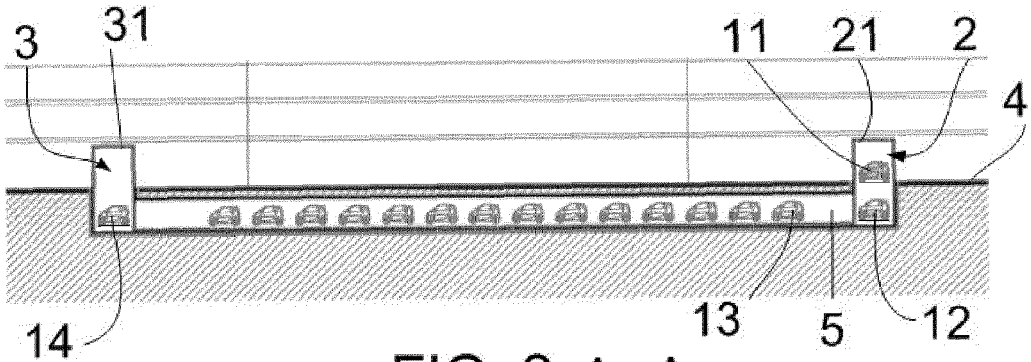

FIG. 2 A - A

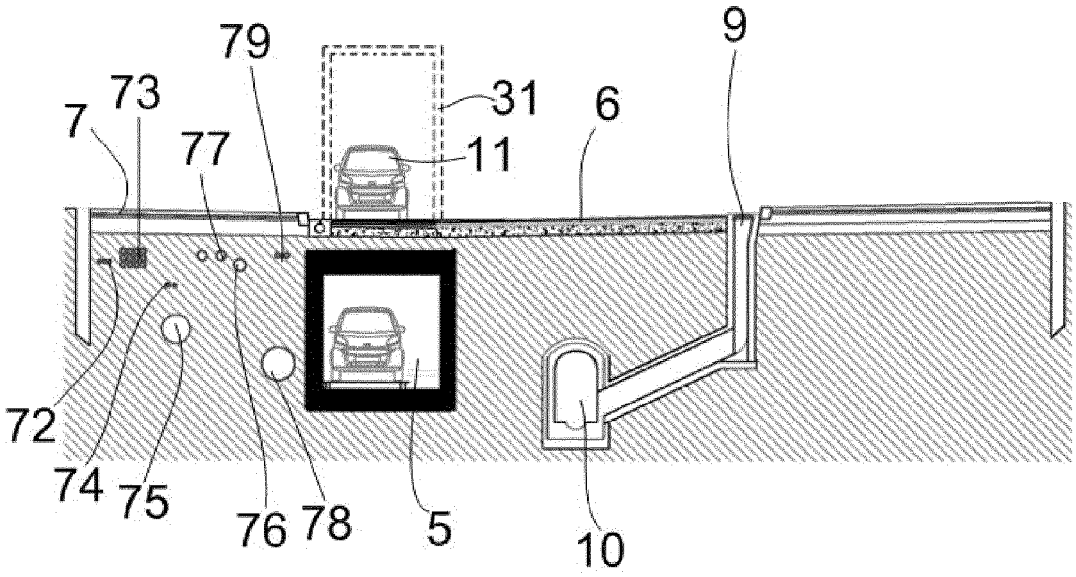

FIG. 3 B-B

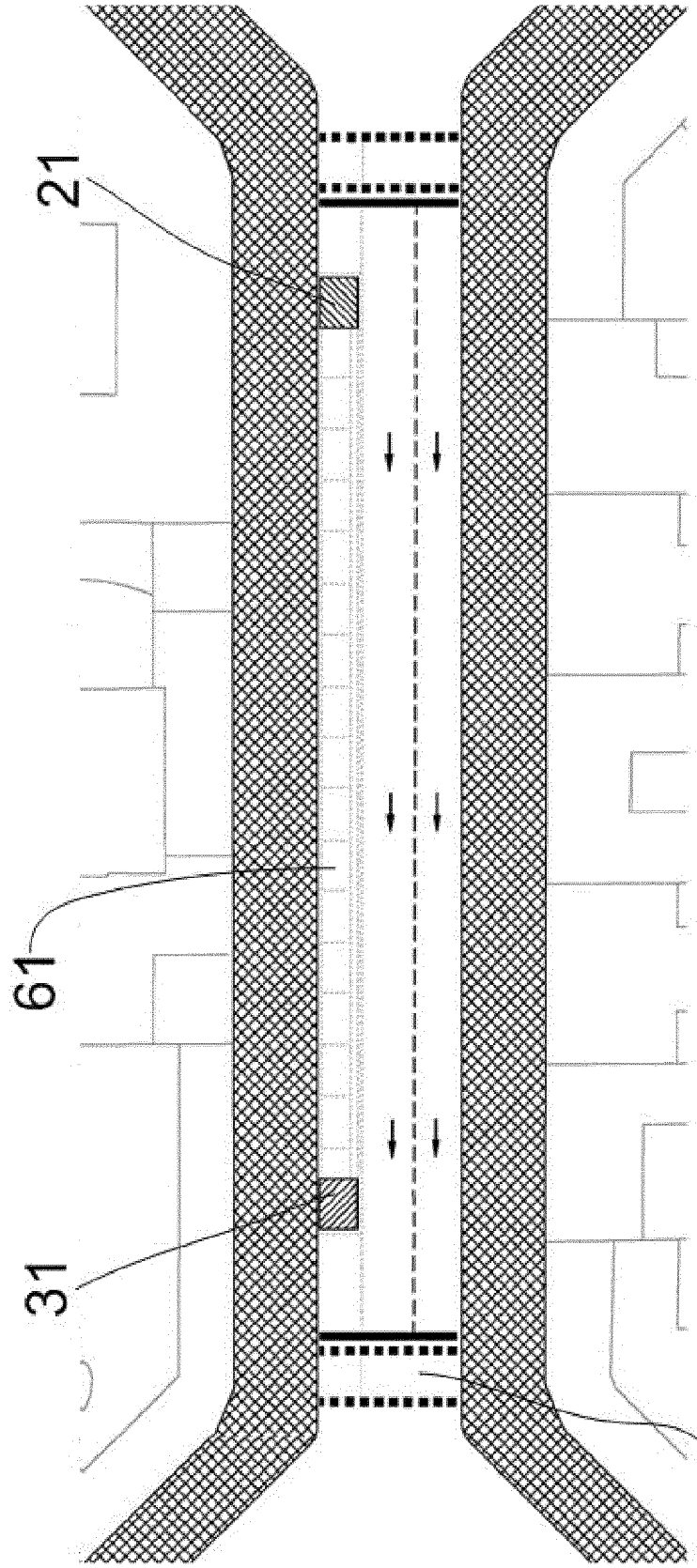

FIG. 4

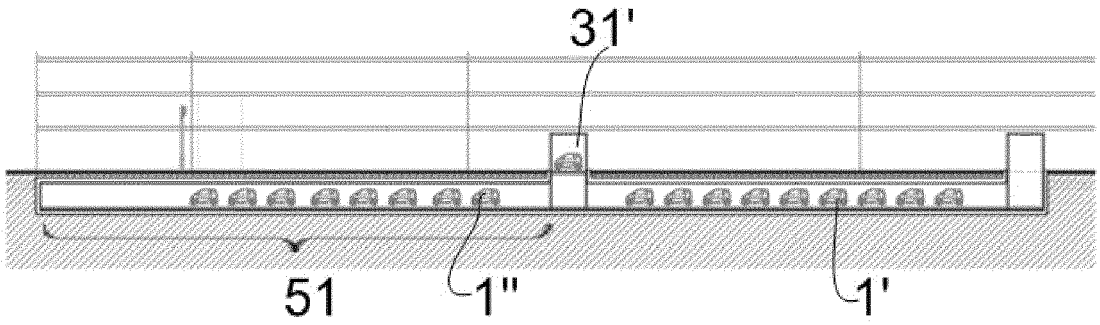

FIG. 5

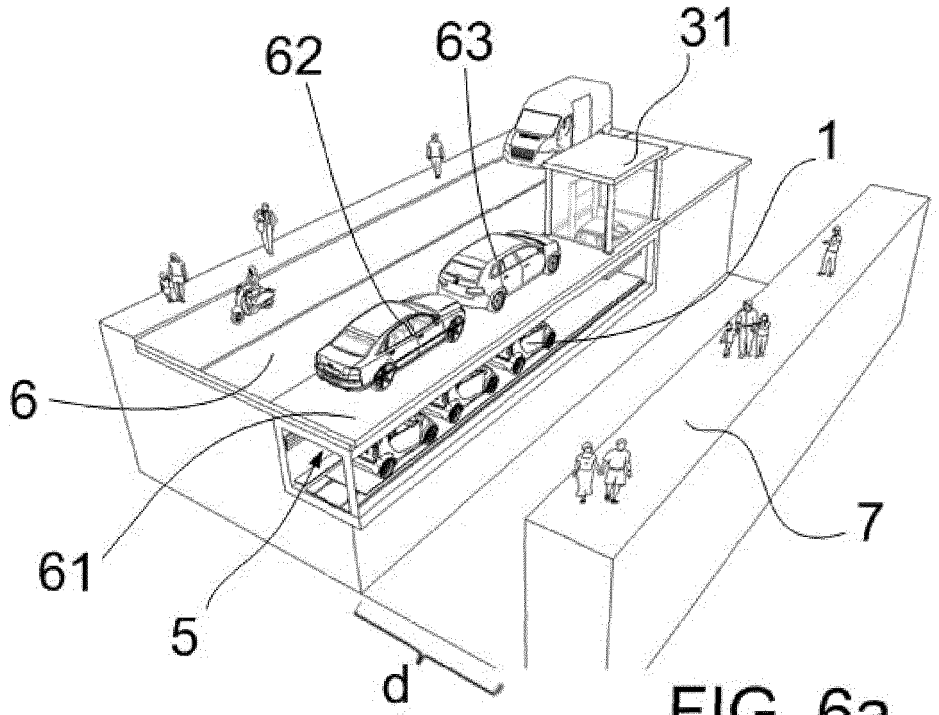

FIG. 6a

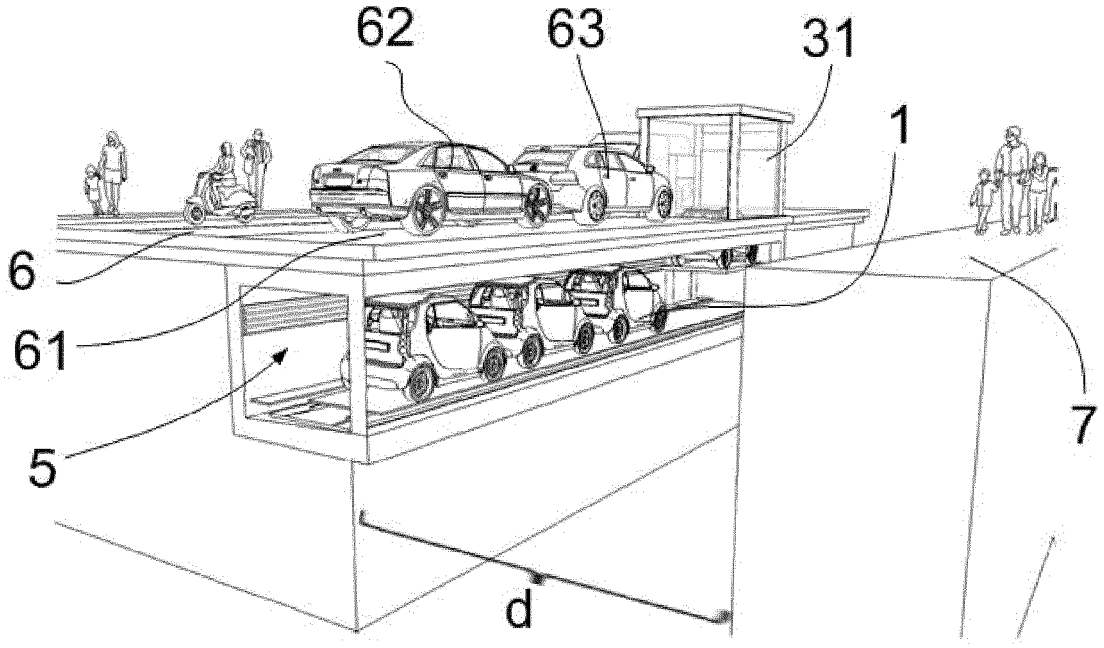

FIG. 6b

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EUROPEAN SEARCH REPORT

Application Number
EP 11 38 2378

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 196 03 660 A1 (RETRABAU AG [CH]) 29 August 1996 (1996-08-29) * column 2, line 5 - line 12 * * column 2, line 68 - column 3, line 14; claims 11-13; figures 5b,5c,6-8 * -----	1-5, 7-11,14, 15	INV. E04H6/14 H02J7/00
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A	EP 0 577 075 A1 (TAKAHIRO TSUBOTA [JP]; TAKENAKA CORP [JP]; HIROSHI KITAJIMA [JP]) 5 January 1994 (1994-01-05) * column 5, line 12 - column 9, line 19; figures 1,3,4,5,6,7 * -----	1-3, 7-11,14, 15	
A	WO 2005/045161 A1 (DOUSKOS IOANNIS [GR]) 19 May 2005 (2005-05-19) * page 1, line 36 - page 3, line 21; figures 1-6 * -----	1-5, 7-11,14, 15	TECHNICAL FIELDS SEARCHED (IPC) E04H H02J B60L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 July 2012	Stefanescu, Radu

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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REFERENCES CITED IN THE DESCRIPTION

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