(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 762 674 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.03.2007 Bulletin 2007/11

(51) Int Cl.:
E04H 6/24 *(2006.01)* ***E04H 6/28*** *(2006.01)*

(21) Application number: **06018515.4**

(22) Date of filing: **05.09.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **09.09.2005 IT PN20050062**
21.10.2005 IT PN20050017

(71) Applicant: **Viapark Europa s.r.l.**
31021 Mogliano Veneto (TV) (IT)

(72) Inventor: **von Mehlem, Luigi Filippo**
31021 Mogliano Veneto (TV) (IT)

(74) Representative: **Dalla Rosa, Adriano**
Via del Troi N. 2
33170 Pordenone (IT)

(54) **Automated parking system**

(57) Automated parking system comprising one or more floors lying above each other, adapted to be installed in town centres, or on variously shaped areas with a limited availability of building space, provided with movable platforms (10; 48) provided with displacement and driving means (30, 34, 35; 49, 50, 51) adapted to cause said movable platforms to displace throughout the parking system for said movable platforms to be eventually arranged on the selected parking floor and the selected parking place and, upon expiry of the parking time, to be then removed from such parking floor and such parking place and brought back to the exit area of the parking system, the latter further possibly comprising elevator means (11) for transporting one or more movable platforms (10; 48), either with or without a motor-vehicle being placed thereupon, to parking floors lying above each other, and possibly comprising also rotating transport means (77, 78, 79) adapted to displace said movable platforms (10; 48), either with or without a motor-vehicle being placed thereupon, from the longitudinal displacement directions to the transverse displacement directions of the same platforms, and vice-versa.

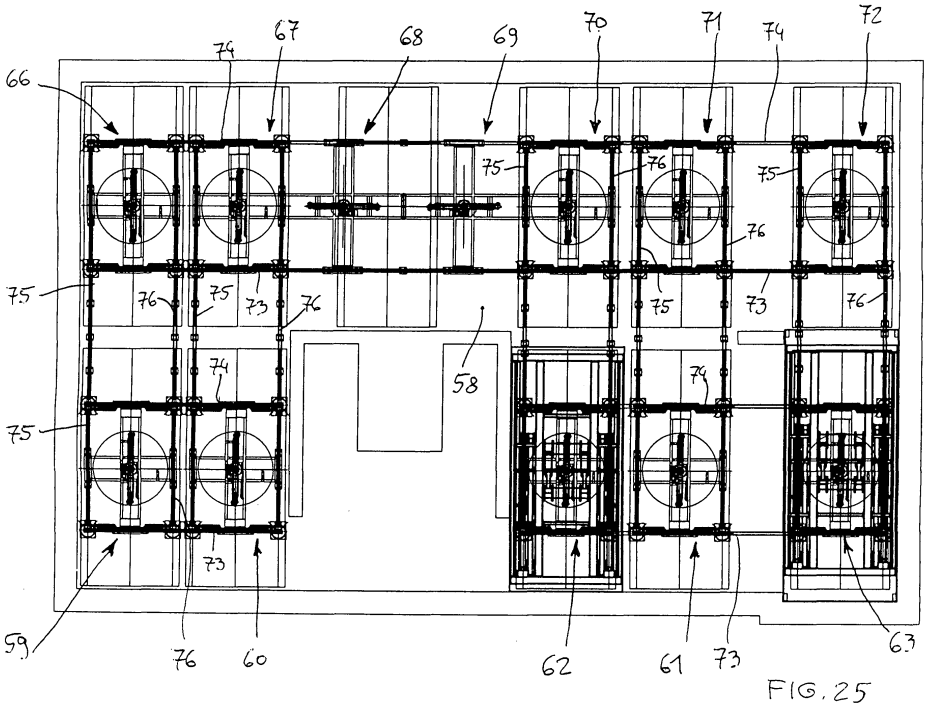


FIG. 25

EP 1 762 674 A2

Description

[0001] The present invention relates to an automated parking system comprising one or more floors lying above each other, with movable platforms for supporting and carrying motor-vehicles on to previously selected parking positions, wherein, in the case of more overlying parking floors being provided, the system also includes a vertically displacing elevator that is adapted to receive and carry the motor-vehicles from a bottom level or floor to a number of higher levels or floors located thereabove, and vice-versa.

[0002] Known in the art are automated car parking systems for installation in urban areas and town centres in general, which are arranged so as to automatically determine and cause motor-vehicles to be parked in preselected or, anyway, available parking positions. These systems generally comprise a modular construction structure formed of a horizontal plane, or floor, or even a number of horizontal planes or floors extending above each other, on which there are provided a number of parking places separated from each other, in defined positions, to temporarily accommodate respective motor-vehicles, and in which the motor-vehicles are introduced through at least an entrance provided in said construction structure to be loaded onto movable carriages that are then selectively transported on to the selected parking positions by means of suitable transmission and driving mechanisms controlled by automatic control means that are adapted to control all displacement movements of the movable carriages and the motor-vehicles resting thereupon, wherein these control means are capable of being preliminarily set by the user to determine the appropriate displacement of the movable carriages into the selected parking positions of the motor-vehicles on said carriages. In the case of structures involving more parking floors extending above each other, these parking systems further comprise suitable translational elevators, i.e. so-called travelling lifts, which are automatically driven and controlled by the above-mentioned automatic control means to cause the movable carriages, and the motor-vehicles carried thereupon, to displace from a floor to another one for parking on the selected or desired positions; in other cases they also include complicated comb-like structures or coupling means to engage the wheels of the motor-vehicles parked thereon. Finally, these prior-art parking systems are adapted to retrieve - when requested or, anyway, upon expiry of the parking time - the movable carriages, with the related motor-vehicles parked thereon, from the parking position thereof, and carry them automatically towards the exit of said construction structure for the same motor-vehicles to be eventually handed over to their owners and/or users, wherein all this takes of course a lot of time, since only a single vehicle delivery operation at a time can be performed, actually.

[0003] Usually, these parking systems necessarily extend over quite large surface areas, so as to allow parking places to be made available in as high as possible a number on each horizontal plane, as well as to enable the movable carriages carrying the motor-vehicles to be handled and displaced in as quick and smooth as possible a manner on each plane or floor of the modular construction structure, for the motor-vehicles themselves to be able to be exactly located on the parking positions becoming each time available at the beginning of the parking time, and be retrieved from such positions at the end of the parking time.

[0004] It is a main object of the present invention to provide a new kind of automated parking system with one or more floors extending above each other, which enables motor-vehicles to be quickly and smoothly parked also on parking areas of limited extent, i.e. on relatively small surface areas that, therefore, involve a smaller number of parking places available or, anyway, provide a significantly increase in the car places to available surface area ratio, with a compact structure that enables the system to be installed in limited building spaces and sites.

[0005] According to the present invention, these and further aims, which will become fully apparent further on in this description, are reached in an automated parking system incorporating the construction features as substantially described and recited in this specification, with particular reference to the appended claims.

[0006] Features and advantages of the present invention will be more readily understood from the detailed description that is given below by way of not-limiting example with reference to the accompanying drawings, in which:

- Figures 1 and 2 are respective front perspective views of an automated parking system according to the present invention in a first embodiment thereof and with a determined number of motor-vehicles parked in different positions, in the assumption that a side elevator is available for eight car places on three levels, whereas Figures 1a and 2a represent the possibility for eighteen motor-vehicles to be parked on the same three levels, if the possibility is given for the elevator to be positioned centrally;

- Figures 3 and 4 are schematical front and side views, respectively, of the parking system shown in Figure 1;

- Figures 5 and 6 are respective schematical plan views of the parking system according to the present invention, with differing numbers of parking places available;

- Figure 7 is an enlarged front view of the displacement mechanism of the motor-vehicle support platforms of the inventive parking system, as viewed in a first embodiment thereof with a platform mounted on it;

- Figure 8 is a side view of a number of motor-vehicle support platforms driven by the displacement mechanism of Figure 7, in a mutually juxtaposed arrangement thereof;

- Figure 9 is a side view of the displacement mechanism shown in Figure 7, with a motor-vehicle support platform mounted on it;

- Figure 10 is a plan view of the motor-vehicle support platform shown in Figure 9;

- Figure 11 is a perspective bottom view of the lower portion of the motor-vehicle support platform of Figure 7, incorporating a displacement mechanism in a second embodiment thereof;

- Figures 12 through to 18 are views illustrating a sequence of operating steps performed to displace a motor-vehicle parked in a given position, in the first embodiment of the parking system shown in Figures 1 and 2;

- Figures 19 through to 24 are views illustrating a sequence of operating steps performed to displace a motor-vehicle parked in another position in the parking system shown in Figures 1 and 2;

- Figure 25 is a schematical plan view of the inventive parking system in a different embodiment thereof, as provided with various displacement mechanisms in a third embodiment thereof, as made necessary by the room being interrupted at the centre owing to the provision of a stairwell and lift-shaft for persons there, wherein it should be noticed that - with any other parking system - such situation would practically make it impossible for either the left-hand half or the right-hand half of the room, depending on the location of the elevator, to be used;

- Figure 26 is a schematical front view of the parking system shown in Figure 25, as viewed with the motor-vehicles displaced into a first position;

- Figure 27 is a same view as the one appearing in Figure 26, showing the parking system with the motor-vehicles displaced into a second position;

- Figure 28 is a plan view of the various component parts of one of the mechanism for handling and displacing the motor-vehicles shown in Figure 25, in which the platform is not provided with a motor of its own, but is simply driven, i.e. displaced by the mechanical system, the hydraulic system or the linear motor, wherein it should be noticed that all these applications enable the platform to be autonomously displaced in the three directions of the Cartesian axis, i.e. two on the horizontal plane and one on the vertical plane with the platform being positioned in the elevator in the latter case;

- Figure 29 is a front view of the component parts shown in Figure 28;

- Figures 30, 31 and 32 are representations of the advantages deriving from the application of the present invention even to medium-to-large parking lots involving 137, 151 and 113 car places on 4 levels, respectively, using just a small surface area and allowing for car delivery and handling rates that would be just unimaginable with other systems, thanks to the possibility for each platform to be moved and displaced concurrently for autonomously reaching the elevator and, from the elevator, the exit;

- Figures 33 and 34 are a schematical front view and a schematical plan view, respectively, of the parking system according to the present invention in a further embodiment thereof, with two movable platforms situated in a given position;

- Figures 35 and 36 are the same views as the one apperaing in Figures 33 and 34, showing the two movable platforms moved into a different position.

[0007] Schematically illustrated in the Figures listed above is a modular construction structure 5 for an automated motor-vehicle parking system according to the present invention, which is adapted to be installed in town centres, or on areas with a limited availability of building space or, anyway, requiring a significant increase in the car parking places to surface area ratio, and in the first embodiment thereof - which is shown by way of example in Figures 1 through to 6 - such construction structure is situated below ground level, i.e. under the ground floor, and distributed over three parking tiers or floors 6, 7, 8 extending above each other, on which there are parked motor-vehicles 9, in differing numbers in the afore-cited Figures. All motor-vehicles are placed on respective movable platforms 10, which are so shaped and driven to displace as this shall be described in greater detail further on, and which are adapted to support and transport the corresponding motor-vehicles into available or pre-defined parking positions. In the example being illustrated, the modular construction structure 5 is made with the use of building-grade materials that are embedded in excavated ground, or it may be alternatively comprised of a plurality of metal beams or section bars (not shown), which, as appropriately shaped and joined to each other, are again embedded in excavated ground to form differently sized and shaped structural arrangements depending on the actual size and the capacity - in terms of number of motor-vehicles accommodated therein - of the parking lots to be built. These modular construction structures - regardless of them being made of building-grade materials or structural metal beams or sections - can most

obviously be built not only as underground structures, but also as structures rising above the ground, without departing from the scope of the present invention.

[0008] Each single parking tier or floor of the inventive parking system is provided with a surface being large enough as to allow for a plurality of motor-vehicles to be parked thereon in positions that are contiguous to, but adequately spaced from each other, or - in this example - three motor-vehicles in a mutually aligned arrangement on each tier or floor. In addition, each platform 10 is provided with a length and a width that are slightly greater than those of the related motor-vehicle that it is due to support and transport, wherein it can be readily appreciated that the car parking places themselves may be provided in any desired number and distributed in any desired arrangement including symmetrical positions, either aligned with each other or in a crosswise arrangement relative to each other, in a departure from the arrangements illustrated in the preceding Figures.

[0009] The inventive modular construction structure is furthermore shaped so as to include - in the case of more parking tiers or floors arranged above each other - at least a metal, vertically displacing elevator 11, which is driven in a manner as largely known as such in the art and capable of sliding along an appropriate vertically extending shaft 12 having a greater size than the same elevator and extending through the various parking tiers or floors 6, 7 and 8 arranged above each other. It can be noticed that such vertical shaft 12 extends in its height, i.e. vertically, from an upper level 13, which is the ground level, and moves through all levels of the various parking tiers to eventually reach a bottom level 14, which is lower than the level of the lower parking tier or floor 6, relative to which it is situated at a depth that is equal to the distance of a parking tier to the next one thereabove. The elevator 11 may in turn comprise a rigid framework 15 in the shape of a parallelepiped and consisting of at least a planar platform and any desired number of further platforms located above each other, such as a bottom planar platform 16 and an upper planar platform 17 similar to, located above and joined to each other in the example being considered, the planar surface of which is larger than the planar surface of a movable platform 10, so as to be able to accommodate the same platform jointly with the motor-vehicle parked thereupon, and these planar platforms 16 and 17 are spaced from each other so as to come to lie at the same height as two contiguous parking floors extending above each other, and so as to enable the motor-vehicles supported by the related movable platform 10 to be introduced onto the bottom planar platform without any hindrance or difficulties whatsoever.

[0010] This elevator 11 may be selectively displaced vertically from the bottom level 14, in which the bottom platform 16 lies at the same level, whereas the upper platform 17 lies at the level of the lower parking floor 6, as this can best be seen in the illustration of Figure 2, up to the upper level 13 of the ground, while moving through the levels of the various intermediate parking tiers or floors extending therebetween, and the elevator 11 may further be stopped at the level of any selected parking floor, in each one of them it comes to lie with its platforms 16 and 17 at the same level as two contiguous parking floors extending above each other, so as to be able to unload or load each motor-vehicle from or onto either both platforms 16 and 17 or even a single one of them. Furthermore, the movable platforms 10 are so shaped as to be able to displace and be arranged in the manner that shall be described in greater detail later on, both lengthwise and crosswise relative to each parking floor, in mutually aligned positions along one or more rows.

[0011] Figures 3 and 4 schematically illustrate the parking system shown in Figures 1 and 2 in a front and a side view thereof, respectively, and in a first embodiment thereof, in which there are shown various motor-vehicles 9 being parked on several parking floors extending above each other, whereas the elevator 11 is shown in the state in which it is displaced into its bottom position. Figure 5 shows the elevator 11 in the state in which it is displaced at a different level than the level of the parking floors, whereas Figure 6 shows some motor-vehicles 9 being parked on a parking floor, whereas the elevator lies at a different level.

[0012] Finally, the inventive parking system also comprises a central electronic control unit (not indicated in the Figures), whose software is pre-set and arranged so as to be able to control all driving and actuating mechanisms used to drive and displace both the movable platforms 10 and the elevator 11, in accordance with the parking place and the parking time being previously selected by the user, so that each movable platform 10 carrying a respective motor-vehicle can be automatically displaced into the selected parking place through a sequence of mutually coordinated movements of the movable platform 10 and the elevator 11, as this shall be described in greater detail further on, and so that - upon expiry of the selected parking time - the same movable platform 10, with the respective motor-vehicle parked thereupon, can be moved and brought back automatically to the place of withdrawal, where the motor-vehicle is handed over to its owner or user. In practice, each motor-vehicle to be parked in the inventive parking system being described is brought to the entrance of the same system, which is situated at ground level, coinciding with the upper displacement level 13 of the elevator 11. It is then placed on a movable platform 10, as this shall be described in greater detail later on, while the parking place and the parking time are selected through the afore-mentioned central electronic control unit, so that the movable platform 10, with the related motor-vehicle placed thereupon, is first moved into the elevator 11 and then displaced by the same elevator in the vertical direction until it reached the selected parking floor, onto which the same platform, with the related motor-vehicle placed thereupon, is first unloaded and then automatically moved - through a sequence of movements that shall be described in greater detail further on - into the selected park-

ing place, where it will then be kept dwelling up to the end of the selected parking time. Upon expiry of such parking time, the movable platform 10, again with the related motor-vehicle placed thereupon, is brought automatically back - through an inverted sequence of the movements of both the movable platform 10 and the elevator 11 - into the withdrawal position situated at the exit of the inventive parking system, which may coincide with the afore-cited entrance or be situated at a different place of the same system.

[0013] Shown in Figures 12 through to 18 are the operating sequences to be performed in order to cause a motor-vehicle that is already parked in a given position within the inventive parking system - which is comprised of several parking tiers or floors extending above each other and a related vertical elevator 11, and in which the movable platforms 10 with the related motor-vehicles 9 placed thereupon are displaced in the longitudinal direction only, and not sidewise - to displace and move towards the exit. From the illustrations in these Figures it can be noticed that, in the example being considered, on both the lower parking floor 6 and the upper parking floor 8 of the parking system there are parked three motor-vehicles 9, whereas on the intermediate parking floor 7 there are parked two motor-vehicles 9 in a mutually juxtaposed arrangement towards the left side of this parking floor. In the assumption that the motor-vehicle that has to be brought back to the exit of the parking system with the related movable platform 10 is the first one to the right on the lower parking floor 6, i.e. the one indicated with the reference numeral 9' in Figure 12, in a first operating step the elevator 11 will therefore be displaced into the lowest initial position, in which its bottom platform 16 comes to lie at the bottom level 14 and its upper platform 17 comes to lie at the level of the lower parking floor 6, in a condition in which both platforms 16 and 17 are clear.

[0014] For such motor-vehicle 9', with the related movable platform 10 thereunder, to be moved and brought back towards the exit, the electronic control unit of the inventive parking system shall in the first place operate to have the two motor-vehicles placed between such motor-vehicle 9' to be handed out and the elevator 11 appropriately displaced. This is done in a second operating step (see Figure 13) by causing the first motor-vehicle on the left-hand side to be displaced to the left with the related movable platform 10 in the longitudinal direction - through a corresponding displacement of the same movable platform occurring in the manner that shall be described in greater detail further on - so as to place the related motor-vehicle/movable platform assembly onto the upper platform 17 of the elevator 11. Similarly, both remaining motor-vehicles, along with the related movable platforms 10, are in the same operating step displaced longitudinally by a position to the left, while both motor-vehicles with the related movable platforms 10 parked on the intermediate parking floor 7 are displaced longitudinally by a position to the right, thereby clearing the first left-hand position of this parking floor. Then, in the third operating step (see Figure 14) the elevator 11 is caused to rise up to the parking floor extending immediately thereabove, in which its upper platform 17 comes therefore to lie, along with motor-vehicle/movable platform assembly placed thereupon, at the level of the intermediate parking floor 7, whereas its bottom platform 16 comes to lie at the level of the lower parking floor 6.

[0015] In the subsequent fourth operating step, illustrated in Figure 15, the motor-vehicle situated on the lower parking floor 6 and lying closer to the elevator 11 is displaced to the left with the related movable platform to be loaded onto the bottom platform 16 of the same elevator, whereas the last motor-vehicle remaining on said parking floor, i.e. the motor-vehicle 9' to be handed out, is in turn displaced by a position, with the related movable platform 10, to the left, so as to be placed near the elevator 11 now. Similarly, in the same operating step, the motor-vehicle and the related movable platform 10 supported by the upper platform 17 of the elevator 11 are displaced by a position to the right onto the intermediate parking floor 7 and located at the side of the other two motor-vehicles that are already parked with their movable platforms 10 on the same parking floor, thereby clearing the upper platform 17 of the elevator 11.

[0016] In the following fifth operating step, illustrated in Figure 16, the elevator 11 is caused to move downwards by a parking floor, thereby regaining its initial position shown in Figure 12, in which the motor-vehicle loaded with the related movable platform 10 on the bottom platform 16 of the elevator 11 remains in the same position, while the upper platform 17 of the elevator 11, which is clear now, come to lie at the level of the lower parking floor 6, where the motor-vehicle 9' to be withdrawn is positioned. In the subsequent sixth operating step, illustrated in Figure 17, said motor-vehicle 9' with the related movable platform 10 are displaced to be placed upon the upper platform 17 of the elevator 11. Finally, in the seventh and last operating step illustrated in Figure 18, the elevator 11 is caused to rise with its loads up to the upper level 13 of the ground and remains at a standstill in this position, in the condition in which the motor-vehicle 9' with the related movable platform 10 are unloaded from the upper platform of the elevator 11 to be eventually handed over to the owner/user, thereby clearing such upper platform.

[0017] At this point, the motor-vehicles that have been displaced with the related movable platforms 10 for the motor-vehicle 9' to be able to be removed for handing over in the afore-described manner, are moved back into the former parking positions thereof. This occurs by causing the elevator 11 to move downwards until its upper platform 17, which is now clear, reaches down to the level of the intermediate parking floor 7, and its bottom platform 16, carrying a motor-vehicle on a related movable platform, reaches in turn down to the level of the lower parking floor 6. In this condition, the first motor-vehicle parked on the right-hand side on the intermediate parking floor 7 is

in the first place loaded - with the related movable platform 10 - onto to upper platform 17 of the elevator 11, and both motor-vehicles still remaining on such parking floor are then displaced, along with the movable platforms 10 thereof, by one position to the left, thereby regaining their original parking position shown in Figure 12.

[0018] At the same time, the motor-vehicle with the related movable platform 10 being carried by the bottom platform 16 of the elevator 11 is unloaded therefrom to be displaced on the related movable platform 10 by two positions to the right on the lower parking floor 6, thereby regaining the former position thereof shown in Figure 12 and, therefore, clearing both the first parking place on the left side and the last parking place on the right side of such parking floor, which was formerly occupied by the motor-vehicle 9' removed. Then, the elevator 11 is lowered by one floor so that its bottom platform 16, which is now clear, comes to lie at the bottom level, while the upper platform 17 lies at the level of the lower parking floor 6. Finally, the motor-vehicle being carried along with the related movable platform 10 on the upper platform 17 is unloaded therefrom, and both said motor-vehicle and the related movable platform are then displaced by one position to the right, thereby taking place beside the other motor-vehicle remaining on the same parking floor and regaining their former position shown in Figure 12. All motor-vehicles remaining at this point in the parking system are in this way located again in the original parking positions thereof - of course, without the motor-vehicle 9' removed in the meantime - and can therefore be retrieved and removed at the end of the related parking time - or in any other desired moment - without any possibility of errors. Similarly, a new motor-vehicle can be parked at any moment in the parking place that has been left free, by having this motor-vehicle, and the related movable platform, going through the whole sequence of operating steps in the reverse order as compared with the above-indicated one.

[0019] Fully apparent from the above description is therefore the fact that, owing to the provision of the elevator 11 with its two platforms 16 and 17 provided above each other, the possibility is given - through a sequence of upward and downward movements of the same elevator and displacements of the movable platforms 10 carrying the related motor-vehicles on the various parking floors of the inventive parking system - for the motor-vehicles to be parked in, as well as retrieved and removed from any parking place whatsoever within the parking system, under the control of the electronic control unit of the same system that is pre-set and arranged to cause the elevator 11 to automatically perform all movements, and the movable platforms 10 to automatically perform all displacements, as required each time in view of obtaining the desired result in as short a time as possible and with as slim and quick an operational sequence as possible. Illustrated in Figures 19 through to 24 are now the operational sequences to be performed in order to cause a motor-vehicle parked in another given position within the inventive parking system to be conveyed towards the exit of the same system. From these Figures it can be noticed that, in the example being discussed, three motor-vehicles are parked on both the lower parking floor 6 and the upper parking floor 8, whereas on the intermediate parking floor 7 there are parked just two motor-vehicles in a side-by-side relation with each other and displaced to the left side of this parking floor. In the assumption that the motor-vehicle to be moved back with the related movable platform 10 to the exit of the system is the second one from left on the intermediate parking floor 7, as indicated in this case with the reference numeral 9" (see Figure 19), the operational sequence would then start with a first step, in which the elevator 11 is initially moved down in its lowermost position, in which its bottom platform 16 lies at the bottom level 14, whereas its upper platform 17 lies at the level of the lower parking floor 6. For the second right-hand motor-vehicle 9" to be able to be picked out and removed from the intermediate parking floor 7, what is at this point needed is to first of all have the first left-hand motor-vehicle on the same parking floor displaced. This occurs by causing in the first place the elevator 11 to move upwards by two floors, thereby displacing it in the second operating step into the position illustrated in Figure 20, in which its bottom platform 16 lies at the same level as the intermediate parking floor 7, and its upper platform 17 lies at the same level as the upper parking floor 8. Then, in the subsequent third phase illustrated in Figure 21, it can be noticed that such motor-vehicle and the related movable platform 10 are then shifted to the left and placed onto the bottom platform 16 of the elevator 11.

[0020] In the fourth operating step, shown in Figure 22, it can be noticed that the elevator 11 is moved downwards by one floor into a position, in which its bottom platform 16 lies at the same level as the lower parking floor 6 and its upper platform 17 lies at the same level as the intermediate parking floor 7 for the motor-vehicle 9" to be able to be loaded thereonto with the related movable platform 10. In the following fifth operating step shown in Figure 23, the motor-vehicle 9" to be handed over to the owner is loaded with its own movable platform 10 onto the upper platform 17 of the elevator 11. Finally, in the sixth and last operating step shown in Figure 24, the elevator 11 is caused to rise until its upper platform 17 reaches up to the same height as the upper ground level 13, in which also the motor-vehicle 9" with the related movable platform 10 lies at the same level and can therefore be collected by its owner/user, thereby clearing said upper platform. Thereupon, the elevator 11 is caused again to move downwards until its bottom platform 16 comes to lie at the same level as the intermediate parking floor 7, wherein the motor-vehicle carried with its own movable platform 10 on said bottom platform 13 of the elevator 11 can at this point be unloaded therefrom and displaced into their original parking position shown in Figure 19.

[0021] Shown now in Figures 7 to 10 is the mechanism

used to move and displace the movable platforms 10 used to carry the motor-vehicles being parked in the inventive parking system, in which these movable platforms are illustrated in a first embodiment thereof. In particular, Figure 7 is a side view of a movable platform 10, without any motor-vehicle being placed thereupon, and the mechanism provided thereunder to move and displace such movable platform, whereas in Figure 8 there are illustrated three movable platforms 10 arranged in a side-by-side relation to each other and carrying respective motor-vehicles 9, with the related mechanism provided thereunder to move and displace all such movable platforms 10.

[0022] As it can further be seen in the illustrations of Figures 7, 9 and 10, each movable platform 10 is comprised of two elongated planar support plates 18 and 19 in the shape of a rectangle, arranged in a parallel relation to and slightly spaced from each other in the longitudinal direction, and joined to each other by upper cross-bars 20 and 21 extending again parallel to and spaced from each other, and such platform is arranged so that its width dimension and its length dimension are oriented in the direction of the length and the direction of the width, respectively, of each parking floor in the inventive parking system, so as to be able to solely move and displace longitudinally, whereas a displacement crosswise is in this case prevented by the limited width of such parking floors.

[0023] The upper surface 22 of the same platform is where each motor-vehicle to be carried is placed. The above-mentioned planar plates 18 and 19 are provided on their lower side with two pairs of sliding wheels 23 and 24, arranged in a parallel relation to and spaced from each other in the direction of the width of the same plate, and adapted to slide along corresponding longitudinal guide rails 25 and 26 provided thereunder and attached to each parking floor along the whole length and width thereof, in this particular case in an arrangement in which they extend in a parallel relation to and spaced from each other transversally across the same floor, so that each pair of wheels 23 and 24 is able to slide along the corresponding guide rail 25 and 26.

[0024] Furthermore, the planar plates 18 and 19 are so shaped as to feature a respective sloping side plane 27 and 28 in the length direction thereof, which is provided so as to allow for each motor-vehicle to be conveniently loaded onto and unloaded from the upper surface of said plates. Finally, the planar plates 18, 19 are provided with a respective blind bore 29 provided in the lower surface thereof, and extending down to a certain depth of the same plates, whose task is to allow for the plates to be displaced in the manner that shall be described below.

[0025] The mechanism used to move and displace the movable platforms 10 is in turn comprised of (see Figures 7 and 8) at least a rectilinear, elongated helical screw or worm 30, which is situated in a position that is slightly raised from the level of each parking floor, and is accommodated in a position below at least one of the movable platforms 10 in the longitudinal direction thereof, wherein such helical screw is provided with a fixed end situated close to the backing wall 31 of the parking room and secured to the floor 33 of the related parking floor by means of anchorage means 32, and is driven rotatably in both directions of rotation thereof by a gearmotor unit 34, which is also supported by such fixed end of the screw, wherein such screw is adapted to rotate freely and to engage, with the free end on the opposite side thereof, a corresponding internal helical thread of a sliding bush 35, which is attached to the side of a movable parallelepiped-shaped carriage 36 situated in a position below the movable platform 10 and provided on its lower side with two pairs of sliding wheels 37 and 38 arranged parallel to and spaced from each other in the width direction of the same carriage, and capable of sliding on corresponding planar and lower inner wings 39 and 40 of the guide rails 25 and 26. As can be seen in Figure 9, the wheels in each pair of wheels of the movable carriage 36 are joined to the ends of a related side transmission shaft 41 along with further stabilizing wheels 42 and 43 arranged orthogonally thereto and capable of sliding along the corresponding planar and upper inner wings of the same guide rails 25 and 26. To the side transmission shaft 41 situated close to the backside end portion of the carriage 36 there are mounted - appropriately spaced from each other - two solenoids 44 and 45 connected to and included in the electric circuit of the parking system, and controlled by the electronic control unit governing the same parking system, wherein such solenoids are adapted to act upon respective movable cores 46 and 47 that are in turn adapted to cooperate with the afore-cited corresponding blind bores 29 in the planar plates in such a manner as to be concurrently displaced from a resting, retracted position (shown in Figure 7), in which they are disengaged from the blind bores 29, when the solenoids 44 and 45 are de-energized, so that the movable carriage 36 is not linked to the movable platform 10 and can be freely displaced in the longitudinal direction by the rotation of the screw 30, owing to the latter engaging the bush 35 in the afore-described manner, to a working extracted position, in which the movable cores 46 and 47 fit into the blind bores 29 when the solenoids 44 and 45 are energized, so that the movable carriage 36 is temporarily linked to the movable platform 10, whereby the rotation of the helical screw 30 causes both the movable carriage 36 and the movable platform 10 coupled thereto to be displaced longitudinally, in either the forward or the backward moving direction thereof depending on the direction of rotation of the same screw. In this manner, the rotation of the helical screw 30, which is constantly in an engaged state with the bush 35, always and in all cases causes the movable carriage 36 to displace, in either lengthwise moving direction thereof, from the closest to the farthest position relative to a possibly provided elevator 11, and the movable carriage 36 being displaced in this way can in turn cause either a single movable

platform 10 or a plurality of movable platforms 10 at a time to be displaced accordingly, in the condition in which said movable platforms are linked to such movable carriage as described hereinbefore, or can even fail to cause movable platforms 10 to be displaced, in the case that these are not linked to the same carriage, so that the possibility is given, actually, to each time select - according to the requirements - whether any movable platform 10 whatsoever - with or without a motor-vehicle loaded thereupon - has or has not to be displaced into given positions as desired.

[0026] Figure 11 can be noticed to illustrate a movable platform 48 in a second embodiment thereof, in which the same platform is provided with its own driving motor system, so that it no longer requires any of the driving and displacing mechanisms and related guide rails described above in connection with the first embodiment. Even in this case, the movable platform 48 is comprised of two elongated planar plates (not shown) in the shape of a rectangle, arranged parallel to and slightly spaced from each other, and adapted to support a motor-vehicle on the upper surface thereof, wherein said plates are joined to each other by means of two cross-bars (not shown) extending again parallel to and spaced from each other. Under these elongated planar plates there are mounted at least three gearmotor packages along with the related motion transmission members that are driven by such gearmotor packages so as to cause the movable platform 48 to displace autonomously lengthwise or crosswise, wherein such gearmotor packages substantially include a first package 49, a second package 50 and a third package 51 mounted under the movable platform 48, and appropriately attached thereto, and wherein the first such package 49 is provided to drive said movable platform in the longitudinal displacement direction - both forwards and backward - in each parking floor of the inventive parking system, whereas the second package 50 is provided to drive the movable platform 48 in the direction moving orthogonally to the longitudinal one - again both forwards and backwards - across the related parking floor. The third package 51 is provided to reverse the direction of rotation of each one of the other two gearmotor packages and, therefore, the direction in which the movable platform 48 is moving longitudinally or transversally on a related parking floor.

[0027] In addition, this movable platform 48 is provided on the lower side thereof with a full set of wheels to enable the same platform to moved, i.e. be displaced in either longitudinal or crosswise direction, as selected. These wheels are comprised of two pairs of wheels 52 and 53, arranged parallel to and adequately spaced from each other, of which at least a wheel is rotatably driven by the first gearmotor package 49, thereby rotatably driving also the remaining wheels, and such wheels are oriented in the transversal direction of the movable platform 48 so as to move the same platform in the longitudinal direction of the parking floor. The movable platform 48 is furthermore provided with another set of wheels arranged thereunder parallel to and adequately spaced from each other, which are in this case oriented orthogonally to the above-cited ones, in the longitudinal direction of the movable platform 48, so as to move the same platform in the transversal direction of the parking floor. In the example being discussed, these wheels consist of two pairs of wheels 55 and 56 provided coaxially to each other, of which at least one of the wheels is rotatably driven by the second gearmotor package 50 via appropriate motion transmission means, which are comprised of a driving belt 54 in this particular case.

[0028] The wheels 55 and 56 for the crosswise displacement of the movable platform 48 are displaceable vertically with the help of appropriate actuation means attached to the underside of the same platform, from a raised position close to the platform, in which they are not in contact with the floor of the parking floor, in the condition in which such movable platform is solely supported on the floor by the other pairs of wheels 52 and 53 and, as a result, can only displace lengthwise, i.e. in the longitudinal direction, to a lowered position in contact with the floor of the parking floor, in the condition in which the platform is solely supported on the floor by the wheels 55 and 56 - while the other wheels 52 and 53 are on the contrary raised - and, as a result, said movable platform 48 can only displace crosswise, i.e. in the transverse direction.

[0029] All such gearmotor packages 49, 50, 51 are included in and connected to the electric circuit of the parking system and are operated by the central electronic control unit of the same system so as to cause each platform - with the related motor-vehicle placed thereupon - to perform the required displacement movements in view of having each motor-vehicle eventually parked in the selected, pre-defined or pre-existing position, as the case may be, as well as in view of having such platforms and the related motor-vehicles removed for withdrawal at the end of the parking time.

[0030] Figures 25 to 27 illustrate another embodiment of the inventive parking system, in which the latter features a different construction. In this case, each horizontal parking floor can be noticed to extend in both the longitudinal and the transverse direction and it is much larger than the previously discussed parking system, thereby ensuring the availability of a greater number of parking places on each single parking floor. Solely considered in this example is a single horizontal parking floor 58 configured so as to allow for two rows of parking places extending parallel to and spaced from each other in the transverse direction of the system, in which the first row of parking places does not extend over the full length of the system, since it is limited by the shape of the existing building, and is therefore formed of a pair of parking places 59 and 60 arranged - on the left-hand side of the building - parallel to and spaced apart from each other in the longitudinal direction of the same building, so that the movable platforms 10 - when parked there - are disposed with the shorter transversal sides thereof aligned in the

longitudinal direction, and the longer longitudinal sides thereof aligned in the transversal direction of the building. Such first row of parking places further comprises another parking place 61, which is similar to and aligned with the other two parking places described above, and is situated on the right-hand side of the building in a position lying between a first and a second vertically displacing elevator 62 and 63, which are substantially similar to the elevator 11 described hereinbefore, wherein the first one 62 of such elevators is displaceable vertically between the level of the parking floor 58 and a level 64 lying therebelow and coinciding with the entrance and the exit of the inventive parking system being illustrated, and wherein the second one 63 of such elevators is displaceable vertically between the level of the parking floor 58 and a level 65 lying thereabove, so as to be able to move the movable platforms 10 - with or without motor-vehicles placed thereupon - on and across three parking levels lying above each other, while supporting the same movable platforms 10 on a single one or both the upper and bottom platforms of the same elevators, and displacing such movable platforms 10 through a sequence of movements not only lengthwise, i.e. in the longitudinal direction of the parking floor 58, but also crosswise, i.e. in the transversal direction thereof, as this can be seen in the example illustrated in Figures 26 and 27.

[0031] In turn, the second row of parking places extends over the full length of the parking system and comprises seven parking places 66, 67, 68, 69, 70, 71 and 72 aligned with and appropriately spaced from each other in the longitudinal direction, of which the two parking places 66 and 67 to the left are aligned transversally with the respective parking places 59 and 60 of the first row, whereas the last three parking places 70, 71 and 72 to the right are aligned transversally with the first elevator 62, the further parking place 61 of the first row and the second elevator 63, respectively. All above-described parking places are provided with longitudinal guide rails 73 and 74 running parallel to each other. In the first row, these guide rails extend between the first two left-hand parking places 59 and 60 and between the elevators 62 and 63, while passing through the further parking place 61; in the second row, they on the contrary extend between all seven parking places provided there, wherein these parking places are additionally provided with guide rails 75 and 76 running transversally and parallel to each other, which extend between the first two left-hand parking places 59 and 60 of the first row and the corresponding left-hand parking places 66 and 67 of the second row, between the first and the second elevator 62 and 63 of the first row and the corresponding right-hand parking places 70 and 72 of the second row, and between the further parking place 61 of the first row and the corresponding right-hand parking place 61 of the second row. Each parking place described above is provided with driving mechanisms for the movable platforms 10, which are adapted to enable the same platforms to be displaced along both the longitudinal guide rails and the transverse guide rails, and also to be displaced - through a 90°-rotation - from the longitudinal guide rails to the transverse guide rails, and vice-versa.

[0032] In this manner, thanks to the provision of the elevators 62 and 63 and the driving mechanisms, which shall be described in greater detail further on, the possibility is given for the movable platforms 10 - along with the motor-vehicles placed thereupon - to be automatically displaced and moved into the selected, pre-defined or previously held parking place, as the case may be, within the inventive parking system being considered, through a sequence of vertical displacements of either or both elevators 62 and 63, as well as a sequence of horizontal movements of the movable platforms along the longitudinal and transversal guide rails, and possibly also rotational movements of the movable platforms from the longitudinal to the transversal ones, or vice-versa.

[0033] Illustrated in Figures 28 and 29 are the above-cited driving mechanisms for the movable platforms 10, as associated with a parking place across which there run a pair of longitudinal guide rails 73 and 74 and a pair of transversal guide rails 75 and 76 embedded in the floor of the parking floor so that the upper portion thereof lies flush with the surface of the same floor.

[0034] In the central portion of the square area delimited by such longitudinal and transversal guide rails, there is provided a turntable 77 secured to the bottom and with a first movable frame 70 provided thereabove to define a rotary platform, wherein to such frame there is linked in an articulated manner a second movable frame 79 lying thereabove and consisting of rigid bars appropriately fastened to each other and featuring a length that is shorter than the distance existing between each pair of guide rails and a reduced width that is smaller than said length, wherein such first movable frame is rotatably driven by at least an electric motor 80 of a traditional kind and capable of being supplied with d.c. or a.c. voltages of differing magnitude, said motor being supported by the same movable frame, connected to and included in the electric circuit of the parking system, and controlled by the central electronic control unit governing the entire parking system. In this manner, the first movable frame 78 can be driven to rotate, jointly with the turntable 77 and the second movable frame 79 thereabove, by such electric motor 80, via appropriate motion-transmission members (not shown), from a position that is aligned with the longitudinal guide rails 73 and 74, as can best be seen in Figure 28, to a position that is angularly displaced by 90° from the previous one and aligned with the transversal guide rails 75 and 76, and can be driven to rotate in the reverse direction, as well. The second movable frame 79 is linked in an articulated manner with the first movable frame 78 by means of a parallelogram-shaped arrangement comprised of a first movable arm 81 hinged with an end portion thereof on to a bracket 82 secured to the first movable frame 78 and, with the other end portion thereof, on to a pin 83 mounted to the second movable frame 79, close to an end portion thereof, where-

in the parallelogram-shaped arrangement also comprises a second movable arm 84 similar to the first one described above and - exactly as the latter - hinged with an end portion thereof on to a bracket 85 secured to the first movable frame 78 and, with the other end portion thereof, on to a pin 86 mounted to the second movable frame 79, close to the other end portion thereof. The above-cited parallelogram-shaped arrangement is further provided with at least a hydraulic or pneumatic cylinder 87 included in a corresponding hydraulic or pneumatic system operated by the central electronic control unit of the inventive parking system, and connected with an end portion thereof to a bracket 88 secured to the first movable frame 78 and, with the other end portion thereof, to the pin 83, on which there is also hinged the movable arm 81, so that this cylinder is capable of being operated into two different working positions, in which it causes the parallelogram-shaped arrangement to displace into corresponding positions, i.e. from a first non-operative position, in which the second movable frame 79 is lowered onto and lying close to the first movable frame 78, to a second working position, in which the second movable frame 79 is raised (see Figure 29) and moved away from the first movable frame 78, and vice-versa. It can be readily appreciated that such lowering and rising movement of the second movable frame 79 relative to the first movable frame 78 can also be brought about with the help of mechanisms that are different from the parallelogram-shaped one described above, without departing from the scope of the present invention.

[0035] In turn, the second movable frame 79 is provided with a set of guide rollers 89 supported by related shafts 90 secured across the same frame and appropriately spaced from each other in the longitudinal direction of this frame, wherein these guide rollers are provided coaxial with pulleys 91 round which there are wound appropriate motion-transmission means, such as sprocket chains 92, or the like, that are concurrently driven to rotate by an electric motor 93 of a traditional kind, which is capable of being supplied with d.c. or a.c. voltages of differing values, is supported by the same movable frame, is connected to and included in the electric circuit of the parking system, and is operated by the central electronic control unit of the same parking system. The guide rollers 89 are rubber-clad and are intended to support and displace a related movable platform 10 with or without motor-vehicle placed thereupon. The displacement mechanisms of each parking place further comprise four rotary planar platforms 94, 95, 96, 97 attached in recessed positions in the floor and located at the angular zones at which the longitudinal rails join with the transversal ones, whose planar upper surfaces 98 lie flush with the upper surface of the movable platforms 10 and are so configured as to feature vertical walls 99 acting as delimiting surfaces or borders adapted to prevent the motor-vehicles carried by the related movable platforms 10 from displacing.

[0036] The rotary platforms 94-97 are provided with corresponding vertical rotating shafts 100-103 fitted into related bushes or bearings (not shown) contained in proper housings (of which only the housings 104 and 105 are shown in the Figures) that are appropriately secured in positions recessed into the floor, wherein such platforms are further provided with appropriate motion-transmission means (not shown) that are connected to each other by driving shafts 106-109, which are c concurrently driven into rotation by an electric motor 110, which is itself mounted at the same level as the above-noted housings, is capable of being supplied with d.c. or a.c. voltages of differing values, is connected to and included in the electric circuit of the parking system, and is operated by the central electronic control unit of the same parking system. In this way, the rotary platforms 94-97 can be rotatably driven at the same time from one to the other of two mutually orthogonal positions, so as to orientate the vertical walls 99 in corresponding positions, depending on the position in which the movable frames 78 and 79 and the movable platform 10 thereabove - with or without a motor-vehicle placed thereupon - are themselves from time to time oriented, in view of enabling such vertical walls to delimit the motor-vehicles loaded on the related movable platforms 10 on all sides, thereby ensuring on the one side a correct positioning of each motor-vehicle on the movable platform, so that it is then enabled to correctly arranged on the longitudinal or transversal guide rails, as the case may be, and, on the other side, effectively preventing each such motor-vehicle from undesirably displacing from that position. It can therefore be most readily appreciated that, thanks to the provision of the above-described displacement and driving mechanisms, the longitudinal and transversal guide rails and the elevators, the possibility is given for the various platforms 10 - either with or without a motor-vehicle placed thereupon - to be displaced with a sequence of synchronized movements that furthermore enable each movable platform, with a related motor-vehicle placed thereupon, to be moved and placed exactly in the selected, pre-defined or pre-existing position, as the case may be, as well as such platform, and the motor-vehicle placed thereupon, to be removed for withdrawal from said parking position, with as low as possible a number of movements, thereby also optimizing the ratio of the available parking surface to the number of parking places obtainable in the inventive parking system. In particular, when a movable platform 10 is displaced into a given parking position, in which it is oriented in the same position as it has been displaced when moving along the related guide rails, and it is due to stay in that position, the parallelogram is moved into the resting, i.e. non-operative, lowered state thereof, jointly with the guide rollers 89, and the platform is arranged and left exactly in that position upon such guide rollers.

[0037] If a platform lying upon the guide rollers 89 - either with or without a motor-vehicle placed thereupon - has on the contrary to be moved along guide rails with a different orientation to be eventually arranged in a park-

ing position situated along these guide rails, the parallelogram-shaped arrangement is first raised, jointly with the movable platform 10 and the motor-vehicle possibly placed thereupon, and then rotated so as to orientate the same platform in the correct manner; then the parallelogram-shaped arrangement is lowered again and the platform is placed on the corresponding guide rails to be finally moved into the required or desired parking position.

[0038] In a parking system implemented in the above-described manner, in each parking tier or floor there are provided suitable free spaces that are available to enable the movable platforms - either with or without motor-vehicles placed thereupon - to be moved among the various parking places provided there, by following the shortest possible routes, to ultimately have each such platform, and the motor-vehicle carried by it, arranged exactly in the selected, pre-defined or pre-existing parking place, as the case may be, and to withdraw such platform, and the motor-vehicle carried by it, at the end of the parking time for carrying it to the exit of the parking system and delivering the motor-vehicle to its owner/user.

[0039] Illustrated in Figures 33 to 36 is now a motor-vehicle handling and displacement mechanism of a rotary kind in a different embodiment thereof, which is adapted to displace the motor-vehicles from one to the other of the longitudinal and transversal directions of the parking system according to the present invention, and even in directions other than said longitudinal and transversal ones, so as to again enable such motor-vehicles to be conveniently parked on several tiers or floors lying above each other. In particular, in Figures 33 and 34 there can be seen two motor-vehicles 9 that, carried by related movable platforms 10, are being displaced into a given position on two horizontal floors 6, 7 lying above each other in a vertically extending building in the shape of a cylindrical tower 111, provided with a plurality of such horizontal floors lying above each other, as well as an elevator 11 arranged in the central portion of the building and displaceable vertically through all such horizontal floors of the same building. As it can be noticed in these Figures, on each floor there is mounted a circular rotating horizontal support platform 113, which is rotatably adaptable in the internal vertical shaft 114 being defined by the circular peripheral wall 115 of the building, and which is configured to feature an internal circumference 116 circumscribing the vertical displacement shaft 117 of the elevator 11, as well as an external circumference 118 that is circumscribed by the peripheral wall 115 of the building, from which it is slightly spaced by a small gap existing therebetween.

[0040] Each support platform 113 can be operated individually to rotate, in the direction indicated at A in the Figures, independently of the other platforms, by means of appropriate motion-transmission or driving mechanisms, which are preferably comprised of a set of rack-work-type gearmotor packages (only the external packages 119 being shown in Figure 34), and which are provided to cooperate with the respective external circumference 118 and internal circumference 116 of the same rotating platform, and the sliding movement of such circumferences may occur either freely or along corresponding tracks or rails (not shown) provided on the related floor of the building. Along the external circumference 118 thereof, each such rotating platform 113 is furthermore delimited by a sequence of upright posts 120 secured to the related floor and angularly spaced from each other, which are adapted to guide the rotary movement of the same platform, and is provided with a plurality of parking places 121 similar to each other, arranged in a star-like pattern and spaced from each other by a same angular distance, each one of which is intended to support a movable platform 10 with the related motor-vehicle placed thereupon, and is provided with mechanisms 122 for raising and lowering the same platforms, which are substantially similar to the mechanisms described in connection with the embodiment illustrated in Figures 28 and 29, except for the rotation mechanisms, which are not contemplated in this case.

[0041] Anyway, each movable platform 10 is carried by the elevator 11 up to the level of a respective rotary platform 113 (see Figures 33 and 34) and placed onto a corresponding free parking place available on the same rotary platform or, in the opposite case, such movable platform, along with the related motor-vehicle, is withdrawn from such parking place on the rotary platform, and these operations are performed by causing the platform 113 to rotate so as to have each parking place 121 from time to time aligned with the position in which the related movable platform 10 is placed, or has to be placed, as the case may be, on the elevator 11.

[0042] If the tower-like building 111 is communicating with further parking floors of either the same or other buildings (not shown) provided adjacent thereto and communicating with the corresponding floors of said building via through-apertures (not shown) provided in the peripheral wall 115 of the same building, the movable platforms 10 with the related motor-vehicles can also be displaced towards the further parking places provided on such floors, in which there are installed the guide rails (not shown) for the movable platforms to move therealong, in view of ultimately arranging such movable platforms on the selected or pre-defined parking places or, conversely, withdrawing such movable platforms from said same parking places.

[0043] The rotary support platform 113 thereby enables the movable platforms to be put on both longitudinally and transversally extending rails - or even into different arrangements - without any need arising for rotation mechanisms of the kind described with reference to Figures 28 and 29 to be provided, actually. It will most readily be appreciated that the rotation of the rotary support platforms 113 may be also brought about with the aid of motion-transmission or driving means other than the ones described above by mere way of example, without departing from the scope of the present invention. In

this connection, on each floor of the tower-like building 111 there may for instance be provided a stationary circular platform and, located thereabove, a rotary circular platform (neither of them shown), on which there is mounted - at each parking place 121 - a turntable (not shown) in the same way as illustrated in Figures 28 and 29, wherein such turntable is adapted to bring about, by its rotation, also the rotation of the rotary platform. In Figures 35 and 36 there can be noticed two motor-vehicles 9 carried by related movable platforms 10, as they are moved into different positions on the two horizontal floors 6, 7 lying above each other.

Claims

1. Automated parking system comprising one or more floors lying above each other, adapted to be installed in town centres, or on variously shaped areas with a limited availability of building space or, anyway, requiring a significant increase in the ratio of number of car parking places to available surface area, provided with movable platforms for supporting and carrying motor-vehicles to previously selected or defined parking positions, the system comprising a modular construction structure that is adapted to be installed, in the case of more parking floors being provided, either below ground level or in positions rising above ground level, the modular construction structure being made with the use of building-grade materials or be comprised of a plurality of appropriately shaped metal beams or section bars joined to each other to delimit one or more horizontal floors for parking motor-vehicles placed on said movable support and transport platforms, and to delimit, in the case of more floors lying above each other being provided, at least a vertical shaft adapted to accommodate vertically displacing elevator means driven by driving means as generally known as such in the art, and displaceable through the various parking floors extending above each other at different heights, to transport said movable platforms, either with or without motor-vehicles placed thereupon, from one to the other of the various parking floors, the system further comprising central electronic control means adapted to control said movable platforms and said elevator means so as to displace said movable platforms, and the motor-vehicles placed thereupon, in accordance with the parking place and the parking time that are previously selected by the user, from an entrance of said parking system up to the selected parking place, and to move back, upon expiry of the selected parking time, said movable platforms with the related motor-vehicles to the exit of the parking system for each parked motor-vehicle to be in this way capable of being returned to its owner/user, **characterized in that** said movable platforms (10; 48) are provided with displacement and driving means (30, 34, 35; 49, 50, 51) adapted to cause said movable platforms, either with or without motor-vehicles being placed thereupon, to displace in the longitudinal and transverse directions throughout the parking system for said movable platforms to be eventually arranged on the selected parking floor and the selected parking place and, upon expiry of the parking time, to be then removed from such parking floor and such parking place and brought back to the exit area of the parking system, and **characterized in that** said possibly provided elevator means (11) are configured so as to be able to carry one or more movable platforms (10; 48), either with or without a motor-vehicle being placed thereupon, to parking floors lying above each other, and **characterized in that** there are possibly included also rotating transport means (77, 78, 79) adapted to displace said movable platforms (10; 48), either with or without a motor-vehicle being placed thereupon, from the longitudinal displacement directions to the transverse displacement directions of the same platforms, and vice-versa, wherein said displacement and driving means (30, 34, 35; 49, 50, 51), said possible elevator means (11) and said possible rotating transport means (77, 78, 79) are controlled and operated by said central electronic control means of the parking system so as to arrange each movable platform (10; 48) with the related motor-vehicle (9) on the selected parking floor at the selected place with the required orientation through a sequence of synchronized movements aimed at first of all temporarily clearing the displacement route to be followed by said movable platform (10; 48) with the related motor-vehicle of all motor-vehicles (9) and the related movable platforms (10; 48) that are already parked along such route and would therefore be a hindrance to the passage of said movable platform carrying the motor-vehicle to be parked, and then moving said movable platform (10; 48) with the related motor-vehicle up to the selected parking place, where it is then left until the end of the parking time, and bringing back to the initially held positions the movable platforms (10; 48) and the related motor-vehicles that had previously been temporarily removed from the above-cited displacement route, wherein said central electronic control means are further adapted to control said displacement and driving means (30, 34, 35; 49, 50, 51), said possible elevator means (11) and said possible rotating transport means (77, 78, 79) so as to have the movable platform (10; 48) with the related motor-vehicle brought back, at the end of the parking time, from the place where it had been parked towards the exit area of the parking system through an inverted sequence of the above-described synchronized movements, so as to clear said parking place and make it available for subsequent parking needs.

2. Parking system according to claim 1, **characterized in that** said displacement and driving means of said movable platforms (10), which are provided with wheels (23, 24) adapted to move along guide rails (25, 26; 73, 74, 75, 76), comprise in this particular case at least an elongated, rectilinear helical screw or worm (30) situated in a position that is slightly raised from the level of each parking floor and is arranged in a position underneath the related movable platform (10), wherein said helical screw (30) is appropriately provided with a fixed end and secured to the floor by means of appropriate anchorage means, and is further provided with a free end on the opposite side of the fixed one, which engages sliding means (moving bush 35) attached to a movable carriage (36) arranged under said movable platform (10) and provided with wheels (37, 38) adapted to move along said guide rails (25, 26; 73, 74, 75, 76), wherein said helical screw (30) is driven rotatably in both directions of rotation thereof by means of motor means (gearmotor package 34) controlled and operated by said central electronic control means of the system, and further comprise restraining means (movable cores 46, 47) firmly joined with the wheels of said movable carriage (36) and actuatable by actuating means (solenoids 44, 45) so that, as said helical screw (30) rotates, said restraining means (46, 47) may be caused to temporarily engage said movable platform (10), thereby causing it to displace jointly with said movable carriage (36), or to disengage said movable platform, thereby preventing it from displacing, while only enabling said movable carriage (36) to displace, wherein the above-noted helical screw can be replaced with an equivalent pushing action exerted by hydraulic pistons, linear motors or pins with drive chain.

3. Parking system according to claim 1, **characterized in that** said displacement and driving means of said movable platforms (48), which are provided with a first and a second pair of wheels (52, 53; 55, 56) oriented orthogonally to each other and adapted to roll on the floor in the longitudinal and transverse directions, comprise first, second and third motor means (49, 50, 51) adapted to rotatably drive said first pair of wheels (52, 53) or said second pair of wheels (55, 56), and to reverse the direction of rotation of said first or second motor means (49, 50), respectively, wherein the wheels of said first and said second pair of wheels are associated with vertical displacement means adapted to alternately raise and lower the one or the other of said pairs of wheels, so that each pair of wheels, when lowered, are in contact with the floor and adapted to roll thereupon.

4. Parking system according to claims 2 and 3, **characterized in that** said possibly provided elevator means (11) are configured so as to feature a single planar platform or any number whatsoever of planar platforms (16, 17) extending above each other, to support corresponding numbers of said movable platforms (10; 48), either with or without motor-vehicles placed thereupon, wherein said planar platforms (16, 17) are spaced vertically from each other such that, at each stop position of said elevator means (11), they come to lie at the level of respective parking floors situated above each other in the parking system.

5. Parking system according to claim 4, **characterized in that** said possibly provided rotating transport means comprise rotary means (turntable 77) provided in the central zone of each parking place, as delimited by pairs of longitudinal guide rails (73, 74) and transverse guide rails (75, 76), wherein said rotary means (77) rotatably support a first and a second movable frame (78, 79) provided above each other and joined with each other in an articulated manner via articulation means (81, 84, 87), and are rotatably driven, jointly with said first and second movable frames (78, 79), by related drive motor means (80) from a position in which said movable frames (78, 79) are oriented in the direction of the longitudinal guide rails (73, 74), to a position in which said movable frames (78, 79) are oriented in the direction of the transverse guide rails (75, 76), and vice-versa, wherein said second movable frame (79) is provided with wheels (89), which are driven by related motor means (93) and adapted to support and displace a related movable platform (10) from one to the other of the positions oriented in the longitudinal direction or in the transverse direction, and is capable of being lowered or raised through said articulation means (81, 84, 87) relative to said first movable frame (78), in the condition in which said first and second movable frames (78, 79) lie close to each other, when the parking place is clear or is accommodating a movable platform (10), either with or without a motor-vehicle being placed thereupon, that needs not to be displaced any more, and in which said first and second movable frames (78, 79) are moved away from each other when in the parking place there has been placed a movable platform (10), either with or without a motor-vehicle placed thereupon, that has to be displaced by the rotation of said wheels (89) in a direction that is orthogonal to the one in which it is oriented **in that** moment, respectively.

6. Parking system according to claim 5, **characterized in that** each parking place is provided with position confinement means (94-97) cooperating with each motor-vehicle loaded on a related movable platform (10) so as to prevent it from displacing from its position, wherein these position confinement means comprise a set of vertical-axis rotary platforms (94-97) situated at the corners of the parking area

and provided with upper resting surfaces (98) at the same level as the upper surface of said movable platform (10), when the latter lies in a parking position, and with upright delimiting walls (99) aimed at preventing the motor-vehicles from displacing, wherein said rotary platforms (95-97) are driven by related drive motor means (110), via appropriate motion-transmission means (106-109), concurrently with the rotation of said movable frames (78, 79), so as to be from time to time oriented in the same direction as the movable frames are.

7. Parking system according to any of the preceding claims, **characterized in that** it enables more platforms to be handled and displaced at the same time, both on the same parking floor and on different parking floors, since said central electronic control means are so arranged and programmed as to be able to concurrently receive even a plurality of parking demands, which are then handled autonomously in a consequential sequence in the horizontal movements up to the elevator shaft, wherein such consequential sequence is only interrupted, albeit for limited time intervals, by the upward or downward displacement movements, thereby allowing the motor-vehicles to be taken in charge for parking and withdrawn for delivery at a fast rate, with handling times that are reduced by half, or even more, as compared with typical handling times of traditional systems.

8. Parking system according to any of the preceding claims, **characterized in that** it enables also pre-existing building, e.g. masonry structures to be used in conjunction with the use of platforms provided with means for moving the motor-vehicle into and out of the pre-existing parking rooms or areas, thereby doing away with the need for any excessive number of platforms to be used.

9. Parking system according to claim 5, **characterized in that** said possibly provided rotating transport means comprise a respective horizontal rotating circular support platform (113), provided on the internal vertical shaft (114) of each horizontal parking floor of a vertically extending building in the shape of a cylindrical tower (111) provided with a plurality of horizontal floors lying above each other, wherein said rotating platform (113) is rotatably fitted in said internal vertical shaft (114) and is configured to feature an inner circumference (116) circumscribing the vertical displacement shaft (117) of said elevator means (11), and an outer circumference (118) circumscribed by the peripheral wall (115) of the building in a slightly spaced relation thereto, wherein each such rotating platform (113) is rotatably driven by motion-transmission and drive means (119) independently of the other rotating platforms (113), and is provided with a plurality of similar parking places (121) distributed in a star-like arrangement at regular angular intervals from each other, wherein each such parking place is intended to support a movable platform (10) with the related motor-vehicle, and is provided with mechanisms (122) for raising and lowering the same platforms, much like said first and second movable frames (78, 79), wherein said rotating platform (113) is adapted to be rotatably driven to each time bring each such parking place (121) into alignment with the position in which the related movable platform (10) is arranged and oriented on said elevator means (11), when the latter are displaced to the same level as the rotating platform, so as to place said movable platforms (10) onto the corresponding free parking places of said rotating platform (113) or to withdraw said movable platforms (10) from the parking places (121) on which they are lying.

10. Parking system according to claim 9, **characterized in that** said motion-transmission and drive means comprise a set of rackwork-type gearmotor packages (119) cooperating with the related outer circumference (118) and inner circumference (116) of said rotating platform (113).

11. Parking system according to claim 9, **characterized in that**, if the tower-like building (111) is communicating with further parking floors of either the same or other buildings provided adjacent thereto and communicating with the corresponding floors of said building via through-apertures provided in the peripheral wall (115) of the same building, said movable platforms (10) can also be displaced towards such further parking places provided on such floors, in which there are installed said guide rails for said movable platforms (10) to be able to move therealong, in view of ultimately arranging said movable platforms (10) on the selected or pre-defined parking places or, conversely, withdrawing such movable platforms (10) from said same parking places.

12. Parking system according to claim 9, **characterized in that** said motion-transmission and drive means comprise a motor-driven rotary plate, or turntable, mounted on each parking place (121) of a rotating platform provided upon a stationary platform on each floor pf said tower-like building (111), wherein such turntable is adapted to cause, by the rotation thereof, also said rotating platform to rotate accordingly.

FIG.2

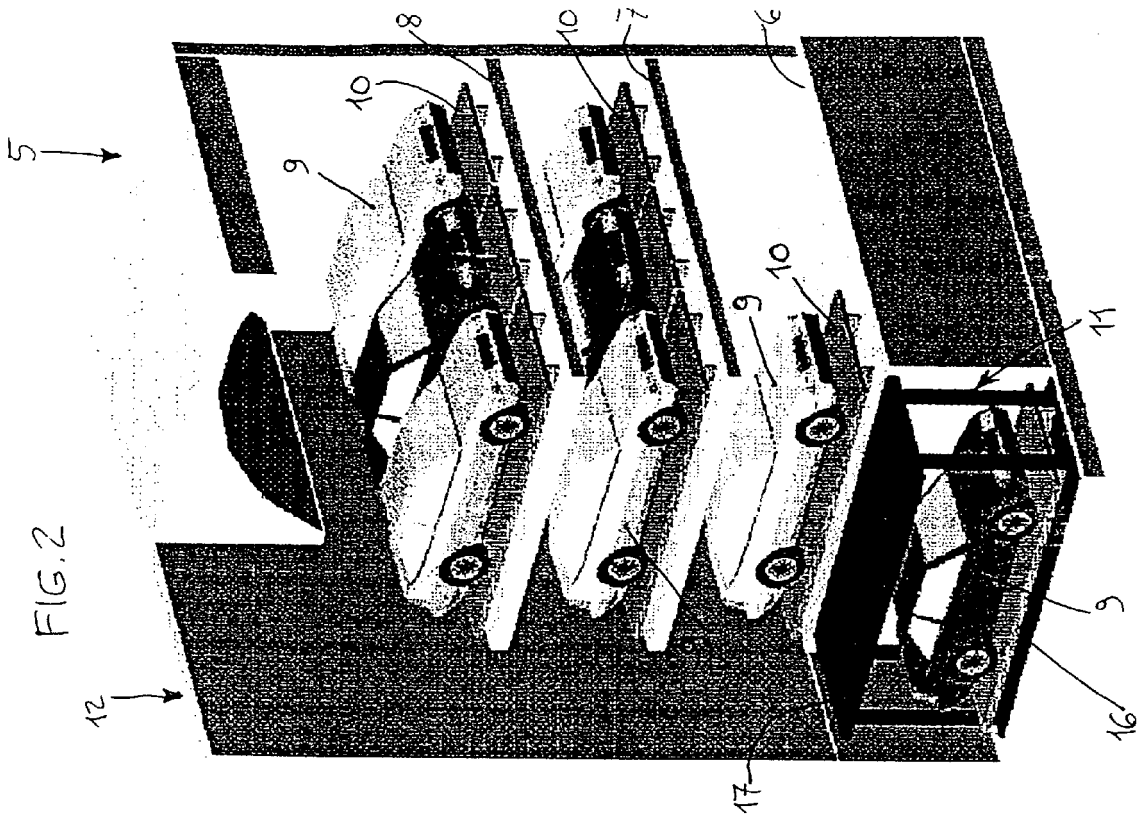
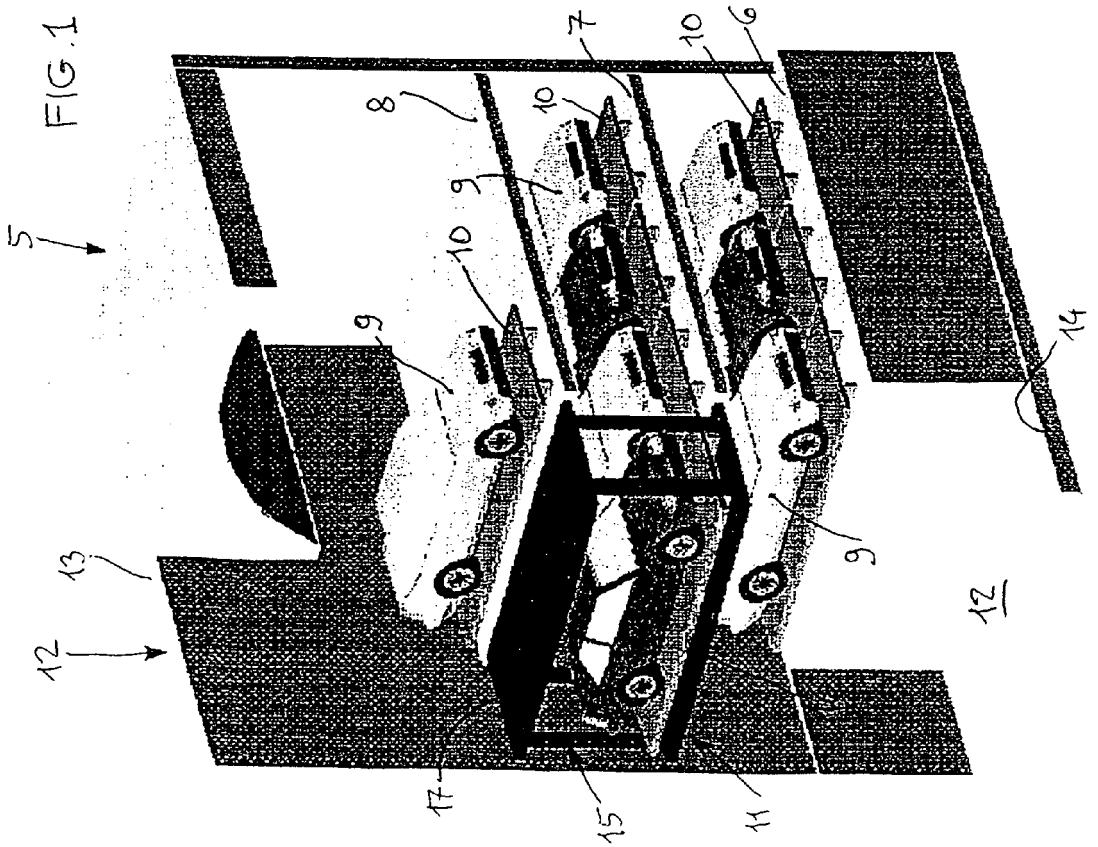


FIG.1



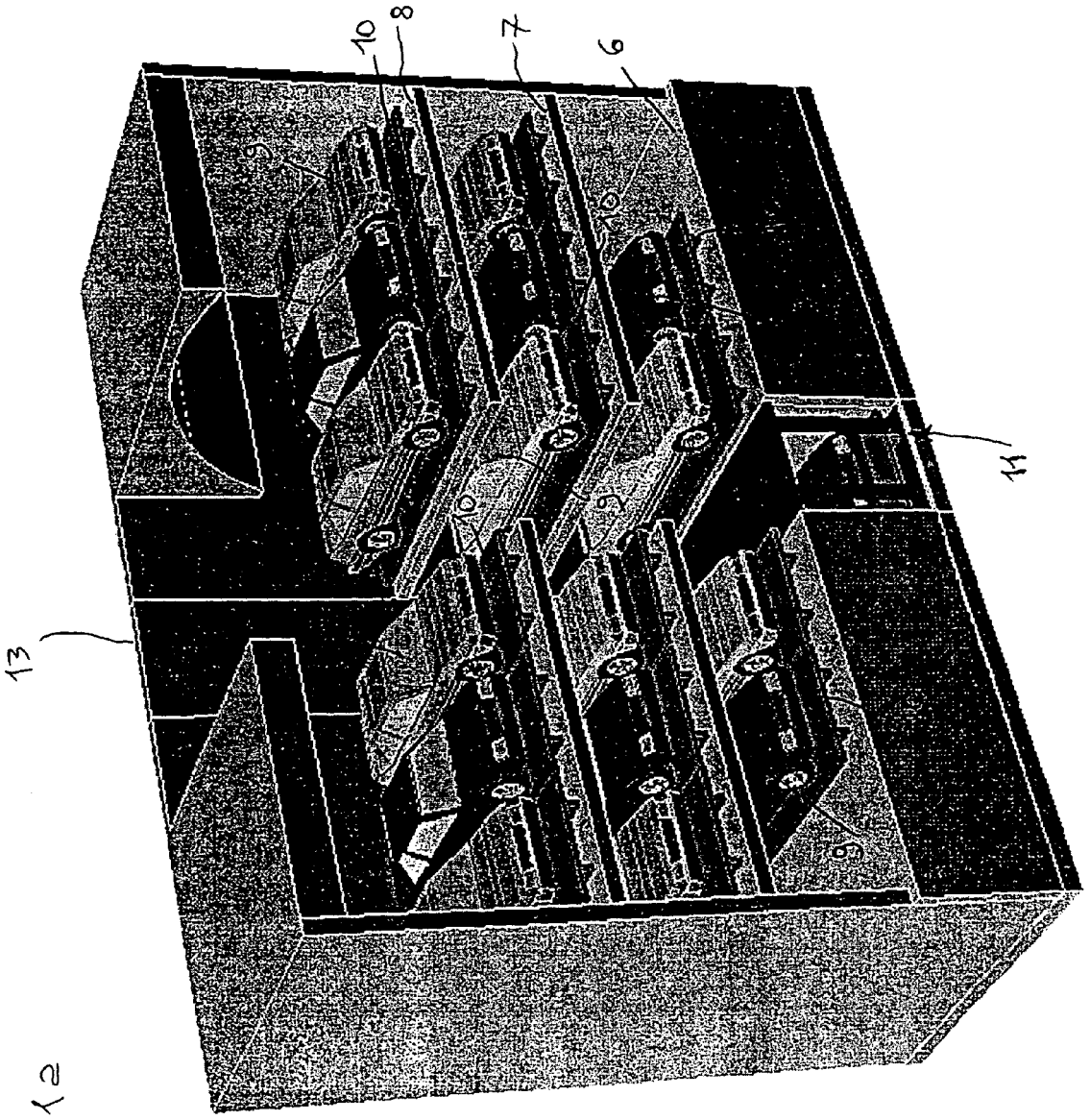
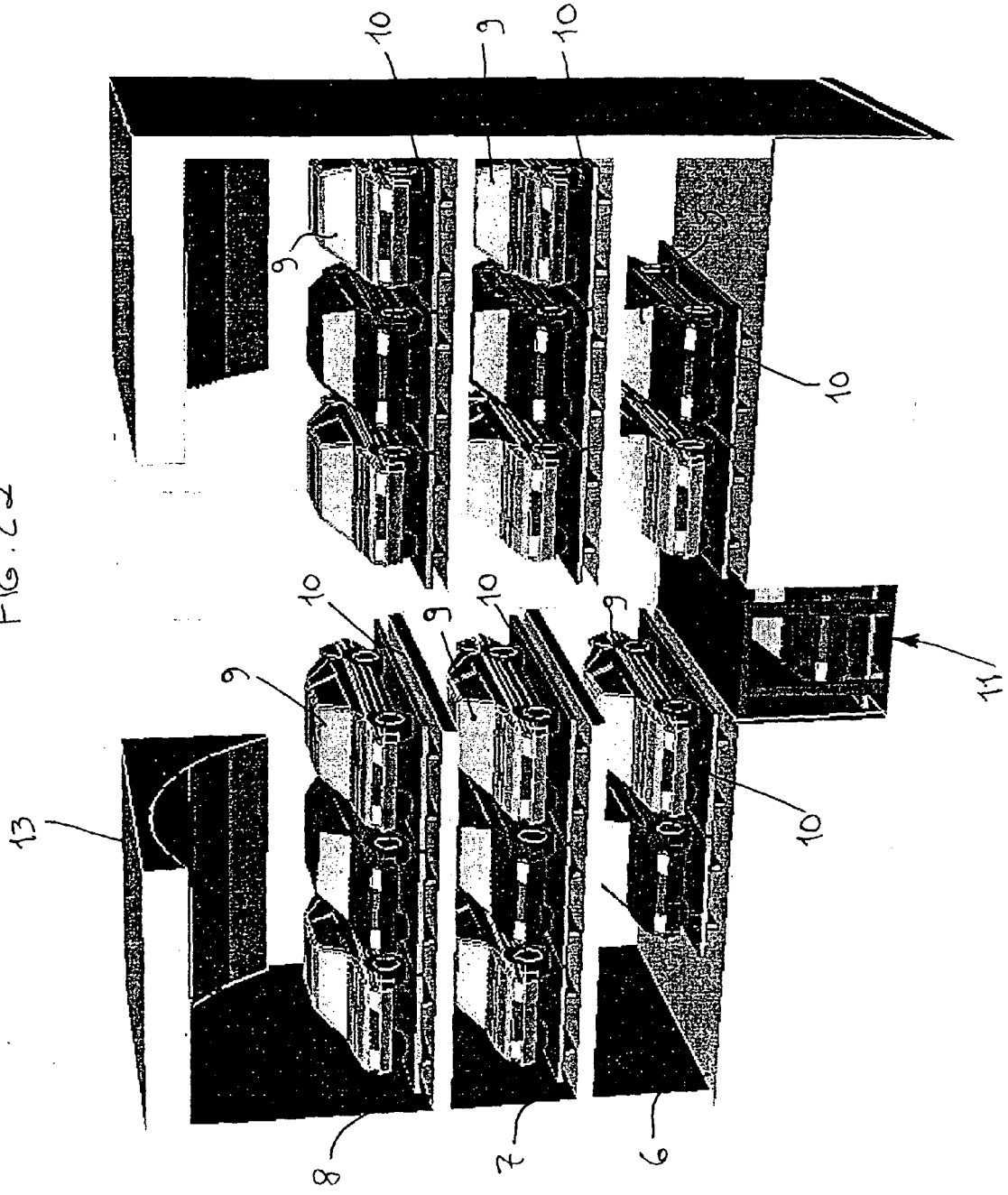


FIG. 12

FIG. 22



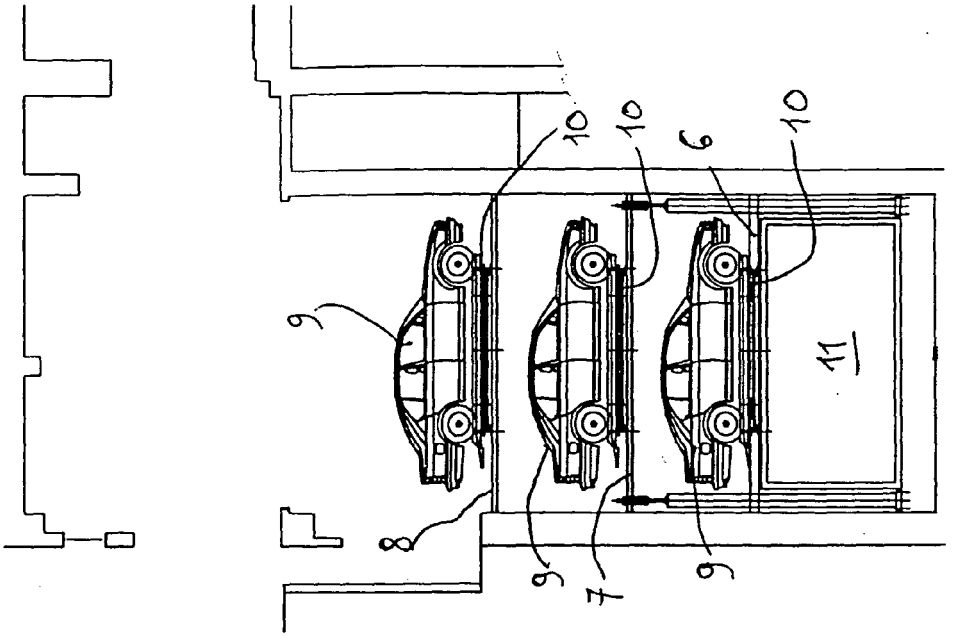


FIG. 4

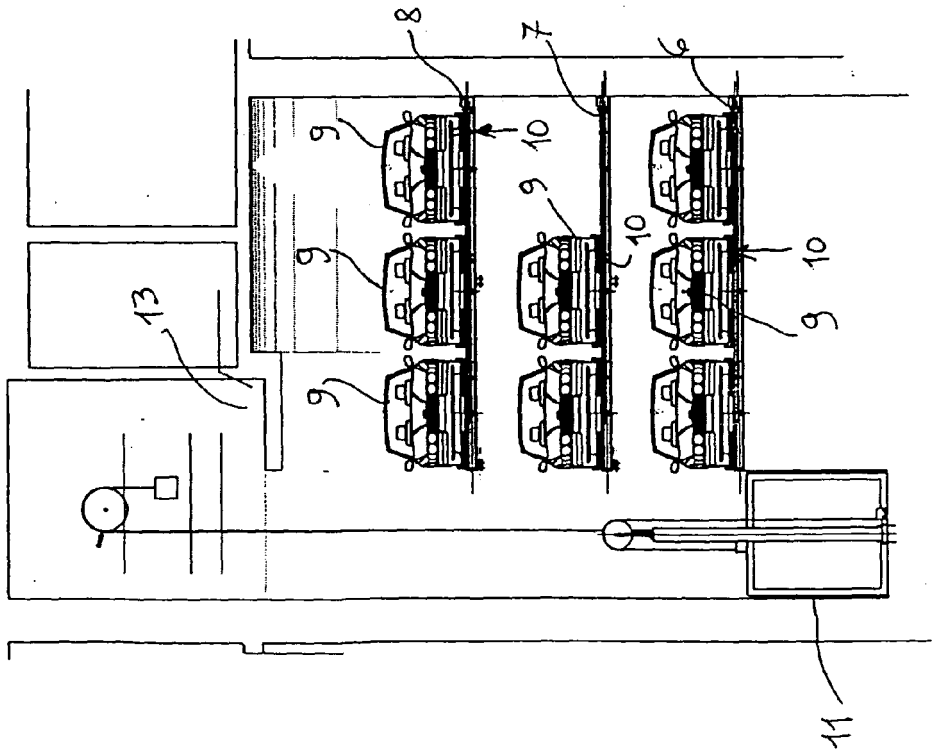


FIG. 3

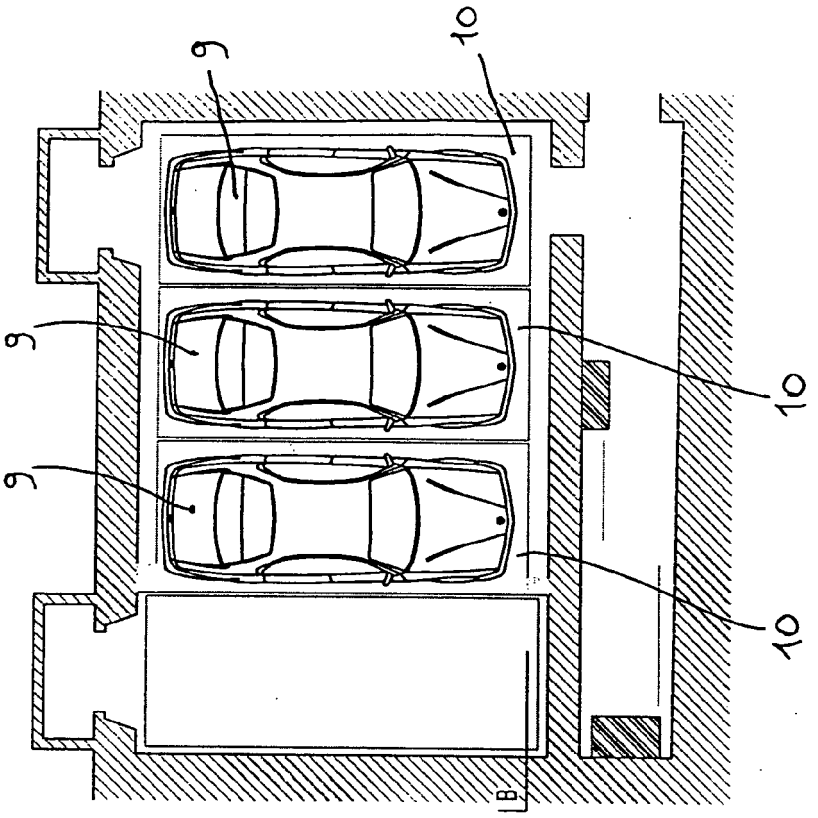


FIG.6

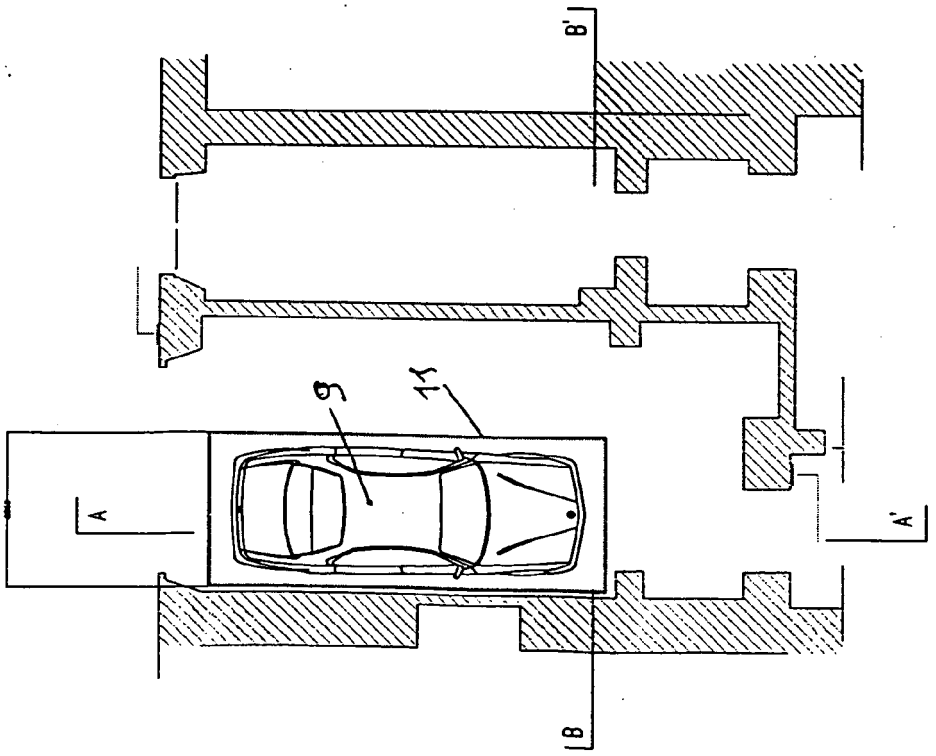


FIG.5

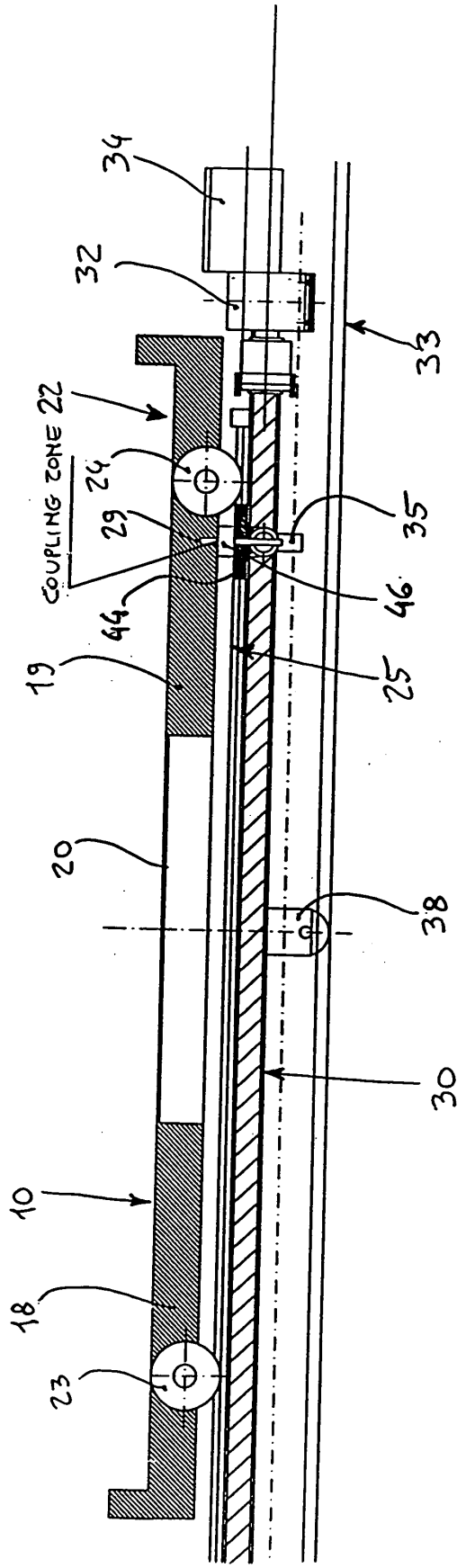


FIG. 7

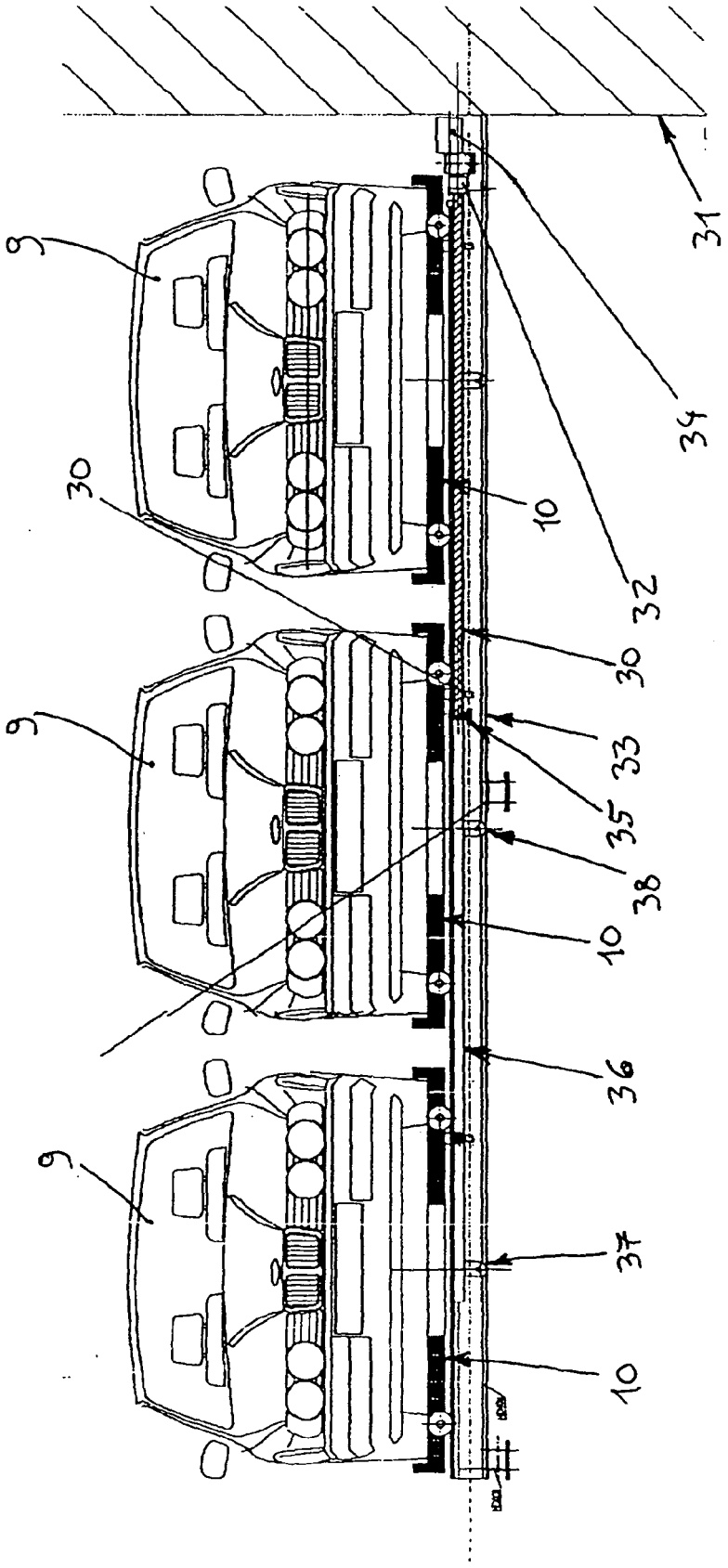


FIG. 8

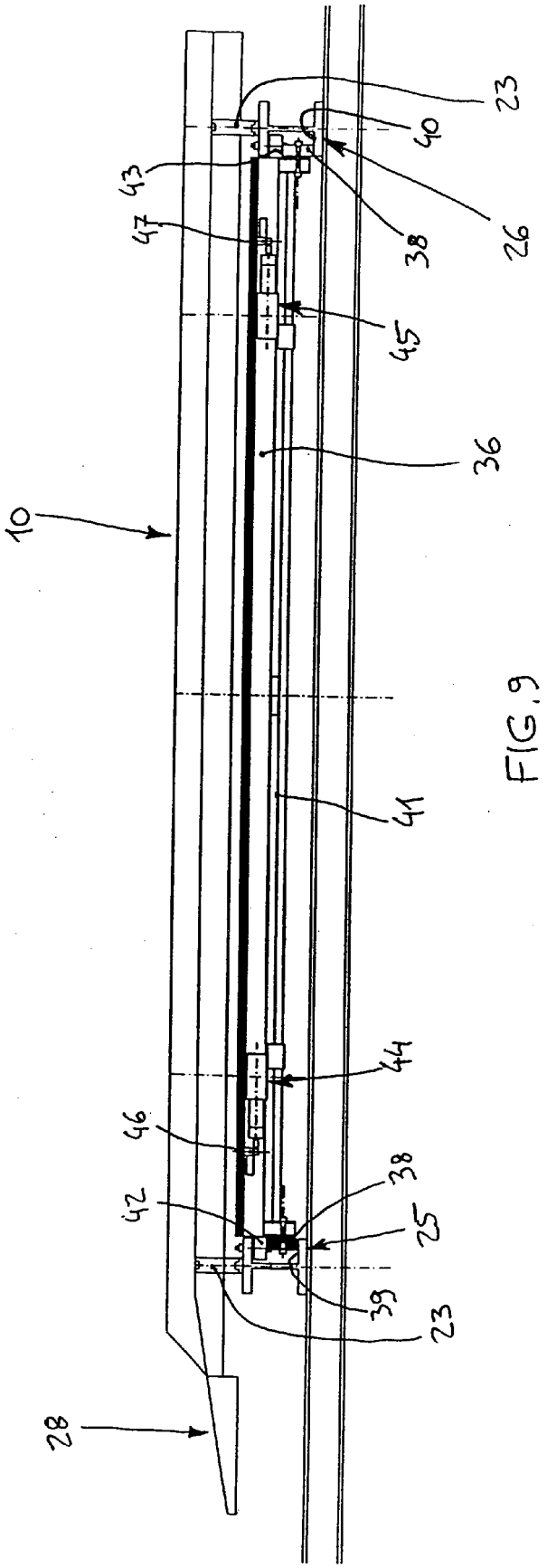
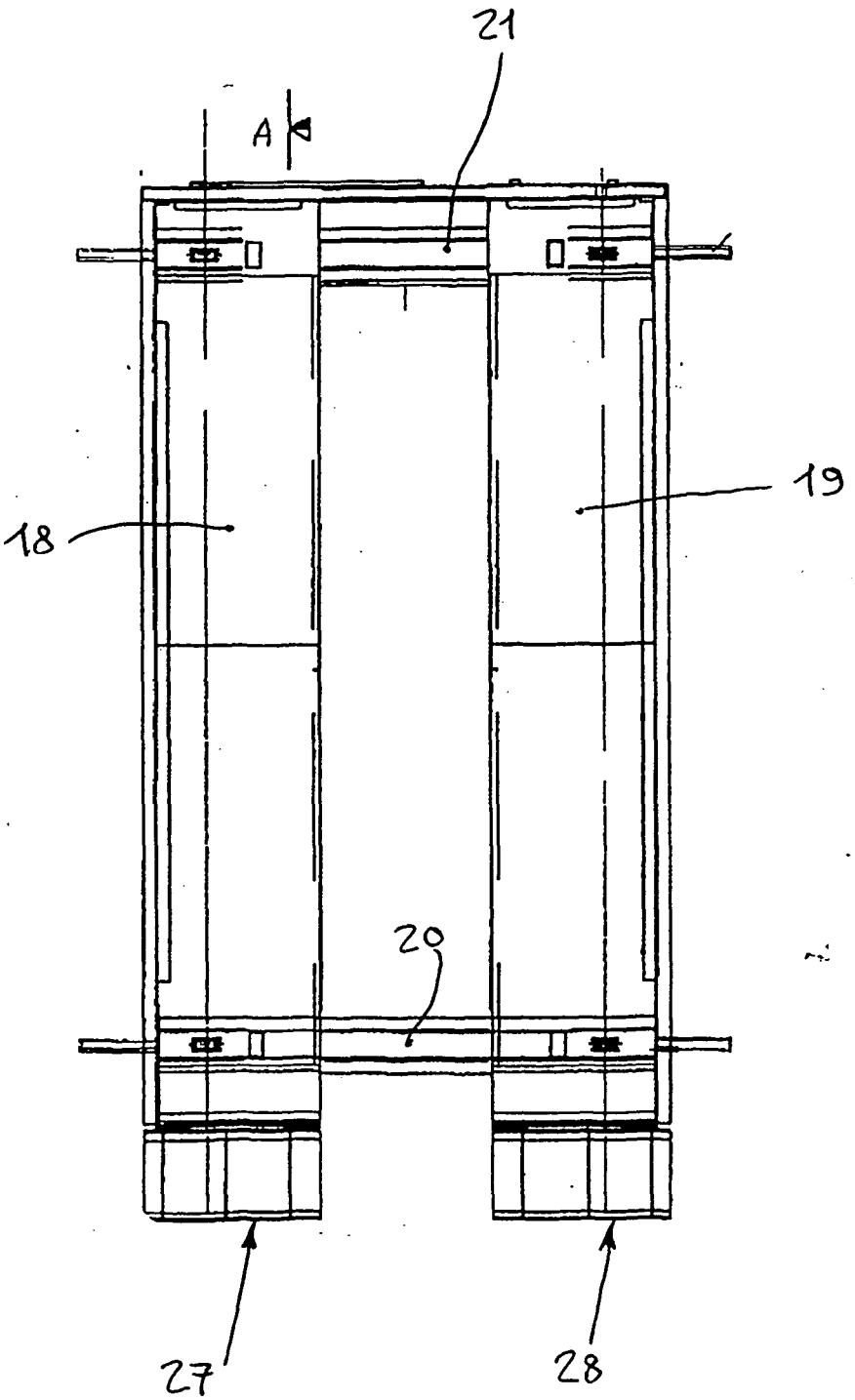


FIG. 9

FIG.10



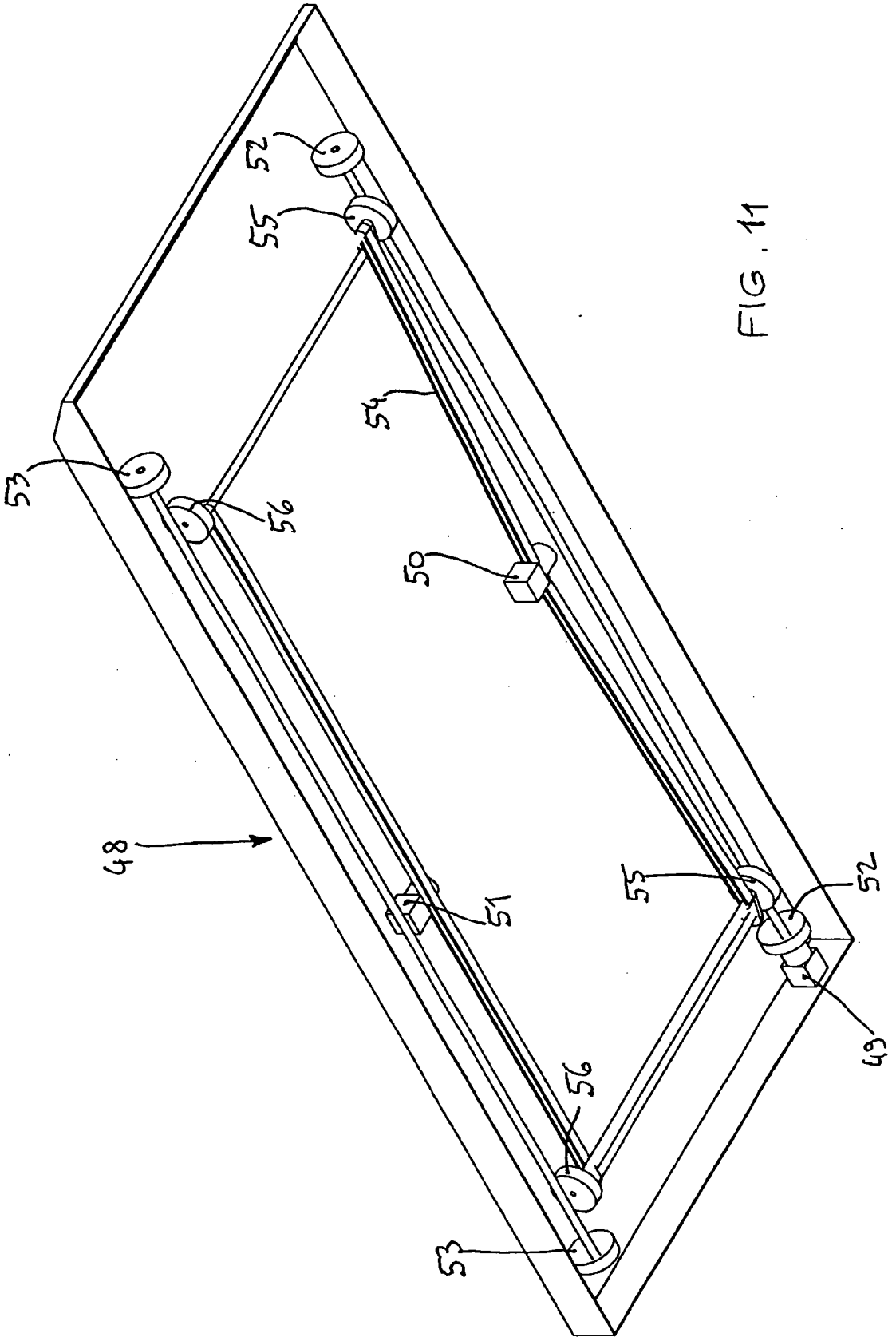


FIG. 11

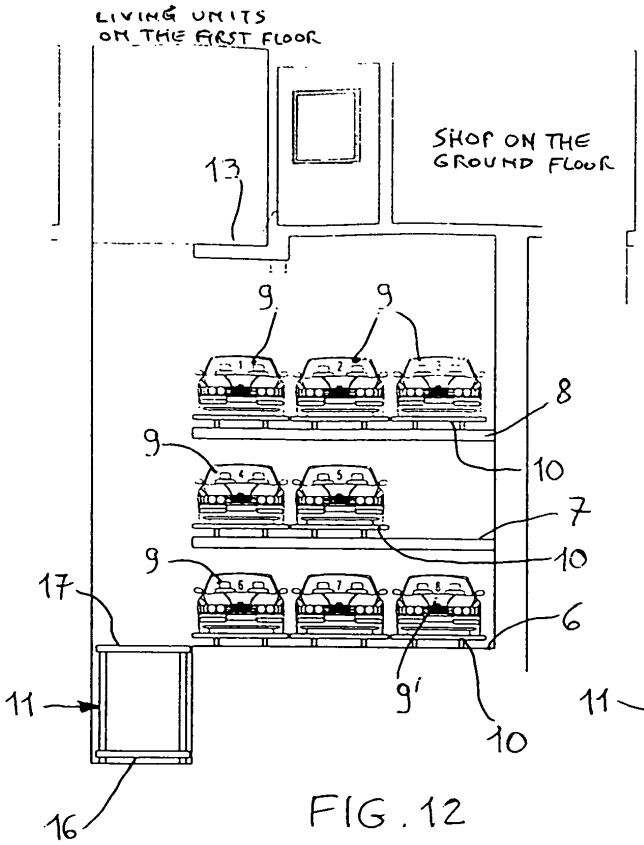


FIG. 12

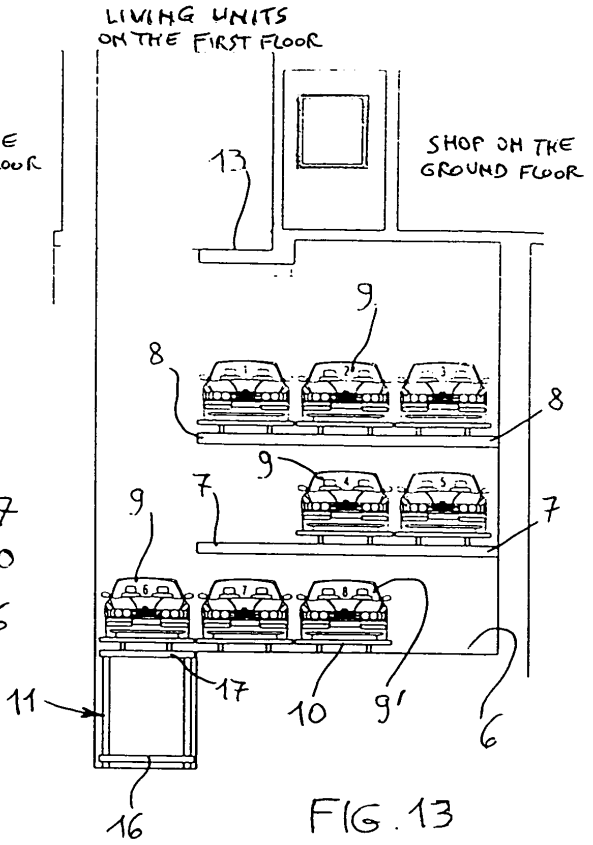


FIG. 13

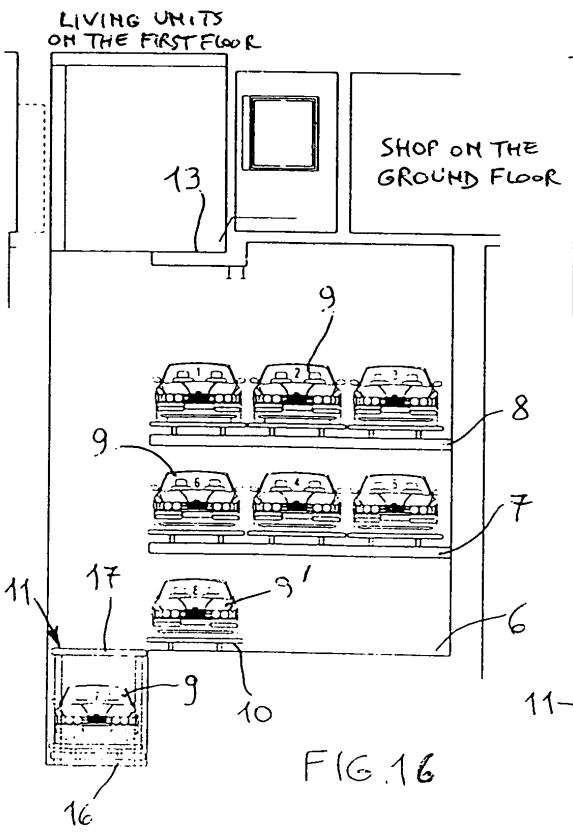


FIG. 16

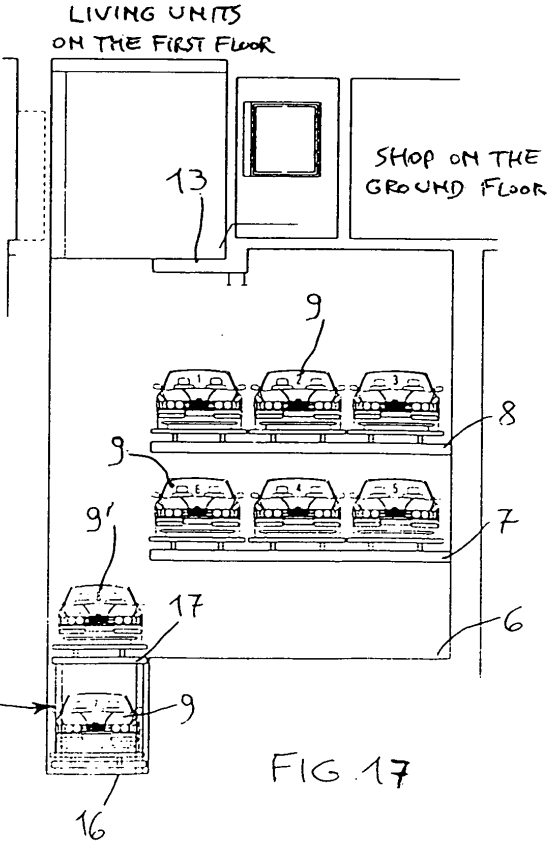


FIG. 17

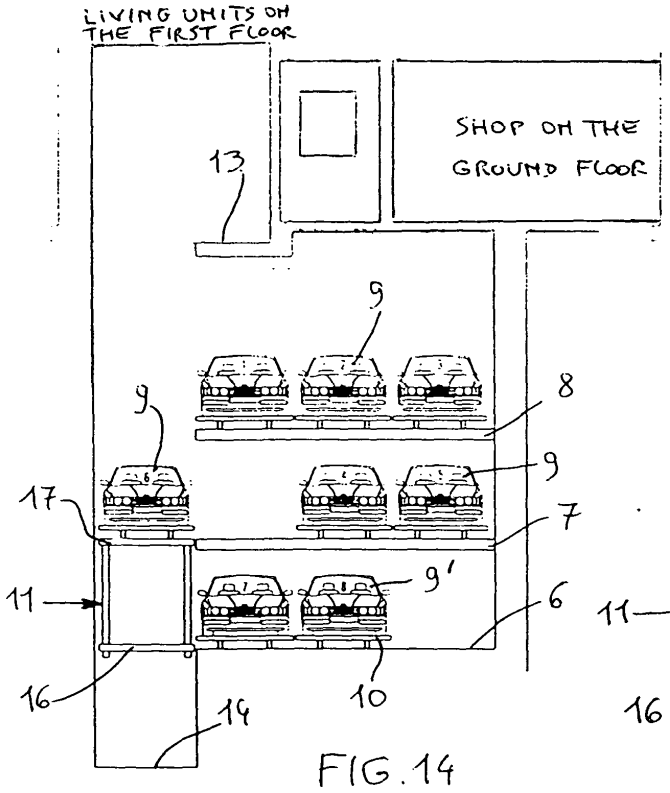


FIG.14

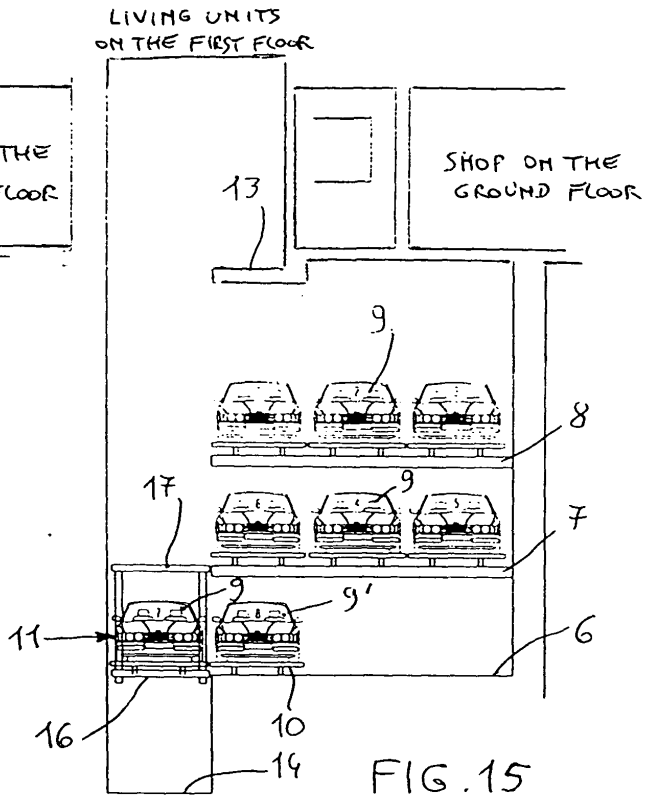


FIG.15

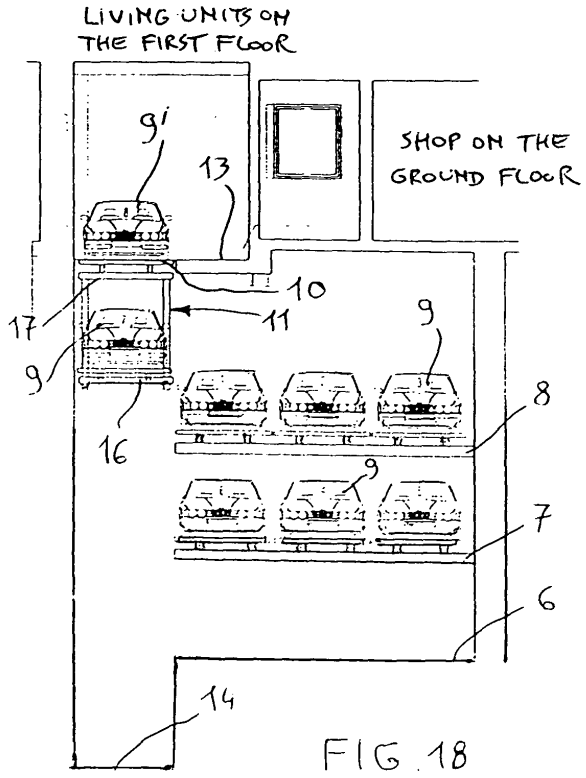


FIG.18

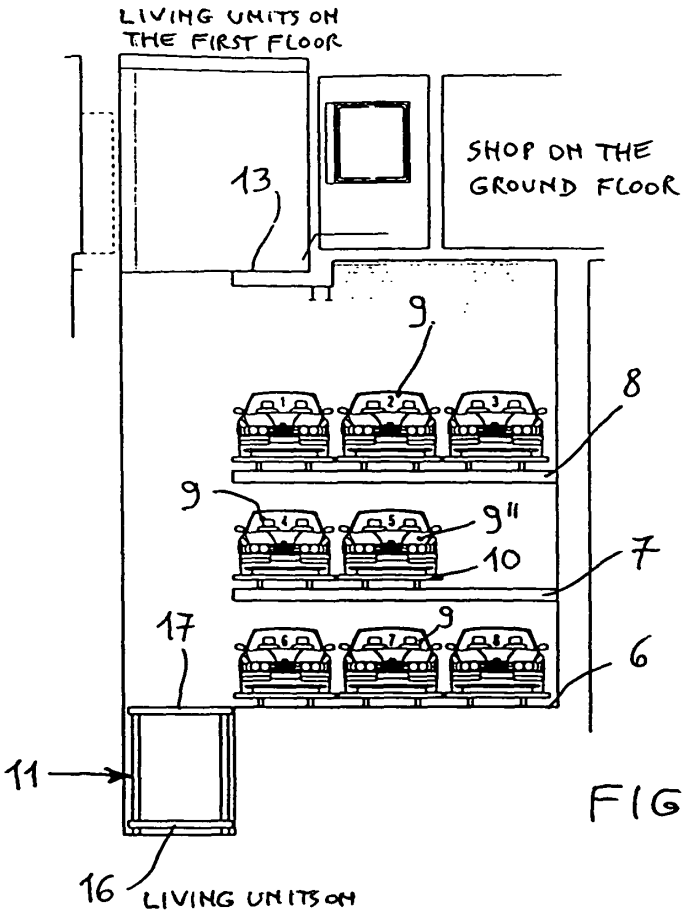

LIVING UNITS ON THE FIRST FLOOR
SHOP ON THE GROUND FLOOR
13
9
8
9
9"
10
7
17
9
6
11
16

FIG. 19

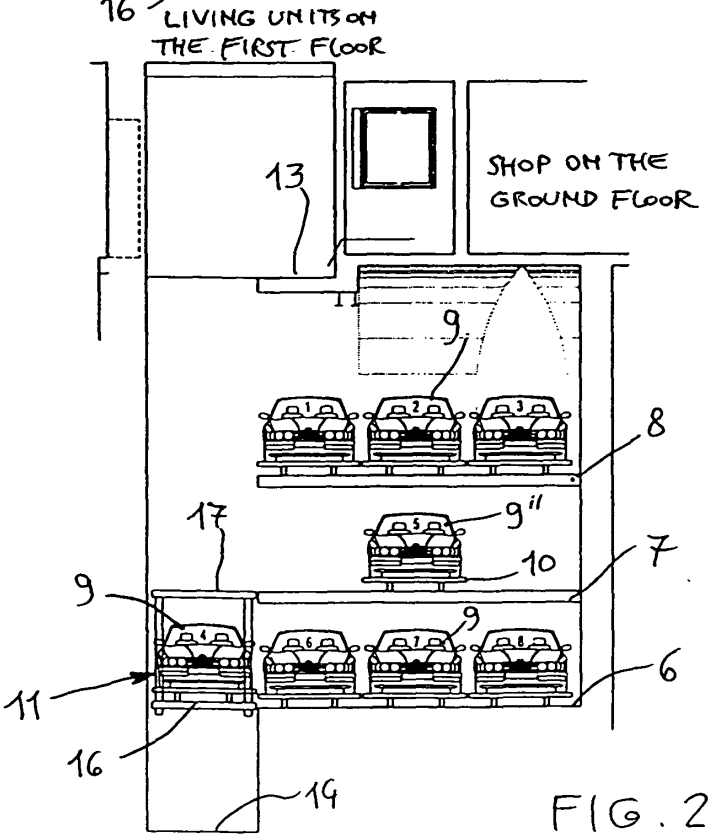

LIVING UNITS ON THE FIRST FLOOR
SHOP ON THE GROUND FLOOR
13
9
8
17
9"
10
7
9
9
6
11
16
19

FIG. 22

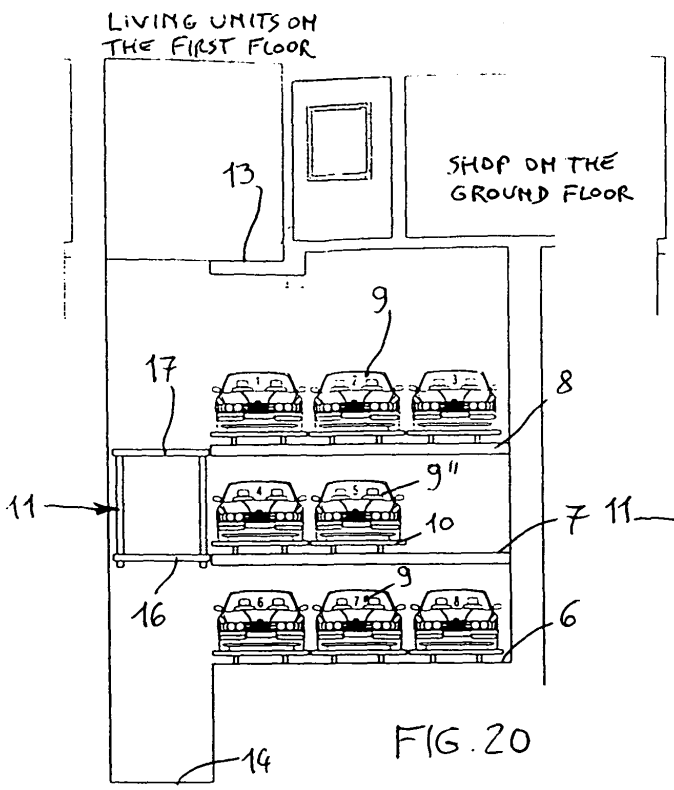


FIG. 20

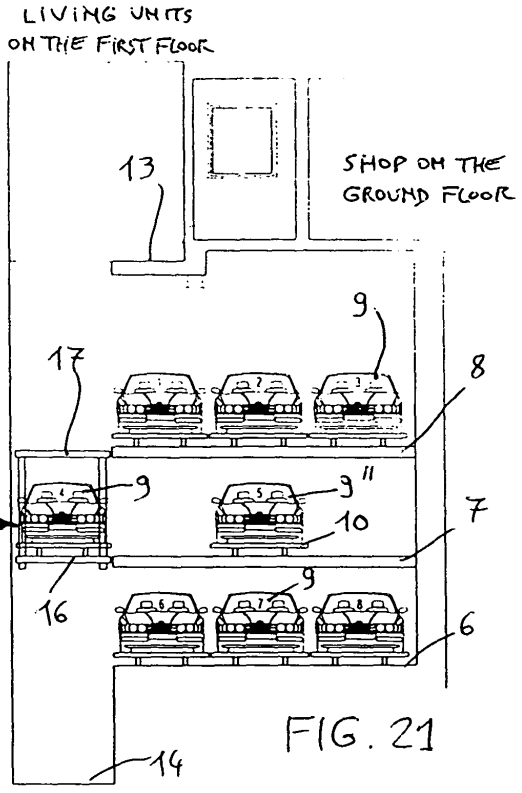


FIG. 21

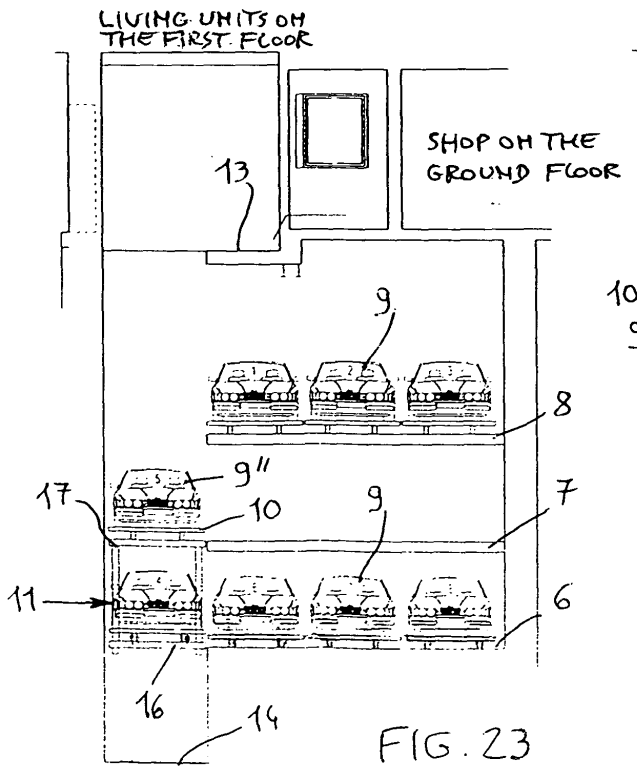


FIG. 23

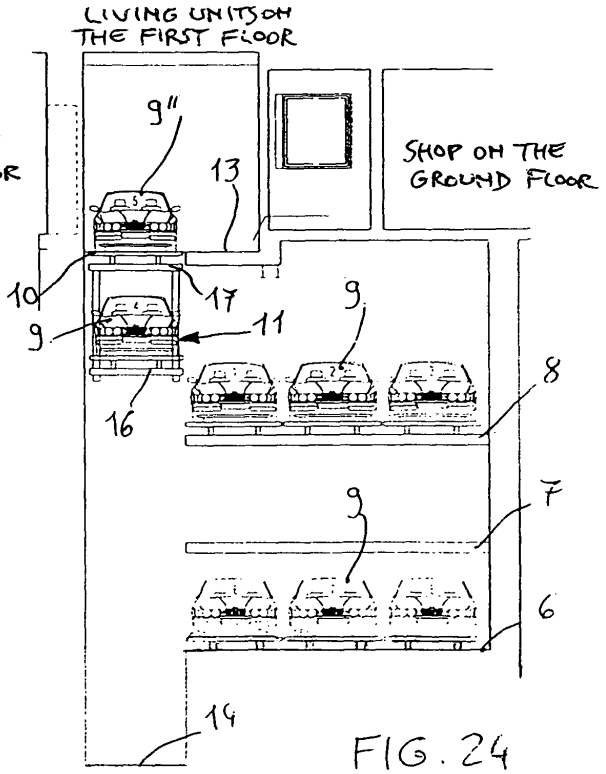


FIG. 24

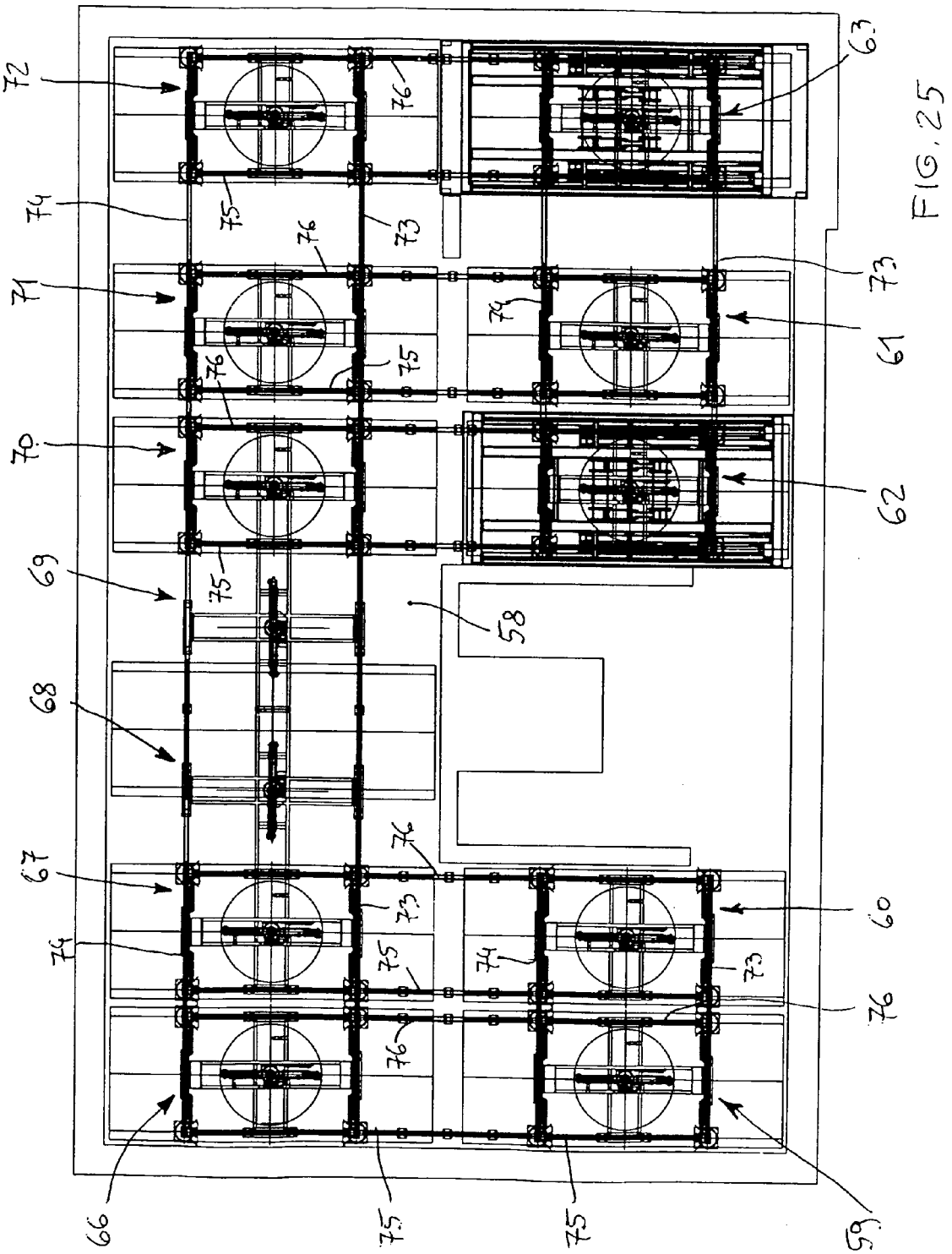


FIG. 25

FIG. 26

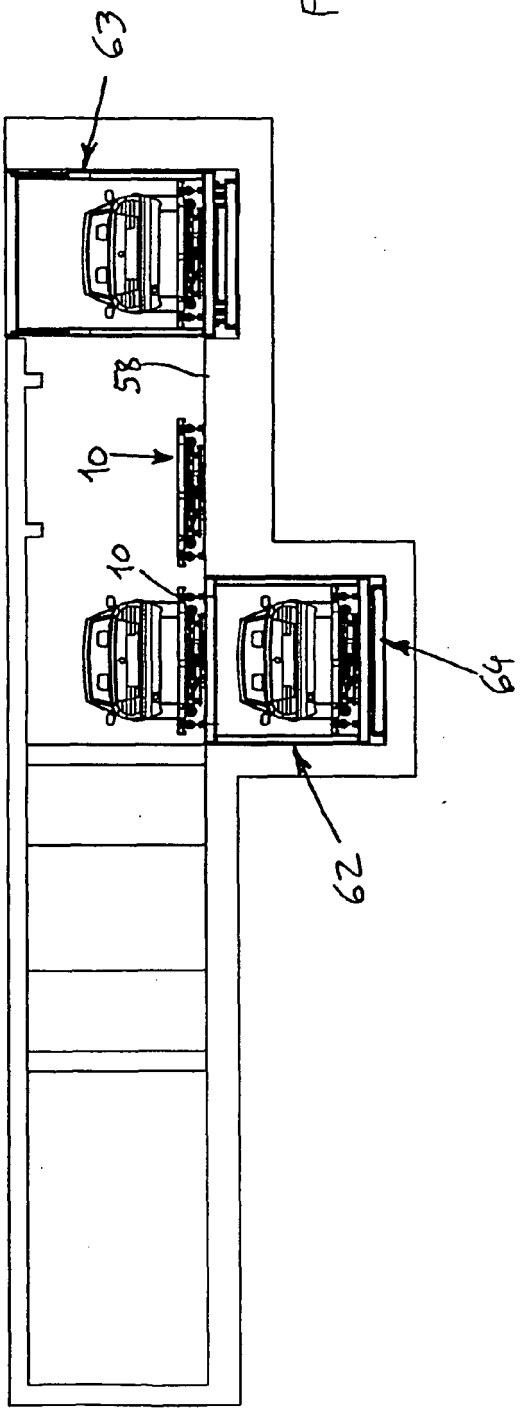
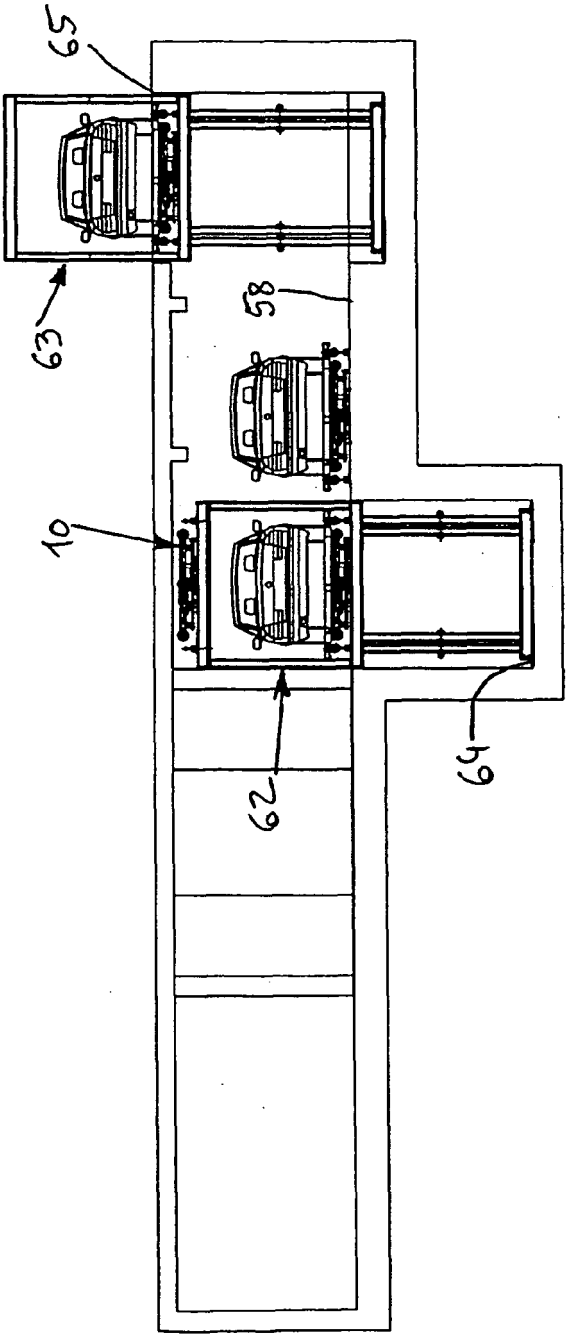


FIG. 27



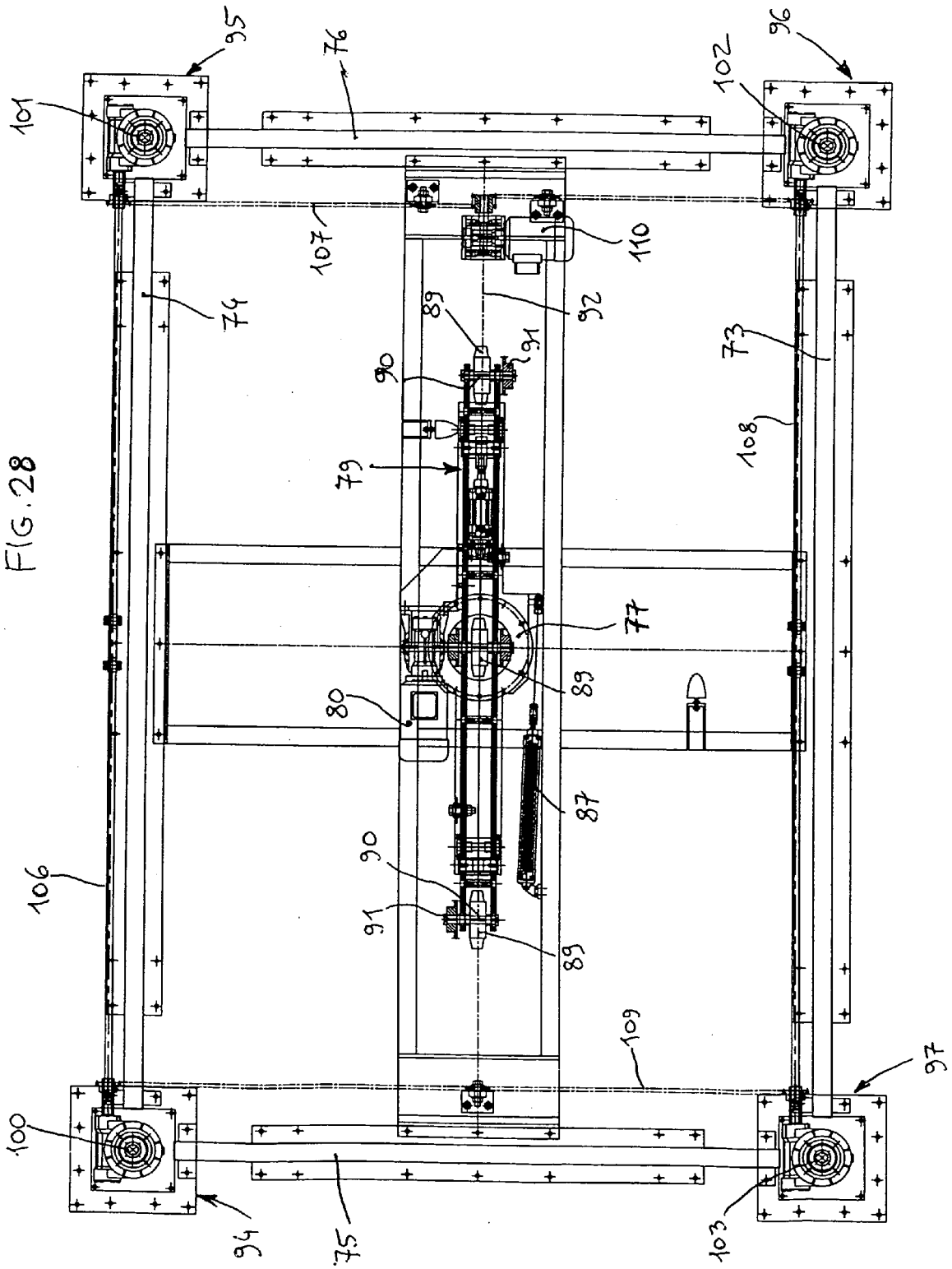

95
76
96
101
102
107
110
74
89
92
73
91
90
108
79
77
89
80
87
90
91
89
106
109
97
100
94
75
103

FIG. 28

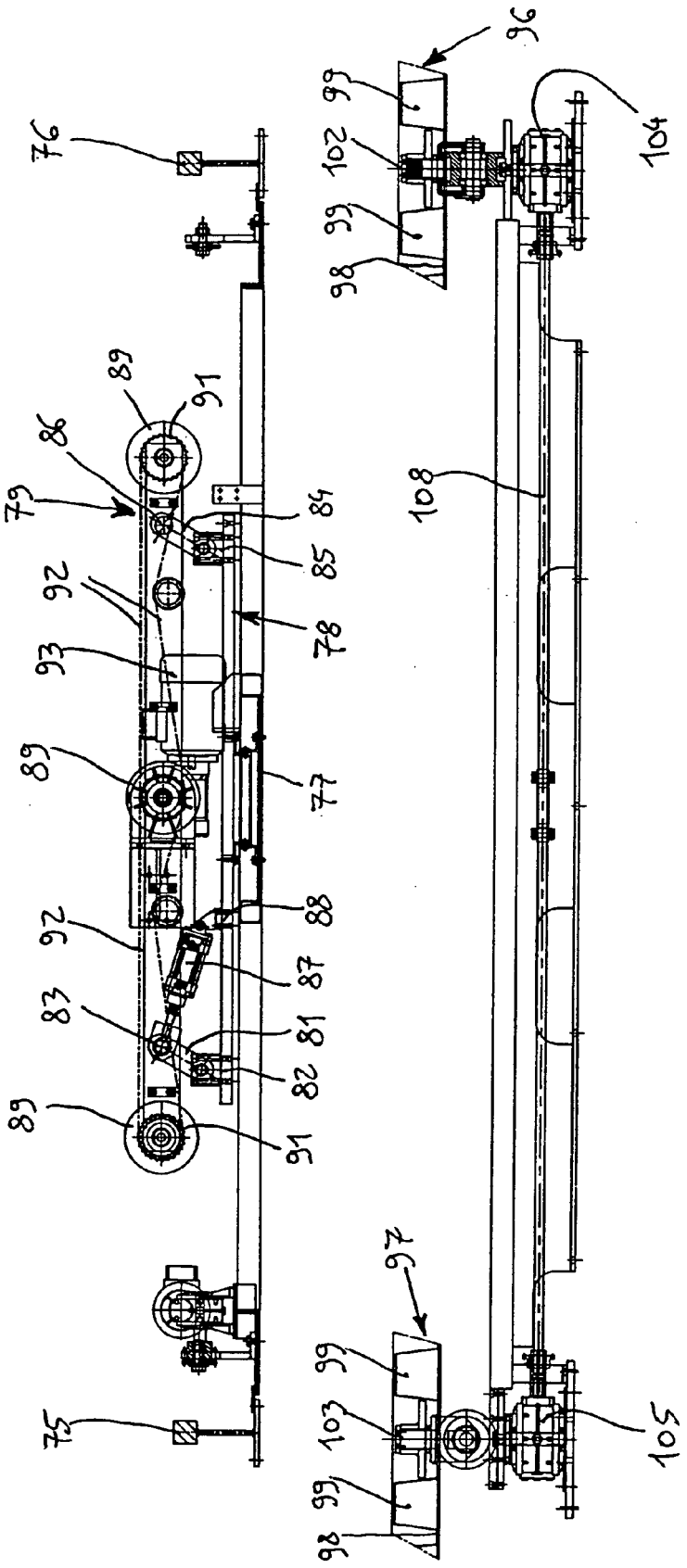

96
99
102
99
98
104
76
89
91
86
79
84
85
108
92
78
93
89
77
88
92
87
83
81
82
89
91
97
99
103
99
98
105
75

FIG. 29

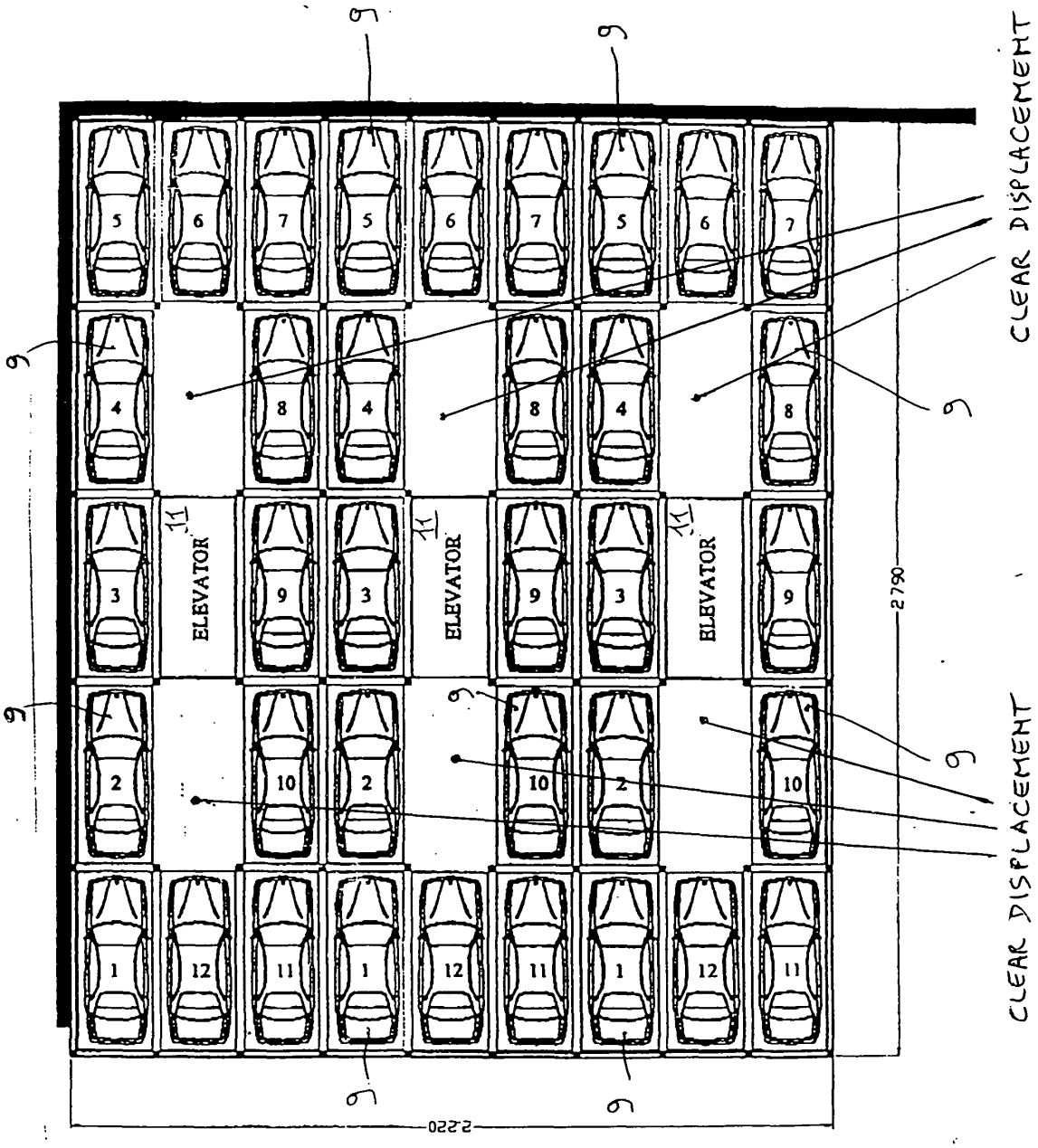

9
9
CLEAR DISPLACEMENT AREA
9
9
ELEVATOR
ELEVATOR
ELEVATOR
11
11
11
2790
9
9
9
9
CLEAR DISPLACEMENT AREA
9
9
2220

FIG. 30

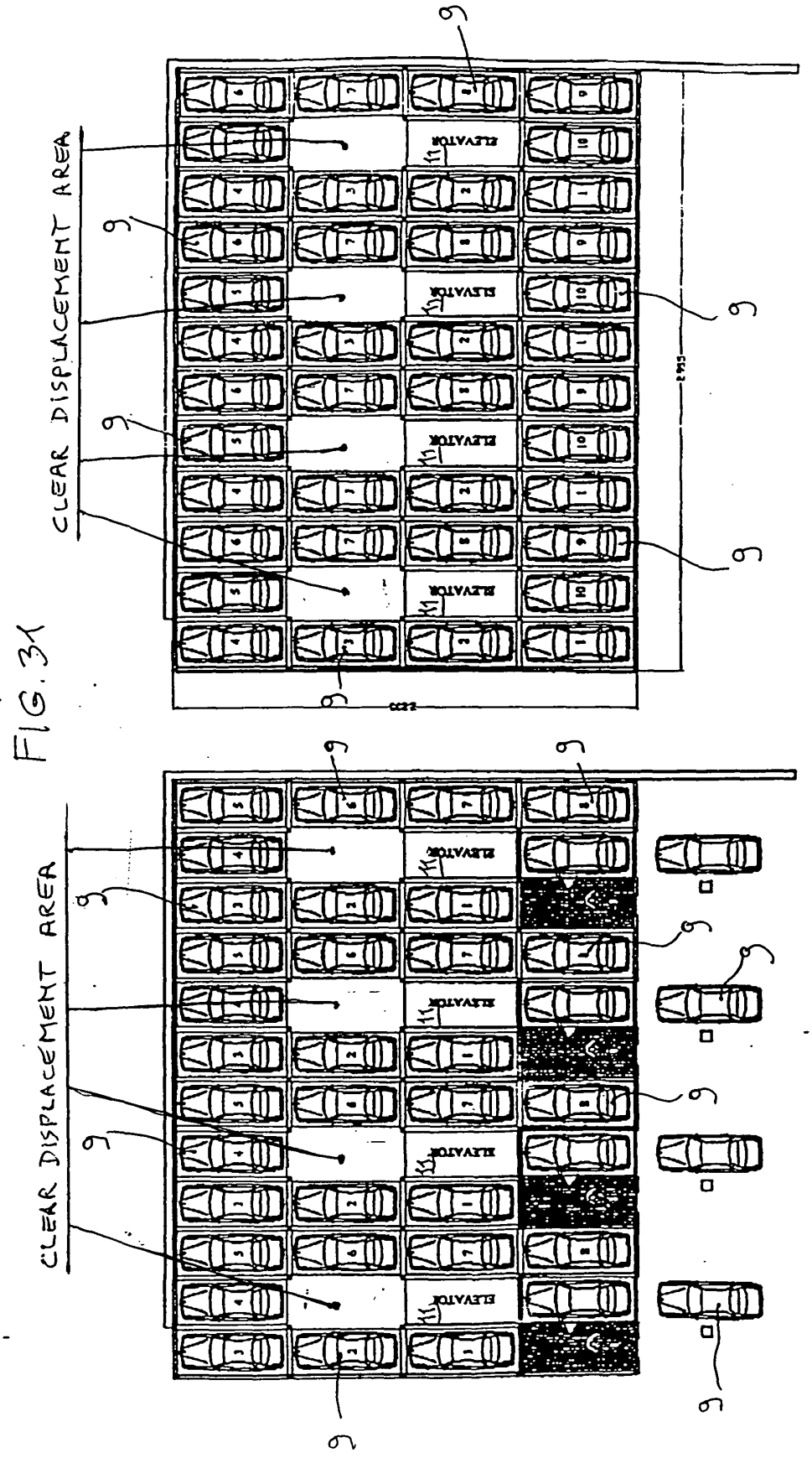

CLEAR DISPLACEMENT AREA
CLEAR DISPLACEMENT AREA
ELEVATOR

FIG. 31

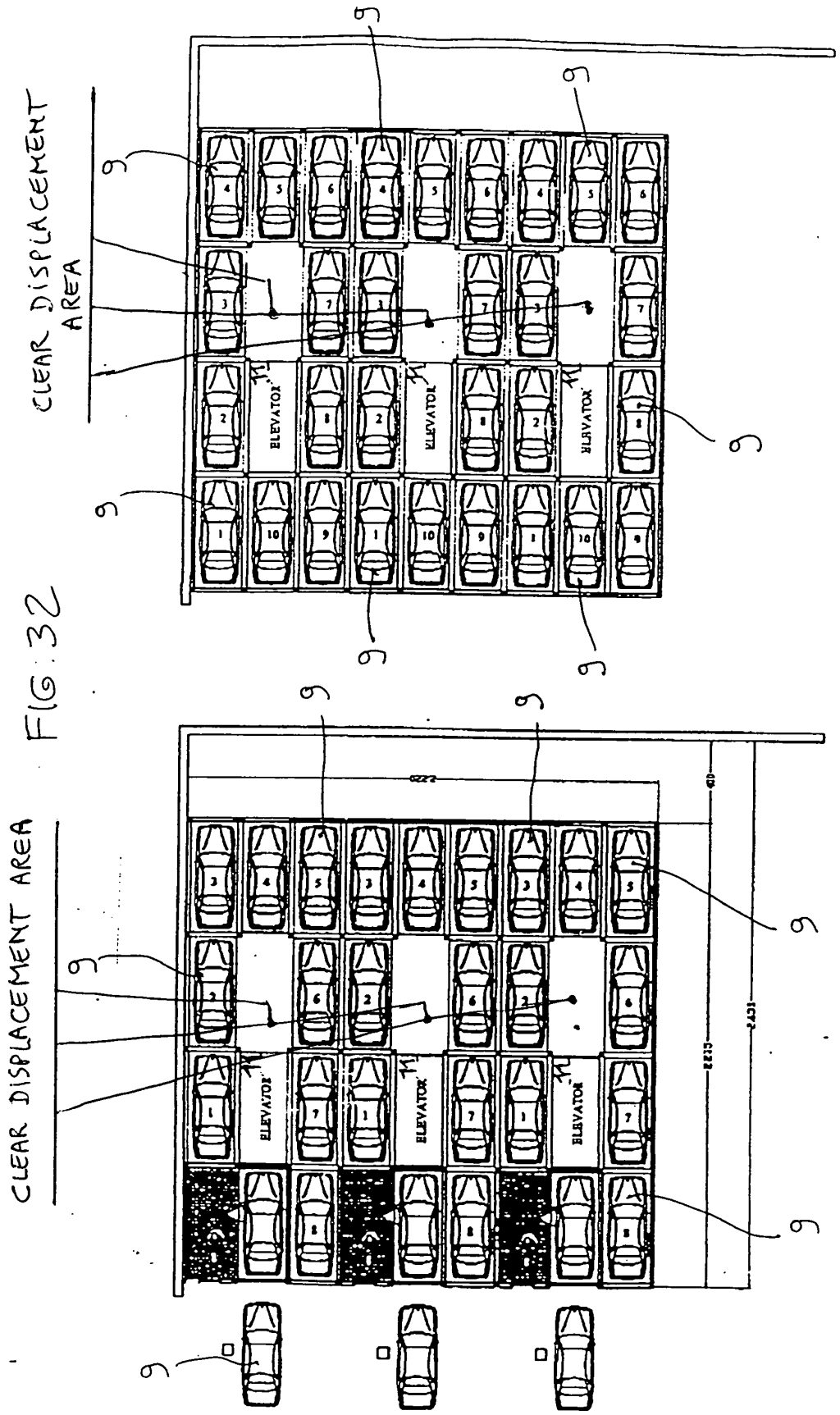

CLEAR DISPLACEMENT AREA
ELEVATOR
CLEAR DISPLACEMENT AREA
ELEVATOR

FIG. 32

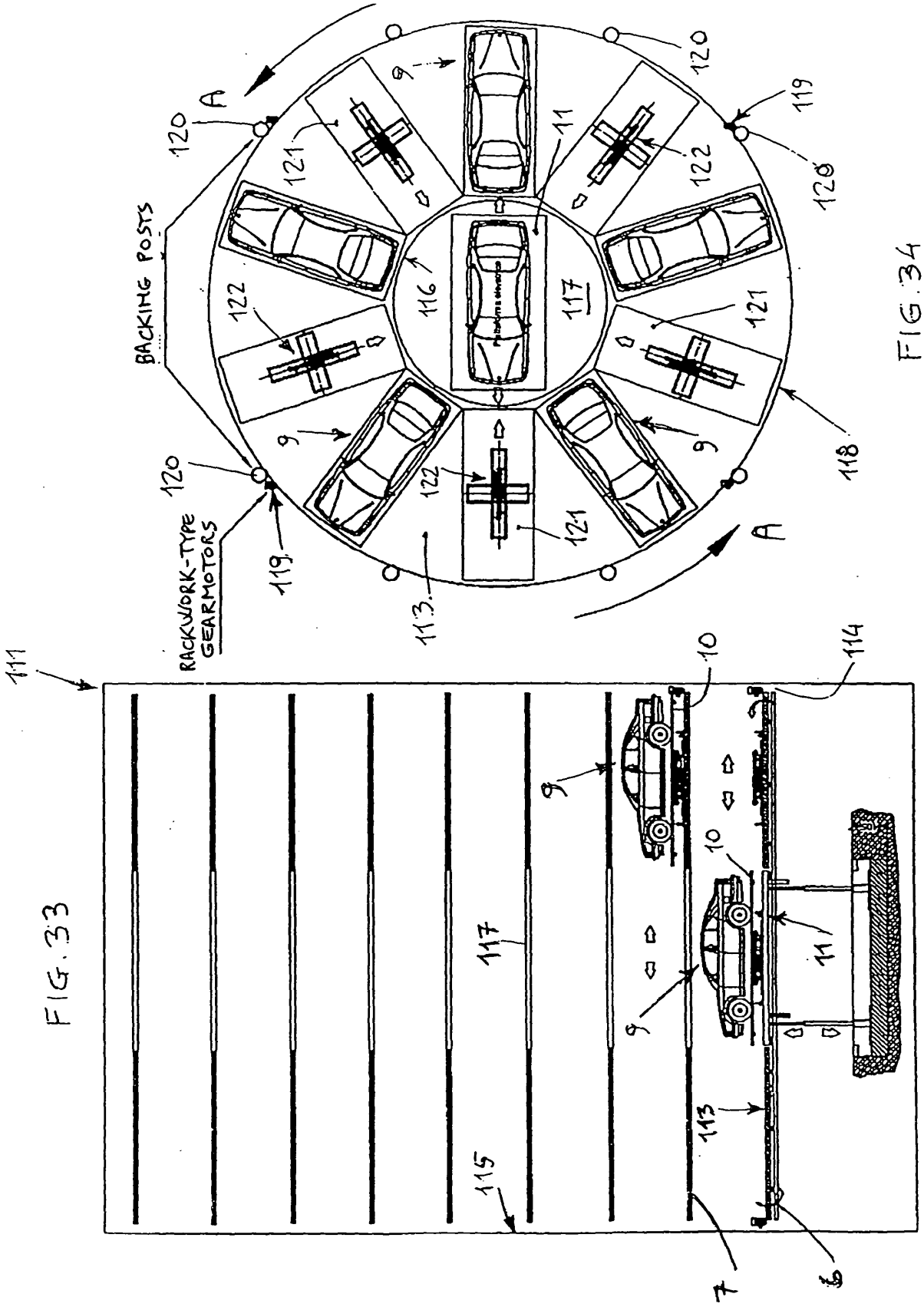

111
117
115
113
114
10
9
11
7
6

FIG. 33

BACKING POSTS
RACKWORK-TYPE GEARMOTORS
A
A
120
119
121
122
116
117
118
9
11
113

FIG. 34

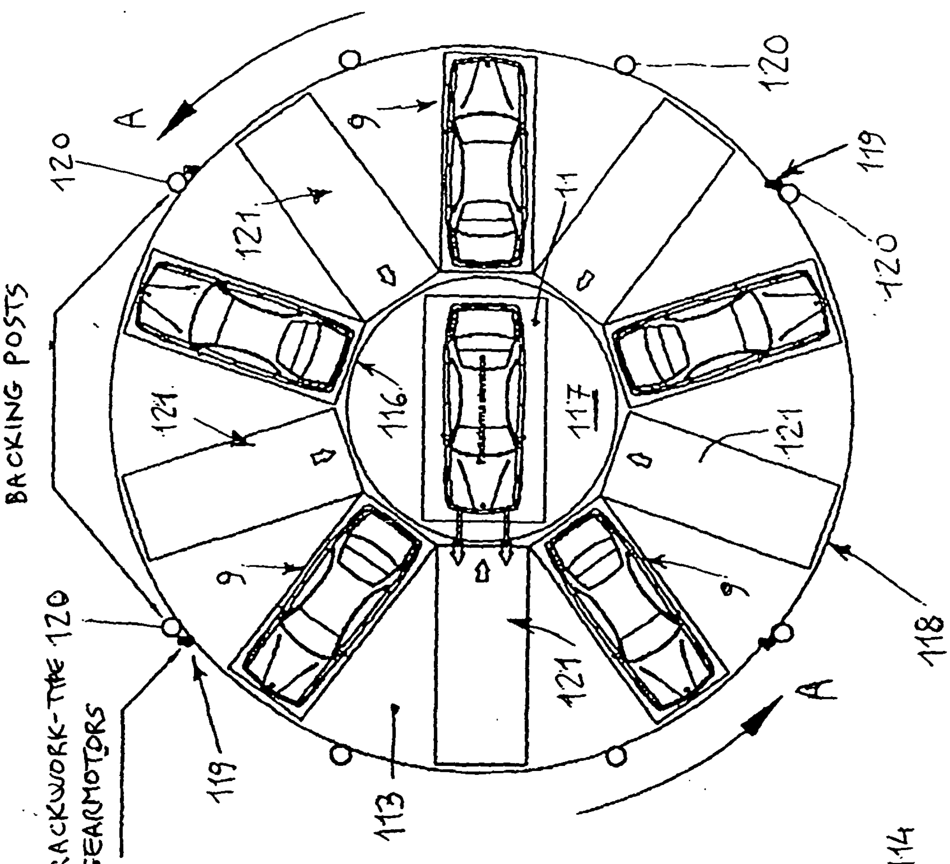
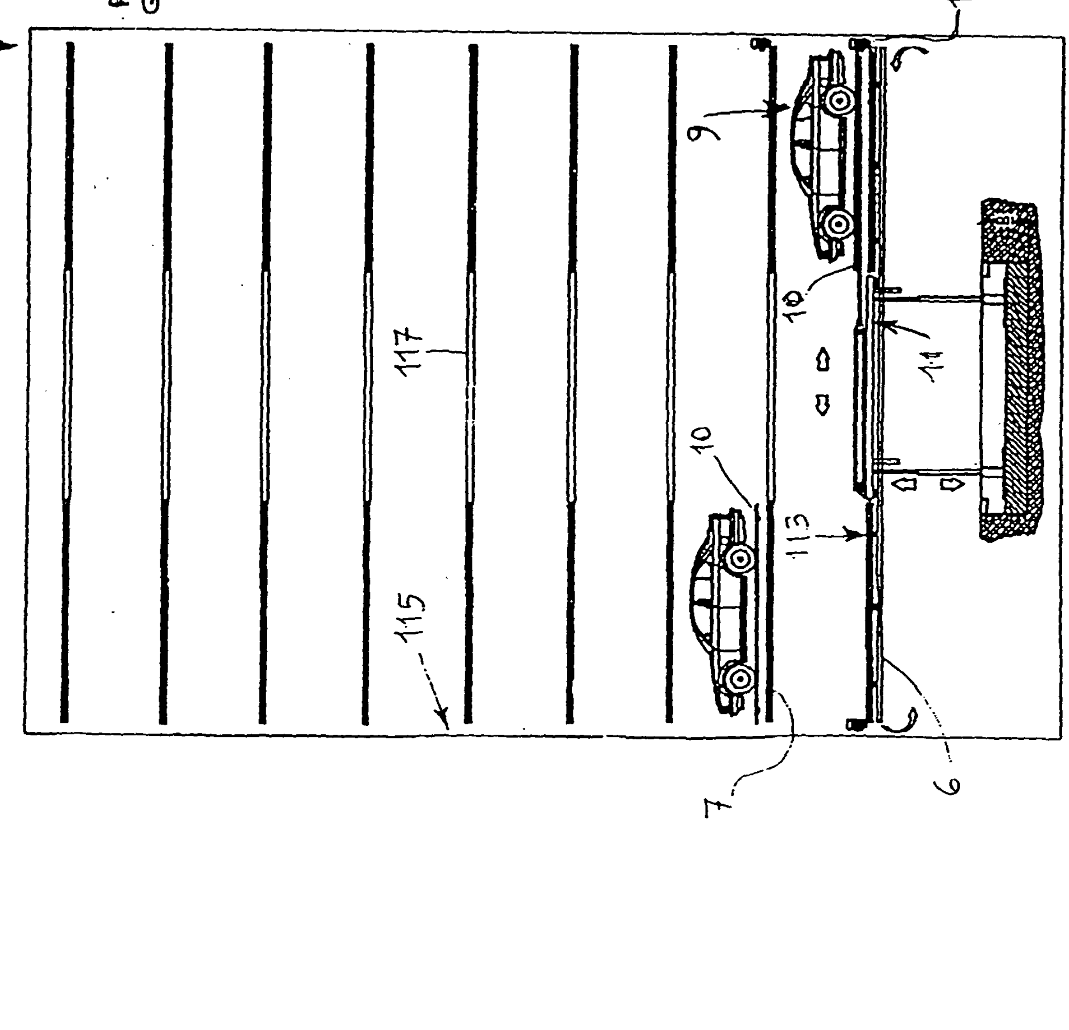

BACKING POSTS
RACKWORK-TYPE 120
GEARMOTORS
A
A
120
120
120
119
119
121
121
121
121
9
9
9
11
116
117
118
113

FIG 36


111
9
10
10
11
113
114
115
117
7
6

FIG, 35