United States Patent [19]

Glass

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[45] **Nov. 27, 1973**

[54] **VEHICLE PARKING SYSTEMS AND MATERIAL HANDLING AND STORAGE AND MECHANISMS RELATING THERETO**

[76] Inventor: **Benjamin Gordon Glass**, San Diego, Calif.

[22] Filed: **Mar. 22, 1971**

[21] Appl. No.: **126,477**

[52] **U.S. Cl.**.. **214/16.1 CE**, 214/16.1 DB, 104/132, 104/99, 104/131, 214/16.1 EB

[51] **Int. Cl.**..... **E04h 6/06**

[58] **Field of Search**..... 214/16.1 CC, 16.1 C, 214/16.1 DB, 16.1 CE

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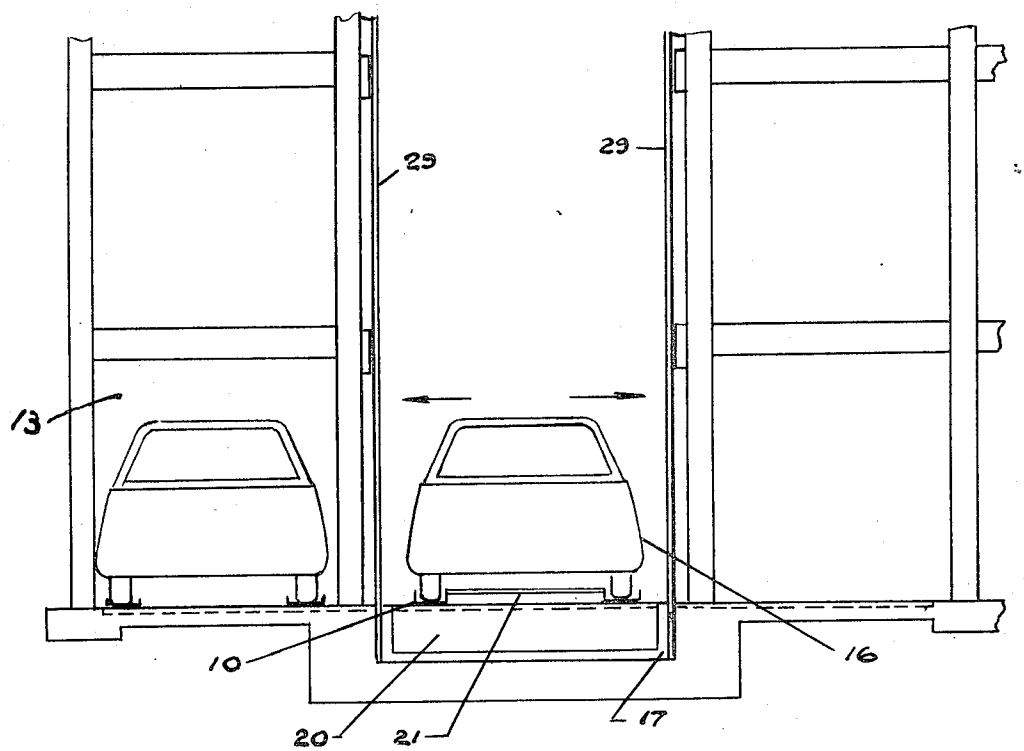
[57] **ABSTRACT**

A rapid multiple vehicle parking system, automatic or semi-automatic, suitable also for cargo handling in which vehicles are driven onto skates at reception and prealigned, in most cases, for eventual exiting, then pulled onto a platform-elevator which includes means of arresting vehicles and on and off loading on either side, then vehicle is conveyed horizontally on gear-rack rails positioned on either side of platform elevator to rows of multi-level storage modules flanking the access bay in which the platform-elevator can move both horizontally and vertically to vacant modules selected by a control or memory bank which monitors the parking positions and vehicle retrieval back to the reception and exiting area when required. Operational speed is assisted by the simultaneous operation of more than one platform-elevator in the same access bay. Platform propulsion power is via bus-bars and rolling-contacts and control is similarly achieved or by telemetered signals to servo units from a radio signal transmitter.

5 Claims, 18 Drawing Figures



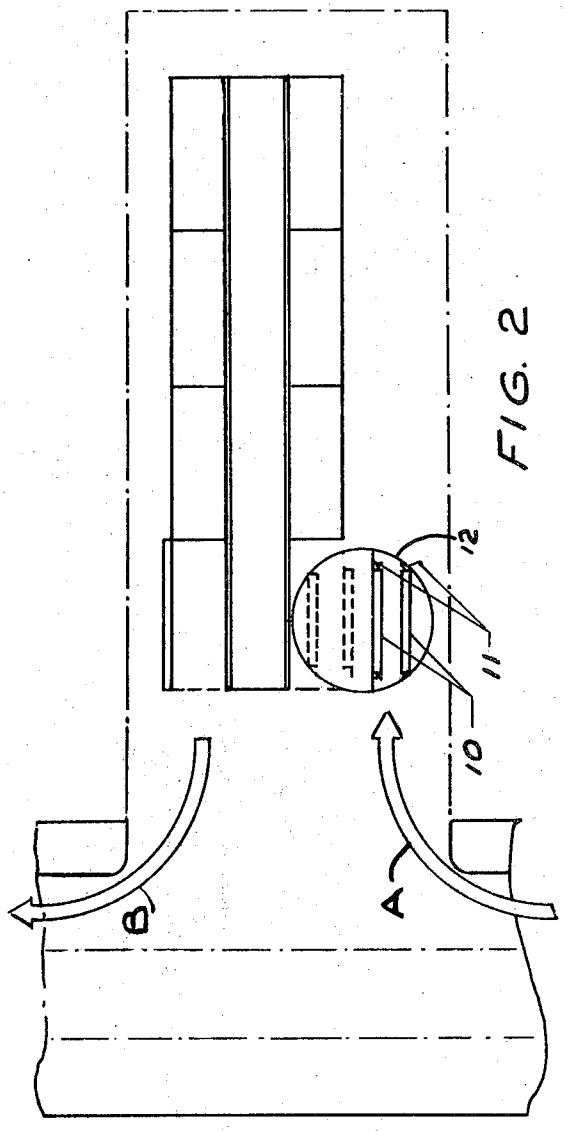


FIG. 2

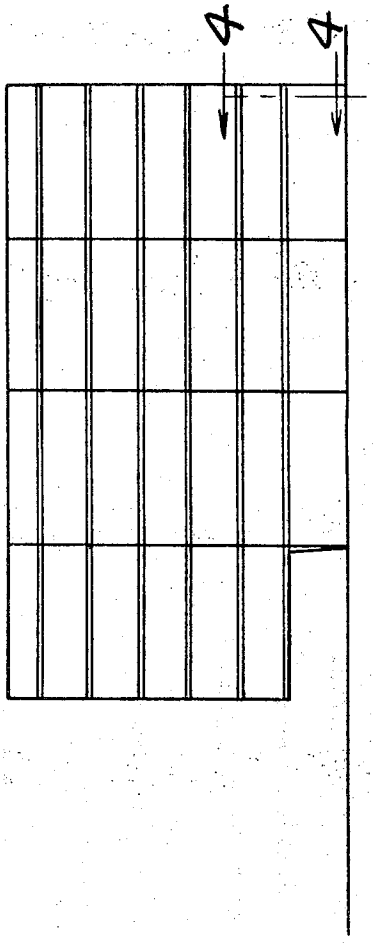


FIG. 1

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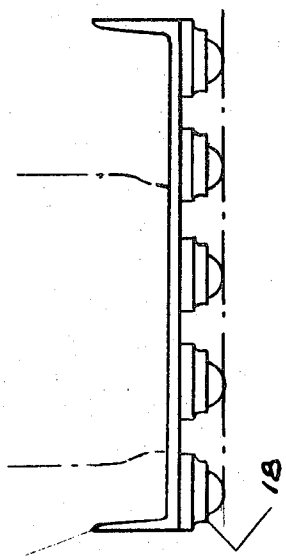

FIG. 5

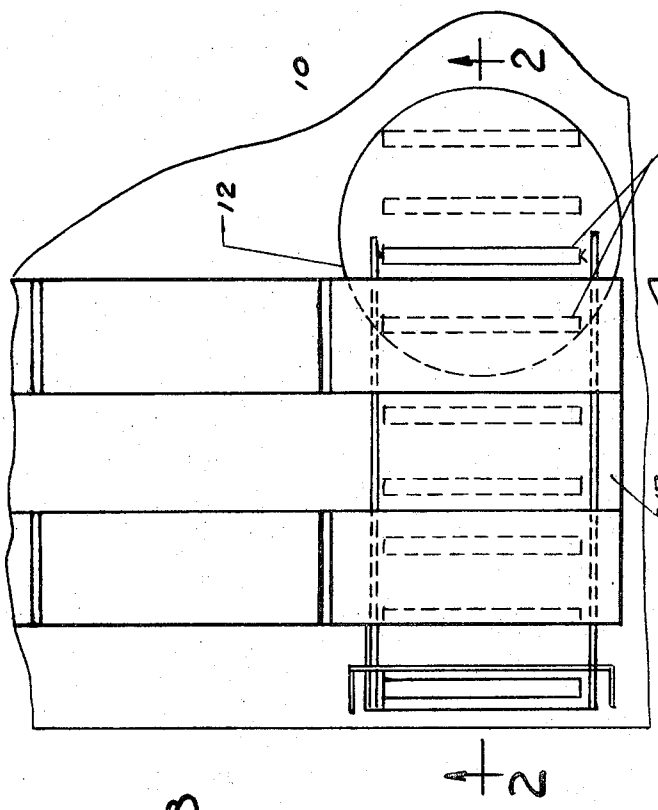

FIG. 3

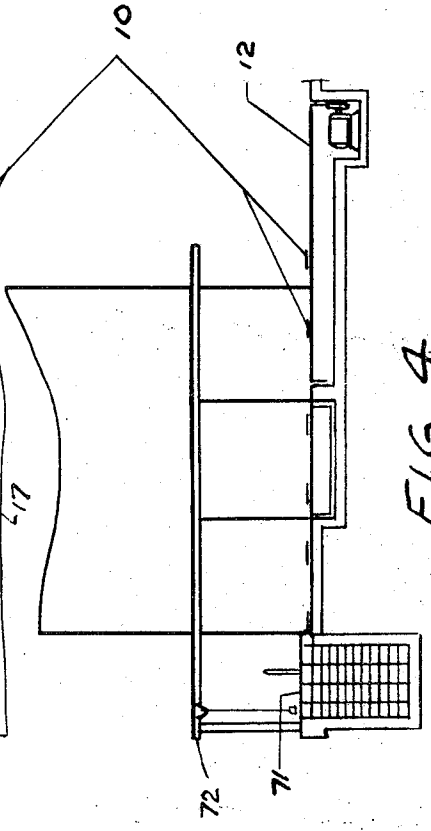

FIG. 4

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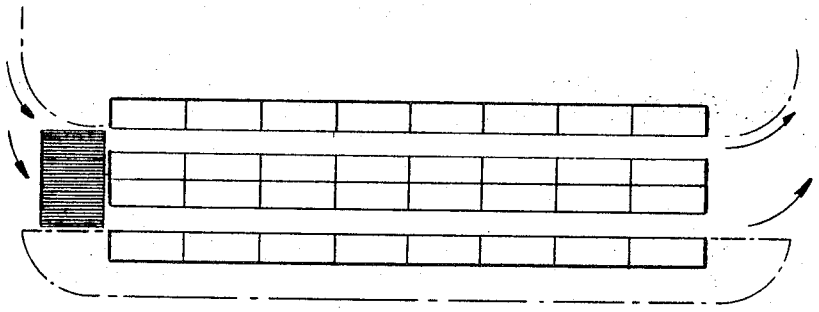

FIG. 6

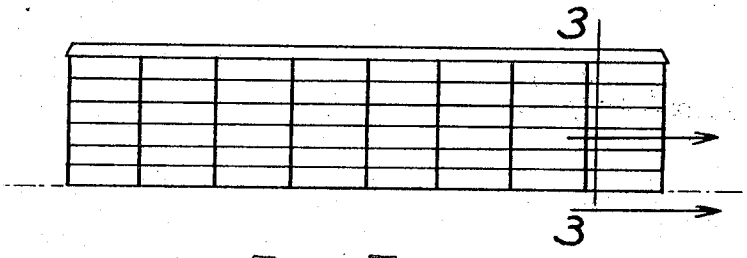

FIG. 7

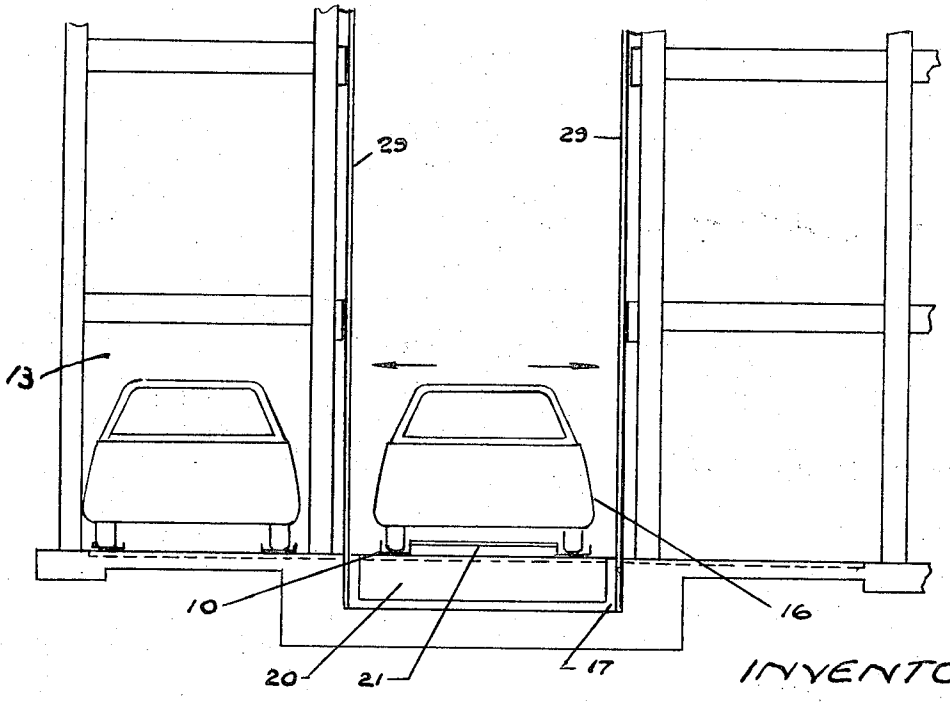

FIG. 8

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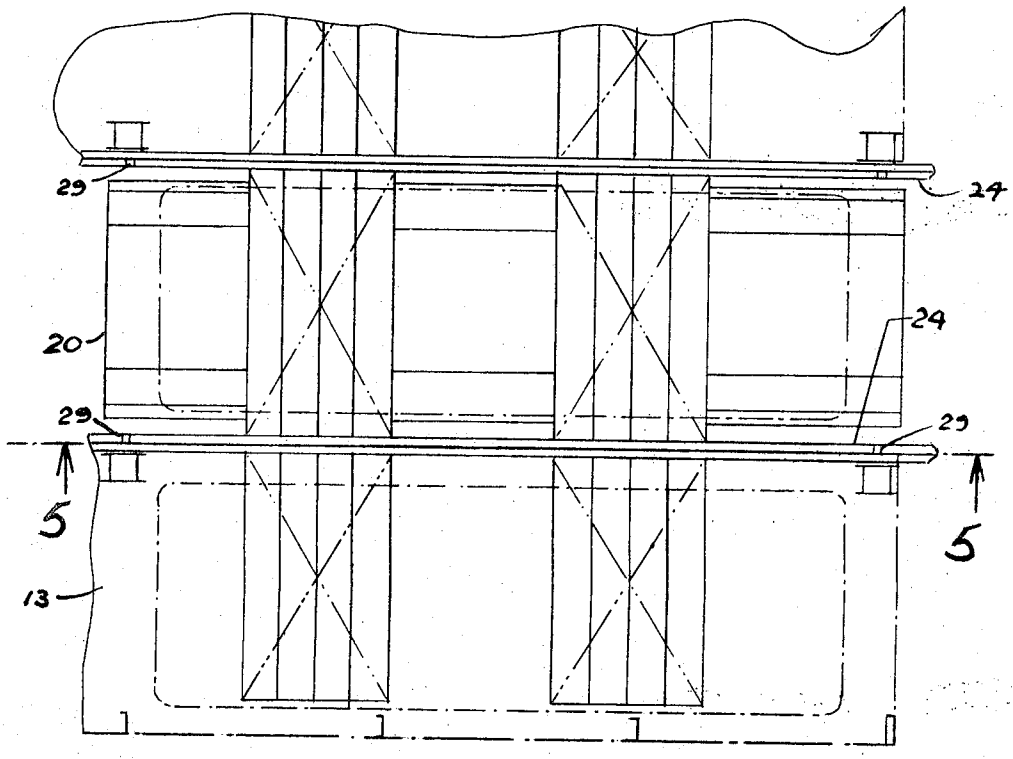

FIG. 9

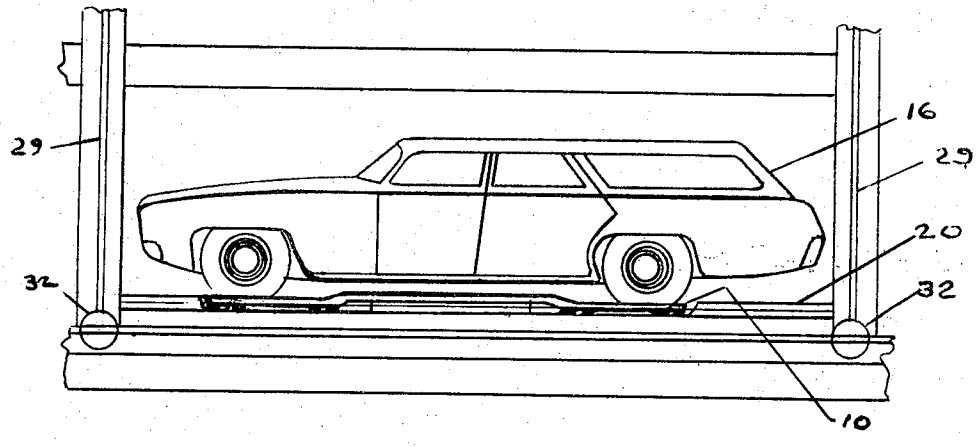

FIG. 10

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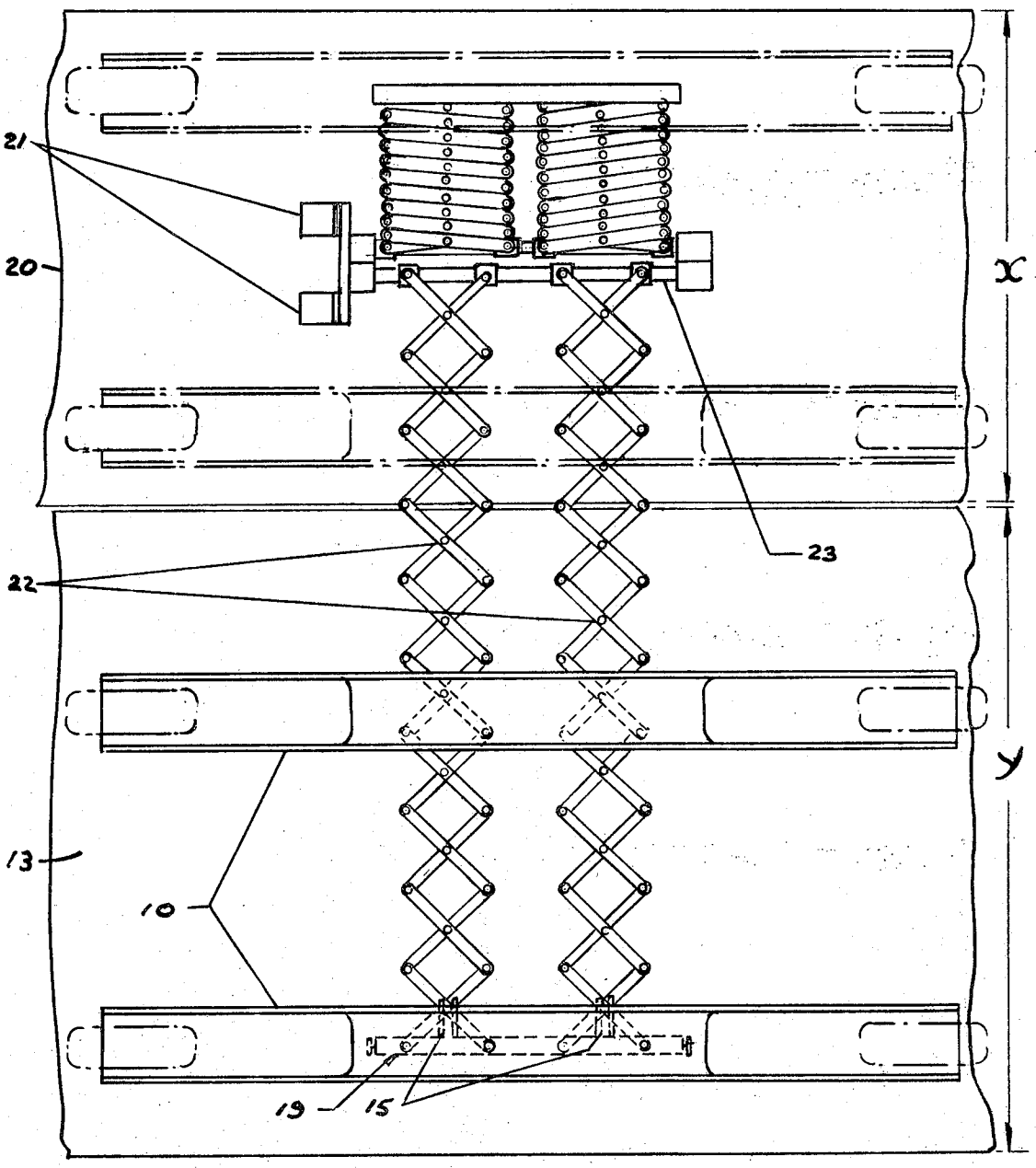

FIG. 12

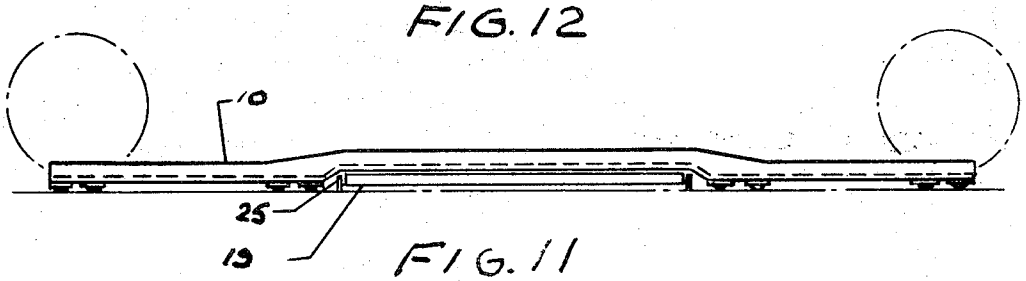

FIG. 11

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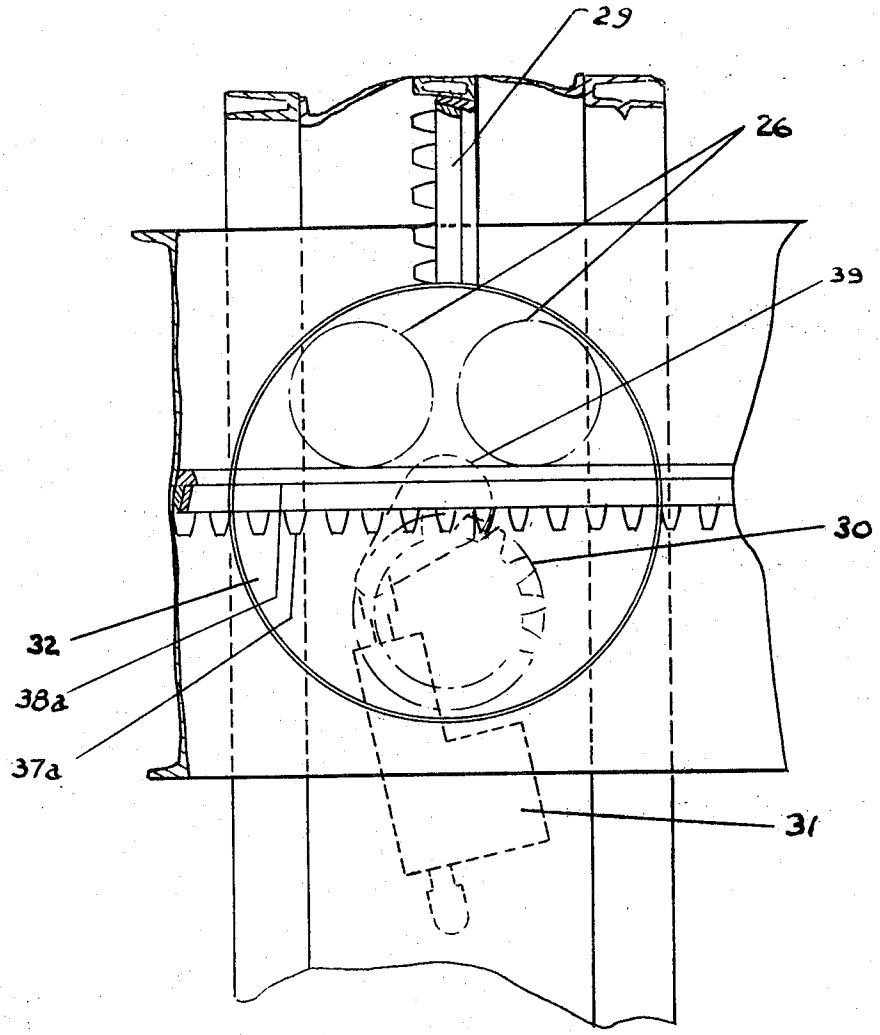

FIG. 13

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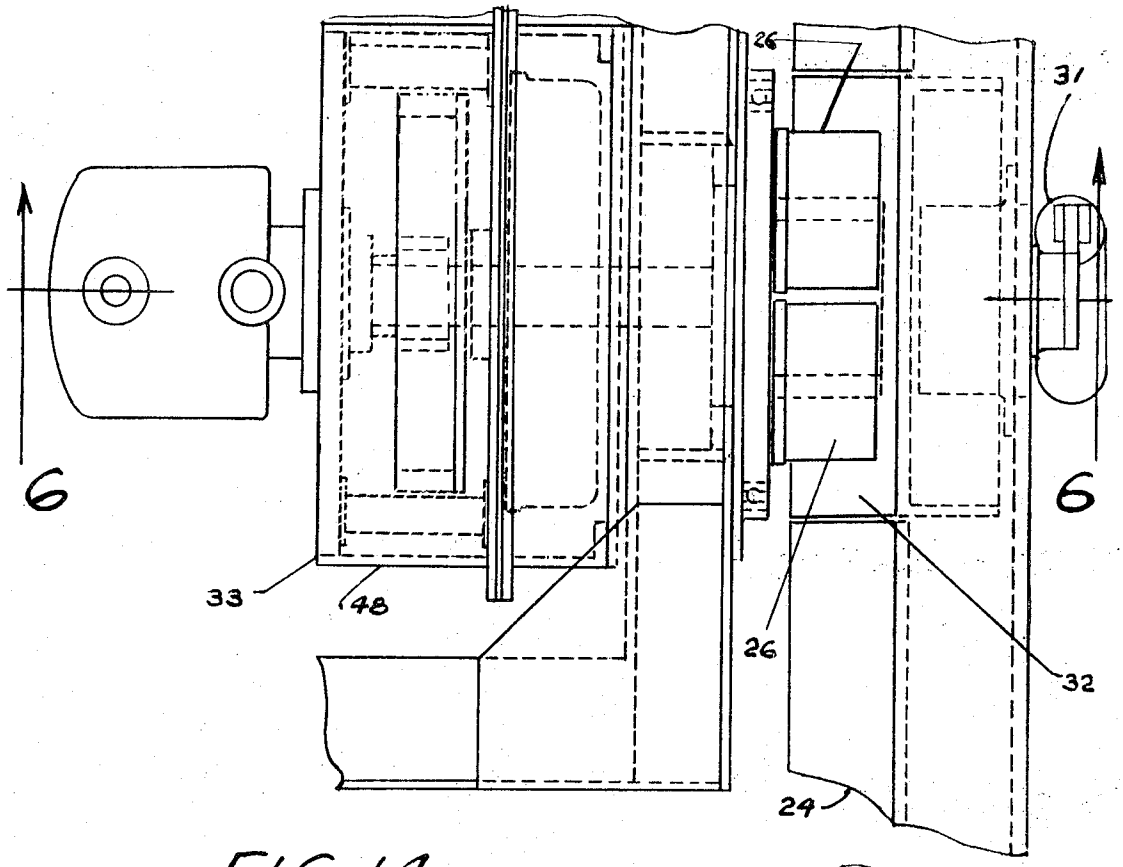

FIG. 14

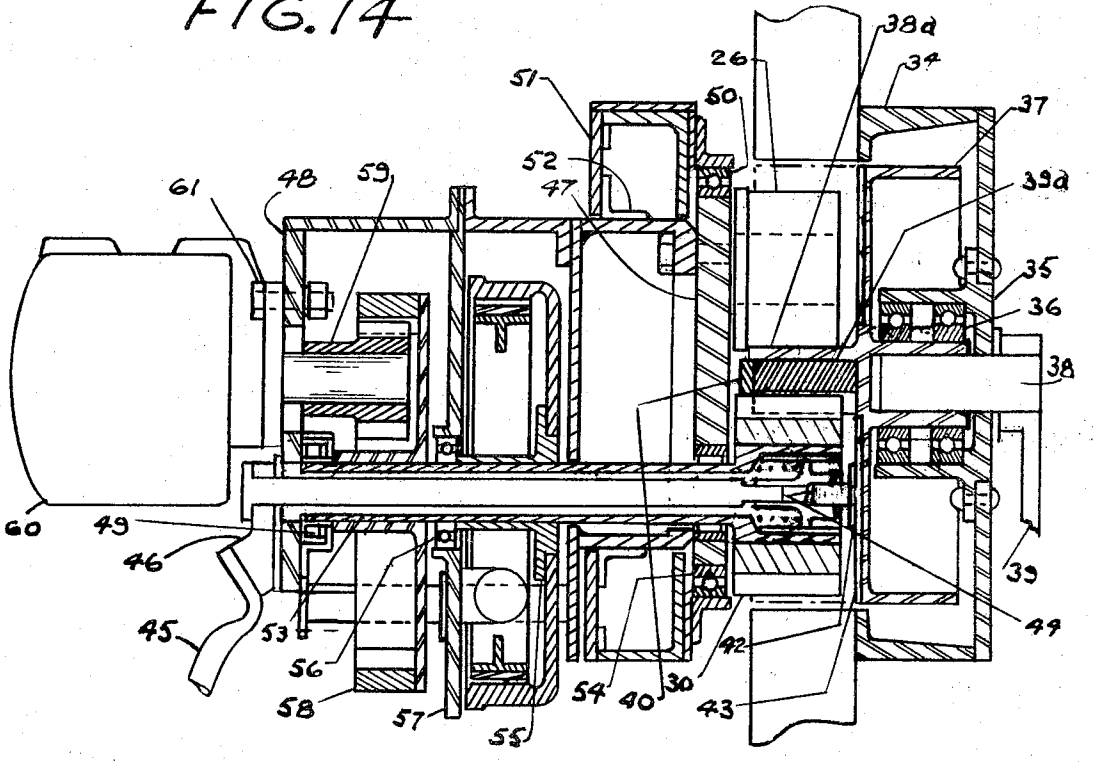

FIG. 15

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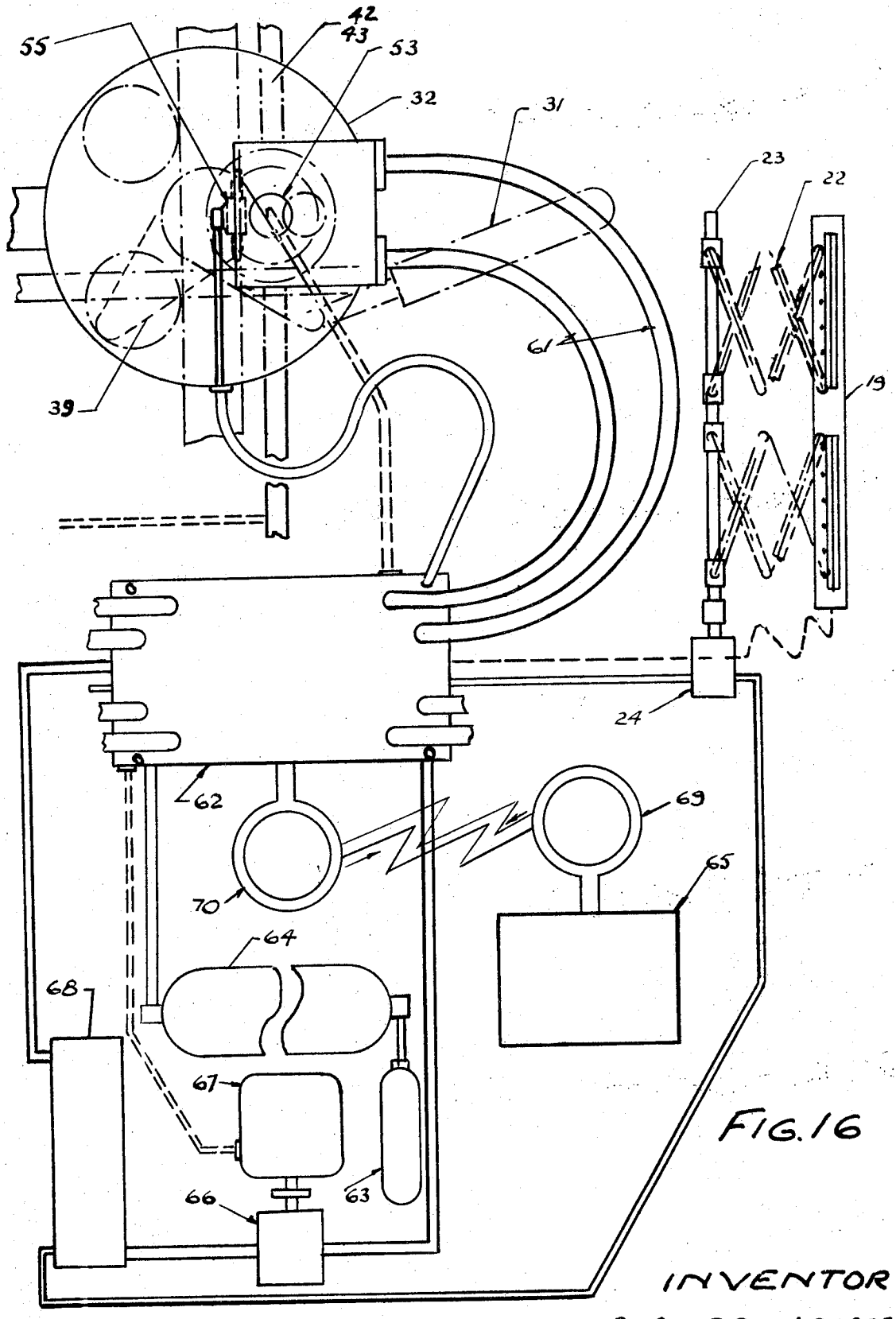

FIG. 16

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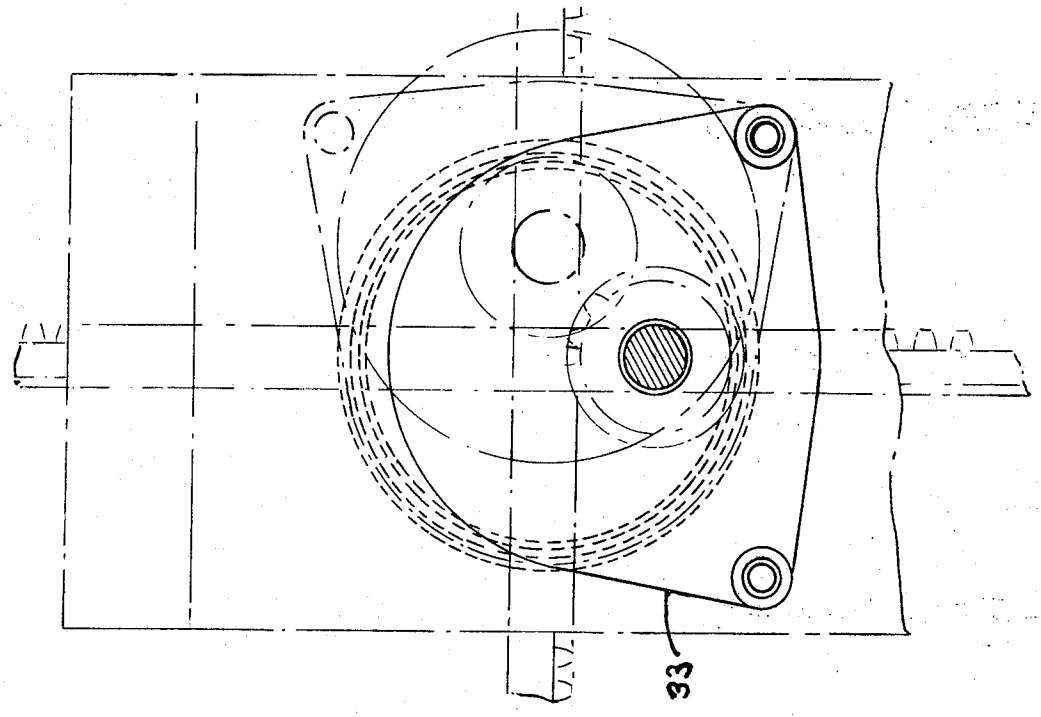

FIG. 18

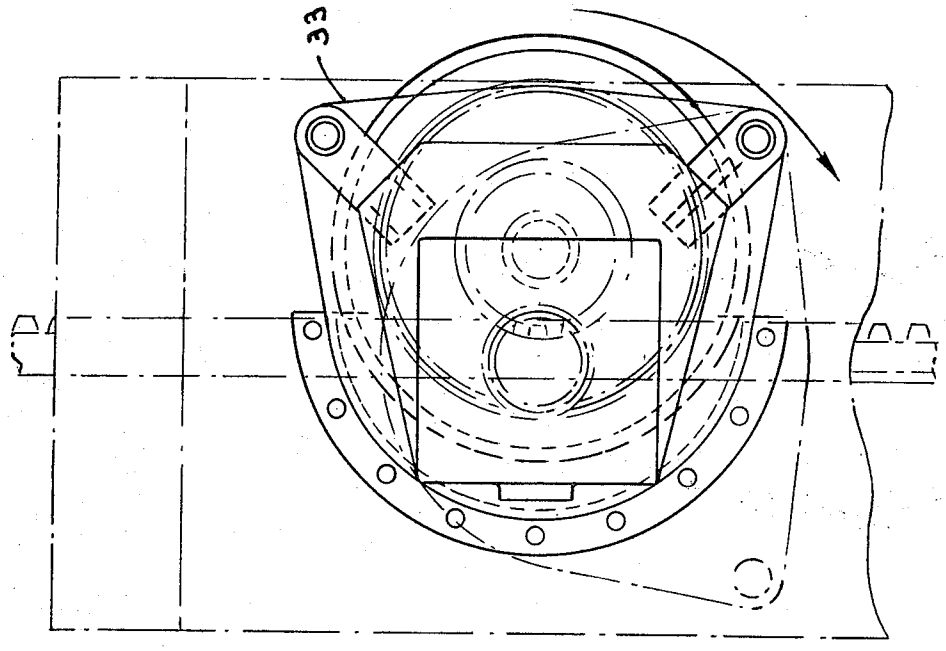

FIG. 17

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VEHICLE PARKING SYSTEMS AND MATERIAL HANDLING AND STORAGE AND MECHANISMS RELATING THERETO

BACKGROUND OF THE INVENTION

This invention relates to improvements in automatic and semi-automatic vehicle or cargo storage facilities particularly car parking facilities either above or below ground where the vehicle is driven onto skates at reception points then automatically moved and stored in multi-level modules until required.

Vehicle, or paletized or containerized cargo, is automatically transferred laterally onto a gear-rack rail-borne platform-elevator, proceeds to base of multi-level storage modules, flanking its access lane, then gear-rack turntables transfer the platform-elevator from horizontal rail gear-racks to vertical ones aligned with the storage module openings into one of which, on either side of the platform elevator, the vehicle is transferred automatically.

Retrieval of vehicle is similarly performed in the reverse sequence when the under-wheel skates are arrested at off-loading point from the platform-elevator and the vehicle is occupied by driver and passengers and then driven away.

It is well known that lack of space and vehicle access in large city centers is a rapidly increasing problem. Existing methodology only appears to aggravate the problems as land availability diminishes, values escalate and high capital expenditures preclude provision of more conventional car parks with their large area needs in relationship to their potential revenue. A solution to more cars parked per unit area is therefore most important. Rapid ingress and egress to and from parking facilities is also mandatory to avoid dangerous traffic-jams and smog proliferation aggravated by many idling vehicle engines awaiting room to park in long lines, raising the local air contamination to dangerous proportions typical of all slowly running engines when combustion efficiency is at a minimum. Some prior art parking and storage systems have improved this situation somewhat by improved space utilization compared with drive-in ramp type car-parks, however this invention affords much better immediate vehicular access, lower space usage and faster deployment and retrieval with lower overall facility costs as will be brought out in the description.

SUMMARY OF THE INVENTION

In an embodyment of the invention a small parking facility with narrow frontage, and difficulty of access for conventional parking systems, is used as an example. Entry and exits are from one side of the lot only, facing onto a public street. Normal vehicle turn radii and manuver space would reduce the parking capacity to uneconomic proportions. With this invention this small site is rendered fully productive by eliminating vehicle turning entirely except at reception when the car is rotated 180° to face outwards towards the road for normal exiting by use of devices enabling the turn to take place within the length of the vehicle. The 180° turn can be accomplished with a rotating boom or on a vehicle turntable.

When the vehicle enters the facility it is driven directly onto underwheel skates formed from channel section members mounted on shallow ball-castors. These castors afford complete directional freedom laterally and enable the vehicle to be turned within its own length, using a rotating boom impinging on the skates dies. Alternatively skates are positioned on a vehicle turntable and the vehicle-laden turntable can then be rotated the requisite amount (180°) for vehicle to face the road ready to exit. Skates are pre-positioned by detents fore and aft preventing longitudinal movement when vehicle mounts for dismounts the skates.

An alternative construction, eliminating the need for skates, is to construct the turntable floor and area adjacent to it, with conveyor rollers where the vehicle wheels traverse laterally. The conveyor roller longitudinal axis normally would correspond with the fore and aft position of the platform-elevator which would still be the case after the vehicle turntable has rotated 180° for car exiting requirements.

Both the platform-elevator deck and strips of each storage module floor would be similarly equipped and the vehicle moving boom would be telescopic with forked ends sliding over the front and rear tires on one side in order to attach to the vehicle and move it, otherwise the whole system remains unchanged for this alternative construction.

Driver and passengers leave the vehicle after application of its parking brake and/or placing transmission in "park". The vehicle transfer from reception point to parking module storage position is accomplished by a platform-elevator which has mounted, on its deck, a shallow mechanism, clear of vehicle's underbody which can extend laterally under vehicles on either side, slide under the first skate then attach to the outer skate by electro-magnetic force or solenoid-actuated latch. The car moving mechanism then retracts pulling the car onto the platform-elevator deck and holding it there while the platform-elevator, which is a light frame structure with four pinion drives engaging the teeth of horizontally-disposed rail gear-racks, the teeth of which face downward and the plain upper face is attached to a structural member on which small wheels or rollers, extending out from the platform-elevator longitudinal sides, roll to provide mobility for the platform-elevator and its load.

The two rollers per pinion drive on each of the four corners of the platform-elevator are arranged in delta formation with the two rollers on top engaging the rail structure and the drive, at rack underside, taking place through each pinion at each of the four corners.

This running-gear is mounted in a cylindrical rotatable gearbox drive assemblies 4 built into the platform-elevator longitudinal members 2 located at front end and rear ends. The gearbox drive consists of a pinion shaft brake assembly and reduction gear to a motor drive consisting of either an electric, pneumatic, or preferably an hydraulic motor and pinion engaging the reduction gear. Power input to the motor is via flexible hose in the case of either hydraulic or pneumatic drive and flexible electric cable in the case of an electric motor drive. High pressure fluid power is supplied by electric motor driven pump also located on the platform-elevator. Electric power is via a distributor panel connected to a bus system on the support structure via rolling contacts housed in the rack pinion drive or roller stub shafts.

From the above description it will be concluded that the traction system consisting of four packs are independent and free to rotate through 90° on rail-gear rack turntables positioned in the horizontal track to coin-

cide with vertical rail gear racks at front and rear ends of the platform-elevator, hereinafter generally abbreviated to PE. Normal to the same planes as the two horizontal rail gear-racks, sets of vertical rail gear-racks are erected to suit each vertical stack of storage modules either side of the access lane in which the PE functions. A horizontal track is required at ground level, but not necessarily at each floor. For most medium height facilities two horizontal runs at ground floor and top floor are adequate to provide for several PE's to operate simultaneously in this single access lane. Switching from one plane to another (horizontal or vertical) is therefore purely a matter of centralizing the PE on the four rail rack-turntables and then actuating the four synchronized turntable actuators. The pinion drives are locked by an automatic braking system on each shaft operative during the switching operation. Pinion drives are locked instantly also should there be power failure at any time by a spring loaded device against which power is used to unlock the brakes.

Constant replenishment of skates at the vehicle reception area is achieved, for example, by an overhead storage system and gantry conveniently arranged under cantilevered floor sections overhanging the reception and departure area where the skates vacated by cars leaving the facility can be picked up into the magazine and moved transversily along to the reception point where they are lowered in position ready for the next incoming vehicle.

The preferred PE propulsion system is to use an electric motor driven hydraulic pump constantly running to supply hydraulic accumulations which feed the hydraulic motors driving the rack pinions also providing power for separate hydraulic motors driving the vehicle mover mechanism. The mover mechanism consists of lazy tongs proportioned to extend from their stowed position on the platform to the outboard skate on the adjoining storage module. The link mechanism is actuated by an hydraulic motor driven screw jack with left hand and right hand threaded portions driving trunion nuts engaging the end links of each lazy tongs. A complete mechanism is provided for each of the two longitudinal sides of the PE to suit the storage modules flanking the PE. These vehicle movers operate therefore to move cars on and off the PE at all times from time of arrival to eventual retrieval from the storage module and off-loading at departure station ready for the vehicle to be driven away.

It will be appreciated that unlike conventional elevator systems where motion is confined to the vertical plane, this invention affords considerable economy in time as simultaneous operations can proceed in the same bay with several PEs operating at the same time enabling multiple operations to proceed simultaneously, not penalized awaiting the access route to be cleared before the next PE can proceed.

This sytem used in multiples enables much faster ingress and egress to the facility as cars approaching the facility can proceed directly to each vacant access lane via their vehicle turntables (for example, two lanes per turntable) and completely avoid queing common to most large parking facilities where ingress and egress is often reduced to a single lane. For very large facilities incorporating this invention, ingress can be from one public street and egress from another, where the facility spans the intervening space between the two streets, in which case no vehicle turntables are required but all other invention aspects are identical with that described for the small facility example described herein. A procedural variation for the large facilities as opposed to smaller ones can be that cars would be driven right onto skates pre-positioned on PEs, thus saving time and eliminating one lateral transfer operation necessary when vehicle turntables are used for blind ended access routes.

Overall control of the above described parking system can be vested in a 100 percent automated control system including the collection of parking fees, provision of change and automatic retrieval of vehicles. Alternately a semi-automated system can be provided utilizing a lesser degree of automation and subject to human monitoring in which video would assist in surveilance of each vehicle being parked or retrieved.

Although the systems described herein are primarily for vehicle parking, cargo and material handling can benefit considerably from the systems and technology created with minor changes to suit, for example, palletized or containerized cargo in place of handling road vehicles.

The object of this invention, generally described as the "AUTOSTAK" system can be summarized viz:

An object of the present invention is to provide improvements in multiple-vehicle parking systems thereby economies effect economics in space and time expended in parking and retrieval of vehicles, particularly with automatic and semi-automatic systems also to eliminate facility ingress and egress bottleneck problems caused by inadequate entry and exit provisions.

Another object, affording space and time economies, is to make vehicles on entry suitable for all directional horizontal mobility utilizing underwheel skates and to orientate vehicles on receipt to face exits and thus eliminate turns or manuvering within the building.

Another object of this invention also affording space and time saving, is to utilize the multi-story access space available from ground to top floor of the single vehicle access lane flanked by the storage modules for both horizontal and vertical access enabling several vehicle carrying platform-elevators to be deployed simultaneously and the access lanes and vehicle transportation capability to extend out of the building at a convenient level for vehicle collection and delivery.

A further object is to provide vertical and horizontal rail gear-rack tracks interfacing with the multi-story storage modules eithe side of the access lane with intersections utilizing rail-gear rack turntables for synchronized actuated transfer of the PE from horizontal to vertical and vice-versa.

Another object is to provide, in conjunction with the PE, rotatable gearbox pinion drives, engaging with and rotated by the rail gear-rack turntables, each gearbox unit comprising a self-contained pinion drive motor (preferably hydraulic), reduction gear and automatic braking system covering all power-off protection for the PE from inadvertent movement of the racks.

Other objectives and advantages of this invention will become more apparent upon reading and observing the detailed description and drawings wherein the like referenced numerals designate the like parts throughout and in which:

FIG. 1 is an elevation of a one-side access only "AUTOSTAK" facility.

FIG. 2 is a plan-view of a one-side access only "AUTOSTAK".

FIG. 3 is an enlarged local plan showing vehicle skate dispositions, skate storage and transfer gantry one-sided access example.

FIG. 4 is a sectional view taken along the line 2 — 2 of FIG. 3.

FIG. 5 is a typical section taken through a vehicle skate.

FIG. 6 is a plan showing a grouping with multiple access lanes and vehicle ingress and egress from different streets.

FIG. 7 is an elevation of the separate vehicle ingress and egress facility.

FIG. 8 is an enlarged part section of Line 3 — 3 of FIG. 7 which is also applicable to FIG. 1 at Line 4 — 4.

FIG. 9 is a local plan of the access lane showing one storage module (lower) and part of the other (upper).

FIG. 10 is a section taken along line 5 — 5 of FIG. 9 with a vehicle in position on the PE.

FIG. 11 is an enlarged elevation of a vehicle skate.

FIG. 12 is a plan view of the PE and adjoining module showing the vehicle handling mechanisms, the upper one in the retracted position and the lower one fully extended to deploy the electro-magnetic boom which attaches to the vehicle's outboard skate.

FIG. 13 is a local elevation of the horizontal and vertical rail gear-rack intersection showing in phantom twin rollers, drive pinion and turntable actuator.

FIG. 14 is a plan view of the PE left hand front corner showing pinion drive, gearbox, brake and hydraulic motor drive.

FIG. 15 is a section taken along line 6 — 6 on FIG. 14.

FIG. 16 is an hydraulic and electrical schematic.

FIG. 17 is an end elevation-looking outboard of the pinion drive gearbox orientated for vertical climb and descent.

FIG. 18 is an elevation looking outboard of the pinion drive gearbox orientated for horizontal travel with the PE structure removed for clarity.

Referring now to FIG. 1, which depicts a 52 – 54 vehicle-capacity "AUTOSTAK" parking facility in side-elevation, there are seven floors including the roof. Vehicles enter the facility from the public street as indicated in FIG. 2 by arrow A. Arrow B shows the route taken by the vehicle when returning to the public street. When entering the facility vehicles are driven onto a pair of underwheel skates 10 kept in position by detents 11 which prevent longitudinal movement but leave the skates 10 free to be pushed or pulled sideways, all of which can be mounted on a conventional vehicle turntable 12. Alternative to the turntable is a rotating boom contacting a skate side and causing the vehicle and skates to rotate approximately 180° so that car faces exit right at the start of the parking cycle (see also FIG. 3).

The skate 10 side elevation is shown on FIGS. 11 and 12 and a typical cross section is shown on FIG. 5. Complete horizontal all-directional mobility is obtained for the skate 10 by multiple ball castors 18, a frequently used prior-art item for all-directional freedom castor applications.

The raised portion of the skate 10 shown in FIGS. 10, 11 and 12 is to enable an electro-magnetic boom 19 to pass under the nearside skate before contacting the outside skate 10 to which it attaches, then retracts with both skates moving spanned by the vehicle carried. Before the car is loaded onto a PE 20, driver has applied his brakes and/or parking lever and vacated the car with his passengers. Pre-rotating the vehicle 16 to face the public street from whence it entered is mandatory only for confined access sites. Facilities large enough to span a complete block can have an entrance in one street and exit in the next street and thus avoid the vehicle turning requirement as is depicted in FIG. 6 achieving identical space saving as for the other method.

FIGS. 8, 11 and 12 show how the vehicle is transferred from the turntable or from a storage module 13 onto the PE 20 or unload from it. The PE 20 travels with vehicle 16 horizontally along the access lane adjoining the turntable 12 into the facility consisting of seven storys of storage modules on either side of the access lane 17 which is a pit at ground level.

The PE 20 has mounted on its deck two shallow vehicle moving mechanisms 21 small enough to clear the vehicle under profile also to fit between the skates 10. The vehicle-mover 21 consists of lazy tongs driven booms 19, one for each side of the PE 20 onto which is attached through slotted holes, lazy tongs linkage mechanisms 22 shown on FIG. 12. Here in plan are shown the PE 20 central portion extending from the top most line to the gap between PE 20 and the storage module 13 fixed structure indicated by the arrow X. The arrow Y shows the approximate width of the adjoining storage module 13 floor.

The boom 19 relationship with the lazy tong link mechanisms is maintained, viewed in plan, by outrigger guides 15 between which the extended fulcrum of the first linkage slides enabling the pin attachments to the boom 19 to slide in slotted holes to suit the extreme positions of the open and fully closed mechanism. Travel of the boom on the floors is aided by small wheels 25 located at the bottom 19 extremities. The lazy tongs is driven by a screw jack with trunnion nuts to which the lazy tong end linkage attaches. The jack 23 comprises right hand and left hand threaded portions providing the opposite motion required. Jack 23 drive is by small hydraulic motors 24 fed from the propulsion system hydraulic accumulator 64.

On FIG. 12 the upper vehicle mover mechanism 21 is shown fully retracted and the lower mechanism 21 is shown fully extended in position on the storage module 13 floor. Motive power for the vehicle mover mechanism 21 could readily be electric or pneumatic motor or by linear actuator. The boom 19 electro-magnets for attachment to the skate could be replaced by a solenoid or other force operating a latch mechanism. The PE 20 is constructed of sheet metal sections to form a rigid rectangular platform. The running gear is mounted on a cylindrical gearbox free to rotate with the rail gear rack turntables 32 at plane transition points (switching from horizontal to vertical motion). As shown in FIG. 13 the running gear consists of two rollers 26 engaging the top of the horizontal rail gear-rack structure 24 and the traction drive is obtained from pinion 30 engaging the rack gear teeth facing downward in the case of the horizontal rail gear-rack tracks 24. As illustrated on FIGS. 6 – 8, also FIGS. 1 and 2 the whole PE vehicle transportation system is based on single vehicle access between multi-story storage modules. Vehicles are transported from place of vehicle arrival in front of the facility to the vacant storage module selected for it via the PE 20 which moves the vehicle on its skates both

on and off its platform as required. FIGS. 8 and 10 show the PE 20 and its vehicle 16 in position at a storage module station on the ground floor, the horizontal rail gear-rack tracks and the interfacing vertical rails 29. FIGS. 9 and 10 show the relationship of the PE 20 with the two storage modules together with the supporting structure. At the base of FIG. 10 are shown two circles representing the rail-rack turntables 32, which when a set of four corresponding with a storage module vertical stack are synchroniously actuated results in the PE 20 switching from horizontal or vertical planes as required.

FIG. 13 shows an enlarged elevation of the rail gear-rack turntable with the PE 20 rollers 26, the drive pinion 30, and the actuator 31 rotating the rail gear-rack turntable 32. All items except the rail gear-rack turntable are shown in phantom.

FIGS. 14 and 15 show a local plan view and section of the PE 20 front left hand corner at the rail gear-rack turntable 32 position on the horizontal rail gear-rack track 24. The structural member 34 of which the rail gear-rack turntable 32 is mounted has a hole into which is shown riveted a boss 35 containing anti-friction bearings 36. These anti-friction bearings 36 support a drum 37 attached to which are a shank 38 pinned to which is a lever 39 which couples to the actuator 31, either operated electrically or hydraulically. On the other face of the drum 37 is a flange 38a providing support for the short length gear rack 39a.

All gear rack used is protected from over meshing and consequent root fretting by an accurately positioned strip 40 attached to the rack side face. Pinion 30 tooth tip will always bed on the strip before interference will occur at critical tooth roots.

Input electrical power for driving the PE 20 mounted electric motor 67, hydraulic pump set 66 is conveyed from facility mains system to the mobile PE 20 via a bus bar 42 distribution strip insulator 43 for which is mounted on the support structure 34. Continuous contact of the strip bus bar 42 is maintained by means of a spring loaded isolated roller 44 located in and concentric with the drive pinion hollow shaft 30. Multichannel control input can be achieved in a similar way utilizing the roller 26 stub shafts however the preferred system is to telemeter coded data from a transmitter to servo systems operated from a receiver-set and distribution system for all control functions eminating from the overall facility master control panel.

The pinion gearbox drive engaging the rail gear-rack rails either horizontally or vertically, located at each of the four corners of the PE 20, is housed in a cylindrical case 48 supported by bearings 50 and 52 attached to the PE 20 longitudinal members 51. The gearbox casing 29 is open on one side enabling the brake and other items to be accomodated from offset positions to the gearbox rotational center.

End-plate 47 forms the support for the anti-friction bearing 50. Plain journal bearings 52 attached to longitudinal member 51 forms the other reaction point for the rotatable gearbox drive 33. The pinion drive-shaft 53 is supported by an anti-friction bearing 54 located on end plate 47, a mid-shaft bearing 56 and at the inward end plate by an anti-friction bearing 49. Shaft 53 assembled includes a standard automobile brake drum internal shoe mechanism and adaptor 55 and support plate 57. Disc brakes can accomplish the same duty and are alternative to the drum type. Mounted on the drive-shaft 53 also is an internal gear sub-assembly meshing with the hydraulic (or electric) motor drive pinion 59. The motor 60 is mounted on the inboard end of the gearbox casing 48 and retained by nuts and bolts 61. Extending through the center of drive shaft 53 is the roller extension shaft which is electrically insulated and assembles with the connector 46 and flex cable 45 which conducts power to the electro-hydraulic pump set via the distributor panel. All connections to the gearbox drive are flexible with sufficient slack to enable free 90° rotation which occurs in changing PE 20 from one plane to another.

The reduction gear using pinion 59 and internal gear assembly 58 are not mandatory to the invention and a straight through drive is feasible but ends up with heavier motors. The roller 26 and pinion drive 30 in conjunction with the rotatable gearbox drive 33 affords a compact means of switching the PE 20 from vertical to horizontal and vice-versa when positioned on the rail gear-rack turntables (4) 32. When the PE 20 is not changing planes the gearbox drive 33 can be locked in position until rotation is again required. FIGS. 17 and 18 show in elevation the gearbox drive in both positions.

Referring now to FIG. 16 in which the major components are shown schematically with electrical connections shown dotted and hydraulic lines solid, purpose is to illustrate system continuity and does not represent actual installation. For simplification, one unit only of the rail gear-rack turntable 32 and the car mover are shown. Electrical power from facility mains is distributed to the mobile PE 20 via a bus system and rolling contact 44 forming part of the rail-rack turntable 32 and drive gearbox 33. From here a flex cable conducts the power to the distributor panel 62 containing the PE 20 programmer, relays and servo switches for the electro-hydraulic pump 67 and 66, the hydraulic accumulator 64 and controls, the vehicle mover hydraulic motor and electro-magnets as part of the boom 19 system and the various timing and position sensors, limit switches and relays under the command of master control and data-telemetry system transmitter to the receiver 62. Transmission antenna 69 transmits coded data from master control which is received by the receiver antenna 70.

FIG. 3 shows a plan view of the single access facility illustrated in FIG. 1 enlarged to provide more detail of the vehicle skate 10 dispositions and how the skates can be stored in a magazine 71, then transferred by an overhead gantry 72 to the initial reception position on the turntable 12 on the right hand side. On rotation 180° the skates then appear on the left of the turntable with the car facing outwards to the exit. Skates vacated by cars at departure bay are picked up and returned to the magazine 71. FIG. 4 shows a section along line 2 — 2 with the PE 20 in position in the access lane 17. Vehicle turntable 12 rolls on bearings around the perimeter of its pit and the turntable is rotated by an electric motor with pinion driving a gear segment attached to the turntable structure.

Having described my invention it will be understood that while preferred embodyments and examples of said invention have been disclosed herein, other embodyments and modifications thereto are feasible to afford full utility of the discoveries made. For example in the applications to material handling and cargo storage and retrieval the systems and devices herein described

are directly applicable with minor revisions to the arrangement used to collect vehicles wherein containers or palletized loads would be loaded onto vehicles and not driven away as is the case with automobiles. Further variations and conbinations may suggest themselves to those skilled in the art to which this invention most nearly appertains without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A multi-level parking facility for vehicles that includes:

a. a pair of laterally spaced building structures that define a plurality of vertically spaced, longitudinally extending rows of compartments, said compartments in each of said pair of building structures being transversely aligned, each of said compartments including a horizontal floor and at least a first open end;

b. a first pair of parallel, laterally spaced, horizontal elongate members that extend the longitudinal length of said pair of building structures adjacent said first open ends, each of said members having first and second opposite sides, and said first side having a plurality of first teeth defined thereon;

c. a plurality of pairs of second elongate, vertical members secured to said pair of building structures adjacent said first open ends, with said second members of each of said second pairs disposed on opposite sides of a plurality of said first open ends that are vertically aligned, and each of said second members having first and second opposite sides, with said first side having a plurality of second teeth defined thereon;

d. a rectangular platform disposed between said pair of building structures, said platform having four corner portions;

e. four roller and pinion assemblies pivotally supported from said four corners of said platform;

f. first power means for selectively pivoting and holding said roller and pinion assemblies in either first or second positions, with said assemblies when in said first position having said pinions and rollers in pressure contact with said first and second sides of said first members, and said assemblies when in said second position having said pinions and rollers in pressure contact with said first and second sides of said second members;

g. second means operatively associated with said platform for driving said pinions to move said platform horizontally or vertically relative to said pair of building structures;

h. a plurality of vehicle supporting skates, each of said skates including a flat bed on which a vehicle may be supported, and a plurality of casters secured to the underside of each of said beds, with each of said skates when supporting a vehicle capable of being rolled on said casters in any desired direction;

i. third means for sequentially moving vehicles to be parked into a position where they can be disposed on one of said skates, with the movement of each vehicle into one of said skates occurring when one of said skates is supported on said platform, and said platform occupies a first position relative to said building structure;

j. fourth means for controlling said first means to permit said platform, skate and vehicle supported thereon to move to a position where they are aligned with a desired one of said compartments;

k. fifth power means on said platform for moving said skate and vehicle supported thereon onto or off said platform, said fifth power means being used to move one of said vehicle supporting skates onto said platform when the latter is in said first position, to move each of said vehicle supporting skates from said platform into any desired one of said compartments in either of said pair of building structures, to move each of said vehicle supporting skates from one of said compartments onto said platform, and to move each of said vehicle supporting skates from said platform into a second position relative to said structure where said vehicle may be driven from said skate; and

l. sixth means for storing said skates after said vehicles have been driven therefrom.

2. A multi-level parking facility as defined in claim 1 in which said third means is a turn table.

3. A multi-level parking facility as defined in claim 1 in which said fifth means is a longitudinally extendable boom that moves transversely relative to said platform and removably engages said skate.

4. A multi-level parking facility as defined in claim 1 which includes a plurality of said platforms that may be operated concurrently to facilitate the speed with which vehicles may be parked in said compartments in said structure.

5. A multi-level parking facility as defined in claim 1 which includes a plurality of pairs of said first members that are vertically separated to permit said platforms to move horizontally without encountering one another.

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