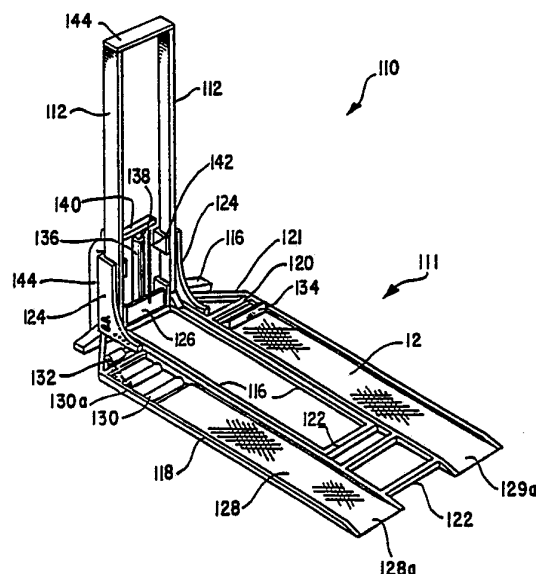




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(54) Title: VEHICLE-POWERED ELEVATED PARKING SYSTEM



(57) Abstract

A system for the elevated parking of vehicles uses a lift (10; 110) powered by the driving wheels of the vehicle (C). The lift includes a vehicle-supporting platform (20) which is raised and lowered by a hydraulic mechanism (34, 36, 38; 136, 138, 140) operated by an accumulator (44; 144) provided with pressurized fluid by a pump (28, 132) operated by the vehicle (C). Use of the accumulator permits operation of the lift without the need for an operator to be in the vehicle to effect elevation of the platform. Major hydraulic mechanism components are located off the platform to reduce system weight which has to be lifted. In a preferred embodiment, only one driving wheel (W) of the vehicle (C) is used to power the pump (28; 132) and the remaining wheel is immobilized. Each lift unit is self-contained and modular, and multiple units can be assembled for increased parking capacity.

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VEHICLE-POWERED ELEVATED PARKING SYSTEM

Technical Field

The invention relates generally to lifts or elevators which permit the vertical stacked parking of automobiles. Specifically, the invention relates to such lifts which are powered by one or both of the driving, or traction, wheels of the automobile itself. More particularly, rotation of the driving wheels is used to pressurize the working fluid in a hydraulic system which includes a fluid accumulator in the control circuit regulating operation of the lift.

10 Background Art

Automobile lifts which derive their operative power from the vehicle's driving wheels have been documented in the art. Examples of such lifts may be found in U.S. Patents 3,270,898, 2,579,688, 2,538,517, 2,358,501 and 1,890,963, and in Japanese patent publications 50-41270, 52-160981 and 61-5983. In Korean Patent Applications 88-5312 and 89-2417, the present inventor has disclosed improvements to vehicle-powered lifts.

In Korean application 88-5312, the lift can be configured with two rollers, a friction roller and a support roller, positioned atop the vehicle support platform to be engaged by the driving wheels. To each roller is attached a series of cables which, through the use of pulleys attached to lift frame, can raise and lower the platform. The lift can also be selectively configured with rack and pinion or bevel gearing and lead screw assemblies as desired so that the lift is powered according to the forward and reverse rotation of the friction and support rollers.

A problem with the geared system was the necessity for the operator to ride up on the platform during elevation, get down and then later use a ladder or some other inconvenient means to regain access to the elevated platform to lower it. This, of course, was inefficient. When rack and pinion gearing or bevel gearing and lead screw assemblies are employed to raise and lower the platform, the potential for wear and tear is great given the great number of parts and the nature of their functioning. Also, repairs become difficult.

The lift described in Korean application 89-2417 can be configured with a hydraulic lift system wherein the friction and support rollers drive

The lift described in Korean application 89-2417 can be configured with a hydraulic lift system wherein the friction and support rollers drive an oil pump which powers a hydraulic cylinder assembly to raise and lower the platform. Pressure generated by the oil pump powers the cylinder to raise the platform and a relief valve is open to lower it.

With vehicle-powered lifts, particularly mechanically-operated lifts, both driving wheels of the vehicle are used to power the lifting mechanism. It was noted early that harnessing both driving wheels created excessive stress on the platform and rendered the load inherently unstable during lifting operations while also requiring a relatively slow lift speed. Further, the known lifts which located the power and operating mechanisms on the platform itself subjected such lifts to an added-weight penalty, requiring sturdier structures to support the additional weight and resulting in slower lifting operation.

In developing the lift of the present invention, the inventor endeavored to remove all imperfections from the design by submitting the system to rigorous testing, particularly with regard to load stability during lifting operations, and then modifying the system design in accordance with the findings of these tests.

Of the points observed during testing was that harnessing of only one of the vehicle's driving wheels to power the platform lifting device was sufficient to raise the platform. It was also observed that use of a single driving wheel served to significantly stabilize the load. However, it was necessary to install a wheel stopper device on the side opposite the driving wheel to support the unused wheel and keep it from rotating.

Disclosure of Invention

The present invention was developed with the foregoing problems in mind. The weight which the lift's operating mechanism has to elevate is significantly reduced by locating the major and heavier components of the operating mechanism off the elevating platform, and making the platform itself of reduced-weight construction. Other weight-reduction features include the use of a single set of rollers driven by one traction wheel of the vehicle.

Although the operator must ride up with the vehicle during initial parking in one embodiment of the invention, it is not necessary for the operator to later regain access to the platform to lower it to the base

position. Instead, a relief valve allows the operator to lower the platform from ground level by use of the system controls. An alternative embodiment of the invention eliminates the necessity of the operator remaining with the vehicle while it is being lifted to the elevated parking position.

The invention comprises a lift for an elevated parking system which is operated by an accumulator device which harnesses the power of the vehicle being parked. Through use of a power accumulator device, the system transfers power from the vehicle's driving wheels to a lift device which raises and lowers the load platform. Of special note is a wheel stopper device on the side opposite the driving wheel being utilized which functions to hold the vehicle securely atop the platform during lifting operations.

Since the lift is powered by the vehicle being elevated, there is no need for electrical operating equipment or a source of electric power. This makes the lift self-contained and portable, permitting it to be easily located at the site of needed additional parking, with minimum site preparation and improvement. The lift is a practical, convenient, energy- and space-saving system which, because of its compact, self-contained design, permits multiple units to be grouped together for further increased parking capacity.

Brief Description of Drawings

Fig. 1 is a side view of one embodiment of the invention.

Fig. 2 is a schematic of the operating system for the embodiment of Fig. 1.

Fig. 3 is a perspective view of another embodiment of the invention.

Fig. 4 is a side view of a portion of the embodiment of Fig. 3.

Fig. 5 is a perspective view of still another embodiment of the invention.

Modes for Carrying Out the Invention

One embodiment of the invention is shown in the side elevational view of Fig. 1. Vehicle lift 10 includes a support frame 12 having four upright columns 14 positioned at the corners of a substantially rectangular configuration. Fig. 1 shows one side of the frame 12 which will be

described; the other side is identical. Two columns 14 are joined in spaced relation at their lower ends by a base member 16 and at their upper ends by an upper member 18 to form one side of the frame 12 shown in Fig. 1, which is joined to the identical other side by front and back connectors 16a secured to the lower corners of the frame. Additional bracing may be provided if desired to increase the structural rigidity and stability of the frame 12. Constructed as described, the frame is sufficiently stable to be placed on level ground and put into service, without having to be anchored.

A lift platform 20 for supporting a vehicle C, such as a car, is disposed within the frame 12 for vertical movement relative thereto, as described below. Platform 20 may be formed of a pair of spaced longitudinal members 22 joined at their ends by cross members 22a to form a rectangular frame. Skids 24 and 25 (not visible) are secured to the upper surface of the frame of the platform 20, adjacent to the outer lateral edges of the platform, and the aft end of each has a downwardly-inclined ramp portion 24a, 25a to facilitate movement of the vehicle onto the platform.

Skid 24 does not extend the full length of the platform 20, but is sized to provide an opening adjacent to one end thereof (left end in Fig. 1). Located within this opening are a pair of rollers 26 which are journaled on the longitudinal member 22 to be rotated by a driving wheel of the vehicle. Also supported within the opening is a fluid pump 28 operatively connected to the rollers 26 to be powered by the rollers. A fluid tank 30 provides working fluid, such as oil, which is pressurized by the pump 28. While Fig. 1 shows the tank 30 to be supported on the platform 20, it may be located elsewhere, such as on the frame 12, to reduce the weight on the platform.

There are known devices which can be used to transmit the rotation of the rollers 26 to operate the pump 28, so that further description is not necessary. While both rollers 26 have been described as being connected to power the pump, if desired only one of the rollers may be so used, with the remaining roller being freely rotatable to support the driving wheel.

Rollers are not provided on the skid 25 since only one driving wheel of the vehicle needs to be used to power the lift's hydraulic system. Instead, a wheel block or stopper (not visible) is mounted on the skid 25, at a location to be engaged by the other driving wheel, to prevent

rotation of the wheel. The wheel block can be similar to that shown in Figs. 3 and 4. Alternatively, the wheel stopper can be replaced with an idler roller which is engaged and rotated by the driving wheel not operating the pump. Further, one or more idler rollers can be arranged to support the wheel and permit it to spin freely without moving the vehicle.

A pulley or sheave 32 is mounted adjacent the upper end of each upright column 14. Supported on the upper member 18 is a hydraulic assembly having a cylinder 34 with a ram 36 reciprocable therein, and on the exterior end of the ram is a bar 38. One end of a cable 40 is anchored to the forward end of the platform 20, such as at A. The cable 40 is passed over the pulley 32, around one groove of an idler pulley 42 mounted on the upper member 18 adjacent to the cylinder 34, and then secured to the bar 38 carried by the ram 36. Another cable 41 is anchored to the aft end of the platform 20, such as at B, and passed over pulleys 32, 42 and secured to the bar 38. An identical arrangement of cables, pulleys and hydraulic assembly is provided on the side of the frame 12 which is not visible in Fig. 1.

Disposed at the base of the frame 12 is an accumulator 44 for receiving pressurized fluid from the pump 28. A controller 46, located at a position not readily accessible to the vehicle driver, such as on one of the upright columns 14, is operable to regulate the flow of the pressurized fluid, as described below. Such a control is available commercially. A pressure indicator 48 provides a visual and/or audible signal when the fluid in the hydraulic system attains a predetermined desired pressure, and is located at a position which is visible to the vehicle driver.

A schematic of the hydraulic system is shown in Fig. 2. Fluid flow check valves 50, 50a are provided in the hydraulic circuit, one between the pump 28 and the accumulator 44, and the other between the accumulator and the controller 46, to permit fluid flow in one direction only. The operation of the lift 10 is described with reference to Fig. 2.

With a front-wheel drive, the vehicle C is driven onto the skids 24, until one of the driving wheels engages the rollers 26 and the other wheel engages the wheel stop. A rear-wheel drive vehicle will be backed onto the skids 24, 25.

The driver operates the vehicle's engine momentarily, causing the driving wheel to rotate the rollers 26, with the rotation being transferred to operate the pump 28 to pressurize the fluid drawn into the pump from

the tank 30. During this time, the controller 46 is in the neutral position, preventing fluid flow through it. Pressurized fluid from the pump 28 is discharged into the accumulator 44.

5 When the pressure indicator 48 shows that the pressure is at the correct level, the driver shuts off the engine, applies the vehicle's parking brakes and leaves the vehicle, along with any other occupant. Operation of the controller 46 directs pressurized fluid from the accumulator 44 into the cylinders 34, extending the rams 36 and moving the attached bars 38 to the right (in Fig. 1). In this position, the controller 46 blocks fluid flow to the tank 30. Movement of the ram 36 in this manner draws up the cables 40, 41 to lift the platform 20 and the vehicle thereon. With the platform 20 at the desired elevation, the controller 46 is operated to stop further flow of pressurized fluid to the cylinders 34, and the rams 36 remain extended to maintain the platform elevated. With one vehicle in the elevated position, another vehicle can be parked beneath.

15 During lifting operations, the driving wheel not powering the pump may be held in place and prevented by the wheel stopper block from rotating, or may be permitted to rotate by engagement with one or more idler rollers which are not used to operate the pump if this latter modification is used.

20 Although not the preferred mode of operation, the operator of the parking system can remain with the vehicle until the platform has reached its upper position. During this time, the operator can continue to run the vehicle engine to drive the rollers 26. However, the inherent design of the system makes it unnecessary for the operator to remain in the vehicle, thus further enhancing the safety of the system.

25 When the platform is to be lowered, the controller 46 is switched, and while pressure is initially maintained between the accumulator 44 and the cylinders 34, the fluid within the cylinders is allowed to flow back into the tank 30 at a controlled rate, permitting the rams 36 to retract and release cables 40, 41, lowering the platform uniformly.

30 Of course it is necessary to maintain fluid pressure between the cylinders and the accumulator at all times, with the amount of fluid pressure in the accumulator maintained in excess of the maximum load (i.e., fluid volume) requirement for operation of the hydraulic cylinders. This prevents accidents caused by an accidental or inadvertent lowering of the platform due to insufficient hydraulic pressure in the system. The flow check valves installed between the pump, accumulator and control

likewise serve to prevent an inadvertent reversal of fluid flow within the system which can also lead to an accidental lowering of the platform.

A unique feature of the invention is how the accumulator allows the fluid pressure required by the system to be generated by the vehicle, used
5 to raise the vehicle into position, and then held in that position until it is required to lower the vehicle again to the base position. The design's use of an accumulator device reduces both installation and operating costs while at the same time improving the overall operating efficiency of the parking system, and it also reduces the risk of accidental lowering of the
10 load platform due to pressure loss within the system.

Additional safety features, automatic or manually-operated, can be incorporated into the lift as required or when desirable. For example, one or more limit switches which are operated by the platform can be mounted
15 on the upright columns, at locations to switch off the controller when the platform reaches upper and lower position limits. Visual and/or audible indicators also can be connected to operate with the position switches. Means can be provided to prevent the vehicle from inadvertently rolling off the platform. Guides can be provided at the corners of the platform which cooperated with the upright columns to further ensure the smooth,
20 steady movement of the platform.

If the structural elements of the lift are of tubular construction, the components of the hydraulic system, such as the cylinders, rams, pulley, cables and fluid conduits, can be located within the structural elements, to protect the components against abuse and the environment and to improve
25 the appearance of the parking system.

Another embodiment of the invention, as illustrated in Figs. 3 and 4, is a cantilever-style lift 110 supported at one end by a pair of upstanding columns 112 arranged in parallel and joined at the upper ends by a brace 114 and at the lower ends by a base 116 to form a rigid support frame.
30 When installed, the base 116 may be suitably anchored to support securely the lift 110 and the vehicle thereon. However, the lift 110 is stable and suitable for use by placement directly on a level ground without further anchoring. Alternatively, the base 116 may be omitted, and the lower ends of columns 112 embedded in the ground or in concrete.

A lift platform 111 is formed of longitudinal frame members 118
35 joined in parallel pairs by spacers 120 and 121, and spaced apart by cross members 122. The joined pairs of frame members 118 are supported at their forward ends by brackets 124 for sliding movement on the columns

112. Brackets 124 are braced at the lower ends by a runner 126 which moves with the brackets, and the function of which is described below. Skids 128, 129 are secured to the joined pairs of frame members 118 to support the vehicle. The aft end of each skid 128, 129 (opposite the columns 112) has a downwardly-inclined ramp portion 128a, 129a to facilitate movement of the vehicle onto the platform 111.

Adjacent to the forward end of skid 128 is a pair of rollers 130, 130a journaled at their ends for rotation on the frame members 118 and spaced to receive one of the traction, or driving, wheels of the vehicle. One or both of the rollers 130, 130a is coupled by known means (not shown) to power a pump 132 also supported on a frame member 118. If only one of the rollers is so used, the remaining roller merely supports the traction wheel.

A block or stop 134 is positioned adjacent to the forward end of skid 129 and is engaged by the vehicle's wheel to prevent rotation thereof. As shown in Figs. 3 and 4, block 134 is provided on the skid which does not have the rollers, and serves to prevent rotation of the driving wheel not being used to operate the pump. Alternatively, the block 134 shown can be replaced with an idler roller which engages and is rotated by the driving wheel not operating the pump. This idler roller configuration can be further modified to include an additional pair of rollers, similar to rollers 130, 130a, arranged to support the wheel and permit it to spin freely without moving the vehicle.

Modifications of the foregoing arrangement include providing rollers 130, 130a on both skids 128, 129, with or without additional idler rollers.

Mounted on the base 116 is a hydraulic cylinder 136 with a ram 138 reciprocating therein. Attached to the ram 138 is a support bar 140 from which one or more links 142, such as lengths of chain or cable, interconnect the support bar with the cross member 122 of the platform. An accumulator 144 stores the pressurized fluid provided by the pump 132, and a pressure indicator 146 (not shown) registers the pressure of the fluid in the hydraulic system. The pressure indicator 146 can be positioned at any location which is visible by the driver in the vehicle, such as on the columns 112, and need not register the actual pressure in the system. It is sufficient if the indicator provides some visual and/or audible indication that the pressure of the system is at the correct level, such as with a flashing light and/or sounding device. Control means 148

to regulate the flow of the pressurized fluid can be mounted on the bracket 124 as shown, or at some other convenient location.

Not visible in Figs. 3 or 4 is a fluid tank 150 which functions identically to the tank 30 in the embodiment of Figs. 1 and 2. Also not shown are connecting hoses and valves which complement the hydraulic system since such items are known in the art and would be incorporated as required or desired.

The operation of the lift 110 is substantially the same as described above for Figs. 1 and 2. For a front-wheel drive, the vehicle C is driven onto the skids 128, 129 until the driving wheels W engage the rollers 130, 130a. The driver can readily tell when the vehicle is in the correct position since the driving wheels will drop noticeably into the space between rollers 130, 130a, and further forward movement of the vehicle will be prevented by the stop 134. A rear-wheel drive vehicle will be backed onto the skids 128, 129.

The driver momentarily operates the vehicle's engine, causing the driving wheel to turn the rollers 130, 130a to operate the pump 132 and pressurize the fluid in the hydraulic system. When the pressure indicator 146 shows that the fluid is at the correct level, the driver shuts off the engine and exits the vehicle, along with any other occupant. Operation of the controls 146 admits pressurized fluid into the cylinder 136, extending the ram 138 to raise the support bar 140. Raising of the support bar 140 lifts the cross member 122 and thus elevates the platform 111 and the vehicle thereon. Thereafter, another vehicle can be parked beneath the elevated vehicle. Operation of the controls 146 in the reverse direction releases the pressurized fluid from the cylinder 136, permitting retraction of the ram 138 and the subsequent lowering of the platform.

During lifting operations, the unused driving wheel may be held in place and prevented from rotating by the wheel stopper block 134, or may be permitted to rotate by engagement with one or more idler rollers which are not coupled to power the pump.

One advantage of allowing only one of the vehicle's driving wheels to rotate is that the overall stability of the load atop the platform is maintained by preventing excessive wheel travel. Instability resulting from the tendency of the drive wheel to spin out of the cradles formed by the rollers, axle sway and the stressed generated during wheel rotation all are significantly reduced. This configuration optimizes the transfer of the wheel's turning force to pressurizing the fluid in the system which, in

turn, ensures that the platform moves up and down in the most efficient manner possible with regard to speed. In addition, the use of a single driving wheel, as opposed to the use of both driving wheels, significantly reduces the amount of stress on both the vehicle and the lift during operations.

While the rollers which engage the vehicle's driving wheels are described above to be located at the forward end of the skids, if desired they can be positioned at the aft end of the skids, near the ramp portions 128a, 129a. However, positioning of the rollers and pump nearer the support columns 112 provides a more stable lift since more of the weight and the center of gravity of the cantilever system is closer to the support columns. The open, framed construction of the platform 111 further reduces the cantilevered weight which has to be supported by the columns 112.

Although not shown, means can be provided adjacent the ends of skids 128, 129 to prevent the vehicle from rolling off the lift platform while the vehicle's engine is running to operate the pump 132 and after the vehicle has been lifted. Such means are known in the art, and need not be further described. Brackets 124 will prevent forward movement of the vehicle; however, additional means may be provided to prevent such movement. A sheet or plate (also not shown) can be placed between the skids 128, 129 to prevent grease, oil, dirt and other debris falling onto the vehicle parked below the elevated vehicle.

With the configuration of Figs. 2 and 3, the lift 110 can be set up for operation directly on flat ground, without having to embed the support columns into the ground. Since the lift 110 is self-contained, with its own power system and controls, it can be readily located at any desired location, and any number of individual units can be grouped together to satisfy parking requirements.

Fig. 5 illustrates an embodiment 200 of the invention wherein a plurality of individual parking systems 210 are assembled, each system substantially similar to the embodiment 110 described above. The lower end of each column 212 is embedded in the ground with the lift platform 211 being supported cantilever-style for vertical movement thereon by brackets 224. In the embodiment shown in Fig. 5, the lift platform 211 is formed as a single unit, with a cut-out to receive rollers 230, 230a which are rotatably mounted on opposed edges thereof. As in the embodiment 110 above, a single roller, such as roller 230a, may be coupled to power

the pump 232 (not shown), or both rollers 230, 230a may be used to power the pump. Wheel stop 234 is provided to prevent rotation of the driving wheel not used to power the pump. The free end of the platform 211 is inclined downwardly to form a ramp for easy drive on of the vehicle.

5 Not specifically shown in Fig. 5 is the hydraulic cylinder, the fluid tank, coupling means operatively connecting the cylinder to platform 211, the pressure indicator and the control means. These items may be similar to those described above, and the various modifications noted for the embodiments 10 and 110 above may be incorporated individually or
10 severally into the lift 210.

To facilitate removal of an elevated vehicle, the parking assembly 200 is provided with a plurality of pallets or lower platforms 250 mounted for movement on spaced rails or tracks 252 which extend along the parking assembly. The number of pallets 250 is one less than the number of lift
15 platforms 211 to permit shifting of the pallets to vacate the space beneath the elevated lift with the vehicle to be removed. The ground beneath the parking assembly 200 is excavated sufficiently to permit mounting the rails 252 below the ground surface such that the upper surface of each pallet 250 is flush with the ground. Preferably, each pallet 250 is mounted for
20 easy sliding manually, such as with low-friction rollers; however, mechanized means may be provided to move the pallet.

Instead of mounting the pallets 250 flush with the ground, the rails 252 and pallets may be mounted at ground level and the under surface of each lift platform 211 conformingly recessed or otherwise shaped to
25 accommodate the height of the pallet on the rails.

The operation of each lift 210 is the same as the lift 110 above, and further description is not necessary. When it is desired to lower and remove an elevated vehicle, the necessary pallets 250 are shifted laterally (with respect to the showing of Fig. 5) to leave vacant the space beneath
30 such vehicle. The lift platform is lowered, and the vehicle driven off. In this way it is not necessary to drive a vehicle off a pallet before an elevated vehicle can be removed.

It is understood that the lift of the present invention is not restricted for use with automobiles and trucks, but can be used with other
35 motorized vehicles such as motorcycles and motor scooters by sizing the lift platform accordingly.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present

embodiments are to be considered in all respects as illustrative and not restrictive, the scope of the invention being defined by the appended claims and not by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Industrial Applicability

The parking system of the present invention was developed for use where parking space is limited or the number of vehicles being parked is great. By enabling vertically-stacked (two-tiered) parking of vehicles, the system ensures that all available parking space is used in the most efficient manner possible.

The system uses readily-available parts and components which are simple in design and have been proven and certified. The system has proven safe and reliable, and found wide acceptance. Numerous units are already in widespread use throughout the Republic of Korea.

Claims

1. A lift for elevating a vehicle and powered by the driving wheels of the vehicle, comprising:

a platform for supporting the vehicle;

5 an upright support assembly for supporting the platform for vertical movement thereon;

a roller assembly having a roller member rotatably supported on said platform and adapted to be rotated by one of the driving wheels of the vehicle;

10 a fluid pump disposed on said platform and operatively coupled to said roller assembly to be driven by the rotation of said roller member to pressurize a working fluid which can be circulated through said pump;

an accumulator for storage of fluid pressurized by said pump;

15 a cylinder assembly operatively coupled to said platform and operated by fluid from said accumulator to raise and lower said platform;

control means to regulate the flow of fluid between said accumulator and said cylinder assembly to control said raising and lower of said platform; and

20 a tank connected between said pump and said control means for receiving fluid diverted thereto by said control means from said accumulator or said cylinder assembly,

said accumulator, cylinder assembly and tank being disposed separately from said platform.

25 2. The vehicle lift of claim 1, further comprising a stop means which engages one of the vehicle's driving wheels to prevent the rotation thereof, such that only one vehicle driving wheel is used to operate said pump.

30 3. The vehicle lift of claim 2, wherein said platform is of substantially rectangular configuration and is supported at its corners by said support assembly.

4. The vehicle lift of claim 3, wherein said cylinder assembly includes a ram reciprocally movable in a hydraulic cylinder in response to pressurized fluid directed to said cylinder by said control means, and further comprising cable means connecting said ram with said platform

such that extension and retraction of said ram relative to the cylinder effects, respectively, raising and lowering of said platform.

5 5. The vehicle lift of claim 4, wherein said cylinder assembly includes a hydraulic cylinder and ram combination operatively connected to each of the two longitudinal sides of said platform to effect the raising and lowering of said platform.

6. The vehicle lift of claim 2, wherein one end of said platform is supported on said support assembly in a cantilever fashion.

10 7. The vehicle lift of claim 6, wherein said cylinder assembly includes a ram reciprocally movable in a hydraulic cylinder in response to pressurized fluid directed to said cylinder by said control means, and further comprising means connecting said ram with the supported end of said platform such that extension and retraction of said ram relative to the cylinder effects, respectively, raising and lowering of said platform.

15 8. A system for the elevated parking of multiple vehicles having a load platform for receiving the vehicle, a frame supporting the platform for vertical movement thereon, and an operating subsystem powered by the driving wheels of the vehicle for moving the platform, the operating subsystem comprising:

20 a roller assembly having a roller member rotatably supported on said platform and adapted to be rotated by one of the driving wheels of the vehicle;

25 a pump disposed on said platform and coupled to said roller assembly to be driven by the rotation of said roller member to pressurize a working fluid which can be circulated through said pump;

an accumulator for storage of fluid pressurized by said pump;

a cylinder assembly operatively coupled to said platform and operated by fluid from said accumulator to raise and lower said platform;

30 control means to regulate the flow of fluid between said accumulator and said cylinder assembly to control said raising and lower of said platform; and

a tank connected between said pump and said control means for receiving fluid diverted thereto by said control means from said accumulator or said cylinder assembly,

said accumulator, cylinder assembly and tank being disposed separately from said platform.

9. The parking system of claim 8, further comprising a stop means which engages and prevents rotation of the vehicle driving wheel not associated with said roller assembly, such that only one vehicle driving wheel is used to operate said pump.

10. The parking system of claim 9, wherein said operating subsystem further includes:

flow check means between said pump and said accumulator, and between said accumulator and said control means to prevent the reverse flow of pressurized fluid; and

pressure indicator means providing an indication of the fluid pressure, whereby the vehicle engine is operated to power said pump until the pressure indicator shows that the fluid pressure at a predetermined level, after which the engine is shut and an operator does not have to remain with the vehicle while it is being raised or lowered.

11. The parking system of claim 10, wherein said control means is located such that it is not accessible for operation by the vehicle operator.

12. The parking system of claim 11, wherein said platform is of substantially rectangular configuration supported at its corners by said frame and said cylinder assembly includes a hydraulic cylinder and ram combination operatively connected to each of the two longitudinal sides of said platform, each of said rams reciprocally movable in the hydraulic cylinder in response to pressurized fluid directed to said cylinder by said control means, and further comprising cable means connecting said rams with said platform such that extension and retraction of each of said rams relative to the cylinder raises and lowers, respectively, said platform.

13. The parking system of claim 11, wherein one end of said platform is supported in a cantilever fashion on said frame, and said cylinder assembly includes a ram reciprocally movable in a hydraulic cylinder in response to pressurized fluid directed to said cylinder by said control means, and further comprising means connecting said ram with the

supported end of said platform such that extension and retraction of said ram relative to the cylinder raises and lowers said platform.

14. A parking system comprising an assembly of a plurality of vehicle lift units defined in claim 13, and further comprising:

- 5 a pair of spaced rails disposed beneath said assembled units; and
a plurality of pallets movably disposed on said rails for receiving vehicles, the number of pallets not exceeding one less than the number of lift units, said pallets being movable to leave vacant the space beneath an elevated vehicle to be lowered.

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FIG. 1

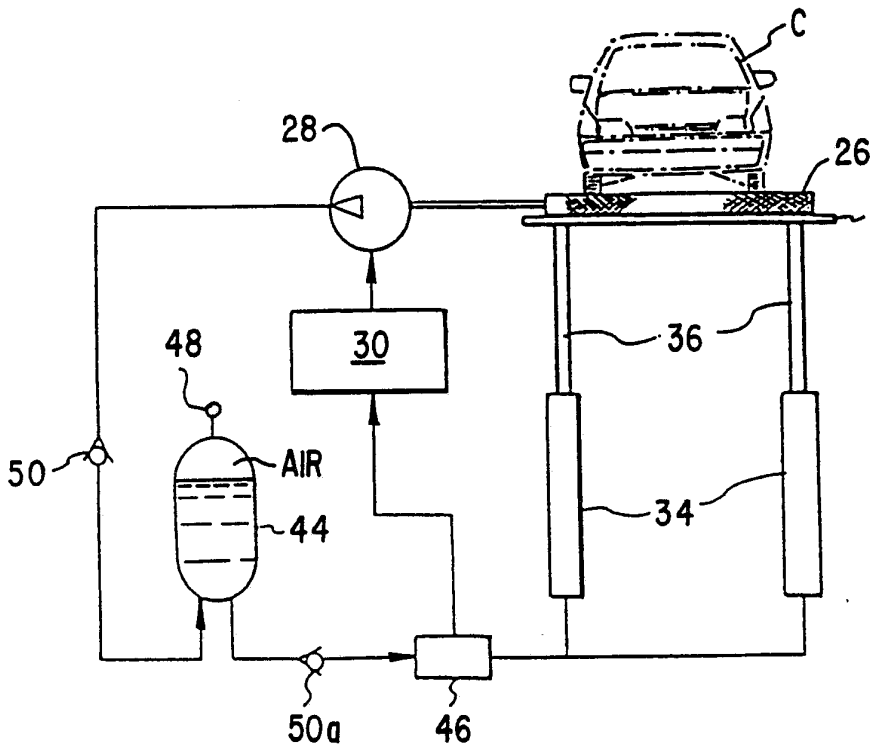
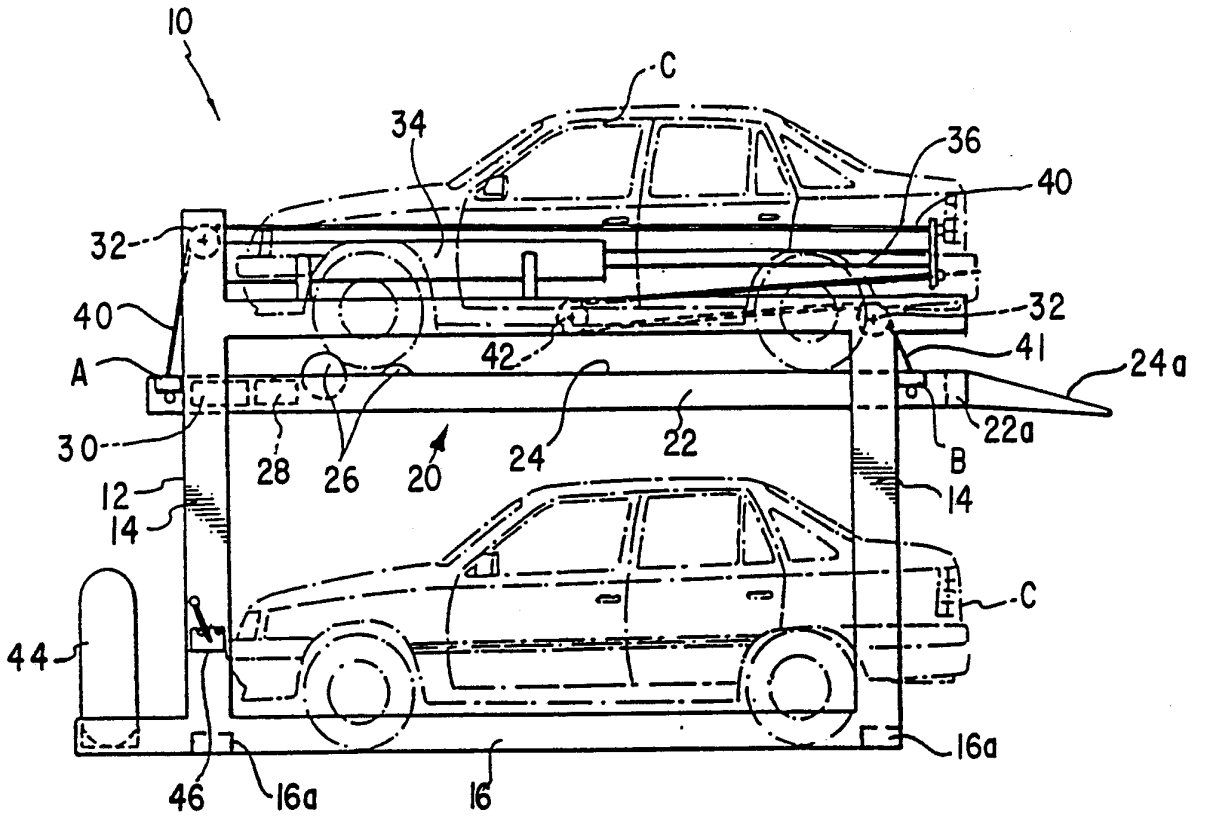


FIG. 2

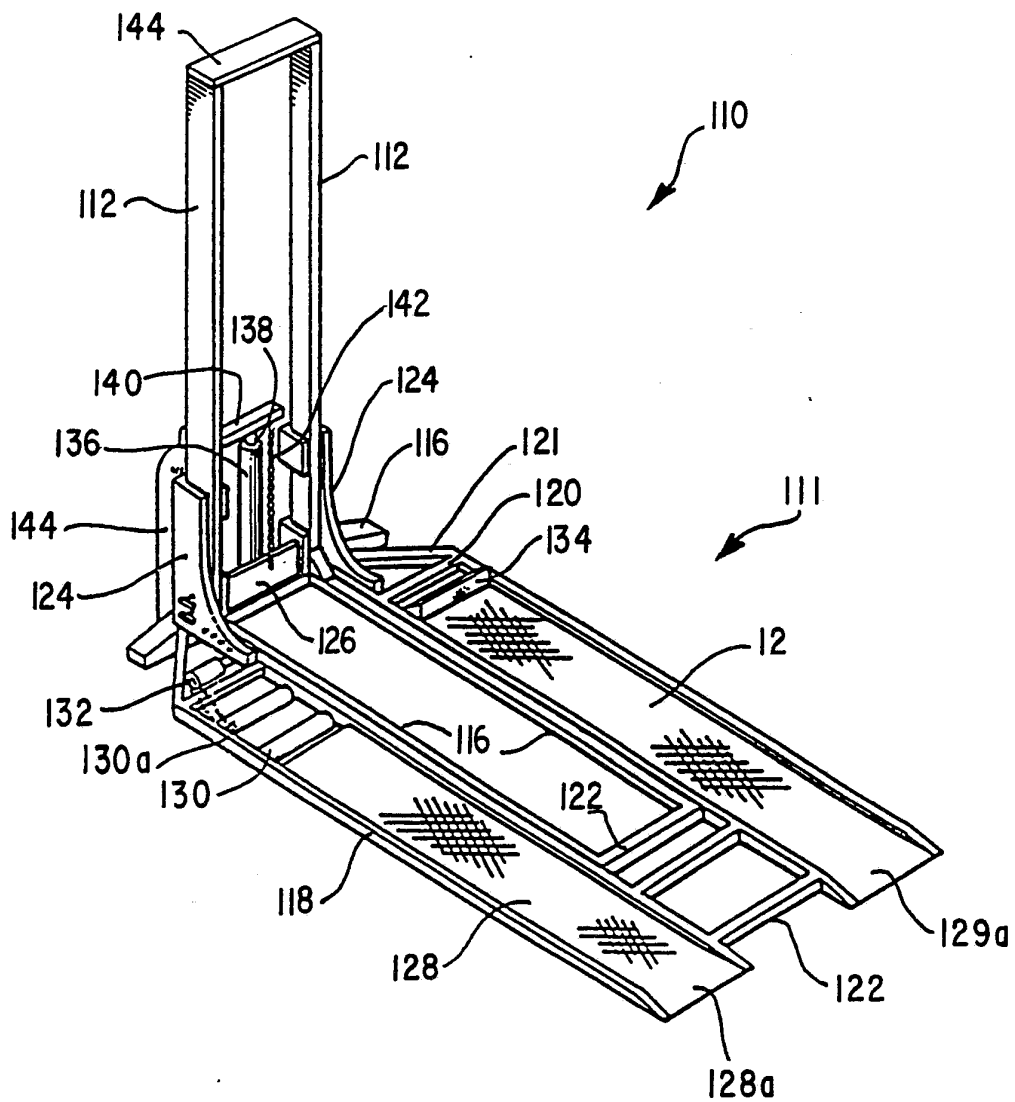


FIG. 3

SUBSTITUTE SHEET

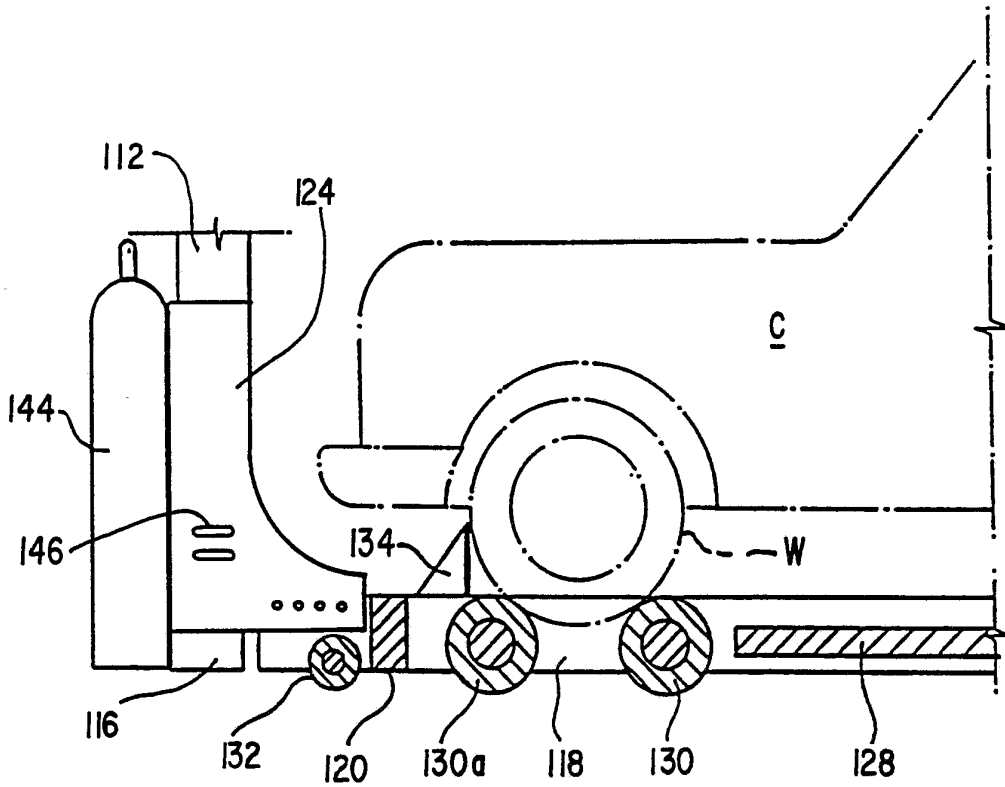


FIG. 4

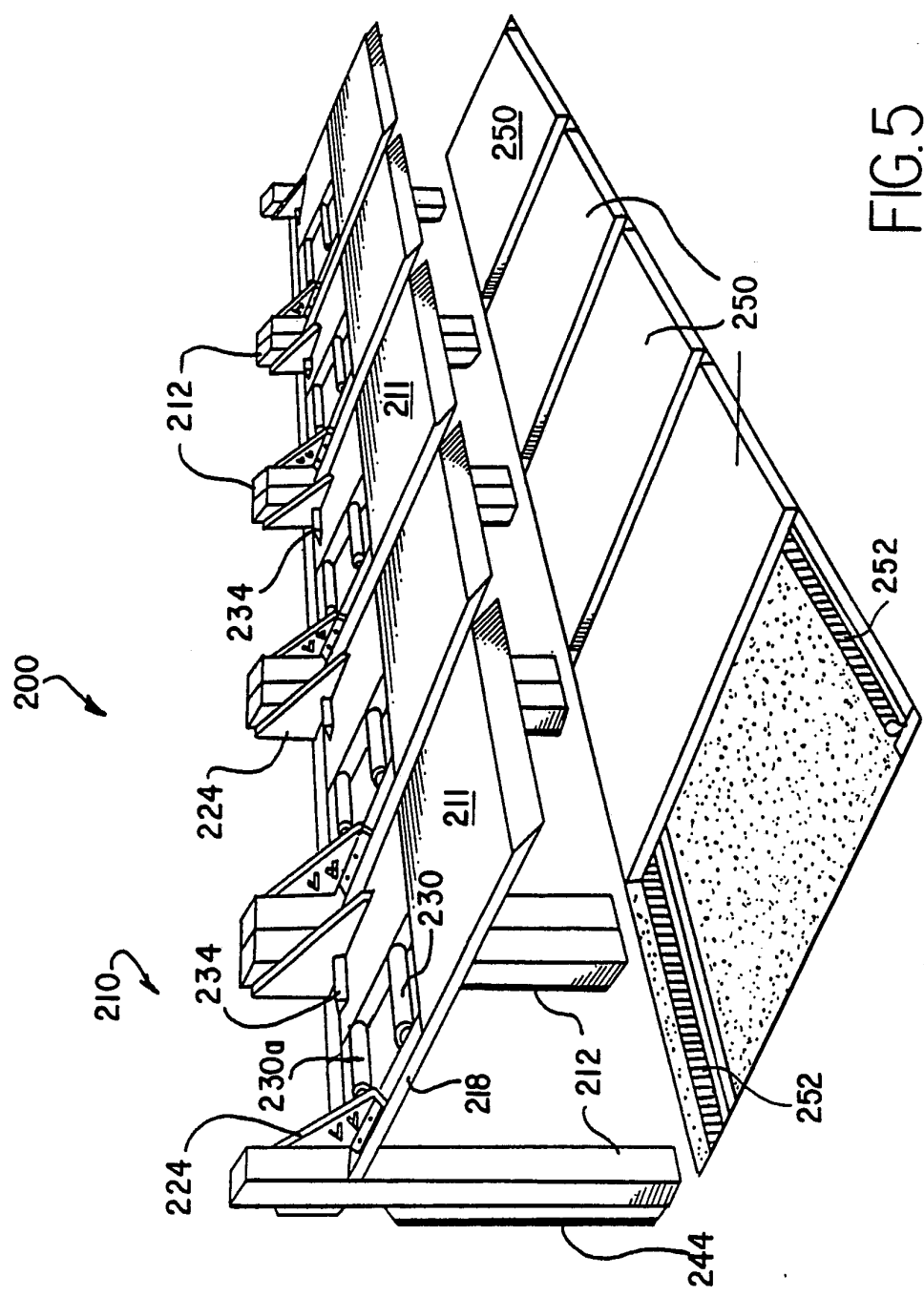


FIG.5

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 91/08313

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶				
According to International Patent Classification (IPC) or to both National Classification and IPC Int.C1.5 B 66 F 7/24				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
Int.C1.5	B 66 F B 60 S	E 04 H B 60 D B 60 P		
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸				
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹				
Category ^o	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³		
A	US,A,2538517 (HAYDEN) 16 January 1951, see column 2, line 23 - column 3, line 34; figures (cited in the application) ---	1,8		
A	BE,A, 504788 (RUSTIN et al.) 21 November 1952, see page 2, lines 8-42; figures ---	1,8		
A	GB,A, 659242 (DAVIES) 17 October 1951 ---			
A	WO,A,9006279 (TIGWELL) 14 June 1990 -----			
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> ^o Special categories of cited documents :¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family </td> </tr> </table>			^o Special categories of cited documents : ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family
^o Special categories of cited documents : ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family			
IV. CERTIFICATION				
Date of the Actual Completion of the International Search 23-03-1992	Date of Mailing of this International Search Report 15 APR 1992			
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer Mme N. KUIPER			

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

US 9108313
SA 54626

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 08/04/92. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 2538517		None	

BE-A- 504788		None	

GB-A- 659242		None	

WO-A- 9006279	14-06-90	AU-A- 4658889	26-06-90
		GB-A- 2226006	20-06-90
