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(54) Parking device

(57) A parking device includes a building (1), several car carriers (51), a lift unit, and an electrically controlled conveyor unit. The building (1) has several parking rooms (20), and a traveling path (22) extending between the lift units and the parking rooms (20). The lift unit can be stopped at a lower level to receive a selected carrier (51), and at an upper level where the carrier (51) can receive a car thereon. The conveyor unit includes a rotatable first worm unit consisting of several spaced worms (33) disposed along the traveling path (22), and a rotatable second worm unit consisting of several spaced second worms (34) transverse to the first worm

unit and extends into the parking rooms (20). The first and second worm units can be activated so as to move the selected carrier (51) from the lift unit to one of the parking rooms (20), and from the parking room (20) to the lift unit. Each of the carriers (51) has a longitudinal rack unit (514) with a length greater than a distance between any adjacent pair of the first worms (33), and a transverse rack unit (516) with a length greater than a distance between any adjacent pair of the second worms (34).

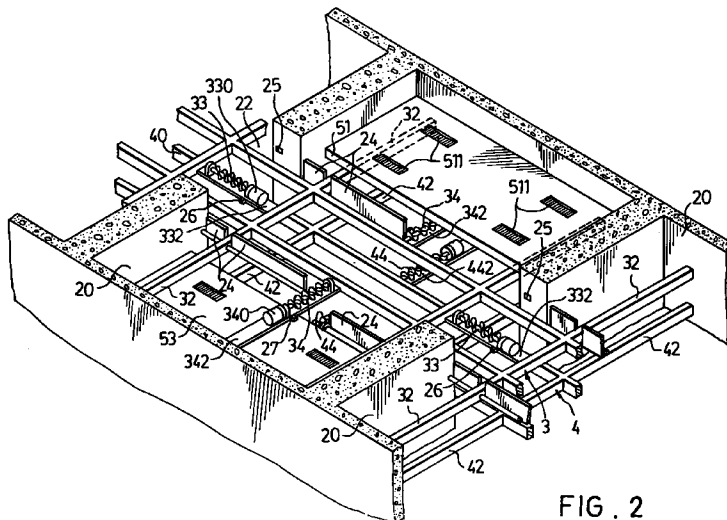


FIG. 2

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Description

The invention relates to a parking device, more particularly to an automatic parking device which permits simultaneous entry and exit of cars, thereby providing high efficiency.

A conventional car parking device includes a building having a plurality of spaced horizontal parking platforms interconnected by a chain unit in such a manner that when it is desired to park a car on a selected one of the platforms, the latter is descended so that the car can be parked thereon.

Some of the disadvantages resulting from the use of the conventional device are as follows:

(I) In the conventional device, a car cannot be removed from a parking platform while another car is being sent to another parking platform at the same time, thereby resulting in jamming or in a long queue of cars around the conventional device.

(II) The chain unit may snap after long period of use or when it is unable to bear the total weight of the loaded car, subjecting the nearby car attendants to danger.

Therefore, the main object of the present invention is to provide an automatic car parking device which is highly efficient and which is safe to use.

Accordingly, the preferred embodiments of parking device include a building, several car carriers, a lift unit, and an electrically controlled conveyor unit. The building has several parking rooms, and a traveling path extending between the lift units and the parking rooms. The lift unit can be stopped at a lower level to receive a selected carrier, and at an upper level where the carrier can receive a car thereon. The conveyor unit includes a rotatable first worm unit consisting of several spaced worms disposed along the traveling path, and a rotatable second worm unit consisting of several spaced second worms transverse to the first worm unit and extends into the parking rooms. The first and second worm units can be activated so as to move the selected carrier from the lift unit to one of the parking rooms, and from the parking room to the lift unit. Each of the carriers has a longitudinal rack unit with a length greater than a distance between any adjacent pair of the first worms, and a transverse rack unit with a length greater than a distance between any adjacent pair of the second worms.

Other features and advantages will become more apparent in the following detailed description of the preferred embodiments with reference to the accompanying drawings, in which:

Figure 1 is a first preferred embodiment of an automatic parking device of this invention;

Figure 2 illustrates a portion of the first preferred embodiment of this invention;

Figure 3 is a top plan view of the first preferred embodiment of this invention;

Figure 4 is a bottom view of a car carrier employed in the parking device of this invention;

Figure 5 illustrates how a car is guided and carried by the carrier of Figure 4 into a parking room according to this invention;

Figures 6 and 7 illustrate a second preferred embodiment of this invention; and

Figures 8 to 10 illustrate a third preferred embodiment of this invention.

Before the present invention is described in greater detail, it should be noted that same reference numerals have been used to denote like elements throughout the disclosure.

Referring to Figures 1, 2 and 3, an automatic parking device of this invention includes a building (1) which has two rows of parking rooms (20) provided at two side portions thereof so as to define a traveling path (22) between the rows of parking rooms (20), a front entry (101) provided with a front lift (6), and a rear exit (102) provided with a rear lift (7). A plurality of car carriers (51, 53) are respectively positioned within the rooms (20). Each of the lifts (6, 7) has a vertically movable floor unit (62, 72) and a worm unit (64, 74), the purpose of which will be described in the following paragraphs. When located at a lower level, the vertically movable floor unit (62, 72) of the lifts (6, 7) can receive a selected carrier (51). Then the floor unit (62, 72) of the lifts (6, 7) can be moved upward to the upper level shown in Fig. 1, in which a car can be driven onto the carrier (51) so as to be sent into a parking room 20 on the first floor of the building (1), or to a parking room (20) on the second or third floor of the building (1) via the lift (6, 7).

As illustrated in Figure 4, each of car carriers (51) is in the form of an elongated rectangular plate and includes a peripheral wall which is provided with a plurality of rollers (510), and a bottom surface which has four spaced sliding balls (512) at four corners thereof, a longitudinally extending rack unit (514), and a transversely extending rack unit (516).

Again referring to Figures 1 to 3, the building (1) further includes an electrically controlled conveyor unit consisting of a lower conveyor assembly (4) and an upper conveyor assembly (3) located above and spaced apart from the lower conveyor assembly (4). Each of the upper and lower conveyor assemblies (3, 4) has a pair of longitudinal main rails (30, 40) extending between the front lift (6) and the rear lift (7), and a plurality of transverse secondary rails (32, 42) extending from the main rails (30, 40) and into the parking rooms (20). Each of the main rails (30, 40) of the upper and lower conveyor assemblies (3, 4) includes a plurality of spaced-apart first worms (33, 43) which are engageable with and parallel to the longitudinally extending rack unit (514) of the carrier (51). Each of the secondary rails (32, 42) of the upper and lower conveyor assemblies (3, 4) includes a plurality of spaced-apart second worms (34, 44) (only two are shown in Fig. 2) which are engageable with and parallel to the transversely extending rack unit (516) of

the carrier (51). The longitudinally extending rack unit (514) of each of the carriers (51) has a length greater than a distance between any adjacent pair of the first worms (33, 43). The transversely extending rack unit (516) of each of the carriers (51) has a length greater than a distance between any adjacent pair of the second worms (34, 44).

As illustrated, each of the first worms (33, 43) is journaled on the mounting rail (332, 432) and is equipped with a sensor (26) which activates a driving motor (330) fixed on the mounting rail (332, 432), when the sensor (26) detects arrival of a selected carrier (51). Each of the parking rooms (20) is equipped with a sensor (25) installed on a U-shaped surrounding wall that defines the room (20), and a guide plate (24) installed rotatably on the surrounding wall and located normally in a vertical position. When the sensor (25) belonging to the vacant parking room (20) detects arrival of the selective carrier (51) at the position in front of the vacant parking room (20), the corresponding guide plate (24) is activated to turn down while the driving motor (330) is stopped. At this time, the sensor (27) installed on the mounting plate (342) activates the corresponding driving motor (340) to rotate the corresponding second worm rod (34) in the vacant parking room (20). Thus, the selective carrier (51) is moved to a parking position in the vacant parking room (20). When the carrier (51) reaches the parking position, the sensor (27) stops the driving motor (340) from rotation. Each of the guide plates (24) is controlled by an adjacent sensor (25) in such a manner that the selective carrier (51) is guided to move between an opposed pair of the guide plates (24) and that the guide plates (24) can be controlled to turn down to a horizontal position, in which the guide plate (24) is flush with the main rails (30) and in which the selective carrier (51) can pass over the guide plate (24). Thus, the carrier (51) can be moved into or out from the parking room (20) by rotation of the corresponding second worm (34).

As shown in Fig. 5, when the selective carrier (51) travels along the traveling path (22), the rollers (512) contact slidably the guide plates (24), while the sliding balls (510) of the carrier (51) contact slidably the main rails (30) so that the carrier (51) moves stably on the main rails (30).

An electrical control unit is employed in this preferred embodiment and includes two controllers (105, 106) (see Fig. 1) respectively installed in the front and rear lifts (6, 7) and which can be operated to activate the first and second worms (33, 34) (see Fig. 2) so as to move a selected one of the car carriers (51) from one of the parking rooms (20) to the front lift (6) in order to carry a car on the carrier (51) when the front lift (6) is located at the lower level. Upon passing the car onto the carrier (51), the sensor (26) connected electrically with the control unit activates the front lift (6) to move upward to the upper level so as to align the floor (62) (see Fig. 1) of the front lift (6) with the main rails (30) of the upper conveyor rail unit (3). The carrier (51) is pushed toward

the main rails (30) of the upper conveyor rail unit (3) by successive rotation of the worm (64) and the first worms (33) one after another. The guide plates (24) permit stable passage of the carrier (51) from the front lift (6) to the corresponding parking room (20), and from the corresponding parking room (20) to the rear lift (7), when the rear lift (7) is located at the high level. The rear lift (7) moves downward to the lower level after the car has been expelled therefrom so that the vacated carrier (51) is moved from the rear lift (7) to the corresponding parking room (20) by successive rotation of the worm (74) of the rear lift (7) at an earlier time and the corresponding first worm (43) of the lower conveyor assembly (4) at a latter time.

Note that in this preferred embodiment, the second worm (34, 44) of the upper and lower conveyor assemblies (3, 4) are arranged in such a manner that, while a car is driven onto one of the carriers (51) by means of the upper conveyor unit (3) so as to move from the front lift (6) to a selected one of the parking rooms (20), a vacated carrier (51) can be moved from a selected parking room (20) to the front lift (6) by means of the lower conveyor assembly (4). The upper surface of each of the car carriers (51) is formed with treads (511) (see Fig. 2) so as to prevent slipping of the car after the latter has been parked thereon.

The parking device of this invention permits simultaneous entry of a car into the front entry of the building and exit of another car from the rear exit of the building and is therefore more efficient than the conventional parking device.

Referring to Figure 6 and 7, a second preferred embodiment is shown with the only difference from the previous embodiment, residing in that the building has a plurality of floors (92). The traveling path (80) is shaped as an inverted U so that the entry (101") and the exit (102") of the parking device are located at the same side of the building. A worm unit (840) is provided to assist in the transfer of a car carrier (not shown) from the left main rails (86) to the right main rails (86).

Referring to Figs. 8 to 10, a third preferred embodiment is generally similar to the second preferred embodiment in construction except that it includes two storage rooms (100) respectively located adjacent to the internal lifts (6, 7), and two external lifts (6', 7'). The carriers (51) are disposed in the storage rooms (100). There is only one conveyor assembly provided along the traveling path (22) such that each of the first and second worms (33, 34) are arranged to rotate reciprocally in order to carry the carrier (51) between the lifts (6, 7) and the selected room (20) in the above-mentioned manner. The floor unit (62', 72') of each of the external lifts (6', 7') can be stopped at any of three lower levels in each of which a carrier (51) can be moved from the storage room (100) onto the floor unit (62', 72') via the passage located under the corresponding internal lift (6, 7). Then the floor unit (62', 72') of the external lift (6', 7') can be moved upward to the upper level as shown in Fig. 8, in which a car can be driven onto the

carrier (51) in the external lift (6', 7') so as to be sent to a parking room (20) on the first floor of the building (1), or to a parking room (20) on the second or third floor of the building (1) via the internal lift (6, 7). A plurality of positioning plates (24A) are provided along the traveling path (22) and are normally in a horizontal position. Under the controlled unit, when detecting arrival of the selected carrier (51) at a position in front of the desired parking room (20), the positioning plates (24A) turn up to a vertical position. At this time, the carrier (51) is located between two positioning plates (24A) and between two opposed guide plates (24), and cannot move in the building (1). Thus, the plates (24A) prevent tilting of the carrier (51) when the latter is being into or out from the selected room 20. The features and objectives of the second and third preferred embodiments are the same as the first embodiment.

Claims

1. A parking device including a building (1) provided with a plurality of parking rooms (20), a lift unit installed in the building (1), and a traveling path (22) extending between the lift unit and the parking rooms (20), characterized by:

a plurality of car carriers (51) disposed movably along the traveling path (22) so as to enter into the lift unit and the parking rooms (20); the lift unit being capable of being stopped at a lower level to receive a selected one of the carriers (51), and at an upper level to receive a car on the selected one of the carriers (51); and an electrically controlled conveyor unit including a rotatable first worm unit disposed along the traveling path (22), and a rotatable second worm unit transverse to the first worm unit and extending into the parking rooms (20), the first and second worm units being capable of being activated so as to move the selected one of the carriers (51) from the lift unit to a first one of the parking rooms (20), and from the first parking room (20) to the lift unit, each of the carriers (51) being formed as an elongated horizontal plate having a longitudinally extending rack unit (514) and a transversely extending rack unit (516), the first worm unit including a plurality of spaced-apart first worms (33) which are engageable with and parallel to the longitudinally extending rack unit (514), and a plurality of spaced-apart second worms (34) which are engageable and parallel to the transversely extending rack unit (516), the longitudinally extending rack unit (514) of each of the carriers (51) having a length greater than a distance between any adjacent pair of the first worms (33), while the transversely extending rack unit (516) of each of the carriers (51) has a length greater than a distance between any adjacent

pair of the second worms (34), so as to move the carriers (51) between the lift unit and the parking rooms (20).

2. A parking device as claimed in Claim 1, wherein the lift unit includes a front lift (6) and a rear lift (7), each of which can be stopped at a lower level to receive the carrier (51) and at an upper level to receive a car on the carrier (51), the conveyor unit including a lower conveyor assembly (4) communicating the parking rooms (20) with the front lift (6) and with the rear lift (7) and being capable of being activated to move the carrier (51) from the parking room (20) to the front lift (6), when the front lift (6) is located at the lower level, in order to carry a car thereon, and an upper conveyor assembly (3) being located above and spaced apart from the lower conveyor assembly (4) and communicates the parking rooms (20) with the front lift (6) and with the rear lift (7), in such a manner that the upper conveyor assembly (3) can be activated to move the carrier (51) from the front lift (6) to the parking room (20) when the front lift (6) is located at the upper level, and from the parking room (20) to the rear lift (7) when the rear lift (7) is located at the upper level, the lower conveyor assembly (4) being capable of being activated to move the carrier (51) from the rear lift (7) to one of the parking rooms (20) when the rear lift (7) is located at the lower level.
3. A parking device as claimed in Claim 1, wherein the lift unit includes two lifts, the building (1) further having two storage rooms (100) adjacent to the lifts respectively, the traveling path (22) extending between the lifts and the storage rooms (100) in which the carriers (51) are placed when vacated, the conveyor unit being capable of being activated to move the carriers between the lifts and the parking rooms (20) and between the lifts and the storage rooms (100).

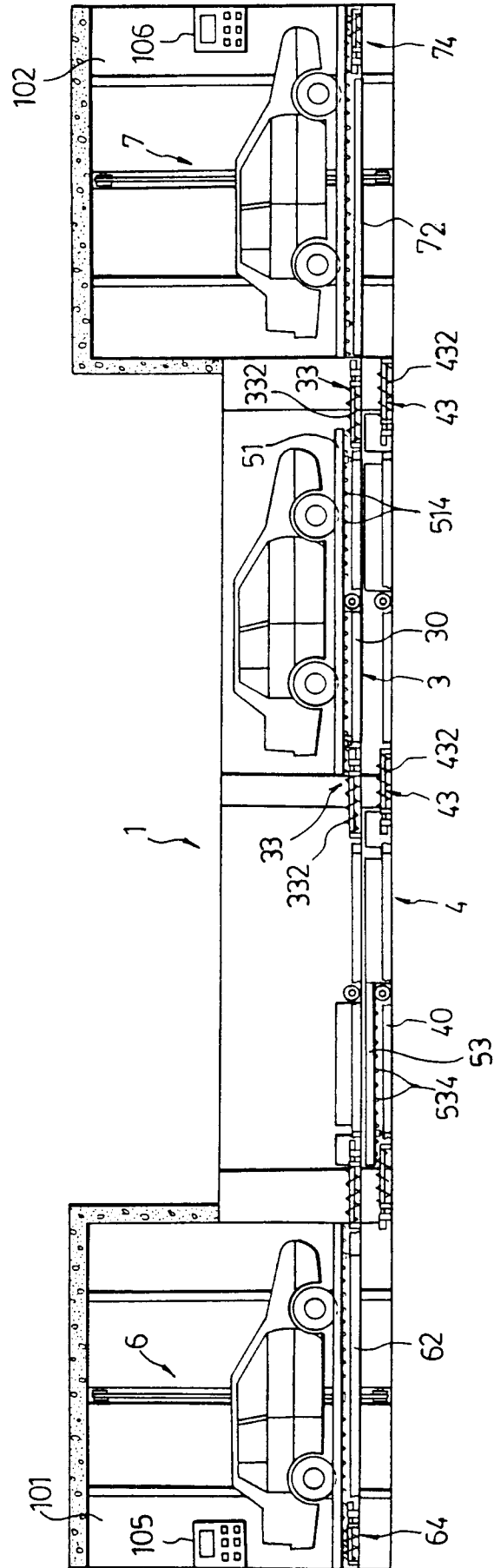


FIG. 1

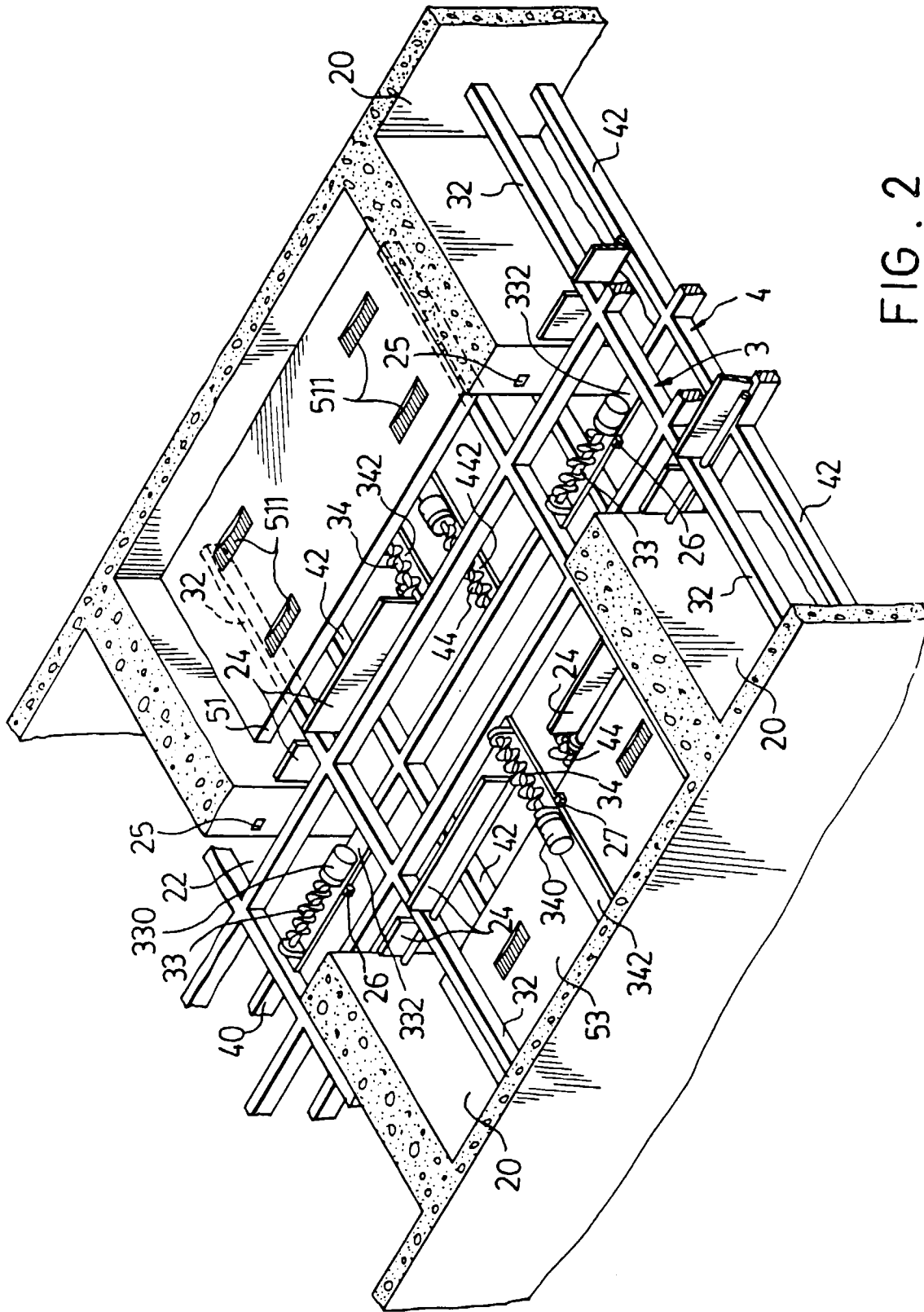


FIG. 2

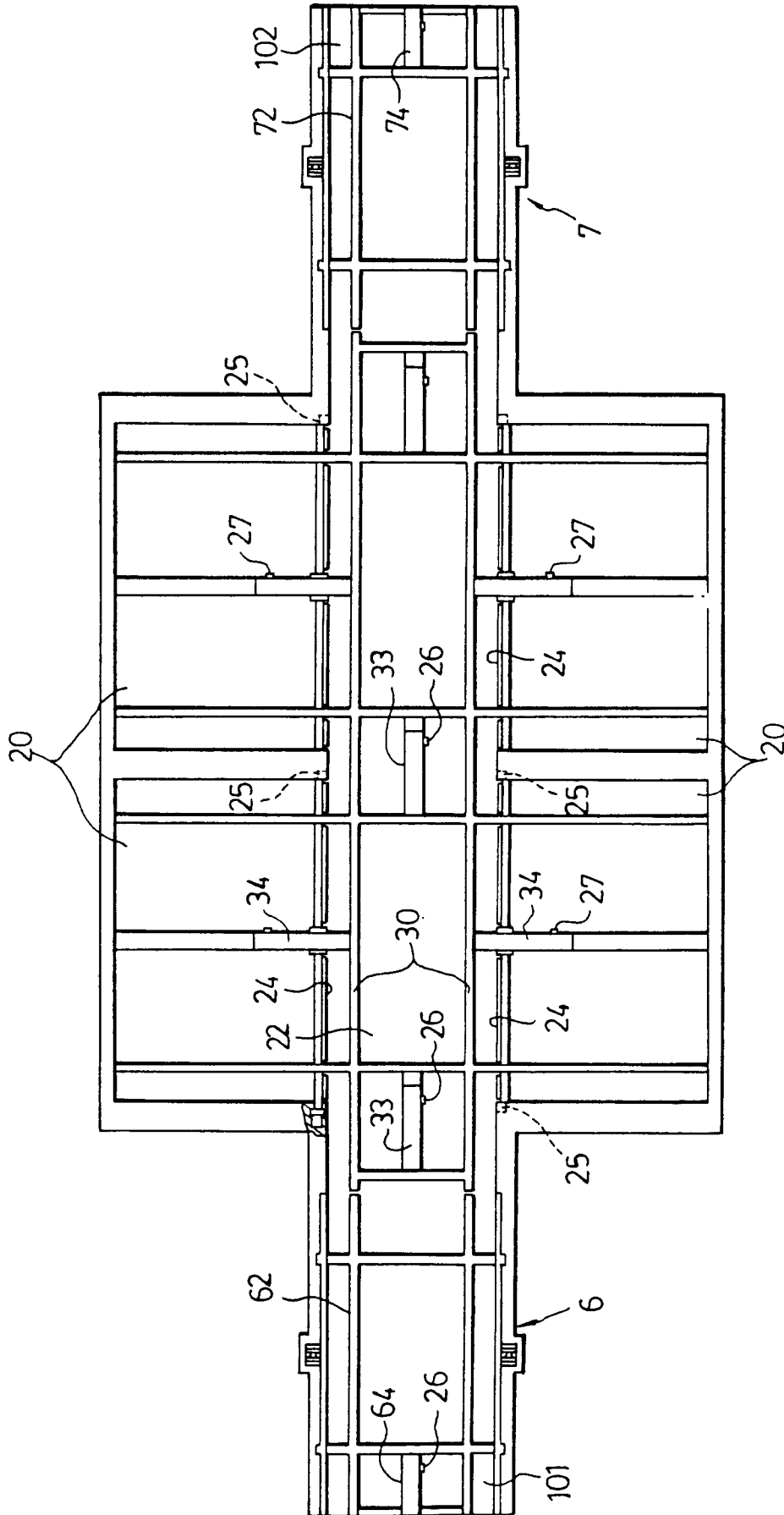


FIG. 3

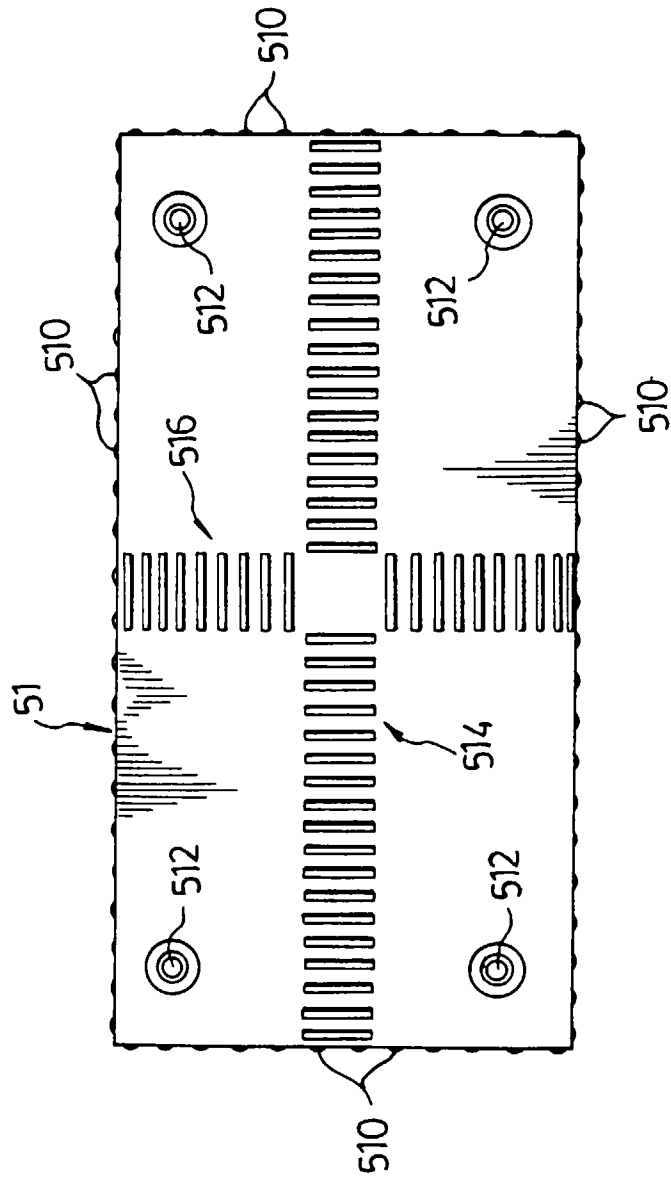


FIG. 4

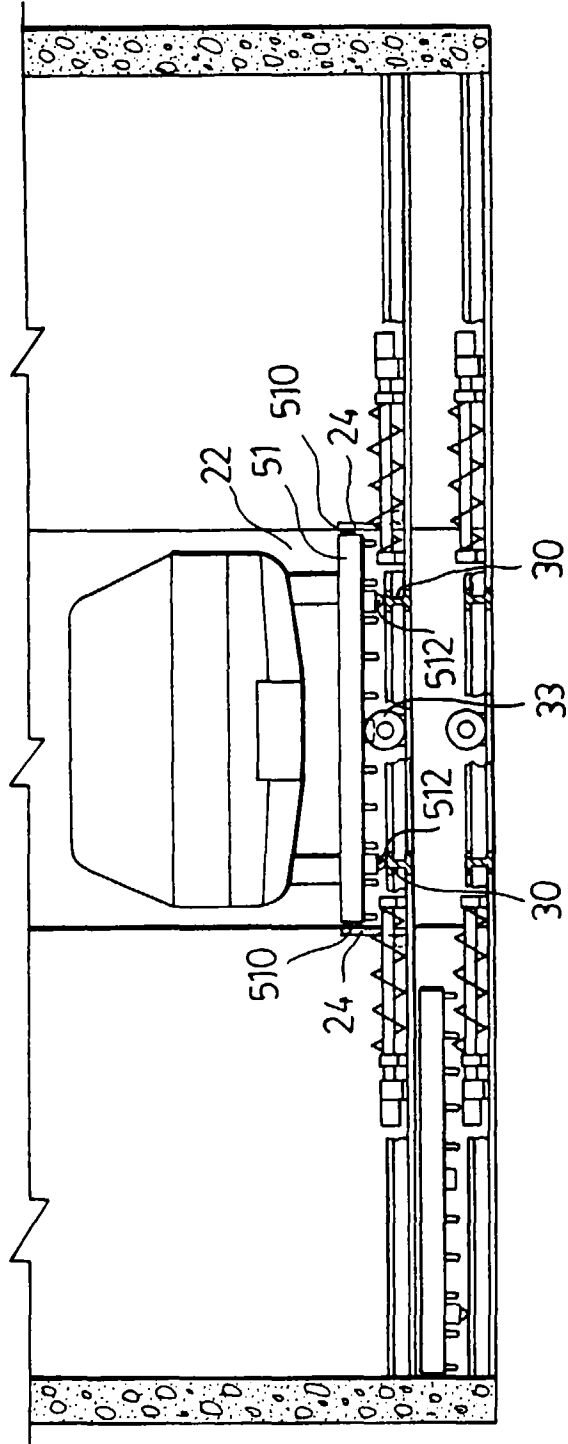


FIG. 5

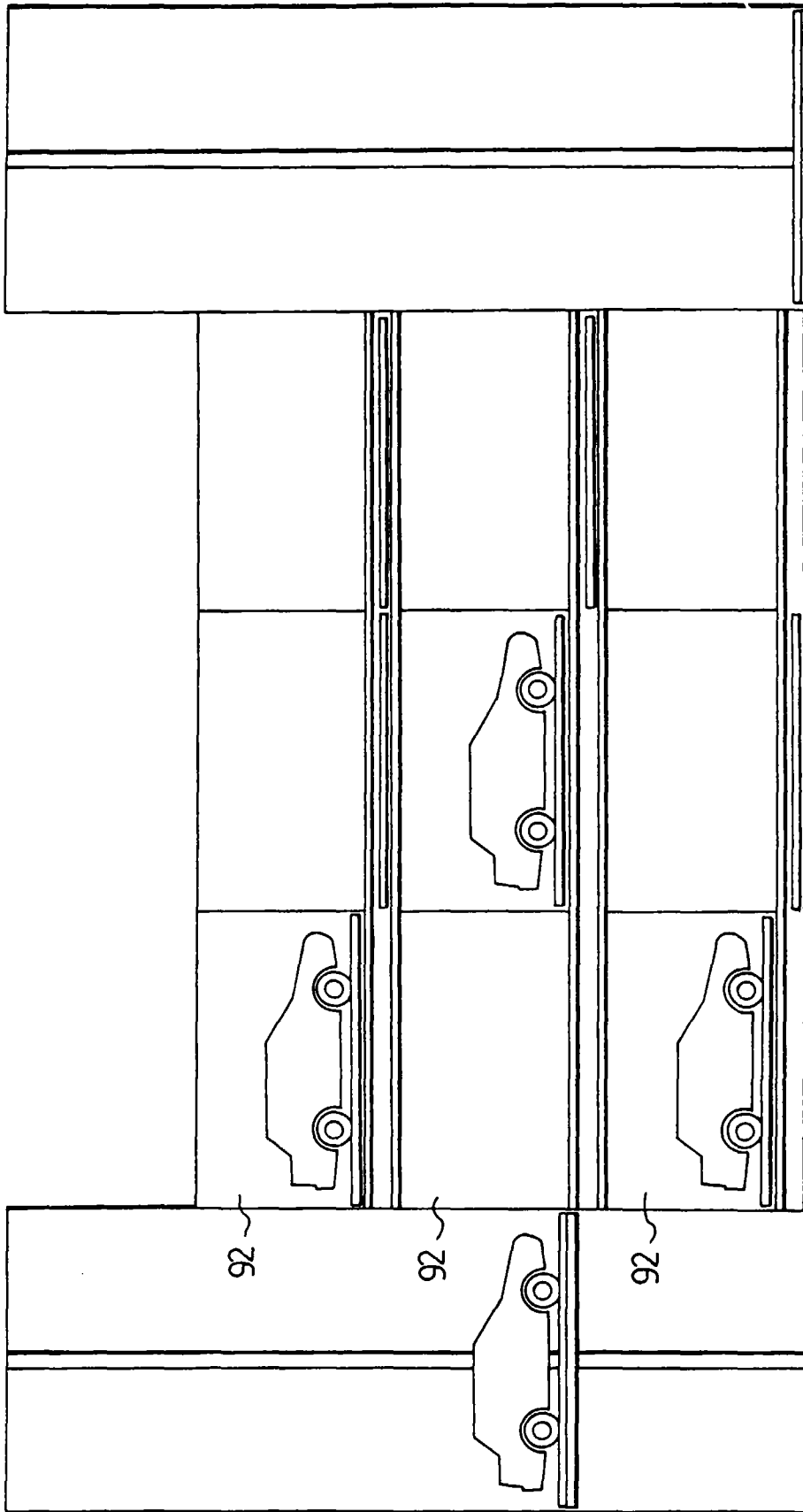


FIG . 6

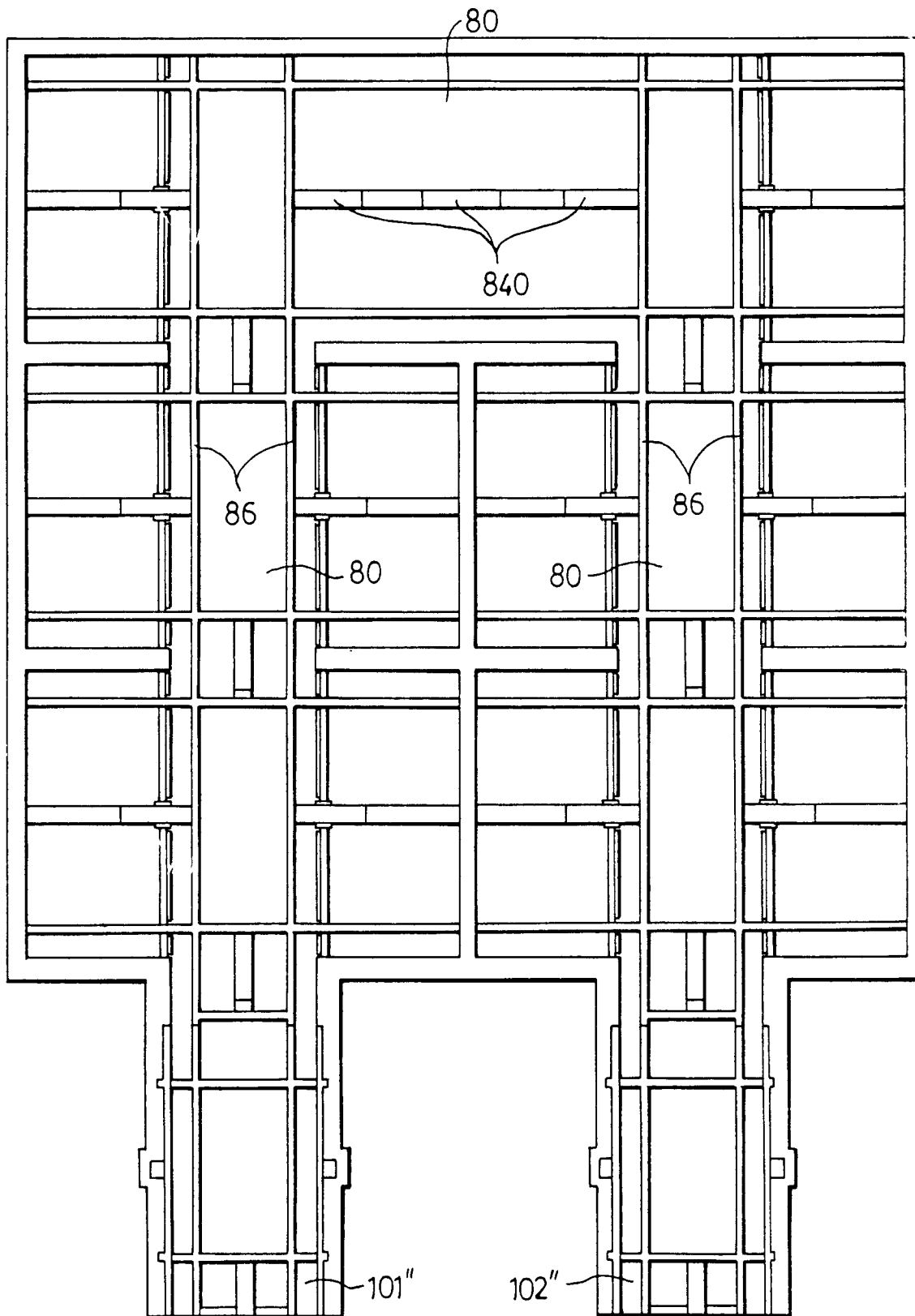


FIG. 7

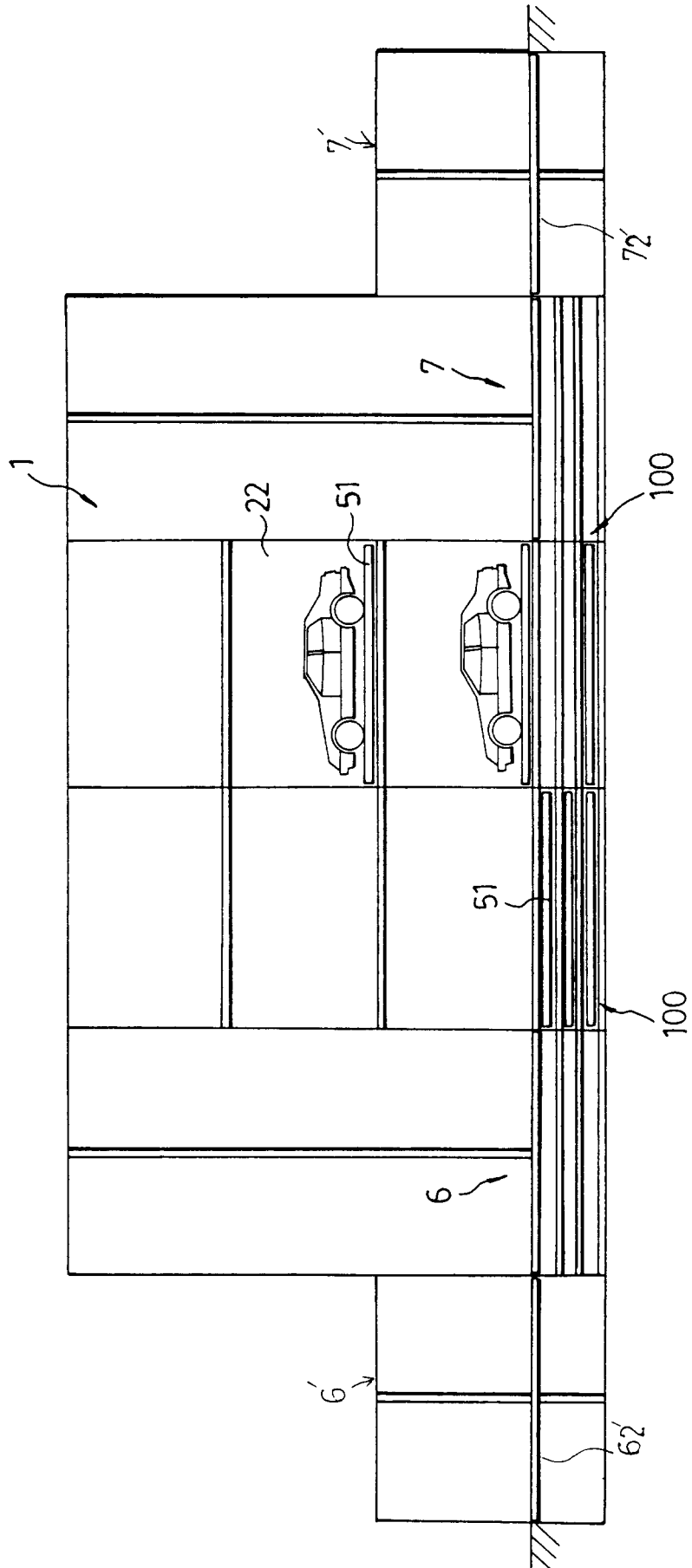


FIG. 8

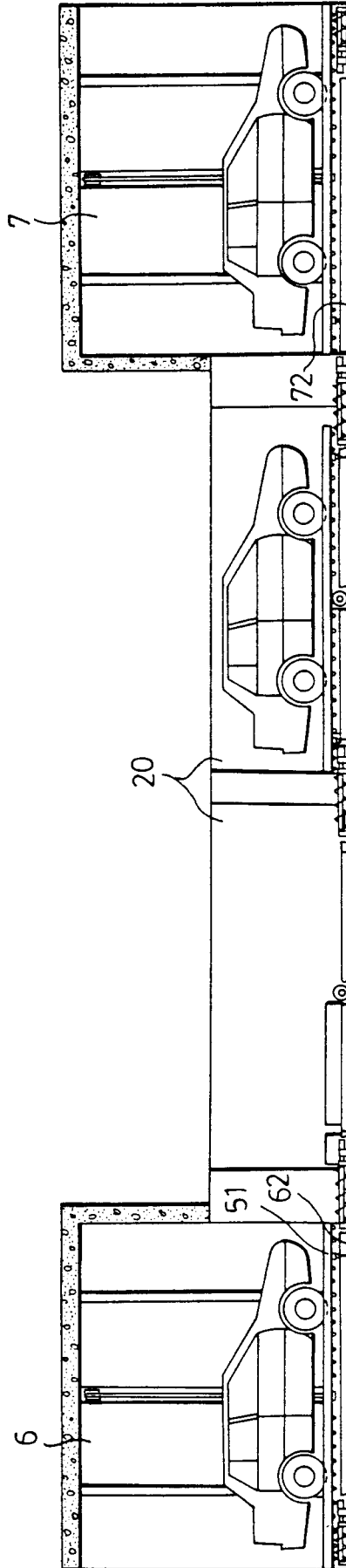


FIG . 9

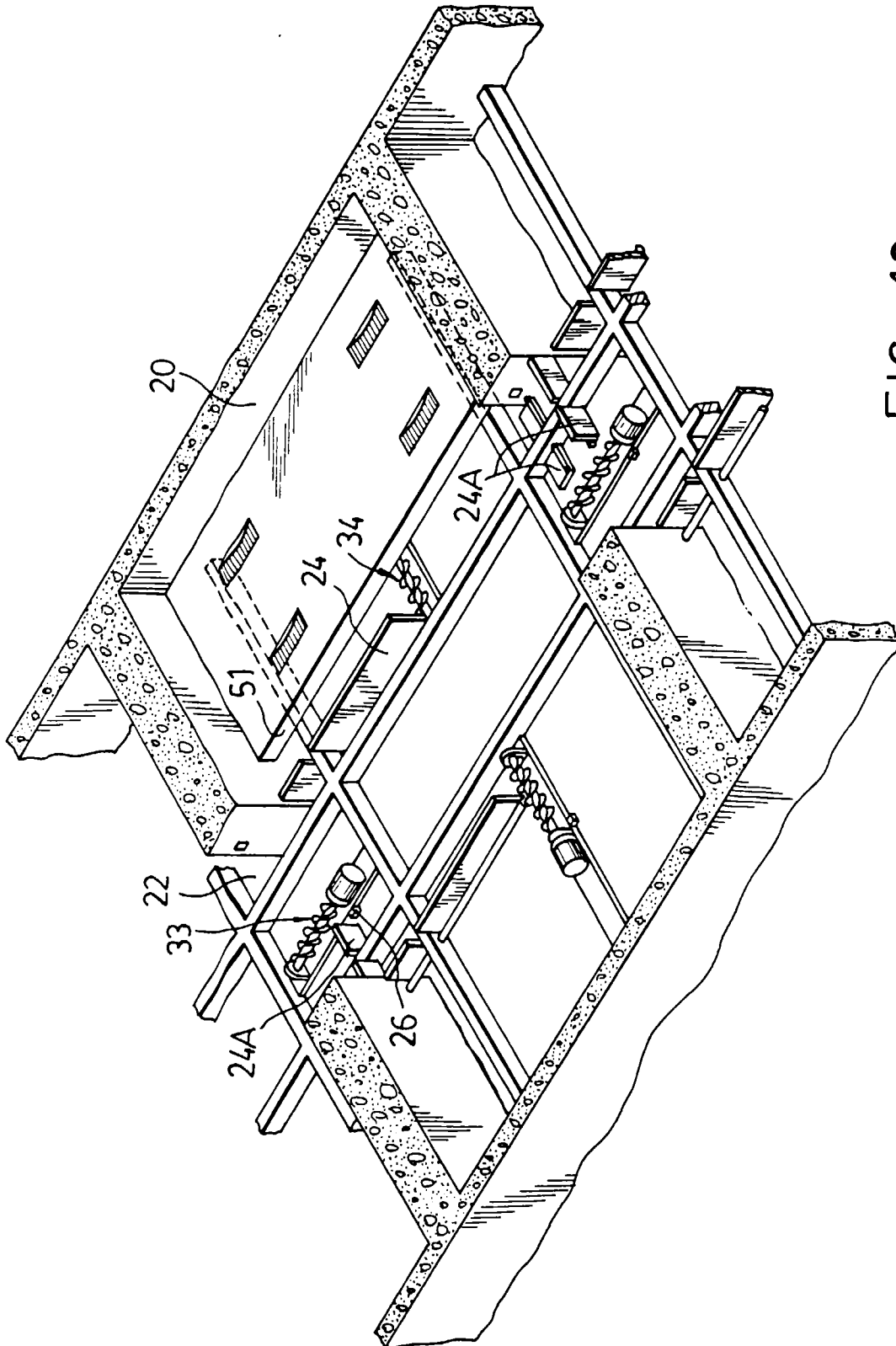


FIG. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 1163

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	WO-A-89 12152 (H. HAMMER) * the whole document *	1	E04H6/24
A	---	2,3	
Y	US-A-2 837 223 (I WOLFF) * the whole document *	1	
A	---	2,3	
A	US-A-3 217 905 (J. W. FRANGOS) * column 4, line 25 - line 39; figure 7 *	1	
A	WO-A-91 12395 (N. A. S. GYNNE) * the whole document *	1	
A	WO-A-86 06434 (KUROSAKI SHUNICHIROU) * the whole document *	1	
A	FR-A-1 362 834 (N. A. S. GYNNE) * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E04H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 July 1996	Examiner Delzor, F
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