

**WHOLLY AUTOMATED MOBILE DEVICE AND CORRESPONDING FAST,
ECONOMICAL AND COMPACT METHOD FOR PARKING PRIVATE
VEHICLES**

[0001] This invention concerns a fully automatic parking system for private vehicles for the fast and economical parking of private passenger vehicles with minimum space requirement. In particular, the system comprises a device and a method for centering and cantering the private vehicles on a platform, gripping them and transporting them quickly, in order to park them in a space-saving way, and upon request getting them again from the parked position automatically and handing them over to the user. In combination with a modular design, such that this device can be quickly and easily mounted, dismantled and remounted, this is a less costly alternative for the indoor car parks, parking silos, multi-storeyed car parks and similar systems with a higher utilisation of space.

[0002] Private vehicles are parked on the road, in parking lots, in garages, multi-storeyed car parks or also in access-controlled automated parking systems. In the typical multi-storeyed car parks, only about 40% of the ground area and around 30% of the enclosed volume can be used for parking the private vehicles. While an average automobile is about 1.7 m wide, 1.6 m high and 4.4.m long, which results in a cubic volume of around 12 m³, the regular multi-storeyed car parks and parking systems include a volume of up to 80 m³ and more per vehicle. In contrast to the earlier models, the modern cars with their compact motors are no longer rectangular in their shape. These taper conically or in oval shape mainly at the front, starting from the rear-view mirror at the side, for which reason a rectangular parking area cannot be used optimally. A lot of valuable space is thus lost in the usual parking systems through entry and exit paths, manoeuvring, space for opening doors, stairs, lifts, footways, solid pillars and beams, the minimum floor height for persons, as well as escape routes,

illumination and fire-extinguishing systems etc. Parking needs time and skill and is perceived as unpleasant.

[0003] In other systems the cars are lifted high with lifting systems, in order to save place, and then these are parked closely by staff (valet parking). This makes parking more expensive and increases the access time. In the existing parking systems, it is necessary to drive-in the car exactly in a parking slot for parking, where the driver automatically receives instructions for cantering and centering the vehicle on a palette. These palettes, which are needed for displacing the vehicle, show a rectangular area with the minimum length and width of the largest car to be parked, plus tolerances for inaccurate parking and manoeuvring. As such, more area is needed than the effective average ground area of the vehicle. Furthermore, before each parking these palettes must be procured or replaced, which needs a complicated mechanism and extensive control and consumes a lot of time and space. In case of other systems with fixed platforms hanging from vertical chains, which can be seen occasionally in Asia, the enclosed space can be used only poorly and the long access time restricts the actual number of parking spots. The known systems are designed as fixed structures, which do not permit an economical and quick parking and hence are suitable only for the long-term permanent usage. The long construction time, high investments and the long-term retention have an investment-dampening effect.

[0004] The general objective of this invention is to devise a simple technical system for the quick, economical and automated parking of private vehicles with minimum space requirement. The system should also allow the quick retrieving of the vehicles for the users upon their request.

[0005] In order that the vehicles can be gripped mechanically, displaced and parked precisely, these must first be positioned correctly. To do this precisely and without errors, it cannot be left to the customers. Placing the vehicle must be simple. Even when the vehicle is not placed correctly, the system must fulfill its

task. The **first sub-task** is thus to centre the vehicle automatically by mechanical means and to bring it in a uniform, precise position for the mechanical and electronic collection.

[0006] The vehicles should be moved and stored automatically through a simple technique without any means of transportation. The **second sub-task** is to grip the vehicles accurately and quickly by means of a method, so as to move it to the assigned position and to pull it out of this again. For this, the components must be designed in such a way that these can grip the vehicle at an appropriate point, suitable for all vehicle types, in order to place it on the platform of the lift and on the parking ramp, and finally pull the vehicle out of there again and place it on the exit ramp to be handed back to the user, when needed.

[0007] The **third sub-task** is to park the vehicles as closely as possible with a smart arrangement, with the least wastage of space and simple construction. The modern basic shapes and the different widths, heights, and lengths of the cars should be used optimally. By means of selected arrangement, the method, the electronic measurement and the IT-supported allocation of the parking positions, wasted empty spaces are avoided to a large extent and the degree of space utilisation is increased manifold as compared to the conventional systems.

[0008] The **fourth sub-task** is to handover the vehicles back to the driver quickly, safely upon request, using a simple and safe design in the direction of traffic, so that the handover is simple and swift.

[0009] The **fifth sub-task** is to design the entire system in such a way that this can be erected, dismantled, moved and re-erected with minimal effort, without using cranes, supports and heavy foundations. For this, the components are to be assembled in such a way that they can be reused.

[0010] The general objective is achieved by an automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles, comprising several columns, rails or pillars, on which circular disc-shaped parking platforms with parking ramps rest in several levels one above the other for parking the private vehicles, where a lift shaft stands or hangs in the middle of this parking platform and delivery ramps are arranged on one or more drive-in and drive-out levels, whereby the system is *characterised by* the fact that this lift shaft has a lift with a fixed or back and forth movable lifting platform, on which a mechanical cantering, centering, lifting and pushing system (tractor) is arranged, with which a vehicle on the parking ramp or parking platform can be gripped at its wheels, centered, lifted and moved forward or backward on to different ramps and platforms, where the lift shaft with its lift and the cantering, centering, lifting and pushing system can be controlled by a central computing unit for a quick and optimum space-saving arrangement of the cars to be parked on the respectively free parking platforms or exit ramps.

As an non-limiting exemple of execution, this systems is shown in the accompanying drawings and the method of its working will be described in detail by referring to these drawings.

They show:

- Fig. 0 3D presentation of the parking system;
- Fig. 1 Complete overview of the parking system;
- Fig. 1b Parking system sectional 3D representation;
- Fig. 2 Parking ramp and centering system details;
- Fig. 2b Parking ramp and centering system with fixed guide rails;
- Fig. 3 Lifting platform with tractor;
- Fig. 4a Tractor positions with movable lifting platform;
- Fig. 4a1 Tractor with roller forks operating principle;
- Fig. 4a2 Tractor positions with fixed lifting platform;

- Fig. 4b Tractor on the lifting platform (fixed and moving);
- Fig. 4c Tractor with roller forks;
- Fig. 5a Roller forks with two rollers;
- Fig. 5b Roller forks with 1 roller and overlaid lifting roller;
- Fig. 6a Lift with fixed lift shaft;
- Fig. 6b Lift and lifting platform;
- Fig. 7 Parking arrangement, arrangement with short and long platforms;
- Fig. 8 Area comparison;
- Fig. 9 a, b, c Erection method and overview of design.

[0011] This system is characterised by the fact that it grips the vehicles automatically, parks them quickly and economically in a special arrangement, discharges them again when required and the entire device can be dismantled and re-assembled on another location with minimal effort. Furthermore, it is also characterised by the fact that the vehicles are gripped automatically, mechanically and brought to the exact initial position, in order to transport them automatically and precisely, horizontally and vertically and to rotate them on the vertical axis, without need for aids like palettes and conveyor belts.

[0012] In order that the vehicles can be parked as closely and precisely as possible, taking the car in and out of the storage should be done automatically. To do this, the modern shapes and the different sizes of the cars should be taken into account for an optimum parking. To keep the usage costs below the current level, the device should be manageable with fewer persons or even without an operator, and it should have low maintenance, minimum susceptibility to faults and high reliability. In order to make the device suitable for temporarily available parcels of lands and gaps between buildings, and for temporary solutions, it should be devised in a simple modular design with little effort, which can be remounted quickly, if needed.

[0013] The parking device as shown in figures 0 and 1 comprises several pillars, rails, or columns 2, to which parking platforms 8 are fixed arranged in circular discs for parking the private vehicles. At the centre of this, on plates, arranged in several decks, stands or hangs a lift shaft of a conventional lift, as shown in figure 6A and 6B, having a fixed or movable lifting platform 31 that can be moved back and forth, on which a mechanical push system (tractor) 40 runs on a horizontal rail (tractor rail) 42, which grips the vehicles mechanically at their wheels, centres, lifts and pulls them on to the lifting platform 31. In the design with movable lifting platform this moves first in the centre (position 2). Thereafter, the lift travels vertically to the assigned deck. When the lift reaches the corresponding deck and this deck or the entire lift shaft has rotated by the calculated angle or to the platform assigned by the computer, the lifting platform is taken to this deck (position 1), in order to push the car on the parking platform with the tractor. With this method and the selected, overlapping parking arrangement as shown in figure 8, the compactness can be enhanced enormously vis-à-vis the conventional systems. When removing the vehicle this is taken back by executing the steps in the reverse sequence and pushed on to the exit ramp 9 (tractor position 3). Owing to its simplicity and modular design the device is assembled, dismantled and assembled again very quickly. To do this, no other constructional measures are needed except for a connection to the power supply and a firm ground.

[0014] This automatic parking system for private vehicles with fixed parking platforms 8 is arranged in circular discs on several decks with a central lift as shown in figure 6, with a connected lifting platform 31, a push and pull device (tractor) as shown in figure 4 and with parking and exit ramps, on which the vehicles are cantered and positioned automatically. The system is further characterised by the fact that the vehicles are gripped automatically in mechanical fashion, are measured electronically and transported with assistance of computer to specially arranged parking platforms 8, without making use of accessories like palettes, such that this parking method and the selected

arrangement (figure 8) help to achieve an essentially higher density of the parked cars. The design is also characterised by the fact that only a few movable parts are needed, which are restricted only to the lift 61, tractor 40, and the parking ramps 22 and the components can be combined together and screwed quickly and easily in modular layout as hanging or supporting structures, such that the entire system is mobile and can be reused.

[0015] Referring now to figure 2, the parking ramp with cantering system is described. The cantering system brings the vehicle to the middle of this ramp by means of two guide rails 21. These rails are equipped with rollers that prevent the wheels from ramming against them, without using any mechanical drive for the purpose, such that these guide rails are mechanically connected with one another through swivel arms 27,28, push rods 28 and cantering rails 25, which are thus in a symmetric position. These rails, kept under tension with springs 23, exercise pressure against the middle of the parking ramp, such that these are pulled away from each other in the front when the vehicle is driven in. At the same time, it results that at the back these come together symmetrically and so push the vehicle with the wheels in the middle of the driveway. The platform is also characterised by the fact that it is designed with rollers 25 laid longitudinally, on which the vehicle wheels 16 can easily be displaced to the side. As an alternative the side guide rails can also be mounted parallel and fixed, in order to keep the lateral deviation of the vehicle within limits.

[0016] Referring to figure 3, the lift shaft and lifting platform are being described. The lifting platform 31 on one hand can be moved forward and back horizontally, and on the other can rotate laterally along the vertical axis and also has the suitable shape and dimensions, so that it can move below the parked front of the car and can join the parking platforms 8 arranged in circle, as also the parking ramps 22 and the exit ramp 9. The lifting platform is also characterised by the fact that the tractor 40, a mechanical gripping and pushing system, is mounted on a rail which is centered and is movable, in order to pull the vehicles on the

lifting platform or to push them from this on to other platforms. As an alternative the lifting platform 31 can be connected permanently with the lift. Similarly, as an alternative, the lift, together with the lift shaft can be designed such that it can rotate on the vertical axis, as shown in figure 4a. This is then characterised by the feature that it can be rotated with rollers between the pillars of the lift shaft (see the guide rails 65 in figure 6b, and the carrying pillars 68 in figure 6b) and parking platforms guided on the side via an electromechanical, hydraulic or pneumatic drive (see the rotational gear of lift 69 in figure 9c), electronically controlled, along the vertical axis. This ensures an exact centering and less gaps between the lifting platform and the parking platform.

[0017] Referring to figures 4a-c, the tractor is explained. The vehicles are gripped, centered and moved on their wheels, without using aids like palettes or conveyor belts by a tractor 40 which is on a rail fixed in the middle of the lifting platform 31. On this, it runs below the vehicle placed on the parking ramp, presses at the wheels with two forked rails 44 that can spread, thereby centres the car exactly and raises the car to some extent with four forks 45 each having two roller fingers 46, which are pushed under the wheels, fixes the vehicle and pulls or pushes it in the desired position.

[0018] The vehicle is gripped, lifted and pushed on each wheel with a roller fork 45 as shown in figures 5a-b, and each comprising two roller fingers 46 with horizontal rollers on its rollers 57. This roller fork 45 is characterised by the feature that it is fixed in such a way at a forked rail 44 that its two roller fingers, comprising of one or two rollers 57 running on the platform, which carry a third roller, that is a lifting roller 58 and travel below the wheel of the vehicle when pulled together and lift it thereby. The lifting rollers can run either on a separate axis between and parallel to the rollers, or can be overlaid on this concentric to the roller (see the lifting roller 58 in figure 5a, and the roller fork 45 in figure 4a1). In this case the lifting roller 58 comprises of a segment of a roller, which runs

over the roller and has the form of a segment of a barrel, on which a straight or a concave plate is set to enlarge the bearing surface of the wheel.

[0019] The parking platform, the arrangement of the cars and the parking method is explained referring to figures 8 and 9. This automatic parking system works with a parking arrangement and a corresponding parking platform 8 whereby the the conical or oval front sections of the modern automobiles are being used. With the corresponding dimensions and specific assignment of these, the vehicles can be parked compactly side by side, when these are centered precisely and moved automatically without using palettes or similar aids, the parking platforms have a specific basic shape and an arrangement in a circular disc and at an angle of 15 to 30 degrees and the optimum space is assigned to the cars with a computer, when broad and narrow vehicles receive the corresponding parking positions. As such the arrangement is characterised by the fact that the rectangular parking areas overlap with the front edges and the side margins, and very little space is needed for manoeuvring and for transporting. Furthermore, it is also possible to manage without vertical and horizontal rails, which reduce space in the usable area.

[0020] Referring to figure 1, the solutions are accordingly represented by a device, which parks the vehicles fully automatically and quickly in a space-saving way by a special arrangement, takes them out and returns them when demanded. Furthermore, the vehicles are first centred on a parking ramp by means of guide rails and rollers, then gripped at their wheels with the help of a device, brought in the starting position and then moved automatically and precisely without making use of the means of transportation, such as palettes or conveyor belts. This is done by pushing small rollers below the wheels of the vehicle, in order to place the vehicle on these and to move it. With the help of a device - hereinafter referred to as the tractor - on a platform, which is mounted at a central lift, the vehicles can be moved horizontally. On the lifting platform these can then be rotated on the vertical axis and at the same time quickly transported

vertically. The complete system is assembled in a modular design with screws and bolts in such a way that it can be dismantled easily when required and then reassembled on another location without making use of any expensive construction machines. The combination of the following individual inventions results in the desired solution with the advantages mentioned above vis-à-vis the existing systems.

[0021] In this solution, as shown in figure 2, the vehicles are centered automatically and exactly on a parking ramp by driving it on longitudinally aligned rollers 25 on the parking ramp and moving it with side guide rails 21 while driving in the vehicle at the wheels 16 in the middle of the parking ramp. Rollers on the guide rails prevent the vehicle from over-rolling. Each of these two guide rails is joined mechanically to each other on the front and at the back with two swivel arms 27,28 and centering rails 29 and are pressed in the middle by means of a central tension spring 23. However, since the rear arms are pressed away from one another by means of another tension spring 23, the guide rails at the back go to the state of rest in the open position. If the guide rails are pressed away from each other by the front wheels when the vehicle is driven in, then the closing force on the rear arms is increased via the central spring 23 and the guide rails also close at the back. As a result of this, the vehicle can be moved in the centre now only at the back. When the vehicle leaves the parking ramp, the guiding rails go back to their original resting position, conically closed at the front and open at the back. In this way, it becomes ready for driving in the next vehicle. This arrangement does not need any mechanical drive and is maintenance-free to a large extent.

[0022] The proper positioning of the vehicle is achieved by instructing the driver to drive till an electronic and mechanical stopper, upon which a stop signal is given to him. The vehicle is now gripped mechanically, measured electronically and a computer determines a suitable parking space for the vehicle. If none is available, the driver - as in the case of a car washer - is instructed to put the

steering wheel in neutral, to apply the brakes, to shift the gear to 1 or P, to leave the vehicle and to close the doors. Once this leaving has been registered electronically, any further access is barred with the help of a gate for security. As such, the vehicle is now ready to be parked and the parking ticket can be issued to the driver. To avoid delays, several such parking ramps as shown in figure 2 can be placed before one or several unloading zones.

[0023] As an alternative, fixed guide rails or rails with mechanical drive can also be used for centering the vehicle. In the variant of a fixed guide rail, the car is held only within a specific limit of the lateral deviations. These guide rails are then aligned for the widest vehicle. The exact centering is then done by the arms (forked rails) 44 of the tractor as shown in figure 4a and 4b which hit upon the wheels synchronously from inside and thus displace the vehicle to the side and centre it. This is shown in figure 4a1 where the swivel arms 37 and the tractor rails are shown. The tractor then executes the horizontal displacement.

[0024] In order to manage without palettes or conveyor belts, all vehicles must be gripped at a uniform point, suitable for all models. This is done with the help of a device as shown in figure 4a. This tractor 40 centers the vehicle, grips it at the wheels, lifts it and moves it. The tractor is fixed on the lifting platform and comprises hydraulically movable tractor rails 42, at which a parallel swivellable forked rail 44 is fixed on both the sides. Each of these are equipped with two forks 45 each having two fingers with rollers 51 (fig. 5a-b) or roller fingers respectively. Each of the roller fingers comprises of one to two rollers 57 and one lifting roller 58. Both the roller fingers of each fork are connected with each other by means of an actuator, e.g. a pneumatic or hydraulic cylinder 48 and can run freely together in the forked rail, but are held in the starting position by means of a spring or else the front-most roller finger can be designed as fixed.

[0025] The forked rail is connected with the tractor rail via two rods 41 and a slider 43 mounted on the tractor rail with pneumatic or hydraulic actuators. This

tractor rail can move over the lifting platform 31 beyond it as shown in figure 4a when it is moved in the corresponding direction by two telescopic cylinders or an electro-mechanical drive. The forked rail is pressed by the tractor rail against the wheels, as a result of which the vehicle is moved exactly in the middle and is stable. Subsequently the two roller fingers of each fork are moved together, through which the wheels are lifted on to the lifting rollers 58. When the fingers are closed, these are fixed with the forked rail, in order to transfer the lateral movement to the vehicle. This brings the vehicle in a uniform and precise initial position and can now be measured electronically, so that the computer can determine the optimum parking space.

[0026] Next the vehicle — rolling on the roller fingers — is pulled on to the lifting platform. This corresponds to tractor position 1 in figure 4a.. The lifting platform 31 — unless designed to be mobile — now moves to the middle of the lift 61 and then travels vertically to the assigned deck. This corresponds to tractor position 2. After the lift has rotated to the calculated parking platform — in the reverse process — the tractor discharges the vehicle again. This corresponds to tractor position 1. The roller fingers then travel away from each other and the forked rails then contract. Thereafter, the tractor retreats back to the lifting platform and is ready for the next vehicle. For discharging the vehicles on the exit platform 9 the lifting platform and the tractor travel in the opposite directions which corresponds to tractor position 3, and which facilitates the parking in the direction of the traffic.

[0027] Relating to figures 5, 4b and 4c the gripping and lifting by the roller fingers is explained. The transfer of the tensile and impact forces from the tractor 40 to the wheels and the lifting of the vehicle is resolved by the mentioned roller fingers 51. These comprise of one to two rollers 57, which carry a lifting roller 58. The rollers roll on the corresponding platform. The lifting rollers 58 serve for lifting and carrying the wheel. The lifting rollers are designed either as separate rollers or concentric on the same axis as the rollers, where these then have the form of a segment of a barrel and overlay the rollers 58 as shown in figure 5a. In this way

the contact surface of the wheels can be enlarged in small increments. The axes of the rollers have a flange 53 on both the sides. The inner flange runs in the forked rail 44, where the drive cylinder 48 is present that contracts the roller fingers. In the open position these roller fingers are held in a certain starting position by means of springs. In the closed position the fingers are mechanically anchored with the rails, in order to transfer the compression and the tensile forces of the tractor to the vehicle. The front-most roller can also be anchored fixed and hence this additional anchoring can be omitted.

[0028] Relating to figures 3 and 6, the transporting and rotating by the lift and its lifting platform is explained. The lifting platform 31 comprises a plate fitted to the parking platform 8. This is placed on the rollers so that it can move horizontally lengthwise against the other platforms and can connect there. This can also be fixed permanently at the lift (at the lift cabin). Its shape is such that it connects centrally with the connecting platforms through the conical or rounded fronts and that the rollers travel over the platform thrusts without hitting. The lifting platform is mounted on a conventional lift 61. This leads to vertical guide rails 65 by means of an upper and lower rail 67 and stabilised. These vertical rails are fixed either at the parking platforms 8 as shown in figure 6a or as a variant on the vertical lift carrying pillars 69 which rotate with the lift along the vertical axis as shown in figure 6b. These then form the lift shaft 62. Thus rotating lift shaft, which is supported on the side with rollers 64 at the platforms as shown in figure 6b, provides an unrestricted access to this without the hindering guide rails and supports.

[0029] The tractor is connected with the lifting platform by means of the mounting of the drive cylinder 48 and through the guide of the tractor rail 42. In case of a movable lifting platform design; so that the lifting platform 31 extending below the front of the vehicle can be moved vertically, it is retracted in the centre position (platform position 2). For discharging the vehicle, the vehicle is gripped in the same way with the tractor on the parking platform, pulled on to the lifting platform

and the pushed on to the other side of this (platform position 3) on the exit ramp 9.

[0030] The parking platform 8 as shown in figures 8 and 9 comprises of conical plates (circular discs) with fixing points for suspension or supports. To ensure that these rails do not extend in the overlapping parking areas and manoeuvring paths, these are placed in the rear part of the platform. The conically converging forms enable close parking. In this way, the rectangular base shapes overlap at the front corners and on the sides. Large vehicles can extend beyond the platform on the sides and the wheels can roll in and out on the adjacent platforms. In case of the movable lifting platform design: The selected front line of the platform enables on one hand the maximum lifting of the lifting platform, helps it in exact centering during thrust and enables a smooth transfer of the rollers when the thrusts are transferred. Through the selected suspension of each individual platform no cross rails are necessary, and hence no vertical space is needed and the distance to the ceiling can be kept low. Possible horizontal reinforcements of the plates can be placed at the side margins, where enough space is available.

[0031] In order that the vehicles can be parked compactly with the least utilisation of space, the cars are pushed on to small, fixed parking platforms 8 in keeping with the conical or oval base forms of the front part of the cars. These are placed star-shaped in a polygon and form a circular disc. With their conically converging front section and rounding the vehicles can thus be parked compactly, in circles, with the front facing the centre point of the circle. This special compact arrangement is enabled by the automatic, without using the displacement of the vehicles done through palettes, through the centered, exact guiding of the vehicle during parking, through the computer-assisted optimisation and allocation of the positions and through the selected design of the platforms. In this way the rectangular parking ground forms overlap and their paths overlap when the vehicles are being pushed in and pulled out. The conical form in the

front and the short front section of the vehicle is used to reduce the distances accordingly. By means of the electronic measurement and gripping of the vehicle done in the angle, these are distributed in such a way on the parking platforms 8 that on the side of each broad car two small cars can be placed, such that the parking distances is further reduced. In this way, space is available only for the average vehicle width for each position and not for the biggest vehicle.

[0032] Calculations show that the optimum number of vehicles per deck is around 14 to 20. In case of a higher number the inner space of the circular discs becomes unnecessarily large. If the number of the parking platforms is less, the space in the centre becomes too small or the space requirement for the lift and the lifting platform becomes too large as compared to the usable area. In contrast to the conventional systems and other automated parking systems with rectangular palettes, the area requirements here is reduced considerably. No movable parts are necessary on the individual parking platforms 8, which makes the design very simple.

[0033] Alternatively, the parking platforms 8 can also be shaped and mounted closely in such a way that these form a gap-less circular disc, through which the vehicles can be parked at an angle, depending upon the width of the car, side by side with the least distance. This is enabled by placing the pillars 2 widely outside and supporting the platforms on horizontal rails. The vertical rails 71 are present in the outer part between the parking platforms. Depending on the arrangement none or only sidewise or radial horizontal rails are necessary below the platforms. In this way, the height of the floors and hence the vertical loss of space can be ignored. The height of the individual decks i.e. the vertical distance can be decided before mounting and, if necessary, can be adjusted to the requirement with least effort. The vertical distance is to be set for the expected vehicle height to several different deck heights. Because the deck is allocated based on the values measured for the vehicle, each vehicle would require only that much height as necessary. In this way, the space utilisation efficiency is

enhanced once again and the increase is about three-fold as compared to the conventional multi-storeyed car parks.

[0034] The exit ramp 9 comprises of a simple plate, on which the vehicle is pushed by the tractor in the same way as on the parking platform, but in the forward direction. After the vehicle has been pushed on to it, the exit ramp is opened and made accessible to the driver. To avoid delays while driving away, several exit ramps can be placed, which can be supplemented with connecting loading zones.

[0035] The lift shaft as well as the cover with the parking platforms comprise of elements that can be combined together. By means of a consistent modular design and the use of plug and screw connection, the mounting is quick and easy. In the reverse sequence, the assembly can be dismantled again. Optionally, the cover can also be fixed on to the walls of the building as a hanging or standing structure. The complete plant can be assembled above or also below the ground. Given the fact that the user has no access to the decks, the emergency devices such as escape routes and fire-extinguishing systems, as also stairs, lifts, illumination and ventilation can be avoided to a large extent. The lift is based on commercial design with the technology used for lifts for carrying people and goods.

CLAIMS

1. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles, comprising of several columns, rails or pillars (2), on which circular disc-shaped parking platforms (8) with parking and delivery ramps (22) rest in several levels one above the other for parking the private vehicles, where a lift shaft (61) stands or hangs in the middle of this parking platform (8) and parking and delivery ramps (22) are arranged on one or more drive-in and drive-out levels, *characterised by*
the fact that this lift shaft (62) has a lift (61) with a fixed or back and forth movable lifting platform (31), on which a mechanical cantering, centering, lifting and pushing system (tractor) (40) is arranged, with which a vehicle on the parking and delivery ramp (22) or parking platform (8) can be gripped at its wheels, centered, lifted and moved forward or backward on to different parking and delivery ramps (22) and platforms (8), where the lift shaft (61) with its lift and the centering, lifting and pushing system (40) can be controlled by a central computing unit for a quick and optimum space-saving arrangement of the cars to be parked on the respectively free parking platforms (8) or for delivery onto the delivery ramps (22) which then serve as exit ramps (9).
2. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per claim 1, *characterised by*
the fact that the parking ramps (22) are equipped with a cantering device, such that a automobile can be centered laterally irrespective of its track width on the shortest possible distance, comprising of guide rails (21) equipped with rollers (25) for avoiding overriding, which are fixed at the parking ramp (22) via swivel arms (37), push rods (28) and centering rails

(29) movable in such a way that the guide rails (21) can be moved only laterally and symmetrically running in the opposite direction and are positioned on the front converging conically by means of springs (23), so that when a vehicle is driven-in its front wheels (16) open these guide rails on the front and these then close in the rear part and in this way the vehicle can be moved laterally in the centre with the wheels travelling on longitudinally-aligned rollers (25), pressing outside on the wheels.

3. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*

the fact that the computer-assisted lift shaft (62) that rotates on the vertical axis (62) contains a lift (61) in the shape of a high-speed lift with lifting platform (31), on which a computer-assisted, mechanical centering, lifting and pushing system (tractor) (40) is placed, with the help of which a vehicle can be gripped and rolled from the parking ramp (22) on to the lifting platform (31), then this lifting platform with the lift can be lifted on to the deck assigned by the central computer and the entire lift shaft (62) with the lift can be rotated to the calculated position, there the vehicle can be pushed on to the parking platform (8) and this can be removed again, in the reverse sequence, from the parking platform on to the lifting platform (31) and can be pushed on to an exit ramp (9) assigned by the central computer in the other direction from the lifting platform in the forward travel direction of the vehicle.

4. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*

the fact that the mechanical centering, lifting and pushing system includes a robot (Tractor) (Fig. 4, 40), which is led on a rail and can travel under the vehicle, with which the vehicles can be precisely centered laterally, lifted

and also moved in two directions and laterally cantered, if parallel and symmetrically designed longitudinal beams (forked rails) (44) are available, with the help of which a vehicle, pushed inside on its wheels, can be moved laterally in the middle of the parking ramp (22) and the steering wheels can be aligned, and with the help of two fingers travelling below the wheels (51) all the four wheels can be lifted and vehicle can be moved back and forth from the lifting platform (31) on to the assigned platform or ramp on the underlying rollers held exactly in the middle of the calculated position.

5. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per claim 4, *characterised by*

the fact that the robot (Tractor) (40) is equipped with four roller forks each having a pair of roller fingers (46), with which the wheels of a car can be gripped, aligned, lifted and the car can thus be pushed rolling on the rollers (57), when the roller finger (46) placed in a movable way on a rail (forked rail 44) can be moved below the vehicle first laterally from inside, before and after the vehicle wheels, and then against each other from the front and the back, such that the wheels can be lifted with two additional rollers, the rollers (57) with overlaid segments of a roller or caps laid on the roller axis (Fig. 5b(58)) and hence the private vehicles can be moved irrespective of the wheel dimension, track width and axis distance, gripped quickly mechanically and the weight distributed on its rollers (57).

6. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*

the fact that these platforms with same or different lengths (8) each have a one-sided conically converging shape and are arranged at an angle of about 20 degrees (about 16 places in each deck) in a star shape on a circular disc having a round or polygonal exterior shape and that with the central

computing unit for a quick and optimum space-saving arrangement the vehicles to be parked can be assigned to an optimum place by taking into consideration the conical and oval shapes of the front sections of the private vehicles with corresponding dimensioning and computer-assisted, specific allocation, such that broad and narrow vehicles are placed side by side in such a way that each platform must have only the width for the average and not for the biggest vehicle size, where the rectangular parking areas overlap with the front edges (Fig. 8), as such platforms with conical basic shapes can be used and through this combination and the corresponding allocation the vehicles can be parked compactly to the maximum possible extent and with the vertical pillars (73) and with the rotating lift shaft (62) even the lift guide rails (65) are present in the non-usable space.

7. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that, as a variant, two parallel lifts (61) or lifting systems are placed in the lift shaft (62) which rotates on the vertical axis.
8. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that, as a variant, the lifting platform (31) is equipped each with two parallel tractor rails (42) with two parallel working tractors (40).
9. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that in case of parallel working tractors (40) always two parking platforms (8) lying adjacent to each other are aligned in parallel.

10. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that, as a variant, a tractor (40) is placed at the lower side of the lifting platform and in case of a failure of the upper tractor the lifting platform can be rotated by 180 degrees along its transversal axis and in this way the lower tractor can be used.

11. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that the forked rails (44) is centered while extending and centering the vehicle by applying pressure on the steering wheel of the car which is possibly not aligned in the direction of travel and simultaneously with the steering deflection of the same.

12. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that with one and the same device, namely the robot, known as tractor (40) (Car Handling Robot), the vehicles can be centered, gripped, lifted, driven, their steering angle can be centered and these can be moved quickly on both the sides, via the lifting platforms, horizontally on to the ramps (9, 22) or on the platforms (8, 31).

13. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that the robot or the tractor (40) can automatically grip, centre, lift and move all the common vehicles irrespective of their dimensions, track width, axis distance and wheel diameter, without having to measure these

values first by placing the roller forks (45) and the roller fingers (46) in the forked rails (44) in their longitudinal direction and through their dimensions and design by taking a position before gripping the vehicle, which lies outside or within the smallest or the largest axis distance, track width, or wheel position.

14. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that with the same device, namely the robot or the tractor (40), in three work steps, namely the driving of the forked rails (44), the bringing together of the roller finger (46) and moving the tractor (40) backward or forward, the vehicle can be cantered, the deflection of the steering wheel can be set to neutral and the car can be lifted, driven and moved on both the sides over the lifting platform.
15. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that all delivery ramps at the drive-in or drive-out level can be used, depending upon the requirement, for driving in as well as for driving out, i.e. as parking ramp (22) as well as also exit ramp (9).
16. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that the robot or the tractor (40) runs on a rail (42) fixed on a lifting platform (31) and can be driven out with the help of a telescopic-shaped expandable guide on both the sides and hence neither a channel, a guide slot nor other devices are necessary for guiding a car on to a parking platform.

17. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that the parking platforms in different lengths are placed in such a way that their outer shape of the circular disc levels form a polygon, where in case of a square or hexagon or octagon of several systems arranged side by side without gaps the ground can be utilised better and so through a specific assignment of the vehicles on the basis of their length a higher utilisation of area results for the parking spaces having different lengths.

18. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that with a control computer and on the basis of the determined dimensions of the vehicle, of the order and of the saved data, such as the dimensions of the vehicle and the parking space, occupied parking spaces, statistical values and vehicle position etc, the allocated position, the necessary angle of rotation of the lift shaft, the vertical position, the necessary direction of travel and the travel distance of the tractor, etc. can be calculated for the best positioning of the vehicles.

19. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, *characterised by*
the fact that data is provided to the central computing unit by electronic sensors, which measure the height, length and the front width of the car based on the layout angle of the circularly placed parking spaces (chord of the distance of the parked car to the centre of the circle) and transfer these to the computer for calculating the optimum space with minimum length, width, and height.

20. Automatic parking system for private vehicles for automatic, compact, efficient and economical parking of private vehicles as per one of the earlier claims, characterised by the fact that the system can be designed over the ground as a tower or also below the ground in a shaft as a standing or hanging structure in modular design and as such can be dismantled and reused with minimum effort.